The College of New Jersey Students' Willingness to Pay for Green Public Goods

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Introduction

After signing the American College & University President's Climate Commitment (ACUPCC), The College of New Jersey (TCNJ) has committed to achieving climate neutrality. This commitment is an assurance that TCNJ plans to reduce and eventually eliminate the College's global warming emissions. Some of the specific objectivities that can be focused on are:

> "Adopting green standards for buildings, Requiring ENERGY STAR certification for products purchased by the university, Offsetting emissions due to air travel, Encouraging public transportation, Purchasing energy from renewable sources, Supporting climate and sustainability shareholder proposals through their endowment" (TCNJ President 1).

Moreover, TCNJ will continue to support its ongoing "Knowledge is Power" energy conservation campaign. These initiatives, with support from student, faculty and administrations, strengthen TCNJ's possibility of reaching climate neutrality.

The key in reaching climate neutrality rests on navigating and positioning TCNJ's collegiate model of internal framework and operations during the time of transition. In attempts to fulfill some of the ACUPCC objectives, TCNJ has the opportunity to institute new initiatives for students, faculty and administration. For example, a faculty commuting survey is currently being conducted to obtain data on driving patterns, which will support future initiatives to reduce driving commutes and CO_2 emissions. One technique to raise funds for various initiatives is to charge an environmental/climate fee to TCNJ community members. An example of such an implemented fee and subsequent initiatives can be taken from the University of Tennessee (UT) and their Student Environmental Fee. Through this fund, UT has been able to fund various initiatives, such as: Green Power Purchase, Lighting Motion Sensors, Hybrid Vehicle Purchase (electric),

Compact Fluorescent Light Bulb Exchange and other initiatives. These programs were all supported by the environmental fee in the year 2006-2007 alone ("Your Student Fee at Work").

To ensure an appropriate fee be applied at TCNJ, this author conducted a *Willingness To Pay* (*WTP*) study to serve as statistical support for a charge for specific projects/initiatives or to inform an overall charge for an overall environmental fund. A survey was created to target specific initiatives that can support the Colleges attempts to reach the ACUPCC objectives. Moreover, it provides a clear indication of the student body's commitment to achieving the ACUPCC objectives. This survey can be used by TCNJ, specifically the Environmental Services Office, in establishing a student fee system to fund student environmental initiatives. This study will attempt to answer: (1) what percentage of the student body is committed towards reaching the ACUPCC objectives through environmental initiatives? (2) How much the student body is willing to pay for specific initiatives or an overall environmental fund? It will also explore the underlying factors that contribute to a greater *WTP*.

Literature Review

Willingness to pay (WTP) studies have often been used to gain some insight into consumer preferences. An early study conducted in 1954 by Samuelson states that every individual will look to have some personal benefit gained from both private and public goods. Bohm (1979) goes on to support Samuelson's findings with specific conditions and examples that will influence consumer demand for public goods. His attempt to statistically manipulate various WTP data prove that when conducted correctly, WTP studies provide an accurate result for true consumer demand of a public good.

Since many students are not the source of their funding, the willingness to pay establishes their personal preferences apart from the actual amount they will pay for various items and services. Regardless of the one step removal of paying for various public goods, students as the main beneficiaries have a strong preference because the public goods add to the higher education experience.

Many economists argue that WTP have no economic relevance because the values are not established by a market. Johansen (1977) states that an individual's WTP is often incorrect in revealing preferences at a level that has any practical significance. He notes that the one factor that does matter in making actual decisions is the "revelation of preferences by the politicians in the actual decision making process" (p. 149). Johansen's conclusion can be transferred and applied to the higher education setting and public goods.

It can be noted that, in the community of higher education, the administration of the college dictates the final revealed preferences and action of consuming a public good on the college premises. This is likened to Johansen's findings that the preferences of politicians are the pivotal factor in decision making. However, a notable difference in higher education is that students have a specific level of representation on the Student Finance Board and on other administration boards. Moreover, students' preferences are kept in mind, as they are ultimately the majority of those who consume and benefit from the public goods around higher education facilities. These issues and more have been address by the work of several current economists and academia members.

Gossling et. al. (2005) work has targeted a sample of students in the city of Freiburg, Germany and interviewed them in order to assess their awareness of

environmental issues, their willingness to change to green power products, and to better understand consumer hindrances in changing the power sources. This is a specific case where empirical data has been gathered from students. Moreover, this study provides crucial warnings about WTP information gained from students. The foremost caution is that students do not always pay for their expenses. This expands the reasons for difficulties in drawing conclusions from students' WTP. Students often do not have a full knowledge base to make appropriate decisions on paying more for "green" power. Gossling et. al. (2005) warns that "reported WTP should be treated with caution, though, as students are generally unaware of their energy costs and do not know how the values mentioned will add on their energy bills."

