

Loper, Taran; Crittenden, Victoria Lynn

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ENERGY SECURITY: SHAPING THE CONSUMER DECISION MAKING PROCESS IN EMERGING ECONOMIES

Taran Loper

Babson College, USA

Victoria L. Crittenden*

Babson College, USA

Abstract. *Energy security is a universal concern among all countries, with all nations struggling for a sustainable solution. Solar technologies are a particularly beneficial utility for emerging economies due to both geography and affordability. Solar Photovoltaics (PV) is one of the highest potential growth markets in emerging economies due to the ability for small-scale systems to be placed on residential rooftops. Distribution of PV to individual homeowners is a new buying and selling process for what has traditionally been a business-to-business marketplace. Because the consumer market is at an infant stage in emerging economies, the messages that PV companies send to consumers will ultimately shape consumer perception about renewable energy. Through content analysis of websites from 12 companies in two of the BRICS markets, this research explores the similarities and differences with regard to consumer-facing messages among companies of various sizes in the two markets.*

Key words: *sustainability; developing markets; energy; solar photovoltaics; content analysis*

1. Introduction

Energy security is defined by the International Energy Agency (2015) as “the uninterrupted physical availability of energy at a price which is affordable while respecting environmental concerns.” Energy security is a universal concern among all countries, with nations struggling for a sustainable solution. Fossil fuels account for 78% of the world’s energy consumption (REN21, 2014). The extraction, transportation, and combustion of these non-renewable resources are known to cause environmental degradation through pollution and carbon emissions, therefore threatening human health and quality of life, ecological balance and biological diversity (Asif, 2007). Thus, Devabhaktuni et al. (2013) call for the aggressive investigation of alternative energy sources, with

* Corresponding author: Malloy Hall – Suite 211, Babson Park, MA 02457, USA, phone: 781.239.5715, email: vcrittenden@babson.edu

Wüstenhagen et al. (2007) noting that market acceptance of renewable energy is the most under-researched angle in the field of renewable energy.

While fossil fuel consumption increased by 23% among developed countries between 1980 and 2010, consumption in developing/emerging countries grew approximately 150% (Blázquez, 2012). With energy consumption growing rapidly in emerging economies, renewable energy sources are the most promising solutions to mitigate environmental damage and energy security concerns. A renewable resource is defined as any source of energy that is naturally regenerated over a short time scale (Bhatia, 2014). This includes “clean” power sources (those that can be continuously operated with an extremely light environmental footprint) and non-clean, traditional sources. Clean sources of renewable energy include geothermal, hydropower, solar photovoltaic, concentrated solar thermal power, wind power, and ocean power (REN21, 2014). Traditional renewable sources are those using biopower, which include the use of wood or biomass, municipal solid waste, or agricultural waste to produce electricity, usually through a process of combustion (Miljkovic, 2015).

Solar Photovoltaics energy generation is the fastest growing sector of renewable energy capacity, increasing at a rate of 39% annually (REN21, 2014) and reaching an estimated global market size of US\$100 billion in 2013 (Aanesen et al., 2012). Solar Photovoltaics (PV) are stand-alone energy generation systems that consist of photovoltaic modules that convert solar radiation into electricity (Paul & Uhomoibhi, 2012). There are no moving parts and the PV cells produce electricity with an efficiency of 15–30% (Wright & Boorse, 2014). One of the highest potential growth markets for PV is distributed small-scale systems on residential rooftops in emerging economies. Devabhaktuni et al. (2013) suggest that solar technologies are particularly beneficial utilities for emerging economies since many developing countries are located in regions with optimal access to the sun’s rays and because the technology is relatively affordable for homes and villages. The PV technology has the potential to significantly reduce electricity demand from grid-connected consumers. Importantly, it also enables rural off-grid homes to become electrified without needing to develop a power distribution infrastructure. Similar to commercial- and utility-scale solar systems, increasing residential solar systems depends on government policies to make the investment attractive to homeowners (under favorable regulatory conditions, homeowners can often see an investment breakeven in five to seven years).

Herein, however, lies the crux of the PV marketing problem. That is, large scale projects have been secured through government proposals involving a traditional business-to-business decision-making process. Much of the country-specific renewable energy research has focused on the macro (e.g., governmental and political) aspects as related to large-scale installations, particularly with regard to partners and investors (e.g., Wang et al., 2015; Wüstenhagen et al., 2007; Karekezi, 2002). Distributed PV to individual homeowners is an entirely different selling and buying process that requires a consumer-facing strategy, with Wüstenhagen and Menichetti (2012) encouraging scholars to pay particular attention to the determinants in the consumer’s strategic choice process.

This paper aims to understand how small-scale PV installation companies are using marketing messages in emerging economies to grow the business in a constantly changing international political economy. All facets of the research context, including macroeconomic forces and regulatory structures, are critically important to understanding how companies communicate with customers. Because such contextual forces play a foundational role in shaping the corporate environment, findings of the analysis will inevitably be influenced by them since policy messages might be translated into consumer-facing messages. It was not the purpose of this study, however, to identify or evaluate specific economic or political structures, but rather to evaluate corporate actions in the contextual environments that have been recognized and assessed to this point.

The paper is organized as follows. The next section briefly describes solar energy research in emerging economies. Within the context of emerging economies, research related to both Brazil and China is discussed since these were the two country sites in which consumer-facing information was explored for the current research. The rationale for choosing these two countries is noted as well. In the third section, the research questions explored in this exploratory research are explained, the sample companies examined in the research project are described, and the content analysis via the use of Nvivo is explained in detail. Next, the thematic results derived from the qualitative research within a small sample of companies are discussed. These results can become the foundation for future relational testing in a larger sample size of consumers and/or companies. Finally, with regard to the need for both breadth and depth, the major limitations of the study are discussed within the overall preliminary implications as related to Brazilian and Chinese companies.

2. Solar Energy in Emerging Economies

According to Oparaku (2006), solar energy technology in developing economies has been under the monopolistic management of government controlled agencies. Thus, the research that has looked into the use of this particular renewable energy for residential purposes has been guided by macro-economic variables related to the adoption of the technology. Martinot et al. (2002) and Nieuwenhout et al. (2001) reviewed the literature to offer insights into experiences related to solar PV adoption in developing countries. Not surprisingly, both sets of researchers found numerous policy-related issues with regard to adoption but little to no consumer-oriented data.

