Institutional management of greenhouse gas emissions: How much does 'green' reputation matter?

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1. Introduction

Firms, institutions, and government entities, like individuals, have begun to identify themselves along with their products as environmentally friendly. For example, colleges, universities, and businesses increasingly highlight the construction and use of 'gold' and 'platinum' LEED Certified buildings.[1] Similarly, corporations are publicizing their voluntary reduction of waste streams as part of their corporate 'greening' initiatives (e.g., Xerox: Malennikova 2000 ; Manufacturing industry: Clelland et al 2000). Such moves toward 'green' behaviors and branding fit generally into the category of pro-environmental behavior, which when carried out by a firm or institution has also been labeled corporate environmentalism. Motivations for firms adopting voluntary, pro-environmental practices may include: reducing future liability, pre-empting mandatory regulation, cost savings, increasing rivals' costs, as well as differentiating one's business or products to increase demand or charge a price premium. Some of these motivations for corporate environmentalism are, no doubt, driven by business considerations such as cost, the attributes of a product or service, and socio-economic characteristics of consumers. Green branding has also served as a signal or measure of product or service differentiation to attract increasingly segmented consumer groups. For example, automobile manufacturers advertise hybrid vehicles by touting financial savings at the gas pump, low carbon emissions, and an environmentally friendly image. These advertisements do not typically mention the vehicles' total cost of purchase or the breakeven point in time when the cost

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[1] See the U.S. Green Building Council <http://www.usgbc.org> for a complete list of LEED certified buildings.

savings for fuel equals the price premium paid for the hybrid version of the automobile. However, the environmentally friendly image is an important attribute for both the parent corporation as well as the consuming public.

The economics literature concerning pro-environmental behavior often examines the private provision of public goods. Bergstrom et al (1984) theoretically predict the importance of income in sorting individuals between contributing to a public good and free-riding. Several studies empirically examine the determinants of pro-environmental consumption of energy related products and services. Welsch and Kuhling (2009) highlight the importance of demographics, income, price premiums and consumption patterns for participating in a green electricity program or installing residential solar equipment. The stated preference literature has examined the price premium consumers are willing to pay to mitigate the effects of global warming (Layton and Brown 2000), for renewable energy technology (Bergman et al 2006; Bollino 2009; Roe et al 2001), and for environmental attributes energy policy (Alvarez and Hanley 2002). For the purpose of this inquiry, "external" influences of pro-environmental behavior include such factors as cost, socio-economic characteristics of consumers, and attributes of a product or service.

In contrast to so-called external influences of pro-environmental behavior and its accompanying scholarly literature, research typically based in psychology offers another perspective, that of "internal" influences on the adoption of pro-environmental behavior. This research suggests that pro-environmental behavior for individuals originates in their underlying values, beliefs and attitudes. For example, Fransson and

Garling (1999) review the link between individuals' attitudes and psychological factors with the level of their environmental concern as well as the impact of individuals' environmental concern on their pro-environmental behavior. Social science scholars have called for research that considers both external (e.g., competition, cost) and internal (e.g., values, attitudes, beliefs) influences on adoption of pro-environmental behavior (e.g., Dunlap and Van Liere, 1980). Guagnano, et al. (1995). These calls suggest that models that integrate the relationship between external and internal influences on behavioral change may yield more informative environmental policy analysis.

It does not appear that the relationship between external influences (i.e., energy production and consumption policy attributes), internal influences (i.e., environmentalism and altruism), and institutional pro-environmental behavior (i.e. promoting 'green' reputation) has been empirically examined. This paper undertakes such an examination in the context of constituencies' preference for alternative energy programs for their institution. Universities, like corporations, range comparably in size and are comprised of a variety of constituents: administration (upper management); faculty (lower management); staff (workers); and graduate and undergraduate students (customers/shareholders). Our analysis uses a stated-preference conjoint survey approach that asked students and employees at a tier 1 research university to rate the green reputation contribution of competing energy policy scenarios. While there has been extensive study in the contingent valuation literature on attributes of renewable energy policy (e.g., Alvarez and Hanley 2002; Bergman et al 2006; Johnson and Desvousges 1997; Layton and Moeltner 2005), the role of alternative energy policy attributes regarding institutions' green reputation has yet to be empirically examined. The 'external' influences of the energy policy scenario attributes include; the mix of fuels, the institution's energy conservation effort (education initiatives and energy efficient technology upgrades), alternative carbon emissions targets, the investment time-frame, and the cost. We also investigate the role 'internal' influences play in an institution's green reputation in the form of altruism (respondents' concern for the welfare of others) and environmentalism (respondents' concern for the environment) by using factor analysis to integrate attitudinal and motivational questions into the analysis.

The reported research takes steps towards examining the effects of an institution's green reputation and image from within the institution, along with exploring how the 'green' attributes of its decisions, in turn, influence it's green reputation. Our novel experimental design and set of energy policy attributes are pertinent to the decision-making contexts of many large firms and institutions. Our research also provides a foundation for analyzing how institutions undertaking infrastructure and policy changes can influence their own 'green' reputation. The paper proceeds as follows: Section 2 provides background literature and reviews the study setting; Section 3 discusses the survey design and administration; Section 4 presents the conceptual framework underlying the analysis; Section 5 presents the research result; and the final section discusses the findings, their implications, and our conclusions.

