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PUTTING AMERICA ON A CARBON DIET: CHALLENGES AND RECOMMENDATIONS

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ABSTRACT

The earth is quickly reaching its limits on the amounts of carbon emissions it can sustain. Consumers must begin to do their part to reduce these emissions at a household level. This research examines the motivation and ability needed for consumers to begin a "carbon diet." The challenge of motivating consumers reflects the role of social influence in both the community, and in the current controversy surrounding climate change. The ability is examined through calibration and an empirical study. The empirical study measured the "miscalibration" of consumers to accurately and confidently rank 15 energy-saving scenarios by carbon emissions. The study also measured how likely consumers were to adopt each of the 15 energy-saving scenarios. Since participants were unable to appropriately rank the effectiveness of each scenario at reducing emissions, it was concluded that consumers are not properly calibrated, or miscalibrated, on the topic of household carbon emissions. This is significant because ability is needed to both accurately measure carbon emissions, as well as understand which scenarios are most effective in reducing emissions. The survey suggests that individuals must be more educated on the topics of carbon emissions before substantial progress can be made.

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Chapter 1

Introduction and Background to Carbon Dieting

Humanity does not exist in a world of inexhaustible resources. Our Planet and everything living inside are constrained by its limits. These limits can be measured by a surface area of 197 million square miles, with only 57 million square miles of land. The rest of Planet Earth is covered by water, approximately 326 million cubic miles. The earth at its equator can be measured by 24,901.55 miles, and from pole to pole, 24,859.82 miles (Dutch, 2004). Since Planet Earth has fixed dimensions, there is a limit to the amount of land, water, minerals, air, and resources provided to humans (McLamb, 2010).

These fixed dimensions create a maximum level of carbon dioxide the atmosphere can contain for life to exist as it has been. The maximum level leading climate scientists have identified is 350 parts per million. In July 2009 we reached 387.81 parts per million of carbon dioxide in the atmosphere, raising a steady 2 or 3 ppm each year (Hansen et al., 2008). Humans are responsible for 9.1 billion metric tons of carbon per year. Plants and soils absorb 30% of the CO2, oceans absorb 25%, and 45% of the 5 billion metric tons of CO2 per year remains in the atmosphere.

Projected rates of growth in developing countries are expected to increase by 2 to 3 percent per year. Leading this growth are China and India, with population expecting to sustain growth of 5 to 10 percent per year (Jackson, 2008). Countries are producing, through today's volume of goods and services, over five times the level of CO2 emissions. These emissions will need to be reduced at least 80 percent by 2050 (Nigel,

2010). There are repeated reports of the broad scientific community documenting these cumulative impacts on the plant's environment. They show sustained human activities are crossing the threshold of sudden irreversible changes. "We cannot live long without a functioning biosphere, and so it is worth everything we have (Guth, 2008)."

It will take humanity hundreds of years to remove most of the CO2 humans are consuming, and over a century to remove it all (Nigel, 2010). Stopping the rise of CO2 will require large cuts in emissions from cars, factories, and power plants; until the inflow of carbon no longer exceeds the possible outflow.

Most people believe that stopping emissions from rising will stop the rise of CO2 in the atmosphere. To visualize this concept, the level of carbon dioxide in the atmosphere is a person's waistline. In order to lose pounds of carbon, the person must burn more calories than he/she eats. Imagine the person can only burn 5 pounds per day; consuming 9.1 pounds will result in constant weight gain. Eventually the system will surpass the limitations and the person will have a detrimental health issue.

Scientists believe with little effort and money most Americans could reduce their energy diets by 25% or more (P. Miller, 2009). The average American household produces around 150 pounds of CO2 a day. This number is more than five times the global average, and twice the average of Europeans (P. Miller, 2009). Americans would be considered dangerously obese if our overconsumption of carbon producing activities were relative to weight. If consumers were motivated to reduce carbon emissions by this information alone less of a problem would exist. The challenge comes from

understanding why scientific evidence of climate change is not enough to motivate the average consumers to take action to reduce household carbon dioxide emissions.

Purpose of Research

The following research will discuss the challenges to motivate Americans to begin a carbon diet. "Carbon diet" is defined, for the purposes of this paper, as limiting the impact on climate change by reducing one's carbon emissions production. Typically the key steps to beginning a carbon diet are not dissimilar to starting a food diet. Individuals must assess their own weight, in this case measured in tons or pounds of carbon dioxide, and then calculate their ideal weight. The steps usually include; 1) Calculating a personal carbon footprint through online or electronic devices; 2) Compare the carbon footprint to that of peers or the national average; 3) Define a goal for reaching an ideal carbon footprint; 4) Utilize electronics or literature to determine the most significant carbon emissions to reduce; 5) Monitor and track results by starting with the most significant sources.

While many books and websites exist to educate, guide, and support the average American through a carbon diet, the purpose of this research is not to reiterate or improve the "carbon diet". The purpose is to value the importance of consumers having both motivation and ability to act on carbon-emission reducing behaviors. Consumers cannot have the ability without the motivation, nor the motivation without the ability. The following research discusses one of the main challenges to motivating consumers is overcoming social influence. This specific social influence relates to the decline of social capital in communities around America, as well as the current controversy over the

reality of “global warming.” Consumers are also challenged by their ability. The ability is represented by an issue of calibration. Minor research has been done on calibration relating to carbon emissions, so for this reason the following empirical study was done. This study reflects miscalibration of carbon reducing scenarios in order to understand the ability factor. To overcome the challenges of motivation and ability recommendations are suggested.

Chapter 2

Motivation: The Role of Social Influence

Social Norms in Communities

Climate change is a local issue. While progressive local governments and businesses have adopted strategies and CO2 programs, most individuals have not. Individuals account for almost half of a community's emissions and a third of America's total emissions (Rabkin, 2006). Since a support structure is crucial to any good diet, a local community is the best support. Finding a strong community willing to aid and empower carbon dieting is a challenge within itself. Dieting to lose weight is not unlike dieting to drop pound of carbon. It takes a group or community to support your decision. The Journal of the American Medical Association studied the effects of self-help weight loss and commercial weight loss, like Weight Watcher, which uses a predetermined program and support systems. (Heshka et al., 2010) The results concluded that structured commercial weight loss programs provided modest weight loss, but more than self-help, over a two year period. Human are designed to live in groups and cooperate in groups. The effects of support systems have affected social norms throughout history.

One of the biggest motivating obstacles that consumers face to become carbon conscious exists in communities built up around social norms. Informal social norms can powerfully influence human behavior and sustain human cooperation. Recent research in game theory has shown that socials norms sustained by the fear of informal neighborly punishment can solve the problems of cooperation in many "games" studied. (G. Miller,

2008) These games include the prisoner's dilemma and common-pool resource dilemma. Miller believes that if social norms backed by informal punishment can promote cooperation in the prisoner's dilemma, they can also promote happiness and peace. He argues that,

> "Informal norms must do 99 percent of the daily work of shaping human behavior in socially desirable directions. This principle has been clearly understood by every sane adult in every functioning society for thousands of years; Euro-American liberal academic subcultures of the late twentieth century are the singular exception. Until the power of informal social norms is more broadly and consciously appreciated, we'll continue to overlook the single most potent way that we can change society in general."

