

Article

## Using Online Tools to Assess Public Responses to Climate Change Mitigation Policies in Japan

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**Abstract:** As a member of the Annex 1 countries to the Kyoto Protocol of the United Nations Framework Convention on Climate Change, Japan is committed to reducing 6% of the greenhouse gas emissions. In order to achieve this commitment, Japan has undertaken several major mitigation measures, one of which is the domestic measure that includes ecologically friendly lifestyle programs, utilizing natural energy, participating in local environmental activities, and amending environmental laws. Mitigation policies could be achieved if public responses were strong. As the internet has increasingly become an online platform for sharing environmental information, public responses to the need for reducing greenhouse gas emissions may be assessed using available online tools. We used Google Insights for Search, Google AdWords Keyword Tool, and Google Timeline View to assess public responses in Japan based on the interest shown for five search terms that define global climate change and its mitigation policies. Data on online search interests from January 04, 2004 to July 18, 2010 were analyzed according to locations and categories. Our study suggests that the search interests for the five chosen search terms dramatically increased, especially when new mitigation policies were introduced or when climate change related events were organized. Such a rapid increase indicates that the Japanese public strongly responds to climate change mitigation policies.

**Keywords:** eco-point; Google Insights for Search; global warming; Keyword Tool; Kyoto Protocol; My bag

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## 1. Introduction

Concerns over the effects of global warming led to the adoption of the Kyoto Protocol in 1997. Becoming effective in February 2005, the Kyoto Protocol to the United Nations Convention on Climate Change (UNFCCC) is aimed at mitigating global climate change by reducing global greenhouse gas emissions during the first commitment period (2008–2012). Annex 1 countries, which include 39 industrialized countries, committed to a reduction of 5.2% of greenhouse gas emissions compared to their levels in 1990. Agreeing to cut 1,163 million tons of carbon dioxide, representing 6.0% of greenhouse gas emissions, Japan proposed the following reduction options: 1.6% reduction under the Kyoto mechanisms, 3.9% reduction using forest carbon sinks, and the remaining 0.5% via domestic measures [1,2]. However, because emissions continued to rise after 2005, Japan must reduce emissions by 14.5% in 2007 to meet the 6.0% reduction commitment made in Kyoto in 1997 [3]. Under the domestic measures, Japan introduced and implemented various policies that would result in huge domestic emission reductions. These policies include implementing ecologically friendly lifestyle programs such as My Bag, CoolBiz, WarmBiz, My Bottle, My Chopsticks, Eco House, and Eco Building; using energy-efficient products such as light-emitting diode goods and eco-car; utilizing natural energy sources such as solar power and biomass; participating in local environmental activities; and amending environmental laws. Furthermore, since the adoption of the Kyoto Protocol, Japan has also revised various energy-use laws and promoted policies to address global warming and use new clean energy sources. Until recently, assessments of the public responsiveness towards climate change mitigation policy were conducted through questionnaire surveys [4–9]. Although questionnaire surveys provide useful assessments, there are other methods that consume less time and costs. The emerging information and communication technology (ICT) makes it possible to assess public responses through the use of an online query-based approach. Nevertheless, studies using such an approach were not available despite rapid increase of internet users. The number of internet users has dramatically increased in recent years. According to Miniwatts Marketing Group [10], there were approximately 1.80 billion internet users worldwide in December 2009, with about 90.91 million internet users in Japan at the end of 2008 [11]. As of September 2008, the number of searches had reached 5.9 billion in Japan [12]. Taking advantage of ICT and the increase of internet users, we can assess the public responses to climate change mitigation policies in Japan by analyzing the search terms performed by the internet users. Using ICT tools can also reduce time and associated costs compared to the conventional studies.

The purpose of this study is to assess public responses on proposed climate change mitigation policies in Japan by using the online tools, namely Insights for Search, AdWords Keyword Tool, and Timeline View provided by Google Inc. The paper is structured as follows: justifications for selecting search terms and online tools are described; analytical results for each search term under various search categories are discussed; and finally, we discuss our conclusions and suggestions for further study.