The consumer-oriented studies that have been conducted have shed minimal insight on the consumer decision making process when it comes to solar energy. In a solar lantern study in India, Velayudhan (2003) found that the government was the information source used by individual lantern purchasers. This was not surprising given the previously mentioned agency control. In their lighting study, Wijayatunga and Attalage (2005) surveyed 125 households in Sri Lanka regarding the solar technology that replaced kerosene lamps for household lighting requirements. While the impetus for the research was concern

about aggressive marketing initiatives pre-empting informed consumer decision-making, the outcome of the study focused more on satisfaction with solar versus kerosene as an energy source. Similarly, Ellegård et al. (2004) found that rural consumers in Zambia enjoyed the use of solar energy services and were willing to pay for such resources. Alternatively, however, Karakezi (2002) reported that analysts thought solar PV was not an option for meeting the needs of Africa's rural poor, with Wamukonya (2007) indicating that African consumers had misconceptions about solar power services. Thus, while there is considerable research suggesting a positive relationship between economic growth and electricity consumption (Akinlo, 2008; Chen et al., 2007; Lee, 2005; Narayan & Smyth, 2009), research at the consumer decision-making level is scarce.

Even with the lack of consumer research on solar energy technology, strong economic and demographic growth highlights important issues of energy security in emerging economies. To this end, economists expect the BRICS emerging economies to maintain growth rates above 4% annually, resulting in an aggregate GDP that will surpass the European Union by 2016 (Schwab, 2015). Furthermore, the BRICS population represents around 45% of the world's population in 2016. Thus, the two BRICS countries of Brazil and China were the focus of the current research. Brazil has the highest portfolio of renewable energy generation in the world with 83% of its produced energy coming from renewables in 2014 (BMI, 2014a). China, on the other hand, is the world's largest total emitter of pollution and greenhouse gases.

2.1 Brazil

With its focus on renewable energy, Brazil has a heavy emphasis on large-scale hydropower, with 90% of its renewable energy coming from hydro plants in 2014, the largest ratio of hydropower production in the world. This presents an energy security challenge, however, due to prolonged droughts causing steep increases in the price of electricity. As a result, non-hydro renewables are forecast to grow 5% annually between 2014 and 2023 (BMI, 2014a).

Brazil's power sector is expected to experience significant growth in the years ahead due to the need to diversify the power mix, government commitment to power supply expansion, and considerable untapped domestic renewable resource. PV is expected to play a growing role in the energy diversification with goals of 3.5 GW of solar installed by 2023 (BMI, 2014a). The residential PV market in Brazil is extremely new but is expected to grow, which is why companies have only recently begun selling small-scale systems. Brazil's market was created in April 2012 when Resolution 482 was passed by ANEEL, The Brazilian Electricity Regulatory Agency (Agência Nacional de Energia Elétrica, 2012). Informally, this legislation is known as Net Metering. The passing of net metering was the defining moment for the Brazilian residential PV market because it made rooftop systems financially viable for homeowners. Under net metering laws, small-scale generators can sell-back excess electricity production to the grid, therefore paying only for the *net* grid electricity used (SEIA, 2013).

Current estimates show residential PV capacity has continued to increase at an average annual rate of 70% in Brazil (Preiser et al., 2014). Rooftop systems have not yet seen the boom in growth that was experienced by developed countries like the USA and Germany. Although policies favor homeowners, the relatively slow growth rates are a sign that companies are struggling to establish a secure model for business-to-consumer sales.

2.2 China

China remains under international pressure to reduce pollution and greenhouse gases. To this end, installed capacity of renewables is forecast to increase at an average annual rate of 11% between 2014 and 2023. If China follows through with the pledge to cap carbon emissions and increase the use of zero-emission energy sources to 20% by 2030, this forecast would likely increase substantially in the PV sector (BMI, 2014b).

China is an interesting and complex environment for solar PV as the world's leading manufacturer of PV panels and the second highest installed capacity. For several years, China has been the primary manufacturer of solar modules, exporting to developed countries where markets are booming (Parkinson, 2013). Recently, however, China has grown in consumption of solar PV, accounting for nearly one-third of global installations in 2014. The country added a record 12.9 GW in capacity, nearly tripling total Chinese capacity to approximately 20 GW. China employed 1.58 million people in the Solar PV industry in 2013, 69.5% of all solar PV jobs worldwide (REN21, 2014).

The Chinese government is ramping up funding for solar projects, the majority of which are extremely large-scale utility projects in rural Western China where existing grid distribution is difficult. The government recently pivoted focus to distributed generation, setting a goal of increasing the current 2 GW capacity of distributed PV tenfold to 20 GW by the end of 2015 (REN21, 2014).

The development of China's residential market is a little more complicated than that of Brazil because regulations are much more diverse in structure and function. While the majority of these regulations were passed over the past five years, the State Council did not formally encourage the installation of residential PV until 2013 (Lee, 2013). Like Brazil, China has a net metering policy where surplus energy is sold back to the grid at a benchmarked price of local coal-fired power (Chadbourne & Parke, 2014). The central government also provides consumers with grants of approximately US\$0.07 per kilowatt hour of output for solar energy generation. These grants are valid for 20 years (Liang, 2014). Local governments have also begun initiating grant programs where solar companies and customers can earn internal rates of return of 10-16% on the PV equipment investment. These grants are shorter in term, usually lasting 3-5 years (Chadbourne & Parke, 2014).

