Abstract

America's contribution to global environmental issues isn't typically caused by a lack of infrastructure or lack of financial investment for more responsible renewable energy sources, rather it may be caused by behavioral and attitudinal characteristics of American culture. Our proposal is a mobile application that aims to daily update informative statistics to reflect the customer's current state of energy consumption and change consumer's behavioral response by direct and indirect routes of persuasion. A survey was conducted to assess behavioral, attitude, and social scenarios of our intended customer base: residents of Atlanta and the city's surrounding suburbs. Results of the survey showed a significant minority of dissatisfaction amongst energy consumers with their respective energy providers of which our app could address and alleviate. Also, it was observed that overwhelming participants have regards towards alternative renewable energy sources and are willing to pay a premium price to switch and convey willingness to spare some of their energy savings by our app towards investing in alternative renewable sources of energy. Behaviorally, surveyors were observed to be fairly energy conscious and responsible despite a large number of surveyors reporting their desire save even more money off their power bill. Given all the above information, the report suggest a solution in which energy providers and consumers can build a firm foundation towards primarily renewable energy sources starting with an initiative to decrease consumption of biofuels. The decreased consumption may very well start with our mobile app by bringing self-awareness to consumers in their daily lives.

Overcoming Conformity for a Sustainable Tomorrow

The world is currently facing a major problem concerning its habitable environment from human abuse, specifically due the increasing consumption of biofuels. The global destruction of valuable natural resources as such comes from many different causes. Some countries lack the infrastructure or financial inability to avoid energy inefficiencies or overconsumption of resources. However, in America, these environmental problems are not typically caused by infrastructure or a lack of economy, rather problems may be a cause of behavioral and attitudinal characteristics of American culture. Americans may have simply adopted a negative attitude toward energy conservation and conformed to a prevailing culture that ignores environmentally sustainable habits. The purpose of our survey was to gauge the attitudes of our sample population towards the environment, conservation of biofuels, and towards our proposed solution. Our solution is a mobile and online application for self awareness of energy consumption. In this report we display attitudinal and behavioral surveys of our sample population and discuss the results relevant to construct and promote our mobile application that will serve as a means to a central route of persuasion towards energy awareness and sustainable behaviors in part by the energy consumers. The app will aim to be dynamic with informative statistics to help reflect the customer's current state of at home (and possibly during commuting) energy consumption. With our mobile app, we hope to support and promote environmentally healthy habits for all customers, specifically those who may superficially commit to helping the environment, but conform to the attitude that energy efficiency or energy conservation is not worth the actual effort. This research will provide the framework for a mobile app that may improve the lives of people across the globe by using personalized statistics to incentivize good energy efficiency and energy conservation habits.

Methods

The survey that we performed contained twenty total questions. This was administered to fifteen people. Due to the requirements of the course, the survey was administered to a random sample of people within our class, isolating the demographics to college students in the late teens to early twenties age bracket. We did not ask for gender or race identifiers. Most of the participants were from the metro Atlanta area, but we did receive two responses that identified themselves as from outside the state. No other demographic questions were asked.

The surveys were administered during class. They were printed on paper and handed out randomly to students in the classroom. Once finished, they were asked to return the paper survey to our group without writing their name or any other identifying information. This procedure was meant to keep the researchers as blind to the participants' responses as possible.

Our survey included three types of questions—behavioral, attitude, and social. While we did include one demographic question, it was incorporated into the social section. Behavioral questions included questions on current behaviors concerning energy consumption, phone and app usage, and social networking usage. In addition, the behavior section asked questions on how the participant's behavior may or may not change with use of the app that we proposed and its link to social networking sites. Attitude questions assessed participant's attitudes regarding their current power company, consumption and comparisons between their current energy source and alternatives. Finally, the social section looked at how participants viewed themselves compared to others in energy usage and their financial potential to invest in alternative energy sources. For further details of the survey, please see Appendix I to view its raw format in its entirety as distributed in class.

Results

1) How satisfied are you with your power bills?

Description	Unsatisfied	Somewhat unsatisfied	N/A	Satisfied	Very satisfied
Response	6.6%	20%	53.3%	20%	0%

2) How satisfied are you with your power company's services and tools available for you to learn more about power usage?

Description	Unsatisfied	Somewhat unsatisfied	N/A	Satisfied	Very satisfied
Response	13.3%	20%	33.3%	26.6%	6.6%

3) To what degree do you prefer fluorescent to incandescent light bulbs in your home?

