Using Social Media to Stimulate the Adoption of Green Energy

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Abstract

Social media can be used to influence perceptions of green products and motivate the adoption of green energy. A key motivator for choosing green energy is concern for the environment. Social media is an effective means of communicating with consumers and stakeholders regarding the benefits of green energy in society. This study empirically examines social media usage in the green energy industry, identifies the most commonly used platforms, and analyzes social media usage according to the sector and financial situation of the company. Findings show there are four social media platforms used by 73 percent or more of green energy firms, with LinkedIn being the most popular. Social media usage was found to vary by sector. Findings can assist managers and marketers of green energy firms make informed decisions regarding their use of social media. Findings will be of interest to academic researchers and policy makers regarding green energy firms.

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JEL Classification: M3, M4, N7, Q4, Q5

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1. Introduction

This study examines the social media usage of companies in the green energy industry, which includes manufacturers, developers, distributors, and installers of green energy technologies. Green energy companies provide or contribute to the development of renewable energy sources that are naturally replenished and are more environmentally friendly than fossil fuels (Arroyo & Carrete, 2019). The purpose of this paper is to provide managers of green energy firms with knowledge of social media usage in their industry so they can make informed decisions regarding their own social media investment.

Due to skepticism of green marketing claims, traditional advertising has not been effective in stimulating the societal transition to green energy. The most significant factor leading to increased green consumption is knowledge of the environmental impact of a product or service (Shukla, 2021). Social media is an ideal venue to promote green consumption by providing accurate information regarding environmental problems and the benefits of green energy. It is common for people today to seek out information via social media (Smith et al., 2015). This has become even more prevalent since people started quarantining in 2020 due to the COVID-19 pandemic. As people were hesitant to visit brick-and-mortar stores, they turned to online purchasing and researching products through their online communities (Koch, 2021). Consumers view social media as a reliable source of product information and recommendations.

There are numerous social media platforms available today, each with its own devoted set of users. While companies tend to employ multiple platforms, it is implausible to be active on all social media platforms. Companies must choose which platforms will reach the majority of their customers and stakeholders, thus, providing the best return on their efforts. To make this choice, it is helpful to know the current status of social media usage in the industry.

This study identifies social media platforms currently in use by green energy companies and whether social media usage varies according to the firm's financial status or the sector it is in. Social media usage within the green energy industry is also compared to other industries that have been the subjects of prior research. Data is collected through an empirical methodology used in prior research (Smith et al., 2019; Chamberlain et al., 2019; Smith, 2017). While previous research has examined social media usage among Fortune 500 companies and within certain industries, there has not been a study concerning green energy firms. Results are helpful to managers and marketers within the green energy industry as they decide which social media platforms to use in their marketing campaigns. As companies in the green energy industry develop improved technologies, social media is an ideal venue for keeping people informed.

2. Research Questions

Social media is increasingly used by business firms in all industries, including green energy firms. Social media is also extensively used by consumers to circulate information about firms in the green energy industry and their products and services. Consequently, the following research questions will be addressed in this study:

RQ1: What social media platforms are used by green energy firms?

RQ2: How does social media usage in the green energy industry compare to other industries?

RQ3: How does the use of social media platforms vary across different sectors of the green energy industry?

RQ4: Does social media use by green energy firms vary according to firm financial performance measures?

3. Review of Prior Research

Around the globe, the energy produced from fossil resources is a primary source of greenhouse gas and carbon emissions, which are harmful to the environment (Judge et al., 2019). Green energy is a solution to diminishing the use of fossil fuels and thereby fostering environmental sustainability (Xu & Buyya, 2020). Green energy consumption is becoming more popular around the world (Ahmed, 2020).

Green energy, also known as green power, encompasses renewable energy resources and technologies that are the least harmful to the environment. These energy sources include the sun, wind, the earth's heat (geothermal), eligible biomass (organic plant and waste material), and low-impact hydroelectric sources (Green Power Partnership, 2018). Electricity produced from solar or wind power is an example of green energy. Green energy is a subgroup of renewable energy. According to the Environmental Protection Agency (EPA), renewable energy encompasses resources that utilize fuel sources that do not diminish because they can replenish themselves in a timely manner.

