An Analysis of

Power Content Label Designs

by

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Duke University

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Thesis submitted in partial
fulfillment of the requirements for the degree
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ABSTRACT

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Abstract

There are currently 22 states with full or partial disclosure requirements for their electricity suppliers. These requirements differ significantly across states, in terms of the specific information content, structure, and presentation, but all have the potential of increasing customers' awareness about the links between their electricity consumption and air emissions, and perhaps create incentives for utilities to reduce those emissions or for customers to reduce their consumption or to switch to a different electricity supplier.

How effective this policy has been is still unclear. The main criterion for effective communication strategies is that they include relevant information for the readers in a usable form. Information needs as well as the ability to process and apply it vary significantly across individuals. However, people are limited in their information-processing capabilities. Policy makers therefore face the trade-off between a large amount of potentially relevant information that ideally needs to be included on the label on the one hand, and decrease in usability as more information is included on the label, on the other.

This paper examines the design, readability and usability of sample labels from 18 different states with information disclosure requirements. The labels are compared and rated according to how they balance the two main dimensions of label design, information content and usability, demonstrating the difficult trade-off between the two.

In addition to this, the labels are analyzed along several key aspects: information load, focus on environmental impact, comparability, understandability, and materiality of information. As part of the analysis, measures for these different aspects of label effectiveness are created. The main finding of the analysis is that there are difficult trade-offs between information content and label usability. However, this trade-off can partially be avoided by carefully designing the labels, easing the cognitive burden of users while still conveying relevant information to the decision maker.

The results of the analysis can help evaluate the various existing disclosure policies, and offer approaches to improve upon them. It will also be shown that while preferred levels of information content are incommensurate with maximum usability, certain structures and form elements succeed at making more complex information content easier to use, improving the overall performance of the labels.

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1. Introduction

Environmental policy design has seen significant changes in recent history. As environmental protection became a more prominent issue on the policy agenda, environmental regulations increased both in number and in scope. Traditional command-and-control policies were augmented more and more with market-based approaches, which encourage behavior through market signals rather than through explicit directives regarding pollution control levels or methods. Policy instruments, such as tradable permits, pollution taxes or subsidies for emerging green technologies are taking advantage of market forces because "if they are well designed and implemented, they encourage firms (and / or individuals) to undertake pollution control efforts that are in their own interests and that collectively meet policy goals" (Stavins, 2002). Most recently, a "third wave" of environmental policy has emerged that emphasizes information provision. Publicly available information is presumed to assist more cost effective private market and legal forces.

One example of these information disclosure policies are so-called power content labels. Electricity suppliers in 18 States are required to periodically report to their consumers the fuel mix used to generate their electricity, along with various other information content, depending on each state's specific regulation. Four additional states have partial disclosure requirements and disclosure regulation is pending in another six states. Please refer to Table 1 for a complete overview of the regulations in these 28

states. These labels place a considerable burden on the regulators and utilities alike; yet so far only few studies have examined the effectiveness of these regulations.

One possible explanation for the link between power content labels and environmental performance is a direct demand effect. In the presence of simple, easily interpretable, and directly provided information, consumers may increase demand for electricity produced with fuels perceived as environmentally favorable and decrease demand for that produced with fuels perceived as environmentally unfavorable. (Delmas, Shimshack, & Montes, 2007) This demand effect can take two forms: consumers can lower their overall electricity consumption or they can make changes regarding their supplier, either by joining a green power program from their current utility or, if the market structure permits, by switching to a different supplier with a preferred power mix. Because of this, the design of power content labels needs to aim at influencing individual decision making.

Delmas et al. (2007) find a change in fuel mix composition in states with mandatory disclosure requirement, away from fossil fuels and towards renewable resources. However, this analysis does not take into account that disclosure requirements differ greatly from one state to the next, nor does it address the causes for this shift in energy mix. Do the labels cause a change in consumer behavior that the utility companies react to, or do utilities decide to change their generating capacity because they are now required to report to their customers about it? Do the various

existing label designs lead to different consumer reactions across states, and if so, which designs are more successful?

Information disclosure strategies rely on stakeholders to act upon the information disclosed. Depending on the specific disclosure policy in question, relevant stakeholders may include individual consumers, NGOs or other specialized interest organizations, firms and investors, or even policy makers. For information to be useful to a consumer, it must provide them with the appropriate information and level of detail, be clearly displayed and simple to understand, and it must be available at a suitable time and place. It is also important that the information is eye-catching in order to draw peoples' attention to it. The major task of disclosure policies is to communicate information in an effective manner. If the information cannot be processed reliably or is not regarded as contributing any new information or perspective on a decision, the policy will not be successful. This in turn raises the question of the appropriate structure and content of the communication, since people do not have unlimited information-processing capabilities (Simon, 1955). People's judgments and decision making is subject to flawed information processing, particularly under situations of uncertainty. However, even in situations that do not involve uncertainty, information provision programs can be an effective policy response to limit decision errors due to lack of available information or to a lack of information-processing capabilities of individuals. Theories

on how individuals process and respond to information can therefore aid in improving communication efforts.

This paper examines the various different designs of power content labels. Sample labels from 18 different states with information disclosure requirements are analyzed along several key dimensions. To this end, measures for information load, focus on environmental impact, comparability, understandability, and materiality of information were created. Labels are rated and ranked along these aspects of label design. In addition, labels are analyzed along the two main dimension of the communication effort: information content and label usability, which for this analysis is defined as a combination of reading ease, information load and quality of label structure. The analysis will demonstrate the difficult trade-off between information content and label usability can help evaluate the various existing disclosure policies, and offers approaches to improve upon them. Finally, it will be shown that while optimal levels of information content are incommensurate with optimal usability, certain structures and form elements succeed at making more complex information content easier to use, improving the overall usability of the labels.

Section 2 of the paper provides background information on power content labels and the corresponding disclosure legislations. Then, in section 3, power content labels are placed into the broader context of information disclosure in general. This is followed by an overview of the relevant literature in section 4, drawing mainly from the

fields of marketing and behavioral decision theory. Section 5 describes the evaluation criteria that will be applied to analyze the different sample label. The analysis section is divided into three separate parts. Section 5.1 consists of an individual qualitative analysis of all 18 labels, briefly describing the content and structure of each label and listing the main positive and negative aspects. In section 5.2, several measures combining individual items of each label are developed, in order to assess each label's level of information load, focus on environmental impact, comparability, understandability, and materiality of information provided. In addition, measures for the broader dimensions of information content and label usability are discussed. The results of this analysis are presented in section 6 and are subsequently compared to the responses to a short survey in section 7, in order to validate the measure development and coding decisions. Finally, the results of the various analyses are discussed in section 8, including a look at possible follow-up studies and some policy recommendations.

2. Power Content Labels

Because electricity is a complex and intangible product – unlike many other products it is not possible to take it off the shelf and examine the package prior to purchase - it presents a challenge for consumers to visualize or experience the benefits of differentiated electricity products (Truffer, 2001). For this reason, utility regulators in the United States adopted a resolution expressing support for information disclosure about electricity products (NARUC, 1996). Influenced by food nutrition labels, the concept is to disclose certain information to electricity consumers in the form of a label to be used with product marketing materials and periodically distributed to each customer (Moskovitz, 1997). All electricity suppliers are mandated to label their products with a list of 'ingredients' (the supply mix), and, in many cases, also with their 'nutritional value' (the environmental effects) (http://www.electricitylabels.com, 2003).

One of the first examples of electricity disclosure in the USA was the State of California's Power Content Label, introduced in 1998. Today, several other States (see Table 1 for a complete list) have similar policies, although each state may have its own label design and information requirements. All but four of the States with full disclosure requirements have deregulated their electricity markets, meaning that consumers in these States are free to choose their electricity supplier. Colorado, Florida, Minnesota, and Washington have disclosure requirements in place but do not have deregulated electricity markets. However, even in those States, consumers generally face choices in

terms of their contract options, for example whether to join a green electricity program or a time of use billing scheme. Power content labels should be designed to assist consumers in making choices about their electric suppliers.

There is no standard disclosure system in the US as each State has jurisdiction over its retail electricity market. Even within a given State there are varying levels of standardization required for the label design. This variation in label design makes it possible to conduct a theoretical analysis of the labels' effectiveness in terms of their information content and usability. The following section reviews the relevant literature drawing on studies assessing different types of disclosure requirements as well as empirical and theoretical papers from the fields of marketing and behavioral decision theory.

Table 1 - Disclosure Requirements by State

Table 1.a) - States with Full Disclosure Requirements

State	Disclosure Requirement	Scope	Frequency	Distribution
California	Fuel mix required in standard format.	Electric service providers	Quarterly	Bill insert, written promotional materials (except ads)
Colorado	Fuel mix. Standard format is suggested.	Investor owned utilities with load >100MW	Twice annually	Bill insert or mailing
Connecticut	Fuel mix and air emissions	Electric distribution companies	TBD	TBD
Delaware	Fuel mix	Electric suppliers	Quarterly	Bill insert, marketing materials
Florida	Fuel mix	Investor-owned utilities	Quarterly	On bill or bill insert
Illinois	Fuel mix and CO_2; NOx; SO_2; nuclear waste emissions	Electric utilities and alternative retail suppliers	Quarterly	Bill insert
Maine	Fuel mix and CO_2 NO_x; SO_2 emissions	Electric service providers	Quarterly	Bill insert or mailing and prior to initiation of service.
Maryland	Fuel mix and CO_2; NO_x; SO_2 emissions in standard format	Electric suppliers	Twice annually	Bill insert or mailing and with contracts
Massachusetts	Fuel mix and CO_2; NO_x; SO_2 emissions in standard format	Competitive suppliers	Quarterly	Bill insert and prior to initiation of service.
Michigan	Fuel mix and SO_2; CO_2; NO_x; high-level nuclear waste emissions in standard format	Electric utilities and alternative electric providers	Twice annually	Bills and on Commission web site
Minnesota	Fuel mix, air emissions, and nuclear waste in brochure	Rate regulated electric utilities	Twice annually	Web, phone referral on bill, full info on bill insert
New Jersey	Fuel mix, energy efficiency, and CO_2; SO_2; NO_x emissions	All electric suppliers	Twice annually	Mailings, direct mail marketing, solicitations, contracts
Nevada	Fuel mix and emissions of high-level radioactive waste, SO_2, CO_2, CO, PM, VOCs, NO_x, and heavy metals.	Electric utilities and competitive power providers	Twice annually	Bill insert and web
New York	Fuel mix and CO_2; SO_2; NO_x emissions in standard format	Load serving entities	Twice annually	Bill insert and prior to offers
Ohio	Fuel mix, CO_2; SO_2; NO_x emissions and high-level and low-level radioactive waste in standard format	Retail electric service providers	Annually	Bill insert or mailing, and contracts
Oregon	Fuel mix and CO_2; SO_2; NO_x; spent nuclear fuel emissions in standard format	Electric service providers	Quarterly	On bill or insert, marketing materials, contracts, URL on bill
Texas	Fuel mix and CO_2; SO_2; NO_x; Particulates; Nuclear waste emissions in standard format	Retail electric providers	Twice annually	Bill insert or mailing, solicitations, Commission web site
Washington	Fuel mix in standard format	Retail suppliers	Twice annually	Bill insert or mailing, solicitations

Table 1.b) - States with Partial Disclosure Requirements

State	Disclosure Requirement	Scope	Frequency	Distribution
Arizona	Fuel mix and emissions to extent reasonably known	Electric suppliers including default suppliers	Upon request, written marketing materials	Upon request
District of Columbia	Fuel mix	Retail electricity suppliers	Twice annually to Commission	Supplied only to the Commission
Pennsylvania	Fuel mix and energy efficiency	Electric generation supplier	Upon request	Supply to Commission annually
Virginia	Fuel mix and emissions to the extent feasible	Competitive service providers; CSP's making claim-based sales	Annually to extent feasible	"Reported to customers."

