If A Rational Consumer Could Choose His Own Utility Function, Would He Choose to "Go Green"?

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This paper utilizes Rational Choice Theory to examine preference dynamics characterizing the average rational electric energy consumer. It focuses on determining whether the average electric energy consumer faced with a defined choice set which reflects a utility function for "green" and carbon based electricity, would ordinarily choose to "go green" given the relative prices of the two electric energy alternatives. A Utility theory based model and logistic regression model developed and tested using actual carbon based electric energy prices indicates that all things being equal, the odds of choosing to "go green" for the average rational electric energy consumer who subscribes to some defined assumptions, tend to decrease at a every dollar increase in price per kilowatt hour of electric energy.

INTRODUCTION

Ongoing consensus on the move towards "going green[2]" or adopting "green" practices, particularly among electric energy consumers, has been hailed in various quarters as a positive trend towards the much needed efforts at reducing our carbon footprints[3] from decades of unregulated carbon emissions. This evolving behavioral shift and receptiveness towards adopting "green" electric energy has been lauded by many; particularly, among politicians and some in the scientific community. The trend has also been well received by environmentalists who continue to espouse the growing notion that humanity's inordinate carbon emissions are mainly responsible for adverse global climatic conditions and extreme weather patterns currently impacting negatively on both humans and plant life. Data from the National Renewable Energy Laboratory (Affiliate of US Department of Energy) shows that this evolving trend ("going green") which has become a novel hallmark to strive for among most households as well as commercial and industrial entities continue to make slow but steady progress in attracting the average consumer's attention towards the need to "go green".

However, available research (to be analyzed in the later sections) also shows that the steady inroads notwithstanding, proponents and policy makers still face enormous challenge in trying to convince most electric energy consumers to opt to "go green" by patronizing clean electric energy. The main challenge facing these proponents and policy makers revolves around a crucial economic proposition. This preposition suggests that all things being equal, the average rational

consumer who has to choose from a choice set containing two perfect substitutes products with varying prices (such as “green” and carbon based electric energy), might not voluntarily choose to “go green” despite the perceived benefits associated with the “green” option.

This study subscribes to the notion that the laudable properties of “going green” notwithstanding, the average rational consumer, given a defined consumption preference domain, and the related prices of electric energy to be consumed, (electric energy from “green” and carbon based sources) might not ordinarily choose to “go green”. Thus, despite the touted environmental benefits of going green, the move might not be that attractive to the average consumer. This projection is based on the predictions of utility theory on how a rational consumer ultimately chooses a particular good or service over another given the constraints set by his choice set and income; as well as the nature and the relationship among the products or services in his choice set (that is whether a product or service has a perfect substitute, etc). A quantitative analysis to verify this projection is presented as part of the empirical analysis of this study.

Given the above projection on whether a rational consumer would ordinarily choose to “go green” or otherwise, this study argues that if for some reason, a rational energy consumer is found to be eagerly willing to “go green”, then the underlying assumptions of rational choice theory requires that there must exist a compensating element driving this consumer’s inclined preference towards “going green”. This stimulus or compensating element could be a perceived higher utility derived by the consumer from the service, or a relatively lower price for the product or service in question. The goal of this paper is not to reinvent the wheel by extensively developing the rational choice theory with all its perceived strengths and weaknesses. Rather, this paper seeks to apply the core principles governing the theory in understanding whether a rational electric energy consumer or the average “economic man” would on his own volition, choose to “go green”.

