THESIS

THE IMPACT OF GREEN BUILDING RATINGS PROGRAMS ON BUSINESS DECISIONS

Submitted by

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ABSTRACT

THE IMPACT OF GREEN BUILDING RATINGS PROGRAMS ON BUSINESS DECISIONS

The purpose of this research is to expand knowledge about the usefulness of green building rating programs for businesses which already participate in green building, and also for those considering participating in green building. This knowledge is important to both businesses interested in green building, and also for universities teaching classes with green building practices in mind.

The research revealed that, while there is growing environmental concern among specialists in the energy design and construction industry, green building alternatives are generally cost prohibitive, and the life cycle cost benefits are insufficient to warrant the use of new material or systems without the support of government subsidies.

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DEDICATION

This thesis is dedicated to my mentors and graduate colleagues at Colorado State University, who are “bringing sexy back to research” (Qualtrics 2014). Thank you for all of your support… you know who you are.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: BACKGROUND OF TOPIC / PROBLEM STATEMENT

Background

Green energy is a pervasive theme in modern design and construction. Assurance that buildings are built and powered by energies alternative to fossil fuels has gained a large market share, especially with the onset of non-profit groups such as Leadership in Energy and Efficient Design (LEED), Green Globes, and Energy Star. This research topic originally began as an assessment of LEED and LEED's qualifications as a science-based assessment tool. After much research on LEED, a broader topic encapsulating the benefits of LEED was identified. This topic was further expanded to include other green building assessment programs, and evolved into an examination of the reasons why or why not various professionals in the construction industry participate in green rating programs.

The reasons for and/or against participation in green building ratings programs on behalf of businesses involved in construction speak volumes as to where the industry is headed. Green building, in the true sense of concern for environmental impact, is an increasingly important aspect to new construction and renovation.

Sustainability is a major topic within the context of this research, yet the reasons for participating in sustainability programs are complicated. The research points to these complicated motives as being driven by finances, perception, growth, market share, and environmental improvement.

Furthermore, the research began as a means to investigate whether or not sustainable projects and certification programs help or hurt businesses, which kinds of

businesses, and why. Sustainability is only driven as far as its supporters are willing to take it. In this case, within the context of this research, sustainability and the green building ratings systems tied to it, are driven by businesses involved in new construction and renovation projects. Sustainability and businesses (suppliers of a service) are intertwined, and cannot function without the other. As a result, it became apparent that research was needed regarding what the relationship is between sustainability and business decision processes, and how that relationship originally formed, and where it is currently headed.

The research was also performed because there is a need to know why businesses choose to become involved with green certified projects; if there is an appealing aspect to these projects, what is it, and how does it benefit the company? Does that same aspect also benefit the environment somehow? Or is that aspect strictly a financial decision, one that does not necessarily impact the environment?

Research Question

Do alternative energy manufacturers, suppliers and constructors perceive sustainable design and construction, associated government programs, and "green" ratings programs to be a benefit or a detriment to long term business practices?

CHAPTER 2: LITERATURE REVIEW

Introduction

In 1993 a not-for-profit and environmentally-conscious organization formed with the intention of creating standards for ecologically-responsible construction. Robert Watson, a former scientist at NASA, spearheaded this new sustainability organization. With the development of the United States Green Building Council (USGBC), Watson encouraged the United States (and the world) to think about how buildings impact the environment, and how their construction process and subsequent operation affect Earth's natural resources.

The USGBC includes a program entitled Leadership in Energy and Environmental Design (LEED), which encompasses the design of buildings in addition to their actual construction and maintenance. This program, now commonly known as LEED, is a "voluntary, consensus-based, market driven program that provides third-party verification of green buildings" (USGBC-LEED, 2012). As a means of reference, "green building" as defined by the United States Environmental Protection Agency is "the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction" (US EPA, 2010). The development of the LEED program marks a turning point for the design and construction industries. While there are materials that are naturally sustainable and have been used as building basics for centuries (straw, mud, brick and more recently plywood), certain construction methods

and material extraction practices are damaging to the atmosphere and may contribute to the increasing carbon emissions found in Earth's atmosphere.

LEED, and other similar green building ratings programs, represent a critical development within the "green movement" because they have encouraged designers and builders to reevaluate current construction practices, and consider the sustainability of existing buildings. Shelter is a basic necessity for human survival, as humans are not equipped with the natural physical insulation to the elements as many other mammal species are. As a result of this basic need, humans have been constructing shelters since first walking upright (McHenry 2009). While fulfilling one of our basic needs as humans, how do we ensure that our buildings are sustainable, and that they do not devastate our natural resources? Watson's LEED program addressed this complicated question in the United States in a way that had not been fully undertaken prior to 1993.

An Examination of LEED and its Benefits to Businesses

Achieving LEED status is a complicated process, involving the submission of significant paperwork and the review of a checklist applicable to the building in question. Any building, whether existing or new construction, can accumulate a range of points up to a maximum ; these points can come from any aspect of the design, construction process or the building function, yet a majority of the points stem from the building's energy efficiency and overall performance. LEED New Construction achievement, for example, is categorized into four classifications: Certified (40-49 points); Silver (50-59 points); Gold (60-79 points); to Platinum (80+ points). This checklist system allows for designers to choose specific points to pursue and ultimately accumulate for LEED certification.

The application of LEED to a project may seem like a strictly environmental choice; however there are additional benefits to receiving a LEED certification. Projects awarded a LEED certification level and which save at least 50% of the energy used by a comparable non-certified building are eligible for a tax credit; as of 2013, this credit is $1.80 per square foot (Beazley, et al, 2012; DSIRE 2014). If an office building of approximately 10,000 square feet were certified LEED Gold and saved at least 55% of the energy used by comparable non-certified buildings, the owner of the building would be eligible for an $18,000 tax credit. The cost of pursuing a LEED certification could be slightly offset with a tax break of this volume.

In addition to providing tax breaks, LEED has become a status symbol, and this status has only grown since the LEED system began in the early 1990's. "Builders covet LEED certification … as a way to gain tax credits, attract tenants, charge premium rents and *project* an image of environmental responsibility" (Navarro 2009, p.A8, emphasis own). *Projecting* an image of environmental responsibility has become just as impressive to clients as a business taking *true* responsibility for their building and reduced energy usage. Businesses and projects are pursuing points on the LEED checklist that are easier and less costly to achieve, and yet still confer the title and reputation which LEED confers. These easily-attained points, however, do not certify that the building is *actually* energy efficient and sustainable in its everyday function. "Critics of LEED – many of them architects who were green before green was cool – see a system that's easy to game and has more to do with generating good PR than saving the planet" (Brook, p.1, 2007). Businesses go "green" for various reasons, and occassionally these reasons do not correlate with the founding principles of the LEED system. Primarily, these reasons are to earn money and to drive up

real estate values (Barringer 2008). Businesses and projects pursue LEED for a broad range of reasons, ranging between altruistic concern for environmental improvement and financial self-preservation; Brook and Barringer each suggest that businesses and projects tent to pursue LEED for mostly financial self-preservation reasons.

Although the USGBC LEED program (which is non-federal and not-for-profit) has become a leader in building efficiency and energy savings, the points assigned to a building do not always guarantee its sustainable function. Some of the point assignments within LEED certification are considered to be arbitrary and disproportionate to the environmental impact that they deliver (Brook 2007). With regard to employee ride-sharing programs to and from a LEED certified business, a building can earn one point by performing either of the following options: distributing an employee newsletter *suggesting* that employees carpool; or purchasing a fleet of vans and creating regional ride-sharing groups, thusly reducing carbon emissions each day the vanpool is used. While distributing flyers informs employees that they *could* carpool, creating a vanpool is an active way to encourage employees to reduce their carbon footprint on the environment and contribute to the high standards sought through LEED certification.

One of the more widely known criticisms of LEED's unweighted point system is the comparison of a brownfield (a previously-developed site with environmental issues) to a bike rack. Installing a bike rack in front of a business has the potential to encourage patrons to ride their bikes to this business, and thereby reduce their carbon emissions. The bike rack does not guarantee that every patron will ride a bike, however; it is a passive and relatively inexpensive way to gain one point on the LEED certification checklist. If a project

site is comprised of, or near a brownfield, rehabilitating that brownfield is also worth one point on the LEED certification checklist. Rehabilitating a brownfield is not nearly as easy, nor cost effective, as installing a bike rack; yet its impact upon the environment is tremendous in that hazardous waste and threatening conditions are reduced or eliminated, making the project site environmentally cleaner and safer. Conversely, the argument is frequently made that rehabilitating a brownfield is not worth the effort required to bring it up to LEED standards. Due to the "significant costs and liability issues associated with brownfields, many developers stay away from these projects all together" (Koncelik, p.1, 2009).

Directly corresponding to the bike rack versus brownfield debate, LEED has become a somewhat questionable system among true green builders because of its unweighted point system. Since LEED is a desired designation due to its associated tax breaks, an entire division of literature has developed detailing how to earn LEED points without doing anything costly, involved, or truly environmentally beneficial. One such article, entitled "How to Cheat at LEED," instructs builders to grasp the "low-hanging fruit" on the LEED checklist and "pick up as many points as you can by doing the easy stuff" (Seville, p.1, 2011). Many of the 22 simple steps listed in Seville's "How to Cheat at LEED" are indeed simple; no fireplace (2 points), bench at the home entry (1 point), and air out the home prior to showings (1 points) . Few of these 22 options are directly related to energy savings and conservation; yet, as the author describes in his article, up to 70 points can be attained for mostly non-environmental-impact objectives derived from the LEED checklist. Additionally, recycled carpet tiles are awarded the same amount of points as an energy-efficient HVAC system; and proximity to public transportation is awarded points even if the

LEED building does not provide a shuttle, bike lanes, or a safe means of pedestrian traffic from the public transportation drop off to the building's point of entry.

Rather than all points being equal across the LEED checklist, a better system might analyze the point spread and give more weight to building improvements which actually have positive impacts on the environment in a renovation setting. Consider a 4,000 square foot residence which qualifies as LEED Certified, and has accumulated 45 points due to recycled interior finishes and zero-water landscaping, yet still features single-pane drafty windows. Now consider a 2,500 square foot residence which also qualifies as LEED Certified, and has accumulated 45 points due to energy efficient heating, cooling, and effectual lighting systems. It could be evaluated, which building will have a greater impact upon the environment, and which has achieved LEED points without considering the energy impacts of different upgrades.

Moreover, an even larger consideration that LEED does not give qualified projects is their location (Malin 2008). LEED projects operating in cold weather climates will have different concerns than LEED projects operating in hot weather climates; likewise, each of these projects will require a different checklist to account for the differences in materials and methods affected by their respective climates. As the LEED New Construction system currently stands, 4 points can be achieved for regional factors out of the 110 point maximum; these 4 points comprise 3.6% of the overall point designation, and count very little toward the endorsement of a project as LEED certified. Regionalization, much like the environmental impact of a product, material or method, should carry more weight per LEED project. The USGBC has begun to address this issue, and in the 2009 revision

introduced “Regional Priority Credits” which consider the climate and location of a particular project (USGBC 2014).

In addition to the uneven point distributions and regional issues associated with LEED, attaining certification is expensive. Submitting a project for LEED certification costs at least $1,200; and the “certification review fee” can range anywhere from $20,000 to $100,000 in additional costs (Brook 2007; USGBC 2014). Additionally, the mere presence of a LEED Accredited Professional designer on the project team adds one LEED point to the “Innovation and Design” category (Seville 2011). For affluent corporations and homeowners, paying between $21,200 and $112,000 for LEED certification is not a major concern. Considering the tax credits earned from LEED accreditation, some of these costs can be recuperated in the following tax year. However, for smaller businesses and more conventional homeowners, LEED costs may be considered excessive and thusly inaccessible (Reiser 2011);s a result, some companies and homeowners choose to become “LEED Certifiable” (Bardaglio 2011), which entails meeting all of the LEED checklist requirements but not submitting for the expensive accreditation. With the money saved, some businesses choose to further enhance their building and reinvest the money otherwise spent on LEED paperwork and certification review (Bailey 2014).

With further regard to cost, sustainable materials and energy-efficient equipment are inclined to be more expensive than traditional non-sustainable counterparts found in older homes and businesses. Despite these higher up-front costs, many of these materials and equipment have a high return on investment, and often recuperate the initial costs within the first few years of operation. These higher initial costs can be discouraging for

businesses, and may deter them from choosing the energy-efficient options on the LEED checklist. In reference to LEED and otherwise-certified green buildings, Vanderpool states that "many green buildings today are neither highly efficient, nor particularly intelligent, and this is a missed opportunity" (Vanderpool, p.2, 2009). As a result, many LEED certified buildings save only the minimum energy as comparable non-certified buildings, and do not exceed the expectations for a building which is LEED rated (Scofield, 2009).

One particular example of a neither highly efficient nor energy intelligent LEED Gold building is the renowned single family dwelling Antilia. This home can be found in Mumbai, India, amongst one of the most poverty-stricken cities in India (Brook 2007). Antilia is 27 stories tall, and features a bowling alley, indoor gardens, a movie theatre, various dining rooms, bedrooms, and living areas. Antilia is called home by a family of six, none of whom reside there full-time (Brook 2007). This home was designed by the American firm Perkins and Will (P+W), who purport on their website to have the most LEED accredited professionals in the United States (P+W 2012). Antilia was granted LEED Gold status for meeting the requirements of the checklist: among these were a stacked building footprint, and energy efficient lighting. While LEED poses no limits on how individuals choose to design and build their homes or businesses, Antilia is an example of a building whose design does not fit the LEED categories of energy efficiency and innovative design (Rich, 2007).

In reflection, the uneven point system combined with high certification costs and the lack of serious regional considerations has given LEED a lackluster reputation among genuine environmental circles (Scofield 2009). And despite the fourth modification LEED is

currently undergoing, many critics suggest that the program should be completely restructured around regional aspects, energy efficiency, and scientific research rather than an arbitrary checklist which has the potential to certify a project for all the wrong reasons (Sorensen 2010). Consequently, other "green-minded" groups have formed to develop alternative certification programs *to* LEED. One such group is the American High Performance Building Coalition (AHPBC). The AHPBC officially formed in 2012, on the premise that a building's "green rating" should be backed by scientific evidence of its success, not an indiscriminate checklist. The AHPBC is currently backed by 32 different groups who have in some way challenged LEED in the past, including the American Chemistry Council (ACC), the Center for Environmental Innovation in Roofing (CEIR), and the National Association of Manufacturers (NAM) (AHPBC 2012). The AHPBC supports sustainable practices and materials that are not only scientifically proven to save energy and resources, but which have also received approval from the American National Standards Institute (ANSI).

In hindsight, LEED has paved the way for a new way of thinking about design, construction and building operation (Quirk 2012). LEED began conversations worldwide regarding the finite state of our planet's resources. And while LEED stimulated this innovation, there are still many process improvements needed. LEED has the potential to become something truly great, and make positive impacts upon the future of design and construction. But without fundamental changes to regional considerations, energy efficiency, and overall building common-sense, the program will remain a half-hearted attempt to engage our cities in sustainable energy consumption (Post 2012).

LEED has given planners, engineers, architects and construction managers a platform and context from which to scrutinize how we design and construct our buildings. Consequently, the sustainability of our structures is continually under review. LEED is currently undergoing its fourth revision in an attempt to include more options as new practices and methods become prevalent (USGBC 2014). This revision is open to public comment via internet feedback and a public ballot at various USGBC tradeshows held throughout the United States (USGBC 2014), allowing anyone with an opinion to impart theirs upon the USGBC. The platform that LEED has created includes sourcing more ecologically sound, regionally-produced renewable resources (USGBC 2014).

A History of Green Building and Popular Green Building Ratings Systems

LEED is undoubtedly a singular program, yet it does not stand alone as the only green building rating program available. Other programs which perform similar certification services are quite prevalent worldwide and are becoming as commonly used and popular as LEED. Green Globes, Energy Star, and High Performance Building Index constitute a few alternatives to LEED.

The initial review of these aforementioned certification programs revealed that a desire to environmentally-improve design and construction processes has existed among architects and constructers for centuries. While Robert Watson solidified the modern green movement through the formation of the USGBC, the aspiration to build in harmony with the natural environment has existed since as early as 15BC. According to Charles Kibert, the "green building movement and the remarkable rise of the US Green Building Council and its counterparts elsewhere is a great success story" (Kibert, 2012, p. xv) which ultimately

began upon the formation of the world's first major cities. "The Roman architect, Vitruvius, once defined the purposes of architecture as creating commodity, firmness, and delight … *emphasiz[ing]* the importance of careful site selection for buildings and cities in order to maximize the salubrious effects of sun, wind, water and shade" (Kibert, 2012, p. xiv, emphasis own).

With the development of the USGBC and programs such as LEED and Energy Star, the need for environmentally-conscious design and construction was given a platform on which to develop and grow. The initial purpose of LEED, for example, was to provide third party verification of green building processes: certified LEED professionals could evaluate the energy consumption of a building and thereby determine its overall environmental impact through energy modeling. This third-party verification system led to an increased awareness of material longevity, material composition, rate of consumption and environmental impact as harvested and implemented. Furthermore, these programs transformed and grew into a green building movement, whose primary concern was to reduce materials used, improve the environmental footprint of buildings, improve infrastructure, and reduce energy consumption (Willson 2008).

Despite the extraordinary steps made toward environmental efficiency and effective material consumption, many green ratings systems lack the scientific evidence to back up their purported claims. Much of the literature review further revealed that while many green building certification programs are improving and becoming more science-based in their definitions and applications, some are heavily reliant on arbitrary point systems that

do not necessarily enhance the environmental standing of a facility (Melton 2012; Stein 2004).

The literature further revealed that LEED is the most commonly used green building standard worldwide (USGBC 2014). Other countries lean more heavily toward programs such as Green Globes (Canada) and Green Building Council (United Kingdom). LEED was originally created as a self-imposed measurement tool for environmental building standards and as a subsequent forum for continuous improvement. The USGBC LEED website states that LEED is a "voluntary, consensus-based, market driven program that provides third-party verification of green buildings" (USGBC-LEED 2012). Although LEED is the most used green building ratings system worldwide, it is often the system most criticized for a significant lack of scientific backing in its point structure. "The LEED rating system is not firmly grounded in building science and economics. Instead, the credits were arrived at by a committee consensus, and, as a result, many of them appear to be subjective or arbitrary" (Stein 2004).

One counterpart to LEED is Green Globes, which has been heavily used in Canada for over a decade (Green Globes 2014). Unlike LEED, Green Globes is firmly grounded in science and technical research: "Green Globes is based primarily on ASHRAE and on the ANSI/GBI 01-2010: Green Building Assessment Protocol for Commercial Buildings" (Green Globes 2014). Green Globes strives to provide a service which is not only simple and accessible (buildings may be evaluated and submitted entirely online), but also continues to affirm a building's energy savings during its lifetime. The Green Globes point system includes a post-occupancy life cycle assessment of a building's systems (HVAC,

plumbing, and/or lighting as examples), which LEED does not (Smith, et al 2006). Green Globes was developed for the Canadian and United States markets from the United Kingdom's BREEAM (Building Research Establishment Environmental Assessment Methodology). BREEAM is the longest established green building assessment tool, established in 1990 (BRE Global 2010-2014). It is noted that while BREEAM was being developed and implemented in the UK (1990), LEED was likewise under development and execution in the United States (1993).

Another frequently-mentioned green building standard identified within the context of the literature review was Energy Star. Energy Star is a "U.S. Environmental Protection Agency (EPA) voluntary program that helps businesses and individuals save money and protect our climate through superior energy efficiency" (Energy Star 2014). The Energy Star seal can apply to both appliances and buildings, but most frequently residential homes. Unlike LEED, in which a building earns a level of certification (Certified, Gold, Silver or Platinum), Energy Star products and buildings either qualify for the Energy Star label or do not. There are no varying degrees of Energy Star achievement, and appliances such as dishwashers, ovens, and washing machines certified as Energy Star can be purchased from more than one manufacturer, providing a potential consumer which a choice in purchase.

An additional green rating program revealed within the context of the literature review was the American High Performance Building Coalition (AHPBC). According to the AHPBC's website, the coalition "is composed of leading organizations representing a range of products and materials relevant to the building and construction industry who are committed to promoting performance-based energy efficiency and sustainable building

standards. We support the development of green building standards through consensus-based processes derived from data and performance-driven criteria" (AHPBC 2012). Unlike LEED, Green Globes or Energy Star, AHPBC's main focus is not to provide third party verification of green buildings, but rather to research and supply the scientific knowledge which backs up certification through those aforementioned programs. "The coalition is a leading industry voice that coordinates and engages representatives in the building and construction value chain in the development of reasonable performance based policies regarding green building standards development and implementation" (AHBPC 2014).

The results of the literature review revealed that, while there is a generous amount of information available to any researcher (academic or applied) about the various green building programs and their subsequent ratings systems, there is little information on how green building certification programs actually *benefit* alternative energy businesses of varying capacities and industries. At best, available literature suggests that LEED paved the way in the United States for green building rating systems to become a tangible part of the construction process, thereby theoretically increasing the energy efficiency of buildings. The literature review yielded very little information regarding the reason why companies (including designers, builders, suppliers, vendors and manufacturers) either pursue or recede from projects with a green building requirement. Despite the lack of information found during the literature review, there are two major elements prevalent regarding the benefit or detriment of green building certifications. The first element is that of cost. The cost to become "green certified," whether through LEED, Green Globes, or another similar program, is high and in some cases unattainable. The second element is that of a return on investment. The return on a green building certification is unclear, and in some cases

downright ambiguous as to what benefits a designer, builder, supplier, vendor or manufacturer will receive in turn. The research project executed as a result of this literature review sought to shed light on this topic, and define why or why not designers, builders, suppliers, vendors and manufactures seek, or do not seek, projects pursuing green building certification.

CHAPTER 3: METHODOLOGY

The data gained during this research was compiled using mixed research methods, which is appropriate for this type of research. This approach was implemented through a survey questionnaire. This instrument was developed as the best means to capture data from large quantities of professionals in companies with a focus on alternative energy within a three-month duration (November 19, 2013 – February 10, 2014). The steps which led up to, and included the survey instrument, are outlined below and summarized in Figure 1:

1. Develop a literature review to determine the necessity for such research;
2. Develop a survey instrument directed toward alternative energy professionals that would provide information to answer the research question;
3. Select a database and develop a subject set using the database LEAD411;
4. Pilot the survey among peers and professors for process, understanding, and complexity of data;
5. Release the survey via Qualtrics to 5,000 email addresses gained through LEAD411;
6. Survey closure and method of analysis (descriptive statistics).

Literature Review

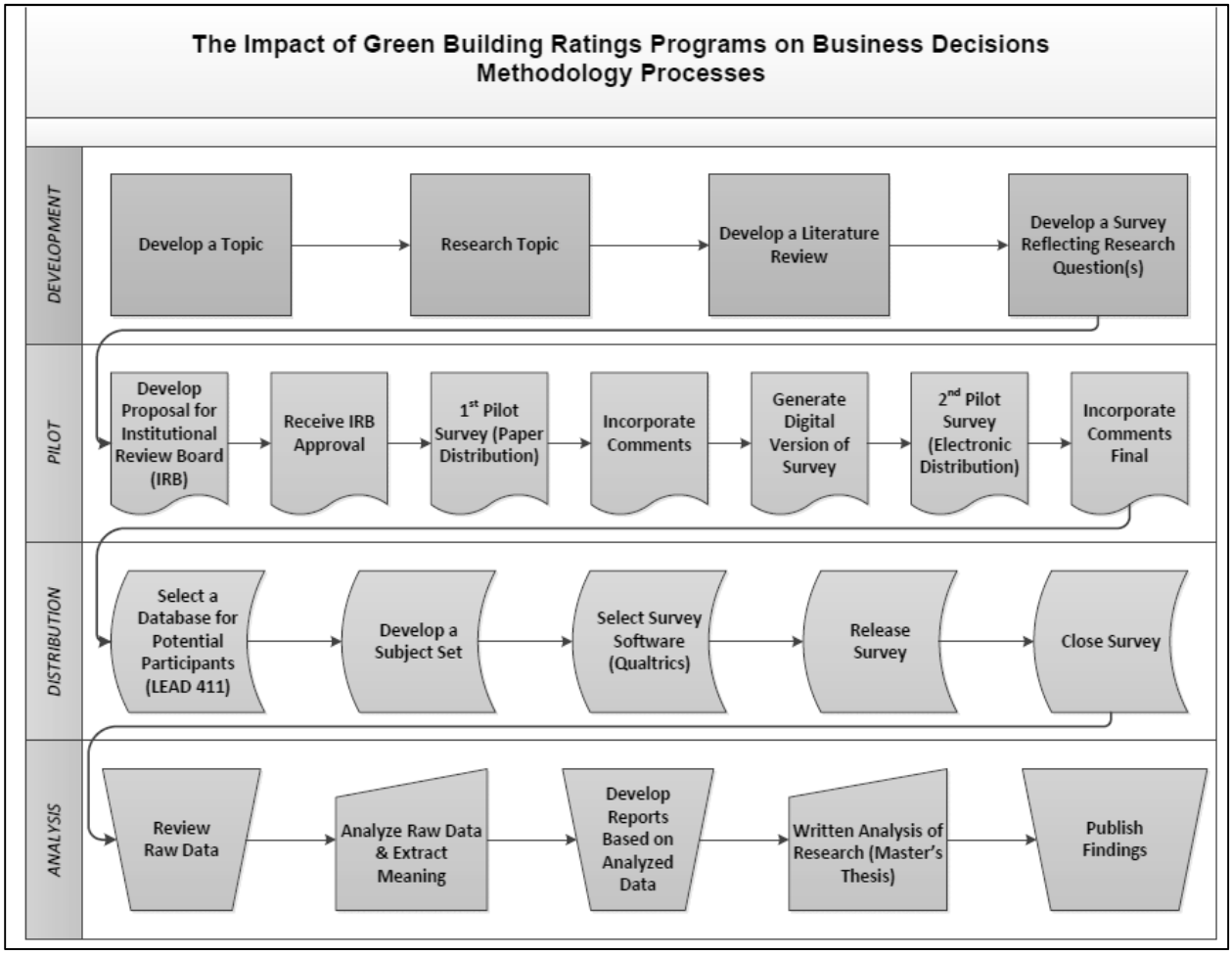


Figure 1: Methodology process used in development of research project.