While advertising has been shown to increase awareness of environmental problems, it is not influential to the degree of changing consumer perception and motivating the purchase of green products (Shukla, 2021). People are skeptical of green marketing claims regarding sustainability. They are skeptical of companies that claim to produce environmentally-friendly products (Wang, 2017). Traditional marketing efforts have not been successful in converting people to green consumption (Nyilasy et al., 2014).

What motivates people to buy green products and actively engage in green consumption is knowing the harmful effects that some products or services have on the environment (Shukla, 2021). A company can promote green consumption by providing accurate information regarding environmental problems and the benefits of green energy. By joining the company's quest to better the environment, a person's self-goal of being environmentally conscious is activated (Arroyo & Carrete, 2019). Research shows that environmental consciousness influences the consumer decision-making process (Sharma & Foropon, 2019), including the decision to choose green energy (Arroyo & Carrete, 2019).

Social media can be used to disseminate knowledge of environmental problems and what the company is doing to alleviate the problem. Posts and interactions via social media can favorably enhance a person's impression of a company and the products or services it offers (Ali et al., 2016). Research has shown social media to be influential in consumer decision-making and purchasing

(Mangold & Smith, 2011). While people use social media to connect with friends, many turn to social media when making a product decision. People rely on product reviews on social media to reduce their cognitive exertion in the decision-making process (Liu et al., 2011). However, measuring social media's return on investment (ROI) is problematic. One reason is that social media posts can have different objectives. Plus, benefits from a post may be delayed until the consumer is ready to take action. The majority of businesses are not devoting resources to tracking the ROI of their social media platforms (Briones et al., 2011).

In addition to communicating with current and future customers, social media can provide useful information to employees, investors, and other stakeholders. Social media platforms are among the most visited websites. Of the top 25 Internet sites with the highest traffic volume in the world, three of the sites are social media platforms: YouTube, Facebook, and Instagram. In the U.S., there are four social media platforms in the top 25 Internet sites: YouTube (ranked 2), Facebook (ranked 6), Instagram (ranked 18), and LinkedIn (ranked 24) (@Alexa, 2021). Google receives the most traffic.

This study replicates prior research on social media usage by major energy firms (Chamberlin et al., 2019), technology firms (Smith et al., 2019), CPA firms (Chamberlin et al., 2017), and law firms (Smith & Smith, 2019). It extends prior research to US-based green energy firms and adds new measures of firm financial performance.

4. Methodology

The sampling frame for this study is the combined list of holdings of the four "clean energy" exchange traded funds (ETFs). Table 1 displays the stock ticker and description of four ETFs that include the phrase "clean energy" or "green energy" in the fund name. It also shows the total number of holdings for each ETF as well as its current net assets and its 2020 increase in net asset value (NAV). Controlling net assets of more than \$12 billion with an average increase in NAV of 168.61% in 2020, clean energy ETFs testify to the growing interest in responsible investing in sustainable and green assets.

Table 1. Green/Clean Energy Exchange Traded Funds (ETFs)

Ticker	Name & Description	# of Holdings	Net Assets1	2020 Increase in NAV
ICLN	The iShares Global Clean Energy ETF seeks to track the performance of the S&P Global Clean Energy Index. This fund allocates holdings to firms that "produce energy from solar, wind and other renewable sources."[2]	30	5.79 B	141.31%
QCLN	The First Trust NASDAQ Clean Edge Green Energy Index Fund seeks to track the performance of the NASDAQ Clean Edge Green Energy Index. Fund holdings include companies in the "clean energy market" including firms that are "manufacturers, developers, distributors and/or installers of clean-energy technologies."[3]	44	2.95 B	183.44%
PBD	The Invesco Global Clean Energy ETF s seeks to track the performance of the WilderHill New Energy Global Innovation Index. Fund holdings include green energy firms that "focus on greener and generally renewable sources of energy and technologies facilitating cleaner energy."[4]	104	0.44 B	144.12%
PBW	The Invesco WilderHill Clean Energy ETF seeks to track the performance of the WilderHill Clean Energy Index. Fund holdings include "companies in the business of advancement of cleaner energy and conservation."[5]	56	2.88 B	205.57%