Table 1.c) - States with Pending or Delayed Disclosure Requirements

State	Disclosure Requirement	Scope	Frequency	Distribution
Iowa	Fuel mix and CO_2; SO_2; NO_x	IOUs	Once annually	TBD
Montana	Fuel mix and CO_2; SO_2; NO_x, spent nuclear waste, hydro	Retail electricity suppliers	Twice annually	Product offers, contracts, ads
Vermont	PSB authorized to set standards for fuel mix and environmental impacts	Electric suppliers	Once annually	TBD
West Virginia	Fuel mix and CO_2; SO_2; NO_x and high-level and low-level nuclear waste	Retail electricity suppliers including default suppliers	Supplied to Commission quarterly	Solicitations
Arkansas	Standards to be set for disclosure of environmental impacts	Electric service providers	TBD	TBD
New Mexico	Fuel mix and associated emissions, standard format required under proposed rules	Competitive electric suppliers	TBD, proposed annually	TBD

3. Disclosure policies

Power content labels are a mandatory disclosure policy in form of periodically distributed labels containing information that was previously already available to experts or interest groups through the EPA's eGRID database. Their main aim is furthering a public good, namely improved environmental performance of public utilities. Disclosure strategies as a policy tool have been applied in numerous settings with different goals and using various designs formats. Information disclosure can be mandatory or voluntary. Many disclosure regulations require the information to be dispersed in the form of content / warning labels, but other forms of communication are also used, for example reports or online databases. Disclosed information can lead to private benefits; attempt to further a public good, or both. Policies can aim at changing individual behavior such as consumption decisions or product use, or they can try to stimulate or support community groups or other types of organizations to take political action. Some policies require the release of information that otherwise would not be publicly available, others only aim at making available information more accessible and more easily usable for consumers.

3.1 Choosing a suitable disclosure strategy

The kind of disclosure strategy needed to have a desired impact depends to a large extent on the type of agent that will be most effective using the information. Public interest groups such as environmental NGOs have the time and resources to analyze

periodic reports such as the EPA's eGrid database, which lists environmental characteristics of almost all electric power generated in the United States, or the Toxic Release Inventory, which contains information on toxic chemical releases and other waste management activities in the United States. These specialized groups are able to use the information for creating public pressure either directly on the firms or on their investors. However, if the disclosure is supposed to influence individual decision makers, as is the case with power content labels, the choice of disclosure strategy has to be different. People have limited time to make their decisions and to search for relevant information for their decision-making process. They are also limited in the cognitive capacity to process and evaluate information. These limitations have to be considered when deciding on and designing an information tool.

The preferred disclosure strategy in many instances where individual decisions are relevant is a product label. Teisl & Roe, 1998, define product labeling as "any policy instrument of a government or other third party that somehow regulates the presentation of product-specific information to consumers." Government-mandated labeling can be a useful tool for achieving social objectives because of the potential power of information to influence consumption decisions. This information can describe use characteristics of the product, such as price, taste, and nutrition, or non-use characteristics, such as the environmental impact or moral / ethical elements surrounding the product's manufacturing process. In the case of power content labels

the residential customer choosing the electricity supplier (and potential measures to reduce electricity consumption) is the targeted decision maker. The actual choices, especially choosing the electricity provider, are not done frequently. This decreases the potential impact of the labels and makes the correct choice of the label placement and frequency of delivery more important for policy makers.

4. Behavioral Decision Research and how it pertains to Information Disclosure

For disclosure policies to be successful, their design has to be in sync with the policy goals. Information has to be conveyed in a way that will be noticed by consumers and be in a form that makes it easy to process and evaluate. Behavioral decision theory can help guide these design decisions. Content and structure influence how consumers use the disclosed information in their decision-making process. Whether the information provided is understood and acted upon by consumers depends on how well the design of the disclosure policy reflects the decision environment that people find themselves in. Information content is critical because without necessary pieces of information in place a disclosure policy will be ineffective. At the same time, the concept of bounded rationality (Simon, 1955) implies that including too much information can also lead to poorer performance by the label user. In this section I will give an overview of the relevant behavioral decision theory literature relating to information content and usability.

4.1 Information content dilemma

The task policy-makers face is not simply to present consumers with all potentially relevant information but, rather, to present consumers with information that is appropriate for their specific current needs (Ariely, 2000). Naresh Malhotra (1982) termed the effect "information-load paradigm". The fundamental premise on which the information-load paradigm is based is that consumers have finite limits to absorb and

process information. "If consumers are provided with too much information such that it exceeds their processing limits, overload occurs leading to poorer decision making and dysfunctional performance" (Malhotra, 1982). Magat and Viscusi (1992) tested various designs of hazard warning labels on toilet bowl cleaners and insect sprays and found that the display of more usage information caused a decline in the recall of the primary usage information.

One thing that is important to note is that consumers themselves do not seem to be aware of the information-overload problem. For example, a study of nutrition labels by Levy et al. (1996) found that many people say they want as much information as possible, but tests indicated that the preferred amount of information leads to poorer performance (Levy, Fein, & Schucker, 1996). Surveys studying consumer preferences for power content labels have found that consumers like to be provided with both the fuel source and environmental indicator information together with their electricity bill (Boardman & Palmer, 2003). Price information is also a feature found desirable by consumers. A recent mall intercept study showed that compulsory display of price information tends to distract attention away from environmental information and makes the ranking of firms' environmental records more difficult (Roe, Teisl, Rong, & Levy, 2001). This study examines how different information disclosure regimes would impact consumers' understanding of the label, their desire for more information, and the

resulting choices of electricity suppliers. Participants chose among three hypothetical products and answered several questions about these hypothetical products.

One possible explanation for the observed effects in the study conducted by Roe et al. (2001) is that price information may be seen as more important compared to environmental information and that price information therefore is processed more carefully and is more salient during the choice process. Whether or not price information should be included in a power content label therefore depends on the stated policy goals. If the primary goal is to increase market efficiency by motivating consumers to switch suppliers based on the attribute that is most important to them, price information should be included. If, on the other hand, the main objective is to improve the environmental performance of utilities, it could be more effective to leave price information of the labels altogether, or at least to organize the labels in a way that draws more attention to the information on environmental performance.

4.2 Structure

Numerous studies in psychology and marketing concluded that there is an important distinction between the availability of information and the format in which it is presented. "Messages which appear to be similar in their information content can have quite different effects depending upon the format and modality of presentation and the context in which the information is presented." (Magat, Payne, & Brucato, 1986) If consumers are to effectively comprehend and use information, it must be presented in a

convenient, understandable form. "The major implication of the distinction between available and understandable is that the same available information can be formatted in ways that will increase or decrease its impact on decisions" (Magat et al., 1986). The design of a disclosure label should increase the processability and evaluability of the information contained on it. This can be achieved both through organization of content and through the form of presentation. Organization strongly influences information acquisition of individuals, while form strongly influences the way information is combined and evaluated (Schkade & Kleinmuntz, 1994).

According to (Kleinmuntz & Schkade, 1993), individual items of information can have at least three distinct forms: numerical, verbal, or pictorial. In addition, variations exist within a given form. For example, numerical representations include fractions, decimals, or scientific notation. Different forms are more effective at conveying certain types of information and / or more conducive to certain types of information being processable by consumers. In order to reduce the cognitive strain of integrating information, any information that has to be stored in memory, inferred from the display, or transformed will be discounted or ignored (Payne, 1982). Therefore, the decision on which form of presentation should be used warrants careful consideration.

Another strategy which has been proven useful in reducing the cognitive burden is the use of symbols (Bettman, Payne, & Staelin, 1986). Processing verbal or numerical information is inherently effortful because it involves rule-based reasoning, in which

data are abstracted into values that are given meaning through formal rules and deliberative analysis (Lurie & Mason, 2007). Visualization of information can greatly reduce the cognitive burden placed on the consumer. It can also enlarge problem-solving capabilities by enabling the processing of more data without overloading the decision maker. Different forms of graphic representation also stimulate different types of analyses. For example, viewing bar charts leads to comparison judgments, whereas viewing pie charts leads to proportion judgments (Lurie & Mason, 2007).

At the same time, visual representations may accentuate biases in decision making and lower performance by increasing attention to less relevant information. More salient or vivid visual information is likely to be acquired and processed before less vivid visual information. In general, when visualizations include both textual and graphic information, the graphic information is likely to receive greater weight (Lurie & Mason, 2007). Therefore, the ease of use of graphs notwithstanding, they should be utilized with some caution.

4.3 Comparability

One basic feature of organization is to increase the comparability of options. In 1977, Edward Russo conducted an influential study of unit pricing in supermarkets. There, the issue was not whether or not unit price information was available, but rather how the same information was displayed differently through separate shelf tags. He found that the use of unit price information increased when the information was

brought together for shoppers in the form of organized lists (Russo, 1977). The improved format aided decision-making by making the same information easier to process. This indicates that offering some form of comparison on the power content labels will increase their usefulness. Many of the existing label designs offer a comparison of fuel mix and, if applicable, of emission levels of the electricity supplier to the State or regional average. Ideally, consumers should receive a direct comparison of all their potential supplier choices from one source, but this would require centralizing the information disclosure to an independent third party.

5. Evaluating Disclosure Policies

Delmas et al. (2007) performed an econometric analysis evaluating outcomes linked to disclosure programs in the electricity sector. The authors describe several effects attributed to the disclosure regulations. They find, disclosure programs decrease firms' percentage of generation attributable to fossil fuels and increase firms' percentage of generation attributable to clean fuels like hydroelectric and renewables. Furthermore, disclosure program responses are sensitive to customer composition and pre-existing fuel mix levels. Firms' clean fuel program responses become considerably stronger (more positive) as the firm sells to more residential consumers. The authors control for the effects of other state and local programs like Renewable Portfolio Standards by using panel data techniques. However, it is hard to assess the effectiveness of information disclosure policies, particularly those of content labels that where the information disclosure is accompanied by general media attention. If greater awareness of the environmental impacts associated with electricity generation is the key driver in some people's switching decisions to lower impact suppliers, an analysis of the effects of power content labels would have to include potential impacts of other sources that can also raise this environmental awareness. In addition, observed changes in behavior (or lack thereof) cannot simply be deemed indicators of success of the policy since the objective of disclosure requirements is a better informed choice by individuals, not necessarily an altered choice.

Because it is difficult to separate effects of disclosure policies from effects of other policies such as renewable portfolio standards, awareness stemming from media coverage, public discourse, as well as general societal trends, the main evaluation criteria applied to the following analysis is how well the various discloser labels convey the decision relevant information to consumers and whether the information is processable and usable for consumers during their decision-making process. For the purpose of the following analysis, the term 'usability' refers to the overall user friendliness of the label, which in turn is defined as a function of the structure of the label, and how it enables the user to better identify relevant information, the reading ease of the text passages contained on the label, as well as the general information load.