The traditional strategy, since 1970, to change consumer behavior related to any green movement has been through verbal preaching and admonishment. For the following decades our culture has given vague encouragements that we should consume less, recycle, buy green, buy locally, and live simply. The issue lies in the fact that protesters and preachers are not reaching to their in-group (G. Miller, 2009). Social norms and trait display tactics most favored by the local community heavily influence in-group behavior. Since humans are beings who interact with other humans who live nearby, any anti-discrimination laws regarding property rental, ownership, unintentionally prohibit the development of cohesive local norms. The side effects of prohibiting housing discrimination based on race, color, national origin, religion, family status, or sex, affect the ability of voluntarily organized communities to create social,

physical, and moral environments their members want (Miller, 2009). The only area where anti-discrimination laws do not affect is income. The result can be seen everywhere around the country, as humans are separated by low-income project housing, working class houses, and professional gated communities.

Social Capital

Robert Putnam has done extensive research on the American communities. His studies have found that communities with high levels of ethnic diversity have lower levels of a sense of community and "social capital" (Putnam, 2001). His data reflected analysis of thirty thousand people living in communities with high ethnic diversity, or equal mixtures of Hispanic, white, black and Asian citizens, tend to have lower:

- sense of political empowerment
- trust within their own ethnic group
- community solidarity and cohesion
- community cooperation
- trust across ethnic groups
- confidence in local government and leaders
- voter registration rates
- charity and volunteering
- interest in maintaining community facilities
- rates of carpooling
- numbers of friends
- general happiness

Similar findings were also uncovered by other researchers. Robert Kurzban said, "Communities without a coherent set of socials norms just don't feel much like communities at all, so the individuals withdraw from community life into their own families and houses (as cited in Miller, 2009 , p. 299)." Each community has its own norms, and they can only be sustained by praising or punishing individuals who uphold or violate those norms and residents. This cooperation is called network reciprocity, and modern multicultural communities make the reciprocity difficult to maintain (Miller, 2009).

While material benefits can be gained by living in a community, such as saving money, Putnam states that the real benefit is, "Networks of community engagement foster sturdy norms of reciprocity: I'll do this for you now, in the expectation that you will return the favor (2001)." Two types of reciprocity exist, specific and generalized. With specific reciprocity you measure and negotiate individual trades. Generalized reciprocity means engaging in an action without expecting anything specific back but being confident you will be paid back down the road. A community who has generalized reciprocity is more effective towards motivating one another do something for the greater good, such as creating a goal to reduce carbon emissions.

Communities have changed over the past century to be more diverse, but in their diversity fundamental qualities of a strong community have been lost. From evidence including almost 500,000 interviews Americans sign fewer petitions, belong to fewer organizations that meet, Americans socialize with friends and families less, and know our

neighbors less than ever before (Putnam, 2001). "Social capital" was measured by Putnam using fourteen indicators:

1. Agree that "Most people can be trusted"
2. Agree that "I spend a lot of time visiting friends"
3. Agree that "Most people are honest"
4. Attendance at any public meeting on town or school affairs in last year
5. Number of civic and social organizations per 1000 population
6. Average number of club meetings attending in last year
7. Average number of group memberships
8. Average number of times volunteered in last year
9. Average number of times entertained at home in last year
10. Average number of times worked on community project in last year
11. Number of non-profit organizations per 1000 population
12. Served as officer of some club or organization in last year (percent)
13. Served on committee of some local organization in last year (percent)
14. Turnout in presidential elections 1988 and 1992

From these fourteen measures Figure 2-1 represents the score and rank given to each state on the Social Capital Index, and the rank given to each state on the carbon emissions produced by tons. The Midwest region represents the highest number of states with the highest index, while the Southwest represents the states with the lowest "social capital". While the size and population of state affects the rank of carbon emissions, none of the

states with a social capital of 0.50 and above are leading producers of carbon emissions. Producers of over 100 million tons of carbon or more can be found at the bottom of the social capital list, representing a challenge for community involvement and motivation in those states towards reducing household emissions.

State	Rank	State	Carbon Emissions in tons
1. North Dakota	1.71	1. Texas	252,055,209
2. South Dakota	1.69	2. Ohio	128,758,069
3. Vermont	1.42	3. Indiana	124,295,100
4. Minnesota	1.32	4. Pennsylvania	123,855,407
5. Montana	1.29	5. Florida	120,968,735
6. Nebraska	1.15	6. Illinois	105,765,973
7. Iowa	0.98	7. Kentucky	93,908,686
8. New Hampshire	0.77	8. Georgia	89,499,954
9. Wyoming	0.67	9. West Virginia	84,471,755
10. Washington	0.65	10. Alabama	82,917,421
11. Wisconsin	0.59	11. Missouri	77,144,453
12. Oregon	0.57	12. Michigan	77,086,215
13. Maine	0.53	13. North Carolina	75,247,200
14. Utah	0.50	14. California	62,543,565
15. Colorado	0.41	15. Tennessee	58,506,374
16. Hawaii	0.40	16. Arizona	58,422,962
17. Kansas	0.38	17. Louisiana	54,603,162
18. Connecticut	0.27	18. Oklahoma	53,145,319
19. Massachusetts	0.22	19. Wisconsin	49,310,268
20. Missouri	0.10	20. New York	47,092,408
21. Idaho	0.07	21. Wyoming	46,516,577
22. Arizona	0.06	22. Iowa	45,834,877
23. Michigan	0.00	23. South Carolina	42,490,369
24. Delaware	-0.01	24. Colorado	41,479,729
25. Rhode Island	-0.06	25. Virginia	41,355,324
26. Indiana	-0.08	26. Utah	39,328,678
27. Oklahoma	-0.16	27. Minnesota	37,497,891
28. California	-0.18	28. Kansas	37,065,160
29. Indiana	-0.18	29. North Dakota	32,917,730
30. Ohio	-0.18	30. New Mexico	30,663,903
31. Pennsylvania	-0.19	31. Arkansas	30,468,105

32. Illinois	-0.22		32. Maryland	29,120,746
33. Maryland	-0.26		33. Mississippi	25,878,510
34. Virginia	-0.32		34. Nebraska	22,303,933
35. New Mexico	-0.35		35. Massachusetts	22,247,982
36. New York	-0.36		36. Montana	20,225,552
37. New Jersey	-0.40		37. New Jersey	20,072,127
38. Florida	-0.47		38. Nevada	18,120,612
39. Arkansas	-0.50		39. Washington	13,622,035
40. Texas	-0.55		40. Oregon	10,793,283
41. Kentucky	-0.79		41. Connecticut	9,429,044
42. North Carolina	-0.82		42. Hawaii	9,045,661
43. West Virginia	-0.83		43. New Hampshire	6,777,318
44. South Carolina	-0.88		44. Delaware	6,589,379
45. Tennessee	-0.96		45. Maine	5,312,800
46. Louisiana	-0.99		46. Alaska	4,366,541
47. Alabama	-1.07		47. South Dakota	4,011,168
48. Georgia	-1.15		48. Rhode Island	2,987,521
49. Mississippi	-1.17		49. Idaho	1,014,966
50. Nevada	-1.43		50. Vermont	7,098

Figure 2-1. Social Capital Index and Carbon Emissions by State Ranking
(Putnam, 2010 and U.S. Energy Information Administration, 2010)

The last part of utilizing a community relies on social diffusion. Everett Rogers of Stanford has studied 1,500 cases of innovations and their dispersion. Since innovations do not fluctuate evenly throughout apartment buildings, city blocks, boards of directors, schools, and any sort of population, the key to dissemination of innovation is "early adopters". These "early adopters" represent individuals attracted to innovation. They have a high tolerance for experimentation and interest in diffusing an innovation to other people (as citied in Rabkin, 2006). If any community structure has 10-15% of early adopters then a critical point can be hit and diffusion will take off at its own momentum (as citied in Rabkin, 2006). Each community needs its own target of early adopters who

the rest of the community will come to, or be approached by. The challenge exists in gaining enough people who represent early adopters in proper communities.