3. Research Questions and Inductive Methodology

Wamukonya (2007) suggested that consumers were likely to have misconceptions about the services that solar power can provide their homes, and Oparaku (2006) went

so far as to suggest that most consumers in developing countries were not aware of the technical viability and commercial availability of PV to meet energy needs. Because the market is at an infant stage in emerging economies, the messages that PV companies send to consumers will ultimately shape consumer perception about renewable energy and residential PV in particular. After exposure to company messaging, consumers are likely to incorporate the marketing content into their own decisions. For example, if many companies stress the low cost of installation for their PV systems, consumers may understand “low installation cost” to be a very important factor when buying a PV system. This expectation leads to the first research question explored in this study:

- 1) *What variables of PV systems are companies communicating to shape the consumer's decision-making framework for purchasing a PV system?*

Additionally, PV companies serving emerging markets include multinational corporations, domestic nationals, and small- to medium-sized businesses. It is expected that these companies are different in the way they attract new customers and sell PV systems; that is, variables that foreign multinationals emphasize are expected to be different from those emphasized by domestic nationals and even more so when compared to small- to medium-sized businesses. *A priori*, one would expect that local companies emphasize more “customized” variables that are aligned with the specific needs of the local target audience, while large, foreign companies would provide more “standardized” variables that remain the same regardless of the local market (Ellegård et al., 2004). This leads to the second research question explored in this research:

- 2) *To what extent are companies customizing content variables to attract customers based on culture, demographics, or other attributes of the local market?*
 - a. *How do variables differ among companies of different sizes?*
 - b. *How do variables differ among companies in Brazil vs. companies in China?*

The research methodology employed in this study to gain an inductive understanding of the variables used by PV companies to communicate with potential customers was a content analysis of consumer-facing marketing material¹ from a small sample of PV companies in Brazil and China. Often referred to within the context of inbound marketing, this consumer-facing material is that used by the PV companies to draw customers in through interesting and engaging content on the companies' websites. According to HubSpot (2015), “By aligning the content you publish with your customer's interests, you naturally attract inbound traffic that you can then convert, close, and delight over time.” Harad (2013) describes this type of messaging as a way to communicate without selling by attracting prospects and building trust. As a strategic marketing approach, the focus is on creating and distributing relevant information that will ultimately result in profitable action by the potential consumer (Content Marketing Institute, 2016). Given that solar energy is a relatively new technology for individual

¹ This consumer-facing marketing material is often referred to as “content marketing.” However, since content analysis was the research methodology employed in this project, we refrain from using the content marketing term so as to avoid confusion.

consumers, the information provided by PV distributors likely contributes to framing the variables of importance in the decision to purchase or not to purchase.

As such, knowledge of the consumer decision-making process is considered critical to the success of consumer-facing materials (Rahim & Clemens, 2012). Historically, the consumer decision-making process has been depicted as a five-step process comprised of need recognition, information search, evaluation of alternatives, purchase, and post purchase behavior. Kabani (2013), however, simplified this process within the context of online marketing to the three steps of attract, convert, and transform. Regardless of whether a three- or five-step process is involved in awareness to conversion process, the data suggests that while the buying behavior of consumers in both developed and developing countries is influenced by renewable energy, sustainability is rarely the primary motivator at the point of purchase (Bemporad et al., 2012; Nielsen, 2015; Umpfenbach et al., 2014). Since consumer-facing marketing messages are intended to impact the consumer decision-making process at specific points in the process (Court et al., 2009), solar PV companies appear to be developing and offering marketing messages driven by what the companies want consumers to know – not by consumers seeking answers to particular questions about solar PV. As such, it is possible that solar PV companies in emerging economies are shaping consumer expectations of solar PV rather than consumers informing companies as to their desires and expectations. Words and visual imagery in website information have both practical and social impact as a communication function with regard to shaping consumers' thinking about products and services (cf. Hodder, 1994).

Companies operating in the PV residential installation sector vary in size, vertical supply chain integration, and national origin. There are three generalized categories of residential PV installation companies in Brazil and China: multinational corporations, domestic nationals, and small- to medium-sized enterprises (SMEs). The distinguishing factors of each category are shown in Table 1. Thus, the consumer-facing messaging might be influenced by the company background, which was reflected in the sampling of companies for the content analysis. To this end, this research seeks to better understand how solar PV companies are contributing to the shaping of consumer understanding and decision-making in making decisions related to residential energy security.

TABLE 1. Shared Attributes of Solar PV Installation Companies in Brazil and China

	Multinational Corporations	Domestic Nationals	SMEs
National Origin	Foreign	Domestic	Domestic
No. of Employees	1,000+	50-1,000	0-50
Vertical Integration	Highly Integrated	Somewhat Integrated	Not Integrated
Product Application Breadth	Residential, Commercial and Utility	Residential and Commercial	Residential Only
Product Line Diversity	Highly Diverse	Somewhat Diverse Product Lines	No Product Line Diversity
Company Age	10+ years	1-10 years	1-10 years

3.1 Sample Companies

According to Econess Energy (2017), there are 49 distributors/wholesalers of solar PV in Brazil and 128 in China. Yet, not all of these distributors/wholesalers are residential installers selling rooftop PV systems to homeowners. Large-scale business-to-business PV projects are regarded as the most profitable segment for energy companies, utility-scale projects are secured through government proposals, and NGOs and non-profit PV installers focus on electrifying the most vulnerable citizens in a given location. Given the exploratory nature of this research, in conjunction with the need for data to be derived from companies definitely operating in the residential PV marketplace, it was decided to go in-depth with a smaller number of companies and websites so as to hopefully gain depth of knowledge within the three generalized categories of companies. Given the nature of the qualitative research methodology, content analysis in use, it was deemed necessary to trade-off breadth of sample size for depth of coverage within companies.

TABLE 2. Company Classification

	Location	Category	Staff	Founded	Vertical Integration	Product Application Breadth*	Product Line Diversity	Offices
Canadian Solar	China	Multi. Corp.	1,001+	2001-2005	Highly	R,C and U	Somewhat	5+
Coray Power	China	Domestic National	51-200	After 2010	Somewhat	R and C	Not	1
Cotech Solar	China	Domestic National	201-500	2006-2010	Highly	R and C	Not	1
EBES	Brazil	SME	0-50	After 2010	Not	R and C	Not	1
Hotsunn Energy	China	SME	0-50	After 2010	Somewhat	R only	Not	1
Insole	Brazil	Domestic National	51-200	After 2010	Not	R,C, and U	Not	1-5
Rene Sola	China	Multi. Corp.	1,001+	2001-2005	Highly	R,C, and U	Very	5+
Rio Solar	Brazil	SME	0-50	1990-2000	Somewhat	R and C	Not	1
Ser Energia Solar	Brazil	Domestic National	501-1,000	1990-2000	Not	R,C, and U	Very	1-5
SunEdison	Brazil	Multi. Corp.	1,001+	Before 1990	Highly	R,C, and U	Somewhat	5+
Sunworth Solar	China	SME	0-50	2006-2010	Somewhat	R and C	Somewhat	1
Yingli Solar	Brazil	Multi. Corp.	1,001+	1990-2000	Highly	R,C, and U	Somewhat	5+

* R=Residential, C=Commercial, U=Utility

Considering these company-type parameters in conjunction with the exploratory, non-theory testing nature of the research, a preliminary understanding of consumer-facing variables was derived by analyzing web content of 12 companies operating in Brazil and China. Two PV companies per country were chosen in each of the three identified categories (multinational corporations, domestic nationals, SMEs). The 12 companies were selected after randomly reviewing company websites to ascertain the depth of available information. Table 2 provides a general overview of each of the companies. To this end, the inductive nature of the research supports the use of information gathering for the purpose of generating premises for which later statistical testing can be conducted. Thus, the conclusions drawn from this research methodology using this small sample size should be used for laying the groundwork for later testing in relation to consumer-facing materials.