The literature review is the preliminary and primary tool to understanding the need for research (Creswell, 2009). The literature review allows the researcher to quantify how much information is currently understood and written about a particular subject, and whether more research needs to be conducted. The development, necessity and applicability of various green building certification programs, such as LEED, Energy Star,

High Performance Building Council, and Green Globes, were researched and discussed within the literature review.

Survey Development

According to John Creswell, "Survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population" (Creswell, 2009, p. 13). The population in question for this research study consists of professionals who self-identify as being involved in the alternative energy market in some capacity. The survey was developed to collect information from architects, engineers and constructors (AECs), regarding their involvement in alternative energy and green building ratings programs. Twenty-seven questions were developed to assess both the financial impact and perceived value of such a certification, as well as the requirement and/or request of Owner's to have such a certification awarded to their project. The survey was composed of multiple choice, rank-order, Likert scale, select all that apply, and open ended written response questions about green building ratings systems as applied to alternative energy businesses. The survey was designed to capture the opinions and perceptions of designers, contractors and suppliers in the energy business, primarily targeted within North America.

The survey was developed in a two-step process. The first step involved a brainstorming meeting in which various concepts, issues and ideas associated with alternative energy companies and their participation in green building programs such as LEED, Energy Star, and High Performance Building Council were addressed. The research concentrates on the motivators for (or against) the implementation of green building

programs, and the driving forces behind those decisions. These ideas and concepts were mapped out on a white board, and the minutes of the meeting were recorded and used later as the basis of the survey development.

The second step of the survey development involved the transition of the literature review and meeting minutes into survey questions. Meeting minutes from prior brainstorming sessions were used in conjunction with the literature review (found within Chapter two of this document) to develop the twenty seven survey questions. The draft version of the survey was developed utilizing Microsoft Word. Upon completion of the survey's first draft, the survey was then reevaluated by all involved researchers to determine the need and accuracy of each question.

Database Selection and Development of a Subject Set

A subject set was developed using the database LEAD411 (http://www.lead411.com/). LEAD411 is a database containing the names and contact information of (high-ranking; first contact; public relations) professionals throughout the United States, with fields ranging from Agriculture to Zoology. A filter was applied to the database to sort out only the names and emails of professionals in alternative energy companies, ranging from small repair companies (HVAC and plumbing contractors) to large solar array installers. The results of this filter yielded 5,000 potential contacts.

Selection of Survey Software

Qualtrics was selected to implement this research project. This software was selected because of its user-friendly interface for survey participants, and also due to the straightforwardness of survey creation. When compared to other available data analysis software, Qualtrics was prefered to Survey Monkey, SurveyGizmo or eSurvey.com. According to the Qualtrics software website, Qualtrics is "bringing sexy back to research" through "sophisticated research [made] simple" (Qualtrics, 2014). Qualtrics allows the researcher to generate a cover email, with a survey link attached, and then records all of the responses, including time of day survey was taken, length of time it took to complete, questions skipped, the rate of completion, etc. This process maintains the anonymity of each survey taker, as well, so that subject set identities are not compromised.

First Pilot of Survey

The survey underwent two piloting periods for purposes of refinement and cohesion. The survey was first piloted to 20 individuals within Colorado State University, all of whom range from somewhat-familiar to extremely-familiar with green building rating systems, alternative energy manufacturing and implementation. The pilot set consisted of eight professors, eight graduate students, and four adjunct faculty. Feedback was sought from the piloting exercise in order to make the survey easily understandable and yet still convey the information desired to the professionals targeted to participate in the survey. Ambiguous or poorly phrased questions were adjusted to better reflect the desired meaning. The initial piloting request letter can be found within the appendix. The format of the first piloting phase was executed via paper copies of the survey, so that edits,

comments and suggestions could be written directly on the document itself. This format was chosen to increase the likelihood of pilot responses. In exchange for a pilot response, all 20 pilot participants were offered a chocolate bar! With this reward system in place, nearly all pilot participants responded with suggestions and comments.

In certain cases, pilot respondents were requested to participate in in-person interviews to clarify any comments or suggestions made to the survey, and to ensure that the intention of response was understood.

The piloting process was necessary to validate the survey questions for this research. The survey needed to be reviewed both internally, by individuals familiar with the content and with the questions, and externally by individuals who mimic the actual subject set. The piloting process was also necessary to remove internal validity threats as well as external validity threats. Through this process, outside individuals familiar with the subject matter, yet not directly involved in the research, can review the survey questions and eliminate leading words, phrases, or concepts which might sway the opinions of actual survey participants.

Transfer of Survey to Qualtrics

Following the completion of the first piloting exercise, the survey questions were transferred from a Microsoft Word document into a Qualtrics survey document. This process involved entering the questions into the survey tool within Qualtrics, and then selecting the appropriate corresponding response mechanism for each question. This survey tool included the participant letter, followed by twenty-seven questions.

Second Pilot of Survey

Following the development of the Qualtrics online survey, the digital version was piloted once more to the same set of six CSU professors who piloted the paper version. This second pilot period was executed as a precaution to ensure that the online software version of the survey worked as intended, and that the questions were reasonable and direct.

Survey Duration

Upon completion of the aforementioned steps, the survey was released to the 5,000 person subject set on November 19, 2013. An email was sent out to the entire subject set, requesting participation in the survey. On February 10, 2014, after 84 days, the survey was closed and data compilation began.

Method of Survey/Data Analysis

Several methods of data analysis were implemented following the closure of the survey. Qualtrics generates a variety of internally-produced reports which tabulate responses; these reports were recorded and printed for further analysis. The responses to each question were reviewed individually, and then reviewed collectively as an entire report. Additionally, graphs and tables were generated to correspond to the data received for each survey question; each question has been addressed in the data analysis portion of this document.

The analysis methodology used for this data set is descriptive statistics followed by an interpretation of the results. Descriptive statistics are defined as "descriptive analysis of data for all independent and dependent variables in the study". Interpretation of the results is defined as "the researcher draws conclusions from the results for the research questions, hypotheses, and the larger meaning of the results" (Creswell 2009).

CHAPTER 4: RESULTS

The survey yielded substantial results. 5,000 email addresses were identified for survey distribution. Out of the 5,000 email addresses sent the survey, 103 surveys were returned, either in full or partially completed. The survey response yielded a 2.06% response rate. This response rate yielded a final sample size which makes the results reasonably generalizable to the overall population, and were sufficient to analyze for this research study. Further discussion of how the survey response rate could have been increased or improved is discussed in Chapter 6: Conclusions & Further Research. The results of each question are presented below, in the numeric order the questions were asked within the context of the survey.

It should be noted that there was a variable response rate found within the survey question responses. While a total of 103 survey responses were recorded within Qualtrics, the distribution of percent-complete surveys varies. See Figure 2 on the following page

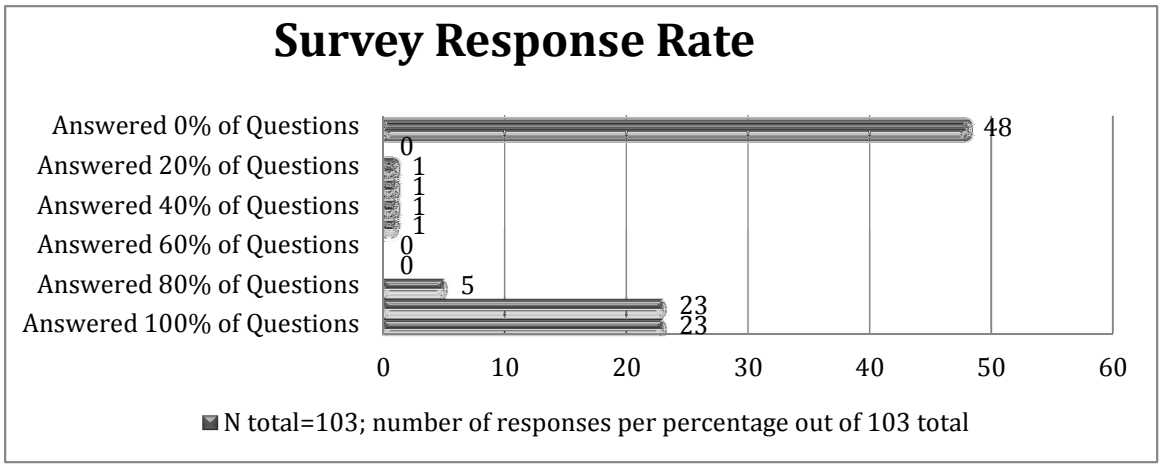


Figure 2: Survey Response Rate

The total cumulative responses to all questions in the survey were 103, with "*N*" representing the total 103 completed responses. The details of these responses are broken out below:

- 46.6% of N, or 48 individuals, answered 0% of the 27 questions.
- 0% of N, or 0 individuals, answered 10% of the 27 questions.
- .97% of N, or 1 individuals, answered 20% of the 27 questions.
- .97% of N, or 1 individuals, answered 30% of the 27 questions.
- .97% of N, or 1 individuals, answered 40% of the 27 questions.
- .97% of N, or 1 individuals, answered 50% of the 27 questions.
- 0% of N, or 0 individuals, answered 60% of the 27 questions.
- 0% of N, or 0 individuals, answered 70% of the 27 questions.
- 4.85% of N, or 5 individuals, answered 80% of the 27 questions.
- 22.33% of N, or 23 individuals, answered 90% of the 27 questions.
- 22.33% of N, or 23 individuals, answered 100% of the 27 questions.

See *Question Response Rate* Figure 3 below.

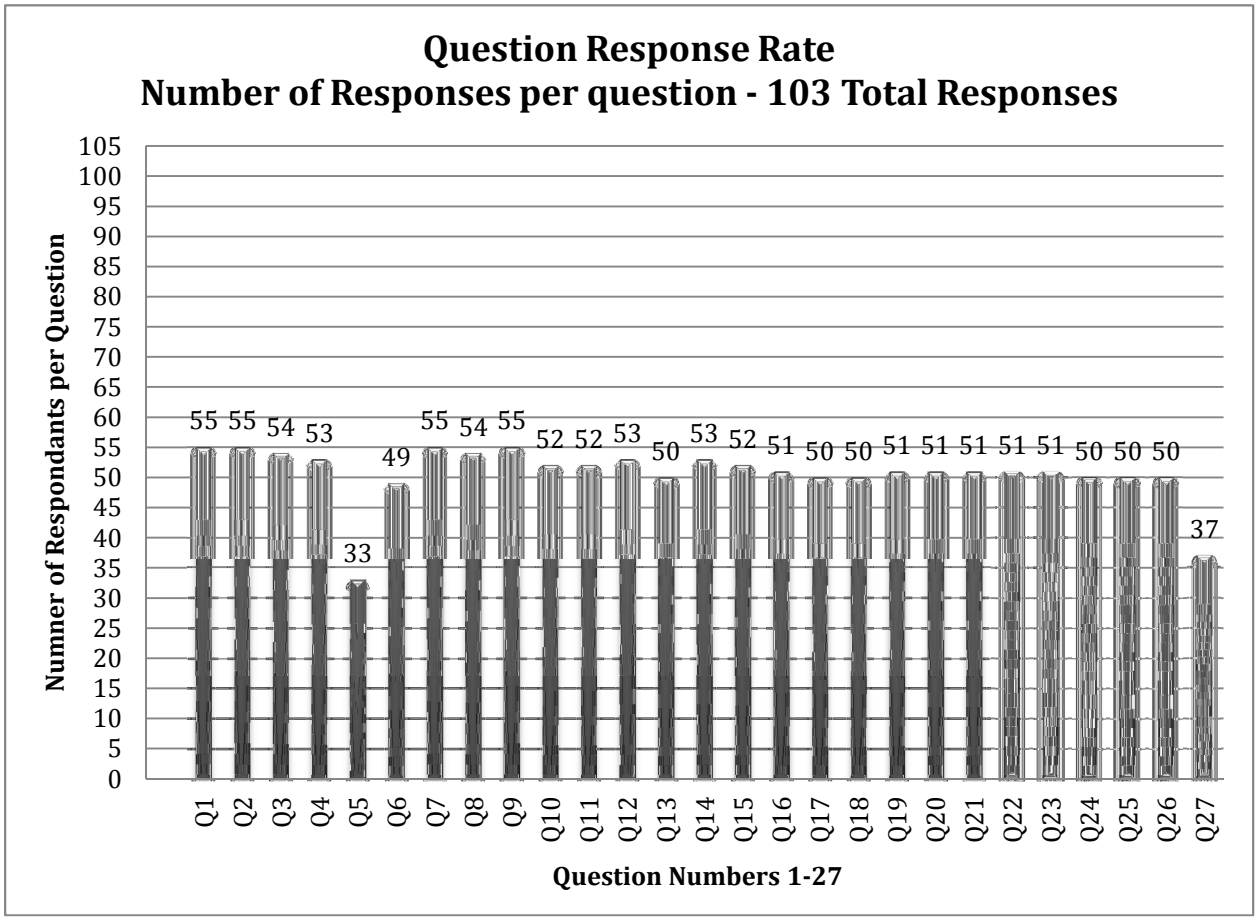


Figure 3: Question Response Rate

The table on the previous page displays the total responses per question within the survey. Of the 5,000 surveys distributed via email through Qualtrics, 103 responses were recorded. Of those 103 recorded responses, 55 usable surveys were submitted and subsequently analyzed. The total responses per question in the graph above include "not applicable" responses; questions 2, 3, 7 and 8 contained an option to select "not applicable" as an answer choice.

Each question contains a graph, table and/or illustration explaining the results of the survey question. The variable *N* is used to indicate the total number of responses

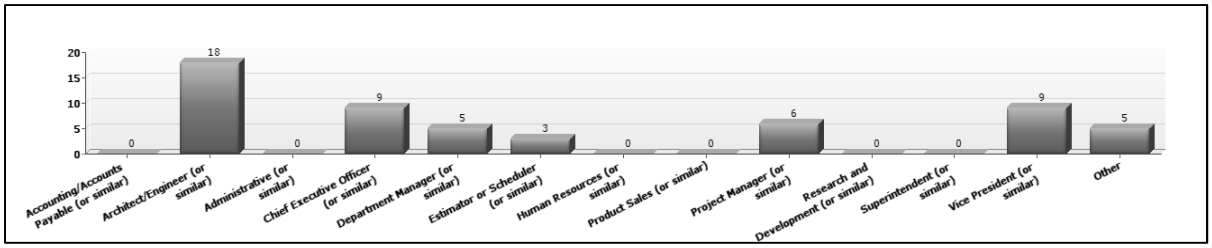
received for each question. The response to each question is delineated in the subsequent section below.

Responses to Questions

See Survey in Appendix to view the survey in its entirety. The results of each question are shown below with ensuing results. Analysis of each question's responses can be found in Chapter 5: Analysis.

Question #1: "What is your role within the company?"

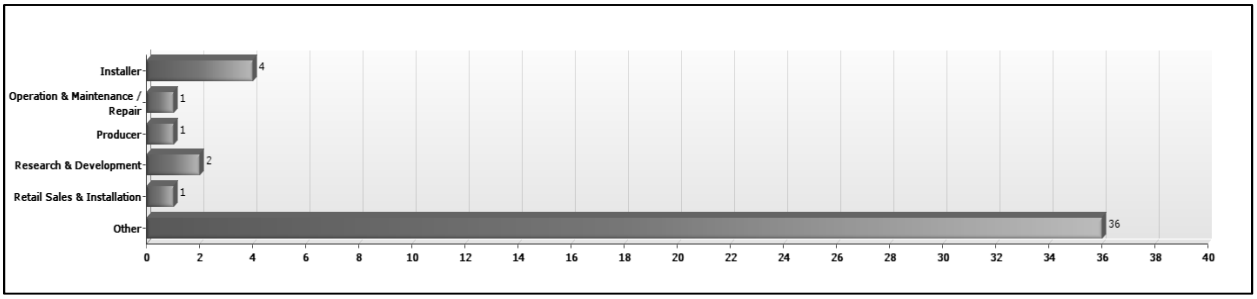
Table 1, N=55.



The responses to question 1 are shown in Table 1 above. Survey participants were given the option to select "Other" as a role, and then fill in the blank; Director, Principal, Architect/Principal, Principal and Director of Sustainability were filled in by survey participants. Over half of the respondents were architects, engineers, or vice presidents.

Question #2: "What is your company's primary role in the alternative energy market?*"*

Table 2, N=45.

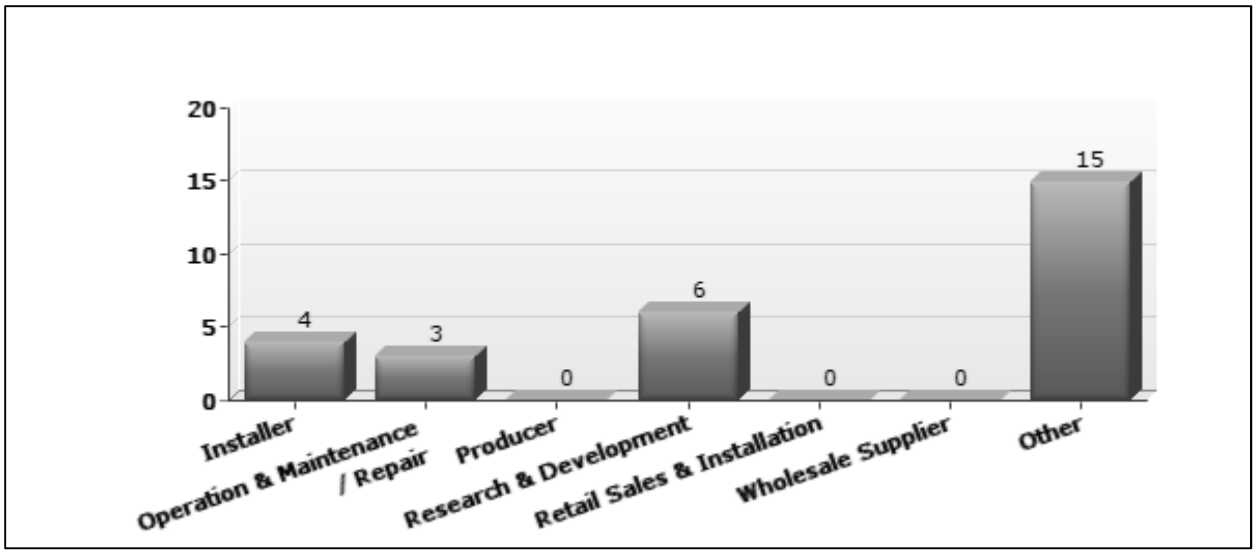


The responses to question 2 are shown in Table 2 above. Survey participants were given the option to select "Other" as a role, and then fill in the blank; responses to "Other" included architect, consultant, engineer, design, general contractor, landscape architect, Design/Engineering manager, Gas & Oil, owner's representative, permitting, existing solutions and specifier. It should be noted that the majority of respondents selected "Other"

as their company's role within alternative energy. Those who chose "other" identified their company's primary role in alternative energy as specifier, designer, engineer, architect, consultant, and permitting.

Question #3: "What are your company's secondary roles in the alternative energy market?"

Table 3, N=54.



The responses to question 3 are shown in Table 3 above. Survey participants were given the option to select "Other" as a secondary role, and then fill in the blank; responses to "other" included advocate for energy efficiency, architect, construction manager, consulting architecture firm, designer, educator, landscape architect and planner, other, owner's representative, planner, and specifier. It should be noted that more than half of the respondents selected other as their secondary role within alternative energy.

Question #4: "What alternative energy system(s) is/are your company's focus?"

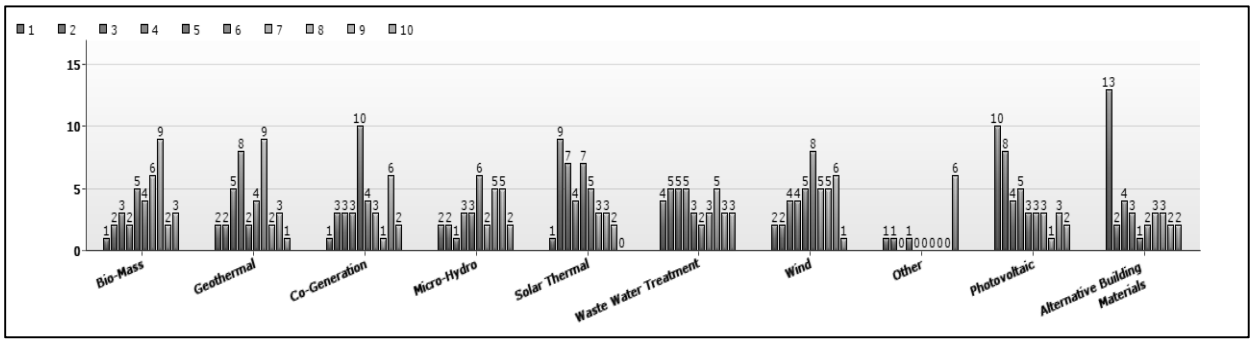


Figure 4, N=53.

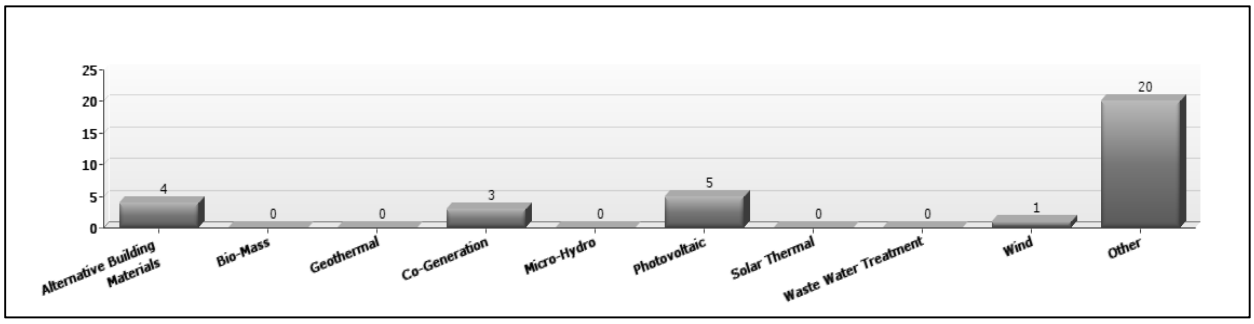
Table 4, N=53.

#	Answer	1	2	3	4	5	6	7	8	9	10	Total Responses
1	Bio-Mass	1	2	3	2	5	4	6	9	2	3	37
2	Geothermal	2	2	5	8	2	4	9	2	3	1	38
3	Co-Generation	1	3	3	3	10	4	3	1	6	2	36
4	Micro-Hydro	2	2	1	3	3	6	2	5	5	2	31
5	Solar Thermal	1	9	7	4	7	5	3	3	2	0	41
6	Waste Water Treatment	4	5	5	5	3	2	3	5	3	3	38
7	Wind	2	2	4	4	5	8	5	5	6	1	42
8	Other	1	1	0	1	0	0	0	0	0	6	9
9	Photovoltaic	10	8	4	5	3	3	3	1	3	2	42
10	Alternative Building Materials	13	2	4	3	1	2	3	3	2	2	35
	Total	37	36	36	38	39	38	37	34	32	22	'-

The responses to question 4 are shown in Table 4 and Figure 3 on the previous page. Survey participants were given the option to select "Other" as a secondary role, and then fill in the blank; responses to "other" included intelligent power inverters, water conservation, and small-hydro. It should be noted that alternative building materials, photovoltaic, and co-generation received the highest rankings.

Question #5: "If alternative energy implementation is the primary source of revenue generation within your business, will you diversify?"

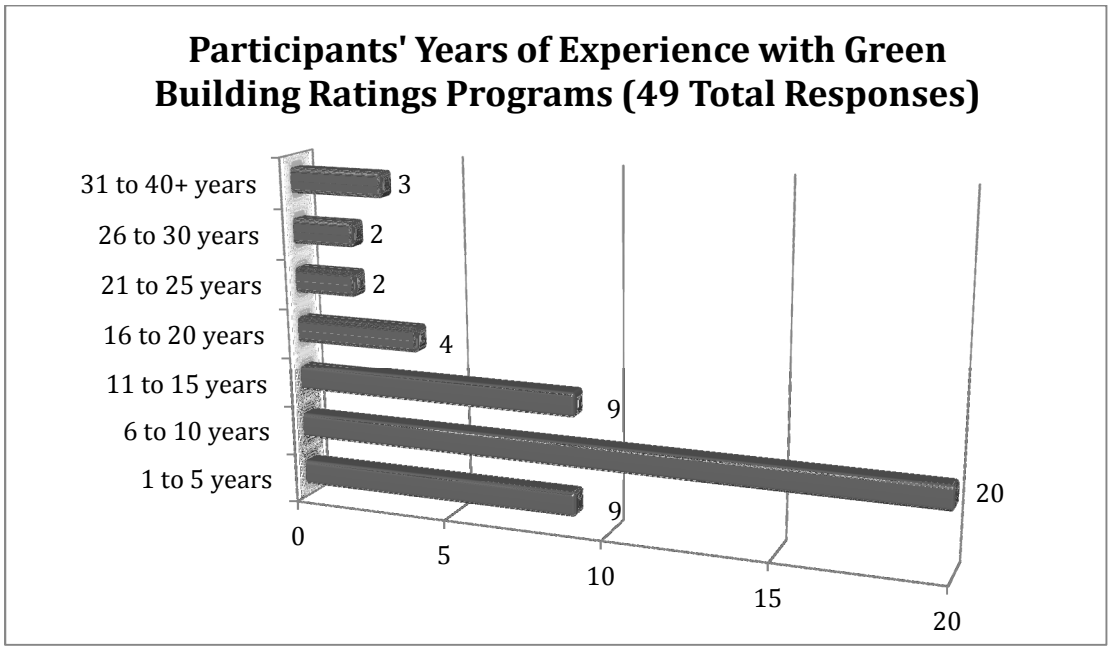
Table 5, N=33.