5.1 Individual Label analysis

One way of analyzing a label's effectiveness is therefore how well the content of a label supports potential policy objectives that can be achieved through information disclosure. The information provided on power content labels can span a broad spectrum of topics and can aim at aiding consumer decision making in different situations. One important policy objective that labels can be designed for is to reduce the environmental impact of consumer electricity consumption. This can happen on the one hand by increasing by persuading more people to choose green electricity options, on the other hand by lowering consumers' energy consumption through behavior changes or investments in energy efficiency. One important driver to achieve this is to increase

people's awareness of the environmental impact associated with energy production, and consequently their own energy consumption choices, as well as to increase awareness about energy saving strategies and programs. Another potential policy objective for power content labels is to improve the fluidity of the electricity markets. Informing consumers about their ability to choose between different suppliers and contract options is a direct way in which labels can support this objective. Besides judging how well the information content of a given label advances potential policy objectives, another important way of analyzing a label is in terms of how the label design helps making the relevant information accessible and useable in the decision making process of individual consumers.

Table 2 summarizes the results of an individual analysis of each of the sample labels' expected performance along four potential label objectives: (1) Reducing the environmental impact of individual electricity consumption choices; (2) Informing consumers about retail choice; (3) Increasing consumers' awareness about the environmental impacts of electricity consumption; and (4) The user friendliness of the label design. Each label received a grade ranging from 0 to 5, where higher values indicate a better performance and a zero was awarded if no information advancing the objective was provided at all.

Points for objective (1) were awarded if the label included information about the fuel mix used for electricity generation, associated emission levels, comparison of fuel

mix and / or emission levels to regional averages, or information about energy efficiency strategies and programs. Points for objective (2) depend mainly on how explicitly consumers are being made aware that retail choice is available to them. For example, labels containing any sort of comparison to a state-wide or regional average are supposed to be more likely to indicate the presence of retail choice than a label without comparisons. However, more explicit mention of choice was necessary to receive a score of higher than one. Scores for objective (3) depend on the presence of emissions information and are highest when the environmental impact of these emissions was also explained in understandable terms on the label. Finally, score for objective (4) depend on the structure of the label, whether the amount of information presented is manageable by a hurried consumer, as well as the use of visual aids such as graphs and tables.

Table 2 - Qualitative rating of the sample labels

State	Reducing Electricity Consumption	Informing about Retail Choice	Increasing Environmental Impacts Awareness	Ease of Use
CA	**	*	**	****
CO	*		*	**
CT	**	****	***	*
DE	**	*	***	***
IL	**		***	**
ME	***	*	****	***
MD	***	*	***	***
MA	***	**	****	**
MI	***		**	***
MN	*****	**	****	*
NV	**	*	**	***
NJ	***	*	***	***
NY	***	*	***	*****
OH	***		***	**
OR	**	**	***	**
TX			*	*
VA	*		**	**
WA	*		*	**
CO	*		*	**

Note: A more extensive version of this analysis that includes a description of the label elements pertaining to each of the objectives as well as detailed reasoning how the respective grades were decided upon can be found in Appendix 1.

5.2 Label Coding

In addition to the qualitative analysis above, the labels were analyzed in terms of their information content, structure, and design elements. To this end I developed a set of items that I coded all labels for (see Table 3 for a complete list). These items were then combined into several measures to assess how the different labels fared along important dimensions.

Table 3 – Item List

Item	Coding Method
Number of fuel types listed in "fuel mix"	Count – total number
Emission levels	Binary – Y/N
If present: Number of emission types	Count – total number
Information about non-gaseous emissions	Binary – Y/N / List
Price information	Binary – Y/N
Environmental impact education / explanation	Binary – Y/N
Consumer choice education / explanation	Binary – Y/N
Non-Essential information	Count / List
Comparisons	
Power Mix	Binary – Y/N
Emission levels	Binary – Y/N
Other (which)	Binary – Y/N / List
Number of pages	Count – total number
Number of tables	Count – total number
Number of items per table	Count – total number
Number of pie charts	Count – total number
Number of items per chart	Count – total number
Number of bar charts	Count – total number
Number of items per chart	Count – total number
Number of pictures, other graphics	Count – total number
Number of text paragraphs	Count – total number
Number of different font sizes	Count – total number
Number of different font colors	Count – total number
Number of underlined words / expressions	Count – total number
Number of bolded words / expressions	Count – total number
Number of different background colors / shadings	Count – total number
Numbers presented in fractions	Binary – Y/N
Numbers presented in decimals	Binary – Y/N
Numbers presented in percentages	Binary – Y/N
If more than one is used, which dominates	List
Overall structure score	Score from 1 to 5
Paragraph length	1 – 2 – 3 (short, medium, long)
Text density / difficulty	
Word count	Count
Sentences per paragraph	Count
Words per sentence	Count
Flesch Reading Ease score	Score – 0 to 100
Flesch-Kincaid Grade Level score	Score – grade level
Source of information stated	Binary – Y/N
Referral to other sources of information	Binary – Y/N / List
Historical information / trends over time	Binary – Y/N
What part of the label grabs immediate attention (list)	List

Note: Descriptive statistics for each of the items are presented in Appendix 2, and example of the coding results can be found in Appendix 3.

5.3 Scales representing five aspects: information load, environmental focus, comparability, understandability, and materiality of information

5.3.1 Information Load

The overall volume of information contained on each of the labels was measured by creating a weighted sum of all items (listed in Table 3) present on a given label that are related to information content. A weighted sum was chosen because an additional page of information was deemed more likely to dilute important facts on the label than one additional graph. Specifically, all items received a weight of one except for "Price Information" and "Environmental impact explanation", which received a weight of two, and "Number of pages", which received a weight of three. A few items were not included in this measure because they do not contribute to information load. These are the two reading ease scores, the number of emission types (only the binary variable whether or not emission information is present in general was included) and the different representations of numerical information. The non-binary items were re-coded into comparable categories, see table 4.

The resulting combined measure for information load ranged from 15.33 to 38.33, with an average score of 25.89 and a standard deviation of 6.31. Chart 1 shows the information load distribution of the 18 labels. The two outliers to the right are Minnesota and Massachusetts, respectively. The next most overloaded label is Oregon. On the low end are California and Virginia, which both received a score of 15.33.

Table 4 – Information Load Items

Item	Original range of values	Recoded values
Number of fuel types	From 5 to 14 fuel types Mean 9.4, St Dev. 3.0	5 to 9 – recoded to 1 10 to 14 – recoded to 2
Non-gaseous emissions	1 to 3 depending on the type of non-gaseous emissions	1 for every label with any non-gaseous emissions
Number of tables	From 0 to 5 tables Mean 1.9, St. Dev. 1.1	0 tables – 0 1 or 2 tables – 1 3 or 4 tables – 2 5 tables – 3
Number or graphs	From 0 to 10 Mean 1.3, St. Dev. 2.4	0 graphs – 0 1 or 2 graphs – 1 3 or 4 graphs – 2 5 or more graphs – 3
Number of paragraphs	From 1 to 21 Mean 5.3, St. Dev. 5.5	Less than 5 paragraphs – 1 5 to 9 paragraphs – 2 10 or more paragraphs – 3
Text variation items	The 4 items of text variation were combined into one score ranging from 1 to 2.67. Individual items were first standardized to make the comparable, then a weighted average was calculated	
Word count	From 100 to 990 Mean 372, St. Dev. 294	Less than 150 words – 1 150 to 299 words – 2 300 to 499 words– 3 500 to 749 words – 4 More than 750 words – 5
Sentences per paragraph	From 1.1 to 4.6 Mean 2.8, St. Dev. 1.1	Less than 3 sentences – 1 More than 3 sentences – 2
Words per sentence	From 13.7 to 36.6 Mean 19.9, St. Dev. 5.1	18 words or less – 1 19 to 21 words – 2 22 words or more – 3

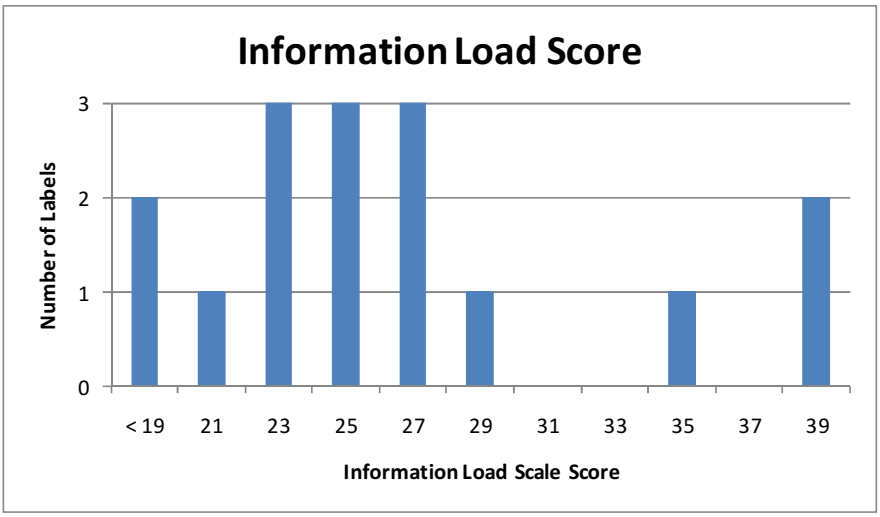


Figure 1 – Information Load Histogram

5.3.2 Focus on Environmental Impact

The focus on environmental impact measure consists of 3 sub-scores. First, all of the items that could include either environmental (e.g. fuel mix, emission levels, explanation of the environmental impacts associated with air emissions, etc.) or non-environmental (e.g. price information, information about electricity generation and transmission, etc.) information were counted for both categories. A score representing the percentage of total information focused on the environmental impact of electricity generation and consumption was calculated. This percentage score ranged from 44.9% to 99.7%, with an average of 77.85% and a standard deviation of 19.25%. I convert the percentage score to a numeric score, where less than 50% received a 2, 50% or more but less than 60% received a 4, 60% or more but less than 70% received a 6, 70% or more but less than 80% received a 8, 80% or more but less than 90% received a 10, and 90% or

more received a 12. This converted percentage score ranged from 2 to 12, with an average of 8.4 and a standard deviation of 3.56.

The second sub-score is related to content. Labels with emission level data received 5 points; labels with price information received -3 points; labels with environmental impact education received either 4 or 2 points, depending on the extent of the information; labels with comparisons of the power mix or emission levels received 3 points for each that was present, while labels with non-environmental comparisons received a score of -3. Labels with price information receive a negative score for this measure because of the findings of Roe et al. (2001) that price information distract attention away from environmental information. The aggregate content score ranged from -1.5 to 15, with an average of 8.17 and a standard deviation of 4.69.

The third sub-score is based on the item "What part of the label grabs immediate attention". The label received a raw score of 1 if the item(s) was (were) of environmental content, a 0.5 for those labels that had more than one element categorized as grabbing immediate attention and not all of them had environmental content, and a 0 if none of the items mentioned had environmental content. I doubled this raw score before incorporating it in the aggregate Focus on Environmental Impact measure because whether or not the label element grabbing a consumer's immediate attention is most relevant in assessing the label's environmental focus assuming that many consumers will only devote limited attention to the label. The range of this immediate attention

score was from 0 to 4, with an average of 2.93 and a standard deviation of 1.49. Because the choice of the element(s) grabbing immediate attention is inherently subjective, I verified my choices using a small, convenience sample survey. For further details on the survey results, please refer to section 7 of this paper.

The aggregate Focus on Environmental Impact measure is the sum of the three sub-scores. It ranged from 0.5 to 31, with an average of 19.5 and a standard deviation of 8.27. Chart 2 shows the distribution of the focus on environmental impact scores. The Texas label contains close to no environmental information. It's score of 0.5 is a far outlier to the left. Colorado, with a score of 10 is the second lowest. Maine's label had the highest score with 31.