3.1.1 Multinational Corporations

Many large, international solar powerhouses are moving into China and Brazil PV markets in strategic attempts to expand international dominance. Most of these solar installation corporations, which are foreign to both Brazil and China, were founded in developed countries where solar markets were first created. Residential, commercial, and utility-scale projects are often all included in the company's operational mix. These players have advantages of scale, industry experience, existing supply chains, and financial backing. These factors allow foreign companies to reduce risk associated with opening new international divisions. All companies in this category, regardless of the location category, operate in both China and Brazil. Companies were categorized based on the website location. Canadian Solar and Rene Sola, for example, both host dedicated websites for a Chinese audience. Similarly, SunEdison and Yingli Solar both host dedicated sites for a Brazilian audience.

It is important to note that Rene Sola was actually founded in China and is therefore not a foreign entity to the country. Because China is home to a vast majority of PV manufacturers that are beginning to expand into small-scale installations, very few foreign companies are entering the Chinese installation market. In fact, Canadian Solar is the only multinational corporation that hosts a dedicated Chinese website, hence the selection of Rene Sola, a Chinese company, to fill the category.

3.1.2 Domestic Nationals

Another category of companies is those that were founded within the country of operation and maintain primary operations within the country. These companies often have roots in other sectors of the solar industry or the broader energy efficiency market, such as solar lighting or heating and air-conditioning products. Diverse product lines give companies advantages of broader industry expertise. A domestic national company may also have a wide product applications breadth, including commercial or utility-

scale installations, giving it advantages of serving a broader customer base. Domestic nationals have grown their size and market capitalization from operations in these sectors and have begun operating in the residential sector. Advantages within this category include cultural knowledge and experience, as well as financial backing and industry experience. But often these companies are not experienced in the residential sector.

3.1.3 Small- to Medium-Sized Enterprises (SMEs)

The last category of solar installers includes the companies that operate much more locally, usually within the metropolitan region of one major city. Typically founded within the last 5-10 years as a result of regulatory actions making the market profitable, the primary function of these companies is residential or small-scale commercial installations. Often with no advantages of scale or experience, small- to medium-sized local enterprises have the biggest advantage in understanding local customers in terms of cultural preferences, buying behavior, and demographics.

3.2 Content Analysis

Content analysis is a widely-accepted research method across many disciplines. Although the methodology varies in specific definition, researchers agree that distinguishing characteristics of content analysis are that it must be *objective*, *systematic*, and *quantitative* (Kassarjian, 1977). Content analysis of consumer-facing marketing data enabled inferences to be made as to how companies of various sizes and nationalities attempt to shape the consumer decision-making process for purchasing residential PV. The consumer-facing marketing material included in the content analysis included any form of digital website communication that originated from the company where the intended audience was residential PV customers. In the context of this study, web pages of the select group of Brazilian and Chinese solar companies were the subject of analysis. This included all text and imagery, as well as business material intended for public visibility such as pamphlets and any other business-to-consumer communication that could be found and accessed on the company website.

All consumer facing marketing material subject to analysis must have originated from the business and not reflect the preferences, perception, or choice of any customers. The analysis, therefore, did not reveal the impact or effect of the business communication; rather, the content analysis transformed the subjective, qualitative messaging of the 12 companies into objective and quantitative data that could be compared across companies.

The process of collecting content from each of the companies involved capturing and organizing company web pages in Nvivo. The data management capabilities of the Nvivo software enable the researcher to organize material from a variety of text- and image-based sources and derive insight in a transparent, comprehensible, and retraceable manner (Kaefer et al., 2015). The organization and coding available through the

use of Nvivo enables a meaningful approach to categorizing qualitative data (Brown et al., 2007). Nvivo has been used in a variety of qualitative marketing research studies, involving a wide range of topics and contexts such as social media usage, not-for-profit, banking, sales, segmentation, and tourism (Beninger et al., 2016; Liu & Ko, 2012; Olotu et al., 2010; Malshe et al., 2009; Bailey et al., 2009; Pan et al., 2007).

Although collection processes were standardized for all companies, the total quantity and variety of content assembled were not constant among companies. Some companies offered a larger and more diverse sample of content, risking the skewing of data. The research accounted for such instances by weighing each piece of content in relation to the overall quantity of content provided by measuring word counts. This way, the importance of each message was determined by its context, rather than content from other companies.

3.2.1 Analytical Process

Hsieh and Shannon (2005) identified three approaches (conventional, summative, and directed) to content analysis. The approaches are separated by differences in coding schemes, origins of codes, and threats to trustworthiness. In the conventional approach, codes are derived from the data and defined during the analysis. This is the most common form of qualitative analysis and is often used when no previous expectations exist. The codes for directed and summative approaches, however, are defined before the analysis begins. The current study was a blend of both the conventional and directed approaches.

Prior to analyzing content from the 12 sample companies, an unstructured analysis of PV company websites in the developed countries of the USA and Germany was conducted merely to gain an overall understanding of the categories of messages used in the industry. These two countries were selected based on the adoption of PV and language differences (with English being the primary language of the research team and Germany enabling practice at exploring non-English websites). This unstructured analysis revealed six repetitive categories of words that occur throughout the content: (1) cost savings, (2) installation costs, (3) regulatory support, (4) macroeconomic forces, (5) energy security, and (6) environmental concern. These categories in developed countries allowed for a set of guiding attributes to use as initial codes when beginning the analysis in Brazil and China (directed content analysis). At the same time, categories of messages were expected to emerge from the data as coding took place (conventional content analysis).