Another key aspect of Gossling et. al. (2005) study is in the method of gathering data. Specific interviews can be conducted with a portion of the student body. Gossling et. al. noted that "all questionnaires were filled in by the interviewers in direct communication with the students." This ensures that a response will be provided. Although there is no strategy on collecting data and ensuring that respondents provided correct information. By being present at the time of surveying, one can be available to directly collect surveys and gather data.

In a WTP study conducted by Nixon and Saphores (2007), a background study on people's history of participation in environmental initiatives was included. In order to analyze a person's pro-environmental behavior (PEB), Nixon and Saphores (2007) incorporate a section of the survey to analyze personal involvement in environmental activities. They cited and measured PC1 to capture a person's level of environmental inactivism. The data analyzed in this section gives a thorough analysis of the

respondent's background. Secondly, this article targets the willingness to pay for advanced recycling fees, (ARF's). It is important to involve ARF's as a specific way to collect the appropriate amount of funding to support a recycling system.

Blaine et. al. (2005) incorporates a lower bound mean calculation that is used to analyze the results of the WTP data to arrive at an overall WTP for the respondents. With use of this calculation, they were able to compare the WTP from a payment card compared to a referendum. Blaine et. al. concluded that respondents were willing to pay more for a referendum rather than a payment card [$1.72 vs. $1.08]. This mathematical theorem provides the necessary technique to render and overall amount that students are willing to pay.

Zarnikau (2003) examines the market and preference effects on demand for 'green power.' One main factor that he notes is the importance of "information about energy resource options" (Zarnikau 2003). This factor is importance because it will increase the public's willingness to pay for both renewable energy and energy efficiency. Knowledge of renewable energy and energy efficiency environmentally conscience factors have the ability to influence an individual's preference and overall WTP for environmentally healthy energy sources. Zarnikau (2003) notes that the consumer's final WTP is greater, when individuals were presented with information prior to establishing their WTP.

Data Sources and Methods

The data that was used in this study was gathered by a random survey given to the student body at TCNJ. The survey included four sections. The first section asked questions regarding a student's background. Some questions focused on such information

as class year, school that oversees major, housing, tuition financing, and previous involvement in environmental initiatives. The second section focused on various issues related to Compact Fluorescent Light bulbs (CFLs). The survey inquired about prior use, knowledge and *willingness to pay* (*WTP)* for CFLs. In the third set of questions, students were asked to assess their own recycling habits in their personal areas (room or house) and while around campus. As with CFLs, the *WTP* for recycling containers to be installed was asked, along with the *WTP* to have recycling containers emptied more often. The final section of the survey centered on student's practice of bicycle usage on and around campus. Specifically, whether students used bicycles to commute or travel around campus, were able to find bicycle racks to lock their bicycles and were able to fit their bicycle on the designated bicycle rack. Again, the student's *WTP* for bicycle racks was inquired about in the survey. The surveys also included specific pictures to give students an image that could recall past or subconscious feelings of the public goods.

Imitating the practice recommended by Gossling et. al. (2005), while students filled out the surveys, this researcher was on hand to answer any misunderstandings or general questions on the survey. This step was taken in order to gain immediate responses and eliminate skipped responses that could have resulted from student's confusion. The pro-environmental behavior (PEB) concept, created by Nixon and Saphores (2007), was incorporated by assessing students' previous involvement in environmental campaigns or initiatives. Any previous involvement in environmental initiatives was included to analyze the possibility of influencing future decisions and *WTP* for environmental public goods. Finally, questions regarding the funding of tuition and other college fees were included to examine student's responses on *WTP* even though

some students did not pay for the tuition and fees themselves. This factor will be able to address the claim that Johansen (1977) made in regards to end users not wanting to pay for actions taken by a higher power with decision capabilities.

With the survey constructed student respondents were randomly selected. This was achieved by having the first professor from each of our seven internal schools (Arts & Communication, Business, Culture & Society, Education, Science, Engineering, Nursing, Health & Exercise Science), who was present in their office, which was on the right side in relation to the building's entrance. If the professor was not willing or not present in their office, the next office on the right with a present professor was solicited. This process was carried on until a professor from each school was willing to allow a portion of their class time to have students participate in the survey. In all, 130 surveys were completed by students over the seven schools.