This paper is organized as follows: the first section is devoted to profiling the “green” electric energy consumer with a view to understanding whether specific features characterizing this consumer could tell us anything about why he will or will not ordinarily choose to “go green”. This is then followed by a brief overview of the rational choice theory and how it drives consumer demand or choice dynamics. Assumptions underlying the study are then introduced. This is followed by a section which utilizes a combination of the basic assumptions of rational choice theory to assess whether the average rational consumer would ordinarily choose to “go green” with regards to his electric energy consumption as some proponents seem to suggest. An empirical analysis of the prospect of choosing to “go green” by a rational energy consumer is then conducted to test the main proposition of the study using logistic statistical framework. The final section draws probable policy implications based on the outcome of our empirical analysis; it also outlines some obstacles to “going green” and provides suggestions as to how consumers of electric energy could be encouraged to “go green” using specific macroeconomic policies. This section concludes with suggestions for managers of green based energy firms on the viable means of marketing ‘green energy’ products to optimize revenue.

Profiling the Green Electricity Consumer

To assess the propensity to “go green” dynamics or the choice preferences among rational consumers of electric energy, it is crucial to provide a concise descriptive features which identifies this average “green” electric energy consumer or what the existing literature refers to as “the profile of the “green” electricity consumer”, Rowlands et al (2003). Such knowledge

would be critical in shaping subsequent conclusions of this study relating to how varied consumer profiles influence the probability of choosing to “go green”. Using the features which make up the “green” consumer profile, we hope to show that favorable “green” consumer profile only constitutes a necessary condition and not a sufficient one in determining whether or not a rational consumer would opt to “go green” by subscribing to green based energy services.

In an attempt to profile the “green” electric energy consumer and their willingness to pay for electricity from green sources, Rowlands, Scott and Parker (2003) identified one of the critical features. They showed that those who exhibit high levels of environmental concern tended to be more open to the idea of opting for electricity from “green” sources; and are willing to pay at least $25 premium per month for “green” electric energy. This outcome is consistent with the work of Straughan and Roberts (1999), who also found that individuals who believe that the choices they make (such as choosing to “go green) can augment efforts to effectively counteract environmental devastation will vigorously seek such benefits linked to their action. That is, all things being equal, consumers who believe that choosing to “go green” would help to mitigate their carbon impact on the environment would make conscious effort to do so.

Apart from this environmental concerns feature which tend dominates most of the existing profile of the “green” electricity consumer, the concept of willingness to pay a premium price has also been sited as a key feature which profiles this consumer. Farhar (1999) and Rowlands and Parker (2002) showed that the exhibition of a desire to pay a premium price is also an important feature which defines the average “green” electric energy consumer. In order words, to these aforementioned researchers, the probable profile of the average “green” electric energy consumer (not necessarily the rational consumer) could be any individual or an entity who is concerned about the impact of their actions on the environment, and are willing to adopt behaviors or lifestyle deemed critical in mitigating it (such as paying a premium price). However there is a crucial piece of information missing from this profile; this proposed profile of a “green” electric energy consumer suggests that exhibition of environmental concerns coupled with willingness to pay premium price to “go green” sufficiently profiles the ultimate green electric energy consumer. The problem however with this notion is that willingness to pay does not automatically constitutes or translate into an ability to pay; a condition which will make a stronger case for the potential to “go green”. Bird and Brown (2005), for instance showed that despite the high percentage of willingness to pay profile among potential “green” utility consumers, the actual participation rate on record lagged far behind. They further showed that contrary to the suggested evidence of willingness to pay for “green” utility among consumers, existing “green” programs have realized a median participation rate of only 1%. This participation rate is far lower than the reported willingness to pay results of between 57% and 80% found in a national poll by Farhar and Houston (1996), in their assessment of the proportion of consumers who were willing to pay more for electric energy from cleaner sources. These results to some extent show that environmental concerns backed by willingness to pay a premium price, does not necessarily tell us whether the average consumer would ordinarily choose to “go green”. This study uses rational choice theory with the goal of understanding this potential of choosing to “go green”.