The coding process started with the guiding set of attributes, then required word-by-word reading, the highlighting of exact words and phrases that captured key messages, and the eventual development of codes and categories of codes that represented more than one key thought. After a first round of coding and categorizing content, definitions of categories were established to structure a framework for a second round of coding. Another round of coding established the reliability of the coding process, ensuring no

missed codes and that the coding process was as standardized as possible. Following a peer evaluation-style process comparable to that suggested by Miles and Huberman (1994) and utilized by Brown et al. (2007), a single coder utilized constant constructive discussion to facilitate the ongoing coding process. This coding and categorizing process helped shape the diversity of data, allowing for a relational analysis to occur.

After deducing variables from the analysis, the content was further analyzed to understand how variables appeared in relation to other variables, as well as the larger context. To accurately prepare the data for relational analysis in the website context, there were two types of codes. The first, message codes, identified the message conveyed in the content. These codes were idea-based and included all of the *a priori* attributes identified in the preliminary review of USA and German companies. The second type of code, characteristic codes, identified the format or medium of the content. Thus, characteristic codes were tangible features of the content, comprised of the different sections of a website. Figure 1 provides an example of how a sentence from the “About Us” page from Yingli Solar was coded.

Content Message	Codes
<p>Yingli Green Energy Holding Company</p> <p>Limited (NYSE: YGE) is one of the world's largest</p> <p>fully vertically integrated PV manufacturers,</p> <p>which markets its products under the brand</p> <p>“Yingli Solar”.</p>	<div> <div>Establishing Trust – message code</div> <div>About Us – characteristic code</div> <div>Supply Chain – message code</div> </div>

FIGURE 1. Yingli Green Coding Example

In this example, the whole sentence was coded as the “About Us” characteristic code because it was found in that section of the website. The other two codes, “Establishing Trust” and “Supply Chain,” were message codes because they were found by examining the ideas of the message. This example also displays how codes are not mutually exclusive. Separating the codes by these types helped clearly identify relational properties when analyzing the data. While message codes were modified and restructured throughout the analysis under the guiding *a priori* attributes, characteristic codes were much more structured due to the tangible nature.

Performing content analysis on images required some amount of subjectivity because images can be interpreted and perceived in a variety of ways. It is important, however, to approach image analysis with the same systematic method as textual analysis,

whereby the image’s *message* was coded to one or more of the established variables. Images need not convey a specific message, however, as they may simply enhance the visual experience of the website. Regardless of the image’s message, images were coded to a separate *characteristic* coding scheme to incorporate what the image was depicting. This coding method applied to all images and graphics. Any imagery that did not fall under one of the following subjects was coded under the umbrella code “images and graphics” to allow for matrix analysis between images and messages.

3.2.2 Coding Results

During the first round of coding, the coding scheme was altered multiple times as new categories of message codes emerged. The six *a priori* attributes quickly evolved into larger categories and gave way to new attributes. For example, “Installation Costs” and “Cost Savings” were combined, while “Macroeconomic Forces” became a parent code that housed new subsets of child codes. Figure 2 depicts the increase in the total number of codes, moving from the six *a priori* attributes to 23 possible codes.

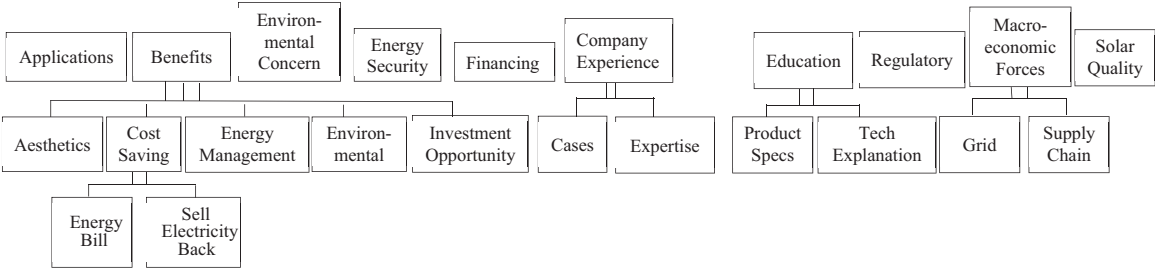


FIGURE 2. Coding Scheme after Round One Coding

Among the 23 possible codes, sub-codes were established to more accurately represent the source’s message, allowing the content to be coded as a broad category or a more specific subset of that category. This turned the originally flat hierarchy into a multi-tiered organizational structure. Parent codes are the categories that hold a portfolio of codes underneath. For example, content was coded under the parent code “Benefits” if it conveyed a message about the product or service benefit for the consumer. If the message was more specific about the aesthetics of the product, however, it was coded under that child code. It is important to note that not all content would fit under a child code within a given category. Child codes simply represented the most common occurrences within a category and were certainly not an exhaustive list. For example, a web page that referenced the low maintenance required for a solar system was coded generally under “Benefits” because it did not fall within one of the five child codes.

Developing a more structured coding hierarchy offered a way to organize the collection of disparate data into categorical buckets, allowing the research process to move closer toward identifying themes and concepts. Categories also enabled a more complex and critical analysis of the data once coded, since queries utilized aggregated data

or standalone codes to study relationships. Furthermore, a categorical coding scheme began to reveal existing marketing communication concepts that have played a role in determining company communication strategies. Repetitive messages across content sources showed that there were re-occurring themes and ideas that multiple companies found value in communicating to customers.

Prior to the second and final round of coding, it was intrinsically important to identify specific inbound marketing concepts to not only sharpen the accuracy and relevancy of the coding scheme but also to develop an analytical framework for running queries and exploring the coded data. Saldaña (2015) emphasized the crucial role that a final coding scheme plays in the analysis, thus enabling coded content that allows the data to be queried for answers and creating the opportunity to draw relationships between themes via a standardized framework. To this end, Jefferson and Tanton's (2015) principles for inbound marketing and Cialdini's (2009) principles of social influence formed the basis for the analytical framework utilized in the final stage of the research process.