2. Background

2.1 Review of pertinent literature

Recently, the research on voluntary corporate environmentalism was extended beyond individual case studies (e.g. Lynes and Andrachuk, 2008; Jones et al 2005; Warhust and Mitchell 2000) and some highly theoretical work (e.g. Besley and Ghatak, 2007) to research that empirically examines why firms or institutions undertake voluntary environmental initiatives. This literature tends to point at two demand-side influences that are said to motivate firms or institutions to adopt more environmentally friendly practices. First, researchers assert that firms seek to market a product or service as 'green' in order to attract consumers that have high levels of concern for the environment (Zimmer et al 1994; Mostafa, 2007). Second, researchers have explored the hypothesis that rather than marketing products or services as being 'green' to 'green' consumers, firms or institutions instead want to improve their overall public image by marketing themselves as 'green' or environmentally friendly. For example, some scholars are developing a line of inquiry that examines the role of a firm's environmental reputation on current employees as well as a firm's recruitment efforts (Behrend 2009; Bauer 1996). Quantifying a firm's gain from improving its environmental reputation can be challenging. One way researchers have addressed this is by examining changes in stock values corresponding to corporate environmental disclosures (e.g., Khanna et al. 1998). Another approach has estimated a model of corporate reputation based on data from mangers' assessments and market analysis (eg. Brammer and Pavelin 2006). All of these instances appear to treat a firm's pro-environmental behavior as a function of mechanisms and feedback to the firm.

Other social science literature on pro-environmental behavior has concentrated on internal mechanisms such as environmental concern and altruism. Bamberg and Moser (2007) suggest a theoretical model that combines self-interest and pro-social motives to explain individuals' pro-environmental behavior. Fransson and Garling (1999) review some previous research to investigate whether environmental concern plays a vital role in understanding individuals' behavior changes. These authors assert that socio-demographic factors such as age, education, rural/urban residence, and political inclination are key factors in predicting levels of environmental concern. That is, the socio-demographic characteristics of individuals, it is suggested, help determine individuals' environmental concern. A second internal mechanism, altruism, has also been noted as a possible determinant of activities such as green branding. Some research on electricity purchases finds that individuals with higher levels of environmental consciousness and higher levels of altruism appear more likely to participate in green electricity programs (Kotchen and Moore 2007). Moreover, Griskevicius et al. (2010) argue that buying green products is inherently altruistic because the purchase of green goods create positive externalities that benefit the environment for everyone.

A few studies appear to have integrated the inquiry of both so-called external and internal influences on firms' decision making. Wiser et al (2001) surveyed 464 firms about their purchase of green power and report empirical results suggesting that altruism and employee morale were important motivating factors in firms' renewable energy purchase. Clark et al. (2003) used elements from psychology on pro-environmental behavior and economic models of the private provision of a public good to identify key internal and external variables that explain voluntary participation of households in a green electricity program. Their study demonstrated that internal factors such as individuals' altruism and environmental attitudes as well as external variables like household income and the number of individuals in a household may be important predictors of pro-environmental behavior. However, there is a gap in the literature as it relates to an institutions' green reputation and how institutional decisions to adopt pro-environmental behavior are influenced by and in turn influences their "green" reputation.

2.2 Research Site

The study was conducted at a tier 1 research university, which sits on a 5,200-acre campus, of which 2,100 acres are in planned or existing development. There are approximately 577 buildings spread throughout the campus that vary in age from new to over 100 years old. The university's constituent population is comprised of approximately 46,000 students and 11,100 academic and support staff and administrators. In 2007, the university's total emissions level in carbon equivalent terms was 601,579 tons. It is estimated that 96% of the university's carbon emissions comes from the university's co-generation power plant, which generates electricity and steam for the campus. The university uses steam created during electricity production to heat buildings in the winter and run refrigeration units for air conditioning in the summer. The university's power plant gives it direct control over its energy supply and a unique ability to manage its carbon footprint.

A variety of mechanisms are available for businesses, firms, and government entities to differentiate themselves, prepare for potential regulation, and signal their environmental stewardship. One approach that signals environmental stewardship and improves carbon footprint management is to join an environmental management organization, such as the Chicago Climate Exchange (CCX). The CCX was developed to provide economic incentives for an institution to reduce its greenhouse gas emissions. Joining the CCX is voluntary, however once an institution joins, its commitment to the CCX's emissions reduction schedule (based on emissions relative to an agreed upon baseline year) is legally binding. CCX members represent all sectors of the economy, including several major research universities. The tier 1 university in our study joined the CCX in 2006 to, among other things, demonstrate its commitment to environmental sustainability and take actions in line with its commitment to being recognized as a "green" university. The university's CCX membership requires a carbon reduction of 6% below year 2000 levels by 2010. Beyond those CCX obligations, the university has pledged to further reduce carbon emissions to 15% or more below its 2000 baseline by 2015.

3. Methods

With the university considering ways to meet or exceed its CCX obligation through changing its fuel and carbon management strategy, we sought to better understand students and employees perceptions of green reputation benefits associated with alternative energy and carbon management policies. Therefore, we conducted a survey of university constituents, where each respondent was presented with two potential carbon management programs and asked to compare the characteristics of each program and rate them on a Likert style scale with respect to the program's contribution to the university's green reputation. (See Figure 1 for an example). The study was a part of a broader energy survey that guided respondents through a series of questions about their, current behaviors, carbon management and energy conservation knowledge, and environmental attitudes and values. We conducted factor analysis on a number of the attitudinal questions to reduce them to two interpretable variables that we used as explanatory variables in our statistical model.