In one part of the study, the data was used as a descriptive assessment of the sample population of TCNJ's students. Totals, averages and percentages were determined to gain some insight on the current demographics and environmental outlook of the students.

The second part of the study focused on a *WTP* model, which regression analysis would determine and significant factors. The model for this study was set up in order to determine the *WTP* for each individual public good (CFLs, recycling containers and bicycle racks). With the *WTP* as the dependent variable, other independent factors (housing, prior knowledge, habits, tuition funding and etc.) were included for each environmental good. The hypothesis was set up as a null hypothesis of zero determining if students were willing to pay for the various goods.

Each individual *WTP* has a specific hypothesis model. Both background question and questions about the specific environmental goods were included in hypotheses. The *WTP* for a bicycle rack (WTPBicycRack) included positively related factors such as whether the used a bicycle to commute to campus (BicycComm), whether they used a bicycle around campus (BicycCamp), if they would participate in a Bicycle Week (BikeWeek) and if they were able to find a bicycle rack near their destination (BicycFindA). The negatively relative variable in the hypthesis was how many miles away from campus the student lived (Miles). It was thought that the further away from campus you live, the less likely you were to use a bicycle and pay for a bicycle rack. These factors combined were thought to produce an indicator for *WTP* for a bicycle rack as show in Table 1 Eq. 1.

The second model focused on *WTP* for a recycling container (WTPContainer). The positive variables were if a student recycling in their residence (RecycRoom), if they recycled while on campus (RecycCamp), if they could not find a convenient recycling container (NoContainerA) and if they lived on campus (HousingCamp). One negative factor that was included in the hypothesis was if they threw recyclable items into regular trash if a recycling container was filled or unavailable (RecycHowB). These factors combined were thought to produce an indicator for *WTP* for a recycling container as show in Table 1 Eq. 2.

The third hypothesis looked at factors involved in students *WTP* for recycling containers to be changed more often (WTPChange). This model was very similar to the model for WTPContainer. The one difference is that student who noted that some

containers were often to filled to even use (TooFillA) in place of NoContainerA. This equation can be found in Table 1 Eq.3

The final hypothesis was set up to form a model for student's *WTP* for CFLs (WTPCFL). The main factors that were thought to positively affect WTPCFL were if they used CFLs in their residence already (CFLHome) and if they had previous knowledge of the energy efficiency and longevity of CFLs (CFLKnow). The negatively related factors were if students knew mercury was often used in production of CFLs (CFLMercury), if they paid the majority of tuition and other college fees (cost of CFLs) themselves (TuitionSelf), and if they lived off-campus where landlords may supply lighting (HousingRent). These factors combined were thought to produce an indicator for *WTP* for CFLs as show in Table 1 Eq. 4.

The first step in the process of determining significant factors in the model was analyzing any correlation between the *WTP* variable and various independent variables of the hypothesis models. Other factors were tested for high correlations, which could be added to the hypothesis models. The second phase of the analysis was to include the higher correlated explanative variables in a regression model. Various models were constructed. Once a strong model was found (Table 3 Eq. 3), other variables were included to enhance the model's overall ability to explain the dependent variable. It was noticed that some variables had strong influences when added into the working models. Testing for both heteroskedasticy and autocorrelation will be run. Corrections for these tests will be made to the final results.

Results and Conclusions

Results for the study have been divided into two categories descriptive results and regression results. Each has their own importance in the study of student's *WTP*. Descriptive results provide an overall look at the status of the student body. Regression results provide specific factors that can explain the *WTP*. By incorporating conclusions from each, the understanding of TCNJ's students' *WTP* will be enhanced.

The overall descriptive results show some interesting commonalties between students renting off campus and *WTP* for a bicycle rack. The majority of students in the sample have on-campus housing (See Table 2). This is a significant factor as most on campus students do not have to rely on a vehicle on a daily basis. It is noteworthy that students, renting housing off-campus within an average of 1.53 miles would pay nearly double ($2.74 to $1.40) for more bicycle racks, relative to other students, whether they drove a vehicle or rode a bicycle to school. This may suggest that there is a higher valuation on bicycle racks for students renting off campus because of the potential to make use of them in the future.

Another interesting aspect of the descriptive data lies within the Recycling Data. Of the student sample surveyed, 86% of respondents recycle around campus (See Table 3). However, 41% of all respondents would throw recyclable items in a regular garbage container if no recycling container was in the area or the closest was too filled. This is interesting to note because for these 53 students, there exists some weaker commitment to recycle, which exits when the student does not originally have negative recycling habits. Put differently, when analyzing the 86% of students that did recycle around campus, 38% of them said they would throw recyclable items in a regular garbage container. An

insufficient number of containers around campus is a likely cause that deters students form recycling because they are not willing to forgo the time to spent on locating the nearest recycling container. Nevertheless, there is a reason why 43 students, who normally recycle, do not in certain conditions. The College is in a position of responsibility to facilitate the good habits of students.