These principles, while offering guidelines for creating marketing communication content, provided themes for evaluating marketing messages. The themes derived from these principles and utilized in the second round of coding were:

TABLE 3. Description of Round Two Coding/Analytical Framework

	Framing the Message		Establish Trust	Education	Specialization
	Company vs. Customer	Product vs. Solution			
Coding scheme elements used in analysis	<ul style="list-style-type: none"> • Benefits, Applications (customer) • Company experience, Quality, Expertise, About us (company) 	<ul style="list-style-type: none"> • Product • Solution 	<ul style="list-style-type: none"> • Cases • Company experience Quality Expertise 	<ul style="list-style-type: none"> • Technological explanation • Product specs • Macroeconomics • Regulatory support 	<ul style="list-style-type: none"> • Images of homes
Goal for effective communication	Don't just say why you're the best, say how you help customers the best	Don't just say what it does, say how it solves a problem	Provide social proof (customer testimonials)	Gain authority as an expert. Give away free information so readers feel indebted	Personalize message for a specific customer's needs
Company challenges	Focusing too heavily on company messages	Focusing too heavily on product messages	Compromising for a short company history in a new market	Introducing a very new, complicated technological innovation	Identifying a specific target market; Awareness of customer preferences
Influencing theories	"Put customers first" (Jefferson & Tanton, 2015)	"Help don't sell" (Jefferson & Tanton, 2015)	"Social proof" (Cialdini, 2009)	"Reciprocation" "Authority" (Cialdini, 2009)	"Niche" (Jefferson & Tanton, 2015) "Liking" (Cialdini, 2009)

1. Framing the message
 - a. Company vs. Customer
 - b. Product vs. Solution
2. Establishing Trust
3. Education
4. Specialization

Table 3 provides a detailed explanation of each theme, including the codes used to analyze the theme, the goal for effective communication, company challenges, and influencing concepts within the category.

4. Thematic Results and Discussion

The four themes provided a framework to query the coded data, creating a standardized method to compare customer-facing marketing efforts. While each individual company revealed its inbound marketing strategy by providing results in each theme, the data also allowed comparisons to be made among different classifications of companies. For example, the extent to which companies of varying levels of vertical supply chain integration were specializing products for a specific target market could be examined. Importantly, this thematic approach, utilizing categories, similarities, and differences, enabled the analysis to be influenced by theoretical insights pertaining to marketing in general and inbound marketing in particular while allowing the data to speak for itself (Liu & Ko, 2012; Welsh, 2002).

4.1 Framing the Message

How companies choose to frame their message plays a big role in how that content is perceived by customers. If the marketing message is focused heavily on the company instead of the customer, it can come across as being too self-promotional or pushy. Similarly, if the content is focused largely on the product instead of the problem the product is solving, the message efficacy may be lost.

4.1.1 Company vs. Customer Content

The balance between company-focused content and customer-focused content is critical to turning a site visitor into a lead. Marketing wisdom suggests that a company needs to communicate how its products or services meet the needs, wants, and demands of its customers and, thus, comprise the consumer-facing message. For this research, customer messaging content included the following codes:

- Benefits: Language that conveys how solar benefits the user
- Applications: Language that conveys the variety of applications for home users, including grid-connected and off-grid systems
- Financing: Language that describes methods of financing a home system

At the same time, a company must establish legitimacy in the eyes of the customer and use website content to position itself as an expert. Because residential PV is such a new market in these developing economies, there is little to no brand recognition among prospective customers. Therefore, companies must use either a higher-than-average percentage of website real estate for company content or more effectively communicate company content to educate customers. Thus, company message content included the following codes:

- Company experience: Language that communicates company history, staff experience, or any message of experience that is not a case study
- Expertise: Language that communicates company services, industry knowledge, or why the company is the “best” in the industry
- Quality: Language that communicates the company’s product or service quality, including certifications and warranties
- About us: Section of the website that describes who and what the company is, usually in a single paragraph (this section was only coded once, even if it was included in multiple areas of the website)

According to Jefferson and Tanton (2015), companies should strive for a 4:1 ratio, with 80% customer-centered content and 20% company-focused content. All 12 companies in the study, on average, used about 10% of total website content for customer-centered information and about 13% for company-centered information. However, although there was little difference within the aggregate data, breaking down the analysis by classification revealed interesting variances.

Companies with a longer history tended to use a larger percentage of website space (as determined by word count) to communicate information about the company. More specifically, PV companies founded before 2005 used approximately 26% of the total website word count to highlight information about the company. Alone, this might not seem negative. However, when compared to a mere 5% for customer-centered content, this should raise a red flag. Among these older companies, the ratio of customer to company content was almost completely opposite of what Jefferson and Tanton (2015) recommended. Newer companies (those founded between 2006 and 2010), on the other hand, had a much more balanced occurrence of the two frames (8% customer content and around 9% company content).

The message frame was also fragmented by company size. Small- and medium-sized enterprises (SMEs) and domestic nationals exhibited somewhat balanced company (7% for SMEs and 11% for domestic nationals) and customer (10% for SMEs and 7% for domestic nationals) content. However, multinational corporations emphasized their experience and expertise with 17% of the frame devoted to company information and only 8% devoted to customer material.

Finally, when examining the data between two geographic locations, a clear distinction appeared. China was much less concerned with communicating customer-focused information than Brazil, with only 5% of its data focused on the customer versus 13%

for Brazil. Additionally, Brazil was much more balanced with regard to the customer-to-company content ratio, coming in almost 1:1 compared to China with a 1:3 customer-to-company content ratio.

4.1.2 *Product vs. Solution*

Meerman Scott (2011) claimed that customers care about a company solving their problems, not about a company's products or services. This distinction was captured in the data with the following two sub-themes:

- **Product Frame:** The message focused on how the *product* benefits something or someone. These messages were built around the product as a tool to deliver benefits without mentioning how it solved a problem or satisfied a customer need or want. Very often, these messages were stated without mentioning the customer at all and, instead, described an ambiguous beneficiary.
- **Solution Frame:** The message focused on how the product's benefits *solved* a problem or *satisfied* a customer need or want. With a solution frame, the customer understands exactly how a benefit translates into their lives. The content essentially answered the questions, "So what? Why should I care?"

The following sentences exemplify the difference between the two frames:

Product: "The solar system helps reduce electricity costs."

Solution: "The solar system helps you save up to 95% on your electricity bill."

As shown, a small change in phrasing turns a product frame into a solution frame.