The responses to question 5 are shown in Table 5. Survey participants were given the option to select "Other" as a means of energy diversification, and then fill in the blank; the overwhelming response to "other" was "not applicable." While most of the respondents entered "not applicable" as a their means to diversify, a minority of respondents selected photovoltaic, alternative building materials, co-generation and wind as alternative energy implementation strategies within their companies.

Question #6: How long has your company been focused on alternative energy products and services?"

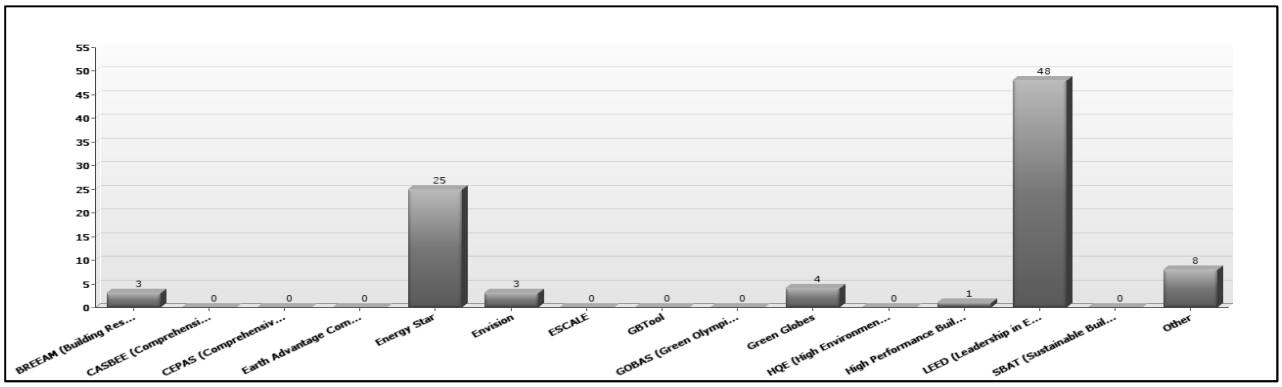
Table 6, N=49.



The responses to question 6 are shown above in Table 6. A majority of the respondents' companies have been focused on alternative energy for between one and fifteen years.

Question #7: "Has your business worked on projects that will or have been certified by a "green" rating program?"

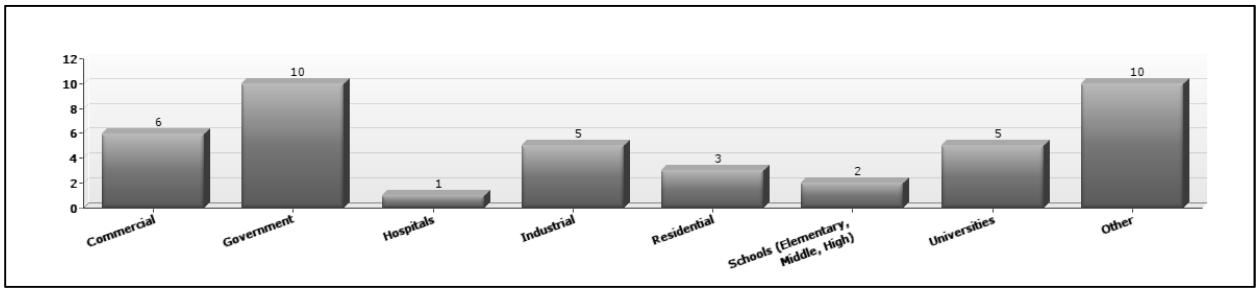
Table 7, N=55.



The responses to question 7 are shown above in Table 7. Most respondents chose LEED, Energy Star, Green Globes, or Other as the green building rating program they are most familiar with. Survey participants were given the option to select "Other" as a green rating program; responses to "other" included tax credits, Masdar, Green Points, Enterprise Green Communities, and Estimada (UAE).

Question #8: "Has your business bid on projects that will be certified by a "green" rating program?"

Table 8, N=54.

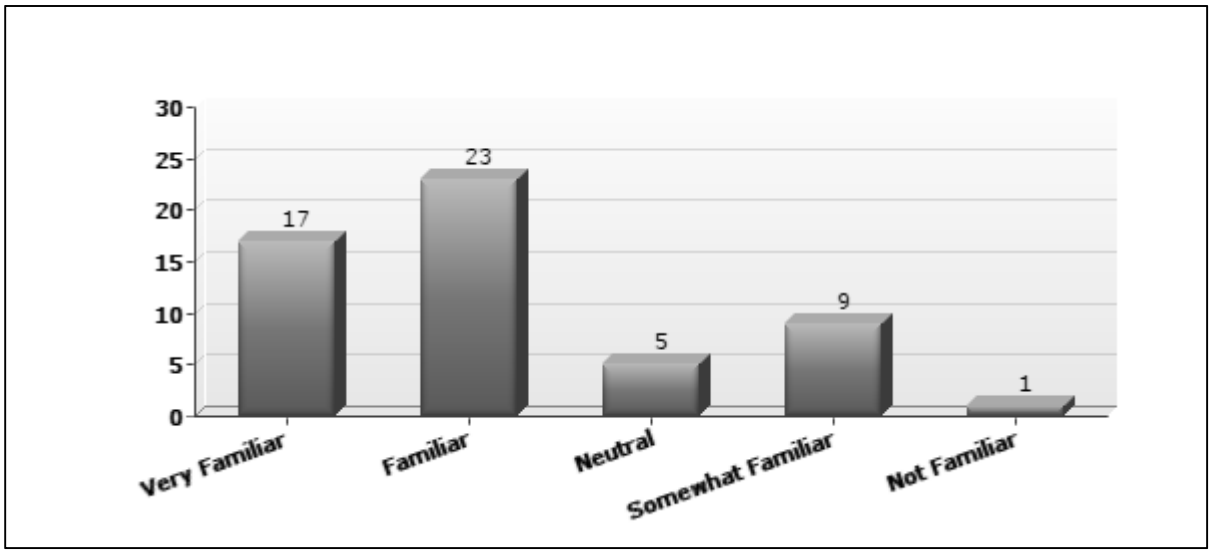


The responses to question 8 are shown above in Table 8. The majority of respondents' companies have bid on Government, Commercial, Industrial and University

projects with green building certification requirements. It should be noted that the most common response within the "Other" category was "all of the above," indicating that respondents' companies bid on multiple types of projects.

Question #9: "What is your familiarity with "green" ratings programs?"

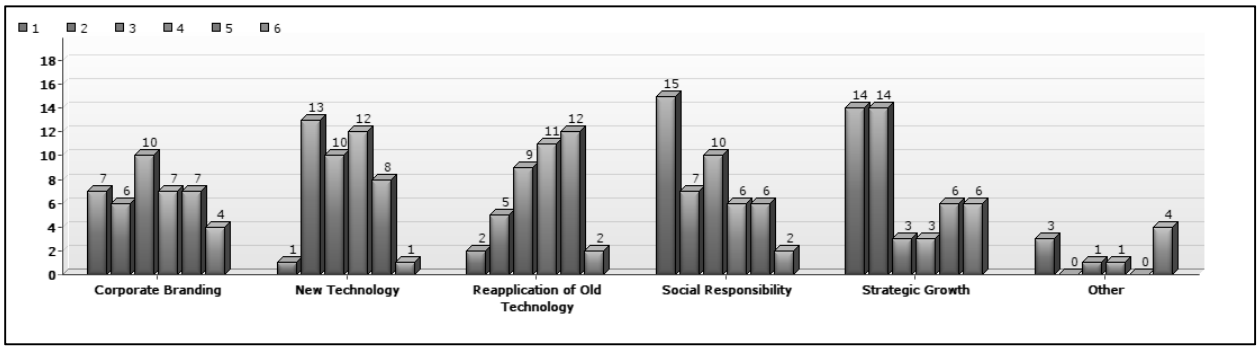
Table 9, N=55.



The responses to question 9 are shown above in Table 9. A majority of the respondents consider themselves to be Very Familiar and Familiar with green ratings programs. A smaller portion of the respondents consider themselves Neutral, Somewhat Familiar, or Not Familiar.

Question #10: "What were the reasons for developing your alternative energy business?"

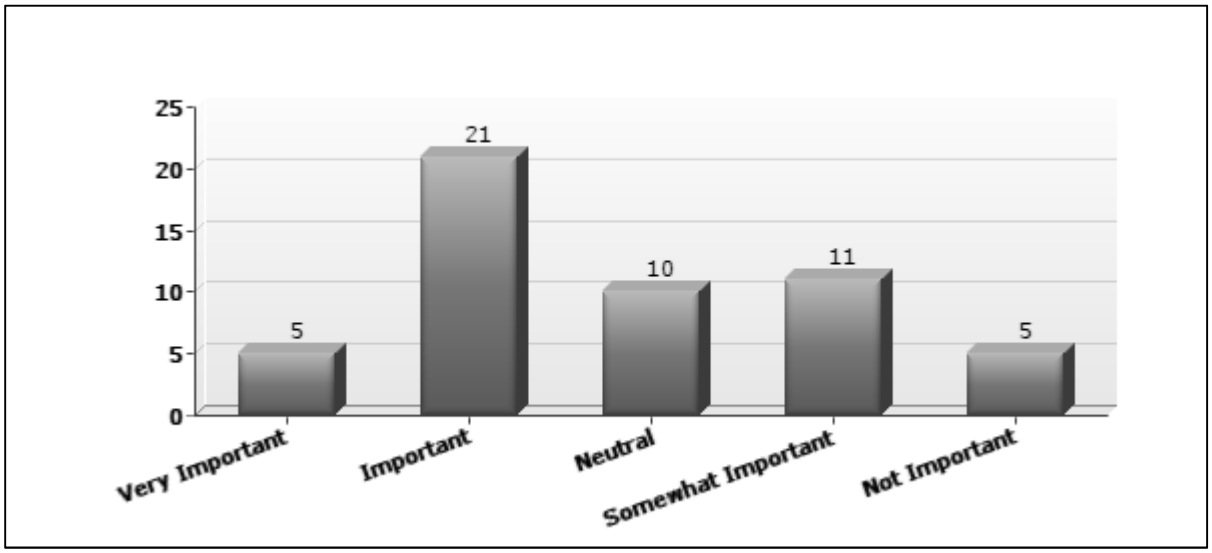
Table 10, N=52.



The responses to question 10 are shown above in Table 10. The two most prevalent reasons for respondents' companies to develop their alternative energy businesses were Social Responsibility and Strategic Growth. Within the Other category, reasons for developing an alternative energy aspect within a business were Client and Code Requirement, Improved Architects, Client Demands and Client Goals.

Question #11: "How important is research in alternative energy to your business?"

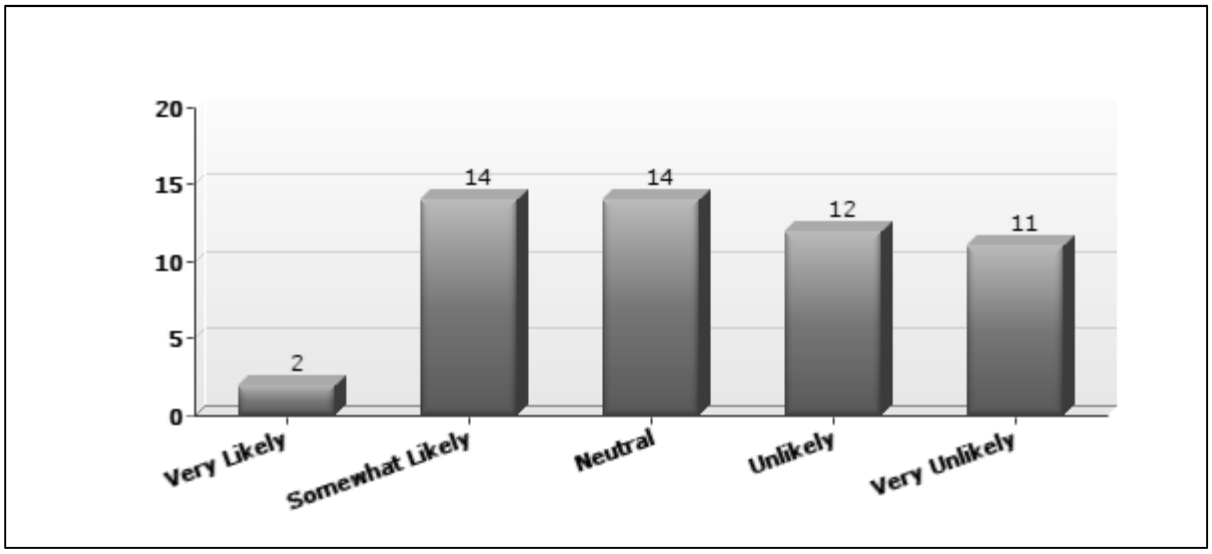
Table 11, N=52.



The responses to question 11 are shown above in Table 11. The distribution across this response suggests that half of the respondents consider research in alternative energy to be Very Important or Important; meanwhile, the other half of respondents consider research in alternative energy to be Neutral, Somewhat Important or Not Important.

Question #12: "How likely is your company to spend money on the research and development of alternative energy products if government subsidies were provided?"

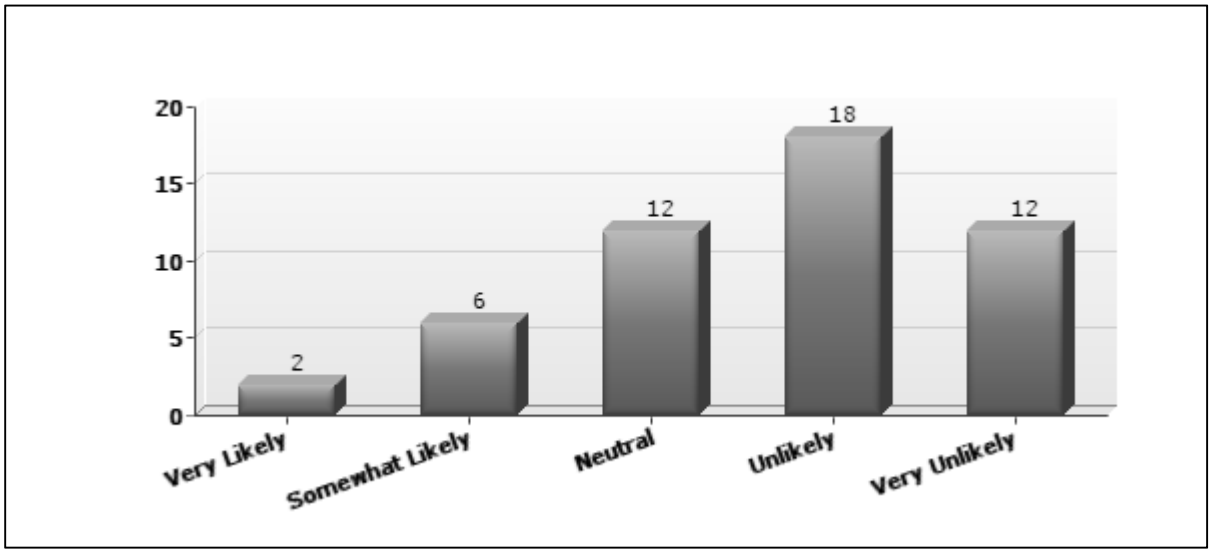
Table 12, N=53.



The responses to question 12 are shown above in Table 12. The overwhelming response to this question is no, respondents' companies are not likely to spend money on R&D of alternative energy products if government subsidies were provided. Conversely, two respondents indicate it Very Likely that their company would spend money on research and development of alternative energy products if government subsidies were provided.

Question #13: "If government subsidies were not provided, how likely would your company be to spend money on the research and development of alternative energy products?"

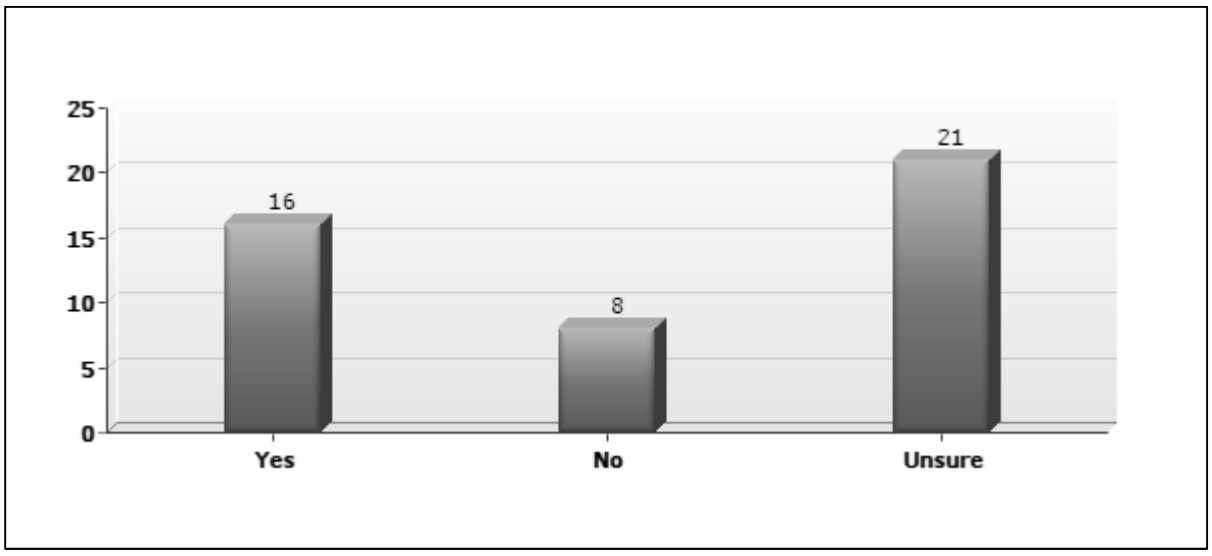
Table 13, N=50.



The responses to question 13 are shown above in Table 13. The overwhelming response to this question is no, respondents' companies are not likely to spend money on research and development of alternative energy products if government subsidies were not provided. Conversely, two respondents indicate it Very Likely that their company would spend money on research and development of alternative energy products even if government subsidies were not provided.

Question #14: "Has your company seen a reduction in alternative energy market activity as global subsidies decline?"

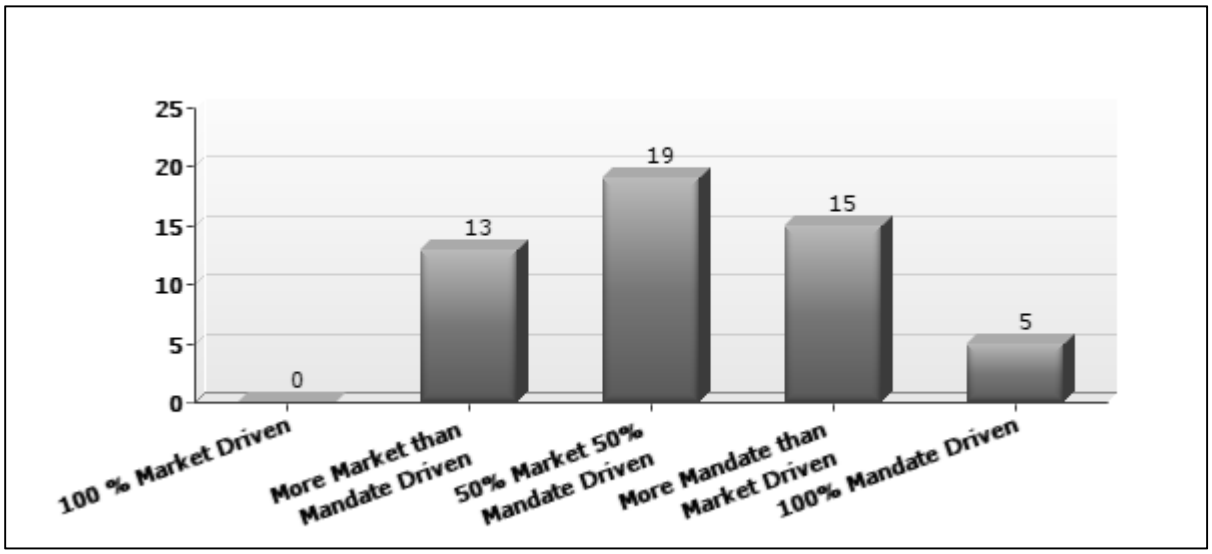
Table 14, N=53.



The responses to question 14 are shown above in Table 14. The respondents' responses indicate that there has been a clear reduction in alternative energy market activity with the decline of global subsidies.

Question #15: "In your opinion, where do you perceive the driving force of alternative energy /sales acceptance to be?"

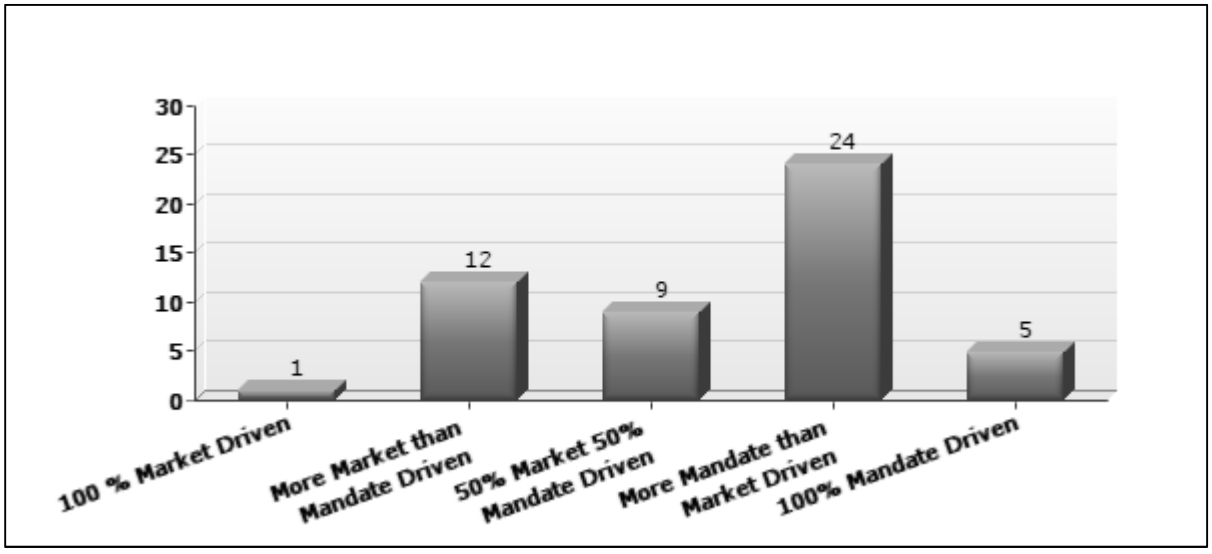
Table 15, N=52.



The responses to question 15 are shown above in Table 15. Respondents' answers indicate that the driving force of alternative energy is mostly mandate driven. None of the respondents indicate the driving force of alternative energy to be market driven.

Question #16: "What does industry perceive as the driving force of alternative energy in the current market?"

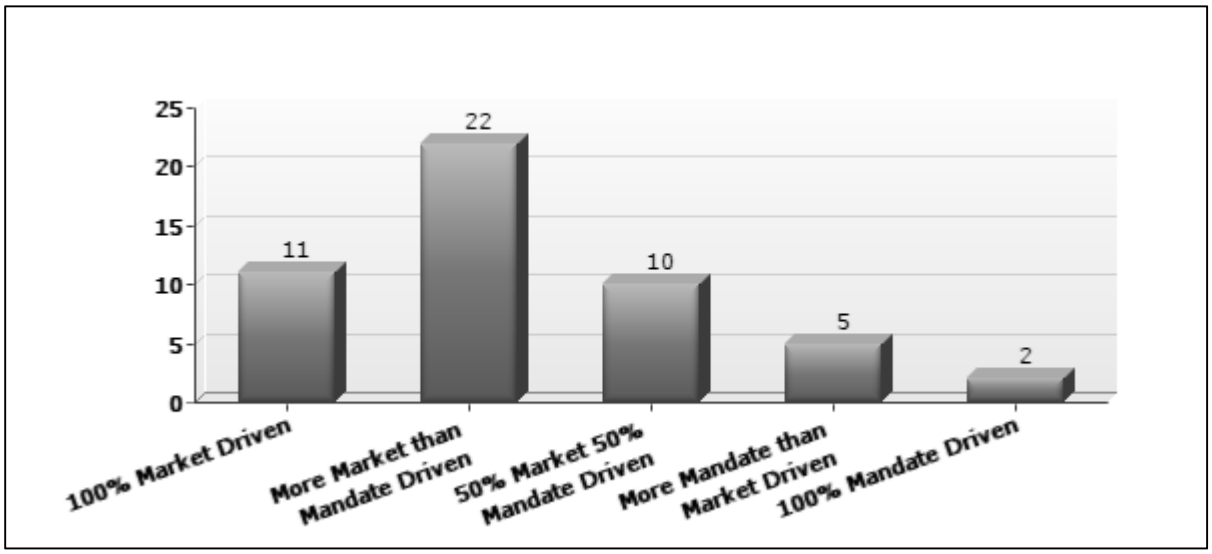
Table 16, N=51.



The responses to question 16 are shown above in Table 16. Respondents' answers suggest that the perceived driving force of alternative energy in the current market is more mandate than market.

