Misleading or Moving Forward? Evaluating Environmental Claims in Green Computing for Greenwashing

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Assad Aijazi

Spring 2020

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

Kathryn A. Neeley, Associate Professor of STS, Department of Engineering and Society

Introduction

Greenwashing, the act of misleading advertising about the environmental features of products (Schmuck et al, 2018), is a pervasive phenomenon in today's society. Modern examples can be found in a wide array of consumer products and services, ranging from airline companies making disingenuous claims on carbon emissions (Sweney, 2020), to political campaigns falsely claiming that their branded plastic straws are recyclable (Plastic News). Of particular interest to this paper is examples of greenwashing in the field of green computing. The "green computing" movement can be described as the study of designing, manufacturing, using, and disposing of computing devices in a way that reduces environmental impact (Khan et. al, 2019).

Many attempts have been made both in legislature and in academia to codify and classify cases of greenwashing, such as the FTC Green Guides (The Green Guides) and Affect-Reason-Involvement model (Schmuck et. al, 2018). However, these models may not work effectively within the context of the green computing sphere. The consequence of these models failing to accurately detect greenwashing is severe; if left unchecked, greenwashing can damage market demand by confusing consumers about green products and cause them to be suspicious, which can take market share away from products that provide legal environmental benefits (Chen et al, 2013). In this paper, I argue that while the ARI model can be used to effectively detect potentially misleading green advertising within green computing, it fails to address the question of whether the misdirection is intentional or simply a result of consumer misunderstanding.

Defining Greenwashing within Green Computing, and its Consequences

As previously mentioned, greenwashing is a term used to describe the practice of companies over claiming the environmental functionality of their products that cannot be substantiated (Chen et. al, 2013). The Federal Trade Commission's "Green Guides" lay out what

the FTC considers examples of environmental claims that could be susceptible to greenwashing, breaking down green advertising into 13 major categories: carbon offsets, certifications and seals of approval, compostable, degradable, free-of, non-toxic, ozone-safe and ozone-friendly, recyclable, recycled content, refillable, made with renewable energy, made with renewable materials, and source reduction (FTC "Green Guidelines").

Within each of these categories, the FTC offers advice for avoiding misleading claims. For claims about carbon offsets, marketers should not advertise a carbon offset if the law already requires the activity that is the basis of the offset. Certifications and seals of approval that don't clearly convey the basis of the certifications should not be used, and any material connections to the organization issuing the certifications should be disclosed. For claims of a product's compostability, marketers must cite reliable scientific evidence, and also disclose whether the product can be composted at home or requires an institutional facility. To be allowed to claim a product is nontoxic, marketers should present evidence that it is nontoxic to both people and the environment. Claiming a product is "free-of" a substance can be deceptive if that substance is not typically associated with the product category, or if the product contains a substitute that is equally as harmful. These examples of disingenuous marketing, as well as many more, can all fall under the category of greenwashing.

One sphere where greenwashing may be apparent is in green computing. The green computing movement, as previously described, is the study of designing, manufacturing, using, and disposing of computing devices in a way that reduces environmental impact (Khan et. al, 2019). The earliest example that is often attributed to the green computing movement is the launch of the Energy Star program by the Environmental Protection Agency in 1992; Energy Star is a government-backed label that products can obtain assuming they meet some

government-set standards for energy efficiency (ENERGY STAR Overview, n.d.). According to Bud E. Smith, many companies that choose to engage in green computing are motivated by three goals: boosting a company's reputation as a marketing effort, cutting costs by wasting less energy and fewer resources, and pursuing altruistic goals of leaving less of a negative impact on the environment (Smith, 2019). The first motivation especially lends itself to companies making the kinds of environmental claims that are susceptible to being greenwashed.

Greenwashing within green computing may have negative ramifications on market demand by confusing consumers and making them uncertain about buying green products (Chen et. al., 2019). Chen et. al. (2019) asserts three major hypotheses about the greenwashing: greenwash is positively associated with green consumer confusion, greenwash is positively associated with green perceived risk, and greenwash is negatively associated with green trust.