Rational Choice Theory and Consumer Choice

Rational Choice Theory in its basic form propounds that consumer’s actions are fundamentally 'rational' in nature and that individuals, households, as well as commercial entities tend to critically assess the likely costs and benefits of any action before arriving at a decision they deem

optimal. Critical to this element of rationality is the condition that consumers in general tend to exhibit transitive preferences, and normally seek to maximize utilities derived from those preferences subject to some constraints. Literature expounding on rational choice theory abound, however, according to Lovett (2006), the theory of rational choice revolves around three basic principal assumptions. The first of these is the 'discrete purposeful actor' assumption. This assumption asserts that in the universe of evolving social phenomenon, there exist entities capable of acting purposefully in conditions or situations which exerts influence on their activities or wellbeing. This purposeful actor position is not however limited to humans or for that matter consumers, but any entity capable of making informed judgment in challenging situations. The second assumption, the utility theory assumption, holds that these discrete purposeful actors (such as consumers) conduct themselves or make decisions which tend to suggest that they usually yearn to optimize the choices they make based on perceived benefits associated with the choices. This assumption basically holds that consumers in general derive some form of satisfaction (utility) from the goods and services they consume, and that at any point in time, they make conscious efforts to maximize this perceived utility subject to some constraints such as the level of income. This utility theory assumption incorporates all its sub-underlying assumptions into the rational choice theory framework. The final assumption which is highly linked to the utility assumption is the concept of rationality; which suggests that the discrete purposeful actor's actions are not haphazard but follows an underlying reasoning often based on cost and benefit analysis of a given situation or phenomenon.

This rationality assumption as alluded to above invokes an element of transitive preferences on the part of the consumer. By transitive preferences, the rational choice theory suggests that if a given choice set contains a bundle of goods denoted as Y, K ,Z, and the discrete purposeful actor (the consumer) at a given point in time prefers Y to K, and also prefers K to Z, then it must follow that the consumer also prefers good Y to Z. Additionally, by projecting that the rational consumer always seeks to maximize utility derived from a bundle of preferred goods and services by opting for those with the highest possible utility, rational choice theory further points to the fact that choices made by consumers are not just a 'random work' as some critics of the theory, tend to argue. These choices, according to proponents of rational choice theory often reflect the consumer's ordered scale of preferences according to the perceived levels of utility associated with the products or services. In order words, at any point in time, these purposeful actors make conscious efforts to maximize the perceived utility from goods and services in their choice set subject to their income. This is done by ordering preferences in such a way that the final choice made constitutes the optimal choice in terms of the level of utility it offers at a given income level. Together, these three assumptions underlying rational choice theory suggests that the rational consumer is purposive and goal oriented; and at any point in time orders his behavior in such a manner to maximize utility or the perceived level of satisfaction from a specific behavior such as demanding a particular product or service. Consequently, we expect that ultimate choices made by the rational electric energy consumers reflect these assumptions as well as the law of demand.

However, it is important to point out that the rational consumer being considered in this study (that is, our presumed rational electric energy consumer) faces a unique demand dilemma. This consumer is confronted with a choice set with two bundles of services (electricity from carbon based sources and electricity from green based sources) which in terms of their basic household, commercial, or industrial energy requirement, offers similar levels of utility or satisfaction. To this rational consumer, these two products or services (electricity from carbon based sources and

electricity from green based sources) lie on the same indifference curve because they offer the same level of utility (with regards to satisfying basic energy needs). Consequently, he becomes indifferent as to the type of service to choose given the two electric energy alternatives. In such a scenario, this paper argues that the rational consumer's choice parameter will consequently shift from comparing the level of utilities associated with the two sources of electric energy to the relative prices per kilowatt hour associated with each alternative. Confronted with these two services which exhibit similar utilities, this paper propose that the rational electric energy consumer, all things being equal, would opt for the service with a relatively cheaper price in response to the basic law of demand; which subsequently amounts to either choosing to "go green" or otherwise depending on the price per kilowatt hour of each service (green or carbon based electricity).