## 2. Materials and Methods

### 2.1. Search Term Selection

Climate change and its mitigation could be defined with one or more of the following eight Japanese terms, namely Kankyou Mondai (Environmental Issues), Chikyu Ondanka (Global Warming), Kankyou Bijinesu (Environmental Business), Kyotogiteisho (Kyoto Protocol), Eko Pointo (Eco-point), Maibagu (My Bag), Shoene (Energy Conservation), Eko Jutaku (Eco House). While Baram-Tsabari and Segev [13] chose three keywords (Global warming, Climate change, Pollution) to study the public interests in environment, here we chose five terms that are relevant to mitigation policy: Chikyu Ondanka, Kyotogiteisho, Eko Pointo, Maibagu, Shoene (Table 1).

**Table 1.** Search terms and related search volumes in June 2010.

Search Term	Related to Climate Change Mitigation	Average Local Monthly Searches
<b>Chikyu Ondanka</b> Global Warming	Keyword concerning climate change	201,000
<b>Kyotogiteisho</b> Kyoto Protocol	Keyword concerning commitment to reducing climate change	33,100
<b>Eko Pointo</b> Eco-point	Keyword concerning Domestic Policies	1,500,000
<b>Maibagu</b> My Bag	Keyword concerning Domestic Policies and Lifestyle	5,400
<b>Shoene</b> Energy Conservation	Keyword concerning energy saving	368,000

Source: Average local monthly searches were generated using Google AdWords Keyword Tool.

**Chikyu Ondanka** represents the current environmental problem. After the Intergovernmental Panel on Climate Change [14] reported that global warming results from human activity, many researchers have become interested in this subject. Most scientists agree that the warming in recent decades has been caused primarily by human activities that have increased the amount of greenhouse gases in the atmosphere [15]. We chose Chikyu Ondanka term to assess the general public's awareness of the global environmental problem. Average monthly searches of this term on Google in Japan were about 201,000.

**Kyotogiteisho** was initially adopted by 39 industrialized countries in 1997, and became effective in 2005. It is the first international binding agreement to combat global warming by requiring Annex 1 countries to fulfill their obligations of reducing greenhouse gases emissions during the first commitment period (2008–2012). Monthly searches of this term on Google in Japan average about 33,100. With this search term, we can evaluate the degree to which the Japanese public is interested in climate change mitigation policies.

**Eko Pointo** is one of the many domestic policies aimed at both reducing greenhouse gas emissions and boosting stagnant consumption to fight against the economic recession. The policy was introduced by the Japanese government to stimulate purchases of energy-efficient appliances. Under the Eco-point system, buyers of certain types of energy-efficient air conditioners, refrigerators, and television sets can exchange the points later for other goods and services worth up to nearly 40,000 yen per item. The end of this program was extended to December 2010 from the previous deadline of December 2009. The Eko Pointo search term will help us determine how effective this government policy is and the degree of public responses in such a policy. Monthly searches of this term on Google in Japan average about 1,500,000.

**Maibagu** is a type of personal shopping bag that can be reused numerous times. In Japan about 30.5 billion plastic shopping bags are discarded after use each year [16], which represents about 300 bags per adult discarded yearly. As part of the country's climate change mitigation policies, "No Plastic Bag Day" occurs on the fifth of every month [17], a plastic bag reduction campaign has been adopted by 12 convenience store chains [18], and the My Bag campaign has been promoted. We use Maibagu search term to understand how people connect the health of the environment and climate change with their everyday shopping. Monthly searches of this term on Google in Japan average about 5,400.

**Shoene** is the effort to reduce energy consumption to preserve resources for the future and reduce environmental pollution. The realization of the need to conserve energy began during the oil crisis in the mid-1970s [19]. In 1979 an energy conservation law was enacted in Japan. In 1993 the Energy Saving and Promoting Resource Recycling law was enacted, and in 1999 this law was widely revised in response to the Kyoto Protocol. We chose Shoene term because it has been familiar to the Japanese public for a long time and it also relates to the search term "Eco-point." Monthly searches of this term on Google in Japan average about 368,000.

## 2.2. Online Web Tools

There are two major search engines in Japan, Yahoo (yahoo.co.jp) and Google (google.co.jp). In Japan, Yahoo is currently more popular and receives more than 3 billion searches, or 51% of the market share, followed by Google, which receives 2.3 billion searches, or 39% of the market share on September, 2008 [12]. However, Google's share in the search markets in Japan is increasing rapidly. The data in this study are based on Google search results because of the availability of data and online tools from Google Inc. We used mainly these tools to collect search data for the five selected terms from January 04, 2004 to July 18, 2010. The 2004 corresponds to the year when search data were made available online and July 2010 was the date when this study was conducted.