Sources: [1]Yahoo! Finance, from the profile for each ETF, retrieved March 10, 2021 from
https://finance.yahoo.com; [2]iShares (2020); [3]First Trust (2020); [4]Invesco (2020); [5]Invesco (2020b).

After consolidating the ETF holdings lists to eliminate duplications (i.e., stocks held by more than one of the ETFs), in spring 2021, the authors extracted data for all the green energy firms in the four ETFs that were publicly held, US-based firms traded on the NYSE or NASDAQ. The resulting sample contained 50 firms for which data was available for all variables in this study.

5. Discussion of Findings

The first research question is, "What social media platforms are used by green energy firms?" The ten social media platforms used by at least one green energy firm are Blog, Facebook, Instagram, LinkedIn, Pinterest, Sina Weibo, Twitter, WeChat, XING, and YouTube. Social media is used by all the green energy firms included in this study. Forty percent of the firms use five or more social media platforms and 94% use at least three platforms. Table 2 shows the percentage of firms using each social media platform. LinkedIn, Twitter, Facebook, and YouTube are the four most heavily used platforms by green energy firms. LinkedIn is the most popular platform, used by over 95% of green energy firms. Twitter is used by almost 89% of the firms in our sample. Facebook is also heavily used with 80% of firms having a Facebook page. About 73% of firms post videos on YouTube. Instagram is used by 37% of firms. Company blogs are maintained by 20% of green energy firms. The remaining social media platforms listed in Table 2 are used by only a few firms.

Table 2. Social Media Platforms Used by Green Energy Firms Relative to Prior Research

	Green Energy Firms (2021)	Major Energy Firms (Chamberlain et al., 2019)	Technology Firms (Smith, Loveland & Smith, 2019)	CPA Firms (Chamberlain, Rudolph & Smith, 2019)	Law Firms (Smith & Smith, 2019)
	% Using	% Using	% Using	% Using	% Using
LinkedIn	95.6%	71.4%	86%	81%	83%
Twitter	88.9%	60.7%	98%	79%	83%
Facebook	80.0%	71.4%	92%	77%	57%
YouTube	73.3%	57.1%	68%	45%	28%
Instagram	37.8%	21.4%	22%	--	9%
Blog	20.0%	14.3%	22%	47%	5%
Pinterest	6.7%	--	6%	3%	--
WeChat	4.4%	--	--	--	--
XING	2.2%	--	--	--	--
SinaWeibo	2.2%	--	--	--	--

Table 2 also shows the results of past studies on social media usage. The second research question asked, "How does social media usage in the green energy industry compare to other industries?" Social media usage is more prevalent among green energy firms than among major energy firms, technology firms, CPAs, and law firms. The green energy industry is the largest user of LinkedIn. While LinkedIn is the popular platform for major energy companies, it is used by only 71%; whereas 95% of green energy firms use LinkedIn. The usage percentages for all social media platforms are considerably higher for green energy firms than found in prior research on major energy firms (Chamberlain et al., 2019). The biggest difference is for Twitter with 88.9% of green energy firms using that platform compared to just 60.7% of major energy firms. Perhaps people are more inclined to follow or tweet about a hot topic like "green energy" than about more traditional energy companies.