Question #17: To ensure long term adaptation of alternative energy, where does the driving force of development need to be?

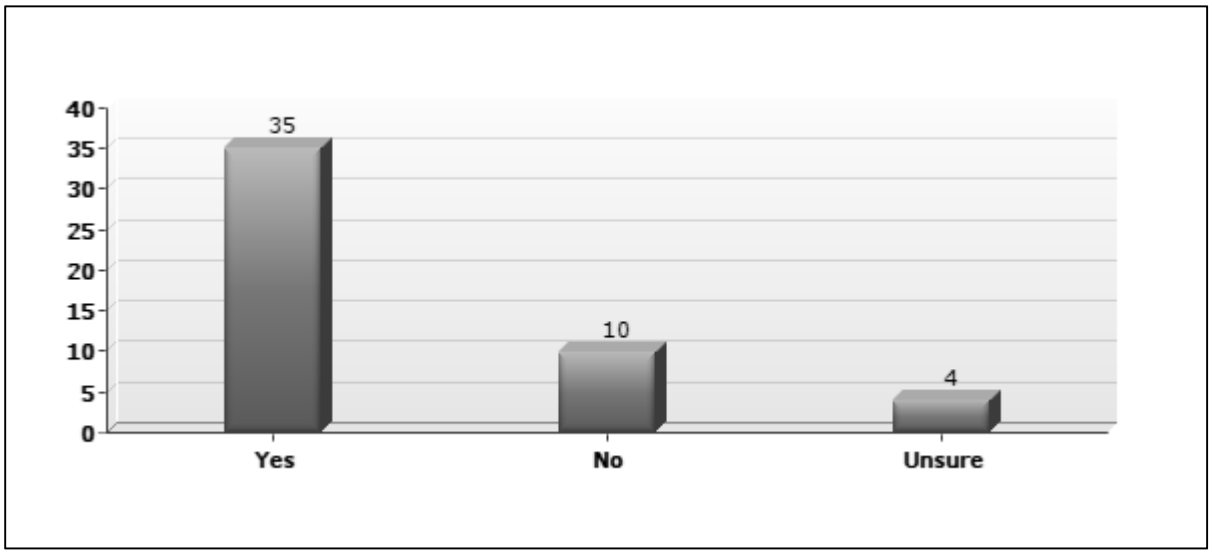
Table 17, N=50.



The responses to question 17 are shown above in Table 17. Respondents' answers indicate that alternative energy adaptation must be driven by more market need than mandate requirement.

Question #18: "Has a customer/client ever approached your business requesting information about how to reduce their carbon footprint?"

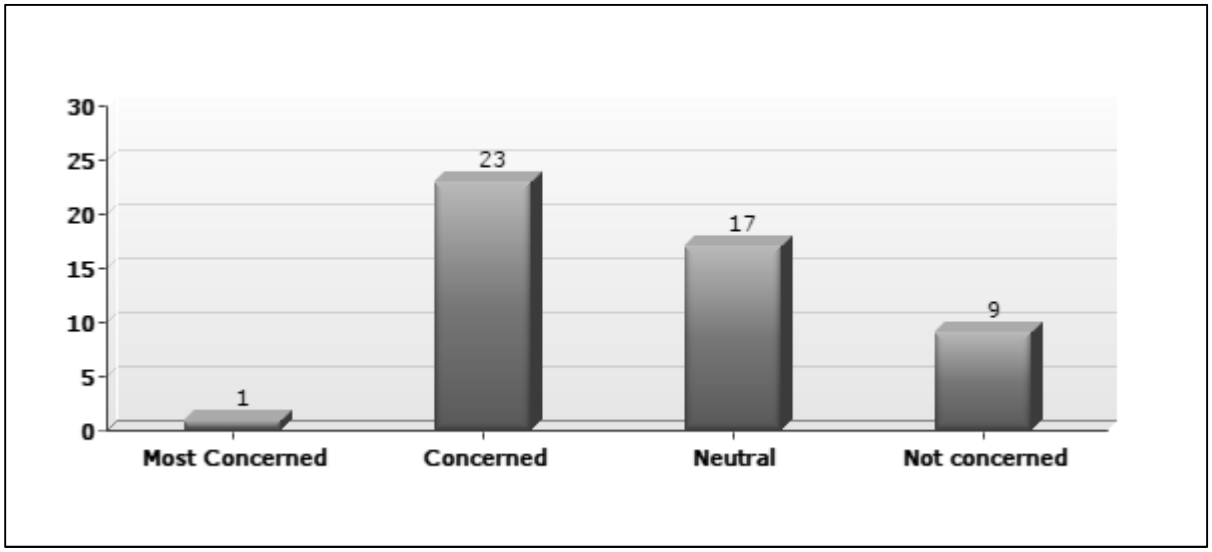
Table 18, N=50.



The responses to question 18 are shown above in Table 18. A majority of respondents have been approached by a client requesting information about how to reduce their carbon footprint.

Question #19: "How concerned are most of your clients about the reduction of their carbon footprint?"

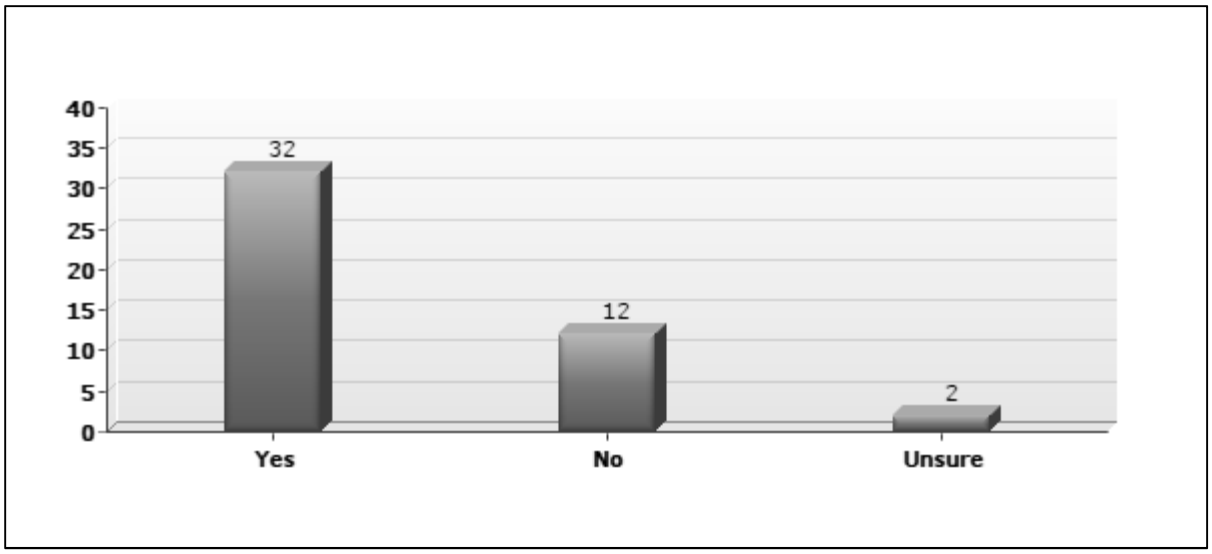
Table 19, N=51.



The responses to question 19 are shown above in Table 19. The data suggest that half of respondents' clients are concerned about reducing their footprint, while half are Neutral or Not Concerned at all.

Question #20: "Do you provide life cycle costs for products or services which you offer?"

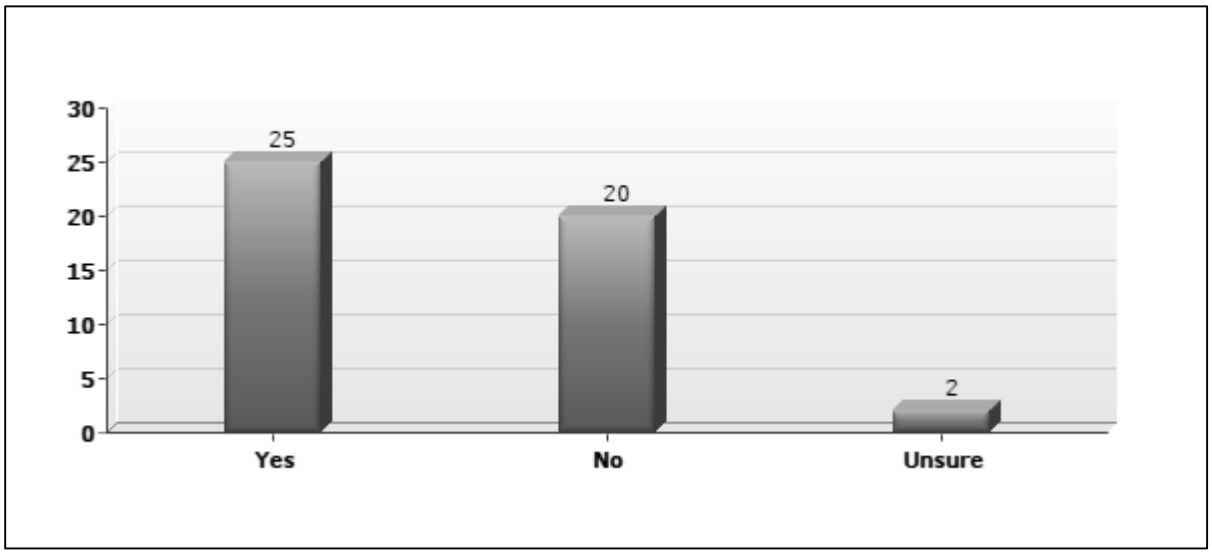
Table 20, N=51.



The responses to question 20 are shown above in Table 20. A majority of respondents indicate that respondents' companies do offer life cycle costs for their products and services.

Question #21: "Do you provide life cycle assessment services (environmental impact reports) for products or services which you offer?"

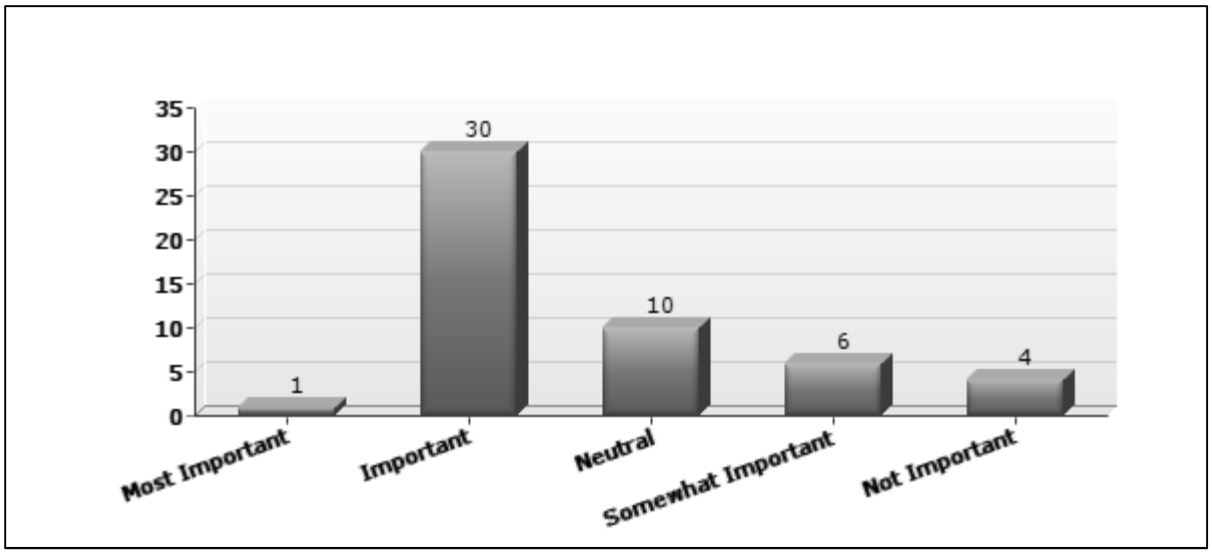
Table 21, N=51.



The responses to question 21 are shown above in Table 21. A majority of respondents indicate that respondents' companies do offer life cycle assessments for their products and services.

Question #22: "How important to your company is the reduction of your carbon footprint?"

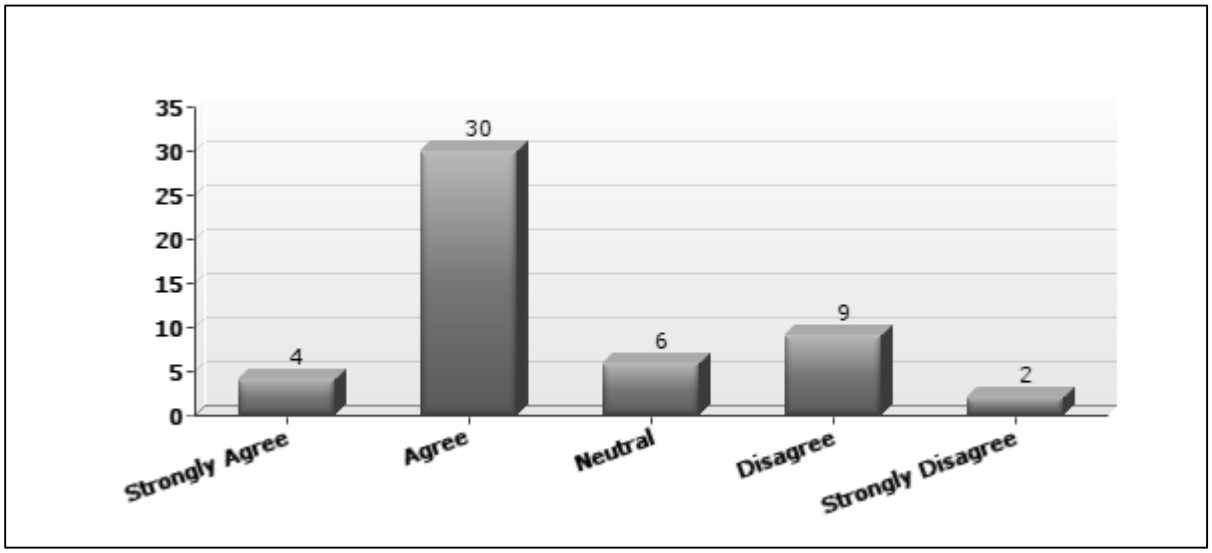
Table 22, N=51.



The responses to question 22 are shown above in Table 22. A majority of respondents indicate that respondents' companies find it important to reduce their carbon footprint.

Question #23: "Alternative energy development and implementation would continue even without the influence of green building ratings programs such as LEED, Green Globes, etc."

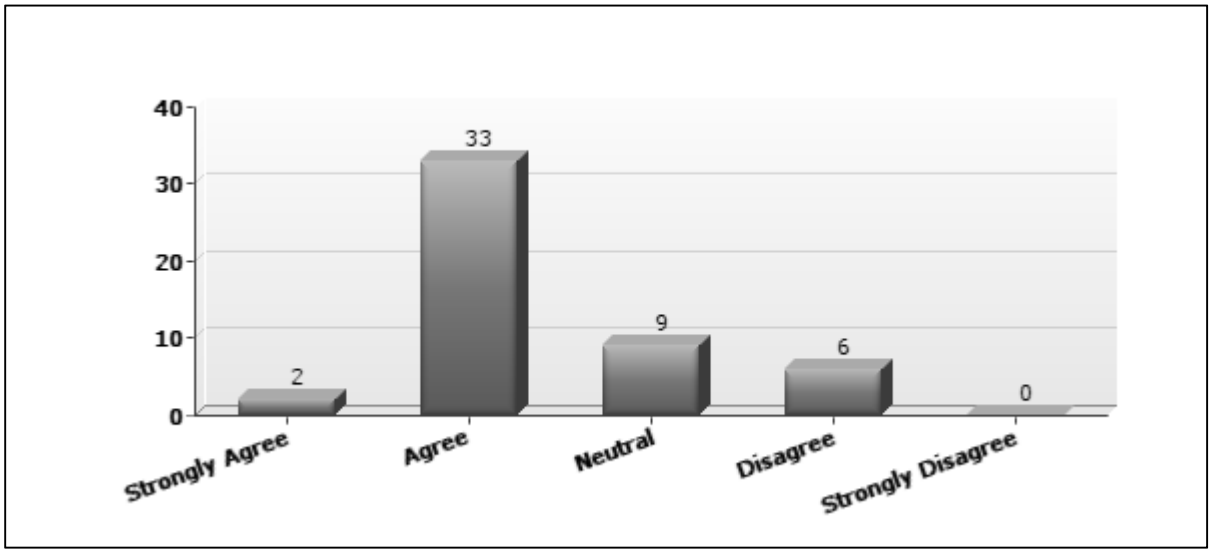
Table 23, N=51.



The responses to question/statement 23 are shown above in Table 23. A majority of respondents agree that alternative energy development and implementation would continue even without the influence of green building ratings programs such as LEED, Green Globes, etc.

Question #24: "If there were not government subsidies or incentives for alternative energy implementation, your company would continue to provide alternative energy goods and services."

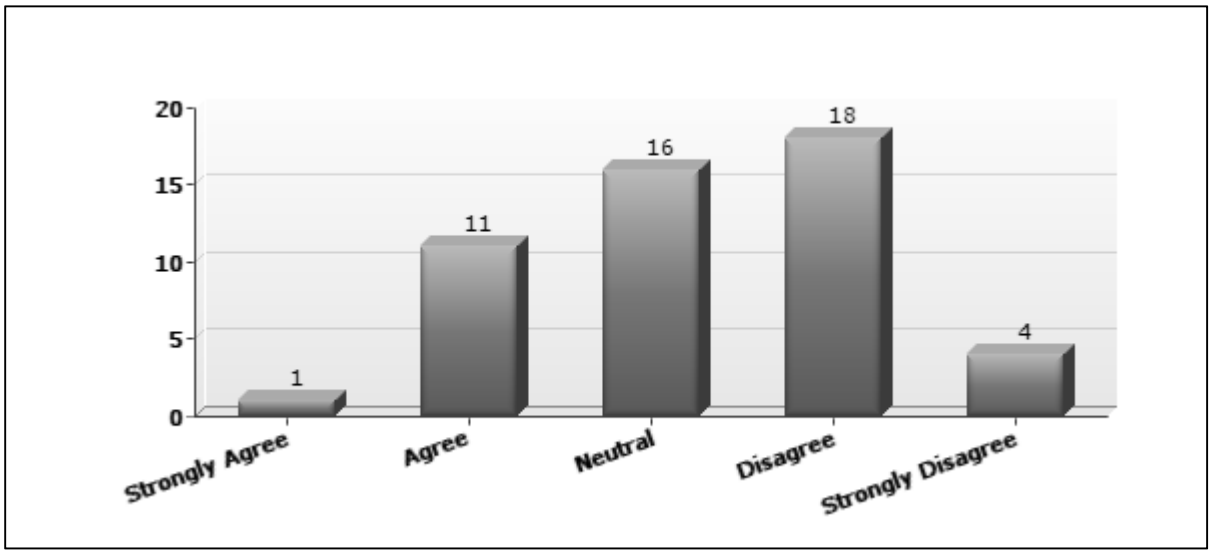
Table 24, N=50.



The responses to question/statement 24 are shown above in Table 24. The overwhelming majority of respondents indicate that their companies would continue to provide alternative energy goods and services, even if there were no government subsidies available.

Question #25: "Green rating programs accurately represent the true value of alternative energy use in sustainable construction."

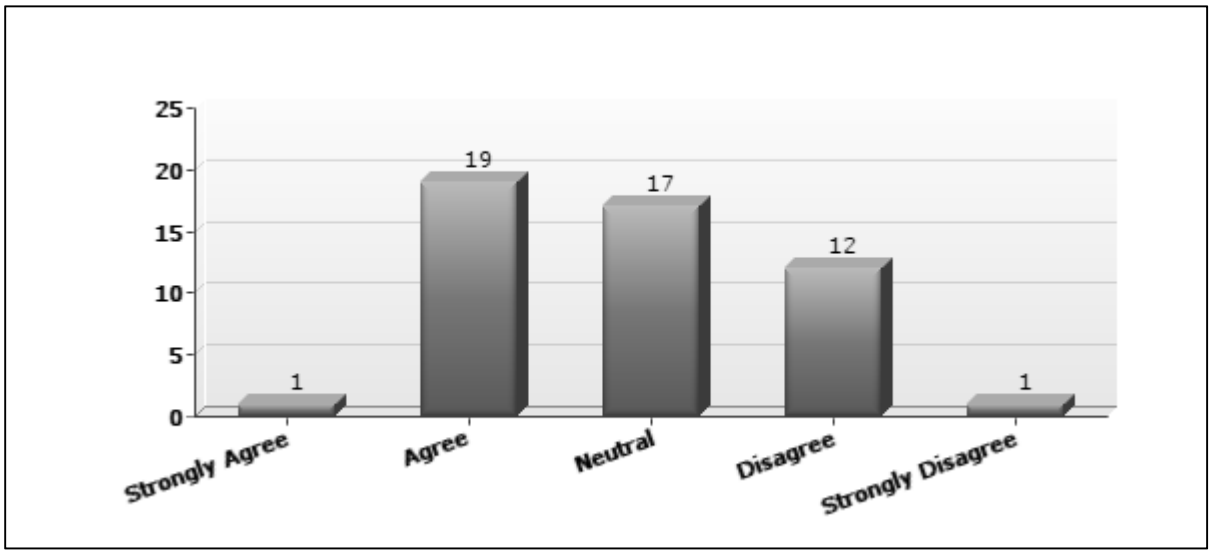
Table 25, N=50.



The responses to question/statement 25 are shown above in Table 25. The overwhelming majority of respondents indicate that green rating programs do not accurately represent the true value of alternative energy use in sustainable construction.

Question #26: "There is an adequate craft labor force available to support alternative energy work."

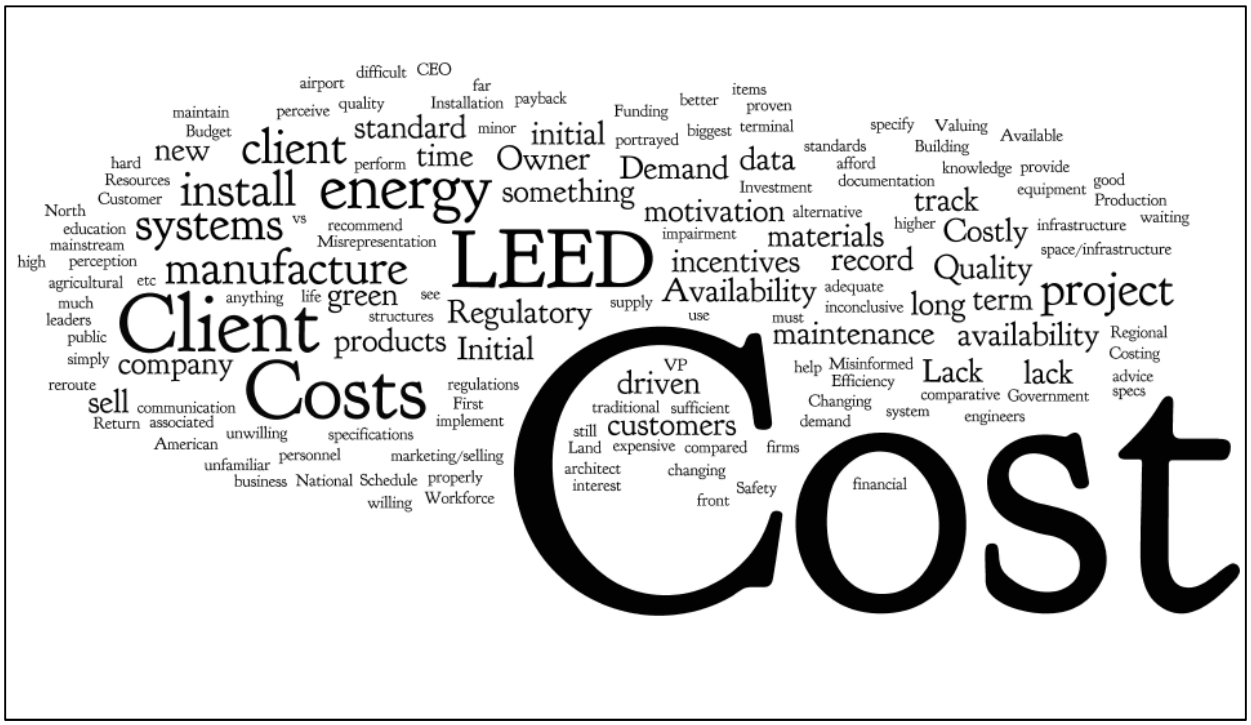
Table 26, N=50.



The responses to question/statement 26 are shown above in Table 26. A majority of respondents are neutral to, or disagree that there is not an adequate craft labor force available to support alternative energy work.

Question #27: "Please list the three (3) most critical factors which impair your ability to sell, manufacture, and/or install alternative energy goods or services."

Table 27, N=37. (Feinberg 2013)



The verbal responses to question 27 are combined above in Figure 2. This graphic was created using Wordle. The online software Wordle generates a visual word graphic (as seen above) by counting the frequency of words used within a selection of words (a paragraph or a page of text). The more frequently a word is used, the larger it is displayed among other words accounted for. The overwhelming obstacle to selling, manufacturing and/or installing alternative energy goods or services was cost, as reported by respondents.

For the analysis purposes of this survey response (found in Chapter 5: Analysis of results),the responses to each question (see Figure 3 below) were evaluated using Textalyser (2004) text analysis tool. Textalyser text analysis tool performs word counts

and summarizes the results in a series of tables which are easy for the researcher to understand and use for research purposes.