Not surprisingly, it is easier to frame some benefit categories as solutions than others, simply due to the nature of the benefit. For example, the analysis found that only 28% of "Energy Management" benefits were framed as a solution, compared to 73% of "Energy Bill" benefits. When discussing the ability to see one's energy consumption in real time, for example, a company can simply state that energy management is a benefit, rather than explaining how energy management translates into solving a problem. On the other hand, communicating electricity bill savings is much easier to frame as a solution because the benefit ties directly to a customer pain point—reducing expenditures.

Yingli Solar exemplified the technique of translating product-framed messages into solutions when discussing energy management in one of its case studies:

"Integrated system monitoring gives the convenience of being able to check earnings from the solar installation continuously."

Yingli Solar, Canadian Solar, and SunEdison comprised a small group of companies able to translate common product-framed benefits, such as "Energy Management" and "Environmental," into solutions, highlighting the ability of multinational corporations to successfully balance the frame of benefits. Across company size, multinational corporations framed 54% of all benefits as solutions, compared to 13% in domestic nationals and 29% in SMEs.

Between the two countries, Brazilian PV companies distributed the message frame evenly between product and solutions. However, Chinese PV companies only framed

16% of benefits as solutions. Many of the Chinese companies manufacture the solar products in-house, resulting in extensive product knowledge. As such, Chinese marketers tended to describe product benefits using technical product specifications, rather than communicating how those specifications could solve a problem for the customer.

4.2 Establishing Trust

According to Jefferson and Tanton (2015), consumers do not trust a sales message. Thus, the importance of legitimizing the company and garnering customer trust is critical to converting a website visitor into a lead. To this end, companies often use a blend of successful case studies, customer testimonials, experience, expertise, and quality to accomplish this feat. For the 12 PV companies examined, an average of 27% of the total website word count was devoted to establishing trust with the customer. Interestingly, Brazil and China were nearly equivalent when using website content to establish trust, with Brazil at 23% and China at 25% of the total website word count.

When examining the data by company size, however, there was a glaring difference in the frequency of establishing trust. Multinational corporations used trust messages

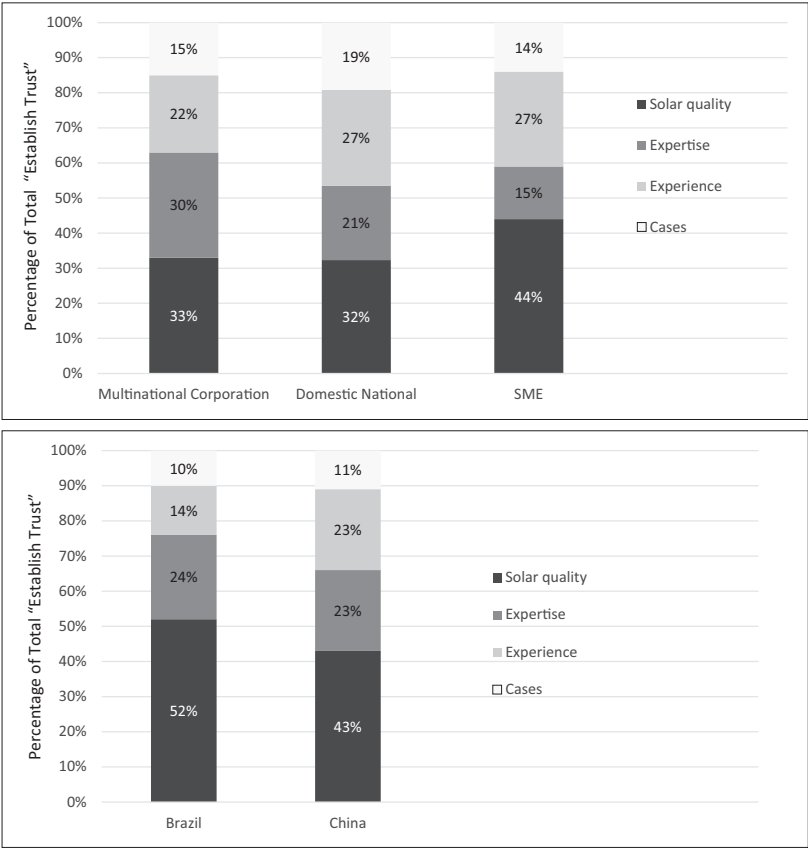


FIGURE 3. Establishing Trust sub-codes by Company Size and Location

at 33% of total website word count, while domestic nationals and SMEs were at 13% and 16%, respectively. It might be that multinational corporations simply have more experience and customer success stories to share, resulting in a larger portion of website content attributed to this cause. Comprising one-third of the total website content, this is likely an intentional strategy by large enterprises to establish the corporation as a market dominator with international reach.

Reviewing the data by the sub-codes of solar quality, expertise, experience, and case studies, in relation to the overall trust theme, offered a much clearer picture of how companies of various sizes depict trust in customer-facing content. Multinational companies tended to focus on experience more than double that of SMEs. Multinationals were not, however, leveraging customer success stories in the form of case studies more so than smaller companies. Despite the lack of experience in the industry, SMEs actually used the highest percentage (44%) of case studies to establish trust when compared to multinationals and domestic nationals. Using this same thematic sub-code breakdown by location revealed that China discussed its expertise significantly more than Brazil, with 23% of the total “Establishing Trust” theme composed of these messages. Brazil, on the other hand, used its successful case studies more than China, with 52% of the total theme composed of these messages. Figure 3 portrays sub-theme use for company size and company location.

4.3 Education

Education is a critical piece to the customer engagement strategies of Brazilian and Chinese PV installers because the solar PV technology is very complex and relatively new to these markets. According to Dholakiya (2015, p. 19), “Product or service complexity challenges successful communication because more people need to be educated on the technology.” Therefore, it would seem critical for all 12 PV companies, regardless of size or location, to have strong educational marketing messages facilitating ease of understanding the technology.

On average, companies used 26% of total website word count to educate the customer on how PV technology works, product specifications, macroeconomic forces, and regulatory support. Similar to the “Establishing Trust” theme, Brazilian and Chinese companies exhibited very little difference when using website content to educate the consumer; companies in both countries used approximately 25% of the total website word count for education. Viewing the data by company size produced a similar result, with the variance between size categories less than 6%.

Breaking down the theme by sub-code composition allowed for a deeper look into the education theme. This analysis showed that Chinese PV companies used a large percentage (82%) of educational content to explain product specifications, compared to 56% for Brazilian companies. This further emphasizes Chinese companies’ historical roots in the business-to-business marketplace. Because product specs are an essential element when selling to other installation companies, Chinese companies already had product details

available for distribution. Unfortunately, there is no data to suggest that residential consumers browse for solar PV products in the same way as business customers.