### 2.2.1. Google Insights for Search

Insights for Search analyzes a portion of worldwide Google web searches from all Google domains to compute how many searches have been done for any term relative to the total number of searches done on Google over time. Although this tool provides many useful features, in this study we used only the total search index, the values of which range from 0 to 100, with 100 representing the highest number of searches performed during the selected timeframe.

This tool has been used by many researchers. For example, Scharnow and Vogelgesang [20] proposed a new method for measuring aggregate issue salience by analyzing data from search queries typed into Google Insights for Search [21] as compared with aggregate survey data from about 500 telephone interviews. They found a substantial correlation between the two longitudinal measures of issue salience. Hoffman and Novak [22] compared data from Insights for Search with traditional brand tracking metrics (WPP) to monitor brand. They found that search trends data have real-world importance, corresponding well to brand attitudes, awareness, and other metrics provided by the WPP database. Doornik [23] compared flu related searched data from Insights for Search and Google trends with influenza-like illness data provided by the U.S. Centers for Disease Control and Prevention. The correlation of the comparison was 0.92. Askitas and Zimmermann [24] used this tool to find the relationship between search queries and the unemployment rate in Germany, and they found that there was a strong correlation between unemployment related keyword searches and unemployment rates using monthly German data on a simple and parsimonious level. Therefore, we believe that data generated by this online tool are suitable for our study.

### 2.2.2. Google AdWords Keyword Tool

AdWords Keyword Tool [25] is used to build a master list of new keywords for advertising groups and to review advertiser competition and search volume using global monthly searches, local monthly searches, and local search trends. We used this tool to retrieve local monthly searches of the five selected terms with the location and language set to “Japan” and “Japanese”, respectively.

### 2.2.3. Google Timeline View

Timeline View is an option of Google web search results that provides users with historical data about any search term. We used this tool to find news or events that occurred within specific periods. Seeing results along a timeline allowed us to match data retrieved from Google Insights for Search with such news or events.

## 3. Results and Discussion

### 3.1. Search Term *Chikyu Ondanka*

From January 04, 2004 to July 18, 2010, the average total search index was about 51 (the highest value for search index is 100 referring to the highest search volume during the chosen period). The interest in this search term fluctuated in a constant manner between January 04, 2004 and late 2006. The interest jumped to the highest levels in February 2007 (point A), January 2008 (point B), and July 2008 (point C) (Figure 1). Point A coincided with the release of the Intergovernmental Panel on Climate Change report stating that global warming is caused by human activities and the news that Al Gore’s environmental documentary, “An Inconvenient Truth,” had won an Oscar [26]. Point B coincided with the announcement from Kanagawa Prefecture about its Cool Renaissance Declaration and the announcement of the Cool Earth Partnership program initiated by the Japanese government. Point C coincided with the G8 Hokkaido Toyako Summit, which took place from July 7 to 9, 2008. According to a survey conducted by the Keizai Koho Center [27] between June 4 and June 11, 2007,

95% of the Japanese public saw global warming as an imminent problem. According to an online web survey about global warming conducted by RJC Research Inc. [28] on June 2 and June 3, 2008, about 82.7% of the Japanese public was concerned about global warming. Before the G8 Hokkaido Toyako Summit, in conjunction with the Yomiuri Shimbun, Goo Research [29] conducted an online survey about the summit and found that 57% of 1088 respondents were interested in the summit and 69% wanted to see global warming and other environmental issues addressed during the summit. Based on these surveys, much of the Japanese public was concerned about global warming in 2007 and 2008, which corresponds to our findings based on the overall data of Insights for Search between 2007 and 2008.

**Figure 1.** Index of interest shown in search term “Chikyu Ondanka”(Graph generated by Google Insights for Search on 19 July 2010).