The Regression Anaylsis has proven to be useful in noting some statistically significant factors that are involved in explaining each dependent *WTP* variable. With regards to the student's *WTP* for a bicycle rack (WTPBicycrack), the main factors that were thought to have some impact were interest in being involved in a future Bicycle Week (BikeWeek) and whether they currently used a bicycle as a mode of transportation, both commuting to campus and traveling around campus, (BicycComm and BicycCamp, respectively). In Table 4 Eq. 1, the variable BicycCamp produced insignificant results. In attempt to capture the overall use of bicycles, the Bicyc variable was formed (Bicyc = BicycComm + BicycCamp). This model still proved to be insignificant (Table 4 Eq. 2). BikeWeek and BicycComm were held as a base model. To increase the ability of the model to explain the results in the dependent variable, we incorporated *WTP* for other environmental goods, under the assumption that pro-environmental behavior would enhance the *WTP* for environmental goods. It was found that the *WTP* for a recycling container (*WTP*Container) enhance the model (Table 4 Eq. 4 & 5).

Another example of where the some other factors of the survey data are able to explain student's *WTP* for CFLs (*WTP*CFL) are knowledge and type of housing. The same method was used for establishing the model for *WTP*CFL, as was used with the *WTP*BicycRack model. In this regression model, previous knowledge about CFLs

(CFLKnow) is included to analyze the impact and significance on *WTP* (See Table 5 Eq.1). Miles from campus one lives (Miles) is also included to represent the fact that those who live off campus usually have to purchase individual light bulbs, more so that those who live on campus. Both factors prove to be significant at the 10% level, when used in the right model. Similarly to the *WTP*BicycRack model, Table 5 Eq. 4 was the model with the greatest level of explanation of the dependent variable. Although the Adjusted R^2 is small, this model still shows that prior knowledge is a significant factor.

In both models *WTP* for bicycle rack and CFLs, the included variables do not explain a significant amount of the variations in the dependent variable. By analyzing the Adjusted R^2 for each model (.31 and .10), it is obvious that there exist more factors that explain student's *WTP* for CFLs and bicycle racks. However, the model for WTPBicycRack, with an Adjusted R^2 of .31, is significant when dealing with cross sectional data that may have many more explanatory variables. This is a testament to the fact that strong predictors of consumers preferences and *WTP* for goods is still in need of analysis as they are constantly changing and are often unknown or subconscious.

This study proves the existence of student's *WTP* for environmental goods. One conclusion drawn from the data is a positive relationship between knowledge and awareness increases *WTP* for environmental goods. Another factor that positively affected students WTP was the interest in participating in environmental initiatives such as a bicycle week. Although these specific examples may not be implemented, they do serve as a base example for which other future campaign and initiatives to be implemented. As The College looks to reaching its goal of climate neutrality, one may start with the overall outcome of this survey is that students are willing to pay for

environmental goods. When confronted with this question on individual environmental goods, there is a positive sum of money that is willing to be contributed. Numerically, the average of 130 students' WTP for CFLs, recycling containers, changing recycling containers and bicycle racks is $2.97, $2.50, $2.85 and $1.75, respectively. In time, The College of New Jersey may follow suit of other ACUPCC schools and established a specific fund that will focus on various environment and energy projects and be fully dedicated to address specific environmental and energy issues on and off campus.

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*To Be Added: Correspondence with Rutgers University and University of Tennessee

Table 1
Hypothesis Models for Each *WTP*

Eq.	Dependent	Var1	Var 2	Var 3	Var 4	Var 5
1	WTPBicycRack	BicycComm	BicycCamp	Miles	BikeWeek	BicycFindA
		$\beta_1 > 0$	$B_2 > 0$	$B_3 < 0$	$B_4 > 0$	$B_5 > 0$
2	WTPContainer	RecycRoom	RecycCamp	NoContainerA	RecycHowB	HousingCamp
		$\beta_1 > 0$	$B_2 > 0$	$B_3 > 0$	$B_4 < 0$	$B_5 > 0$
3	WTPChange	RecycRoom	RecycCamp	TooFillA	RecycHowB	HousingCamp
		$\beta_1 > 0$	$B_2 > 0$	$B_3 > 0$	$B_4 > 0$	$B_5 > 0$
4	WTPCFL	CFLHome	CFLKnow	CFLMercury	TuitionSelf	HousingRent
		$\beta_1 > 0$	$B_2 > 0$	$B_3 < 0$	$B_4 < 0$	$B_5 < 0$