3.1 Survey Instrument Design and Implementation

The survey instrument was developed in multiple phases using an iterative process (Kaplowitz et al 2004) as part of a larger campus sustainability effort. First, in person interviews were conducted with university administrators and technical experts to identify policy relevant attributes. This was followed by focus groups with students and staff in order to obtain qualitative information on their concerns, knowledge, and understanding of energy use and production at the institution. Following the focus groups, a draft survey instrument was developed and pre-tested in the field. The pre-testing allowed for the collection of additional information, which along with the input of technical experts, was used to refine the survey, the information treatments, the attributes and the attribute levels for the energy policy scenario. For an accurate representation of the stakeholder population the university registrar provided a stratified random sample of student, faculty and staff email and mailing addresses. The sample population was invited by either an email or postcard to participate in the web-based survey during March 2009[2]. The invitation informed recipients about the study and provided them with a link to the survey as well as a unique username and password. Those failing to complete the survey were contacted up to two more times, either through email or a postcard, and invited again to take part in the survey. After adjusting for undeliverable mail and email addresses, the overall response rate was about 25%. The various subpopulations had significantly different response rates with faculty responding at a 36% rate; and staff at 49%; and students at 15%. A total of 4,092 individuals responded yielding 12,125 usable choice responses.

3.2 Energy Program Attributes

Five key attributes were chosen to describe energy policies: the mix of fuels used to generate electricity and steam; the level of energy conservation efforts; the carbon emissions reduction target; the time frame for achieving the emissions reduction target; and an additional semester fee per person to cover the cost of the policy. Table 1, presents the program attributes and the attribute levels used in the final survey.

[2] Invitation mode (i.e. mail or email) was part of an experiment on survey methods. Subsequent analysis shows no substitutive difference in responses based on invitation mode.

Table 1. Carbon Management Program Attributes and Attribute Levels		
Attribute	Attribute Description	Attribute Level
Fuel Type		
Coal	Using coal in co-generation power plant	0% to 100%
Natural Gas	Using natural gas in co-generation power plant	0% to 100%
Biomass	Building a biomass facility on campus and using biomass in the co-generation power plant	0% to 30%
Wind	Erecting utility scale wind turbines on or near campus	0% to 30%
Solar	Installing solar panels on several buildings on campus	0% to 30%
Nuclear	Installing a small, self contained nuclear underground at the university	0% or 50%
Energy Conservation Effort	The energy conservation effort consists of a combination of an education initiative and energy efficient technology adoption designed to lower energy demand	Minimal, Moderate, Extensive
Carbon Emissions Reduction	The amount that the University's carbon emissions would be reduced by undertaking a particular energy policy	15%, 17%, 19%, 21%, 23%
Year Emissions Reduction Achieved	The investment timeframe under which the emissions reductions would be fully achieved	2015, 2020, 2025
Additional Semester Fee Per Person	The additional fee paid by faculty, students and staff each semester	$25, $50, $100, $150

For our purposes here, it is important to note that energy conservation effort as explained to respondents was made up of two components -- some level of energy conservation education campaign and some level of energy conservation technology adoption. The two types of conservation components were combined to provide 'minimal', 'moderate', and 'extensive' levels of energy conservation efforts for possible adoption by the university (see Table 2).

Table 2. Energy Conservation Effort		
	Education Initiatives	Technology Adoption
Minimal	Campus wide energy conservation education campaign	Upgrade outdated appliances/ fixtures
Moderate	Energy conservation training for all incoming students	Required energy efficiency certification for new buildings
Extensive	Energy conservation training for all faculty/staff/students	Required energy efficient certification for all buildings

3.3 Conjoint Experimental Design

There are many different ways to combine the attributes and attribute levels described above. Therefore, we used an experimental design to vary attributes across respondents. This allows for the use of statistical techniques to identify the effect that each attribute has on the green reputation contribution. Due to the unique nature of the fuel type attribute (i.e., the need for steam generation, the scale requirement for small nuclear power, etc.), we impose several constraints on the experimental design. We allow for both coal and natural gas to be any level at a 10% increment up to 100% of the fuel portfolio, while biomass, wind and solar may range from 0% to 30% at 10% increments. This is because biomass, wind and solar do not generate needed steam for the university. The nuclear fuel attribute was limited to either not a part of the fuel portfolio or 50% of the portfolio due to the scale requirements needed to construct a nuclear facility. We also account for engineering feasibility and the restriction that the overall fuel mix must add to 100%.

The ensuing experimental design incorporates our algorithm-based approach to produce the levels for the fuel type and couples that with a conventional main-effects design for the non-fuel attributes. In the algorithm design we were faced with a trade-off between the distribution of fuel type and the correlation between fuel types, which potentially induces multicollinearity among the fuel type estimates. Therefore we constructed the fuel type distribution around technical feasibility provided by power plant engineers while minimizing the correlation between fuel and non-fuel attributes. A fractional factorial design was generated for the non-fuel type variables such that the main effects were identifiable and orthogonal. The experimental design for the non-fuel attributes is from a main-effects design for the attribute levels and a random pairing of the attribute levels. The full experimental design is comprised of both the fuel mix and non-fuel attributes.