Challenge Behind Controversy of Climate Change

If communities don't agree there is a problem, there exists no motivation to correct the problem. As social capital declines in America, so does the belief that humans are responsible for climate change. Recent surveys of consumer sediment and beliefs reflect a challenge facing any momentum carbon dieting may receive. After looking at the recent Gallup Polls on the topic of Global Warming, up to 2008 Americans have been increasingly concerned over global warming. Yet in 2010 the percentage of Americans saying there is solid evidence of global warming has fallen from 71% to 57%. Today only 50% of Americans surveyed believe increases in the Earth's temperature are due to human activity. Nearly half of Americans now believe the threat of global warming has been exaggerated; the highest levels since polling began thirteen years go (Newport, 2010). "The last two years have marked a general reversal in the trend of Americans' attitudes about global warming," Newport said, "It may be that the continuing doubts about global warming put forth by conservatives and others are having an effect (2010)."

A nationally representative survey done of 2,129 Adults over the age of 18 years old, with a 95% confidence level for the full sample was performed by the Leiserowitz, Maibach, and Roser-Renouf of the Yale Project on Climate Change and the George Mason University Center for Climate Change Communication (2010). Their study demonstrated similar results to that of the Gallup Poll. With 39% of American's

"Alarmed" or "Concerned" by climate change, the number has dropped from 50% since 2008. The amount of citizens who are dismissive about Climate Change has doubled in the past two years, from 7% to 16%. "Dismissive" citizens are at the entirely skeptical end of the scale, believing global warming is not happening, and possibly a hoax.

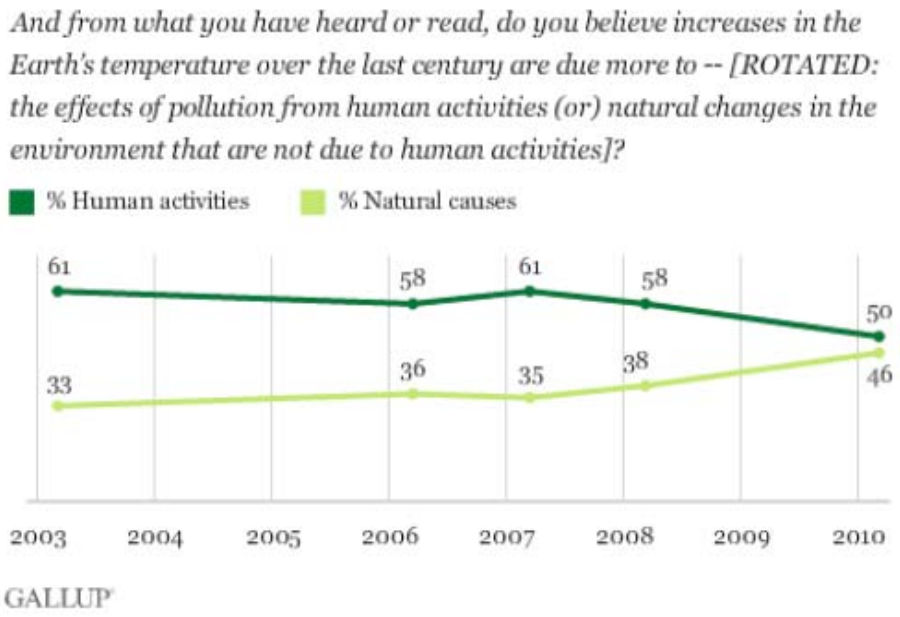

Figure 2-2. Gallup Polls Climate Change Graph *(Newport, 2010)*

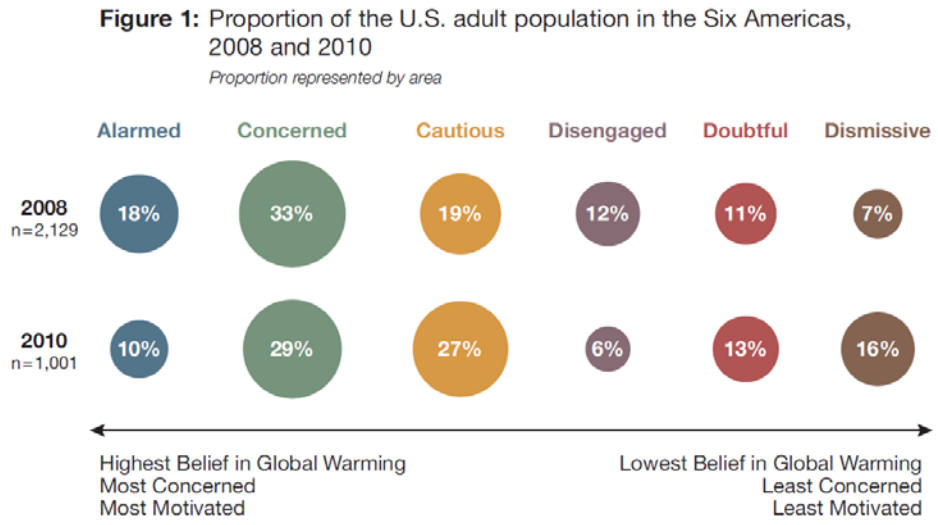

Figure 2-3. Proportion of the U.S. adult population in the Six Americas *(Leiserowitz, Maibach, and Roser-Renouf, 2010)*

Figure 2-3 demonstrates the scale of motivation that the Americans fall upon. The most motivated individuals capture only 10% of the population, while the least motivated captures 16% of the population. The other three-fourths of the population fall somewhere in-between the motivation scale.

The Scientific Consensus

There exists a discrepancy between from the conclusions of the current consumer data on climate change and actual scientific data on climate change. Naomi Oreskes in The Scientific Consensus on Climate Change (2004) examines the leading peer-reviewed literature, and Government Organizations, attempting to answer the question, “Is there a scientific consensus regarding anthropogenic climate change?”

Various scientific surveys have been done to evaluate the scientific opinion on climate change. A poll done by Peter Doran and Maggie Zimmerman (2009) received replies from 3,146 of 10,257 polled Earth scientists. As they examined the results by specialization, 75 out of 77 climatologists who listed climate science as their area of expertise and had published more than 50% of their recent peer-reviewed literature on the subject, believe that human activity is a significant factor in changing mean temperatures. 82% agreed that humans significantly influence the planet's temperature. The paper concludes, "It seems that the debate on the authenticity of global warming and the role played by human activity is largely nonexistent among those who understand the nuances and scientific basis of long-term climate processes (Doran, Zimmerman, 2009)."