Rational Choice Theory and Demand for Green Electric Energy

Utility theory, one of the principal assumptions of rational choice theory according to Lovett (2006), suggest that consumers in general tend to gravitate around goods and services which offer the highest level of utility at a given income level among comparable alternatives. However, as indicated earlier, this underlying principle of choosing a product or service based solely on it's associated utility seizes to apply in a case where a rational consumer's choice set is made up of bundles of substitute services or products with similar utilities. Ordinarily, in conditions where an average consumer's choice set is made up of varied goods and services exhibiting different levels of utilities, the rational consumer's choice for a particular product or service often reflects the structure of his scale of preference, ordered according to perceived level of utility per income. In other words, in a choice set devoid of perfect substitutes, the level of utility per income characterizing a good or service function as the dominant determining factor driving choice and ultimate demand for a product or service. The product or service offering the highest level of utility per income is thus preferred and tend to attract higher demand compared to other items in the consumer's choice set.

This choice procedure however, becomes a deficient yardstick in selecting a product or service in the case of a rational electric energy consumer who perceives "green" and carbon based electric energy as perfect substitutes. In such instance, utility theory suggests that the rational consumer's choice for a particular service (given the two substitutes services) will rather be influenced by the relative price of each individual service or product. Consequently, the consumer will ultimately choose the product or service with the lowest price all things being equal. In other words, given the option of "green" electric energy (with prices which are often between 10% and 25% higher than carbon based electric energy) and carbon based electric energy in a consumer's choice set, the rational electric energy consumer, we posit, would rather choose carbon based electric energy and opt not to "go green" over the choice of going "green". This view stems from the fact that the carbon based option is often cheaper and offers the same level of utility in terms of meeting his basic energy needs. That is, all things being equal, the rational consumer, given the relationship between "green" and carbon based electric energy and associated prices, would not ordinarily choose to "go green". This condition prevails because to this rational consumer, relative prices of the two services serve as the only feature distinguishing one service from the other; consequently, he subscribes to the basic law of demand by choosing carbon based electric energy over "green" electric energy. The following analysis provides theoretical verification of the proposition that the average rational consumer characterized by certain assumptions, would not ordinarily choose to "go green".

Quantitative Analysis - Assumptions

The following assumptions form the basis of this study's projections and subsequent quantitative analysis:

- Electric energy from "green" and carbon based sources are perfect substitutes.
- To the rational consumer, "going green" by patronizing electric energy from "green" sources constitutes a luxury which offers "shared public utility[4]" at a premium price per kilowatt hour.
- Consumer's utility realization from a kilowatt hour of electricity only depends on the extent to which the service or product meets his basic energy needs.
- Consumers are rational and highly price sensitive.
- Price of Green based electric energy is relatively higher than Carbon based electricity because of higher cost of production.
- All other factors affecting demand for electricity are held constant.
- All assumptions of consumer utility theory applies.

Quantitative Analysis of Propensity to "Go Green"

Let $\boldsymbol{x_1}$ represent electric energy from Carbon based sources

$\boldsymbol{x_2}$ represent electric energy from "Green" sources (such as wind)

Additionally, let:

$\mathbf{P_1} = \mathbf{10.65}$ = price in cent per kilowatt hour of carbon based electricity[5]

And

$\mathbf{P_2} = \mathbf{13.01}$ = price in cent per kilowatt hour of "green" based electricity[6]

Based on the assumption of perfect substitutes, the rational consumer's utility function is expressed as follows:

$$U(x_1, x_2) = mx_1 + nx_2 \qquad (1)$$

where: $m = n = 1$

Equation one illustrates utility function for the two perfect substitute services ("green" and carbon based sources of electric energy) facing the rational electric energy consumer. Utilizing

this function, we address the following question: which electric energy service (green or carbon based) will the rational energy consumer customarily choose if he is confronted with a choice set which reflect the utility function in equation (1)?. We answer this question in two stages; the marginal utility consideration and the Lagrange multiplier method.