Description	Very unfavored	Somewhat unfavored	N/A	Somewhat favored	Very favored
Response	0%	40%	20%	40%	0%

4) Consider your daily energy usage within your household. How often do you…

	Never	Almost Never	N/A	Usually	Always
Turn off lights outside of room	0%	0%	0%	33.3%	66.6%
Turn off lights outside of house	40%	46.6%	13.3%	0%	0%
Turn off computer	13.3%	20%	0%	53.3%	13.3%
Leave TV/radio on	46.6%	40%	0%	13.3%	0%
Minimize power usage	0%	66.6%	20%	53.3%	20%
Use little power	0%	0%	33%	66%	0%

Want to use less power to save money	0%	0%	0%	53.3%	46.6%

5) I consider alternative sources of energy.

Yes	80%
No	20%

Due to poor response rate on the sub question, we chose not to include the results.

6) I rely on my smartphone for day-to-day usage.

Description	Never	Almost Never	N/A	Usually	Always
Response	6.6%	6.6%	0%	6.6%	80%

7) Answer the following questions about your behavior considering a situation where an app were created that could monitor your daily household energy consumption and show how changes could affect your bill.

An app showing me my energy consumption would have little effect over my behavior.
(Circle your answer)

Yes	20%
No	80%

Description	Never	Almost Never	N/A	Usually	Always
Yes/No	6.6%	6.6%	26.6%	26.6%	6.6%
App would change my consumption if it monitored my energy usage	0%	6.6%	0%	73.3%	20%

8) Answer the following questions about how your behavior would change considering that you can post your daily results from the app to social networking sites such as Facebook and Twitter, as well as view your friends' results.

Posting my results would not change my behavior.(Circle your answer)

Yes	46.6%
No	53.3%

Viewing my friends' results would not change my behavior.

Yes	46.6%
No	53.3%

If my results were posted on social networking sites, I would be more likely to try to improve my energy consumption.

Description	Never	Almost Never	N/A	Usually	Always
Response	0%	26.6%	13.3%	40%	20%

If I could view my friends' results, it would make me want to improve my results or encourage them to improve their results.

Description	Never	Almost Never	N/A	Usually	Always
Response	0%	26.6%	13.3%	40%	20%

9) Where is your residence outside of Georgia Tech campus? (out of total 15 data points)

a: Atlanta Suburbs
- 0: In Atlanta – 2
- 1: NE Atlanta – 2
- 2: N Atlanta – 4
- 3: NW Atlanta – 1
- 4: W Atlanta – 0
- 5: SW Atlanta – 1
- 6: S Atlanta – 1
- 7: SE Atlanta – 0

8: E Atlanta – 1
b: Out of sate : Maryland (1), Florida (1)

10) Given that your current annual energy bill is 7% of your annual salary, by what percentage would you be willing to consider to pay more to switch to a renewable green energy source like nuclear, wind, geothermal, hydro, etc) NOT biofuels.

Answers	0%	0.5%	1.0%	1.5%	2.0%	2.5%	> 2.5%
Response	5	2	4	2	2	1	0

11) Given that our app has the potential of helping you decrease your energy bill, would you consider investing those savings towards obtaining energy from renewable resources, particularly energy not derived from biofuels with high carbon emissions? If so by what percent?

YES, I would consider spending _____ percent of my energy saving from my traditional bill towards obtaining my energy from renewable non carbon emitting resources.

OR

NO, I would NOT consider spending my savings towards changing my energy source.

Answers	No	5-10%	10-25%	25-50%	50-75%	75-100%
Response	2	6	3	3	1	0

12) Was your house or apartment constructed in the last…. (if you are enrolled in housing from Georgia Tech, answer this question with regards to your previous or off campus residence)

Answers	2 years	3 years	5 years	10 years	15+ years
Response	0	1	1	4	9

13) How many individuals in your house hold own a car with less than 20 mpg?

Answers	0 indv.	1 indv.	2 indiv.	3 indv.	4 indiv.	5 or more

Response	4	6	2	3	0	0

14) How often do you commute to you're destination by carpooling or by any form of public transportation?

Description	Not very often	Sometimes	Exclusively
Response	1	5	9

Average: 6.066

15) In comparison to the rest of the world, do you think most American's think they consume more or less energy in their homes?