Oresekes summarized a study of the scientific literature on climate change concluding that there is a scientific consensus on the reality of anthropogenic climate change (2004). Scientific consensus is defined as the collective judgment, position, and opinion of the community of scientists in a particular field of study. While the consensus may be general agreement, it does imply unanimity. Her research analyzed 928 abstracts of papers from scientific journals between 1993 and 2003. These articles were split into six categories: explicit endorsement of the consensus position, paleoclimate analysis, evaluation of impacts, mitigation proposals, methods, and rejection of the consensus position (Oresekes, 2004). The majority of the articles (75%) were placed in a category of explicitly or implicitly accepting the consensus view that humans are responsible for climate change. The rest of the articles (25%) took no position on the subject that humans are responsible. The underlying result expressed that none of the articles

disagreed with the consensus position. In the study Oreskes states, "Authors evaluating impacts, developing methods, or studying paleoclimatic change might believe that current climate change is natural. However, none of these papers argued that point (2004)."

Increased research in the last decade has provided more concrete consensus across the scientific community that climate change is a necessary issue. The research also concludes that human activity today will result in excessive environmental issues in the future. The majority of research also shows that there has been an undeniable increase in CO2 levels resulting in a greenhouse effect in the atmosphere. The scientific community has continued to confirm that the fluctuations in the CO2 levels are resulting in changing activity of the Earth's climate. As scientists trace over human history, the increased CO2 levels directly correlates to the increased burning of fossil fuels and other human activity that emits CO2. Therefore, the research done on both climate activity and human influence defines that the climate change has a direct influence of humans.

Figure 2-4 classifies organizations to whether they concur or are non-committal with the IPCC view from the Fourth Assessment Report, in "Impacts of a Warming Arctic," stating that human actions are "very likely" the cause of global warming, with 90% or greater probability (2004).

Non-committal organizations include: American Association of Petroleum Geologists, American Association of State Climatologists, American Geological Institute, and the Canadian Federation of Earth Sciences. Excluding statements by individual scientists opposing the mainstream assessment of global warming, no remaining

scientific body is known to reject the basic findings of human influence on recent climate change (DiMento, Doughman, 2007).

CONCURRING ORGANIZATIONS
Academies of Science • **InterAcademy Council** • **European Academy of Sciences and Arts** • **International Council of Academies of Engineering and Technological Sciences** • **Network of African Science Academies** • **Royal Society of New Zealand** • **Polish Academy of Sciences** • **National Research Council (US)** • **32 National Science Academies**
General Science • **American Association for the Advancement of Science** • **American Chemical Society** • **American Institute of Physics** • **American Physical Society** • **Australian Institute of Physics** • **European Physical Society** • **European Science Foundation** • **Federation of Australian Scientific and Technological Societies**

Earth Sciences

- **American Geophysical Union**
- **European Federation of Geologists**
- **European Geosciences Union**
- **Geological Society of America**
- **Geological Society of Australia**
- **International Union of Geodesy and Geophysics**
- **National Association of Geoscience Teachers**
- **American Meteorological Society**
- **Australian Meteorological and Oceanographic Society**
- **Canadian Foundation for Climate and Atmospheric Sciences**
- **Canadian Meteorological and Oceanographic Society**
- **Royal Meteorological Society (UK)**
- **World Meteorological Organization**
- **American Quaternary Association**
- **International Union for Quaternary Research**
- **American Society for Microbiology**

Miscellaneous

- **The Wildlife Society (international)**
- **American Medical Association**
- **World Health Organization**
- **American Astronomical Society**

Figure 2-4. Concurring Organizations (2010)

For the past two years, Dr. Richard Schuhmann has challenged his Engineering Leadership 408 class to find one peer reviewed journal article that the class agrees is a valid scientific paper, from a valid journal, and written by real scientists. The article must state that either a) the earth is not warming or b) the earth is warming, but humans

are not responsible for the trend. For the past two years the students have failed to find any valid articles (Schuhmann, 2010).

If there is a scientific consensus among leading scientists that humans are responsible for climate change, then why do the other 50% of American citizens express strong confusion and disagreement on the topic? Boykoff and Boykoff attempt to answer that question in their paper, Balance as bias: global warming and the US prestige press. (2004). Their research argues the US prestige-press (the *New York Times*, the *Washington Post*, the *Los Angeles Times*, and the *Wall Street Journal*) coverage has contributed to a "significant divergence of popular discourse from scientific discourse." The paper focuses on balanced reporting, hypothesizing that journalists are constantly contending with political norms, economic norms, and journalistic norms to create a balance in journalism. Historically the news represents two sides, where there is a "balance that should aim for neutrality. It [Journalism] requires that reporters present the views of legitimate spokespersons of the conflicting sides in any significant dispute, and provide both sides with roughly equal attention (Gans, 1978)." The major issue with the prestige press on global warming comes from "illegitimate spokespersons", whom of which are not climate scientists, getting as much attention as the actual findings of the scientific community. This imbalance leads to a biased coverage for anthropogenic contributions to climate change. Boykoff and Boykoff examined a sample of 636 articles from 3,543 articles from the prestige press, and their results showed the majority of the stories were written using the journalistic norm of balanced reporting (2004). These balanced stories gave an impression that our scientific community is in a serious debate

over whether anthropogenic climate change is a reality.

Journalistic Balance as Global Warming Bias Results
• **53 percent of the articles gave roughly equal attention to the views that humans contribute to global warming and that climate change is exclusively the result of natural fluctuations.**
• **35 percent emphasized the role of humans while presenting both sides of the debate, which more accurately reflects scientific thinking about global warming.**
• **6 percent emphasized doubts about the claim that human-caused global warming exists, while another 6 percent only included the predominant scientific view that humans are contributing to Earth's temperature increases.**

Figure 2-5. Journalistic Balance as Global Warming Bias Results *(Boykoff, Boykoff 2004)*

Reporter and Editor Ross Gelbspan (1998) also claims that balanced reporting of issues on global warming has contributed to inadequate U.S. press coverage.

> "The professional canon of journalistic fairness requires reporters who write about a controversy to present competing points of view. When the issue is of a political or social nature, fairness—presenting the most compelling arguments of both sides with equal weight—is a fundamental check on biased reporting. But this canon causes problems when it is applied to issues of science. It seems to demand that journalists present competing points of view on a scientific question as though they had equal scientific weight, when actually they do not."

All quality journalism needs to represent multiple viewpoints, but when generally agreed-upon scientific findings are presented with equal weight as the view-points of a few skeptics, readers are left to choose. This choice represents another challenge of putting America on carbon diet. If half of the population of the U.S. is questioning whether humans are in fact responsible for carbon emissions, then little motivation exists to reduce their carbon consumption.

Chapter 3

Ability: The Role of (Mis)Calibration

Understanding Calibration and Miscalibration

To understand the ability of consumers to reduce carbon emissions the following study was completed based on calibration. The challenge exists, for consumers wishing to begin a carbon diet, in accurately measuring their carbon output to track savings. The topic of calibration represents a key in understanding these challenges. Measuring accurate carbon emissions from everyday scenarios is a complex task for experts and especially consumers. Since the action of measuring carbon emissions from scenarios is prone to error, calibration represents a strong research theory. The first goal of the empirical study is to understand whether individuals are miscalibrated on certain energy-saving scenarios and their effectiveness of reducing carbon emissions. The second goal is to examine which of the energy-saving scenarios individuals are most likely to adopt.

