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A STUDY ON THE DEPLOYMENT OF WEB TECHNOLOGIES BY BUSINESS WEBSITES ON SUSTAINABLE ENERGY

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ABSTRACT

Three major challenges faced by human race today are energy crisis, climate change and environmental issues. Increasing the use of sustainable energy is a possible solution to address these problems. While huge amount of money and effort has been invested, a good return on the investment is definitely required by the commercial and business sectors in order to ensure an ongoing and sustainable development of the industry. One mechanism that can be used to drive the business and wider acceptance of sustainable energy by the community is through marketing. An important channel that helps the relationship between companies and customers is the World-Wide-Web. This in turn depends on the design and web technologies being deployed. This paper reports a survey study on the use of web technologies by E-business arena websites on sustainable energy and explains the opportunities for customer acquisitions and relationship management.

Index Terms— sustainable energy, E-business website, web technology, customer relationship acquisition

1. INTRODUCTION

Since early ancestors discovered and managed the use of fire, human have utilized energy of all forms for comfort and survival. Energy is the essential support for the human society and all kinds of activities ranging from personal, family, social, food production and processing, transportation to commerce. Most energy sources are produced from crude oil, coal and natural gas extracted from the earth. Over the past decades, with the increasing population and numerous new devices, systems and equipment developed, the amount of energy consumed is expected to exceed the amount of energy being produced [1]. The traditional natural energy resources are carbon-based and it can be expected that such resources are finite. In addition, during the process of conversion, carbon and other related substances are released into the atmosphere as 'emission'. In particular, carbon emission in the form of carbon dioxide (CO₂) has attributed as a cause of the global climate change. On the other hand, due to nature of scarcity of the carbon-based resources, the price of oil and other related resources has been increasing continually. These are

the main challenges faced by human society in the 21st century.

One of the solutions to address the above problems is to increase the use of sustainable energy (SE). The use of such energy that is reproduced, if efficiently used, will reduce the long term environmental damages and reliance on the traditional energy resources [2]. While many researchers are working toward this solution, this also opens up a new market opportunity for businesses in the sustainable energy sector. Recently, sustainable energy investments have reached \$148.4 billion in 2007, which is 60% more than 2006[3]. There are definite expectations on return of investment from the companies that have invested in sustainable energy. One way to meet such expectation is to expand the market through wider involvement and participation from the community. This calls for intensive marketing operation and many tools to recruit customer as well as improving customer retention[4]. An essential tool and channel of communication is the World-Wide-Web[5]. The Internet can provide more than information on products or services concerning sustainable energy, but also process business transactions in the forms of both business-to-consumer (B2C) and business-to-business (B2B). This is enabled by the fact that Internet usage of the world has grown significantly over three times from 2000 to June 30, 2008[6].

Nowadays, websites are a necessary channel to communicate between companies and not only current customers but also prospective customers [5]. This channel may assist to convert prospective customers to a company's consumer since the customers can obtain extensive information and assistance from the company's website. However, this is only possible with the use of different web technologies to provide the information and to nurture the relationship between companies and customers. Therefore, it is necessary to conduct a study to identify the current web technologies that will assist the companies to gain customers and to foster a strong customer relationship.

This study only focuses on web technologies currently used by sustainable energy business websites. (Investigation on the design of these websites is conducted in another study.) This research aims to investigate the characteristics that help to establish customer relationship and to create

opportunities to gain new customers into the use of sustainable energy. This study extends the results of an ongoing research which has surveyed over 100 websites on sustainable energy in the first phase of this endeavour.

In the next section, customer relationship acquisition using web technologies is described. Section 3 describes the methodology of collecting the websites including the categories used. Section 4 provides the result of this study and section 5 is the conclusion and discussions on the work so far.

2. WEB TECHNOLOGIES USED FOR THE ESTABLISHMENT OF CUSTOMER RELATIONSHIP

A website is a virtual location that hosts a collection of electronic documents. The electronic documents are also known as web pages, which can be displayed using software called web browser. The web pages may also link to other web pages and different types of files or documents. Web pages can be generally categorised into two types. The first type is static web pages that provide static information to the viewers in a one-way direction. In other words, a viewer has to “visit” a website and will only read the information available on that site. The static web pages are created with HTML (Hypertext Markup Language). On the other hand, the other type is dynamic web pages created by a combination of HTML and web-programming languages. Such languages are also known as scripting languages. Examples are PHP (Hypertext Preprocessor), ASP (Active Server Pages) or Java technology in the form of JSP (Java Server Pages), Servlet or java applet. The dynamic web pages provide not only information but also services to the user. This means a user can interact with information in the website. For example, search function can help a user to filter the information following the needs of the user. Hence, dynamic web pages may lead to better user satisfaction than static web pages as they are able to offer information in a flexible and interactive manner [7].