Figure 1. Example of a choice set

Characteristics	Program	
	A	B
Fuel Type	Coal 70% Biomass 20% Wind 10%	Coal 60% Biomass 30% Solar 10%
Energy Conservation Effort	Minimal campus wide education campaign upgrade outdated appliances/fixtures	Extensive training all faculty/staff/students efficiency cert. for all buildings
Carbon Emissions Reduction	17%	23%
Year Reduction Achieved	2020	2020
Additional Semester Fee Per Person	$50	$100

Please compare Program A with Program B and select the box below that best describes their contribution to the university's green reputation.

Program A better — About the same — Program B better

☐ ☐ ☐ ☐ ☐ ☐ ☐

3.4 Factor analysis

The survey instrument contained a variety of questions about each respondent's current behaviors, energy conservation knowledge, and their demographic characteristics. These questions and attendant information were designed to inform individuals of the energy policy scenarios and attributes, and for use in the empirical model to better understand any preference heterogeneity within constituent groups. The survey also included two sets of attitudinal and motivational questions designed to elicit latent constructs regarding respondents. In particular, we are interested in individuals' degree of altruism and concern for the environment. Previous literature in the social sciences has noted the effectiveness of attitudinal and psychometric style questions for understanding unobservable latent characteristics of individuals (eg. Boxall and Adamowicz 2002). Responses to these questions are used in the empirical model to help understand energy policy scenarios green reputation ratings. All of the attitudinal and motivational questions asked respondents to use a five point Likert-type scale to indicate their level of agreement or disagreement. The questions were pre-tested for clarity and to ensure consistency with the underlying constructs of interest. After the data were collected, we checked responses for internal consistency, and tested whether they could be combined into summated scales for each underlying construct.

The number of attitudinal and motivational questions used to build measures (i.e. scales) for each underlying latent characteristic was limited due to space constraints of the survey instrument. The final environmentalism scale was adopted from a subset of the full New Ecological Paradigm questions (Dunlap et. al 2000), and has also been used by Kotchen and Moore (2007) and Clark et al (2003). The altruism scale was adopted from modified versions of Kotchen and Moore (2007) and Lusk et al. (2007).

We use principal components factor analysis in order to collapse the motivational and attitudinal data into indices representing their underlying constructs. The indices were created separately for student and employee samples. Following the Kaiser criterion, we retained factors with an eigenvalue greater than 1. The factors were rotated using the

Varimax rotation method (Kaiser, 1958) and the factor loadings and eigenvalues can be found in Table 3.

Table 3. Rotated Factor Loadings

		Students		Employees	
		Factor 1 Environmental Index	Factor 2 Altruism Index	Factor 1 Environmental Index	Factor 2 Altruism Index
A	Plants and animals have as much right as humans to exist.	-0.4049	0.3132	-0.4835	0.2219
B	The so-called 'ecological crisis' facing humankind has been greatly exaggerated.	0.7485	-0.2243	0.7866	-0.2647
C	Human ingenuity will insure that we do not make the earth unlivable.	0.6054	0.3166	0.5738	0.0785
D	The earth is like a "spaceship" with very limited room and resources.	-0.4558	0.3019	-0.6110	0.1808
E	The balance of nature is strong enough to cope with the impacts of modern industrial nations.	0.7617	-0.0748	0.7685	-0.1078
F	I am willing to sacrifice for the good of those around me.	-0.0682	0.7654	-0.1446	0.7566
G	Paying taxes is important because they fund programs such as schools and roads from which everyone benefits.	-0.2156	0.5809	-0.3126	0.5810
H	I take actions to improve the well-being of people I don't know.	-0.0455	0.7567	-0.0480	0.7990
I	My responsibility is to provide only for my family and myself.	0.4102	-0.3889	0.2977	-0.5903
	Eigenvalues	2.71	1.375	3.19	1.231

In practice, factors loadings that are above .4 are considered highly loaded and representative of the same underlying construct. Using this criterion our factor loadings match up relatively well with the previous literature. Items A through E load on factor 1 for both students and employees. Since those items were chosen from the New Ecological

Paradigm, we label this factor as the 'Environmental Index'. Items F through I all load on factor 2, with the close exception of question I for students. This factor is labeled as the 'Altruism Index' and can best be described as attitudes and motivations towards higher degrees of altruism. For simplicity and ease of interpretation in the empirical model the altruism and environmentalism indices were transformed so that higher and positive altruism index corresponds to a higher likelihood of altruistic behavior and a positive environmental index corresponds with a higher concern for the environment.

4. Data Analysis

The purpose of this study is to examine how attributes of alternative energy and carbon management policies influence an institution's green reputation. We empirically model the effects of the energy policy attributes, respondents' demographics, as well as motivational and attitudinal factors on the institutions' 'green' reputation. In our conjoint style empirical model, the dependent variable is the Likert-scale rating comparing two alternative policy scenario's contribution to the institution's green reputation. Since we are particularly interested in each individual's perception of how policies effect the university's green reputation, it is helpful to account for individuals that perceive to benefit from the university's green reputation. We account for this by conditioning the Likert-scale rating comparing energy policies' impact on green reputation on whether or not the respondent indicated that he/she benefited from the university's green reputation in response to a specific survey item (see item M in Table 7). Therefore, our dependent variable enabled us to examine stakeholder view of energy program's green reputation effects as a function of the program attributes for those claiming to gain a benefit from the institutions' green reputation as well as those that did not.