Issue 1	Issue 2	Issue 3
Understanding payback	Valuing social benefits	Available funding
Cost	Installation Time	Warranty
Cost	Quality	Schedule
not cost effective	no proven track record	maintenance issues
Misrepresentation of LEED	Non communication of LEED personnel	LEED is too costly
Cost - there are still cheaper alternatives out there utilizing standard energy	Clients don't see the importance of "being green". It simply adds cost to the manufacture of their products	The objectivity of engineers. It is hard to recommend the use of alternative energy when the return on investment is higher than standard technologies
Return on Investment is not as good as it should be.	Changing Technology has customers waiting for something better	Costs are too high.
initial Costs		
there is no LEED rating for agricultural structures	length of time to recoup costs	lack of financial incentives
Cost and budget limitations	Client has different priorities	Regulatory barriers
availability of comparative data	changing product specifications	
Cost of materials	Documentation associated with green (LEED)	
Cost of goods and services	Government interference they perceive is help	
Misinformed and uninformed clients, who receive almost no quality information from mainstream media.	National leaders unwilling implement data driven, long term changes to the national infrastructure and energy / water policy.	The perception that it is to costly - compared to traditional energy that is subsidized while being portrayed as 'market driven'

Issue 1	Issue 2	Issue 3
Client Interest	Client Capability to maintain properly	Initial costs to client
we do sell, manufacture or install. We design. Cost is the impediment		
Consumer interest	Market demand	Incentives
Up front cost to owner of project - as incentives decline less able to afford to install - cost is by far the biggest impairment, the below 2 are minor	Lack of adequate space/infrastructure for systems on project	Owner unfamiliar with system - uncomfortable trying something new
cost, implementation	motivation, client	cost, marketing/selling
I am an architect, I specify these items I don't create or supply them		
Commoditization of the business		
Budget	Building / Land Owner Wishes	Aesthetics
Initial cost	Lack of clear standards for airport terminal buildings	Availability of equipment and materials
Client motivation	Funding	Resources
First cost of products, systems, etc.	Pay-back = life cycle costing	Proven technology & track record
initial cost	lack of public education	it's not the norm, seems difficult
Cost	availability	client knowledge
Cost	Availability	Quality
Customer must be willing to absorb the added cost		
Cost	Production time	Reliability of the new solution
My company	North American CEO	Regional VP
to expensive	unproven systems	too much maintenance
Costs, firms just don't want to spend the extra money unless it's mandate or they can reroute the cost to their customers	Workforce is sufficient to perform the specialty work	long term results are inconclusive

Issue 1	Issue 2	Issue 3
Governmental regulations	Cost vs Benefit	Safety
Our company don't sell, manufacture or install anything, we are owner's representatives and only provide advice		
Regulatory Demand	Client Demand	Cost Efficiency
Not included in project specs	Cost	documentation

Figure 5, Factor 1-3 Responses.

CHAPTER 5: ANALYSIS OF RESULTS

Analysis of Each Question

Each question has been broken out individually for analysis. The analysis methodology used for this data set is descriptive statistics followed by an interpretation of the results. Descriptive statistics are defined as "descriptive analysis of data for all independent and dependent variables in the study". Interpretation of the results is defined as "the researcher draws conclusions from the results for the research questions, hypotheses, and the larger meaning of the results" (Creswell 2009).

Question #1: “What is your role within the company?”

The results of question #1 suggest that the survey participants’ roles within their companies vary greatly. A broad spectrum of roles are recorded as occupied positions within companies. However, as noted within Chapter 4: Results, out of 55 total respondents, 47 fell into categories considered to be high-level positions: Architect/engineer, Chief Executive Officer, Department Manager, Project Manager, and Vice President. 5 individuals selected other, and self-identified as Director, Principal, and Architect. These results suggest that out of 55 respondents to question #1, 53 hold high-level positions. Based on this it is assumed that the perspectives gained throughout the survey are that of managerial positions; a similar survey conducted of subordinates to these positions may yield different results. The data further suggests that the contacts extracted from the database, LEAD 411, consist of high-level positions, such as CEO, VP, etc., and may only represent such. Other options in future survey research would be to re-distribute the survey to non-management personnel or other project partners (e.g. financiers, owners, property management companies).

Question #2: “What is your company’s primary role in the alternative energy market?”

Respondents’ selections are indicative of prevalent roles in the current alternative energy market. While a small number of respondents selected Installer (4), Operation & Maintenance (1), Producer (1), Research & Development (R&D) (2), and Retail Sales & Installation (1), the majority of respondents selected Other (36). The “other” category was composed of the following responses, as depicted in the Wordle (word pattern software) below (Figure 4).

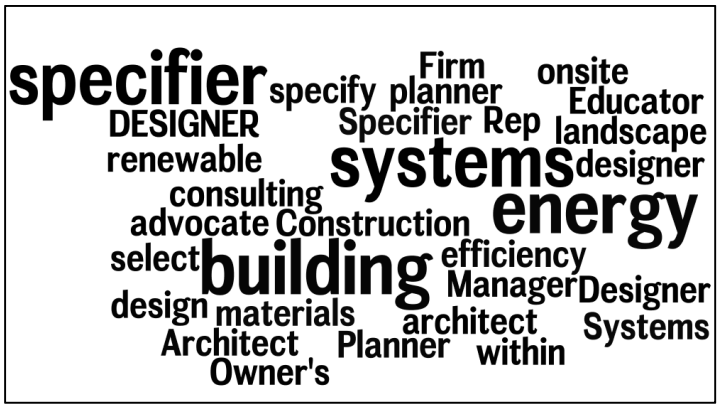


Figure 6. Question #2 Response Wordle (Feinberg 2013)

The response pool is further indicative of role-specific interest in a survey on green building rating programs. Since a majority of the respondents indicated that their businesses fall within Architecture, Consulting, Engineering, and Specifying, it can be reasoned that there is a significant interest in green building and green building ratings programs among these businesses. By extension, businesses whose main function falls within architecture, consulting, engineering and/or specifying must design buildings,

roadways, etc. to the demands of a client; in the current market, there is a demand for buildings which meet or exceed certain green building ratings programs. Thus, the response pool most likely has a vested interest in green building ratings programs.

Question #3: "What are your company's secondary roles in the alternative energy market?"

Respondents' selection of secondary roles within the alternative energy market suggest that there is little diversification within businesses involved with alternative energy. The responses to question #3 are similar to question #2, which asked survey participants to identify their primary role within the alternative energy market. The results suggest that companies which install alternative energy products may also perform operation and maintenance upkeep; the results further suggest that companies whose first role is to produce or install secondarily perform some degree of R&D in alternative energy.

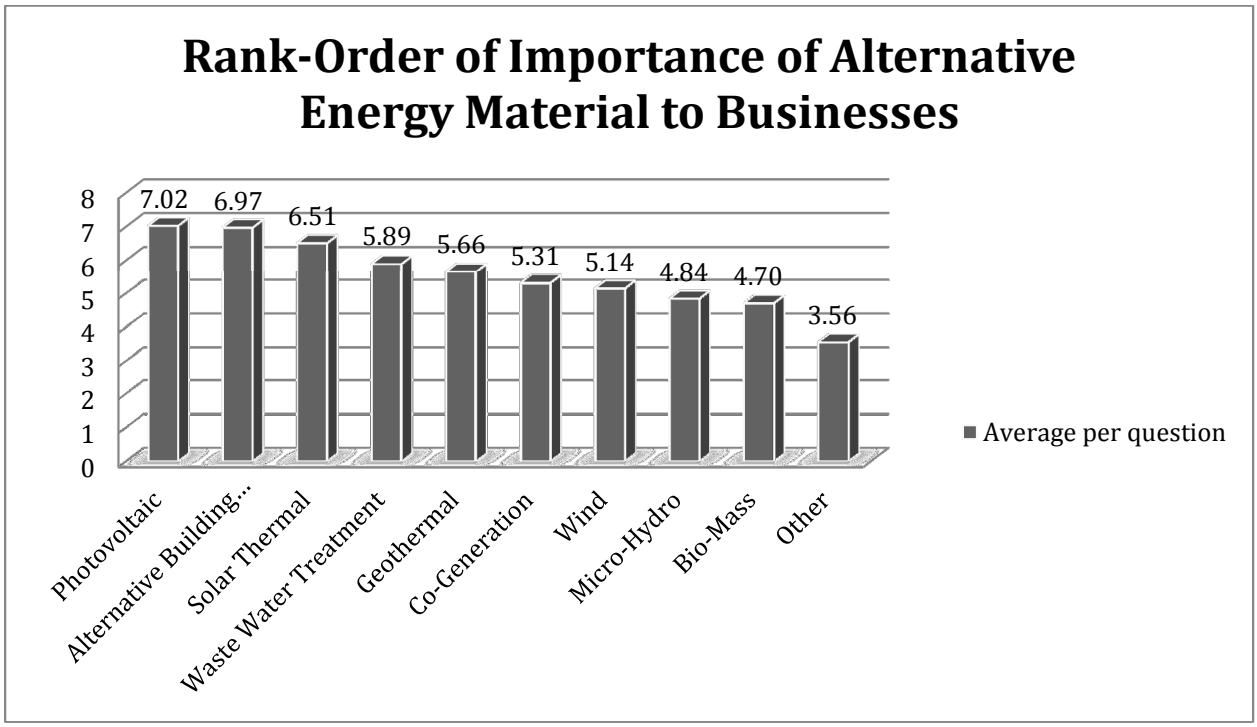
Out of 54 responses to question #3, Installer (4), Operation & Maintenance (3), and Research & Development (6) were selected for a total of 13 responses. Additionally, the Other (15) category was comprised of architect, construction manager, designer, educator, planner, and specifier. Furthermore, 26 individual selected "not applicable" as a response to secondary roles in alternative energy, suggesting that nearly half of respondents do not identify with a secondary role in the AE field.

Question #4: "What alternative energy system(s) is/are your company's focus?"

Table 28, Question 4 Rank Order

Rank Order Breakout 1-most to 10-least important	
Photovoltaic	1
Solar Thermal	3
Waste Water Treatment	4
Geothermal	5
Co-Generation	6
Wind	7
Micro-Hydro	8
Bio-Mass	9
Other	10

Table 29, Question 4 Rank Order Graph



Survey participants were asked to rank 10 different alternative energy foci on a scale of 1-10, with 1 having the most focus and 10 having the least focus within their

companies. The results suggest that alternative building materials (13) and photovoltaics (10) lead the industry with the most number 1 ranks within the survey results. Alternative building materials and photovoltaics receive the most government subsidies per year (Myers 2014) and are the most popular means of gaining certification points within systems such as LEED and Green Globes (Myers 2014). LEED points to be gained from the incorporation of photovoltaics in new construction or renovation of an existing building can be as high as 33, out of 110 possible (USGBC 2012). Within Green Globes, the incorporation of photovoltaics into energy efficient HVAC and lighting systems can achieve up to 390 points, out of 1,000 possible points (Green Globes 2014).

Question #5: "If alternative energy implementation is the primary source of revenue generation within your business, will you diversify?"

Survey participants were asked if their companies would potentially diversity from the product they currently manufacture, design, sell or install. A minority of respondents replied in the positive, that their company would most likely diversity into other alternative energy products than those currently used. Not surprisingly, alternative building materials (4), co-generation (3), photovoltaic (5) and wind (1) received the most votes as potential fields to expand into. Alternative building materials and photovoltaics are the two most commonly implemented "alternative" building trends in the United States; according to the Solar Energy Industries Association, 4,751 megawatts of photovoltaic panels were installed in the United States in 2013 alone (SEIA 2014). *(For reference, 1 megawatt is equivalent to 1 million watts of electricity; 4,751 megawatts are*

equivalent to 4.75 billion watts of electricity. These numbers reflect the maximum output capacity of all solar units installed in the United States, and do not account for cloudy weather, dirty panels, or shadows cast from buildings, trees, telephone poles, etc., which might decrease the maximum energy-generating output of each panel.)

While 13 individuals responded to question 5 in the positive, with potential future diversification into other means of alternative energy, 20 individuals responded to the question by selecting "other." Within the other category, the most prevalent response was "not applicable," suggesting that these respondents' companies either have no plans to diversify into other means of alternative energy; currently do not depend on alternative energy products as a primary financial model; or do not base their business within alternative energy at all. Furthermore, the average number of responses per question throughout the entire survey was 50.667. Question number 5 only received 33 answers, suggesting that the remaining 22 individuals participating in the survey chose not to answer this question. The reasons for not answering could vary widely, and thus cannot be identified. However, it could be inferred that individuals chose to skip this question due to their lack of involvement with either alternative energy products and/or services, and/or individuals did not know whether their company would diversity its alternative energy products and/or services in the future.

The responses to question 5 also suggest that businesses whose primary source of revenue generation is alternative energy will not diversity in the foreseeable future because in order to profit, they must be able to sell their product. If their product is little-known and/or little-researched and thus life cycle studies have not been performed, then

the likelihood of that company making a profit from that new product is low. Therefore, most companies will not diversity unless there is a relatively secure guarantee of profit upon investment.

Question #6: How long has your company been focused on alternative energy products and services?"

Survey participants' experience in the green building industry varies widely. While 20 of the 49 respondents state that they have been involved in the green building industry for between 6-10 years, the most frequent answers to this question fell in between 1-5 years (9), 6-10 years (20), and 11-15 years (9). Therefore, a majority (38) of the respondents have been involved in green building and green building ratings systems between 1 and 15 years. The 15 year mark coordinates with approximately 1998-1999, when the USGBC, LEED, and other green building ratings programs became significant contributors to the construction industry and common vocabulary amongst designers, architects, and builders (Freeman 2013).

Figure 7 on the following page illustrates the frequency of the terms LEED, Green Building, Energy Star, USGBC, Green Globes, and High Performance Building in published books between 1980 and 2008. The data in this figure corroborates the data received from question 6 within the survey, upholding the theory that a majority of survey participants' experience in green building began with the onset of the USGBC and similar green entities. While the concept of green building has existed long before the formation of the USGBC or

Green Globes, it is clear from this figure that green building and its associated organizations have received significant attention in the last 20 years.

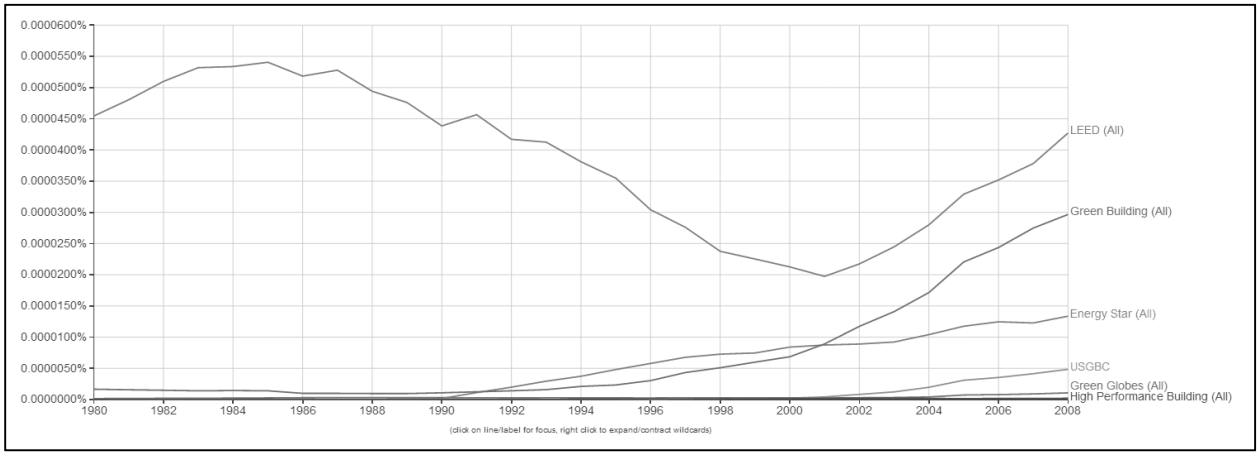


Figure 7. Frequency of Terms (Google Ngram Viewer 2013)

Question #7: "Has your business worked on projects that will or have been certified by a "green" rating program?"

Survey participants' responses to question 7 indicate that a majority of experience with green building ratings systems falls within the categories of Energy Star (25) and LEED (48). The Energy Star program is funded by both the United States Environmental Protection Agency and the United States Department of Energy. As a result, Energy Star is supported by significant tax funding each year (Energy Star 2014). Energy star is a voluntary program (Energy Star 2014) which offers tax breaks to homeowners and businesses whose buildings qualify for the Energy Star rating. Unlike Energy Star, the USGBC's LEED program is not affiliated with the Environmental Protection Agency or the Department of Energy; however, certification through LEED will likewise earn homeowners and business owners tax breaks for energy efficiency.

Four survey participants cited involvement with projects certified by Green Globes. While Green Globes offers third party verification of a building's energy efficiency, it does not offer participants any tax breaks in exchange for verification. According to Green Globes' mission statement, "[i]t is interactive, flexible and affordable, and provides market recognition of a building's environmental attributes through third-party verification" (Green Globes, homepage, 2014).

Significant survey participant involvement in Energy Star and LEED certification programs suggest that companies pursue such programs in search of tax breaks first, and environmental improvements second. With other equally competent and more scientifically based evaluation tools available, which are less frequently used than LEED and Energy Star, it can be reasoned that financial incentives drive the decision to pursue LEED. One possible explanation for the higher use of consensus point systems over more scientifically-derived ratings program is the presence of tax subsidies or other financial incentives. It appears that cost factors associated with new construction outweigh environmental performance factors.

Question #8: "Has your business bid on projects that will be certified by a "green" rating program?"

42 individuals responded to this question, indicating that their companies have bid on projects that will be certified by a green rating program. 53 total responses were recorded, indicating that 12 individuals responded "not applicable" to question 8. Overall, 79% of respondents indicated that their company has bid on projects that will be certified

by a green building rating system. The results of this question indicate that most companies surveyed have at the very least *an interest* in building green-certifiable projects. The results also suggest that these green-certifiable projects, which include commercial, government, hospitals, industrial, residential, schools, universities, religious and financial institution buildings, are to some extent required to meet the green building requirements required by (either) state and/or federal mandate.

The 12 individuals who opted to select "not applicable" for question 8 may indicate a different industry within construction. Several responses within the context of the survey indicate that some participants are not involved in alternative energy, but rather traditional forms of energy and energy generation. One respondent indicated that s/he is involved in industrial/gas/oil construction, and that their company does not currently pursue green certification. While all respondents to select "not applicable" are not likely involved in industrial power projects, it is possible that some are, hence the results.

Question #9: "What is your familiarity with "green" ratings programs?"

Survey participants indicated that a majority (73%) are familiar with green building rating programs, and consider themselves either very familiar (31%) or familiar (42%). Out of the 55 individuals to respond to this question, 5 consider themselves neutral (9%), 9 somewhat familiar (16%), and 1 not familiar (2%), for a total of 15 respondents (27%). The reasons for the mostly familiar response set may be explained by the popularity of green rating systems, especially LEED. Many companies now pay a portion or all fees associated

with an employee becoming LEED certified. The reasons for an employee becoming LEED certified are manifold and not necessarily identifiable within this study; however, some motivations might be an increase in salary for certification, access to more visible projects, and/or promotions or preferred workload.

Figure 8, Question 10 Rank Order

Rank Order Breakout 1-most to 6-least important	
Social Responsibility	1
Strategic Growth	2
Corporate Branding	3
New Technology	4
Other	5
Reapplication of Old Technology	6

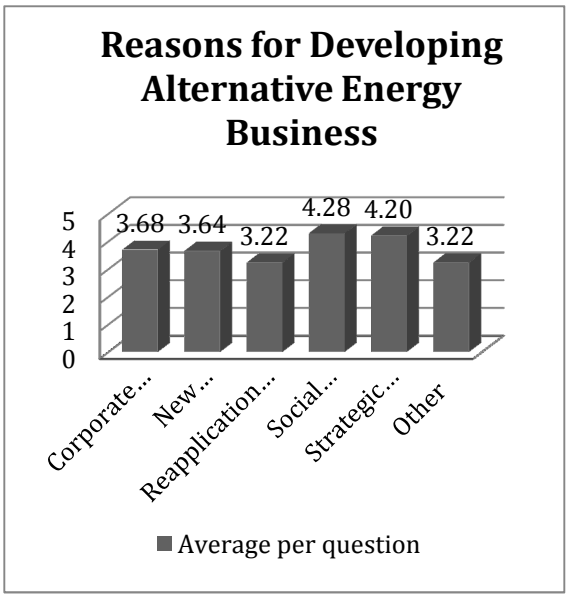


Table 30, Question 10 Rank Order Graph

Question #10: "What were the reasons for developing your alternative energy business?"

Survey participants' responses to question 10 reflect varying opinions regarding the reasons for developing alternative energy products or services as a business model. Social responsibility generated the most feedback with a 4.28 average, while strategic growth followed with a 4.20 average, as seen in Table 30 to the right/above. A correlation can be reasoned in which social responsibility and strategic growth are synonymous, and in a sense dependent on one another for a green company to develop, grow and profit. See Figure 8 above.

While there is not much variance among the other reasons (corporate branding, new technology, reapplication of old technology, and other), the data suggests that green building ratings programs lean away from scientific research and/or technological advances, and instead favor green ratings programs which provide financial incentives for business, all the while potentially improving the environment through the veil of green building certification. This conclusion is reached because of the high correlation between the popularity of LEED among the survey response set, and also the equal inspiration of social responsibility and strategic growth as core reasons for alternative energy development. Furthermore, LEED has been cited by many users and critics to be less about actual scientifically proven environmental enhancements, but rather about a point system which achieves tax credits for business owners and may, subsequently, have positive effects on the environment (Barringer 2008; Unidentified 2007; Koncelik 2009; Bardaglio 2011).

For most businesses surveyed, alternative energy products and services have most likely not been the primary business model/means of revenue /focus since the inception of the company. As a result, green building is an add-on service for many companies, and not necessarily the primary focus in mind for all projects. As an add-on service, many green designs feature products or methods which are more costly, and whose long-term impact and strength is undetermined due to the lack of a life cycle assessment. Many green building ratings programs have been incongruously accused of being unsustainable, even as they profess sustainability and their means to promote it (Quirk 2012).

State and federal subsidies have undoubtedly altered the green building landscape, as government-driven requirements now mandate for varying degrees of energy-efficiency in most new construction (USDoE 2014). The intertwined elements of social responsibility and strategic company growth are therefore driven by federal and state requirements, which in turn generate the need for energy subsidies.

Question #11: "How important is research in alternative energy to your business?"

The results of question 11 suggest an evenly-split market, in which half (26 participants) of the surveyed participants view alternative energy R&D as important or very important to their business, while the other half (26 participants) do not place as much (or any) value on such research. The support for, and nearly equal support against, alternative energy R&D strongly implies that companies are hesitant to commit significant resources to long-term exploration.

Miles and Covin (p. 299, 2000) state that a "corporate reputation is an intangible asset that is related to marketing and financial performance" and that environmental performance is "an increasingly important component of a company's reputation." If environmental performance is critical to a company's reputation, growth and development, then research and development in alternative energies would seem practical and appropriate in maintaining a reputation. If financial constraints prevent a company from becoming involved in active product R&D, then passive market research (reviewing product publications, attending alternative building materials conferences, etc.) may be an appropriate alternative.

To some extent, the findings extrapolated from question 11 indicate a wait-and-see attitude among alternative energy businesses. While approximately half support research either completely or partially, the other half does not support research for various reasons. Some companies may be testing the market, assessing the impact of the green building industry and waiting to see how programs such as LEED, Green Globes and Energy Star evolve. Others may not be fully convinced that green building is the way for the future and therefore are testing the market for proven results in green building. Additionally, these same companies may be involved in research and development to a lesser extent, simply to lay claim to having involvement with the green building industry. Maintaining a minor stance in the event alternative energies become more accessible, inexpensive and proven; they can easily launch into a more proactive undertaking while preserving their stance of long-term involvement.

However, an equal portion of survey participants appear to be reluctant to become involved in R&D at all. The motivating factors that propel R&D are confidence and the

strong probability of financial reward. If either of those factors are not present, businesses whose primary services and/or products that are deemed more traditional may have trouble investing faith and money into products whose mainstay in the industry have yet to be legitimized. (life cycle assessment).

Question #12: "How likely is your company to spend money on the research and development of alternative energy products if government subsidies were provided?"

The data gained from participant responses in question 12 suggest that even with government subsides provided for R&D of alternative energy products, a majority of companies are only marginally interested, and most are not at all interested. This result may be generated by the fact that government subsidies do not fully cover the costs companies incur to perform product R&D (Helbling 2012).

According to Thomas Helbling (p. 1, 2012) of the International Monetary Fund, "research and development (R&D) activities are widely considered to have positive effects beyond those enjoyed by the producer that funded the R&D—normally, the company that pays for the research. This is because R&D adds to the general body of knowledge, which contributes to other discoveries and developments. However, the private returns of a firm selling products based on its own R&D typically do not include the returns of others who benefited indirectly. With positive externalities, private returns are smaller than social returns."

Cost is a driving factor in the decision to undertake R&D projects, and some companies are simply not willing to absorb those costs. According to Helbling's findings, R&D generally contributes to general knowledge, thus furthering new research and new developments. Yet many companies cannot afford, or do not want to afford, the front-end costs of beginning a research project. An R&D project does not guarantee viable results or profit, and in some cases will cost businesses significant amounts of money without any return.

Question #13: "If government subsidies were not provided, how likely would your company be to spend money on the research and development of alternative energy products?"

The likelihood of survey participants to engage in R&D drops considerably without the provision of government subsidies. Out of 53 respondents, 16 individuals (30%) concur that they would continue to participate in R&D without government subsidies, while 37 individuals (70%) concur that they would most likely not participate in R&D without the support of government subsidies. These results point to a lukewarm investment and interest in R&D without the support of government subsidies. This reduction in forecasted participation does not necessarily indicate a lack of interest from participants surveyed; while interest in alternative energy cannot be gauged within the context of this research study, the decision not to pursue R&D with fewer government subsidies only indicates that cost of R&D is an issue; interest may or may not be an issue unto itself.