Additionally, the analysis showed that Brazilian companies used more educational content (16%) to educate the consumer on regulatory support than that used by Chinese companies at 3%. This difference might be attributable to policy regulations, as Brazil has a single, watershed policy that makes solar PV technology financially viable, whereas China's regulatory environment is much more complicated.

4.4 Specialization

Specialization refers to the extent to which companies customize content to adhere to a specific target market's preferences. According to Jain (1989, p. 70), "Standardization is the use of a standard marketing mix in all markets, while in contrast, adaptation [specialization] is the idea of customizing the marketing mix to meet the needs and wants of each consumer." Broadly, standardization leads to reduced costs, while adaptation leads to increased sales (Singh et al., 2005).

Specialization was the most difficult theme to measure due to the abstract nature of the target market and consumer preferences. While the effectiveness of specialization efforts could not be discerned without identification of the specific scope of each company's target market, the analysis could examine the extent to which companies customized content for the broad residential audience, the narrowest common denominator of specialization that all 12 companies shared. One method to accomplish this was calculating the frequency of images that contained single-family homes in relation to all website images. This image analysis showed that, on average, companies specialized 21% of their imagery to the residential market. With regard to the two country locations, companies in Brazil used a higher percentage (17%) of homes in the imagery mix, as compared to Chinese companies (12%). With regard to company size, domestic nationals allocated 19% of the imagery mix to homes, while multinationals and SMEs were at a 13% allocation.

To pursue the specialization theme a step beyond that available via visual imagery, each company's website was reviewed by the research team to assess possible specialization that might not be readily assessed with Nvivo. This analysis revealed that multinational corporations tended to communicate case studies from countries outside the one in which the company was being assessed (i.e., Brazil and China). For example, all of Yingli Solar's case studies showcased customer testimonials in Europe and the U.S., with no examples from Brazil where the website was hosted. Canadian Solar and Sun-Edison had similar results, with only a few domestic examples.

5. Conclusions and Implications

The analysis of customer-facing messaging from 12 solar PV companies offers several implications for companies operating in the energy arena, and these implications cross

a span of areas. With regard to context as related to emerging economies, the research shows that there is not one approach that is being taken to inbound marketing. Some of the clearest variances in the data were between the companies in Brazil and China. In particular, Chinese companies have extensive product knowledge about PV because most companies were founded as manufacturers, later vertically expanding into installations. Though this knowledge is useful for business-to-business sales, the level of detail could potentially drown consumers in too much technical information. Practically, Chinese companies might want to consider reducing the number of product downloads and replace unnecessary specification details with high-level explanations of how solar technology works.

Additionally, Chinese companies could study Brazil's approach in framing more "Benefit" messages as "solution-focused" instead of "product-focused." This would involve a more critical attention to detail, examining the precise language of "Benefit" statements as communicating a solution to a customer problem. Finally, Chinese companies might learn from Brazilian companies on how to pivot a heavy quantity of company-focused messages to more customer-focused content.

Insight was also gained when looking across company size. Multinationals provided extensive insight on establishing trust with customers. That is, instead of focusing heavily on providing customer testimonials, companies could try to leverage industry experience to establish more legitimacy. A balance of variables is key here in terms of case studies, company experience, company expertise, and solar quality. Similar to many Brazilian companies, multinational corporations have refined the art of communicating benefits in terms of a solution instead of a product-focused statement. Multinationals were especially talented at translating benefit variables that are traditionally product-only into solutions, such as "Environmental" benefits or "Energy Management."

Finally, messaging with regard to "Specialization" was clearly an area in which there is room for discovery and possible growth. It was obvious in the data that companies are taking a standardized approach to customer-facing content, with little to no specialization for the residential market. SMEs have the advantage of locally-sourced customer success stories and could possibly use these to their advantage as the market grows.

5.1 Energy Security

Given both the importance of renewable energy to the future of society and its growth potential in emerging economies, it is imperative that companies not focus solely on the selling side of the exchange. While providing options, the companies are, importantly, educating consumers on renewable energy. To their credit, solar PV companies have experience selling large scale projects via government procurement processes in emerging markets, yet the same companies have little experience with individual consumer buying processes. At the same time, consumers have little knowledge with regard to the purchasing of solar power for their homes. This lack of experience on the seller's side combined with the lack of knowledge on the consumer side of the exchange creates a

situation where the seller can actually shape the consumer decision making process for solar energy.

As shown in this research, companies of varying sizes and in different countries have different approaches to crafting consumer-facing content and that content will likely shape the future of solar power consumption in these infant markets. Currently, it appears that companies are leveraging individual company strengths in determining consumer-facing messages. While this makes sense for the companies, the potential to shape consumer perception of renewable energy in general, and PV in particular, suggests the opportunity for policy-makers to pursue research with regard to the impact of such messaging on consumer perception.

Combining a new technology with a new application in two emerging markets highlights the unfamiliar territory that companies are entering. It is an exciting opportunity to shape consumer perception and influence the consumer decision-making process for this quickly developing industry. In doing so, residential PV installation companies can aid in pursuing the overall goal, as identified by Devabhaktuni et al. (2013, p. 562), of “increasing the general well-being of individuals in these countries.”

5.2 Limitations

A major limitation of this study was the focus on the seller, solar PV companies, within only two emerging economies. In conjunction with that the focus was the need to explore company materials in-depth, which limited the sample in terms of both size and selection. But, acknowledging this limitation, the data do suggest a multitude of opportunities, diverse in both size and breadth, for companies to understand, refine, adapt, and modify the inbound marketing strategies for residential PV installation companies and for policy-makers to ensure that consumers are educated on various aspects of renewable energy options.

Future research would benefit from a dyadic approach by capturing consumer perceptions possibly via experimental work in which messaging is controlled and consumer perception gauged based on particular type of messaging. From a traditional scholarly perspective, future research could focus on the findings from this inductive research to form hypotheses that could then be tested within a group of residential consumers with regard to purchase decision, within a larger sample of solar PV companies with regard to conscious creation of content materials, and/or even with a dyadic perspective to gauge fit between buyers and sellers.

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