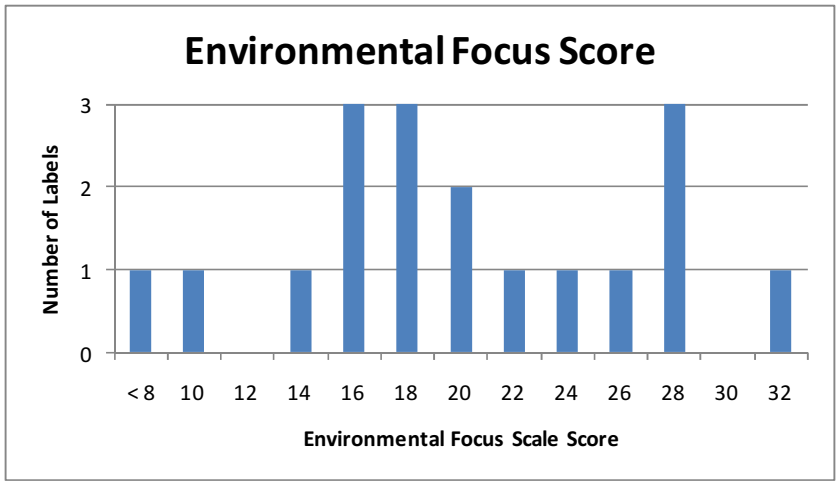


Figure 2 – Focus on Environmental Impact Histogram

5.3.3 Comparability

Comparisons are present on most labels. The power mix specific for that utility is regularly compared to a state or regional fuel mix average. Emission levels, if present,

are also often compared to the state or regional average. Some labels compare prices, either to state averages or to different products offered by the same utility. Some comparisons are in form of tables only, others are supplemented by graphs. A comparability score was developed based on how many different types of comparisons are present on a given label. The scores distinguished whether the comparison was offered in form of a table, graphics or in text form. Whenever a label had a comparison in form of a table it received a score of two points, if it was in the form of graphics it received three points and if the comparison was in text form it received one point. The reason for this is that graphics are easier to compare than numbers or text. The measure ranged from 0 to 8, with an average of 2.72 and a standard deviation of 2.30. Chart 3 shows the distribution of the comparability measure. The three states without any comparisons on their labels are Texas, Connecticut and Colorado. Oregon and Michigan are the states with the most comparisons on the label.

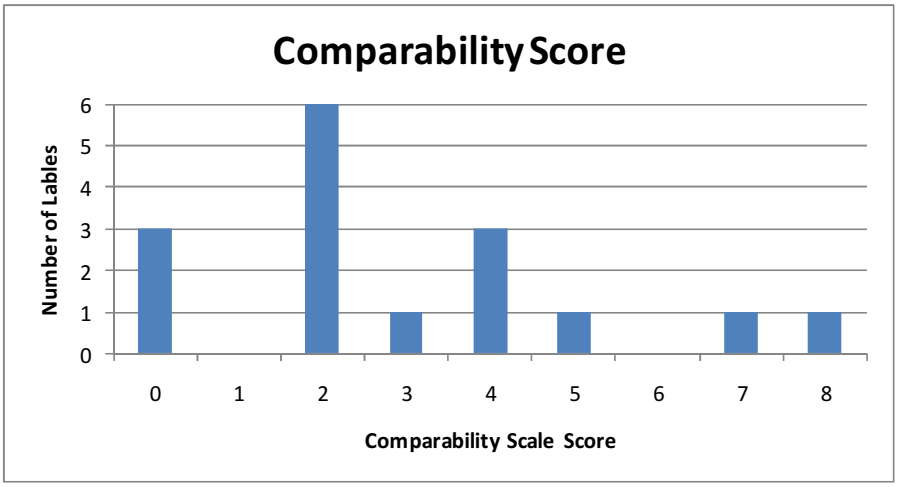


Figure 3 – Comparability Histogram

5.3.4 Understandability

Understandability to a large part depends on the level of reading difficulty of the text on a label. There are several established measures for assessing how difficult a text is to read. For this analysis I used two related ones: the Flesch Reading Ease Readability Formula and the Flesch–Kincaid Grade Level Formula. Both use average words per sentence and average syllables per word to assess how difficult a text is to read. The formula was originally proposed by Rudolph Flesch in his article "A New Readability Yardstick" (Flesch, 1948), published in the Journal of Applied Psychology in 1948 and has since become a standard readability formula used by many US Government Agencies, including the US Department of Defense. The output of the formula is a number between 0 and 100, with higher numbers indicating an easier to read text. These scores are then commonly transformed into a scale from 1 to 7 representing a range from very easy to very confusing. See table 5 for details.

Table 5 – Flesch Reading Ease

90 to 100	Very Easy
80 to 89	Easy
70 to 79	Fairly Easy
60 to 69	Standard
50 to 59	Fairly Difficult
30 to 49	Difficult
0 to 29	Very Confusing

The Flesch–Kincaid Grade Level Formula results in the necessary reading grade to fully comprehend a given text. The lowest theoretically possible score is -3.4. The

lowest grade level score in theory is −3.40, but there are few real passages where every sentence consists of a single one-syllable word. Scores can be interpreted as the number of years of education generally required to understand the text, where scores of 13 or higher represent texts that are thought to require an education level that goes beyond a high school diploma. According to the National Center for Education Statistics, the average adult American reading level is 8th to 9th grade. However, nearly 1 in 5 adults read at or below the 5th grade level; and nearly 2 out of 5 older Americans and minorities read at or below that level. The Flesh-Kincaid Grade Levels range from 10.6 to 16.6, with an average of 14.3 and a standard deviation of 2. I converted these grades into "grades above average literacy levels", subtracting 8.5 from each raw score, based on the statement above that the average adult American reading level is 8th to 9th grade.

While the Flesch reading scales were not developed specifically for short texts like the ones found on power content labels, the formula itself does not include elements that would automatically disqualify it from being applied to shorter texts. The actual resulting grade levels may not realistically reflect the level of education needed to understand the labels; however, the relative reading ease is still adequately reflected in the Flesch scores.

Word count was also considered for the overall understandability of the label, because labels with similar levels of reading difficulty become harder to understand if there is more text involved. The raw word count was converted into a score from 1 to 6,

where labels with texts of less than 150 words received a score of 1; labels with texts ranging from 150 to 299 words received a score of 2; labels with texts ranging from 300 to 449 words received a score of 3; labels with texts ranging from 450 to 599 words received a score of 4; labels with texts ranging from 600 to 749 words received a score of 5; and labels with more than 750 words received a score of 6.

The structure of the information content on a label, as well as effective use of tables and graphs also contribute to the understandability of a label and are therefore also considered in the measure. Scores in the range of 0 to -2 were assigned for graphs and tables, and scores in the range of 0 to -4 for the general structure of the label. Information that was presented in both table and chart format received a lower score on the second medium. The aggregate understandability score was determined according to the following formula

$$\text{Understandability} = \text{Word Count} + \frac{\text{Flesch Reading Scale} + 2 * \text{Above Average Grade}}{2} - \text{Graphs} - \text{Tables} - \text{Structure}$$

I decided on the weights used in the formula above because word count confounds understandability additionally simply by making it harder to locate relevant information, no matter how well it is described or presented, and because the above average grade score allowed for more variation than the Flesch Reading Ease score (which was either a 6 or a 7 for all labels). Chart 4 depicts the distribution of the understandability score. Michigan is the most easily understood label, Minnesota, Massachusetts and then Connecticut and Texas are hardest to comprehend.

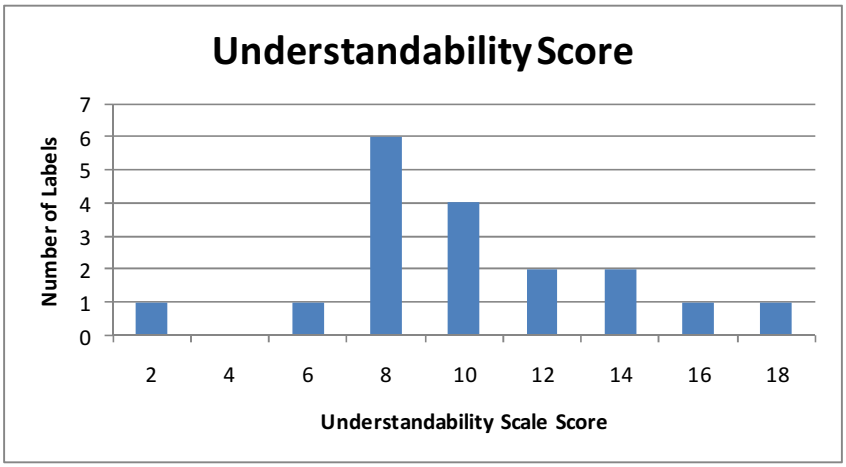


Figure 4 – Understandability Histogram

5.3.5 Materiality

Information on the label is intended to guide or assist a consumer's decision-making process. Any information that helps the understanding of the label and helps the user apply the label better in their decision making therefore can be seen as material. Immaterial information, on the other hand, tends to confound the positive effects of material information based on the limited rationality theorem. There are different aspects that decision makers might look for in a label for helping their decision-making process. One important piece of information is an explanation on why consumers have a choice between different suppliers and how the label helps them in this choice process. Price information or price comparisons will be an important driver for many individuals. People who want to include environmental attributes into their decision-making but who don't necessarily have the background to interpret simple and compact environmental information on a label will rely on some form of environmental impact

explanation and a description of what harm various air emissions associated with electricity generation may cause. Interpreting any sort of numeric information is easier if the label offers a basis of comparison. Non-essential information, on the other hand, distracts decision makers from more useful pieces of information. One example is measures of energy efficiency, which are helpful and necessary in general, but whose ideal place is not a disclosure label that is supposed to inform consumer choice.

Table 6 – Materiality Measure

Information about consumer choice	Information about choice in electricity suppliers received a score of 1. If this was augmented by information on how to use the label in the decision making process, an extra 1 to 3 points were awarded, depending on the extent and quality of the explanation.
Price Information	Labels that include price information receive a score of 1, which increased to 2 if the information also includes price comparisons.
Environmental impact education	Labels received between 1 and 3 points for fuel mix explanations, emissions explanations and other environmental impact education, respectively, depending on the extent and quality of the explanations.
Benchmark comparisons	Benchmarks make existing information pieces more meaningful and therefore more valuable. Labels received a score of 1 if comparisons were present and a score of two if these comparisons were explained.
Non-essential information	Any information that is not considered material will decrease the value of material information. The materiality score of a label decreased by 1 point for each type of non-essential information that is included on it. This makes possible for a materiality score to be negative.

The resulting measure of materiality ranged from -1 to 6, with a mean of 1.78 and a standard deviation of 2.12.The distribution can be seen in chart 5. Nevada and Texas are the two labels on the low end; the two highest scores are Massachusetts and Maine.