Marginal Utility Consideration

The marginal utility consideration takes into account the additional utility or benefits which accrue to the rational consumer from consuming any of the two electric energy services. To identify this consumer's ultimate preference based on the utility function in equation 1, a partial derivative of his utility function with respect to services x_1 and x_2 is assessed**.** The resultant marginal utilities (derived from the consumer's utility function in equation 1) shows that the two services offer the consumer similar levels of additional benefits in terms of meeting his basic energy needs. Consequently, this rational consumer is deemed indifferent as to which service he might choose; and the probability that he might opt to "go green" is estimated to be just about 50%. Thus, based on the additional utilities associated with the two services alone, we might not be able to accurately predict whether this rational electric energy consumer will choose to "go green" or not.

Lagrange Multiplier Consideration

Despite the identical marginal utilities associated these services, it could be shown through Lagrange Multiplier method that the marginal rate of substitution for this consumer's utility function is constant and equal to one; which in equilibrium must be equal to the slope of his budget line (P_1/P_2); that is:

$$MRSx_1x_2 = \frac{MUx_1}{MUx_2} = \frac{m}{n} = \frac{P_1}{P_2} = 1 \qquad (2)$$

Thus, this consumer will spend income budgeted for electric energy on:

$$\text{Only product } x_1 \text{ if } \quad \frac{MUx_1}{MUx_2} = \frac{m}{n} > \frac{p_1}{p_2} \qquad (3)$$

and

$$\text{Only product } x_2 \text{ if } \quad \frac{MUx_1}{MUx_2} = \frac{m}{n} < \frac{p_1}{p_2} \qquad (4)$$

Given the earlier stated parameters relating to relative prices per kilowatt hour of electric energy from "green" and carbon based sources, it could be shown that the rational consumer will buy from the cheaper source (i.e. carbon based electricity) and opt not to go green as follows:

Since, $m = n = 1$; $P_1 = 10.65$, and $P_2 = 13.01$

then

$$\frac{m}{n} > \frac{p_1}{p_2} = \frac{1}{1} > \frac{10.65}{13.01} \quad = 1 > 0.82 \tag{3b}$$

And in the second case:

$$\frac{m}{n} < \frac{p_1}{p_2} = \frac{1}{1} < \frac{10.65}{13.01} \quad \text{where 1 is not} < 0.82 \tag{4b}$$

Consequently, the rational consumer chooses not to "go green" by choosing service x_1 over x_2; that is, carbon based electric energy over "green" electric energy because only x_1 satisfy the condition in equation (3).

This Lagrange procedure, contrary to the marginal utility analysis shows that all things being equal, the average rational electric energy consumer who subscribes to the assumptions outlined in this study would not ordinarily choose to "go green" given the present relative price disparities between the two electric energy alternatives. That is, as long as consumers perceive the two services as perfect substitutes with similar utilities in terms of meeting their basic energy needs, they will tend to gravitate towards carbon based sources of electricity because it offers comparable level of utility per cent per kilowatt hour at a lower price.

However, we need an empirical verification of this theoretical framework. We need to verify statistically that all things being equal, the odds of opting to go green tend to decrease at a given percentage increase in electric energy prices for residential, commercial and industrial consumers. We conduct this test using data on electric energy prices for the three consuming sections of the economy in a logistic framework. The odds ratios from this logistic framework is intended to provide the means to ascertain how a percentage increase in electric energy prices per kilowatt hour for any of the three consuming segments of the economy impacts the odds (either positively or negatively) of choosing to go green. In this framework, if the odds ratios assessing the propensity to "go green" associated with Residential, Commercial and Industrial prices of electricity are greater than 1, then the odds of choosing to go green increases as the predictors (prices of industrial, residential and commercial electricity) increases. On the other hand, if the odds ratios are less than 1 then the odds of going green tend to decrease as the predictor prices increases. We conduct this logistic regression analysis utilizing panel data of carbon based electric energy prices from the three sections of the consuming public in the United States. The data set is made up of 1415 observations over a period of eighteen years.