Description	Much less	Somewhat less	N/A	Slightly more	Much more
Response	0%	20%	6.6%	3.3%	40%

16) To which country do you think America's total private electricity consumption is most similar to?

Answers	China	India	Australia	Russia	Brazil
Response	7	2	5	1	0

17) How would you compare your personal private energy consumption to that if the rest of the U.S? (1 being much lower than the average per capita, and 10 being much higher than the average per capita, and 5 being the average per capita)

Average: 5.266

Discussion

Prior discussion, it should be noted that the surveys in class were hard copy, paper distributions of questioners contrary to an electronic distribution system. Unintended and ambiguous responses to select questions were observed and were not accounted for during analysis. However, every question had well over majority responses; the maximum sample size was 16 (n=16) and minimum sample size was 14 (n=14) for questions being asked. Also to be noted is the sample size may not accurately represent our customer base (Residence of Atlanta and surrounding suburbs). The sample population consisted of only college students of which were assumed to be representative of their respective areas of residence in Atlanta's suburbs, prior or during college (see question 9). Most of the sample population affiliated with North and North East Atlanta (Johns Creek, Alpharetta, Greater Gwinnett, Suwannee, etc.) which is indicative of a white upper to upper middle class majority (2000 and 2010 US census). Rest of the suburban Atlanta region was represented by at maximum only one data point, along with two surveys coming from out of state residents. All survey takers can be considered as "energy users," hence their input to our statistics is relevant, however only 12 out of 14 can be representative of Atlanta and its suburbs —that too biased towards suburban residents from North/ North East Atlanta.

It should also be noted, the main energy provider for the city of Atlanta and its suburbs is Georgia Power Company. Greater than 62% of Georgia Power Company's source for providing electric energy comes from biofuels such as natural gas, oils, and coal (Georgia Power about energy page). Thus, in the following discussion, the use of the term "energy" should be kept in mind with regards to majority of that energy originating directly form biofuels. Also, with regards to the notion of energy consumption, in context this discussion primarily focuses on

household consumption of electricity and gas, but it should be noted that the term also apples to commuting on biofuel based transportation as a significant contributing factor of energy consumption. Also, the phases “alternative energy” and alike are used as contrary to sources of energy extracted from biofuels.

Part A: Customer Base Attitude Assessment (Questions 1,2,3,5,7,8,15,16,17)

This aspect of the survey aimed to assess our potential customer base’s attitude towards energy consumption in general, their specific energy cost, and most importantly their attitude of themselves with regards to energy consumption and efficiency. Overall, 26.6% of surveyors are to some extant dissatisfied with their power bills and 33.3% of the surveyors have expressed dissatisfaction with their power companies lack of information with regards to customers power usage. Of the surveyors, 80% of them consider “alternative energy” sources. These statistics indicate our app’s applicability market and its potential to bridge the marginal gap between customer satisfaction and transparent relay of information in part of the energy company, however marginal it may be (26% - 33 %). If the mobile application can partner with the energy provider with sufficient information for its customers, it is very possible that customer satisfaction may increase as well assuming lack of information on power usage can be correlated to power company’s customer satisfaction. Also given the fact that well over majority surveyors already think of alternative energy sources allows the app to market and advertise information regarding alternative sources of energy, for example private solar panel investment options. This can act as an indirect route of persuasion.

Attitudinal assessment also revealed that the app’s potential to make a different is overwhelmingly likely. Approximately 80% of surveyors indicated that constant energy

monitoring and displaying of statistics would have an effect over their behavior on energy consumption, and with the implementation of social media and friendly customer competition (see question 8), 60% would improve or encourage others to possibly reduce their energy consumption. It can be concluded form these results that consumers of energy are already, very possibly aware of their lack of efficiency and high energy consumption considering surveyors indirectly acknowledge their room for improvement and possible interest in alternative energy source.

Part B: Customer Base Behavioral Assessment (Questions 4,5,6,7,8)

Behaviorally, surveyors are more or less diligent with specific miscellaneous energy consuming sources around the house like light bulbs, TVs, and computers. Despite generally having environmentally positive behaviors around the house, and even majority of the surveyors claiming to use little power and actively minimize power usage, surveyors still overwhelmingly express their desire to save more (see question 4). Also, it should be noted that nearly 80% of the surveyors rely on their smartphones to execute day to day activities. These statistics are in favor of our product's potential as it is marketed mainly (though not exclusively) as a smart phone application. Our app could potentially be successful in achieving its end goal/primary function to reduce biofuel consumption by behavioral change and simultaneously reduce the energy bill by those same behavioral changes. Through a selling point's perspective, we would have to provide evidence and convince customers that our app can actually help save customers money, not just provide energy statistics.