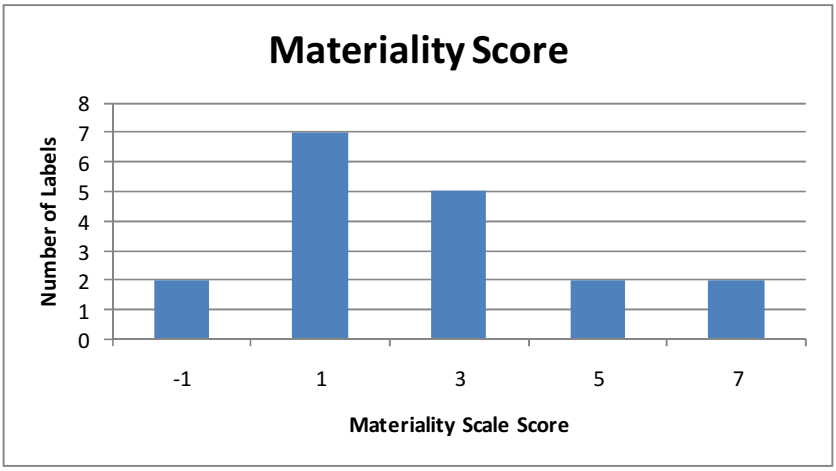


Figure 5 – Materiality Histogram

5.4 Scales representing two main dimensions: content and usability

The 5 scales all describe important aspects of the power content labels, but since they recombine some of the same items in different ways, there is some concern about how meaningful they are, especially if the intent is to combine them into a sort of aggregate rating of the labels. Therefore, a second set of measures was developed, corresponding to the two main dimensions of the power content labels: content and usability. While the quality and materiality of content can differ greatly, all else being equal, more content is preferred. However, more content automatically increases the information load and threatens to reduce the attention each individual piece of information receives, thereby reducing the usability of the label. The same information can be packed in more or less usable form, depending on the readability, density of information (i.e. information load) and the structure of the label.

Therefore, the coded items were recombined into two more fundamental measures representing content and usability, where each coded item was only used in one of the scales. While this approach guarantees that there is no high correlation between the two measures caused by re-using the same items multiple times, the expectation is to see a negative correlation between content and usability, reflecting the underlying tension to balance including all potentially important content with over-crowding the labels.

5.4.1 Content

The content scale used the same items as the materiality scale described above. In addition, labels received a score ranging from 0 to 2 based on how many different fuel types were presented on the label, a score ranging from 0 to 1 based on how many different emission types were presented on the label, a score of 0 or 0.5 depending on whether or not non-gaseous emissions were mentioned and scores of 0 and 1 based on whether the reader was referred to additional sources of information and whether the source of information contained on the label was mentioned, respectively. The resulting scale had an average of 4.98 and a standard deviation of 2.48.

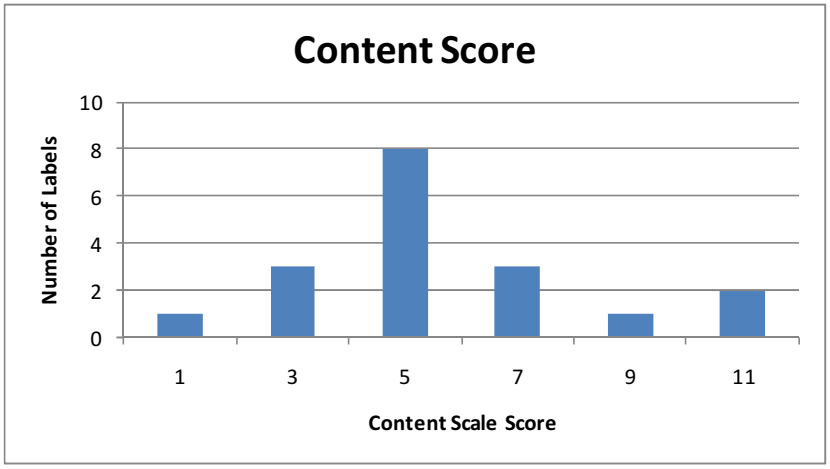


Figure 6 – Content Histogram

5.4.2 Usability

Usability was divided into three categories that received equal weight aggregating them to the usability scale. These categories were readability, structure and information overload. Readability and structure are assumed to make labels more

useable, while information overload is assumed to make it less useable. Readability was determined using total word count and a combination of the Flesh Reading Ease (using the rule of thumb values between 1 and 7 as described above) and Flesh Reading Grade (using grades above average US reading level as described above) measures. Each label received a word-count score ranging from 1 to 5 based on the total number of words used on the label. The two Flesh reading ease measures were combined in a weighted linear average, counting the grades above average reading level double. These two values were aggregated to form the readability sub-scale by adding the two values. Structure has the following components: each label received a score from 0 to 4 based on the number of tables and graphs present on the label, a score ranging from 0 to 2 based on the number of different background colors present on the label, and a text variation score based on the number of different font sizes and colors as well as bolded and underlined expressions present on the labels. In addition, each label received a structure grade ranging from 1 to 5. This is a new item that was coded assessing how well the structure elements counted in the other categories actually formed an overarching structure to increase usability. Overload was determined taking into consideration the number of pages, paragraphs and non-text items as well as individually assessed scores of 0 or 1 based on whether the numbers format used made sense (e.g. the Maryland label, which reports numbers to 6 decimal points, received an overload score). The three scores were combined by adding the readability and overload scores and subtracting

from that the structure score. The overall usability scale had an average of 5.58 and a standard deviation of 3.34.

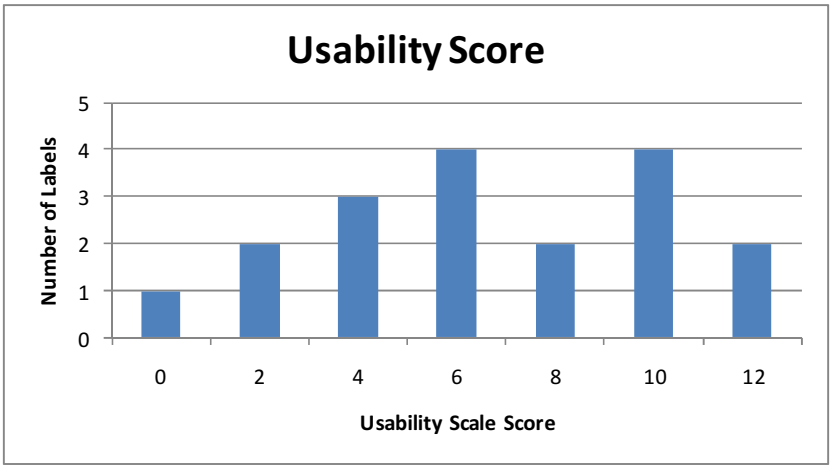


Figure 7 – Usability Histogram

6. Summary of Findings

The results for each set of scales will be presented in two ways. First, labels are ranked along each of the dimensions that are analyzed. Then, standardized scores (where the mean for each score is subtracted from each individual state's score, and the result is divided by the standard deviation) for each measure are reported to enable a comparison of relative performance across the dimensions and to help identify outliers within individual dimensions, which can then be taken into account when assessing overall performance of a label. Tables 7 and 8 report the ranking and standardized score results for the first set of measures, respectively. The standardized scores are calculated so that for all scales, higher values indicate superior performance along that dimension.

Table 7 – Ranking of Each Label for the Individual Measures

	Information Load	Focus on Environmental Impact	Comparability	Understand-ability	Materiality
California	1	16	8	8	10
Colorado	5	17	15	14	13
Connecticut	15	13	15	16	6
Delaware	6	10	8	6	3
Illinois	14	5	8	2	6
Maine	9	1	3	4	1
Maryland	7	6	8	11	3
Massachusetts	17	13	4	17	1
Michigan	12	4	2	1	10
Minnesota	18	7	4	18	13
Nevada	9	8	8	9	17
New Jersey	11	2	4	12	5
New York	3	2	8	6	6
Ohio	8	8	7	5	6
Oregon	16	13	1	3	13
Texas	13	18	15	15	17
Virginia	1	12	8	13	13
Washington	3	10	15	10	10

Table 8 – Standardized Raw Scores of Each Label for Each State

	Information Load	Focus on Environmental Impact	Comparability	Understand-ability	Materiality
California	1.50	-0.84	-0.31	0.42	-0.37
Colorado	0.56	-1.23	-1.19	-0.59	-0.83
Connecticut	-0.44	-0.57	-1.19	-1.25	0.10
Delaware	0.45	-0.17	-0.31	0.45	1.04
Illinois	-0.28	0.89	-0.31	0.97	0.10
Maine	0.14	1.55	0.99	0.56	1.98
Maryland	0.35	0.62	-0.31	-0.13	1.04
Massachusetts	-2.01	-0.57	0.56	-1.53	1.98
Michigan	-0.07	1.02	1.86	2.23	-0.37
Minnesota	-2.12	0.36	0.56	-1.99	-0.83
Nevada	0.14	0.09	-0.31	0.29	-1.30
New Jersey	0.03	1.15	0.56	-0.21	0.57
New York	0.77	1.15	-0.31	0.45	0.10
Ohio	0.24	0.09	0.12	0.50	0.10
Oregon	-1.33	-0.57	2.30	0.83	-0.83
Texas	-0.18	-2.49	-1.19	-0.87	-1.30
Virginia	1.50	-0.31	-0.31	-0.29	-0.83
Washington	0.77	-0.17	-1.19	0.15	-0.37

The results show that there are some labels that are better than others over all: while no single label dominates all scores, some manage to score high in several categories without scoring very low in the remaining one(s). For example, the Maine label ranks among the four best labels in all categories except for information load, where it still ranks a respectable 9th. New York is ranked 8 or higher in all 5 categories. The results also suggest that more information (i.e. higher comparability and materiality) leads to poorer understandability and more information load.

The interaction between measures can be expressed by the correlations between them. The tables 9 and 10 show the correlations between the 5 measures for standardized scores and for ranks, respectively. The first letter of each variable indicates

the score type (R = ranking, S = standardized scores). The abbreviations for the 5 measures are IO = information load, ENVF = environmental focus, COMP = comparison, UND = understandability, and MAT = materiality.

Table 9 – Correlations Between Measures of Standardized Scores

		SIO	SENVF	SCOMP	SUND	SMAT
SIO	Pearson Correlation					
	Sig. (2-tailed)					
SENVF	Pearson Correlation	.017				
	Sig. (2-tailed)	.947				
SCOPM	Pearson Correlation	-.443	.443			
	Sig. (2-tailed)	.066	.066			
SUND	Pearson Correlation	.423	.424	.409		
	Sig. (2-tailed)	.081	.079	.092		
SMAT	Pearson Correlation	-.143	.460	.192	-.014	
	Sig. (2-tailed)	.570	.055	.445	.957	

Table 10 – Correlations Between Measures of Rank Scores

		RIO	RENVF	RCOMP	RUND	RMAT
RIO	Pearson Correlation					
	Sig. (2-tailed)					
RENVF	Pearson Correlation	-.041				
	Sig. (2-tailed)	.872				
RCOMP	Pearson Correlation	-.331	.533*			
	Sig. (2-tailed)	.180	.023			
RUND	Pearson Correlation	.180	.457	.416		
	Sig. (2-tailed)	.474	.056	.086		
RMAT	Pearson Correlation	-.029	.474*	.276	.178	
	Sig. (2-tailed)	.908	.047	.267	.479	

The environmental focus scale has statistically significant correlations (at the .05 level) with both the Comparison and Materiality measures of the rank scores. Other than this, only the correlation between Comparability and Understandability, even though not statistically significant, is of some concern. None of the standardized score measures have statistically significant correlations (at the .05 level), but there are several who do have relatively large correlations that are significant at the .1 level.

Table 11 reports raw and standardized scores as well as resulting ranks for the 18 labels for the content and usability measures. Reducing the analysis to these two main dimensions makes comparison of relative performance easier and further emphasizes the inherent trade-off along those two dimensions.