Consumer confusion, according to Turnbull, can be defined as consumer failure to develop a correct interpretation of various facets of a product or service during the information processing procedure (Turnbull et. al 2000). The more information a consumer is trying to process, the greater the chances of consumer confusion (Mitchel et al. 2005). According to Walsh et. al. (2007), greenwash can overload customers with information could make it more difficult for them to evaluate products; thus, greenwash can cause consumer confusion with respect to green claims (Laufer, 2003).

Perceived risk is a subjective estimation by consumers connected with possible consequences of wrong decisions (Peter and Ryan, 1976). The higher the perceived risk, the more uncertain consumers feel in purchasing decisions (Mitchel, 1999). Since there is a strong association between negative consumption emotions and risk perceptions (Chaudhuri, 1997), greenwash can increase consumer perceived risk (Slaughter, 2008). If consumers cannot reliably

validate green claims, greenwash can create more significant consumer perceived risk about the environment (Gillespie, 2008).

Green trust is "a willingness to depend on a product or service on the belief or expectation resulting from its credibility, benevolence, and ability about environmental performance" (Chen, 2010). Greenwashing has the effect of invoking suspicion and skepticism about green claims (Self et al., 2010). Thus, greenwashing may lead consumers to distrust all environmental efforts of marketers and manufacturers, causing the environmental movement to lose the support of the market to make great progress sustainability (Gillespie, 2008).

Thus, based on the review of literature, defining greenwashing as well as its negative consequences is well studied. However, what is not well-known is how this general understanding of greenwashing applies specifically to products and case studies within the green computing movement. This gap in understanding may lead to the negative consequences of greenwashing to be realized within the green computing consumer market. Thus, in this paper I attempt to take a model used to understand greenwashing, the Affect-Reason-Involvement (ARI) model, and apply it to specific case studies within the green computing movement. I then analyze how effective this model is, and make an assessment of any shortcomings.

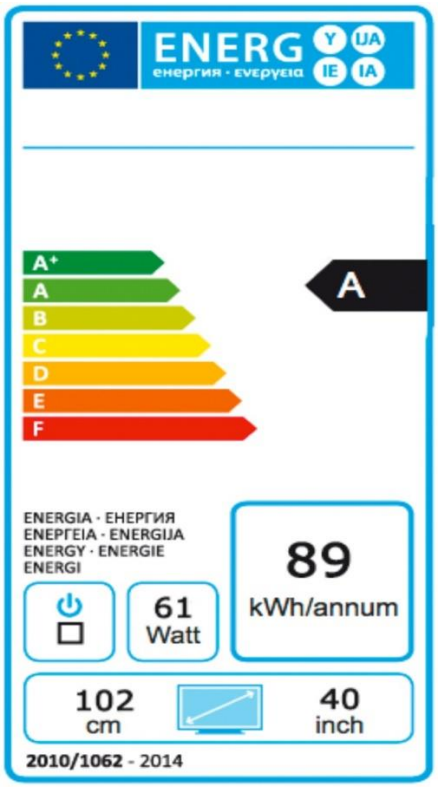
Case Studies within Green Computing: Energy Efficiency Labeling and Google's Environmental Report

In order to complete my research, the main body of evidence that I will be examining will be case studies within the Green Computing movement. In particular, I am interested in looking at different examples of energy efficiency labels that can be placed on electronics, and how the environmental claims made by these labels may have impacts on consumers. One such energy efficiency labeling program that was already mentioned was the Energy Star program, which is a

United States government-backed label that products can obtain assuming they meet some government-set standards for energy efficiency (ENERGY STAR Overview, n.d.).

The main case study in energy efficiency labeling is a program in Europe, where the Council of European Communities introduces an energy label to target consumers; decision making at the point of sale (Waechter et. al, 2015). On this label were two pieces of information: energy efficiency and actual energy consumption, with the energy efficiency rating being color coded on the label ranging from letter grades A+++ to F, with the scale varying slightly depending on the product type (Waechter et. al., 2015). An image of an example label is shown in Figure 1.