4.1 Descriptive statistics

Descriptive statistics for the demographics and energy conservation techniques are presented in Table 4. The descriptive statistics coincide with many of our *a priori* assumptions concerning the population. The high average student age seems to reflect changing student demographics and the number of graduate students responding to the survey. Not surprisingly, students were more aware of their current energy fee than faculty and staff, while faculty and staff were more aware of the power plant's role on campus than students. The descriptive statistics show that faculty have a much higher mean income than staff, and that students are the lowest income group[3].

[3] We use a standard recoding procedure, where the income of the constituent groups was measured at the midpoint of income ranges reported by each respondent. The income choices had a range of $15,000 for the levels from $0 up to the $60,000 threshold, then increased to $20,000 ranges from $60,000 up to the $100,000 threshold and end with a range of $100,000 to $150,000 and more that $150,000.

Table 4. Descriptive Statistics of Individual Characteristics			
	Students	Faculty and Staff	
% Male	44.43%	43.48%	
# of respondents	1,722	2,366	
Average Age (in years)	23.92 (6.29)	46.93 (11.26)	
Political Ideology			
1= strongly conservative to 5= strongly liberal	3.34 (1.02)	3.33 (1.06)	
Average Income ($)	$16,442	$84,986	$45,508
Standard Deviation	$23,609	$42,085	$28,272
Aware of the current energy fee imposed on students	65.10%	25.77%	
Aware of the need for the power plant for producing steam and electricity	46.14%	71.36%	
Turn off lights in unoccupied room*	4.26 (.9844)	4.33 (.8234)	
Turn off computers, printers, etc. overnight *	3.43 (1.486)	4.08 (1.3)	

*Ranges from 1 = never to 5 = always

In addition, Figure 2 shows that the majority of students and employees (which includes academic and administrative staff) think that the university's emissions target of 15% reduction by 2015, which is greater than its CCX commitment, is either too little or just the right amount. Not only do the constituent groups support lowering the campus' carbon footprint, but the constituents also believe that they gain a benefit from the university's green reputation. Figure 3 shows evidence that 71% of employees and 72% of students benefit from the university's green reputation. Together this evidence suggests that examining the ways constituents benefit from an institution's green reputation is a worthwhile endeavor.

Figure 2. "The university's target of a 15% emissions reduction by 2015 is:"

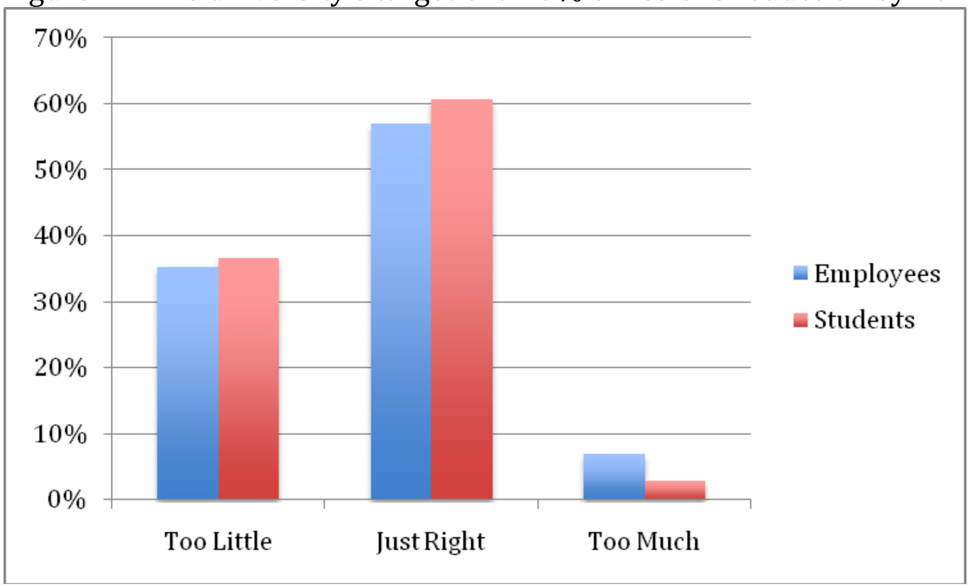
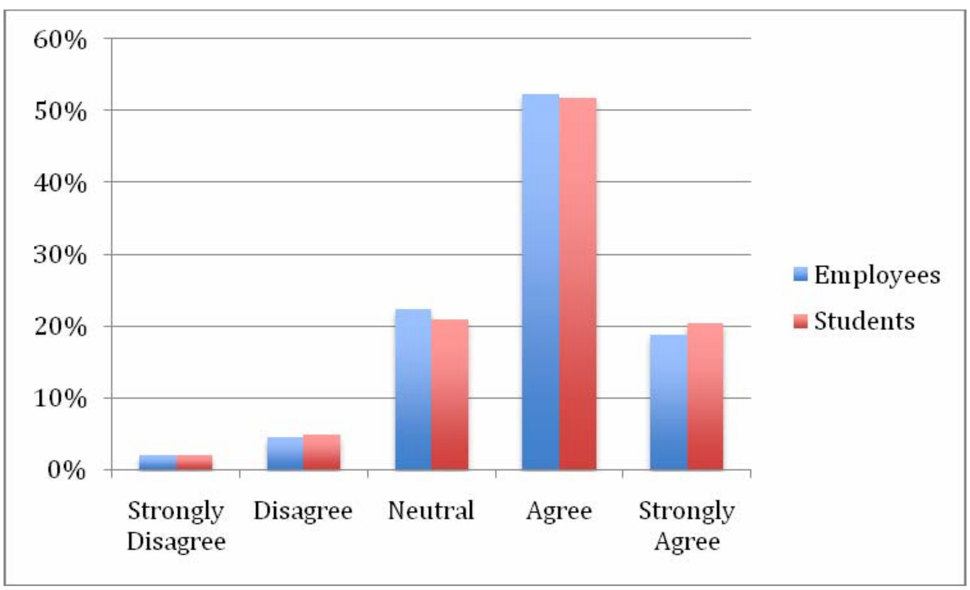


Figure 3. "I think that the university's green reputation benefits me.