Part B: Customer Base Socio-Economical potential (Questions 9,10,11,12,13,14)

This part of the survey intended to assess our customers' financial potential to invest in alternative energy sources for a long term solution to reduce biofuel consumption and their desire

to. Also, with this analysis, we hoped to elucidate any potential selling points for energy providers to cooperate and invest in our potential application. When asked if surveyors were willing to pay more to switch from biofuels as an energy source, approximately 55% indicated they would pay 1.0% or more of their annual salary. The demand to switch away form biofuels is clearly evident and possibly a long term incentive for energy companies to take note. Next, when asked that if this app were to save on their energy cost, what percentage of the saving would the surveyors invest towards alternative renewable energy sources, the majority responded 5%-10% of their savings and only 13.3% refused to invest their savings at all. These statistics are further supportive of our mobile app's cause to not only reduce biofuel consumption but by doing to hoping to reduce the cost of the energy consumer and establish a foundation for a long term solution of further if not completely diverging from our dependence on biofuels.

Our theory is as follows. Suppose that our mobile app is able to save optimistically 10% on customers' power bill by decreasing the customer's energy consumption. The power company's infrastructure of delivering electricity is already established and of minimal cost to maintain, thus the largest overhead is the resource its self which will also reduce due to a 10% decrease in demand. With the loss in revenue, if customers are already willing to spend at least 5%-10% of the saving towards alternative resources, then than company can share the burdensome initial cost of investing in alternative renewable energy source(s) with the customers along with generous government subsidies. Given that the initial cost is still difficult to swallow for some power companies. According to our poll however, customers are already willing to pay a higher price for alternative energy sources, which means a possibly a quicker return investment for power companies. Overall our results paint a picture as a win-win situation if our app can successfully reduce consumption of biofuel based energy resources in households.

References

Bina, S., Dowlatabadi, H. (2005). Consumer lifestyle approach to US energy use and the related CO2 emissions. Energy Policy, 33(2), 197-208. Retrieved from http://www.sciencedirect.com/science/article/pii/S0301421503002106

Delshad, A.B., Raymond, L., Sawicki, V., Wegener, D.T. (2010). Public attitudes toward political and technological options for biofuels. Energy Policy, 38(7), 3414-3425. Retrieved from http://www.sciencedirect.com/science/article/pii/S0301421510000960

Georgia Power Company. Energy Sources: Diversity for Responsibility. Retrieved from http://www.georgiapower.com/about-energy/energy-sources/

Savvanidou, E. , Tsagarakis, K.P., Zervas, E. (2010). Public Acceptance of Biofuels. Energy Policy, 38(7), 3482-3488. Retrieved from http://www.sciencedirect.com/science/article/pii/S0301421510000960

U.S. Census 2000 and 2010 [xls document]. Retrieved from http://www.census.gov/census2000/xls/ga_tab_5.xls

Appendix I

The following is a copy of the survey that was distributed. The responses that were received were used to compile this write-up.

Group 16 Survey

Answer the following questions about your behavior in energy consumption. Circle the answer that best fits with how you think you behave, from1 (Never) to 5 (Always).

1. **How satisfied are you with your power bills?**

1 2 3 4 5
Unsatisfied Somewhat unsatisfied N/A/unknown, satisfied very satisfied

2. **How satisfied are you with your power company's services and tools available for you to learn more about power usage?**

1 2 3 4 5
Unsatisfied Somewhat unsatisfied N/A/unknown, satisfied very satisfied

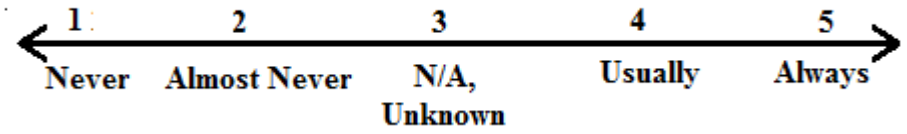
3. **To what degree do you prefer fluorescent to incandescent light bulbs in your home?**

1 2 3 4 5
Very unfavored Somewhat unfavored N/A/unknown, somewhat favored very favored

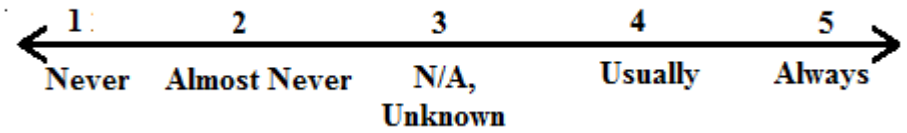
Why do you prefer one over the other?