Figure 1: CEC Energy Efficiency Label



An example of an energy efficiency label used in the study. A is the indicated score for the product, where A+ is the highest and F is the lowest. The bottom indicates which category of product is being used for the comparison, which in this example is a 40-inch TV.

A study of the effects of this label found evidence of a problem the study dubbed "the energy-efficiency fallacy." This fallacy refers to peoples' tendency to assess a product's performance in

terms of energy consumption based on its energy-efficiency rating, rather than on the actual energy consumption. In a follow up study, Wachter et. al. used empirical data by setting up an experiment involving tracking the eye movements of consumers in a simulated environment to back up their claims that "the presence of an energy label does not result in more energy-friendly choices or facilitate the integration of energy-related information (Wachter et. al., 2015).

Another case study within Green Computing is analyzing Google's statements on its environmental impact. Every year, Google releases its annual environmental report, in which it highlights its various environmental initiatives, as well as data for metrics such as greenhouse gas emissions, energy use, and waste generation. The report is filled with environmental claims, such as the claim that Google has achieved twelve consecutive years of carbon neutrality, is using automated AI to increase data center efficiency, and is striving to build sustainability in everything that they do.

Defining the ARI Model and its Applications to Greenwashing

In an attempt to make sense of these case studies, one model that I will attempt to apply is the Affect-Reason-Involvement (ARI) model, a model applied to greenwashing by Schmuck et. al. (2018). The ARI model suggests that three factors influence a consumer's overall reaction to a persuasive message: affect, reason, and involvement. Consumers use two modes to evaluate claims in advertising: affect, which can be simplified as their emotions, and cognition, which can be simplified as their rational thoughts. Both of these modes are active at the same time, and different types of advertising can target these modes. In addition to these modes, the consumers' involvement moderates the depth and quality of consumers' responses to advertising messages and thus interacts with those messages (Schmuck et. al, 2018).

By applying the ARI model to green advertising, Schmuck et. al (2018) makes several claims about different types of greenwashing. Negative green advertising is separated into two major categories: false appeals, which are demonstrably false based on objective evidence, and vague appeals, which are overly broad and poorly defined and can create incorrect impressions (Schmuck et. al, 2018). One claim that Schmuck et. al. (2019) make is that false appeals produce a much stronger impression of perceived greenwashing than vague appeals; these false appeals tend to be almost entirely dominated by the reason aspect of the ARI model. Another claim Schmuck et. al. (2018) makes is that vague claims involving positive natural imagery can actually have a positive effect on consumer perceptions of the product; this is because the imagery appeals more to the affect mode of the ARI model. Finally, Schmuck claims that consumers who are more knowledgeable and involved about environmental concerns may actually be more susceptible to changing to a more positive view of a product if it displays green advertising, as the issue is more important to them. The table in Figure 2 summarizes the ARI model and its important conclusions to greenwashing.