Furthermore, government subsidies may not play a large role in R&D within businesses whose primary function is in the research of alternative energy. Businesses whose primary function is to research and test alternative energy technology may continue

their R&D despite a downturn in government subsidies. Some of this interest in the pursuit of alternative energy R&D could come from private financing.

One possible explanation for the findings in questions 11 through 14 is that the technologies being subsidized are not market tested, and therefore not ready for public use. Moreover, the underlying science behind these R&D technologies is not yet established due to insufficient data supporting its environmental benefits. Under these conditions, long term investment could be considered precarious due to the uncertainty over the maintenance of government subsidies, such as might occur in a change of administration or reprioritizing of federal budgets.

Question #14: "Has your company seen a reduction in alternative energy market activity as global subsidies decline?"

The data extracted from question 14 suggest that companies have seen an overall reduction in alternative energy market activity as global subsidies decline. Despite that nearly half of the respondents to question 14 (47%, 21 individuals) are unsure of how a global subsidy decline has impacted their company, the "yes" (16 individuals) and "no" (8 individuals) results provide sufficient evidence to conclude that companies are hesitant to invest their own money in R&D. Due to uncertain results of alternative energy R&D, and without a guaranteed buyer of the resultant technology, investing in R&D without the promise of government subsidies is a dangerous exchange for most companies, and is thus avoided.

Question #15: “In your opinion, where do you perceive the driving force of alternative energy /sales acceptance to be?”

Survey participants relayed that alternative energy sales/acceptance is driven more by governmental mandates rather than by market demand. Beyond federal mandates that establish percentages that must be satisfied on various green built projects, the data suggests that there is little incentive for companies to pursue alternative energy sales. Furthermore, much of the technology recommended to be utilized by these mandates has not necessarily undergone significant (or any) life cycle analysis, thus forcing the implementation of technology neither market proven or proven to be environmentally beneficial to society at large. Additionally, some forms of alternative energy are heavily driven through government subsidies along with federal mandates, despite life cycle analysis stating that the product is in fact not beneficial, or in some isolated cases even detrimental to society overall.

One particular example of such a material is a photovoltaic solar panel. According to the solar panel manufacturer and installer SunPower Corporation (homepage, 2014), solar panels can “generate your own clean energy, 365 days a year.” While solar panels do indeed generate clean energy *once they are installed*, the process by which minerals for solar panel use are mined, extracted, manufactured, and then transported create a tremendous amount of pollution, thus rendering a solar panel toxic (UCS 2013). While PV manufacturing is becoming cleaner, it is a process that could be improved to contribute less carbon to the Earth’s existing carbon footprint.

Question #16: "What does industry perceive as the driving force of alternative energy in the current market?"

The data resulting from question 16 suggests that a majority of survey participants believe the current alternative energy market to be mostly mandate driven. 47% (24 of 51) of participants feel that the current market is more mandate than market driven, suggesting that there is indeed a lack of R&D and technical support backing alternative energy products and services. Additionally, the data suggest that there is a lack of support and/or funding by the federal government to provide subsidies to research these products and services more in depth.

Question #17: To ensure long term adaptation of alternative energy, where does the driving force of development need to be?

The results of question 17 indicate that in order to promote the long term adaptation of alternative energies, the driving force of development must be generated from scientific research and subsequently through technological adaptation. Federal requirements demanding the use of specific products primarily because the rate of return is profitable, does not make a product scientifically sound. The sustainability movement in its current market condition is not sustainable without federal subsidies to support it. While the concern for environmental improvement is alive and continuing to grow in the business community, products are overwhelmingly selected on the criteria of how many green building points they garner or by which earn the largest government subsidies, eliminating the base reasons for the utilization of environmentally sound products.

According to Todd Myers of the National Center for Policy Analysis (2014), the subsidy per kilowatt hour (S/KWH) for eco-products such as photovoltaics and wind turbines are high ($0.9680 S/KWH and $0.0525, respectively), while recognized environmental dangers such as coal and natural gas are low ($0.0006 each). Understandably, the United States government is pushing for a nationwide proliferation of alternative/renewable energies as the threat of global warming becomes more realistic and scientifically confirmed; however, the R&D is simply not significant enough to prove that mining for solar silicon is not as harmful to the environment as coal mining is. To summarize, there is concern among the general public and the scientific community that we as a global society could be trading one current energy problem for a future energy problem without sufficient testing to verify the environmental impacts of new alternative energies.

Question #18: "Has a customer/client ever approached your business requesting information about how to reduce their carbon footprint?"

The overwhelming majority of respondents indicated that a customer has approached their business seeking means to reduce their carbon footprint. These results suggest that there is a reason (or series of reasons) for this request.

The actual process of constructing a building creates a carbon footprint, yet the more significant footprint is found within the operations and maintenance (O&M) of a building: lighting, water distribution, heating, and cooling. One way many construction projects can easily reduce their carbon footprint is through more efficient O&M of a

building. More efficient heating, ventilation and air conditioning (HVAC) systems are more costly than traditional HVAC systems, as are tankless water heating systems and compact fluorescent lighting systems; yet all of these eco-friendly changes are considered a long term investment within a building, and thus steps toward a reduced carbon footprint. Additionally, O&M changes such as the aforementioned contribute to a higher green building rating program score, thus contributing to further tax breaks available to business owners.

As a result of the data analysis for question 18, business owners tend to invest in more efficient O&M systems to offset long-term project costs, and subsequently earning green building credits in the process.

Question #19: "How concerned are most of your clients about the reduction of their carbon footprint?"

The results of question 19 indicate that out of 50 responses, 24 individuals (48%) have clients who are concerned about their carbon footprint. The data gained in question 18 provides corroborating evidence to the data gathered in question 19, suggesting that concern for carbon footprint reduction is mostly based on some elements of cost reduction (O&M) in addition to environmental concern.

A majority of survey respondents self-identified as architects, designers and specifiers. Many of the survey participants most likely design buildings, interiors, systems, or a combination thereof, and therefore suggest energy-efficient elements to buildings

during the planning and design phases. The results of question 19 suggest that altruism alone does not drive a company to alter their practices for environmental benefits. Financial gains must be available to companies in order for them to consider the benefits of a reduced carbon footprint.

Question #20: "Do you provide life cycle costs for products or services which you offer?"

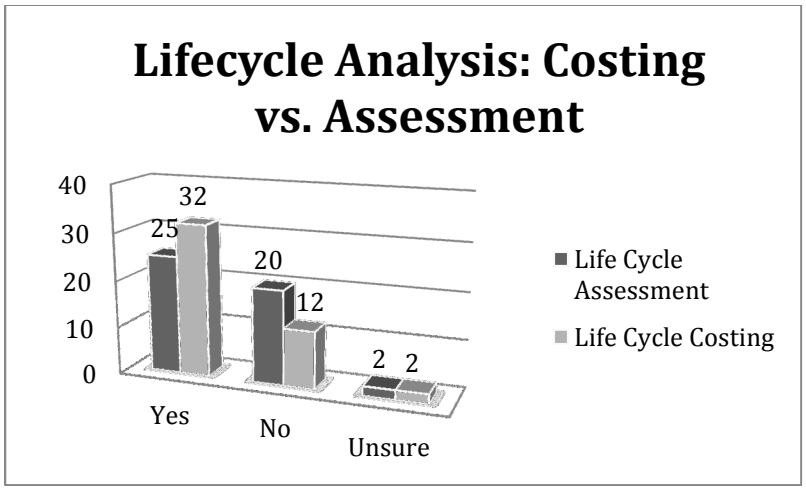
70% (32 of 46) respondents indicated that their company provides life cycle costing for products or services offered. Life Cycle Costing is the process whereby a product is analyzed for its installation (up-front) costs, as well as the costs incurred to operate and maintain over its lifetime. A majority of respondents indicate that they do provide life cycle costing, suggesting that clients are concerned not only about the cost of products and/or buildings up front, but also the cost to maintain products and/or buildings over an extended period of time. Overall, owners are concerned with lifetime and lifecycle costs.

Question #21: "Do you provide life cycle assessment services (environmental impact reports) for products or services which you offer?"

Question 21 did not revolve around lifecycle costs, but rather lifecycle assessment. A lifecycle assessment identifies the environmental impacts of a product and/or building, and what those long-term (beneficial or detrimental) impacts will be. It is clear from the data gathered for question 2 that fewer clients are interested in life cycle assessment than are clients interested in life cycle coting. The data suggests that lifecycle costing is more frequently performed and potentially requested by clients more often, than lifecycle

assessment (see table 31 following page). Life cycle assessments for a new building may be performed when required by city, county or state laws, but not necessarily requested as frequently as life cycle costing assessments, which directly financially impact (benefit) the owner of a building.

Table 31, Question 21 Lifecycle Costing vs. Lifecycle Assessment Graph



The data gathered for question 21 further suggests that lifecycle analysis is driven by cost concerns, not by environmental concerns. Consequently, the subsidies supporting the proliferation of products such as photovoltaic panels, alternative building materials, and solar thermal are not driving real change in building strategies and methods. The rise in these products' use suggests lower operation costs first and environmental concern second. Furthermore, the green building ratings programs driving the aforementioned products' installation are not driving real change either. Green building ratings programs are driven by alternative products, which are in turn driven by government subsidies.

While green building ratings programs have not driven real change within the construction industry, they have created an awareness of the *need for change* (Willson 2008,). The subsidies provided to businesses for the installation of alternative building products has brought new technologies to the forefront for further examination and improvement. Additionally, when examined together, lifecycle analysis and costing reveal the interrelatedness of carbon footprints and the *cost* of the carbon footprint.

Question #22: "How important to your company is the reduction of your carbon footprint?"

The results of question 22 suggest that some companies surveyed *are* concerned with their carbon footprint. 61% (31 out of 51) respondents identify the reduction of their carbon footprint as most important or important to their company. However, 40% (20 out of 51) consider their carbon footprint to be a neutral, somewhat important or not important topic. These results suggest that there is genuine concern for environmental impact within the corporate construction industry; yet the abilities for companies to address that concern are not necessarily in reach. Furthermore, while some companies may be concerned about their carbon footprint, they may not actually make environmental changes within their scopes of work.

While 61% of companies surveyed indicate that there is concern for the reduction of their carbon footprint, there is no indication as to why. It can be reasoned that companies choose environmentally-beneficial products and services for the same reasons that clients frequently request lifecycle costing, but less frequently choose lifecycle assessment. The reduction of a carbon footprint is not only beneficial to the environment, but also helps

companies/owners/clients to achieve certification by a green building ratings system and thus tax incentives.

Question #23: "Alternative energy development and implementation would continue even without the influence of green building ratings programs such as LEED, Green Globes, etc."

The data from question 23 suggest that there is genuine interest in developing environmentally-beneficial products and services even without the influence of green building ratings programs. The data suggest that green building ratings programs do not actually drive the development of alternative products and services; rather, government subsidies drive the development and implementation of alternative energy products. Green building ratings programs provide companies with third-party verification that said products are installed and in operation, therefore making a company or owner eligible to receive the benefits of those subsidies. Without green building ratings programs, companies and/or owners would need to submit verification directly to the Internal Revenue Service, without the use of a middleman, to receive energy tax-breaks.

Question #24: "If there were not government subsidies or incentives for alternative energy implementation, your company would continue to provide alternative energy goods and services."

The response to question 24 is overwhelmingly positive, in that 70% of respondents (35 out of 50) believe that their company would continue to provide alternative energy goods and services in the event that there were no government subsidies for alternative energy implementation. This poignant response suggests that financial benefits aside,

companies are beginning to recognize that alternative energy products are not only the "next big thing" in sustainable construction, but that they are a necessity to reduce/improve the environmental impact humans have exacted on the planet. This is a positive step into the future of alternative energy, as it suggests that the demand for better and more truly efficient products will potentially change the market from mandate driven to demand driven, thus forcing more scientific research into the development of alternative energy products.

The caveat that must be addressed within the context of this question, however, is that of financial benefit to a company. It is easy for a survey participant to indicate that their company would happily continue alternative energy development and implementation without the benefit of subsidies. However, within the framework of a budgetary review, it may prove financially unlikely for a company to pursue alternative energy products without government subsidies due to the expense of many alternative products.

Question #25: "Green rating programs accurately represent the true value of alternative energy use in sustainable construction."

The overwhelming majority of respondents (76%, 38 out of 50) to question 25 indicate that green building ratings programs do not accurately represent the true value of alternative energy use in sustainable construction. This data is distressing as it indicates that programs such as LEED and Energy Star are not performing as advertised. LEED, for example, professes to help "buildings around the world save energy, water, resources, and

money" (USGBC LEED 2014), yet a majority of survey participants indicate an opposing opinion on green building certification, with 16 participants neutral, 18 participants disagreeing, and 4 participants strongly disagreeing with the statement posed in question 25. With LEED as the forefront energy-efficiency tracker in the United States, and also the most-used certification program cited within the context of this research study's participants, the data suggests that certification programs are implemented strictly for financial reasons, with environmental concerns secondary and possibly inadvertently.

The literature review for this research yielded articles with titles such as, "How to Cheat at LEED" (Seville 2011), and "In US building industry, is it too easy to be green?" (Schnaars & Morgan 2013). The former article addressed easy ways to gain points and qualify for LEED, without much focus on reducing energy costs or carbon footprints. Some of the suggestions within that article were leaving the windows open for 48 hours prior to occupancy, leaving out fireplaces, and installing appropriate signage/advertising. None of these suggested actions actually improve the environment around a building (or even a private residence). The latter article presents scientific evidence for LEED buildings operating at the same energy levels (or worse) than traditionally-constructed comparable buildings, stating that a hotel and casino in Las Vegas with an "indoor waterfall, a smoke-filled gaming area, seven decorative fountains and guest suites with three TVs and power-controlled curtains" achieved LEED Platinum certification due to having "bike racks in the garage, room cards telling guests when towels are replaced; landscaping that does not use grass, which local law prohibits anyway; and preferred parking for fuel-efficient cars" (Schnaars & Morgan 2013).

Both articles addressed LEED and its use as a tax break generator, and also as a means to garner more rent from corporate lessees The title, “Leadership in Energy and Environmental Design” suggests that LEED is a steward of environmental efficiency and energy reduction; however, with buildings such as the Palazzo Hotel and Casino (Schnaars & Morgan 2013) blatantly misappropriating LEED points for financial gain, it is clear that green building ratings programs need a serious adjustment. This conclusion does not at all indicate a lack of concern for environmental improvement within the United States; but rather, it indicates a need for green building certification programs to overhaul their processes and address real environmental issues that actually apply to real regions, situations and buildings.

Question #26: “There is an adequate craft labor force available to support alternative energy work.”

The majority of responses to question/statement 26 indicate that while there is a craft labor force available to support alternative energy, it is not sufficient to sustain the growing mandate for alternative energy product installation. Craft labor pools can be trained in installation of various sustainable products, yet training required additional financial and temporal investments by a company. Furthermore, the Associated General Contractors of America (AGC) reported in 2013 that 74% of construction firms surveyed (700 firms total) reported having trouble finding qualified workers amid growing labor shortages. According to the AGC, “[a]ssociation officials called for immigration and education reform measures to help avoid worker shortages” (AGC 2013). The data gathered through question 26 in conjunction with the AGCs statement suggests that many

alternative energy products have been on the market for a very short time, not allowing enough time for craft forces to become trained in their installation. The data further suggests that these products have been pushed forward to comply with programs such as LEED and Energy Star, and now allowing sufficient time for the construction industry to meet the needs of alternative energy products.

Question #27: "Please list the three (3) most critical factors which impair your ability to sell, manufacture, and/or install alternative energy goods or services."

The results of question 27 are noteworthy for their repetitive theme, as all respondents indicated very common concern surrounding the emergence and implementation of green building within the construction industry.

The most frequently recurring response recorded within the three open-answer choices was *cost*: the cost of green building certification; the cost of alternative energy materials; the cost of goods and services; budget limitations that prohibit the use of alternative energy materials even for projects receptive to the idea(s); the initial start-up costs; the unforeseeable maintenance costs due to a lack of product life cycle/cost analysis; added costs of new technologies; the lack of incentives for the more expensive green products and services installed/used on a project. The term cost was identified over 40 times within the answers received for question 27.

The second most significant theme in the open responses was the lack of knowledgeable or informed clients regarding green building certification process and the utilization of green building products and services. One respondent stated that there is a "lack of public education" regarding what green building actually means, while another

respondent indicated that "Owners (are) unfamiliar with green systems, and uncomfortable trying something new." Furthermore another respondent stated that, "misinformed and uninformed clients who receive almost no quality information from mainstream media" are very hesitant to commit to green building. The participants' responses suggest that there is a lack of communication between the relevant industry professionals (including contractors, designers, and architects), and the green building councils, researchers, products and service providers who manufacture, implement and/or install green products and services.

The third most frequent theme in the open responses was the complexity and cost of maintenance concerns. Many respondents cited maintenance-related issues as a reason why clients choose not to implement green building products and/or services on a project. Respondents cited issues such as questionable "reliability of the new solution," "too much maintenance," warranty concerns or specifically unclear warranties, lack of life cycle costing/analysis, "unproven systems," and a concern that the "long-term results (of products) are inconclusive." These responses suggest an overall mistrust and discouragement of green products and services within the construction industry while there are proven traditional materials readily available for use.

When considered together, the implementation costs, lack of public education and maintenance concerns intertwine to form a common problem within the green building industry. The up-front unsubsidized costs of green certification, products and/or services dissuade many owners from further research, and as a result, little information is known about the products that are available for construction use. Furthermore, due to a combination of high unsubsidized costs and an overall lack of knowledge, life cycle costing

and analysis has been neglected and/or ignored by many owners, resulting in a cycle of misinformed clients who do not trust green building methods and products. Moreover, the complexity and costliness of green certification through LEED, Energy Star, and other similar programs deters companies from pursuing a certification, thus perpetuating the cycle of misinformation and little scientific investment in green building.

Other prominent issues addressed by respondents include the *perception* of LEED and other green building ratings programs. Respondents stated that "LEED is greatly misrepresented"; "LEED does not offer a rating for agricultural structures"; "non-communication of LEED personnel"; "LEED is too costly;" and "complicated documentation associated with becoming green (LEED). Ultimately, the data gathered within question 27 alludes to a major theme within the context of this research, which is the lack of scientific research within the green building industry to corroborate the need for green products. One respondent succinctly stated that "[n]ational leaders [are] unwilling to implement data-driven, long-term changes to the national infrastructure and energy/water policy." Data-driven change is needed to change the perception and necessity of green building ratings programs in the United States. Furthermore, scientific research studies are needed to provide substantiating evidence of the effectiveness and longevity of LEED, Energy Star and similarly certified buildings.

CHAPTER 6: CONCLUSIONS & FURTHER RESEARCH

Conclusions

The inclusive results of this research project suggest that green building ratings programs have had an overall positive effect on the construction industry. The development of programs such as LEED and Energy Star have allowed for an open dialogue to cultivate between building owners and alternative energy providers. This dialogue has and will continue to lead to a better understanding of what is required of a green building rating program.

Taking a more focused view of the survey results, however, it is clear that the current green building ratings systems in use today require revision in order to better address the needs of future construction projects. The initial research question, *"Do alternative energy manufacturers, suppliers and constructors perceive sustainable design and construction, associated government programs, and "green" ratings programs to be a benefit or a detriment to long term business practices?,"* has been answered through the literature review and the subsequent data collected within this survey. The results of this study suggest that at present, businesses focusing on alternative energy perceive green ratings programs to be a detriment to long term business practices. The costs to implement green products are too high, while the long-term results of alternative products are unknown and therefore uncertain as a business choice. The majority attitude toward green building ratings programs is that they have created awareness of environmental issues and the potential solutions, yet there is a lack of evidence in place to validate the position LEED has taken in the current construction market. LEED currently stands at the forefront of green

design and building in the United States; thus, it would benefit LEED to restructure their current point systems to incorporate data-driven, science-based point structures for building certification.

A frequent criticism of LEED within the context of the research findings was the inconsistency of regional points for varying projects: regional climates are minimally accounted for, further contributing to the perception that LEED is an ineffective system for a building's ecological evaluation. Another recurring criticism of green building ratings systems overall was that certification programs do not account for occupant actions (for example, office occupants opening windows even though the heating or cooling systems are operating, or office occupants leaving lights and computers on all night when the office is not occupied). Many of these criticisms could be alleviated through the use of annual energy audits for previously certified projects, therefore allowing green building ratings programs to evaluate the *actual* effectiveness of an energy-efficient building over time. Additionally, energy audits could provide building owners and operators with better information regarding the proper maintenance of a building and its mechanical systems.

In conclusion to this research study, several points have been established as suggestions for future improvement of green building ratings systems. These points include increased scientific research of green alternatives, a closer examination of alternative energy subsidies and revised tax policies with regard to green building certification and associated tax breaks.

Increased scientific research of existing alternative energy products would allow for more efficient goods and increased knowledge of their environmental impact. As an

example of specific product research, a more in-depth examination of the photovoltaic panel manufacturing process (extraction process of minerals/materials, transportation of minerals/materials, health and wellness of those individuals involved with this extraction, and the manufacturing of the panel and all of its components) would lead to the development of a less-caustic solar panel capable of generating clean energy.

A closer examination of alternative energy subsidies could yield details as to why certain products are so heavily subsidized, while others are not. Whereas photovoltaics and wind turbine systems are modern breakthroughs in energy generation, and coincidentally heavily subsidized by the United States government, they are not the only extant alternatives to coal and oil. Bio-Mass, geothermal, co-generation, steam/geo-thermal and water conservation are only a few alternative energy systems in development. With further scientific research and development, alternative energy methods with lower long-term environmental impacts could be developed and subsidized for widespread use.

Lastly, existing United States tax policies regarding green building certification programs should be reexamined for effectiveness and, most importantly, ecological benefit. It is possible for a building to become LEED Platinum certified, and yet benefit the environment very little. Despite minor environmental improvements, the owner of such a building can still receive substantial tax breaks each year due to the LEED certification and in theory, for reducing their carbon footprint through increased building efficiency. Two such buildings previously mentioned are Antilia in Mumbai, India, and The Palazzo Hotel and Casino in Las Vegas, Nevada. Both buildings are excessively large and consume tremendous amounts of energy, yet have been granted LEED certifications due to point

distributions. If LEED and similar green building ratings systems are designed to reward environmentally-conscious builders with annual tax breaks for such a tremendous investment in green building, then the environmental aspects of each certified building should be verified annually for consistency and continual improvement.

Further Research

This research project was initially distributed to a subject set of 5,000 individuals. Further research could garner more information by distributing a similar survey to a greater number of people. An expanded subject set of between 50,000 – 100,000 participants would yield more data, and possibly stretch out into the international market. International perspectives on green building ratings systems and their effectiveness might yield different answers and thusly a different viewpoint.

It is possible that, because the survey within the context of this research was distributed from the Western United States, that a set of Western concerns are predominant within the results. While the Eastern half of the United States does not usually concern itself with the issues of drought, the Western half of the United States does; therefore, water conservation and waste-water treatment may be more of a concern within the context of this survey than a survey distributed out of New York state, for example. A better way to garner more generalizable survey responses would be to target a certain number of businesses within each state, therefore decreasing the chances for a regional bias within the survey results.

An enhanced research study might also take place several years from now, allowing for better and different technologies to develop. Improved technologies would yield different reactions and a different data set, thus potentially changing the perspectives of individuals involved in the alternative energy industry.

Another aspect to consider for future research is that of opposing viewpoints. If the same survey were marketed toward the businesses whose primary purpose is to push subsidies for alternative energy, an entirely different viewpoint may emerge. Moreover, a survey targeting the United States Department of Energy, or specific certification programs would yield further interesting and different results.

One final aspect to consider within the context of this survey is the subjectiveness of some of the potential responses. Many individuals selected "social responsibility" as an answer to question #10, which asked participants to identify reasons why their company participates in alternative energy applications. The definition of "social responsibility" will vary not only between individuals on a personal basis, but also between companies on a professional basis. A definition of terms, especially those which might be interpreted as rather subjective, might help to improve the results of a similar survey.