The third research question was, "How does the use of social media platforms vary across different sectors of the green energy industry?" Our sample contains firms from seven different sectors of the green energy industry: consumer cyclical, technology, basic materials, industrials, utilities, and energy. Because the energy sector has only one firm, we combined it with the utilities sector based on similarity in purpose (all are involved in the production and delivery of green energy). Table 3 shows the average number of social media platforms used by firms in each sector. Firms in the consumer cyclical sector are the heaviest users of social media, maintaining a presence on average on nearly 6 platforms. The energy & utilities sector uses the least social media with an average of just 2.8 platforms. The driving force of social media usage within the consumer cyclical sector may be connected to the fact that all the firms are involved with electric vehicles (EV). As an emerging industry, firms involved in electric vehicles may have a larger, more diverse, and less informed customer base than firms involved in the production of renewable energy, and thus, may need to use more platforms to reach different groups of consumers. The technology sector of the green energy industry uses 4.4 social media platforms on average. Both the basic materials sector and the industrials sector use an average of 3.7 social media platforms.

Table 3. Average Number of Social Media Platforms Use by Sector

Sector	Average Number of Platforms Used
Consumer Cyclical	5.9
Technology	4.4
Basic Materials	3.7
Industrials	3.7
Energy & Utilities	2.8

Sources: Sector classification data obtained from Yahoo! Finance (https://finance.yahoo.com). Sectors indicate the area of business in which the firm operates. Average number of platforms used obtained from firm websites.

We then turned our attention to examining what platforms are being used by firms in each sector. Because of the small number of firms using the three foreign-based social media platforms (WeChat, XING, and Sina Weibo), we combined them into a single "Other" category for this analysis. Table 4 shows the percentage of firms in each sector that used each of the social media platforms. All of the firms in the basic materials sector used LinkedIn, Twitter, and Facebook, with one firm also using YouTube and Instagram. Given that the companies are all involved in the production of chemicals and compounds for business-to-business (B2B) markets, we found the use of the consumer-oriented Facebook and Instagram platforms surprising.

Table 4. Platform Use by Sector

Platform	Basic Materials	Consumer Cyclical	Energy & Utilities	Industrials	Technology
	n = 3	n = 6	n = 5	n = 17	n = 19
LinkedIn	100.0%	83.3%	80.0%	100.0%	100.0%
Twitter	100.0%	100.0%	60.0%	88.2%	94.7%
Facebook	100.0%	100.0%	40.0%	64.7%	84.2%
YouTube	33.3%	83.3%	40.0%	70.6%	78.9%
Instagram	33.3%	83.3%	20.0%	29.4%	31.6%
Blog	0.0%	16.7%	20.0%	17.6%	31.6%
Pinterest	0.0%	33.3%	20.0%	0.0%	0.0%
Other	0.0%	0.0%	0.0%	0.0%	10.5%

Sources: Sector classification data obtained from Yahoo! Finance (https://finance.yahoo.com). Sectors indicate the area of business in which the firm operates. Average number of platforms used obtained from firm websites.

In the consumer cyclical sector, all the firms use Twitter and Facebook, and five out of six use LinkedIn, YouTube, and Instagram. This sector is also the most likely to use Pinterest. As players in the EV industry, it is not surprising that firms in the consumer cyclical sector find value in using photo-oriented sites (Instagram and Pinterest) to promote the design/appearance of their vehicles and a video platform (YouTube) that allows them to showcase vehicle performance.

The fourth and final research question asked, "Does the use of social media by green energy firms vary according to firm financial performance measures?" Table 5 shows how many social media platforms are used by each company along with the firm's TTM revenue, 2020 EBITDA, and market capitalization at the end of CY 2020. We compared green energy firms from the two ends of the spectrum of social media usage: heavy users with 5 or more platforms and light users with 3 platforms or less.