Research is limited in the carbon emissions domain about calibration, but general knowledge calibration has been extensively examined by Joseph W. Alba and J. Wesley Hutchinson (2000). Their research suggests that consumer knowledge is seldom errorless and complete. Calibration is an important issue for the study of consumer decision making because it allows consumers to live with incomplete and erroneous information. Alba and Hutchinson (2000) define calibration as "the agreement between objective and subjective assessments of the validity of information," or calibration reflects the correspondence between what consumers know (accuracy), and what they think they know (confidence). Accuracy depends on a

consumer's independent ability or expertise. Confidence is based on expertise but can also be influenced by other factors, such as experience (Alba, Hutchinson 2000).

Several sources of miscalibration has been suggested: cognitive bias, sample error, response error, and response bias. Cognitive bias is most important to examine in regards to consumer over confidence and accuracy.

Cognitive bias is the human tendency to draw incorrect conclusions in certain circumstances base on cognition rather than accurate evidence. The biases are often considered a "cognitive short-cut", based on rules of thumb and errors in statistical judgment, social attribution, and memory (Haselton, Nettle, Andrews, 2005). Since cognitive processes are often suggested but less often tested Alba and Hutchinson (2000) aim to explain reasons for miscalibration of the cognitive bias by: 1) Consumers experiencing failures of memory; 2) Consumers have attention failures and mis-weighing of evidence; 3) Consumers have inappropriate decision outputs; 4) Consumers have motivated reasoning.

In order to measure miscalibration a study was completed based on the literary article of Wouter Poortinga (2002). Poortinga's study, Household preferences for energy-saving measures, focused on the influence of physical characteristics of energy-saving measures based on their acceptability. In the study, preferences for different energy-saving scenarios were measured then examined. Poortinga's study characterizes energy-saving measures by the domain of energy-savings, the strategy of energy-savings, and the amount of energy savings. In this specific study, in general, the strategy of energy savings was the most important factor contributing to the acceptability across all respondents. Strategy means each of their 23 energy-saving scenarios were categorized by technology, behavior and a combination of the two. The

technical scenarios were more acceptable than behavioral measured, and respondents were more accepting of scenarios aimed at reducing direct energy use than indirect energy use.

The predictions of the following empirical study were that they would mirror Poortinga's study. While not all of the same 23 energy-saving measures were used, it was predicted that indirect energy saving measures are less acceptable among college students than direct energy saving measures. Most indirect energy-saving measures are expensive and require a change in consumption patterns, this leads individuals to be more likely in adopting direct energy-savings. It is predicted that whether participants are more likely to adopt a scenario should not consciously effect whether they find the scenario effective. It is also predicted that participants will rank carbon emission scenarios which receive strong news and advertising attention higher than scenarios which receive less attention, whether they are accurate in rating how effective the scenario is at reducing emissions or not.

Procedure and Methods of the Empirical Study

A survey study was conducted during February and March of 2010. This survey was aimed at evaluating future scenarios with respect to household energy consumption, and the effectiveness of scenarios at reducing carbon emissions. The scenarios varied on the domain of energy saving (home versus transportation) and energy-saving strategy (technology).

One hundred and sixty seven college students completed the survey. The survey was presented electronically using a survey builder on the Internet. The survey participants are a non-representative convenient sample, somewhat representative of college students. All respondents were above the age of 19, with the mean age of 22 years old. Over 75% of the respondents are currently enrolled in college, and approximately 90% have attended college.

Women were slightly over-represented. Likewise, Pennsylvania residents were also slightly over-represented.

First, respondents were asked to indicate on a 5-point Likert-scale how likely they were to adopt fifteen different energy-saving measures within one year. The scale ranged from 1: "unlikely" to 5: "very likely". Next the respondents were then asked to indicate on a 10-point Likert-scale how effective each of the same 15 energy-saving measures from the first question were at reducing carbon emissions. The scale ranged from 1: "not effective" to 10: "extremely effective". The respondents were also told that their likeliness to adopt an energy-saving scenario from the first question should not reflect their responses to the second question.

Aim of the Study

The primary aim of the study was to identify whether college students are miscalibrated on the emission of carbon dioxide from each of the 15 scenarios. The secondary aim of the study was to examine how likely college students are to adopt certain energy-saving scenarios in their daily lifestyle within one year (Table 3-1). To measure the miscalibration the scenarios were ranked from what the respondents believed were most effective at reducing carbon emissions to the least effective. The results were then compared to the actual rank of each energy-saving scenario.

Measuring Carbon Output

Each of the fifteen scenarios has been ranked in Table 3-5 according to their actual carbon emissions in pounds. The sources for each energy-saving scenario can be found beside the data. Assumptions were made for each scenario and many scenarios were quite difficult to measure. Each scenario represented an energy-saving strategy that could be defined as a

common solution for household carbon emissions reduction. The problem of miscalibration can also be found in the accuracy and confidence of measuring each scenario's carbon emissions savings in pounds. Even the Environmental Protection Agency failed to give solid measurements on certain scenarios.

Results of the Empirical Study

Data

Table 3-1. The Average Likeliness of 15 Energy-saving Measures

Energy-saving measure	Domain	Means
Switching off lights in unused rooms (D)	H	4.67
Turn off water while brushing teeth (D)	H	4.12
Recycling all plastic, paper, and glass products (I)	H	4.11
Walking short distances (1 mile) (D)	T	4.09
Replace light bulbs with CFLs (I)	H	3.53
Walking or Bicycling places (1 mile +) (D)	T	3.36
Carpooling to work (D)	T	3.21
Rinsing dishes with cool water (D)	H	3.10
Altering your food shopping habits (I)	H	2.91
Unplugging unused appliances (D)	H	2.88
Buying a fuel efficient or hybrid car (I)	T	2.86
Take Shorter Showers (D)	H	2.83
Buy an energy efficient heating system (I)	H	2.70
Composting food waste (I)	H	2.51
Limit your apartment or household to one TV (I)	H	2.28

Note: The scale range is from 1 unlikely to 5 very likely.
Note: H: Home measures T: Transport measures
Note: (I): Indirect Savings (D): Direct Savings

Table 3-2. Gender Means and Regression of Carbon Effectiveness and Overall Likeliness