Table 11 – Content and Usability

	Content			Usability		
	Total	Standard. Total	Rank	Total	Standard. Total	Rank
California	5.00	0.01	7	2.11	1.04	4
Colorado	2.00	-1.20	17	8.80	-0.96	15
Connecticut	4.33	-0.26	12	10.18	-1.38	17
Delaware	5.67	0.28	5	5.44	0.04	9
Illinois	5.67	0.28	5	4.83	0.22	8
Maine	10.00	2.02	2	3.09	0.74	5
Maryland	7.67	1.08	3	3.97	0.48	6
Massachusetts	10.17	2.09	1	5.99	-0.12	10
Michigan	6.00	0.41	4	-0.62	1.85	1
Minnesota	5.00	0.01	7	8.97	-1.01	16
Nevada	2.67	-0.93	15	7.04	-0.44	12
New Jersey	5.00	0.01	7	8.54	-0.89	14
New York	4.33	-0.26	12	4.10	0.44	7
Ohio	5.00	0.01	7	0.80	1.43	2
Oregon	4.67	-0.13	11	1.78	1.13	3
Texas	0.50	-1.81	18	11.05	-1.64	18
Virginia	2.67	-0.93	15	8.07	-0.75	13
Washington	3.33	-0.66	14	6.24	-0.20	11

Better structure and less complicated formulations of the text passages enables labels with high content scores to also score high on usability, leading to an overall superior performance of some labels over others. Most noticeably, Texas, Connecticut, Colorado, Virginia and Washington score low on both dimensions. Michigan, Maine and Maryland, as well as to a certain extent California and Massachusetts and Ohio perform well. An overall ranking could easily be calculated combining these two dimensions; however, the decision on how to weigh content against usability is difficult. It depends on specific policy goals, actual usage patterns in the population, potential biases in the types of people who use the labels (e.g. it is conceivable that people with higher levels of education are more likely to pay attention to the disclosure labels, making usability a little less important than if the average user is closer to the overall population average across the US).

7. Survey

In order to have a more objective measure to calibrate the analysis above, a short web-survey was constructed and administered. Because of time constraints a non-random convenience sample of 72 subjects was used. I did get some variety of location, age and socio-economic status by expanding from just my immediate circle of friends and family, using a variety of online music related forums as well as the Nicholas School PhD student community. I do not know the identity of the people from the online forum who answered the survey, but they do represent the majority of the response recorded, and generally these forums are frequented by people from all over the United States.

The survey included 8 of the 17 labels that are being analyzed in this paper. The number of labels on the survey was limited to 8 in order to cut down on the time it took to complete all the questions. To select the 8 labels that would be included in the survey, these were grouped into 8 categories and one example of each was included in the survey. The 8 label categories were built based on how many tables (zero, one, two or three or more), how many graphs and charts (zero, one, two or three or more), amount of text (little, medium, much) and number of pages (one or two). Table 12 summarizes the results of this analysis.

Table 12 – Survey Selection Criteria

	tables				Graphs / Charts				Text			pages	
	0	1	2	3+	0	1	2	3+	little	medium	much	1	2
California		X			X				X			X	
Colorado	X						X			X			X
Connecticut			X		X						X		X
Delaware			X		X					X		X	
Illinois			X			X			X				X
Maine			X		X					X		X	
Maryland			X		X				X			X	
Massachuisetts				X		X					X		X
Michigan			X				X		X			X	
Minnesota			X				X				X		X
Nevada			X		X					X		X	
New Jersey		X				X				X			X
New York		X				X			X			X	
Ohio		X					X		X			X	
Oregone				X				X	X				X
Texas			X		X						X		X
Virginia			X		X				X			X	
Washington			X		X				X			X	

California (group 1) and Oregon (group 2) stood out at opposite ends of the spectrum and each formed their own "group". California has only one table, no charts and almost no text. All other labels with one or less tables had at least one or more graphs and most had more elaborate text passages. Oregon, on the other hand has more tables and more graphs than any other label. Colorado (group 3) is a third label that was included as its own group because it is the only example that does not include any tables at all. Connecticut and Texas form group 4. They both have two tables, no graphs and a lot of text spread over two pages. They also both have very little focus on environmental impacts. Connecticut was chosen to represent this group. Massachusetts and Minnesota form group 5. They are the other two labels with a lot of text, but they both have several tables and graphs and do focus more on environmental impacts that Connecticut and

Texas. Illinois, New York, Ohio and Michigan form group 6, consisting of relatively bare bone labels. Except for Illinois, they all are only one page long (and Illinois' second page only has one large pie chart on it), they all have both tables and charts with little text. New York was chosen to represent this group. Maryland, Nevada, Virginia and Washington represent group 7, another group of relatively bare bone labels. However, none of these include any graphs or charts, and their text passages, while short, are a little more extensive (most of the text for the first group of bare bone labels comes in the form of notes only, whereas this second group has some short sentences explaining different aspects of the label). Maryland was chosen to represent this group. Finally, group 8 consists of Delaware, Maine and New Jersey. All three have medium text length, the former two both have two tables, no graphs and are only one page long, whereas New Jersey has one table and one chart apiece and is two pages. I decided against making New Jersey its own category to keep the survey to 8 samples because I felt it still was similar enough to the other two that I would not have gained much by expanding to nine. Maine was chosen as the representative for this group. Table 13 summarizes the 8 groups, indicating the representative for each of the groups in bold.

Table 13 – Group Representation on the Survey

Group 1	**CA**			
Group 2	**OR**			
Group 3	**CO**			
Group 4	**CT**	TX		
Group 5	**MN**	MA		
Group 6	**NY**	OH	MI	IL
Group 7	**MD**	NV	WA	VA
Group 8	**ME**	NJ	DE	

The survey was structured as follows: First each label was presented separately on one page followed by two questions. The first question asked the respondent about the part of the label that was most noticeable to them at a first quick glance. As mentioned earlier, the results of this question were used to confirm the coding decisions on the respective item. The second question asked the participants to rate how well the label performed along the dimensions of understandability, structure, explanation of environmental impacts and comparison to benchmarks / other options, each on a 5 point Likert scale ranging from very poor to very good with a neutral option in the middle. After this was completed, the respondents were asked to mention the two labels they liked best and the two they liked least overall. An option was included to review all labels once more before answering these questions. Please see Appendix 4 for a complete list of questions used.

To elicit responses the survey was sent out to various contacts, both private and university related, and was posted to a number of different online message boards. The latter was meant to (1) increase the number of responses and (2) reach beyond the network of friends and acquaintances. Using these different avenues resulted in a sample that should be fairly diverse geographically as well as by other demographics. However, no demographic data was collected to assess these claims, for brevity and because the objective of the survey was restricted to confirm the measures developed in this paper.

Over the course of 5 days, 72 responses were collected. The results of the study confirm coding decisions and are generally in line with the rankings resulting from the measures. The survey results are summarized in the tables below.

Table 14 – Results for the Question "What Part of the Label is Most Noticable?"

	Fuel Mix Table	Emissions Table	Bar / Pie Charts	Text Passages	Pictures	Other	Non-response
California	46	4	0	5	0	16	1
Colorado	5	0	43	14	8	2	0
Connecticut	30	2	2	26	0	11	1
Maine	47	21	0	1	0	2	1
Maryland	56	3	1	2	0	9	1
Minnesota	7	1	42	6	9	7	0
New York	19	20	31	0	2	0	0
Oregon	9	1	54	2	2	4	0

California and New York do not have emission tables. For the California responses, these are likely due to confusion between fuel mix and emission levels in the one table that is present on that label. In the case of New York, these answers are attributable either to the fuel mix table, or to the emission level information in form of a bar chart.

Table 15 – Means and Standard Deviations of the 4 Rating Questions

	Understandability		Structure		Environmental Impacts		Comparability	
	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
California	2.875	1.113	2.833	1.088	1.889	0.865	2.569	1.059
Colorado	4.097	0.772	3.972	0.878	3.000	1.222	3.097	1.344
Connecticut	2.333	1.021	2.111	0.928	2.944	1.209	2.375	1.067
Maine	3.681	0.728	3.625	0.846	3.486	1.048	3.375	0.956
Maryland	3.917	0.852	3.944	0.803	3.181	0.998	2.903	1.177
Minnesota	3.722	0.982	3.569	1.098	3.764	1.014	3.583	1.084
New York	3.972	0.822	4.125	0.730	3.000	1.138	3.111	1.284
Oregon	3.278	1.236	3.125	1.278	3.083	1.297	3.500	1.256

Note: Answer choices from 1 to 5, where higher numbers correspond to higher levels of satisfaction with the label concerning the attribute in question

Table 16 – Number of Times Each Label Was Mentioned as One of the Top Two and Bottom Two

	Top 2	Bottom 2
California	5	37
Colorado	30	8
Connecticut	3	34
Maine	15	9
Maryland	16	12
Minnesota	29	12
New York	28	16
Oregon	24	17

These results indicate that the respondents neither liked the very bare bone labels (California, and to a lesser extent Maryland and New York) nor the very wordy labels (Connecticut and Minnesota, and to a lesser extend Oregon). However, some respondents do find more information appealing (Minnesota and Oregon were second and fourth most popular label, respectively). The popularity of the Colorado label is surprising and deviates from the results coming out of the scale analysis. One possible

explanation for this is that the order in which all respondents saw and analyzed the labels was not randomized. Potentially, many respondents welcomed the more extensive details included on the Colorado label compared to the California label.

Comparing the survey results to the measures is challenging. For example, the responses to the question about understandability of the labels likely included both information load and understandability. How well environmental impacts are perceived to be explained is not capturing exactly the same as the measure of focus on environmental impacts. Table 17 compares the relative ranks of the 8 sample labels from the survey to how they rank comparatively in the related measures. Table 18 compares the coding decisions on structure grade and which item grabs the user's immediate attention to the survey results.

Table 17 – Comparison of Survey Results and Measure in Terms of Rank

	Understandability			Environmental Impacts		Comparability	
State	Survey	Measure(1)	Measure(2)	Survey	Measure	Survey	Measure
California	7	1	4	8	7	7	4
Colorado	1	5	6	5	8	5	7
Connecticut	8	7	7	7	5	8	7
Maine	5	3	2	2	1	3	2
Maryland	3	4	5	3	3	6	4
Minnesota	4	8	8	1	4	1	3
New York	2	1	3	5	2	4	4
Oregon	6	5	1	4	5	2	1

(1) corresponds to a simple average of the information load and understandability measures
(2) corresponds to the understandability measure only

Overall, the results correspond well to the measures. The most noticeable exceptions are for the understandability of Colorado and Minnesota, which were seen as more easily understandable by survey participants than what the measures in the subjective analysis indicate, and Maine and California, which were seen as less understandable than what the analysis of this paper suggest. The result for Oregon exemplifies the concern that respondents to the survey interpreted understandability as a combination of the information over load, and understandability measures.

Table 18 – Comparison of Survey Results and Item Coding Decisions

	Structure		**Attention**	
State	Survey	Coding	Survey	Coding
California	7	1	Fuel Mix	Fuel Mix
Colorado	2	5	Chart	Pie Chart
Connecticut	8	7	Fuel Mix	Nothing
Maine	4	1	Fuel Mix	Emissions
Maryland	3	1	Fuel Mix	Fuel Mix
Minnesota	5	8	Charts	Charts
New York	1	4	Chart	Emission Chart
Oregon	6	5	Charts	Charts

8. Discussion

It is difficult to decide on exactly what information should be included on a disclosure label due to varying levels of knowledge across consumers as well as their varying opinions on what constitutes relevant information. This is especially pertinent for power content labels, since the effects of various emissions on the environment are extremely complex. The above analysis shows that there are difficult trade-offs between information content and label usability. Some of these trade-offs can be avoided by improving the structure of the label as well as the form in which information is presented. However, the results from the pilot survey indicate that no single label design will satisfy all different tastes. Furthermore, potential issues of consumer's lack of attention towards labels that come in the form of multi-page leaflets rather than concise labels printed onto the electricity bill and / or other mailings have to be considered.