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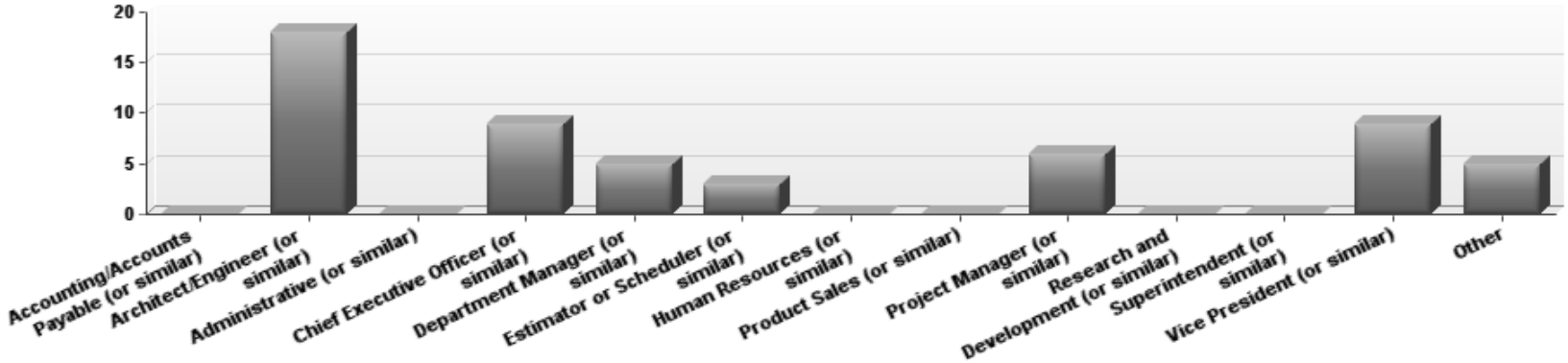
APPENDICES

Survey Responses

Initial Report

Last Modified: 02/11/2014

1. What is your role within the company? Please check all that apply.

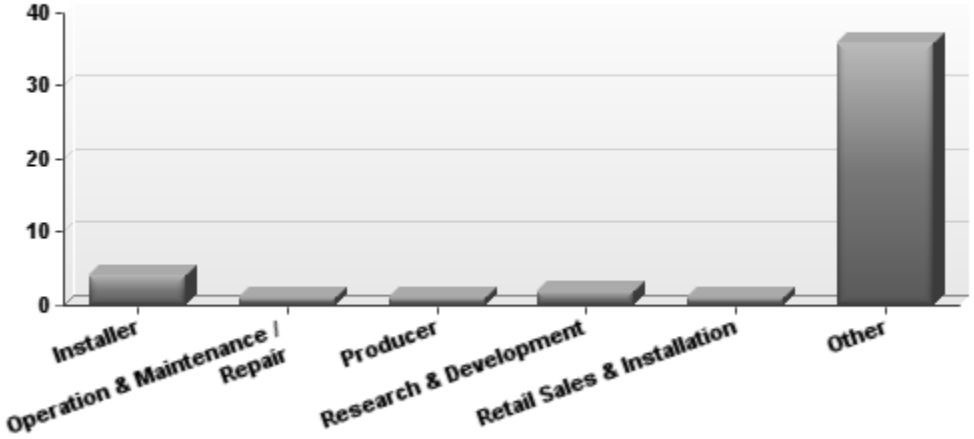


#	Answer		Response	%
1	Accounting/Accounts Payable (or similar)		0	0%
2	Architect/Engineer (or similar)		18	33%
3	Administrative (or similar)		0	0%
4	Chief Executive Officer (or similar)		9	16%
5	Department Manager (or similar)		5	9%
6	Estimator or Scheduler (or similar)		3	5%
7	Human Resources (or similar)		0	0%
8	Product Sales (or similar)		0	0%
9	Project Manager (or similar)		6	11%
10	Research and Development (or similar)		0	0%
11	Superintendent (or similar)		0	0%
12	Vice President (or similar)		9	16%
13	Other		5	9%
	Total		55	100%

Other
Director
principal
Architect/Principal
Principal
Director of Sustainability

Statistic	Value
Min Value	2
Max Value	13
Mean	6.22
Variance	17.58
Standard Deviation	4.19
Total Responses	55

2. What is your company's primary role in the alternative energy market? Please mark the appropriate selection.



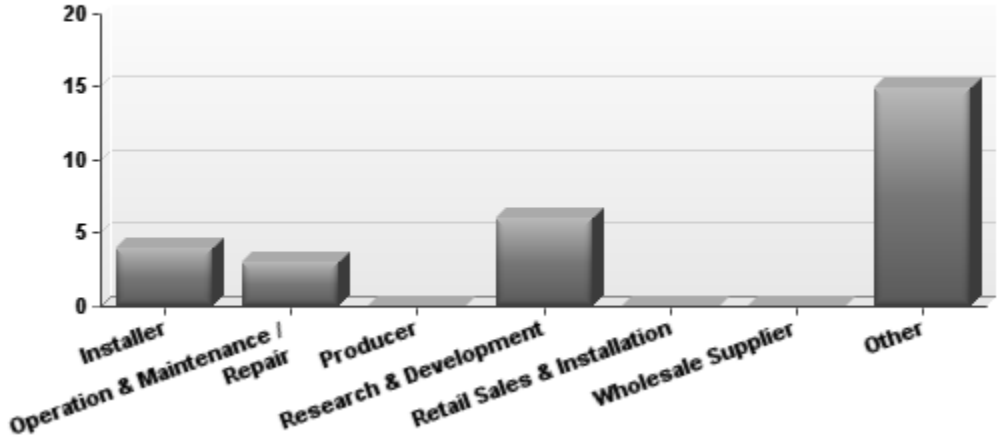
#	Answer		Response	%
2	Installer		4	9%
3	Operation & Maintenance / Repair		1	2%
4	Producer		1	2%
5	Research & Development		2	4%
6	Retail Sales & Installation		1	2%
8	Other		36	80%
	Total		45	100%

Other
Specifier
Engineer
Consulting Engineer
Architect
Designer
Engineering service provider
DESIGNER
select systems and specify
architect
Designer/Specifier
specifier
consultant
Design Professional
Designer / recommend / specifier
design/engineering
specifier / incorporate in to project design
specify/recommend for projects
design
specifier
permitting
designer
Specifier
manage design & construction
specifier within building design
Architect
Designer
Design
landscape architect and planner
Consultant
Consulting
Engineering & Project Management
Propose existing solutions to clients

Consultant
Our core clients are Gas & Oil and they're starting to pursue alternative markets
Owner's Rep
General Contractor - So managing Subs who install

Statistic	Value
Min Value	2
Max Value	8
Mean	7.09
Variance	3.86
Standard Deviation	1.96
Total Responses	45

3. What are your company's secondary roles in the alternative energy market? Please check all that apply.

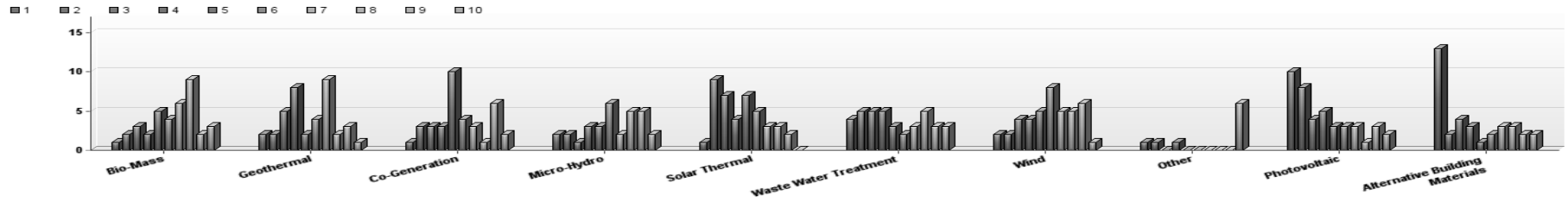


#	Answer		Response	%
2	Installer		4	14%
3	Operation & Maintenance / Repair		3	11%
4	Producer		0	0%
5	Research & Development		6	21%
6	Retail Sales & Installation		0	0%
7	Wholesale Supplier		0	0%
8	Other		15	54%

Other
Architect
Construction Manager
DESIGNER
select systems and specify
Educator
Specifier of building materials & onsite renewable energy systems
Planner
consulting A&E Firm
specifier
designer
advocate for energy efficiency
specifier within building design
landscape architect and planner
Systems Designer
Owner's Rep

Statistic	Value
Min Value	2
Max Value	8
Total Responses	28

4. What alternative energy system(s) is/are your company's focus? Please rank the following in order of importance for your company 1-8; 1 most important.

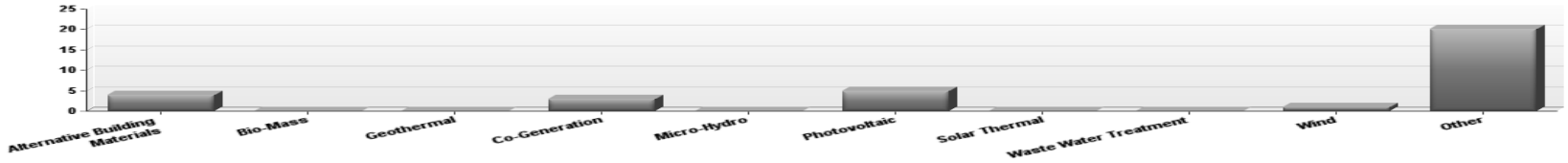


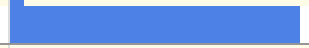
#	Answer	1	2	3	4	5	6	7	8	9	10	Total Responses
1	Bio-Mass	1	2	3	2	5	4	6	9	2	3	37
2	Geothermal	2	2	5	8	2	4	9	2	3	1	38
3	Co-Generation	1	3	3	3	10	4	3	1	6	2	36
4	Micro-Hydro	2	2	1	3	3	6	2	5	5	2	31
5	Solar Thermal	1	9	7	4	7	5	3	3	2	0	41
6	Waste Water Treatment	4	5	5	5	3	2	3	5	3	3	38
7	Wind	2	2	4	4	5	8	5	5	6	1	42
8	Other	1	1	0	1	0	0	0	0	0	6	9
9	Photovoltaic	10	8	4	5	3	3	3	1	3	2	42
10	Alternative Building Materials	13	2	4	3	1	2	3	3	2	2	35
	Total	37	36	36	38	39	38	37	34	32	22	-

Other
intelligent power inverters
Water Conservation
Small-Hydro
Cost

Statistic	Bio-Mass	Geothermal	Co-Generation	Micro-Hydro	Solar Thermal	Waste Water Treatment	Wind	Other	Photovoltaic	Alternative Building Materials
Min Value	1	1	1	1	1	1	1	1	1	1
Max Value	10	10	10	10	9	10	10	10	10	10
Mean	6.30	5.34	5.69	6.16	4.49	5.11	5.86	7.44	3.98	4.03
Variance	5.60	5.53	6.05	6.81	4.86	8.53	5.69	15.28	8.07	9.85
Standard Deviation	2.37	2.35	2.46	2.61	2.20	2.92	2.38	3.91	2.84	3.14
Total Responses	37	38	36	31	41	38	42	9	42	35

5. If alternative energy implementation is the primary source of revenue generation within your business, will you diversify? Please check all that apply.



#	Answer		Response	%
1	Alternative Building Materials		4	12%
2	Bio-Mass		0	0%
3	Geothermal		0	0%
4	Co-Generation		3	9%
5	Micro-Hydro		0	0%
6	Photovoltaic		5	15%
7	Solar Thermal		0	0%
8	Waste Water Treatment		0	0%
9	Wind		1	3%
10	Other		20	61%
	Total		33	100%

Other
n/a
na
It is not our primary revenue source. We provide engineering services for the industries listed above
It is not a primary source of revenue.
NA
most, won't allow multiple clicks
N/A
NA
N/A
not a revenue source for our business
NA only minor part of the business
sustainability
it isn't
Not Applicable
Not applicable to us
not applicable
N/A
Its not

Statistic	Value
Min Value	1
Max Value	10
Mean	7.73
Variance	10.70
Standard Deviation	3.27
Total Responses	33

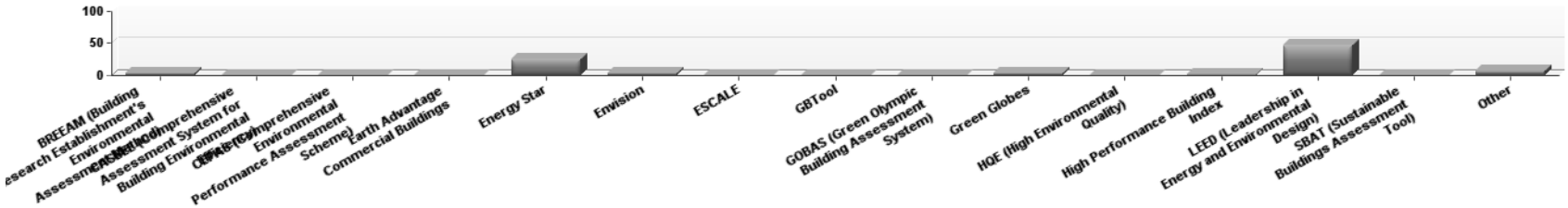
6. How long has your company been focused on alternative energy products and services? Please enter specific months and/or years.

Years	Months
6	
40	
10	
10	
10	
6	6
5	
10	
4	
10	
10	
24	
15	
35	
10	
10	
17-18 years since the founding of hte USGBC	
20	6
13	
30	
15 years	
6	6
30 years incorporating on projects	
7	
20	
15	
13	
5	
20	
10	
five	
10	

4	48
10	
15 +/-	
10	
90	
25	
11	
10	
3	
5	
5	3
10	
4	
10	
15	
10	
15+	

Statistic	Value
Total Responses	49

7. Has your business worked on projects that will or have been certified by a "green" rating program? Please check all that apply.



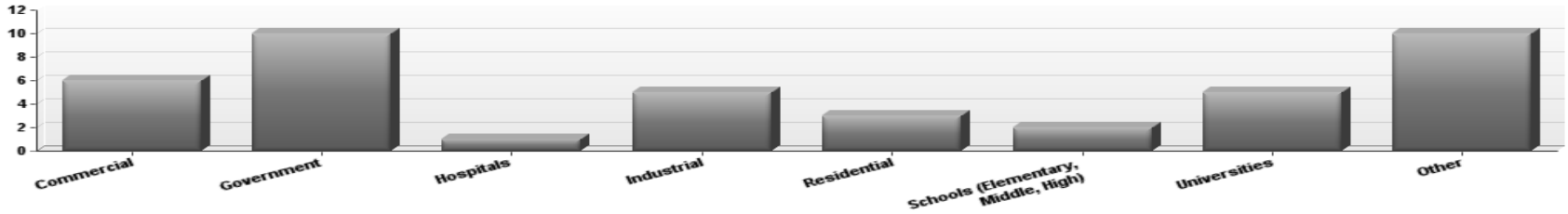
#	Answer		Response	%
2	BREEAM (Building Research Establishment's Environmental Assessment Method)		3	6%
3	CASBEE (Comprehensive Assessment System for Building Environmental Efficiency)		0	0%
4	CEPAS (Comprehensive Environmental Performance Assessment Scheme)		0	0%
5	Earth Advantage Commercial Buildings		0	0%
6	Energy Star		25	49%
7	Envision		3	6%
8	ESCALE		0	0%
9	GBTool		0	0%
10	GOBAS (Green Olympic Building Assessment		0	0%

	System)			
11	Green Globes		4	8%
12	HQE (High Environmental Quality)		0	0%
13	High Performance Building Index		1	2%
14	LEED (Leadership in Energy and Environmental Design)		48	94%
15	SBAT (Sustainable Buildings Assessment Tool)		0	0%
16	Other		8	16%

Other
Most of our work is in the industrial sector without rating programs. We have worked on projects where client is getting energy tax credits
Masdar
Green Points
Enterprise Green Communities
company too big for me to know
Green Point Rating System
Estidama (UAE)

Statistic	Value
Min Value	2
Max Value	16
Total Responses	51

8. Has your business bid on projects that will be certified by a "green" rating program? Please check all that apply.

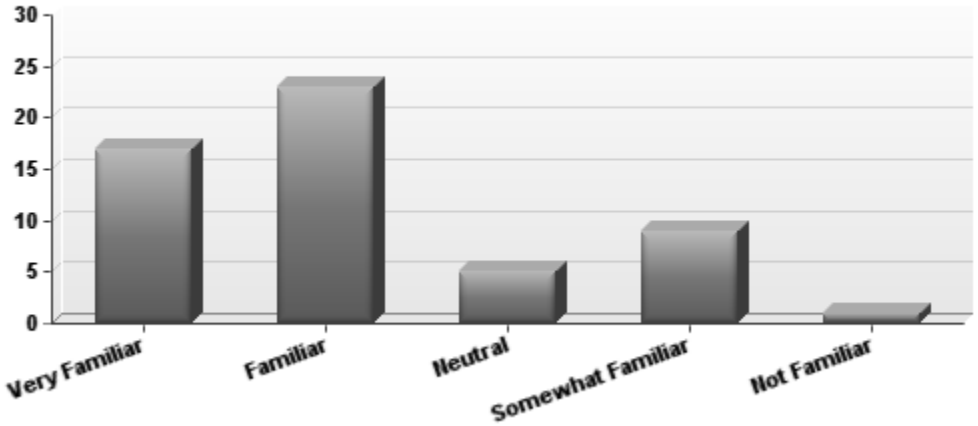


#	Answer		Response	%
2	Commercial		6	14%
3	Government		10	24%
4	Hospitals		1	2%
5	Industrial		5	12%
6	Residential		3	7%
7	Schools (Elementary, Middle, High)		2	5%
8	Universities		5	12%
9	Other		10	24%
	Total		42	100%

Other
Religious
commercial, university, government
Commercial/Government/Residential/Universities
Healthcare, K-12 Schools, University, Industrial / Comm., and Hospitals
All above (button wouldn't allow to select more than one)
survey won;t let you pick more than one
most of the above
ALL of the above
Government, Hospitals, Universities, Financial Institutions
All of the above

Statistic	Value
Min Value	2
Max Value	9
Mean	5.55
Variance	7.28
Standard Deviation	2.70
Total Responses	42

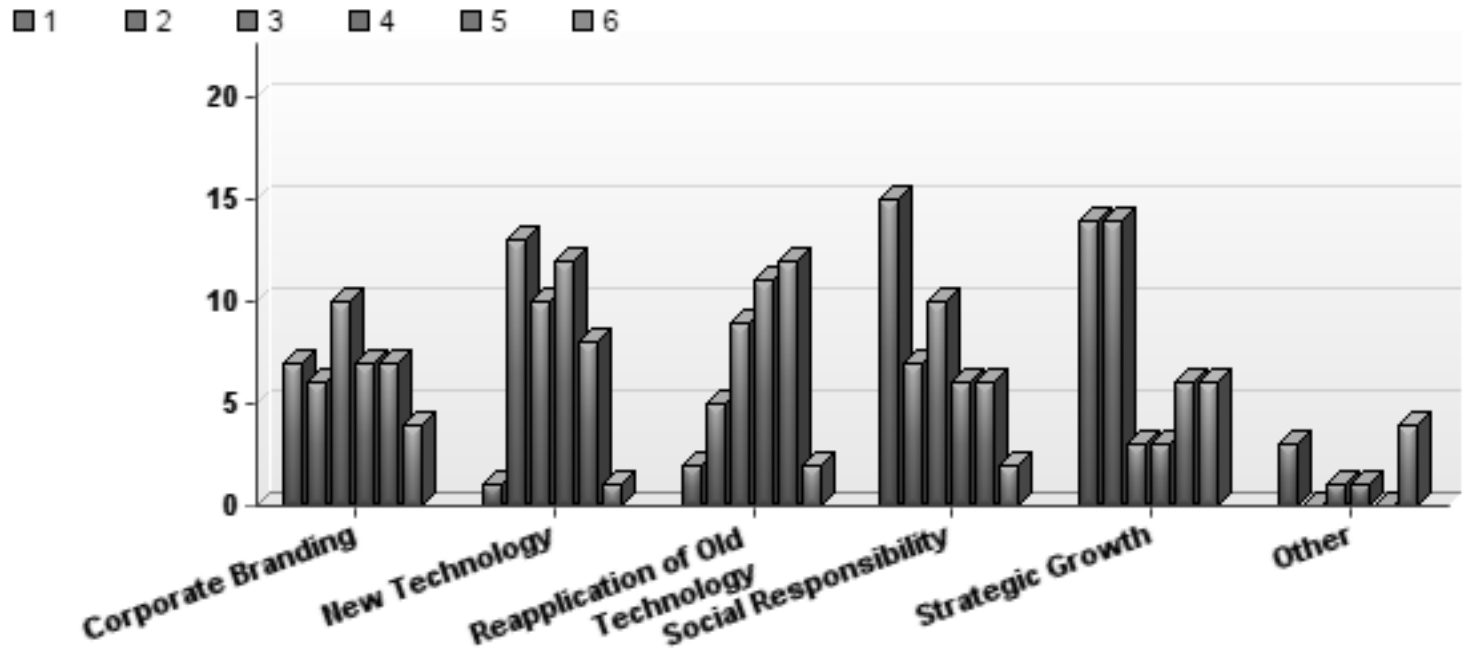
9. What is your familiarity with "green" rating programs? Please mark the appropriate selection.



#	Answer		Response	%
1	Very Familiar		17	31%
2	Familiar		23	42%
3	Neutral		5	9%
4	Somewhat Familiar		9	16%
5	Not Familiar		1	2%
	Total		55	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	2.16
Variance	1.21
Standard Deviation	1.10
Total Responses	55

10. What were the reasons for developing your alternative energy business? Please rank 1-6; 1 most important.

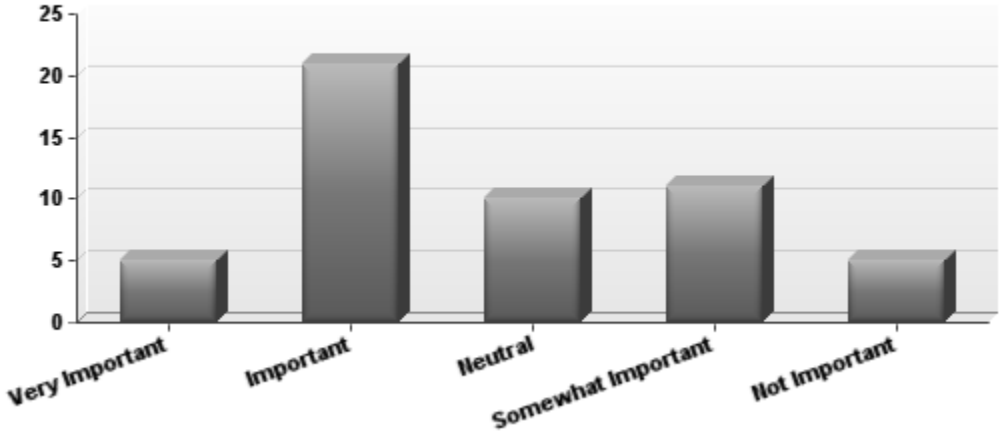


#	Answer	1	2	3	4	5	6	Total Responses
1	Corporate Branding	7	6	10	7	7	4	41
2	New Technology	1	13	10	12	8	1	45
3	Reapplication of Old Technology	2	5	9	11	12	2	41
4	Social Responsibility	15	7	10	6	6	2	46
5	Strategic Growth	14	14	3	3	6	6	46
6	Other	3	0	1	1	0	4	9
	Total	42	45	43	40	39	19	-

Other
Client/code requirement
to be good architects
projects pursuing sustainable strategies for variety of reasons
client demand
client goals
Design

Statistic	Corporate Branding	New Technology	Reapplication of Old Technology	Social Responsibility	Strategic Growth	Other
Min Value	1	1	1	1	1	1
Max Value	6	6	6	6	6	6
Mean	3.32	3.36	3.78	2.72	2.80	3.78
Variance	2.52	1.46	1.63	2.47	3.32	5.44
Standard Deviation	1.59	1.21	1.27	1.57	1.82	2.33
Total Responses	41	45	41	46	46	9

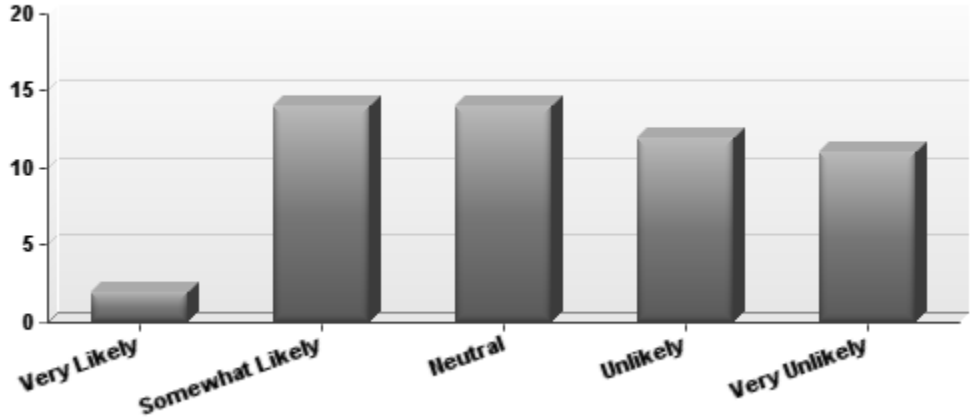
11. How important is research in alternative energy to your business?



#	Answer		Response	%
1	Very Important		5	10%
2	Important		21	40%
3	Neutral		10	19%
4	Somewhat Important		11	21%
5	Not Important		5	10%
	Total		52	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	2.81
Variance	1.37
Standard Deviation	1.17
Total Responses	52

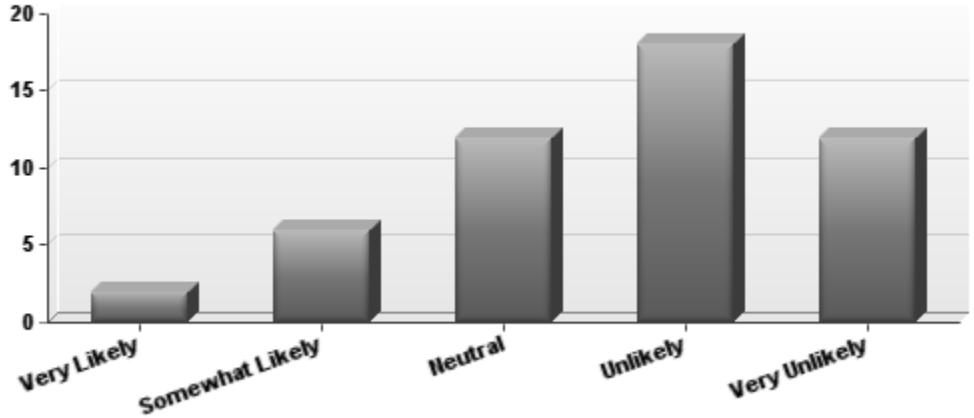
12. How likely is your company to spend money on the research and development of alternative energy products if government subsidies were provided?