### 3.2. Search Term *Kyotogiteisho*

From January 04, 2004 to July 18, 2010, the average total search index for this term was about 22. The greatest interest in this term occurred in February 2005, and among the prefectures of Japan, residents of Kyoto showed the greatest regional interest. Public interest in this term peaked during three periods: February 2005 (point A), October 2005 (point B), and January 2008 (point C) (Figure 2). Point A coincided with the entry into force of the Kyoto Protocol on February 16, 2005. Around this time, many events were held in Kyoto, such as the Climate Change Seminar about COP-10 and the Perspectives of International Collaboration against Global Warming on February 15, 2005, an event commemorating world’s entry into the Kyoto Protocol, and an international forum on the afforestation and reforestation on February 16, 2005 organized by the Japan International Forestry Promotion and Cooperation Center. Point B coincided with the start of the Railway Eco Campaign, a climate change mitigation policy of the Odakyu Electric Railway, in October 2005. Point C coincided with the commitment period of the Kyoto Protocol, which began in January 2008. Interest in this search term showed by far the highest peak at point A, but interest rapidly decreased and then showed sporadic peaks at points B and C. Goo Research [30], in cooperation with the Nikkan Kogyo Shinbun, conducted an online survey about climate change mitigation policies on February 12, 2005, four days before the Kyoto Protocol entered into force. The survey found that 53.1% of 1075 respondents felt that Japan should achieve its Kyoto Protocol commitments, showing an increase from 47.1% in a 2004

survey. Likewise, our data show that public interest in the Kyoto Protocol increased from 2004 to 2005, although our findings suggest a much sharper increase (Figure 2) than reported in the survey. However, overall search interest in this term has decreased gradually from point A.

**Figure 2.** Index of interest shown in search term “Kyotogiteisho” (Graph generated by Google Insights for Search on 19 July 2010).



### 3.3. Search Term Eko Pointo

Because Eko Pointo was recently introduced in 2009, only data from April 9, 2009 to July 18, 2010 are available for this search term. The average total search index during this period was about 42. Among the peaks of interest in this search term, we analyzed three periods: May 10–16, 2009 (point A), June 28 to July 4, 2009 (point B), and March 21–27, 2010 (point C) (Figure 3). Point A coincided with the start of the Eco-point system (March 15, 2005). Point B coincided with the date when the Japanese government started to accept and exchange points for the goods and services via the internet (July 1, 2009). Point C coincided with the start of the Eco-point system for housing (the end of March, 2010), the extension of the Eco-point system deadline (from March 31, 2010 to December 31, 2010), and the announcement of improvements in the Eco-point system for home appliances. On the first day of the Eco-point system, search interest in this term increased, as seen at point A. However, interest then decreased sharply between May 17, 2009 and June 6, 2009, and then search interests increased sharply at point B, when the government started to accept and exchange points for the goods and services online. According to Markezine [31], the Eco-point website ([eco-points.jp](http://eco-points.jp)) had about 1,330,000 visitors on July 1, 2009. Our data show that the number of searches for the term “Eco-point” on Google increased dramatically at point B. According to GF’s telephone survey [32] awareness of the Eco-point system increased from 91.7% to 92.9% between June 3, 2009 and July 23, 2009, and this finding agrees with our data as well.

### 3.4. Search Term Maibagu

The average total search index for this term from January 04, 2004 to July 18, 2010 was about 42. We analyzed three periods when interest in this term peaked: June 2007 (point A), June 2008 (point B), and May 2009 (point C) (Figure 4). Point A coincided with the launch of My Bag campaigns by many

shops, including the Seiyu Group [33], Jusco Sendai Saiwai-cho branch, Miyagi Co-op Saiwai-cho branch, Fresh Food Moriya Saiwai-cho branch, York-Benimaru Yamato-machi branch in Sendai, and Co-op in Kobe. Likewise, My Bag campaigns were launched by the Marui Group and Lawson at point B and by Sakuruk convenience stores in Nagano and Izumiya stores at point C. In addition to My Bag campaigns, interest in this term was also driven by the revised Containers and Packaging Recycling law that required shops to charge customers for plastic bags and recommend that they use a reusable personal shopping bag instead. In March 2007, the Ministry of the Environment [34] conducted a survey about the use of plastic shopping bags, and found that 59.8% of 1011 respondents used a reusable personal shopping bag. According to a survey conducted by Japan Broadcasting Corporation in March 2008 [35], 51% of 2,625 respondents wanted to use a personal shopping bag and refused unnecessary wrapping, which was an increase from 35% of respondents surveyed in 2000. In agreement with these survey results, our data showed that public interest in My Bag campaigns increased in 2007 and 2008.