Energy-saving Action	Overall Likelihood Means	Means of Males	Means of Females	Overall Carbon Effectiveness Means	Means of Males	Means of Females	Regression Model Likelihood as a Function of Carbon Effectiveness and Gender
Turn off Lights	4.67 (0.72)	4.55 (.08)	4.78 (.07)*	7.22 (2.42)	6.80 (.28)	7.55 (.25)	F>M b= .04 (.02)
Teeth brushing	4.12 (1.17)	4.01 (.14)	4.13 (.12)	5.91 (2.45)	5.57 (.28)	6.10 (.25)	N.S. b= .02 (.04)
Recycling	4.11(1.02)	3.96 (.12)	4.22 (.11)	8.00 (2.26)	7.53 (.26)	8.37 (.23)	N.S. b= .06 (.03)
Walking (1mi)	4.09 (1.02)	4.05 (.12)	4.11 (.12)	8.00 (2.03)	7.10 (.24)	8.19 (.21)	N.S. b= .11 (.04)
CFLs	3.53 (1.31)	3.61 (.15)	3.60 (.13)	7.12 (2.34)	6.70 (.27)	7.46 (.24)	N.S. b= .06 (.04)
Walking (1mi+)	3.36 (1.23)	3.28 (.14)	3.36 (.13)	7.71 (2.12)	7.20 (.22)	8.64 (.20)	N.S. b= .17 (.05)
Carpooling	3.21 (1.18)	3.07 (.14)	3.33 (.12)	8.05 (2.05)	7.50 (.23)	8.50 (.21)	N.S. b= .23 (.04)
Rinsing Dishes	3.10 (1.24)	3.19 (.14)	3.04 (.13)	5.17 (2.28)	5.04 (.27)	5.27 (.24)	N.S. b= .10 (.04)
Altering Food	2.91 (1.25)	2.64 (.14)	3.13 (.12)*	5.80 (2.67)	5.07 (.30)	6.39 (.27)	F>M b= .17 (.03)
Unplugging	2.88 (1.25)	2.67 (.14)	3.04 (.13)*	5.88 (2.47)	5.22 (.28)	6.40 (.25)	F>M b=.15 (.04)
Hybrid Car	2.86 (1.25)	2.53 (.14)	3.11 (.13)*	8.00 (2.22)	7.29 (.25)	8.56 (.22)	F >M b = .15 (.04)
Shorter Showers	2.83 (1.24)	2.92 (.14)	2.77 (.13)	6.09 (2.39)	5.89 (.28)	6.26 (.25)	N.S. b= .09 (.04)
Heating System	2.70 (1.30)	2.78 (1.5)	2.64 (.14)	8.01 (2.11)	7.64 (.24)	6.10 (.25)	N.S. b= .11 (.05)
Composting	2.51 (1.23)	2.53 (.14)	2.49 (.13)	6.10 (2.56)	5.48 (.29)	6.60 (.26)	N.S. b= .18 (.04)
One TV	2.28 (1.28)	2.14 (.14)	2.30 (.13)	5.57 (2.37)	4.97 (.26)	6.37 (.23)	N.S. b= .12 (.04)

*Statistically significant: females are more likely than males

Table 3-3. Average Correlation between Likeliness and Effectiveness of Direct and Indirect Scenarios

Direct Energy-saving Scenarios • Switching off lights in unused rooms • Turn off water while brushing teeth • Walking short distances (1 mile or less) • Walking or Bicycling places (1 mile +) • Take Shorter Showers • Rinsing dishes with cool water • Unplugging unused appliances • Carpooling to work	Average Correlation of Direct = **0.0274** (.34) p-value= **.306** > .05 (N.S.)
Indirect Energy-saving Scenarios • Limit your apartment or household to one TV • Composting food waste • Buy an energy efficient heating system • Altering your food shopping habits • Replace light bulbs with CFLs • Recycling all plastic, paper, and glass products • Buying a fuel efficient or hybrid car	Average Correlation of Indirect = **0.0963** (.42) p-value= **.004** < .05

Table 3-4. Average Correlation between Likeliness and Effectiveness of Domain Scenarios

Transportation Energy-saving Scenarios • Walking short distances (1 mile or less) • Walking or Bicycling places (1 mile +) • Buying a fuel efficient or hybrid car • Carpooling to work • Turning off water while brushing teeth	Average Correlation of Transport = **0.0231** (.59) p-value= **.645** > .05 (N.S.)
Household Energy-saving Scenarios • Limit your apartment or household to one TV Composting food waste • Buy an energy efficient heating system • Altering your food shopping habits • Replace light bulbs with CFLs • Recycling all plastic, paper, and glass products • Unplugging unused appliances • Switching off lights in unused rooms	Average Correlation of Household = **0.0135** (.35) p-value = **.631** > .05 (N.S.)
Water Related Energy-saving Scenarios • Take Shorter Showers • Rinsing dishes with cool water • Turning off water while brushing teeth	Average Correlation of Water = **0.1518** (.70) p-value = **.013** < .05

Table 3-5. Actual Carbon Emissions of 15 Energy-saving Scenarios

Altering your food shopping habits	**8,000** lbs	This is measured eating only a few meals per month that are completely locally grown. *Foodcarbon.co.uk*
Buy an energy efficient heating system	**6,367** lbs	Based on a Gas Furnace CO2 emissions. Oil Furnace would emit **14,380** lbs of CO2. *National Geographic Magazine*
Buying a fuel efficient or hybrid car as your next car	**5,000** lbs*	*Wiredmagazine.com*
Carpooling to work (If currently jobless, in the future	**2,796** lbs	Based on a 15 mile average commute. Driving twice a week, for one year, carpooling the other days. *U.S. EPA Personal Emissions Calculator* *US Census Bureau Reports*
Replace current light bulbs with Compact Fluorescent light bulb	**1140** lbs	Assuming a 100W incandescent is replaced by a comparable CFL. Also assuming 10 light bulbs were replaced. *Carbonfootprint.com*
Limit your apartment or household to one TV	**948** lbs	The national average for Television sets is 2.73 per household.

		Nielson Study in USA Today
Rinsing dishes with cool water	**796** lbs	Assuming it takes 10 minutes to rinse your dishes per day. *US Environmental Protection Agency*
Take Shorter Showers	**796** lbs	Assuming you reduce your shower by 10 minutes each day. *US Environmental Protection Agency*
Walking or Bicycling places (1 mile or more)	**720** lb	Assuming 3 miles of walking to work or school 48 weeks per year. Using 1 mile saves 1 pound of CO2. *US Environmental Protection Agency*
Unplugging unused appliances	**619.5** lbs	This is measured by unplugging: Hairdryer, Stereo, PC, Toaster, DVD player, Cable Box, Coffee Maker, Laptop, Exterior Light, Microwave, Rechargeable toothbrush, Alarm Clock, Cell Phone Charger. (including AC **2,725** lbs) Since 50% of energy is used when the appliance is turned off. *National Geographic Magazine*
Switching off lights in unused rooms	**600 lbs**	*US Environmental Protection Agency*
Recycling all plastic, paper, and glass products	**447** lbs	*US Environmental Protection Agency*
Turn off water while brushing teeth	**398** lbs	Assuming you turn on the faucet for 5 minutes per day. *US Environmental Protection Agency*
Walking short distances (1 mile or less)	**365** lbs	Assuming 1 mile = 1 pound of carbon. *US Environmental Protection Agency*
Composting food waste	**35** lbs	Assuming that composting for one year would save a local garbage truck one trip to the landfill.

* The Prius can illustrate the difficulties in computing the annual carbon emissions savings since one could also take into account the emissions required for production of the hybrid car. It uses 113 million BTUs of energy to produce a Prius because of the nickel needed for the battery. 113 million BTUs translate to about 19,560 lbs of CO2. At 5,000 lbs of CO2 saved annually, would take the average person 5 years to reach the CO2 savings of simply buying a used car.