A potential policy solution to this problem is to limit the actual labels in terms of size and content, but to include a reference to a website that enables consumers to compare all the products that are available to them. Ideally such a site should be operated and maintained by the Public Utility Commissions, to increase transparency and trust in the information source. After typing his or her ZIP code, customers would be presented a comparison of all of their supplier choices, including price information, fuel mix data and emission levels. Another advantage of such a website is that further information could easily be made available to the interested consumers without

crowding this initial comparison because of the more interactive nature of the worldwide web, compared to printed information material.

The present analysis attempts to outline general criteria for evaluating power content labels and applying these criteria to rank a set of sample labels, however, it leaves important questions about disclosure policies in the electricity sector unanswered. The Difficult trade-off between usability and content has been explained and the measures and aggregate rankings attempt to compare the relative values. However, the question on how an ideal disclosure label should be designed remains unanswered. In order to define features of such an ideal label more clearly, future work should elicit expert opinion about content as well as design elements, including experts from the energy policy realm as well as experts in marketing, risk communication and communication design.

Even with the best design possible, the effectiveness of environmental disclosure policies in the electricity sector depends entirely on how consumers use the information contained on the labels. Anecdotal evidence indicates that many people in states with disclosure policies are not actually aware of the labels' presence. Therefore, future studies should evaluate the actual level of awareness in the various states with disclosure requirements. This type of study should assess usage patterns in the population, ask people's expectation of disclosure labels and find out how well people understand the information that is contained on the labels. With a large enough,

stratified sample, differences across states could be assessed and compared to the predictions of this analysis based on varying designs across states.

Finally, a randomized control trial should be set up to test the hypotheses about label usage and about the quality of varying design elements in conveying information effectively to the reader. The same data of a hypothetical utility would be presented to participants using varying existing label designs, and variations in answers about various attributes of that utility could be analyzed.

Appendix A - Detailed Qualitative Analysis

California: (1) No information about energy efficiency measures or programs, no education about environmental impacts associated with electricity generation. Only comparison table with CA power mix, which can help distinguish companies with favorable or unfavorable environmental electricity mixes. (**)
(2) No concrete mention of consumer choice options, comparison to CA power mix indirectly indicates that other supplier options exist. (*)
(3) CA power mix table facilitates some comparison, but without information about the associated emissions and the environmental impacts of these emissions, only consumers with pre-existing knowledge about these issues will benefit. (**)
(4) The CA power mix comparison can help inform people who desire a different fuel mix, and the table is easy to read and compact. However, without additional information this again requires some prior familiarity with the environmental problems associated with electricity generation. (***)

Colorado: (1) The existing power supply mix chart may conjure up worries about the use of fossil fuels, but without a comparison to a regional average and / or explanations of the environmental impacts associated with using these fuel types for electricity generation, only consumers with previous knowledge of the issue will be able to use this information. (*)
(2) Colorado does not have a deregulated electricity market; therefore the only choice customers are facing is between different contracts offered by their supplier (e.g. green power options or time of use pricing schemes). ()
(3) The label contains no comparisons of fuel mix or emission levels or explanation of environmental impacts present on the label. There are some statements about pollution control measures undertaken by the utility. (*)
(4) The label is spread out over two pages and contains a fair amount of text that does not have any of its main points highlighted through variations in the layout. The fuel mix is displayed in form of a pie chart on page 2, which does draw most of the attention on that page. (**)

Connecticut: (1) A box explaining the impacts of the three most common air emissions associated with burning fossil fuels for electricity generation, as well as information about Renewable Portfolio Standards, and a table

showing the regional power mix are included on the label. However, there is only indirect link between the emissions impacts on the environment and consumers' electricity choices. The label also lacks a way of comparing the environmental impact to other suppliers or to a State or Regional average. (**)
(2) Consumers are being made aware of the fact that they have a choice in supplier, and a box on page one of the label summarizes important considerations when considering an electricity supplier. (****)
(3) The impacts associated with different types of air emissions and how these emissions relate to various fuel options is described in details. (***)
(4) The information is divided into several text boxes, which helps to group different topics together. However, there is a lot of text included on the label and it is spread over two pages without any information in the form of charts or graphs to ease the cognitive burden. (*)

Delaware: (1) The label depicts air emissions associated with electricity generation and explains their impacts briefly, but no other information about energy efficiency is presented. (**)
(2) There is no direct information about choice in the retails electricity sector, but both the text passage as well as the fact that the air emissions are compared to a regional average indicates that consumers do have the option of choosing their supplier. (*)
(3) The power mix used to generate electricity is included in form of a table, which also depicts relevant air emissions that are compared to the regional average. The environmental impacts associated with these emissions are explained, although the explanation is very scant and printed in a smaller font. (***)
(4) The label has a clear lay-out and the tables attract consumers' attention to the power mix and emission levels. Emissions explanations are in a smaller font at the bottom, which is more difficult to read. (***)

Illinois: (1) The label depicts air emissions associated with electricity generation and explains their impacts briefly, but no other information about energy efficiency is presented. (**)
(2) There is no information indicating or explaining retails choice to consumers. ()
(3) The power mix used to generate electricity is included in form of a table, which also depicts relevant air emissions that are compared to the regional average. The environmental impacts associated with these

emissions are explained, although the explanation is very scant and printed in a smaller font. (***)
(4) The label is clearly organized, with two tables depicting the fuel mix and associated emission levels on the first page and a pie chart on page 2 that also contains the fuel mix information. The fact that the label is spread out over two pages and that the environmental impact information is printed in a smaller font at the bottom of page one decreases the usability somewhat. (**)

Maine: (1) The label depicts air emissions associated with electricity generation and explains their impacts in details, but no other information about energy efficiency is presented. (***)
(2) The fact that consumers have a choice in suppliers is only indicated indirectly in the description of the disclosure policy that mandates the label. (*)
(3) The power mix and the associated air emissions are both shown in table form and both include comparisons to the regional averages. Environmental impacts of emissions and local renewable portfolio standards are explained in details. (****)
(4) The label is clearly structured and form elements such as underlined text and variation in background colors draw attention to the most important pieces of information. However, there are no graphs to less the cognitive burden. (***)

Maryland: (1) The label depicts air emissions associated with electricity generation and explains their impacts, but no other information about energy efficiency is presented. (***)
(2) The fact that consumers have a choice in suppliers is only indicated indirectly in the description of the disclosure policy that mandates the label. (*)
(3) The power mix and the associated air emissions are both shown in table form and the emission levels table includes comparisons to the regional averages. Environmental impacts of emissions are also explained. (***)
(4) The label is clearly structured and form elements such as bolded text and variation in background colors draw attention to the most important pieces of information. However, there are no graphs to less the cognitive burden. (***)

Massachusetts: (1) The label depicts air emissions associated with electricity generation and explains their impacts in details, but no other information about energy efficiency is presented. (***)
(2) The fact that consumers have a choice in suppliers is only indicated indirectly in the description of the disclosure policy that mandates the label. The fact that price information is included may serve as an additional stimulus to consumers to think about switching suppliers. (**)
(3) The power mix and the associated air emissions are both shown in table form and both include comparisons to the regional averages. Environmental impacts of emissions and fuel mix are explained in details. (****)
(4) The label structure makes it easy to locate relevant information, but the fact that it is spread out over two pages and contains a large amount of text decreases its usability. (**)

Michigan: (1) The fuel mix is presented in form of a pie chart and a table, and both include the regional average for comparison. In addition, the airborne emissions and nuclear waste associated with electricity generation is presented in a table that also includes the regional average. No other information about energy efficiency is presented. (***)
(2) There is no information indicating or explaining retails choice to consumers. ()
(3) The power mix and the associated air emissions are both shown in table form and both include comparisons to the regional averages. There is no explanation of the environmental impacts associated with the air emissions. (**)
(4) The available comparisons and the structure using tables and graphs make the label easy to use. (***)

Minnesota: (1) The disclosure of fuel mix and emission levels as well as their associated environmental impacts is augmented with information about several energy efficiency and other programs to reduce the environmental impact of energy consumption (e.g. recycling of CFCs, energy audits, etc.). (*****)
(2) Minnesota does not have a deregulated electricity market, but customers are being made aware of the available green power program. (**)
(3) The power mix and the associated air emissions are both shown in table form and as graphs and both include comparisons to the regional

averages. Environmental impacts of emissions and fuel mix are explained in details. (****)
(4) The label uses two full pages with a lot of text and several tables and charts, making it difficult to locate any particular piece of information quickly. (*)

Nevada: (1) Fuel mix and emission levels are presented in table form, the fuel mix table includes the regional average for comparison. No other information about energy efficiency is presented. (**)
(2) No concrete mention of consumer choice options, comparison to state power mix indirectly indicates that other supplier options exist. (*)
(3) The emission levels table lacks a comparison to a state or regional average and emissions are not linked to specific fuel sources. Environmental impacts associated with emissions are not explained further. (**)
(4) The label does use two pages, but on each page the structure allows to locate specific information easily. There is not too much text and the fuel mix and emissions tables are attracting attention of the reader. (***)

New Jersey: (1) Fuel mix and emissions information is present, and environmental impacts of air emissions are further elaborated upon. No other information about energy efficiency is presented. (***)
(2) No specific mention of consumer choice is being made, but the fact that consumers have a choice in suppliers is indicated indirectly in the description of the disclosure policy that mandates the label. (*)
(3) The power mix and the associated air emissions are both shown in table form and the emission levels table includes comparisons to the regional averages. Environmental impacts of emissions are also explained. (***)
(4) The label does use two pages, but on each page the structure allows to locate specific information easily. There is not too much text and the fuel mix and emissions tables are attracting attention of the reader. (***)

New York: (1) Fuel mix and emissions information is presented, and environmental impacts of air emissions are explained briefly. No other information about energy efficiency is presented. (***)
(2) There is no information indicating or explaining retails choice to consumers. ()

(3) There is a table showing the power mix and a graph that depicts the associated emission levels including comparisons to the state average. Below the graph is a description of the environmental impacts associated with these emissions. (***)
(4) No unnecessary text is present, the table and graph are centrally located and immediately grab the reader's attention. The bar graph makes the comparison easy to comprehend. (*****)

Ohio: (1) Fuel mix and emissions information is presented, and environmental impacts of various fuel sources is explained briefly. No other information about energy efficiency is presented. (***)
(2) There is no information indicating or explaining retails choice to consumers. ()
(3) The power mix and air emissions are shown in graph form, and both feature comparisons to the regional averages. In addition, the environmental characteristics of various fuel sources are briefly described. No explanation of the environmental impacts associated with air emissions is included. (***)
(4) The label does not distract the user with unnecessary text and the fuel mix and emissions information grab the immediate attention. The included comparison of projected and actual emissions is not grasped intuitively. (**)

Oregon: (1) There is no information about environmental impacts beyond the emissions levels and no other energy efficiency programs are mentioned. (**)
(2) No mention is made of being able to choose among competing suppliers, but the label does compare 5 different contract options in details, including price and fuel mix for all of them. (**)
(3) The comparative environmental impacts of the various contract options are made explicit by the comparison contained on the label, but actual impacts associated with air emissions are not explained further. (***)
(4) The label includes too much information to be used quickly. Visual aids are used well. (**)