4.2 Empirical Model

Empirically, we use the regression model $Y_i = \beta \Delta X_j + \gamma Z_i \Delta X_j + \mu_i + \varepsilon_{ij}$. The observable independent variables X_j are the energy policy scenario characteristics of the two competing alternatives for the jth alternative. In order to take into account the tradeoffs made by respondents with respect to each choice pair we use the difference between the attribute levels in the choice set (i.e. Choice A – Choice B), which is represented in the econometric model as ΔX_j. Using the differenced attributes allows us to identify and estimate β, the effect of the attributes on the green reputation ratings. The actual numerical values were differenced for the fuel type, carbon emissions reduction, time-frame, and fee, while a dummy variable procedure was differenced for the discrete energy conservation effort variable. The dependent variable Y_i is the Likert-scale comparison of the two competing alternatives that indicates which of the scenarios, according to the respondent, contributes more to the institution's green reputation. The data for the dependent variable was coded to match the structure of the independent variables. The model also considers interaction terms with the differenced energy policy attributes ΔX_j in order to examine heterogeneity within constituent groups. We use demographic characteristics as well as altruism and environmentalism indices, which are represented by Z_i, allowing us to identify and estimate the parameter γ. Finally, because of the panel nature of our data we include an individual specific error component μ_i and a random error term ε_{ij}. Due to the multiple responses from each individual, we used panel data methods to analyze ratings. It is likely that individual specific effects carry across responses (i.e. unobserved characteristics unique to each individual can induce correlation among responses). Therefore, the random effects estimation technique is used (Wooldridge 2002) in an ordinary least squares (OLS) linear random effects regression model.

As discussed above, the data were drawn from stratified random samples of the campus constituent groups. Therefore, using a Chow test we tested to ascertain whether any of these three groups shared the same underlying preferences to see if it might be appropriate to pool any of the groups together(Chow 1960). The results show that we cannot reject statistically that faculty and staff have the same underlying preferences at the 5% significance level. At the same time, we found that students had preferences that differed significantly from the faculty and staff segments. These results suggest that it is appropriate to combine the faculty and staff together as 'university employees' but to consider the students as a separate segment.

4.3 Model Estimation Results

We first consider separate regression model results for the student group and the employee constituent group. The results for the student segment are presented in Table 5 and the employee segment results are in Table 6. Model 1 for each group consists of only the energy policy scenario attributes found in the conjoint analysis. The results from Model 1 show that all of the coefficients for both groups are significant at the 1% level and have the expected sign. Interpreting the positive coefficients for all of the fuel types for both groups should be taken in the context of the baseline category for the fuel variable, coal. These results indicate that energy produced by coal has the lowest green reputation benefit to university constituents, and that green reputation benefits increase as the use of carbon intensive fuel decreases. We find, using a Wald test, that for students wind and solar provide green reputation benefits that are statistically indistinguishable from each other, while for the employee group wind provides a higher green reputation benefit than solar. Nuclear power's green reputation is found to be slightly more favorable to coal for both students and employees. It is likely that wind and solar power have the highest reputation effects because they are carbon free energy production technologies and that they also may provide a visible symbol of the university's environmental commitment. While nuclear power is also a carbon free technology, there are a variety of negative characteristics associated with it such as perceptions of higher risks and the issue of nuclear waste. The results also show that increasing the emissions reduction target has a positive influence on green reputation. The negative sign on the emission reduction timeframe attribute suggests that both students and employees view shorter timeframes for emissions reduction as enhancing the institution's green reputation.

4.4 Examining the Heterogeneity of Preferences

We extend the conventional model described above to take into account heterogeneity within constituent groups by incorporating interaction terms of both socio-demographic characteristics as well as the previously defined environment and altruism indexes. The interaction effects take into account several key factors that are believed *ex ante* to influence respondents' attitudes and preferences towards a program's green reputation. We evaluate each of the successively expanded models and perform a Wald test to ensure the additional covariates improve model fit. For the student segment, we can reject the null hypothesis that the simple and expanded models are equal at the 10% level for Model 3 and Model 4, but not Model 2. For the employee models, we can reject the null hypothesis at the 5% level for all of the models. Therefore, including the interaction terms increases the explanatory power of the model. Our test results suggest that there are heterogeneous preferences within each of the stakeholder segments that can be further evaluated by incorporating socio-economic characteristics as well as our environmentalism and altruism indices.

We present the model results including several different interactions with respondent characteristics and psychometric (i.e., environmentalism/altruism) indices for students in Table 7. The results from Model 2 indicate that awareness of the current energy fee that is levied on students does not have a statistically significant effect on contributing to university's green reputation. This result is consistent throughout all three of the expanded interaction models. In light of the factor loadings of the environment and altruism indices, Model 3 suggests that the higher a respondent's level of environmentalism, the more weight the respondent puts on larger and quicker emissions reductions targets and for the programs' enhancement of the institution's green reputation.