Determining the Impact of a Percentage Increase in Electric Energy Prices on the Odds of "Going Green"

The odds of going green in this case is measured as the probability of going green *(p)*, divided by one minus the probability of going green (1-p); stated as: (p/(1-p)).

The basic Logistic Model is formulated as follows**:**

$$logit(p) = log(p/(1\text{-}p))Gg = \beta o + \beta_1 Resx_1 + \beta_2 Comx_2 + \beta_3 Ind\, x_3 + \varepsilon \tag{5}$$

where: p = the probability going green parameter
Gg = Going green
β_0 = Constant
$\beta_1, \beta_2, \beta_3$ = Coefficients of the independent variables
$Resx_1$, $Comx_2$ and $Indx_3$ represent the independent variables
(Residential = $\mathbf{Resx_1}$, Commercial = $\mathbf{Comx_2}$ and Industrial = $\mathbf{Indx_3}$ Prices of Electricity)
$\boldsymbol{\varepsilon}$ = the error term

Given that changes in log-odds ratios which are normally obtained from equation (5) in statistical packages are tricky to interpret, and might even lead to misleading projections, equation (5) is transformed to present the results in a more convenient form which makes it easier for intuitive interpretation. Taking log on both sides of equation (5) coupled with some derivative manipulation produces the following multiplicative equation:

$$(p/(1-p))Gg = e^{\beta o}\, e^{\beta 1(Resx1)}\, e^{\beta 2(Comx2)}\, e^{\beta 3(Indx3)} \qquad (6)$$

This transformed equation (6) makes it possible to assess how an increase in electric energy price impacts the odds of choosing to go green for the average electric energy consumer. The following table presents the odds ratios of logistic regression analysis for residential, commercial and industrial electric energy consumers.

TABLE 1
LOGISTIC REGRESSION RESULTS FOR RESIDENTIAL, COMMERCIAL AND INDUSTRIAL ELECTRIC ENERGY CONSUMERS.

	$\mathbf{Resx_1}$	$\mathbf{Comx_2}$	$\mathbf{Indx_3}$
	Odds ratio/se	**Odds ratio/se**	**Odds ratio/se**
Odds ratio	.9223997***		
Std Err	(0.0209031)		
P>|z	0.000		
Odds ratio		.9208543**	
Std Err		(0.0255542)	
P>|z		0.003	
Odds ratio			.8636566 ***
Std Err			(0.0267594)
P>|z			0.000

***p <0.05, **p <0.01, ***p <0.001**

NB: To prevent any form of interaction effects among the three variables, stepwise approach is adapted to capture actual individual odds ratio of opting to go green among the three electric energy consuming sectors of the economy.

Table 1 presents the odds ratios facing the three core electric energy consumers in the United States. It shows that the three segments of electric energy consumers in the United States exhibit varied odds ratios. To interpret these odds ratios, this study adopts the Inverse Odds Ratio procedure developed by DesJardins (2001). The inverse odds ratio procedure utilize a simple transformation technique to convert negative or less than one odds ratios into the same metric as positive odds ratios. To achieve this transformation, DesJardins (2001) recommends a procedure which could be succinctly captured as, [(1/odds ratio) – 1] *100. That is, 1 divided by an observed odds ratio, minus 1; the final answer is then multiply by 100. Using this inverse odds ratio procedure, the odds of choosing to go green for the three consuming sections of the public are computed and analyzed in table 2.

TABLE 2
TRANSFORMED ODDS RATIOS FOR RESIDENTIAL, COMMERCIAL AND INDUSTRIAL CONSUMERS OF ELECTRIC ENERGY

Residential		Commercial		Industrial
1/. 9223997		1/. 9208543		1/.8636566
1.08412871		1.085948124		1.157867606
0.08412871		0.085948124		0.157867606
8.41%		8.59%		15.79%