Where $WTP = f(\beta_1 Var1 + \beta_2 Var2 + \beta_3 Var3 + \beta_4 Var4 + \beta_5 Var5)$

Table 2

Descriptive Data on Background Responses

Respondent Characteristics	Respondents n	(%)
Class Year		
Freshman	24	18%
Sophomore	50	38%
Junior	38	29%
Senior	18	14%
School of Major		
Arts & Communications	18	14%
Culture & Society	23	18%
Education	32	25%
Science	16	12%
Engineering	15	12%
Nursing, Health & Exercise Science	26	0.2
Housing		
On-Campus	85	65%
Rent Off-Campus	27	21%
Commute from home	18	14%
Travel Distances	Miles total	(mean)
Miles	162.5	1.25
Tution Funding		
Self	34	26%
Parents	85	65%
Scholarship	9	7%
Environmental Initiatives	14	11%

TABLE 3

Descriptive Data on Environmental Responses

CFL Data	Respondents n	(%)
CFL used at home	67	52%
CFL knowledge of efficiency	81	62%
CFL knowledge of mercury	17	13%
CFL buy next time	115	88%
	Respondents Aggregate	(mean)
CFL *WTP*	$386.50	$2.97

Recycling Data	Respondents n	(%)
Recycle in room	99	76%
Recycle overfill	71	55%
Recycle around campus	112	86%
Notice lack of containers	70	54%
Notice overfilled containers	30	23%
How do you recycle?		
Find availavle container	34	26%
Throw in regular garbage	53	41%
Place upon filled container	39	31%
	Respondents Aggregate	(mean)
Add Container *WTP*	$325.00	$2.50
Change Container *WTP*	$371.00	$2.85

Bicycling Data	Respondents n	(%)
Use a bicycle to commute	5	4%
Use a bicycle around campus	9	7%
Unable to lock bicycle	5	4%
Unable to find bicycle rack	3	2%
Would participate in a Bike Week	50	38%
	Respondents Aggregate	(mean)
Bicycle rack *WTP*	$227.00	$1.75

Table 4
Regression Results on *WTP* for Bicyde Racks

Eq.	C	BikeWeek	BicycComm	BicycCamp	Bicyc	WTPContainer	WTPChange	WTPCFL	R^2 Adj. R^2	F	# of Obs.
1	1.21	1.11	4.44	-0.39					0.14	6.76*	124
	(4.16)*	(2.32)	(3.17)	(-0.36)					0.12		
2	1.27	0.97			1.85				0.08	5.66*	125
	(4.28)*	(2.02)			(2.13)				0.07		
3	1.21	1.08	4.14						0.14	10.29*	125
	(4.20)*	(2.38)	(3.65)						0.13		
4	-0.44	0.90	2.25			0.37	0.07	0.22	0.34	12.05*	124
	(-0.75)	(2.20)^	(2.11)^			(3.40)*	(0.78)	(1.31)	0.31		
5	0.25	0.90	2.31			0.44			0.32	19.19*	124
	(0.82)	(2.20)	(2.17)			(5.67)*			0.31		

Notes: *significant at 5% level, two-tailed test for t-statistics
^significant at 10% level, two-tailed test for t-statistics
Willingness to pay for Bicyde Racks is the dependent variable (*WTP*BicycRack).

Table 5
Regression Results on *WTP* for CFLs

Eq.	C	CFLBuy	CFLKnow	Miles	CFLHome	CFLMercury	WTPBicycRack	R^2 Adj. R^2	F	# of Obs.
1	2.03	0.61	0.38	0.15				0.09	4.24*	130
	(5.83)*	(1.83)	(1.80)	(2.24)				0.07		
2	2.01	0.57	0.32	0.15	1.90			0.10	3.38*	130
	(5.75)*	(1.68)	(1.46)	(2.23)^	(0.89)			0.07		
3	2.02	0.62	0.35	0.14		0.18		0.09	3.25*	130
	(5.79)*	(1.85)	(1.65)	(2.14)^		(0.58)		0.07		
4	1.80	0.65	0.49	0.13			0.08	0.13	4.45*	128
	(4.93)*	(1.90)	(2.28)^	(2.02)			(2.10)	0.10		

Notes: *significant at 5% level, two-tailed test for t-statistics
^significant at 10% level, two-tailed test for t-statistics
Willingness to pay for CFLs is the dependent variable (*WTP*CFL).