Table 3-6. Rankings of Actual Carbon Emissions vs. Gender Means of Effectiveness

Male Ranking	Actual Ranking of Energy-saving Scenarios	Female Ranking
Heating System	1. Altering your food shopping habits (I)	Walking (1mi+)
Recycling	2. Buy an energy efficient heating system (I)	Hybrid Car
Carpooling	3. Buying a fuel efficient or hybrid car (I)	Carpooling
Hybrid Car	4. Carpooling to work (D)	Recycling
Walking (1mi+)	5. Replace current light bulbs with CFLs (I)	Walking (1mi)
Walking (1mi)	6. Limit your household to one TV (I)	Switch off Lights
Switch off Lights	7. Rinsing dishes with cool water (D)	CFLs
CFLs	8. Take Shorter Showers (D)	Composting
Shorter Showers	9. Walking or Bicycling places (1 mile +) (D)	Unplugging
Teeth brushing	10. Unplugging unused appliances (D)	Altering Food
Composting	11. Switching off lights in unused rooms (D)	One TV
Unplugging	12. Recycling all plastic, paper, and glass products (I)	Shorter Showers
Altering Food	13. Turn off water while brushing teeth (D)	Heating System
Rinsing Dishes	14. Walking short distances (1 mile) (D)	Teeth brushing
One TV	15. Composting food waste (I)	Rinsing Dishes

Observations

Observationally the results showed that while college students are motivated to make behavioral changes in their lifestyles, they are micalibrated on certain energy-saving scenarios. The scenario of altering one's shopping habits ranked number twelve out of fifteen at a mean of 5.80. The carbon emissions saving are actually the highest of any scenario (Table 3-5). The reasons for this micalibration could be a result in the lack of education on the topic of carbon emissions of food production. While this scenario was more subjective in measurement than

other scenarios, it is clear the majority of college students are unaware of the effectiveness of altering food patterns to purchase locally grown produce and packaged goods.

Since recycling has become adopted at an ever quickening rate, and receives high news coverage, college students placed recycling higher on the list of effectiveness than expected. The reality is that recycling reduces less carbon emissions than simple behavioral changes, such as rinsing the dishes with cool water, or unplugging appliances when not in use. While recycling is still an extremely necessary energy saving scenario, it is less effective at reducing carbon emissions than college students would expect.

Effectiveness

Overall the participants were accurate and confident in ranking the effectiveness of buying a hybrid car, carpooling to work, and buying an efficient heating system, since they represent high carbon reducing scenarios (Table 3-2). Gender as a function of effectiveness showed that females ranked almost every scenario higher in effectiveness at reducing carbon emissions than males. Females gave each scenario an average effectiveness of 5 or more on a scale of Likert-scale of 1-10 (Table 3-2). While females may be more sensitive in general, an assumption can be made that a possible experimental bias exists. Since respondents were aware that the survey administrator was a female these results could be affected by bias. Looking at strictly at females, women were much more miscalibrated on scenarios of walking long distances, which they found to be the most effective of all 15 strategies at reducing emissions, and composting, which women ranked as being more effective than altering one's food pattern and buying an efficient heating system.

Whether the scenario was a household strategy or a transportation strategy was not statistically significant at predicting effectiveness. Scenarios which indirectly reduced carbon emissions had higher actual carbon savings than scenarios which directly reduced carbon emissions (Table 3-6), yet whether the energy-reducing strategy was indirect or direct made no difference for the participants rating the effectiveness of reducing carbon emissions.

Correlation

The results of computing the average correlation of likeliness and effectiveness (Table 3.3) measured whether the likeliness of an individual to begin an indirect scenario, such as buying a hybrid car, or replacing bulbs with CFLs, can predict how effective they find the scenario. The indirect scenarios had an average correlation of 0.09, and where statistically significant (<.05). While the same could not be said for direct energy-saving scenarios, (Unplugging appliances and electronics, Walking short distances) the domain of transportation scenarios, or the domain of household scenarios, water related energy-saving scenarios were also statistically significant. Participants who said they would be likely to take shorter showers or turn off the water while brushing teeth can predict whether they found water reducing activities to be effective at reducing carbon emissions. The water producing scenarios had an average correlation of 0.15 (Table 3-4).

Likeliness

College students are more likely to change direct behaviors over indirect behaviors. Table 3-1, shows the scenarios with the highest means are direct behaviors, with the exception of recycling and replacing light bulbs with CFLs. With these two indirect scenarios, it can be

assumed that college students are well aware of these scenarios because of the attention recycling and replacing incandescent bulbs with CFLs receive.

Women were also more likely to adopt the majority of the scenarios than men. It is statistically significant that women are more likely to turn off lights, alter food patterns, unplug appliances, and buy a hybrid car. Targeting college women in these domains may be very effective. Men were not significantly more likely to adopt any of the scenarios before women (Table 3-2).

Final Results

In order to prove whether consumers are actually miscalibrated on carbon emissions, a comparison of genders was needed. The since the standard deviation was relatively high for the means of all participants, it was necessary to divide the participants in smaller groups (the most practical groups being female and males). Table 3-6 uses colors to show which of the scenarios representing the highest miscalibration (only scenarios where there was a difference of four or more ranks were colored). Neither gender was able to accurately rank any of the scenarios, with recycling, altering one's food pattern, and walking short distances being the most miscalibrated. With the high levels of standard deviation for the average means, the assumption will be made that confidence is also low. With low confidence and low accuracy it can be assumed that miscalibration exists and represents a challenge of ability for consumers.

Limitations and Future Studies

The limitations to this study reflect more than just a time and budget constraint. The convince sample represents a college population, and with more time and a budget the survey could be mailed to other university campuses. In this study behavior intentions were measured,

and the actual behaviors were not. Behavior intentions can be overstated in order for the participants to engage in socially desirable behavior resulting in a social desirability bias. Even though the survey was given through an online provider, and anonymously, social desirability bias is impossible to eliminate completely. Another limitation is the ranking of carbon emissions. The 15 scenarios represented were complex for consumers to estimate on a Likert-scale, so the effectiveness was prone to error. When assessing consumer calibration it is also crucial to have accurate carbon emissions data. The confident and accurate numbers on the actual emissions of each scenario were quite difficult to find and estimate, representing one of the least expected limitations of this study.

Future Studies

Future studies could include using the same set of 15 energy-saving scenarios and include a questions asking whether the participants "agree," "disagree," or are "unsure" if humans are responsible for climate change. Another study to measure calibration could include asking participants to read an article which lists carbon emissions in pounds for different activities. After a significant amount of time participants would be asked to recall the carbon emissions in pounds to measure accuracy. Then participants would record how confident they are at their recall of the information. Any future studies relating to the calibration of consumers on climate change could provide more detailed information of how to direct marketing for specific carbon reducing appliances and products.

Chapter 4

Recommendations and Key Learning

As the Planet's limits of carbon dioxide emissions are stretched, a stronger reaction is needed from our global leaders and policy makers. While they work to solve the problem on a larger scale, American consumers interested in reducing emissions, are challenged by their miscalibrations, lack of social influence in communities, and the controversy surrounding the validity of climate change. Since individuals cannot have motivation without ability, nor ability without motivation, the following recommendations are suggestions to overcome the challenges of putting America on a carbon diet.

Calibrating Consumers

Until individuals and communities have an appropriate way of measuring emissions they do not have the ability needed to know the effectiveness and savings of carbon reducing strategies. This re-calibration suggests: 1) educating consumers on direct or indirect behaviors they are not confident reduce emissions; 2) utilizing websites that calculate estimated emissions or 3) utilizing technologies which measure carbon emissions accurately from everyday behavior. The empirical study supported the claim that individuals are more likely to adopt behaviors which directly reduce emissions, such as walking instead of driving, taking shorter showers, and carpooling. Individuals or communities should begin with direct behaviors first, then work towards supporting the bigger indirect behaviors. Indirect behaviors are harder to measure carbon emission savings, and are usually more expensive requiring a change in consumption patterns.