Table 5. Social Media Use and Clean Energy Firm Financial Performance Measures

#	Firm	Social Media Platforms	TTM Revenue (000)	EBITDA (000)	Market Capitalization (in Mil.)
1	Tesla, Inc.	7	$31,536,000	$4,224,000	$677,337
2	Littelfuse, Inc.	7	1,445,695	278,508	6,239
3	Arcimoto, Inc.	6	2,513	(14,465)	452
4	Renewable Energy Group, Inc.	6	2,637,853	555,724	2,785
5	Plug Power Inc.	6	307,536	(61,184)	17,040
6	Itron, Inc.	6	2,360,866	151,495	3,880
7	Power Integrations, Inc.	6	420,669	72,456	4,894
8	SolarEdge Technologies, Inc.	6	1,459,271	204,015	16,460
9	SunPower Corporation	6	1,864,225	159,402	4,373
10	Air Products and Chemicals, Inc.	5	8,976,800	3,751,300	60,458
11	Blink Charging Co.	5	4,478	(11,472)	1,537
12	Acuity Brands, Inc.	5	3,283,600	454,400	4,461
13	MYR Group Inc.	5	2,121,535	107,646	1,009
14	Bloom Energy Corporation	5	794,247	(47,763)	4,128

#	Firm	Social Media Platforms	TTM Revenue (000)	EBITDA (000)	Market Capitalization (in Mil.)
15	TPI Composites, Inc.	5	1,626,679	42,039	1,930
16	Enphase Energy, Inc.	5	721,172	107,111	16,658
17	LSI Industries Inc.	5	280,873	17,212	225
18	ON Semiconductor Corporation	5	5,275,000	771,800	13,481
19	Sunrun Inc.	5	922,191	(213,978)	13,705
20	Veeco Instruments Inc.	5	424,480	(4,282)	863
21	Fisker Inc.	4	0	(52,954)	2,123
22	Gentherm Incorporated	4	971,684	108,160	2,148
23	Workhorse Group Inc.	4	376,562	(7,629)	2,443
24	Advanced Energy Industries, Inc.	4	1,383,125	197,077	3,722
25	Flux Power Holdings, Inc.	4	13,605	(12,837)	217
26	Infrastructure and Energy Alternatives, Inc.	4	1,880,998	136,020	380
27	Orion Energy Systems, Inc.	4	107,235	5,177	304
28	FuelCell Energy, Inc.	4	70,871	(54,390)	3,601
29	Beam Global	4	4,506	(4,210)	518
30	Cree, Inc.	4	898,000	(43,300)	11,685
31	Universal Display Corporation	4	405,177	192,761	10,826
32	Vicor Corporation	4	296,576	28,424	2,920
33	Albemarle Corporation	3	3,128,909	678,619	17,205
34	Livent Corporation	3	288,200	3,300	2,757
35	Ameresco, Inc.	3	929,234	95,098	1,580
36	Broadwind, Inc.	3	198,951	8,491	134
37	Willdan Group, Inc.	3	423,499	14,066	503
38	First Solar, Inc.	3	2,711,332	550,151	10,484
39	ReneSola Ltd.	3	119,117	6,381	550
40	Sunnova Energy International Inc.	3	134,670	24,289	4,426
41	Clearway Energy, Inc.	3	1,032,000	774,000	2,577
42	NextEra Energy Partners, LP	3	917,000	737,000	5,052
43	American Superconductor Corporation	2	60,286	(17,851)	135
44	EnerSys	2	2,946,196	266,942	3,546
45	Quanta Services, Inc.	2	12,111,571	881,796	9,965
46	Eos Energy Enterprises, Inc.	2	219	(43,375)	1,080
47	Array Technologies, Inc.	2	916,806	163,060	5,478
48	ESCO Technologies Inc.	1	821,333	153,991	2,688
49	Atlantica Sustainable Infrastructure plc	1	1,011,452	764,985	4,051
50	Ormat Technologies, Inc.	1	729,954	373,873	5,054
	AVERAGE ALL FIRMS		**$2,027,095**	**$329,422**	**$19,401**
	AVERAGE <= 3 PLATFORMS		**$1,582,263**	**$301,934**	**$4,293**
	AVERAGE >= 5 PLATFORMS		**$3,323,284**	**$527,198**	**$42,596**

Source: Yahoo! Finance, retrieved March 8, 2021 from https://finance.yahoo.com.