Dynamic web pages can help companies to revise information on the web pages easily. Companies can provide active information such as news, events, articles or newsletters, to the customers and to maintain an active relationship between the companies and the customers. Moreover, the web pages may provide sense of ownership to the customers as they can participate in customising the layout according to their individual needs or preferences.

Another web technology that can provide information to the customer’s computer or device is the web syndication technology. Subscribed users are able to get their information without the need of returning to the websites. Although e-mail has been used extensively, it may annoy the customers as they might have an excessive amount of incoming mails already. Emails could also be blocked by the spam filters unknowingly and never reaches the intended receiver [8]. On the other hand, subscribed users who expressed their willingness to use the services will obtain

their needed information by either independent software or web browser plug-ins known as web feeders. These are just some of the web technologies that can assist companies to establish and retain the relationships with their customer. With the maturity and acceptance of Web 2.0, the social and collaborative nature of the new technologies will provide further opportunities to gain new customers or recruit new members into the sustainable energy community.

3. RESEARCH METHODOLOGY

3.1 Process of Websites Collection

Sustainable energy websites are collected using a similar process proposed by Croft [9]. Four search engines, Google (www.google.com), Yahoo (www.yahoo.com), Cuil (www.cuil.com) and Kartoo (www.kartoo.com), are used. The initial key words (or “seed”), “*sustainable energy*” is used in the searching process. The first website was checked after the result of the search is returned. If the website that is being checked has links to other websites, the links are opened to the connected websites and checked again. Next, the following result from the search result is fetched. The process continues until the first ten in each search results. Finally, 100 websites are collected in initial phase. This process could be implemented with an agent and the results could be collected automatically.

3.2 Website Evaluation Criteria

The websites are mainly evaluated based on Barker’s evaluation criteria [10]. In the present study, only websites, which are based on English language, are considered. (Multi-language web-site investigation will be conducted in another study.) Attention is given to websites, which have explicit objectives of promoting and enhancing knowledge or information relevant to sustainable energy. Next, structure of the URL is investigated which provides information on the type and domain name. The collection is prioritized according to the types of organization in the order of: Government, Non-profit organization, Education, Research and Business websites respectively. If any website which is likely to be involved with more than one type, only the main type is recorded in the collection. In addition, in case that web technologies are used on the website, they are recorded as the latest technology in the collection.

If the “About us” link is available, it is investigated to determine the creators and the objectives of the website. The time of the last updated information is also considered including references of such information.

The collection has excluded imprecise and ambitious information as well as personal pages. The websites that do not specify their objectives explicitly are also ignored. Moreover, temporary websites such as sustainable energy conferences advertisement are excluded as well.

3.3 Categories of the Collection

The categories of information in the collection are listed as follows:

- **Type of Organization** this indicates the key objectives of the sustainable energy information providers.

- **Continent** This refers to the country or region of where the providers are located. This provides the implied opportunities on sustainable energy businesses and operations as indicated by the number of websites in the region.

- **Business Type** This corresponds to the type of business functions or services that are provided to the customers. There following five functions are noted from the websites collection:

- **Services** This means the company is providing services about sustainable energy such as renewable energy consultation, environmental impact study and resource assessment.

- **Sales** This refers to companies that are selling products related to the sustainable energy industry. Examples of the products are PV panels, wind turbines, solar pumps and energy storage systems.

- **Services and Sales** These are companies that offer both services and sales of sustainable energy products.

- **Portals** Sustainable energy portal websites are normally provided by companies in order to network the members or being a centre of communications.

- **Others** These are companies that operate products or services indirectly related to sustainable energy. Examples of such services are telecommunication or multimedia developer.

- **Functions on the websites** with their sub-categories are listed as follows:

- **Products or services information** means websites provide information about their products or services.