Table 1 showed that the odds ratios facing all the three segment of electric energy consuming public, (residential, industrial and commercial) were less than one; which indicates that in general, the odds of choosing to go green given the prevailing price disparities between green and carbon based electric energy tend to decrease at every percentage increase in price. In order words, the odds of choosing to "go green" by purchasing electric energy from green sources, as opposed to electric energy from carbon based sources tend to decrease for all the three electric energy clients whenever price increases. Transformed odds ratios in table 2 following the methodology of DesJardins (2001), presents an intuitive depiction of the odds of choosing to go green among the three electric energy consumers. It shows that all things being equal, a percentage increase in price per kilowatt hour of electric energy respectively reduces the odds of opting to go green by 8.41%, 8.59% and about 16% for residential, commercial and industrial consumers. The results further shows that among these three electric energy consumers, industrial consumers tend to experience the highest diminishing odds of opting to go green whenever price per kilowatt hour of electric energy increases. Based on these outcomes, we conclude that all things being equal, a percentage increase in price (a reasonable expectation for green based sources of electricity because of the relatively higher cost of production) would tend to decrease the odds of opting to "go green" among the various segments of the consuming public in United States. These results thus supports the initial theoretical framework suggesting that the average rational electric energy consumer might not ordinarily choose to 'go green' despite the known benefits of doing so; because the option often tend to be relatively expensive.

Prospects of "Going Green": Probable Obstacles and Policy Perspectives

The foregoing theoretical and empirical analysis offers critical insights crucial in understanding some of the factors mitigating against efforts at "going green" among average

electric energy consumers in United States. The outcome of this study further highlights a critical piece of the "going green" debate which hardly attracts any attention and consideration. This piece revolves around this notion: that is, as long as consumers of electric energy continue to assess perceived utility derived from a kilowatt hour of electricity primarily in terms of the extent to which the service meets their basic energy needs, (instead of an urgent need to mitigate perceived worsening carbon impact on the environment) efforts at encouraging them to adopt "green" electric energy will not yield the needed patronage. Our results additionally suggest that the wavering consumer preference in adopting "green" electric energy might be an indication that the average electric energy consumer characterized by the stated assumptions, does not place the same amount of utility on "green" electric energy as most proponents and policy makers do. Consequently, there tend to be a mismatch in the level of receptiveness to the notion of "going green" anticipated by policy makers and the business community as a whole, and the final consumers of these services. This variance often leads to conflicting projections on the economic viability of investing in "green" electric energy projects and the estimated number of potential consumers who might actually opt for the service.

Additionally, given the current rate of participation in "green" electric energy programs reported in some existing studies, it seems most consumers tend to place a much lower utility on the perceived additional benefits associated with adopting green energy; such as lower levels of environmental pollution. This view stems from the fact that all things being equal, we expect the average electric energy consumer to voluntarily choose to "go green" if the perceived utility associated with the option of doing so is very high. This expectation is supported by the utility theory assumption under Rational Choice Theory. The failure by consumers to associate "going green" with a higher utility might have been responsible for the extremely low median participation rate in "green" electric energy programs found by Bird and Brown (2005); and the low average consumer participation rate in green utility pricing program of only 2.0% in 2007 reported by Bird, Kreycik, and Friedman (2008).

The apparent lack of enthusiasm on the part of consumers to adopt "green" electric energy could also be attributed to the fact that, although most of consumers are fully aware of the known benefits of "going green", they tend to fall into what we call in this study "the public utility trap". The public utility trap refers to a situation where the perceived marginal utility or benefits associated with an individual's efforts, such as paying a premium price for energy for a cleaner environment are shared publicly. In such condition, if a rational electric energy consumer offers to pay a premium price for "green" electric energy, the additional benefit of doing so (relatively cleaner environment which accrue because of his action) becomes a public good which he has no exclusive right to benefit. In such a scenario, the incentive to pay a premium price to "go green" diminishes for this rational consumer since he could also free ride on others who might choose to do so.