#	Answer		Response	%
1	Very Likely		2	4%
2	Somewhat Likely		14	26%
3	Neutral		14	26%
4	Unlikely		12	23%
5	Very Unlikely		11	21%
	Total		53	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	3.30
Variance	1.41
Standard Deviation	1.19
Total Responses	53

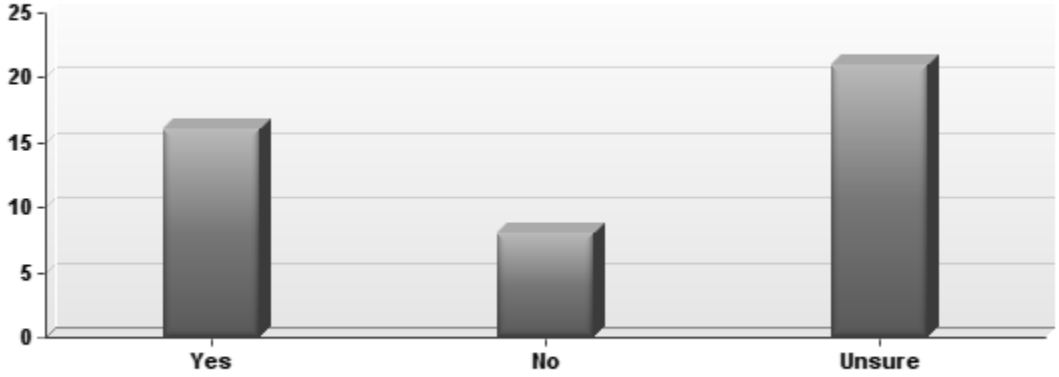
13. If government subsidies were NOT provided, how likely would your company be to spend money on the research and development of alternative energy products?



#	Answer		Response	%
1	Very Likely		2	4%
2	Somewhat Likely		6	12%
3	Neutral		12	24%
4	Unlikely		18	36%
5	Very Unlikely		12	24%
	Total		50	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	3.64
Variance	1.21
Standard Deviation	1.10
Total Responses	50

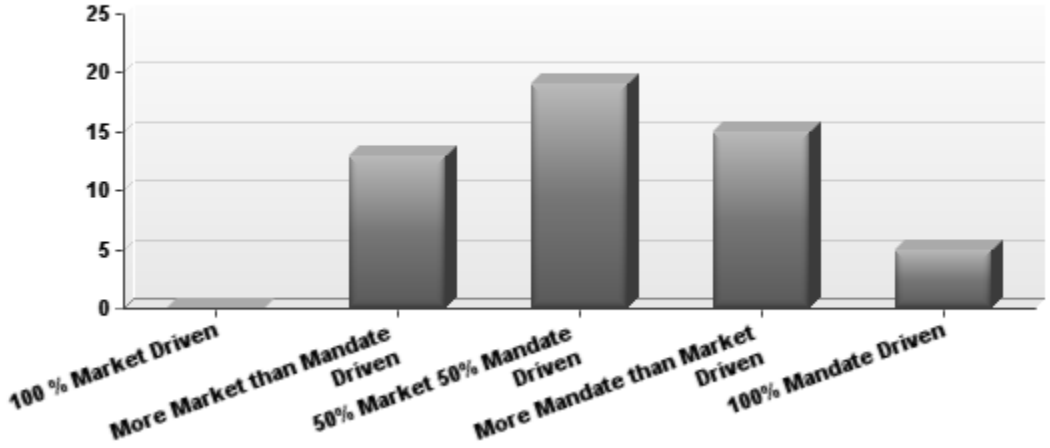
14. Has your company seen a reduction in alternative energy market activity as government subsides decline?



#	Answer		Response	%
1	Yes		16	36%
2	No		8	18%
3	Unsure		21	47%
	Total		45	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	2.11
Variance	0.83
Standard Deviation	0.91
Total Responses	45

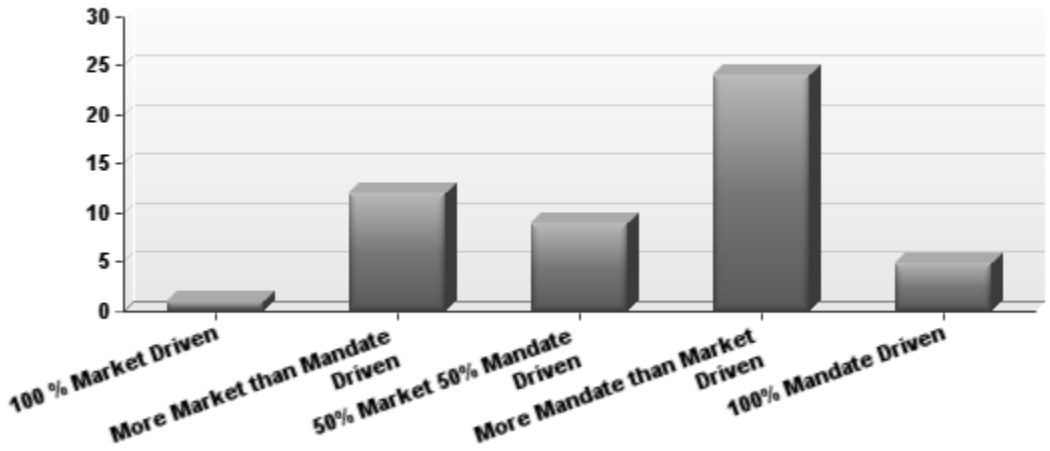
15. In your opinion, where do you perceive the driving force of alternative energy sales/acceptance to be?



#	Answer		Response	%
1	100 % Market Driven		0	0%
2	More Market than Mandate Driven		13	25%
3	50% Market 50% Mandate Driven		19	37%
4	More Mandate than Market Driven		15	29%
5	100% Mandate Driven		5	10%
	Total		52	100%

Statistic	Value
Min Value	2
Max Value	5
Mean	3.23
Variance	0.89
Standard Deviation	0.94
Total Responses	52

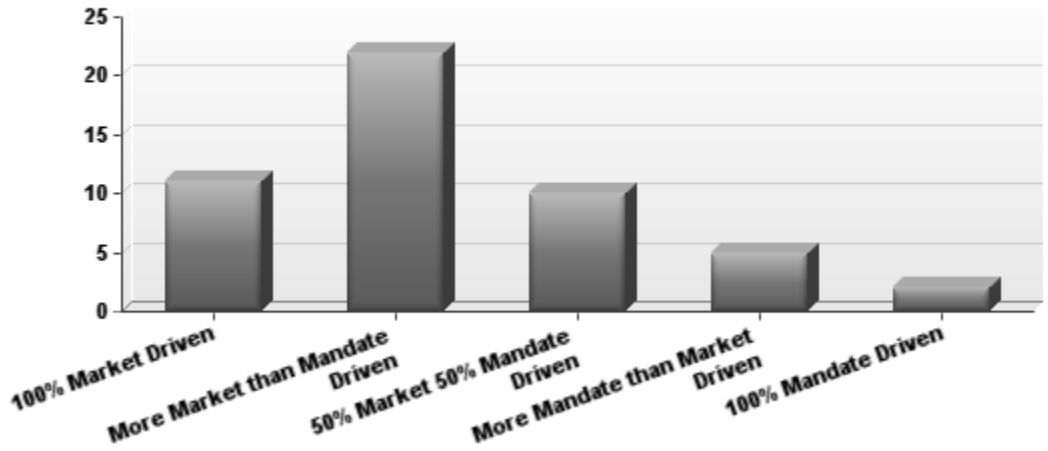
16. What does industry perceive as the driving force of alternative energy in the current market?

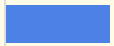


#	Answer		Response	%
1	100 % Market Driven		1	2%
2	More Market than Mandate Driven		12	24%
3	50% Market 50% Mandate Driven		9	18%
4	More Mandate than Market Driven		24	47%
5	100% Mandate Driven		5	10%
	Total		51	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	3.39
Variance	1.04
Standard Deviation	1.02
Total Responses	51

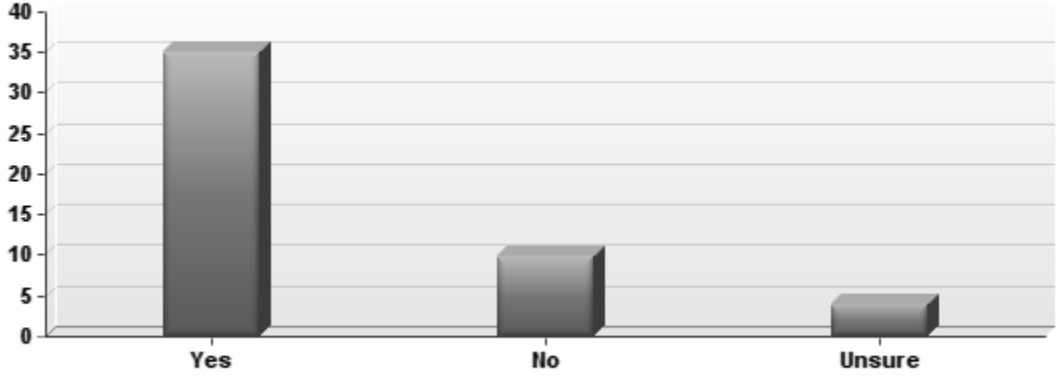
17. To ensure long term adaptation of alternative energy, where does the driving force of development need to be?



#	Answer		Response	%
1	100% Market Driven		11	22%
2	More Market than Mandate Driven		22	44%
3	50% Market 50% Mandate Driven		10	20%
4	More Mandate than Market Driven		5	10%
5	100% Mandate Driven		2	4%
	Total		50	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	2.30
Variance	1.11
Standard Deviation	1.05
Total Responses	50

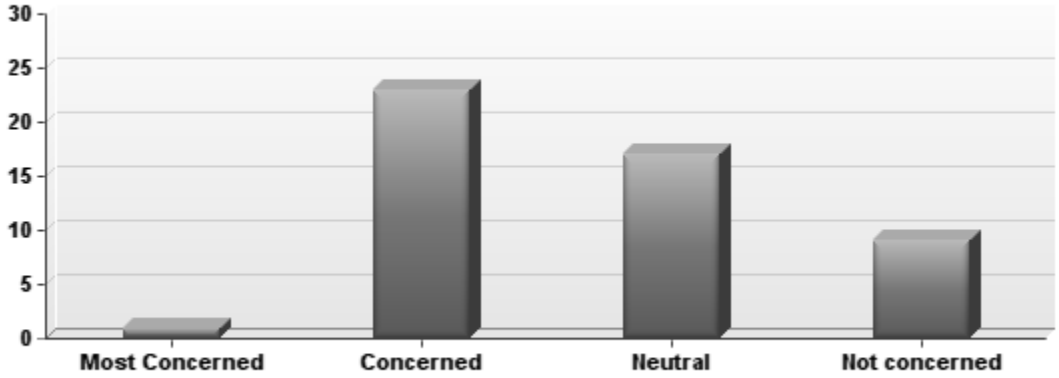
18. Has a customer/client ever approached your business requesting information about how to reduce their carbon footprint?



#	Answer		Response	%
1	Yes		35	71%
2	No		10	20%
3	Unsure		4	8%
	Total		49	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.37
Variance	0.40
Standard Deviation	0.64
Total Responses	49

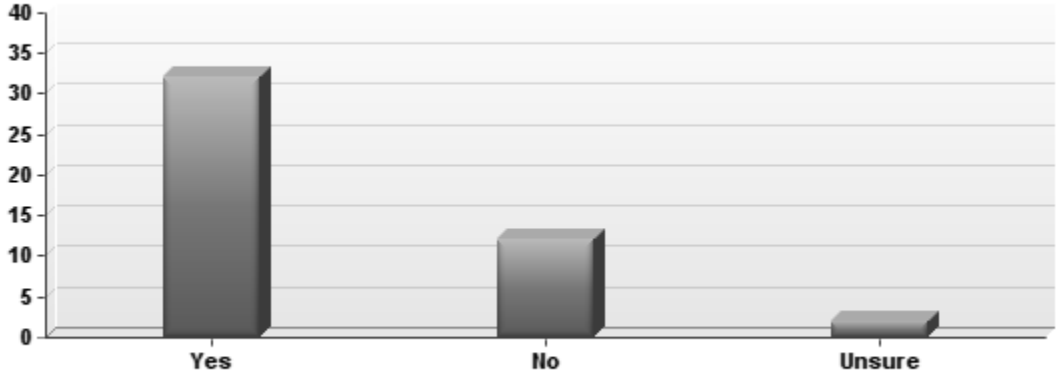
19. How concerned are most of your clients about the reduction of their carbon footprint?



#	Answer		Response	%
1	Most Concerned		1	2%
2	Concerned		23	46%
3	Neutral		17	34%
4	Not concerned		9	18%
	Total		50	100%

Statistic	Value
Min Value	1
Max Value	4
Mean	2.68
Variance	0.63
Standard Deviation	0.79
Total Responses	50

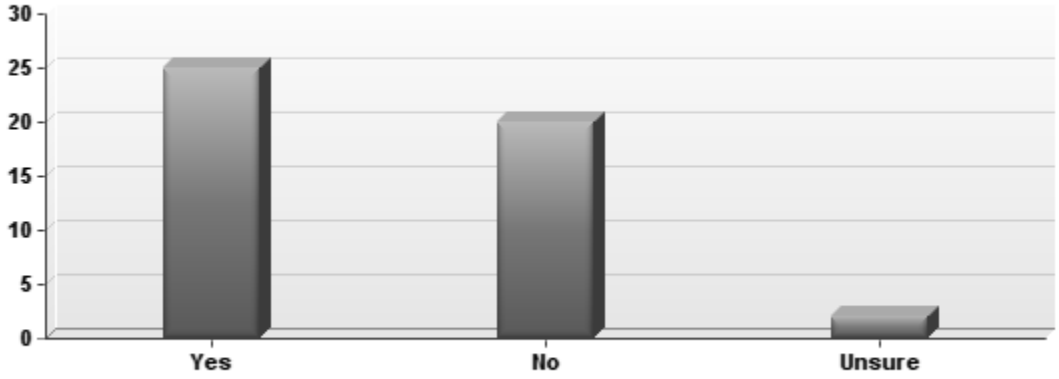
20. Do you provide life cycle costs for products or services which you offer?



#	Answer		Response	%
1	Yes		32	70%
2	No		12	26%
3	Unsure		2	4%
	Total		46	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.35
Variance	0.32
Standard Deviation	0.57
Total Responses	46

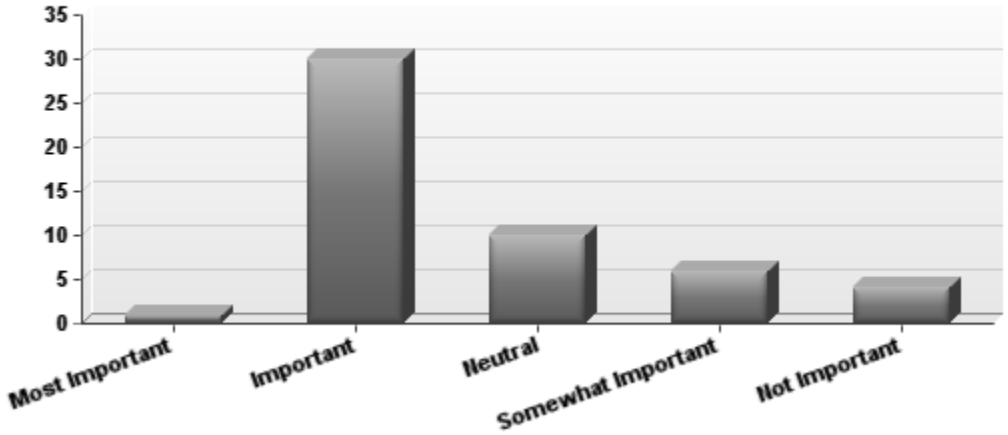
21. Do you provide life cycle assessment services (environmental impact reports) for products or services which you offer?



#	Answer		Response	%
1	Yes		25	53%
2	No		20	43%
3	Unsure		2	4%
	Total		47	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.51
Variance	0.34
Standard Deviation	0.59
Total Responses	47

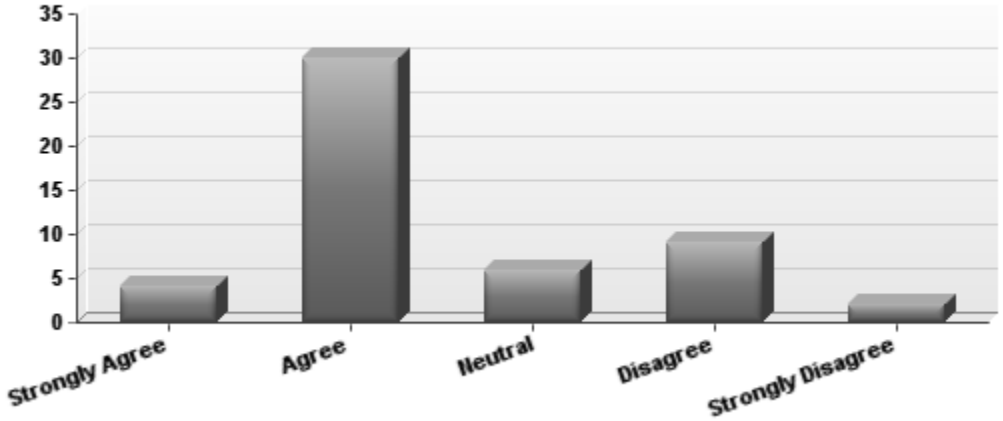
22. How important to your company is the reduction of your carbon footprint?

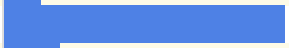


#	Answer		Response	%
1	Most Important		1	2%
2	Important		30	59%
3	Neutral		10	20%
4	Somewhat Important		6	12%
5	Not Important		4	8%
	Total		51	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	2.65
Variance	0.99
Standard Deviation	1.00
Total Responses	51

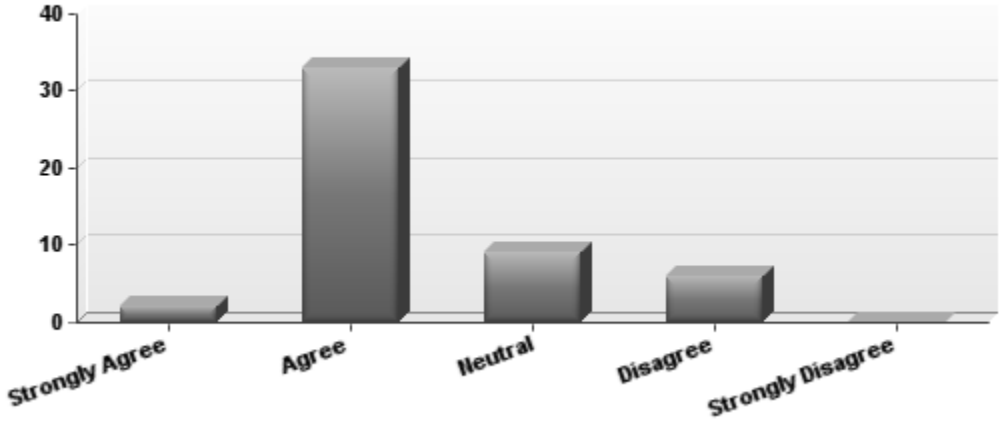
23. Alternative energy development and implementation would continue even without the influence of green building ratings programs such as LEED, Green Globes, etc.



#	Answer		Response	%
1	Strongly Agree		4	8%
2	Agree		30	59%
3	Neutral		6	12%
4	Disagree		9	18%
5	Strongly Disagree		2	4%
	Total		51	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	2.51
Variance	1.01
Standard Deviation	1.01
Total Responses	51

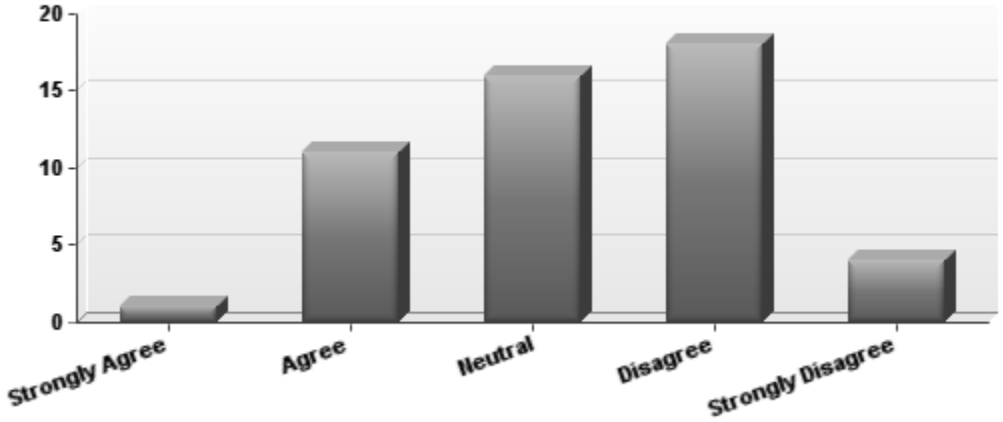
24. If there were not government subsidies or incentives for alternative energy implementation, your company would continue to provide alternative energy goods and services.

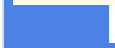


#	Answer		Response	%
1	Strongly Agree		2	4%
2	Agree		33	66%
3	Neutral		9	18%
4	Disagree		6	12%
5	Strongly Disagree		0	0%
	Total		50	100%

Statistic	Value
Min Value	1
Max Value	4
Mean	2.38
Variance	0.57
Standard Deviation	0.75
Total Responses	50

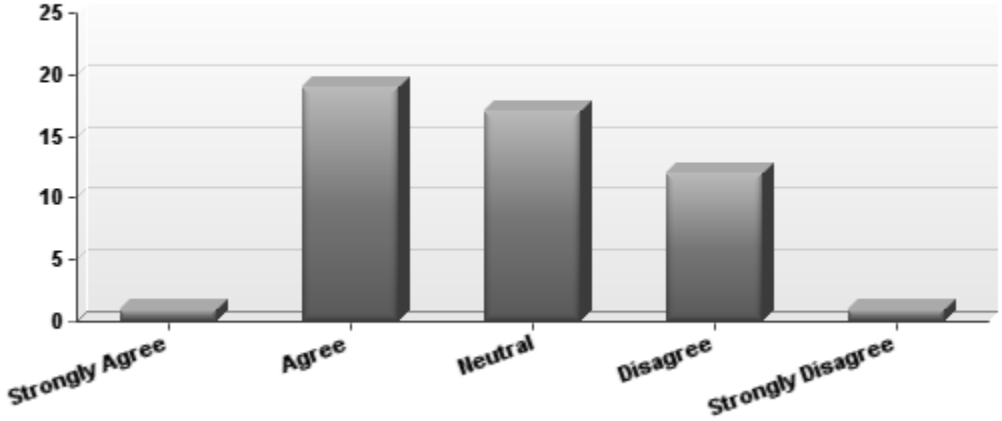
25. Green rating programs accurately represent the true value of alternative energy use in sustainable construction.



#	Answer		Response	%
1	Strongly Agree		1	2%
2	Agree		11	22%
3	Neutral		16	32%
4	Disagree		18	36%
5	Strongly Disagree		4	8%
	Total		50	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	3.26
Variance	0.93
Standard Deviation	0.96
Total Responses	50

26. There is an adequate craft labor force available to support alternative energy work.



#	Answer		Response	%
1	Strongly Agree		1	2%
2	Agree		19	38%
3	Neutral		17	34%
4	Disagree		12	24%
5	Strongly Disagree		1	2%
	Total		50	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	2.86
Variance	0.78
Standard Deviation	0.88
Total Responses	50

27. Please list the three (3) most critical factors which impair your ability to sell, manufacture and/or install alternative energy goods or services.

Factor 1	Factor 2	Factor 3
Understanding payback	Valuing social benefits	Available funding
Cost	Installation Time	Warrenty
Cost	Quality	Schedule
not cost effective	no proven track record	maintainence issues
Misrepresentation of LEED	Non communication of LEED personel	LEED is too costly
Cost - there are still cheaper alternatives out there utilizing standard energy	Clients don't see the importance of "being green". It simply adds cost to the manufacture of their products	The objectivity of engineers. It is hard to recommend the use of alternative energy when the return on investment is higher than standard technologies
Return on Investment is not as good as it should be.	Changing Technology has customers waiting for something better	Costs are too high.
initial Costs		
there is no LEED rating for agricultural structures	length of time to recoup costs	lack of financial incentives
Cost and budget limitations	Client has different priorities	Regulatory barriers
availability of comparative data	changing product specifications	
Cost of materials	Documentation associated with green (LEED)	
Cost of goods and services	Government interference they perceive is help	
Mis-informed and uninformed clients, who recieve almost no quality	National leaders unwilling impliment data driven, long term changes to the national	The perception that it is to costly - compared to traditional energy that is

information from mainstream media.	infrastructure and enrgy / water policy.	subsidized while being portraid as 'market driven'
Client Interest	ClienCapability to maintain properly	Initial costs to client
we do sell, manufacture or install. We design. Cost is the impediment		
Consumer interest	Market demand	Incentives
Up front cost to owner of project - as incentives decline less able to afford to install - cost is by far the biggest impairment, the below 2 are minor	Lack of adequate space/infrastructure for systems on project	Owner unfamiliar with system - uncomfortable trying something new
cost, implementation	motivation, client	cost, marketing/selling
I am an architect, I specifiy these items I don't create or supply them		
Commoditisation of the business		
Budget	Building / Land Owner Wishes	Aesthetics
Initial cost	Lack of clear standards for airport terminal buildings	Availability of equipment and materials
Client motivation	Funding	Resources
First cost of products, systems, etc.	Pay-back = life cycle costing	Proven technology & track record
initial cost	lack of public education	its not the norm, seems dificult
Cost	availability	client knowledge
Cost	Availability	Quality
Customer must be willing to absorb the added cost		

Cost	Production time	Reliability of the new solution
My company	North American CEO	Regional VP
to expensive	unproven systems	too much maintenence
Costs, firms just don't want to spend the extra money unless it's mandate or they can reroute the cost to their customers	Workforce is sufficient to perform the specialty work	long term results are inconclusive
Governmental regulations	Cost vs Benefit	Safety
Our company don't sell, manufacture or install anything, we are owner's representatives and only provide advice		
Regulatory Demand	Client Demand	Cost Efficiency
Not included in project specs	Cost	documentation

Statistic	Value
Total Responses	37