- **Activities on information** means the websites provide information that is updated frequency for keeping in touch with the customers by providing information such as news, conferences and events...etc.

- **Search** means the users can search for the information within the website.

- **Newsletters** means the websites provide information regularly. This channel can keep a close contact with the customers [11].

- **FAQ (Frequency Asked Questions)** means the websites provide a section on questions and answers that are frequency asked. The answers are provided to help customers to gain knowledge and clarify any queries concerning the products or services.

- **Articles** means the sustainable energy information provided by the websites are in the forms of short passages or essays.

- **White papers** mean the websites provide the information about sustainable energy in the form of formal publications for the customers.

- **Web technology** means the web technology is used in the website. This will enable identifying the types of web pages. This is an important factor to enable various techniques to establish the customer relationship.

- **Web syndication technology** means the websites provide syndicating information through either RSS or Atom to the customers.

4. RESEARCH RESULTS

In the study so far, more than one hundred websites that provide sustainable energy information or knowledge were collected. There are 42 Non-profit organization websites (37.17%), 32 Business websites (28.32%), 31 Government websites (27.43%) and 8 Educational websites (7.08%) as shown in Table I.

TABLE I
RESULTS FROM SURVEYING SUSTAINABLE ENERGY WEBSITES

Type of Organization	Number	Percentage
Non-profit organization	42	37.17%
Business	32	28.32%
Government	31	27.43%
Education	8	7.08%
Total	113	100.00%

In order to group the data for further analysis, this study uses the non-Business websites by combining the non-Profit organization websites, Government websites and Educational websites. They are used to compare with the Sustainable Energy Business websites. There are 64.41% of non-Business websites and 35.59% of the Business websites are in Europe. 76.32% of non-Business websites and 23.68% of Business websites are in North America, and 85.71% of non-Business websites and 14.29% of Business websites are in Oceania as shown in Table II.

TABLE II
PERCENTAGE OF BUSINESS WEBSITES
AND NON-BUSINESS WEBSITES BASED ON CONTINENTS

Continent	Business Websites	Non-Business Websites
Europe	35.59%	64.41%
North America	23.68%	76.32%
Oceania	14.29%	85.71%

Table III shows the details information about the 32 business websites. The focus of this study on these websites is to investigate the fundamental information about the business opportunities in the sustainable energy industry. There are seven countries in Europe where the information was collected. United Kingdom (UK) has 7 service-oriented businesses (21.88%), 2 sales-oriented businesses (6.25%), 3

TABLE III
THE RESULT OF BUSINESS TYPE ON 32 BUSINESS WEBSITES

Continent	Country	Services		Sales		Services & Sales		Portals		Others		Total Count	Total Percent
		Count	%	Count	%	Count	%	Count	%	Count	%		
Europe	United Kingdom	7	21.88	2	6.25	3	9.38	1	3.13			13	40.63
	Netherlands			1	3.13			1	3.13			2	6.25
	Spain					2	6.25					2	6.25
	Belgium									1	3.13	1	3.13
	Ireland	1	3.13									1	3.13
	Norway			1	3.13							1	3.13
	France									1	3.13	1	3.13
Europe Total		8	25.00	4	12.50	5	15.63	2	6.25	2	6.25	21	65.63
North America	United States of America	4	12.50	3	9.38					1	3.13	8	25.00
	Canada	1	3.13									1	3.13
North America Total		5	15.63	3	9.38					1	3.13	9	28.13
Oceania	Australia	1	3.13					1	3.13			2	6.25
Oceania Total		1	3.13					1	3.13			2	6.25
Grand Total		14	43.75	7	21.88	5	15.63	3	9.38	3	9.38	32	100.00

service and sales-oriented businesses (9.38%) and 1 web-portal business (3.13%). As the most of the business websites are in UK, it may indicate that the UK government promotes a balance between economic and environmental problems[12]. This similar signal may indicate opportunities to operate sustainable energy business in other countries as well. Netherlands has both a sales-oriented business (3.13%) and a web-portal business (3.13%), while Spain has 2 service and sales-oriented businesses (6.25%). Ireland has a service-oriented business, and Norway has a sales-oriented business. Both Belgium and France have others businesses. It should note that other countries in EU may have many SE websites in languages other than English. Hence, the figures in Table III are confined to English speaking countries.