From the foregoing, it is evident that limited inroads made by policy makers towards achieving accelerated drive in promoting the use of "green" electric energy cannot be attributed to inadequate education on the benefits of "going green" as some proponents tend to suggest. Willingness to pay (WTP) surveys on "green" electric energy have shown that most consumers fully understand, and are aware of the additional benefits of "going green" because of the ongoing debate over the highly sensitive issue of global warming. Additionally, recent upsurge in "green" advertising techniques aimed at attracting consumers to adopt products and services perceived to be good for the environment or "green" have in some sense also helped to broaden this knowledge base. However, we are of the opinion that most electric energy consumers are

reluctant to fully embrace “green” electric energy or have opted out of the program altogether mainly because of the high cost associated with the service. The additional cost often associated with going green sometimes proves to be far more than what most consumers could accommodate or sustain over a long period given their limited budgets. Alan Gomez (2009), provides a classic case which illustrates how high cost associated with “going green” sometimes become a disincentive to most consumers who wish to patronize “green” electric energy. Gomez showed that the city of Durongo, Colorado, which used to purchase green electric energy for it’s government buildings from wind farms in an integral move of being “green”, ended the program in 2009 and reverted to the use of electricity generated from carbon-based sources (reversing the goal of “going green”) because of the growing cost of the program. The decision to opt out of the “green” program according to Gomez ended up saving the city about $45,000. This case, to some extent point to the fact that although most consumers are aware of the benefits of “going green” and espouse the general notion of becoming “green”, excessive cost in terms of higher electric energy prices associated with such move significantly diminish the potential to do so.

CONCLUSION

The average rational electric energy consumer will not on his own volition choose to “go green” because it’s an expensive option. To effectively encourage and attract more consumers to voluntarily choose to “go green” by purchasing from “green” electric energy sources, policy makers should pursue programs which makes going green attractive. This could be achieved by either subsidizing “green” based electric energy prices to make it more affordable to consumers, or instituting a pollution tax (on carbon base electric energy) commensurate with or slightly higher than the prevailing premium price on “green” electric energy. Such policy will bring prices of the two products at par, or make clean electric energy relatively cheaper; ultimately enhancing the likelihood that a rational consumer will choose to “go green” by purchasing from green based electric energy source despite prevailing “public utility trap”. Finally, to ensure the viability of green electric energy investments which is expected to continue enjoying appreciable growth, it is crucial that managers and investment analyst understand the long term preference dynamics of energy consumers and the factors which influence their attitude towards ‘going green’. Such knowledge base will provide managers with the necessary information needed to effectively position green electric energy services in the market place.

ENDNOTES

1. By rational consumer, we mean the consumer defined by the assumptions underlying rational choice theory (purposeful actor, rational and subscribes to the basic assumptions of utility theory)
2. Going green in this study refers the adoption of processes, lifestyle or consumption of goods and services with limited or no carbon footprint or impact on the environment.
3. A consumer’s carbon footprint is the sum of all CO_2 emissions that are directly and indirectly associated with his or her activities over a given time frame (usually a year).
4. Utility or benefits enjoyed by all, including those who decide not to pay for it. (Utility associated with “green” electricity such as clean environment etc becomes a shared public good which benefits all; in such instance, the rational consumer is also willing to free ride on others instead of paying for it)

5. According to the Energy information Administration (the entity which manages the official energy statistics for the US government), the average price in cent per kilowatt hour (KWh) of carbon based electricity in US by the end of 2007 (most current data available) is 10.65cents.
6. Additionally, according to The National Renewable Energy Laboratory (NREL), premium price for consumers patronizing "green" electricity which was 3.48cents per kilowatt hour in the year 2000, currently ranges between 2cents and 2.36cents per KWh. We utilize 2.36cent per KWh as the maximum premium price which is about 22% over the price of carbon based electricity prices. Consequently, price in cents per Kilowatt of "green" electric energy which is the summation of the average carbon based electricity price in cents per kilowatt hour (10.65cents) and the "green" electricity premium price (2.36cents) equals 13.01cents.

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