Texas: (1) No content that helps entice energy savings. ()
(2) There is no information indicating or explaining retails choice to consumers. ()
(3) It is mentioned that having renewable in the supply mix helps increase the renewable portfolio in the region. There is no mention of air

emissions or other environmental impacts associated with electricity generation. (*)
(4) The label contains a large amount of hard to understand text and is two pages long. There is no use of graphics to ease the cognitive load of the reader. (*)

Virginia: (1) Only reports regional fuel mix and emission levels. (*)
(2) There is no information indicating or explaining retails choice to consumers. ()
(3) Fuel mix and emission levels are present, but no environmental impact explanation is contained on the label. (**)
(4) The label has a clear structure and is not overloaded with unnecessary text. There are no charts to reduce the cognitive burden of the user. (**)

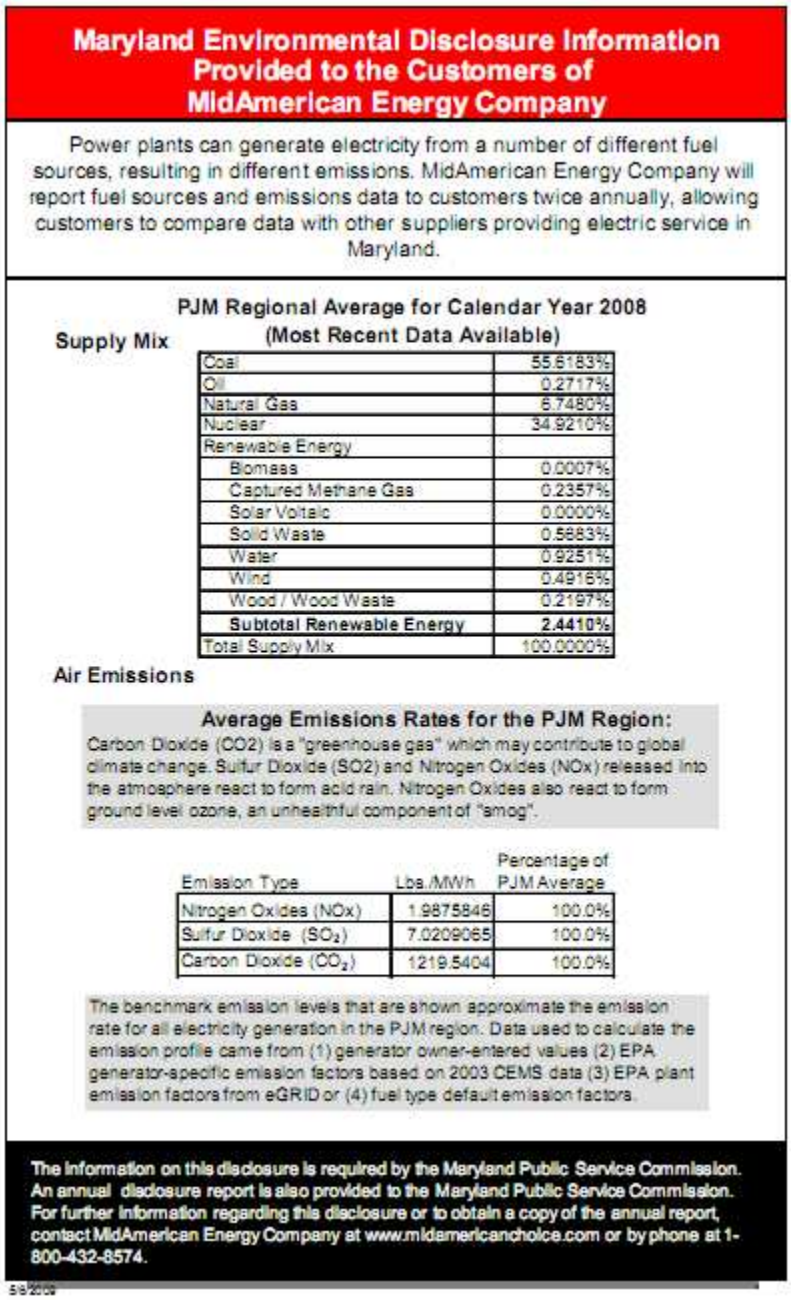
Washington: (1) Reports regional fuel mix and describes the various fuel sources, but there is no information about impacts and no other energy efficiency information is being provided. (*)
(2) Washington does not have a deregulated electricity market; therefore the only choice customers are facing is between different contracts offered by their supplier (e.g. green power options or time of use pricing schemes). ()
(3) No emission levels are reported and no environmental impact explanations are being provided. (*)
(4) The label has a clear lay-out and relevant facts are easy to locate. However, it is spread out over two pages. (**)

Appendix B – Descriptive Statistics by Coding Item

Item	Min	Max	Mean	St. Dev.
Number of fuel types listed in "fuel mix"	3	14	9.40	3.00
Emission levels	binary		0.70	0.50
If present: Number of emission types	0	8	2.70	2.10
Information about non-gaseous emissions	binary		0.28	0.50
Price information	binary		0.20	0.40
Environmental impact education / explanation	binary		0.40	0.50
Consumer choice education / explanation	binary		0.17	0.38
Non-Essential information			0.39	0.50
Comparisons				
Power Mix	binary		0.40	0.50
Emission levels	binary		0.60	0.50
Other (which)	binary		0.10	0.30
Number of pages	1	2	1.60	0.50
Number of tables	0	5	1.90	1.10
Number of items per table	0	20	11.56	5.39
Number of pie charts	0	5	0.89	1.73
Number of items per chart	0	7	2.43	2.97
Number of bar charts	0	5	0.71	1.47
Number of items per chart	0	5	2.11	2.31
Number of pictures, other graphics	0	1	0.17	0.38
Number of text paragraphs	1	21	5.28	5.45
Number of different font sizes	2	5	3.40	0.80
Number of different font colors	1	3	1.60	0.70
Number of underlined words / expressions	0	6	0.70	1.70
Number of bolded words / expressions	2	18	7.00	5.60
Number of different background colors / shadings	1	5	1.83	1.25
Numbers presented in fractions	binary		0.00	0.00
Numbers presented in decimals	binary		0.60	0.50
Numbers presented in percentages	binary		1.00	0.00
If more than one is used, which dominates	N/A			
Overall structure score	1	5	3.56	1.34
Paragraph length	1	3	1.70	0.80
Text density / difficulty				
Word count	100	990	371.90	294.40
Sentences per paragraph	1	5	2.80	1.10
Words per sentence	14	37	19.90	5.10
Flesch Reading Ease score	0.5	43.0	24.30	12.50
Flesch-Kincaid Grade Level score	10.6	17.8	14.30	2.20
Source of information stated	binary		0.30	0.50
Referral to other sources of information	binary		0.60	0.50
Historical information / trends over time	binary		0.10	0.20
What part of the label grabs immediate attention (list)	N/A			

Appendix C – Coding Example

Maryland Power Content Label



Maryland Environmental Disclosure Information Provided to the Customers of MidAmerican Energy Company

Power plants can generate electricity from a number of different fuel sources, resulting in different emissions. MidAmerican Energy Company will report fuel sources and emissions data to customers twice annually, allowing customers to compare data with other suppliers providing electric service in Maryland.

PJM Regional Average for Calendar Year 2008
(Most Recent Data Available)

Supply Mix

Coal	55.6183%
Oil	0.2717%
Natural Gas	6.7480%
Nuclear	34.9210%
Renewable Energy	
Biomass	0.0007%
Captured Methane Gas	0.2357%
Solar Voltaic	0.0000%
Solid Waste	0.5883%
Water	0.9251%
Wind	0.4916%
Wood / Wood Waste	0.2197%
Subtotal Renewable Energy	**2.4410%**
Total Supply Mix	100.0000%

Air Emissions

Average Emissions Rates for the PJM Region:

Carbon Dioxide (CO2) is a "greenhouse gas" which may contribute to global climate change. Sulfur Dioxide (SO2) and Nitrogen Oxides (NOx) released into the atmosphere react to form acid rain. Nitrogen Oxides also react to form ground level ozone, an unhealthful component of "smog".

Emission Type	Lbs./MWh	Percentage of PJM Average
Nitrogen Oxides (NOx)	1.9875846	100.0%
Sulfur Dioxide (SO_2)	7.0209065	100.0%
Carbon Dioxide (CO_2)	1219.5404	100.0%

The benchmark emission levels that are shown approximate the emission rate for all electricity generation in the PJM region. Data used to calculate the emission profile came from (1) generator owner-entered values (2) EPA generator-specific emission factors based on 2003 CEMS data (3) EPA plant emission factors from eGRID or (4) fuel type default emission factors.

The information on this disclosure is required by the Maryland Public Service Commission. An annual disclosure report is also provided to the Maryland Public Service Commission. For further information regarding this disclosure or to obtain a copy of the annual report, contact MidAmerican Energy Company at www.midamericanchoice.com or by phone at 1-800-432-8574.

5/8/2009

Item	Coding Result for Maryland
Number of fuel types listed in “fuel mix”	11
Emission levels	Yes
If present: Number of emission types	3
Information about non-gaseous emissions	No
Price information	No
Environmental impact education / explanation	Yes
Consumer choice education / explanation	No
Non-Essential information	No
Comparisons	
Power Mix	No
Emission levels	Yes
Other (which)	N/A
Number of pages	1
Number of tables	2
Number of items per table	8
Number of pie charts	0
Number of items per chart	N/A
Number of bar charts	0
Number of items per chart	N/A
Number of pictures, other graphics	0
Number of text paragraphs	4
Number of different font sizes	3
Number of different font colors	2
Number of underlined words / expressions	0
Number of bolded words / expressions	4
Number of different background colors / shadings	4
Numbers presented in fractions	No
Numbers presented in decimals	Yes
Numbers presented in percentages	Yes
If more than one is used, which dominates	Percentages
Overall structure score	3 of 5
Paragraph length	Short (1)
Text density / difficulty	
Word count	250
Sentences per paragraph	2.5
Words per sentence	19.5
Flesch Reading Ease score	16.9
Flesch-Kincaid Grade Level score	15.7
Source of information stated	No
Referral to other sources of information	Yes
Historical information / trends over time	No
What part of the label grabs immediate attention (list)	Fuel Mix table

Appendix D – Survey Questions

What part of the label is most noticeable to you? Please answer this based on your first glance at the label. Not all answer choices apply to each label presented.

- ☐ The table showing the fuel mix
- ☐ The table showing emission levels
- ☐ The bar / pie chart(s)
- ☐ The text passages
- ☐ The picture(s)
- ☐ Other

On a scale from very poor to very good, please rank how well the label performs on each of the following attributes.

	Very poor	Poor	Neutral	Good	Very good
How understandable is the label?	☐	☐	☐	◉	☐
Does the structure make the label easy to follow?	☐	☐	☐	☐	◉
How do you rate the explanation of environmental impacts?	☐	☐	☐	☐	☐
How does the label help you put the utilities performance into perspective compared to other choices?	☐	☐	☐	☐	☐

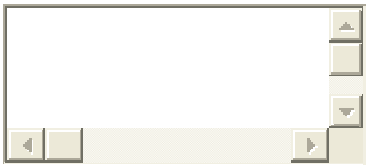
Which are the two labels you like best? (Feel free to elaborate on your thought process in the box below)

- ☐ California
- ☐ Colorado
- ☐ Connecticut
- ☐ Maine
- ☐ Maryland
- ☐ Minnesota
- ☐ New York
- ☐ Oregon

Which are the two labels you like least? (Feel free to elaborate on your thought process in the box below)

- ☐ California
- ☐ Colorado
- ☐ Connecticut
- ☐ Maine
- ☐ Maryland
- ☐ Minnesota
- ☐ New York
- ☐ Oregon

Comments



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