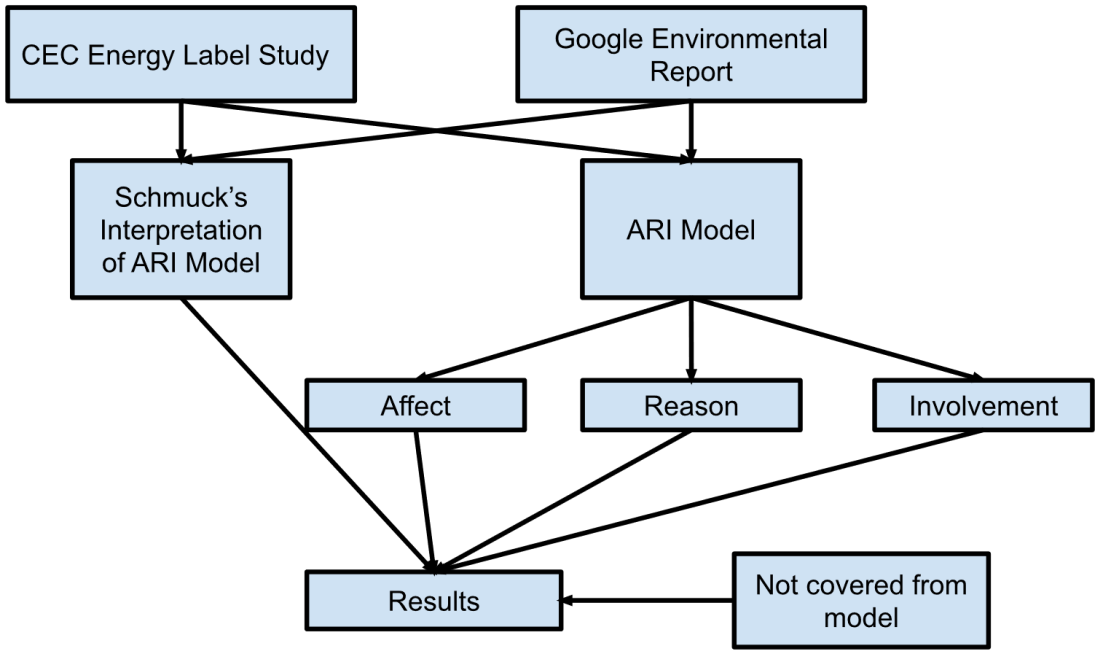
Figure 2: The Three Modes of the ARI Model and Applications to Greenwashing

Mode	**Definition**	**Greenwashing Applications**
Affect	Emotionally-driven	Consumers are likely to be persuaded by images provoking "green" or nature that are displayed alongside green claims
Reason	Rationally-driven by facts and logic	Consumers are likely to driven away from green claims that are demonstrably false, may also be susceptible to more fact-based or data-driven arguments

Involvement	How invested consumer is in the product	Consumers who are environmentally conscious overall may be more likely to persuaded by environmental claims

Using Schmuck's model of ARI in greenwashing is an appropriate model to use for this paper because it attempts to rationalize some of the reasons why consumers act the way that they do in the presence of green advertising. With this model, I will be able to analyze the case study of energy-efficiency labels and determine to what extent Schmuck's postulates apply. While some aspects of the model may be difficult to apply due to lack of information, specifically the section about consumer involvement, the concept of vague vs. false claims as well as the discussion of imagery may yield interesting research results. Figure 3 shows the flow graph used to produce results from the evidence and the ARI model.

Figure 3: Evidence and Model to Results Flow Graph



Applying the ARI Framework to Energy Efficiency Labeling

Utilizing the ARI framework as described in the previous section yields interesting conclusions when analyzing the case of the European energy efficiency labeling. According to the model, there are three different dimensions that affect consumers' perception of the labeled productions: affect, reason, and involvement. The affect section of the model seems to be a result of the actual color codes. These bright colors stimulate an emotional response as to what information on the product is actually important. In this case, the "affect" comes at a negative consequence, as in this case, the information that the consumer's eyes are drawn to is in fact misleading. Since the consumer is drawn only to the energy efficiency information rather than the actual energy usage, the consumer is inclined to make decisions based on the information from the former rather than the later.

Reason also has a very large part to play in this example. From the perspective of the consumer, the decision seems to be mostly reason based. The reasonable interpretation of the energy label is that products with a higher energy efficiency label will be better for the environment, and products with a lower energy efficiency label will be worse for the environment. However, in this case, the vagueness of the label comes into play in that the information presented on the label is not necessarily the right information needed to make a proper conclusion that the creators of the label intended. So while reason in this case was pervasive in the decision making process, it ultimately resulted in the wrong conclusion being made, which ended up resulting in the wrong conclusion being made by consumers.

According to the ARI, involvement also plays a role in how consumers interpret the label. In this case, the lack of involvement may have resulted in negative consequences. Because the average consumer is not involved in the field of green computing, they may not have the relevant

background knowledge to understand the correct conclusion that needed to be made here. Without having the proper technical expertise in understanding the difference between energy usage and energy efficiency, consumers instead relied upon involvement in their more generic perception of environmental-friendliness, which in this case, resulted in negative consequences.