**Figure 3.** Index of interest shown in search term “Eko Pointo” (Graph generated by Google Insights for Search on 19 July 2010).



### 3.5. Search Term Shoene

The average total search index for this term from January 04, 2004 to July 18, 2010 was about 56. We analyzed two peak periods of interest: July 2008 (point A) and April 2009 (point B). At point A, the G8 Hokkaido Toyako Summit took place (July 7–9, 2008) and many manufacturers such as Sony, Toshiba, and Mitsubishi started to offer energy-efficient products. Point B coincided with the enforcement of a revised energy conservation law and the application of energy-efficient products into the Eco-point system. Although public interest in this search term markedly increased around the time of the Toyako summit (point A), the Eco-point system seems to be the main factor driving the interest in this term.

### 3.6. Analysis of Search Terms by Search Categories

In order to assess the types of internet users who performed the search terms (*i.e.*, whether they are general or specialized climate change users), search interests of five chosen search terms were classified into five search categories to investigate the relationship between search terms and public responses Table 2. The ranges shown in Table 2 were taken from Google Insights for Search, and the values represent the percentages of searches that contain the term and are classified into the

particular category [36]. Higher values indicate that the term has greater relevance with regard to any particular category. The Lifestyles and Shopping categories are categories under which general users (non-specialized climate change users) performed the search. The data indicate that searches were actually performed under both categories suggesting that general users were interested in climate change mitigation while preserving their lifestyles. From 25% to 50% of searches for the terms “Eco-point” and “global warming” were related to the Lifestyle category, 25–50% of searches for the term “My Bag” were related to the Shopping category, and 10–25% of searches for the term “energy conservation” were related to the Lifestyle category. On the other hand, the search term “Kyoto Protocol” was mostly performed under the category of Science search interests of search term suggesting that this term was performed by specialized users who may have better knowledge about climate change. The relevant values of the five search terms in the various categories (Table 2) indicated that “Eco-point,” “My Bag,” “Global Warming,” and “Energy Conservation” were searched for by the Japanese general public, whereas “Kyoto Protocol” was searched for by specific internet users researchers whose awareness about global warming is higher than that of the general public.

**Figure 4.** Index of interest shown in search term “Maibagu” (Graph generated by Google Insights for Search on 19 July 2010).



**Figure 5.** Index of interest shown in search term “Shoene” (Graph generated by Google Insights for Search on 19 July 2010).



**Table 2.** Percentage of searches performed under five search categories.

	Lifestyles	Shopping	Industries	Computers	Science
Eco-point	25–50%	0–10%	0–10%	0–10%	–
My Bag	0–10%	25–50%	–	–	–
Kyoto Protocol	0–10%	–	0–10%	–	25–50%
Global Warming	25–50%	–	0–10%	–	10–25%
Energy Conservation	10–25%	–	0–10%	10–25%	0–10%

Source: Google Insights for Search accessed on 23 July 2010.

### 3.7. Limitations of This Study

In this paper, we discuss public responses to climate change mitigation policies based on search query results. The data generated by Google Insights for Search is scaled data, and thus it is possible to make the comparison qualitative rather than quantitative [13]. Therefore, our research results should be interpreted with caution because, in addition to responding to government's climate change mitigation policies, there could be other factors that drive the internet users to perform searches on the five chosen terms. To determine those factors, questionnaire surveys on a number of users before and after performing searches should be conducted. Although questionnaire surveys can help us understand the characteristics of individual users, such surveys are beyond the scope of our paper. Another possible reason that could limit our understanding of the search behavior is the lack of disclosure of how a search query is categorized.

## 4. Conclusion

We used online ICT tools, such as Google Insights for Search, AdWords Keyword Tool, and Timeline View, to assess the public responses to climate change mitigation policies in Japan based on search queries on five chosen search terms, namely Chikyu Ondanka, Kyotogiteisho, Eko Pointo, Maibagu, and Shoene. Rapid increases in search volume were observed when mitigation policies were introduced or environmental events were organized. Therefore, we conclude that online tools could be used to assess the public response to mitigation policies as well as other purposes of the online search. Nevertheless, conducting questionnaire surveys along with analysis of disclosed information provided by the search providers would help us better understand the search behavior of the internet users, and thereby allowing us to propose effective measures for implementing the mitigation policies.

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