In the case of North America, the United States of America has 4 service-oriented businesses (12.50%), 3 sales-oriented businesses (9.38%) and other businesses (3.13%), and Canada also have a service-oriented business (3.13%). On the other hand, Australia has a service-oriented business (3.13%) and a web-portal business (3.13%). Moreover, the results also show that most of the operations on sustainable energy businesses are found among the 21 business websites (65.63%).

TABLE IV
PERCENTAGE OF FUNCTIONS ON 32 BUSINESS WEBSITES

Functions	Percentage
Product or Service Information	100.00%
Activities on Information	71.88%
Search	50.00%
Newsletters	21.88%
FAQ	21.88%
Articles	15.63%
White Papers	12.50%

All the business websites provide a variety of functions on their websites. Product or service information are provided by all of the companies on their website. Information that has movement such as News function are providing content to 71.88% of the websites, while 50% of

the websites provide search functions to the users. Both Newsletters and FAQ function are provided in 21.88% of the websites. 15.63% of the websites provide Articles function, and 12.50% of the websites provide white papers as shown in table IV.

From the web technology aspect, the most used web technology is ASP at 25.00%. The other popular web technologies used are PHP, HTML, Java Technology, ASP.NET, Perl and SHTML with 21.88%, 18.75%, 15.63%, 9.38%, 3.13% and 3.13%, respectively. This is shown in table V. On the other hand, web syndication technology is another point that is focused in this study. There is only 15.62% of the business websites providing this technology, whereas Non-Business websites applying this technology has 23.46% of the share as shown in table VI.

TABLE V
PERCENTAGE OF WEB TECHNOLOGY USED BY 32 BUSINESS WEBSITES

Web Technology	Percentage
ASP	25.00%
PHP	21.88%
HTML	18.75%
Java Technology	15.63%
ASP.NET	9.38%
Undefined	3.13%
Perl	3.13%
SHTML	3.13%
Grand Total	100.00%

TABLE VI
PERCENTAGE OF THE USE OF WEB SYNDICATION TECHNOLOGY

Web Syndication Technology	Business Websites	Non-Business Websites
Use	15.62%	23.46%
Don't use	84.38%	76.54%
Total	100.00%	100.00%

5. CONCLUSION AND DISCUSSION

Operating a successful sustainable energy business has to deal with many factors such as local resources and sustainable energy technologies. On top of these factors, marketing is an important aspect that has the capability to help companies to reach their objectives. One important marketing tool is the World-Wide-Web. Web has become an essential channel to establish a successful relationship between companies and customers. This paper reports the survey results from analysing the web technologies used in websites concerning with sustainable energy. This provides the means to establish good customer relationship with the aim to recruit new customers and to retain the existing ones.

Summaries of the results are showed in Tables I, II and III. It is observed that there are one-fourth of the businesses on SE are located in the USA, and the companies provide both services and sales. Moreover, Americans are agreeable to pay for renewable energy technologies[13], and the percentage of non-business websites may indicate the support on sustainable energy to the customers. Therefore, it is likely that these companies may have more opportunities to recruit customers from this region.

According to the percentage of web technologies in Table V, there are only 18.75% of Business websites, which provide their information through HTML. These companies may face obstacles when information is updated on the websites. These websites may have less opportunity if they fail to provide updated information. On the other hand, there are over 80% of the Business websites providing information with dynamic web pages. This means the websites are capable to be developed for providing updated information and more services such as FAQ or Newsletter to foster and improve the relationship. For example, the news, events or white papers may be sent through the web syndication technology to the customers directly. In addition, companies may consider the use of web syndication technology. This may allow the website to subscribe the technology with other web syndication providers rather than develops them from scratch.

Furthermore, Table VI indicates that there are only 15.62% of the Business websites utilizing web syndication technology for providing information to the customers. Employing such technology will enable the websites to be checked regularly and to find out the marketing activities on the websites. The study also found that some of the websites have provided facilities for as conferences, seminar or prizes campaign for their customers. Providing information to the customer directly will create more business opportunities. Information can be supplied to the customer's computers or devices directly and offer new products or services to customer easily.

In this paper, only the analysis of the web sites and technologies are reported. The ongoing project will conduct further analysis of the collected websites and to investigate

any correlations between the web technologies, customer acceptance and their knowledge on SE.

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