Evaluating Schmuck's interpretation of ARI in green advertising is also relevant in this scenario. Schmuck emphasizes the distinction between vague claims and false claims. In this case of the energy efficiency labeling, the claim seems to be more of a vague claim; factually speaking, the information available on the efficiency label is entirely accurate, and thus demonstrably not false. Thus, in this case his claims concerning false claims don't really apply. However, observing his claims about vague claims can be insightful. One of the claims that Schmuck makes is that vague claims involving positive imagery may have a positive effect on the consumer perception of the model. In this case, the positive imagery comes from the vague claims made by the energy labels combined with the positive imagery of the rating system, with more positive images being associated with higher ratings of energy efficiency. Thus, in this case it makes sense that consumers would be more inclined towards the positive imagery described by the ratings, and thus were persuaded to buy those products with the higher energy efficiency instead of the products with actual lower consumption.

Applying the ARI Framework to Google's Environmental Report

Google's environmental marketing statements also show evidence of the marketing strategies discussed within the ARI model. In the Google Environmental Report 2019 (Google, 2019) appeals to affect are made at the introduction, provoking fear by bringing up references to climate change as a "pressing global issue that poses an imminent threat to our planet". In addition, images provoking nature and green text are scattered throughout the report, appealing

to human associations of those things with environmental friendliness. Appeals to reason and facts are also scattered throughout with citations made to various facts and statistics about Google's goals and initiatives, such as Google having achieved "twelve consecutive years of carbon neutrality" and "matched 100% of the electricity consumption of global operations with renewable energy" (Google, 2019). The involvement piece of the ARI also manifests in the many references Google makes to the modern technologies that it is employing in its environmental initiatives, such as Artificial Intelligence, which allows Google to appeal to insiders in the computing industry who are attracted to these technologies.

However, while Google clearly has made progress towards moving towards environmental sustainability, its marketing statements do conveniently leave out many of its shortcomings in its efforts. According to Google Workers for Action on Climate, a group of Google employee environmental activists, in 2018 Google funded 111 members of Congress who voted against climate legislation at least 90% of the time (Wong, 2019). In a similar vein, this group also calls out the company for providing cloud computing services for the oil and gas industry, including using its artificial intelligence technology to help fossil fuel companies perform data analysis (Wong, 2019). In light of these revelations, the intentions behind Google's environmental report are put under suspicion; is the report's purpose to accurately convey Google's progress on environmental sustainability, or is it merely a marketing ploy meant to improve Google's own status among environmentally-conscience stakeholders? While it is not abundantly clear what the answer to the question is, the consequences of Google misrepresenting its environmental efforts link back to the consequences of greenwashing discussed earlier. If Google does not accurately represent the environmental impacts of its services, environmental harms may be hidden from the public eye. Also, it may lead to wider consumer confusion about

what companies are actually making valid progress in environmental sustainability and what companies are just making claims for marketing purposes.

Evaluating the Applicability of the ARI Model within Green Computing

The aptitude of the ARI model being applied to green advertising within green computing demonstrates that like all other fields involving green advertising, green computing is indeed susceptible to greenwashing, and that a lot of the literature produced towards understanding greenwashing can indeed be applied to green computing as well. However, while the marketing strategies described by the ARI model are indeed evident, it is difficult to conclusively say whether greenwashing is present due to how nebulous the term is. In the case of the energy efficiency labeling, it is clear that there was an element of misdirection that occurred, but nothing in the label was necessarily inaccurate or vague. Similarly, the information presented in Google's environmental report is all accurate and verifiable; however, the misdirection may come from what was omitted from the report rather than included. Thus, misdirection in this case does not necessarily come from the actual information that is presented, but more from the way that it is interpreted. So, while it is clear that green computing is susceptible to greenwashing, making conclusive decisions on whether it is actually present is much more difficult. Most literature seems to focus more on how green advertisements may be **intentionally** misleading, but not as much emphasis is placed on how consumers may unintentionally mislead themselves due to the complexity of information that they are presented with, as may be the case in the examples studied in this paper.