4. **Consider your daily energy usage within your household.**

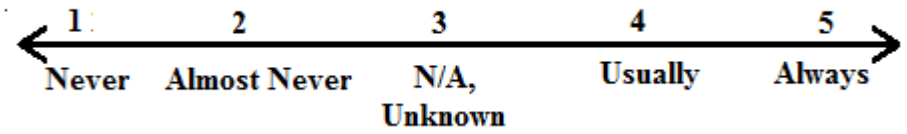
I turn off the lights when I leave the room.



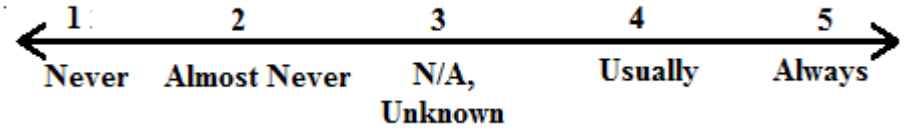
I leave lights on when I leave the house.



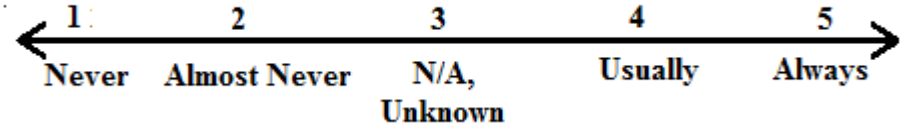
I turn off my computer when I'm not using it.



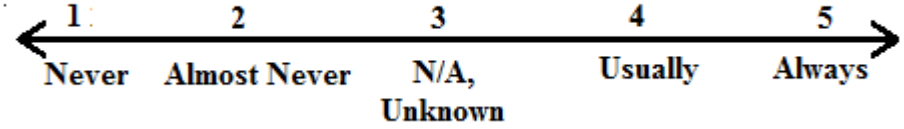
I regularly leave the television or radio on even if I'm not using them.



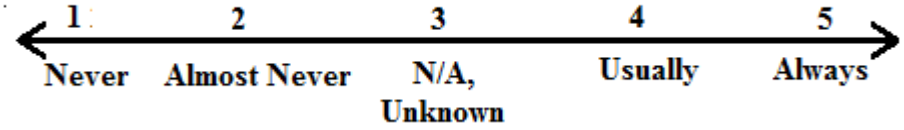
I keep my power usage at a minimal level.



5. **I use as little energy as possible.**



6. **I would be willing to change my behavior if it would positively affect the price of my energy bill.**



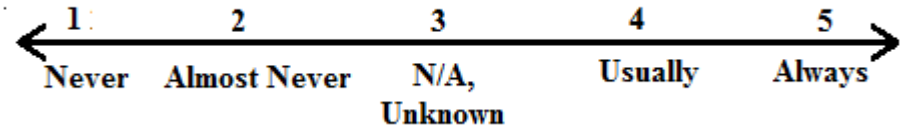
7. **I consider alternative sources of energy.**

No.
Yes.

If YES, rank the following sources of energy in terms of how much you consider them as a good source (order from 1- best source, to 6- worst source)

Nuclear Power _____
Hydropower_____
Solar Power_____
Wind Power_____
Geo-thermal Power_____
Biofuels_____

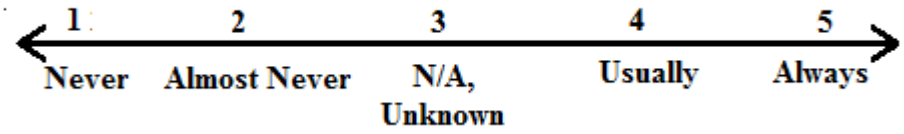
8. **I rely on my smartphone for day-to-day usage.**



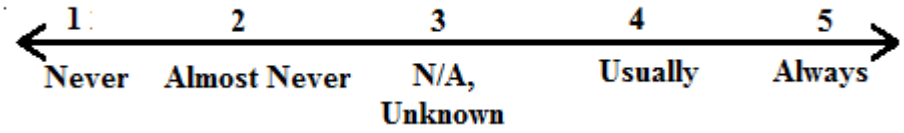
9. **Answer the following questions about your behavior considering a situation where an app were created that could monitor your daily household energy consumption and show how changes could affect your bill.**

An app showing me my energy consumption would have little effect over my behavior. (Circle your answer)

No.
Yes.