The average revenue for the green energy firms in this study is $2.03 billion. Firms that use three or fewer social media platforms have average revenue of $1.58 billion compared to $3.23 billion in revenue for firms that use five or more platforms. While there is not a statistically significant difference between the two groups (p=0.15), the firms engaging more heavily in social media do have higher revenue on average.

The average 2020 EBITDA for the firms in this sample is $329 million. Firms using three or fewer social media platforms have an average EBITDA of $302 million compared to $527 million for firms using five or more platforms. While this is not a statistically significant difference (p-0.21), the firms using more platforms do have a higher EBITDA.

The average market capitalization for the green energy firms in this study is $19.4 billion. The average market capitalization for heavy and light users of social media is virtually the same. The average market cap for firms using five or more platforms is 42.6 billion compared to 4.3 billion for firms using 3 or fewer platforms.

6. Summary and Conclusions

The purpose of this paper is to provide knowledge to managers and marketers as they decide on the appropriate social media platform to use in their campaign to stimulate the diffusion of green energy in society. The green energy industry is comprised of manufacturers, developers, distributors, and installers of green energy technologies. Green energy firms provide or contribute to the development of environmentally-friendly and sustainable energy sources. This paper identifies the social media platforms currently in use and whether social media usage varies according to the firm's financial status or the sector it is in.

People today consider social media to be a reliable source of information about products, including green products. Recommendations and reviews on social media have proven to be influential in decision making and purchasing. Consumers are skeptical of company claims in traditional marketing venues, thus traditional advertising has not been successful in stimulating the societal transition to green energy. What motivates people to buy green products and actively engage in green consumption is being informed about environmental conditions and the negative effects of some products. Social media is an ideal venue for communicating information regarding environmental problems, the benefits of green energy, and the solutions offered by a company.

With a plethora of social media platforms available, it may be hard for a company to know which platform to engage with. To help make this decision, it is useful to know what social media platforms are being used in the industry. Findings from this study revealed that LinkedIn, Twitter, Facebook, and YouTube are the four most heavily used platforms in the green energy industry. LinkedIn is the most popular, used by 95% of green energy firms. Using multiple platforms is commonplace in this industry; 94% use at least three platforms and 45% use five or more platforms. Social media usage is more prevalent among green energy firms than among major energy firms, technology firms, CPAs, and law firms.

In our sample of green energy companies, firms in the consumer cyclical sector are the heaviest users of social media, maintaining a presence on an average of nearly 6 platforms. The energy & utilities sector uses the least social media with an average of just 2.8 platforms. While there was not a statistically significant difference in social media usage by the firms' financial measures, the firms with more social media platforms did have higher revenue and EBITDA on average.

Social media can be used to influence consumer perception of green products and motivate green consumption. A company should provide accurate information regarding environmental problems and what the company is doing to help. Research has shown that company posts and interactions with consumers through social media have a positive impact on the consumer's perception of the company and its products. Keeping consumers abreast of advances in green technology is essential to stimulating the diffusion of green energy in the marketplace.

There has not been a study of social media usage in the green energy industry. Thus, these findings are of practical interest to marketers and managers of green energy firms as they decide which social media platforms to use in their marketing campaigns. For academicians, these findings add to the knowledge of information technologies and the use of social media as a marketing tool.

7. Limitations and Future Research

The study is limited by the fact that it only looks at the number and types of social media platforms in use. Information regarding social media posts, which includes the number of posts made, edited, deleted, number of views, along with responses by customers and other persons external to the firm, such data is either proprietary or unavailable. Future studies might be able to evaluate such data, if firms were willing to provide it. If so, future studies could investigate the types of information posted and the frequency of posts. Future research could examine the interactions between the company and consumer, along with interactions between consumers.

When comparing social media usage according to firm financial measures, there were no statistically significant differences at the traditional $\alpha = .05$ level of significance. However, that level of rigor may be inappropriate for this exploratory study given that the costs of a Type I error are negligible and there may be much to be gained by further study of the relationship between social media usage and firm financial performance.

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