Conclusion

As my results have shown, while ARI model is effective at detecting potentially misleading environmental claims within green computing, identifying whether the misdirection

is intentionally done is much more difficult. The case study of the CEC energy label is a compelling example of how even with the best intentions, consumers can still be misled into making incorrect decisions concerning the environmental impact of their products in green computing. Ultimately, in green computing, the challenge of making environmental claims is further complicated by the need to convey complex information to a perhaps uniformed userbase. Thus, a significant next step will be looking into how actors in the green computing space can effectively communicate environmental information in such a way that is technically accurate yet understandable as to not be misleading.

References

Chaudhuri, A. (1997). Consumption emotion and perceived risk: A macro-analytic approach. Journal of Business Research, 39

Chen, Y.-S. (2010). The drivers of green brand equity: Green brand image, green satisfaction, and green trust. Journal of Business Ethics, 93(2), 307–319.(1), 81–92.

Chen, Y.-S., & Chang, C.-H. (2013). Greenwash and Green Trust: The Mediation Effects of Green Consumer Confusion and Green Perceived Risk. *Journal of Business Ethics*, 114(3), 489–500. https://doi.org/10.1007/s10551-012-1360-0

Gillespie, E. (2008). Stemming the tide of greenwash. Consumer Policy Review, 18(3), 79–83.

Google. (2019). *2019 Environmental Report*. Retrieved from https://services.google.com/fh/files/misc/google_2019-environmental-report.pdf

Johnson, J. (2019, July 26). Trump straws 'recyclable'? Not according to FTC's Green Guides. Retrieved February 25, 2020, from https://www.plasticsnews.com/news/trump-straws-recyclable-not-according-ftcs-green-guides

Khan, S. N., Aljaberi, M. A., & Muammar, S. (2019). Success factors model for green computing implementations. *International Journal of Technology Management & Sustainable Development*, 18(1), 37–54.

Laufer, W. S. (2003). Social accountability and corporate greenwashing. Journal of Business Ethics, 43(3), 253–261.

Mitchell, V.-W. (1999). Consumer perceived risk: Conceptualizations and models. European Journal of Marketing, 33(1), 163–195.

Mitchell, V.-W., Walsh, G., & Yamin, M. (2005). Towards a conceptual model of consumer confusion. Advances in Consumer Research, 32(1), 143–150.

Schmuck, D., Matthes, J., & Naderer, B. (2018). Misleading Consumers with Green Advertising? An Affect—Reason—Involvement Account of Greenwashing Effects in Environmental Advertising. *Journal of Advertising*, 47(2), 127–145. https://doi.org/10.1080/00913367.2018.1452652

Self, R. M., Self, D. R., & Bell-Haynes, J. (2010). Marketing tourism in the Galapagos Islands: Ecotourism or greenwashing? International Business & Economics Research Journal, 9(6), 111–125.

Slaughter, P. (2008). Avoid the pitfalls of greenwash. Home Furnishings Business, 3(2), 32–36.

Smith, B. E. (2013). *Green Computing* (1st ed.). Retrieved from https://doi.org/10.1201/b15098

Sweney, M. (2020, February 5). Ryanair accused of greenwash over carbon emissions claim. Retrieved February 25, 2020, from https://www.theguardian.com/business/2020/feb/05/ryanair-accused-of-greenwash-over-carbon-emissions-claim

The Green Guides: Statement of Basis and Purpose. (2012, October). Retrieved from Federal Trade Commission website: https://www.ftc.gov/sites/default/files/attachments/press-releases/ftc-issues-revised-green-guides/greenguidesstatement.pdf

Turnbull, P. W., Leek, S., & Ying, G. (2000). Customer confusion: The mobile phone market. *Journal of Marketing Management*, *16*, 143–163.

Waechter, S., Sütterlin, B., & Siegrist, M. (2015). Desired and Undesired Effects of Energy Labels—An Eye-Tracking Study. *PLoS One*.

Wong, J. C. (2019, November 4). Google workers call on company to adopt aggressive climate plan. Retrieved March 3, 2020, from https://www.theguardian.com/technology/2019/nov/04/google-workers-climate-plan-letter