Educating individuals or communities on behaviors they are not confident reduce emissions means taking the scenarios which had high levels of miscalibration and creating awareness around them. For example, altering food shopping pattern and unplugging electronics and appliances at night, represent examples from the empirical study. Consumers should be constantly reminded of these high energy saving strategies, and creative advertising represents one way to educate consumers on this topic. The following figures are moderately incongruent, centrally focused advertisements which can re-calibrate the confidence of energy-saving scenarios.

Figure 4.1. Advertisement for Altering Shopping Habits

Figure 4.1 represents an advertisement which educates the consumer about the carbon emissions used by one serving of the following food products. Almost 10% of all the energy used in America goes to farming food, processing food, transporting food, from the seed to the

plate. The savings are incredible if individuals can just purchase produce from people living in their communities. Over the course of a year pounds add up, and consumers should be made aware of the emissions which can be saved by eating shrimp less per year, or giving up bananas.

Figure 4.2. Advertisement to Unplug

This advertisement can be used to educate consumers who are unaware of how effective unplugging unused appliances and electronics can be. Communities and states such as California are already well calibrated on the issue of unplugging appliances. The California's Vampire

Slayer Act of 2006 names the most problematic energy-drainers: Tivo, sound systems, computers, TVs, and cable boxes. These items use anywhere from 6 to 30 kilowatt-hours a month if off but not unplugged (Hoffman, 2010).

Another way to re-calibrate consumers on their accuracy of measuring carbon emissions requires technology. The simplest form requires a website such as carbonfootprint.com or nature.org, yet these are estimates which do not always take into account the specific scenarios, kinds of appliances, and utilities households own. The calculators are an estimate and a good starting point, but more accurate technology should be required.

Everything bought by American consumers has a carbon footprint. This footprint is measure by the product or services total carbon dioxide and greenhouse gas emissions during its lifecycle. Carbon emission labeling empowers the consumer with choosing products which have measured their footprint and contribute less to climate change. While this trend has just begun in Japan and the UK, if used properly it presents the consumer with accurate information about the carbon emissions of a product's lifecycle.

The labeling would act like the labeling of calories on food products. Knowing one's calories allows dieting individuals to reduce consumption of high calorie foods. If all food products had a label with a carbon emissions number from its lifecycle, one could assume that the survey results would show a higher rating of effectiveness towards the strategy of altering one's food shopping pattern. Carbon labeling would also allow for companies to assess how they produce their goods and services as they go back to the beginning and re-step through the lifecycle.

Households also need a more accurate system of feedback from adopting energy saving strategies. Since consumers cannot rely on motivation alone, or the support of a community, feedback technology can change the way a person measures their carbon output. In the future the development of more precise instruments to measure carbon emissions from individual household utilities and appliances are recommended. These instruments could show total emissions, and then the best places to reduce emissions in the home.

Utilizing Virtual Communities and Federal Regulations

The challenge of overcoming the current lack of physical community in America will not be an easy venture. Community involvement and "social capital" as explained by Robert Putnam may never reach the levels once seen in the 1950s. As our social norms in communities continue to change, individuals will need to connect to others who share their same social motivation and beliefs. If less and less Americans can live together to develop social norms we have the option to go virtual. Virtual communities can arise with their own social norms. Virtual Communities can also provide motivation to individuals in physical communities where they find little support surrounding them. These virtual communities are breaking down the geographical and legal barriers that have traditionally constrained people's abilities to form the like minded communities (Miller, 2009). Low Carbon World.com and Planet Green.com are examples virtual community websites build up around the idea of creating support, guidance, and information for individuals who are interested in being a part of the low carbon movement.

Using, Figure 2-1, The Social Capital Index and Carbon Emissions by State Rankings, it can be assumed that Texas, Ohio, Pennsylvania, Indiana, Florida, Illinois, and Kentucky will have an even larger challenge of motivating individuals in communities to reduce emissions

(Future studies could also predict whether higher emissions result in lower social capital). With high dependency and population diversity the community will have little network reciprocity, a crucial aspect of upholding social norms. These specific areas will require virtual communities, with a strong presence within larger cities and suburban high transportation areas.

After joining a community, whether it is virtual or real, focused on reducing emissions the next steps require motivating others to reduce their emissions. Since a scientific consensus exists, claiming that humans' actions are responsible for climate change, the 50% of the public who are disagree may need to be motivated to support the reduction of emissions in a different way.

The same 2,129 individuals who participated in the study done by Leiserowitz, Maibach, and Roser-Renouf of the Yale Project on Climate Change and the George Mason University Center for Climate Change Communication (2010) also showed promising results related to the regulations of carbon dioxide. Figure 4-3 illustrates (by taking the percentages from Figure 2-3) approximately 65% of Americans are strongly supportive to somewhat supportive of the signing of an international treaty to reduce greenhouse gas emissions. Recalling that "Disengaged," "Doubtful," and "Dismissive" represent the low end of the motivation scale, approximately 75% of these unmotivated individuals support the regulation of carbon dioxide as a pollutant. Pushing legislation towards regulation of carbon emissions shows prospect in motivating action from the Americans who do not believe humans are responsible.

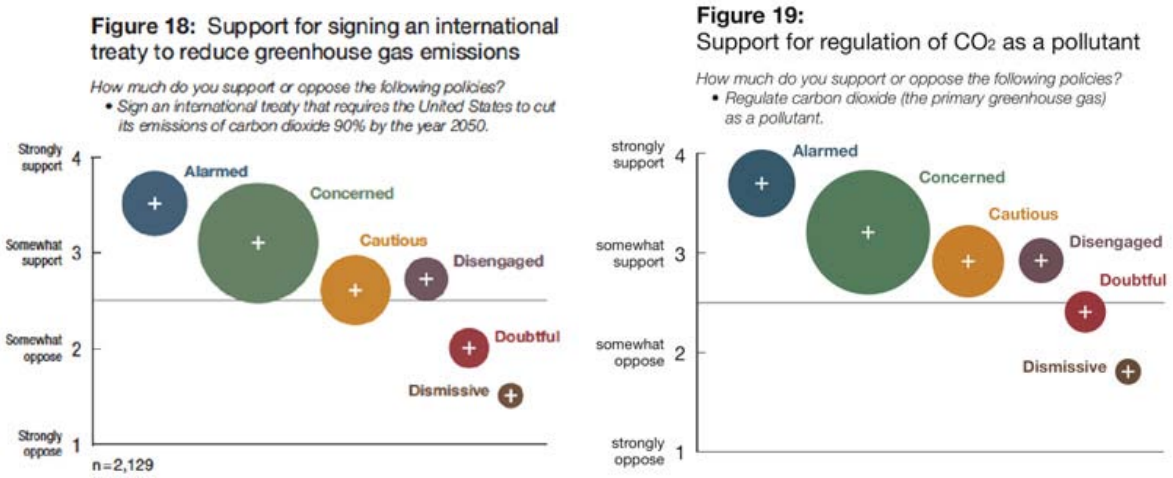

Figure 4-3. Support for Carbon Emissions Regulations (*Leiserowitz, Maibach, and Roser-Renouf, 2010*)

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HONORS

- Deans List 7 / 7 semesters
- The National Society of Leadership and Success: Sigma Alpha Pi, *Founding member*
- Wherry Honors Scholarship In Business
- Edward R. and Helen Skade Hintz International Scholarship