When evaluating increased concern for the environment at the mean of both emissions reduction and time frame, the results suggest that emissions reduction plays a larger role in perceived green reputation benefits than the reduction in time-frame. Likewise, increasing altruistic motivations were found to increase weight on emissions reduction as well as a shorter time frame for reductions to be made. The effects of adding the altruism and environmental concern indices are similar across population segments.

To examine the influence of respondents' political affiliation, we used a dummy variable for the political affiliation interaction variable where a one indicated that respondents thought of themselves as either 'conservative' or 'moderate' and a zero indicates instances where respondents considered themselves to be 'liberal'. The political affiliation variable was interacted with the fuel mix for both stakeholder segments. We found that 'conservative/moderates' were less likely to perceive green reputation benefits from increasing the use of carbon-free technologies in the fuel portfolio mix. This was generally consistent between students and employees with the exception of wind and biomass not having a statistically significant difference between students with different political affiliations.

In considering preference heterogeneity among university employees we find that age does not seem to have a statistically significant affect in their choice of the structure of the fuel portfolio except with respect to nuclear energy. We find that nuclear energy contributes less to one's perception of enhancing the institution's green reputation for older employees than it does so for younger employees. The results also show that as respondents' income increase they are less sensitive to the program fee (price) attribute.

5. Discussion and Implications

Despite increased pressure in recent years on many firms and institutions to move toward more sustainable and environmentally friendly practices, little research has examined the effects of green or environmentally friendly reputation from within the firm. This study seeks to help build this literature by examining how constituents' (students and employees) green reputation benefits are derived from energy production and consumption policies. Our use of a Likert-style scale to rate alternative energy policy scenarios impact on green reputation energy production and consumption attributes, such as the fuel mix, carbon emissions reduction and investment time frame, on an institution's green reputation. Another strength of the study is that it takes socio-economic characteristics and motivational factors into account in examining internal influences and heterogeneity within constituent groups.

The results show that constituents do benefit from their institution's green reputation and that energy policy attribute choices can contribute to or detract from the institution's reputation. We find that constituents gain a higher green reputation benefit from incorporating renewable energy generation such as wind and solar power in the institution's fuel portfolio along with increased emissions reduction and investment time frames can significantly influence an institution's green reputation among stakeholders. The analysis also incorporated social, economic and latent motivational characteristics to examine preference heterogeneity within the population. We find a significant amount of heterogeneity within constituent groups as measured by respondent's demographic characteristics and altruistic and environmental indices. For example, respondents with more altruistic motives were found to have higher green reputation benefits from increased carbon emissions and shorter investment time frames. While conservative employees and students showed lower green reputation benefits for changing from coal to wind or solar than more liberal employees and students.

Compared to the previous literature on pro-environmental behavior and corporate environmentalism, our results coincide with the literature suggesting the importance of integrating both internal and external influences to create a more informative model. Similar to Clark et al (2003) we find that both internal and external influences have implications on preferences for energy policy. In line with Wiser et al (2001), which noted the importance of altruism and employee morale in firm environmentalism, we see the importance of altruism in constituents' perception of a policy's green benefit. Our results also coincide with the social science literature on socio-economic characteristics and environmental concern. As previously noted, social scientist assert that younger, more educated individuals with liberal political ideologies are the most environmentally concerned (Fransson and Garling 1999). In comparison, our results show that older employees and more politically conservative individuals gain a lower green reputation benefit from lower carbon intensive fuel sources.

This study has implications for both policy makers and decision makers within firms and institutions. First, it shows that constituent groups care about their institutions green reputation, and thus an institution has the ability to influence its green reputation through its energy production, consumption and management policies. Therefore, an institution should look at the full scope of a policy's costs and benefits, even hidden benefits found within the firm, such as a policy's green reputation. Second, the heterogeneity both between constituent groups and within each group suggests that there is not only one energy policy that can influence an institution's green reputation. This implies that an institution should take into account its constituency's composition and preferences in order to make appropriate policy decisions.

Table 5. Students Coefficients and Interaction Terms for Carbon Management Programs								
Variable	(1)		(2)		(3)		(4)	
Constant	-0.02161	(0.0228)	-0.02288	(0.0228)	-0.02536	(0.0230)	-0.02204	(0.0232)
Natural Gas	0.01545	(0.0010)	0.01553	(0.0010)	0.01528	(0.0010)	0.01743	(0.0016)
Biomass	0.02488	(0.0015)	0.02489	(0.0015)	0.02459	(0.0016)	0.02666	(0.0023)
Wind	0.05031	(0.0032)	0.05019	(0.0032)	0.05046	(0.0033)	0.06010	(0.0048)
Solar	0.05092	(0.0033)	0.05104	(0.0033)	0.05057	(0.0033)	0.05557	(0.0049)
Nuclear	0.00943	(0.0011)	0.00950	(0.0011)	0.00932	(0.0011)	0.00958	(0.0016)
Mod Effort	0.08911	(0.0366)	0.09052	(0.0366)	0.08885	(0.0370)	0.08760	(0.0372)
Ext Effort	0.08663	(0.0396)	0.08819	(0.0397)	0.08631	(0.0401)	0.08920	(0.0403)
Emissions Reduction	0.07843	(0.0047)	0.07852	(0.0047)	0.07910	(0.0048)	0.07945	(0.0048)
Year Reduction Achieved	-0.03296	(0.0040)	-0.03332	(0.0040)	-0.03344	(0.0040)	-0.03362	(0.0041)
Fee	-0.00349	(0.0003)	-0.00327	(0.0009)	-0.00285	(0.0009)	-0.00280	(0.0009)
Income*Awareness of fee			-0.00015	(0.0006)	-0.00039	(0.0006)	-0.00043	(0.0006)
Emissions Reduction*NEP					0.01765	(0.0047)	0.01639	(0.0048)
Year Reduction Achieved*NEP					-0.00946	(0.0040)	-0.00963	(0.0040)
Emissions Reduction*ALT					0.01920	(0.0048)	0.01956	(0.0049)
Year Reduction Achieved*ALT					-0.01325	(0.0040)	-0.01297	(0.0040)
Natural Gas*Politic							-0.00401	(0.0021)
Biomass*Politic							-0.00390	(0.0031)
Wind*Politic							-0.01829	(0.0066)
Solar*politic							-0.00951	(0.0066)
Nuclear*politic							-0.00046	(0.0021)
Groups	1696		1693		1647		1633	
Sigma u	0.34202		0.33849		0.32530		0.32950	
Sigma e	1.50996		1.51037		1.50814		1.50947	
rho	0.04880		0.04782		0.04446		0.04548	
R-squared	0.1917		0.1922		0.2006		0.2025	