I would change my behavior to decrease my energy consumption if I could monitor it through a smartphone app.



10. **Answer the following questions about how your behavior would change considering that you can post your daily results from the app to social networking sites such as Facebook and Twitter, as well as view your friends' results.**

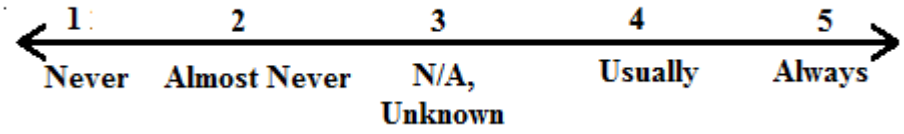
Posting my results would not change my behavior.(Circle your answer)

No.
Yes.

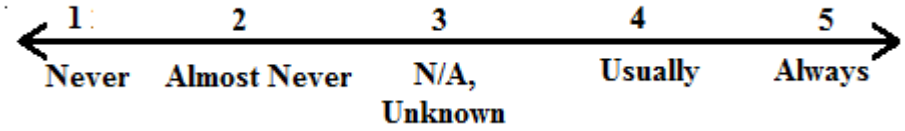
Viewing my friends' results would not change my behavior.

No.
Yes.

If my results were posted on social networking sites, I would be more likely to try to improve my energy consumption.



If I could view my friends' results, it would make me want to improve my results or encourage them to improve their results.



11. Where is your residence outside of Georgia Tech campus?

a: Atlanta Suburbs

0: In Atlanta
1: NE Atlanta
2: N Atlanta
3: NW Atlanta
4: W Atlanta
5: SW Atlanta
6: S Atlanta
7: SE Atlanta
8: E Atlanta

b: Out of sate

Please specify city and state _____

c: Out of country

Please specify country and city _____

12. Given that your current annual energy bill is 7% of your annual salary, by what percentage would you be willing to consider to pay more to switch to a renewable green energy source like nuclear, wind, geothermal, hydro, etc) NOT biofuels.

a: 0% (would not switch)
b: 0.5%
c: 1.0 %
d 1.5%
e: 2.0 %
f: 2.5%
g: > 2.5%

please specify: _____

13. Given that our app has the potential of helping you decrease your energy bill, would you consider investing those savings towards obtaining energy from renewable resources, particularly energy not derived from biofuels with high carbon emissions? If so by what percent?

a: YES, I would consider spending _____ percent of my energy saving from my traditional bill towards obtaining my energy from renewable non carbon emitting resources.

1: 5-10%
2: 10%-25%
3: 25% - 50%
4: 50%-75%
5: 75%-100%

b: NO, I would NOT consider spending my savings towards changing my energy source.

14. Was your house or apartment constructed in the last…. (if you are enrolled in housing from Georgia Tech, answer this question with regards to your previous or off campus residence)

a: 2 years
b: 3 years
c: 5 years
d: 10 years
e: 15 or more years

15. How many individuals in your house hold own a car with less than 20 mpg?

a: 1
b: 2
c: 3
d: 4
e: 5 or more

16. How often do you commute to you're destination by carpooling or by any form of public transportation?

Not very often 1 2 3 4 sometimes 6 7 8 9 Exclusively

17. In comparison to the rest of the world, do you think most American's think they consume more or less energy in their homes?

1	2	3	4	5
much less	Somewhat less	N/A/unknown,	slightly more	much more

18. To which country do you think America's total private electricity consumption is most similar to?

a. China
b. India
c. Australia
d. Russia
e. Brazil

19. How would you compare your personal private energy consumption to that if the rest of the U.S? (1 being much lower than the average per capita, and 10 being much higher than the average per capita)

1 2 3 4 5 6 7 8 9 10

20. Please list any other affects that you believe the usage of this app or its link with your social networking sites would have on your personal energy consumption.

_____

_____