*1% significance, ** 5% significance, *** 10% significance

Table 6. Faculty and Staff Coefficients and Interaction Terms for Carbon Management Programs								
Variable	(1)		(2)		(3)		(4)	
Constant	-0.01645	(0.0210)	-0.02096	(0.0218)	-0.02650	(0.0217)	-0.02579	(0.0218)
Natural Gas	0.01544	(0.0009)	0.01549	(0.0009)	0.01157	(0.0040)	0.01986	(0.0014)
Biomass	0.02585	(0.0014)	0.02636	(0.0014)	0.02882	(0.0062)	0.03218	(0.0022)
Wind	0.05486	(0.0028)	0.05461	(0.0029)	0.05703	(0.0126)	0.07070	(0.0045)
Solar	0.04623	(0.0028)	0.04640	(0.0029)	0.06365	(0.0127)	0.05444	(0.0044)
Nuclear	0.00252	(0.0010)	0.00235	(0.0010)	0.01297	(0.0042)	0.00113	(0.0015)
Mod Effort	0.08627	(0.0319)	0.08427	(0.0329)	0.08626	(0.0331)	0.08691	(0.0330)
Ext Effort	0.13018	(0.0351)	0.12132	(0.0363)	0.12682	(0.0365)	0.12436	(0.0364)
Emissions Reduction	0.05799	(0.0042)	0.05753	(0.0043)	0.05784	(0.0044)	0.05689	(0.0043)
Year Reduction Achieved	-0.03718	(0.0035)	-0.03629	(0.0036)	-0.03640	(0.0037)	-0.03590	(0.0036)
Fee	-0.00313	(0.0003)	-0.00381	(0.0005)	-0.00380	(0.0005)	-0.00384	(0.0005)
Income*Fee			0.00001	(0.0000)	0.00001	(0.0000)	0.00001	(0.0000)
Emissions Reduction*NEP			0.01556	(0.0041)	0.01551	(0.0042)	0.01494	(0.0042)
Year Reduction Achieved*NEP			-0.00987	(0.0034)	-0.00991	(0.0035)	-0.00944	(0.0034)
Emissions Reduction*ALT			0.01314	(0.0046)	0.01291	(0.0046)	0.01284	(0.0046)
Year Reduction Achieved*ALT			-0.00833	(0.0037)	-0.00817	(0.0038)	-0.00821	(0.0037)
Natural Gas*Age					0.00008	(0.0001)	-	-
Biomass*Age					-0.00005	(0.0001)	-	-
Wind*Age					-0.00006	(0.0003)	-	-
Solar*Age					-0.00036	(0.0003)	-	-
Nuclear*Age					-0.00023	(0.0001)	-	-
Natural Gas*Politic							-0.00774	(0.0019)
Biomass*Politic							-0.01023	(0.0029)
Wind*Politic							-0.02724	(0.0059)
Solar*politic							-0.01392	(0.0059)
Nuclear*politic							0.00243	(0.0020)
Groups	2329		2168		2138		2150	
Sigma u	0.47849		0.48510		0.46205		0.47866	
Sigma e	1.53271		1.52588		1.52804		1.52151	
rho	0.08881		0.09179		0.08377		0.09006	
R-squared	0.1684		0.1774		0.1795		0.1833	

*1% significance, ** 5% significance, *** 10% significance

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Table 7.	
A	Plants and animals have as much right as humans to exist.
B	The so-called ‘ecological crisis’ facing humankind has been greatly exaggerated.
C	Human ingenuity will insure that we do not make the earth unlivable.
D	The earth is like a “spaceship” with very limited room and resources.
E	The balance of nature is strong enough to cope with the impacts of modern industrial nations.
F	I am willing to sacrifice for the good of those around me.
G	Paying taxes is important because they fund programs such as schools and roads from which everyone benefits.
H	I take actions to improve the well-being of people I don’t know.
I	I am comfortable receiving benefits even if I don’t contribute.
J	My responsibility is to provide only for my family and myself.
K	I don’t have to take actions to control climate change because others will do so.
L	When there is a collection jar for a free event I am attending I always contribute.
M	I think that MSU’s green reputation benefits me.