Renewable and Sustainable Energy Reviews 43 (2015) 432–439

Contents lists available at ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

The public's value for developing ocean energy technology in the Republic of Korea: A contingent valuation study

So-Yoon Kwak [a,1], Seung-Hoon Yoo [b,*]

[a] Environmental Strategy Research Group, Korea Environment Institute, 290 Jinheungno, Eunpyeong-Gu, Seoul 122-706, Republic of Korea
[b] Department of Energy Policy, Graduate School of Energy & Environment, Seoul National University of Science & Technology, 232 Gongreung-Ro, Nowon-Ku, Seoul 139-743, Republic of Korea

ARTICLE INFO

Article history:
Received 23 November 2011
Received in revised form
23 July 2014
Accepted 2 November 2014

Keywords:
Contingent valuation
Ocean energy
Public value
Willingness to pay

ABSTRACT

Ocean energy is a type of renewable energies and is considered as having a potential power of providing a substantial amount of energy. Although some forms of ocean energy are developed, there is a need for further technological advances to better utilize ocean energy. Government should take observable actions to compensate for the costs of developing the technology. This paper attempts to apply a contingent valuation (CV) method to obtaining at least a preliminary evaluation of the benefits that ensue from the development of the technology that commercializes ocean energy in the Republic of Korea. Overall, the CV survey was successfully carried out to elicit the willingness to pay (WTP) for ocean energy. The WTP was statistically significantly estimated from one-and one-half bounded spike model and the monthly mean WTP estimates was KRW 1003 (USD 0.9) per household. The estimates of the annual benefits to relevant residents amounted to KRW 206.4 billion (USD 183.8 million).

Contents

1. Introduction

Renewable energy is defined as an energy which comes from natural resources such as sunlight, wind, ocean and geothermal heat, which are naturally replenished. Climate change concerns

* Corresponding author. Tel.: +82 2 970 6802; fax: +82 2 970 66800.
E-mail addresses: sykwak@kei.re.kr (S.-Y. Kwak), shyoo@seoultech.ac.kr (S.-H. Yoo).
[1] Tel.: +82 2 380 7654; fax: +82 2 3290 2535.

http://dx.doi.org/10.1016/j.rser.2014.11.036
1364-0321/

and scarcity of conventional energy sources have led to aim of reducing the consumption of fossil fuels and urged the development of innovative renewable technologies for production of energy. Various countries make an investment in renewable energy projects and take an interest in ocean among several renewable energy sources in these days. Oceans cover almost three-fourths of the earth's surface and they are considered to have a tremendous amount of energy. In addition, many researches show that ocean energy has the potential power of providing for a substantial amount of new renewable energy around world. The Republic of Korea which is a small country with a dense population and surrounded by seas on three sides needs to pay attention to ocean energy.

The oceans represent a vast and largely untapped source of energy in the form of surface waves, fluid flow and thermal. Waves are caused by the wind blowing over the surface of the ocean and tremendous energy is in the ocean waves. Another form of ocean energy is called tidal energy. When tides come into the shore, they can be trapped in reservoirs behind dams. Then when the tide drops, the water behind the dam can be let out just like in a regular hydroelectric power. The form of thermal uses the energy from the sun. It heats the surface of water of the ocean and the temperature differences are used to produce energy. Some forms of ocean energy are developed [1], however, there is a need for further technological advances to better utilize some of these sources of ocean energy. To develop a technology that enables commercialization of ocean energy, the government should take visible actions to compensate for costs and needs to estimate the value of the technology and ask consumers about their preferences. To this end, we attempt to elicit respondents' willingness to pay (WTP) for ocean energy technology by applying a contingent valuation (CV) method.

The remainder of this paper is organized as follows. Section 2 provides a brief literature review on the valuation of energy. Section 3 explains the measurement method employed in this study, the methodological issues on questionnaire design, and the survey. Section 4 describes the WTP model. Section 5 presents and discusses the results. Some concluding remarks are made in the final section.

2. Literature review

Renewable energy has become the focus of attention among governments and policy makers [2]. As they needed information about the assessment of the value of renewable energy and consumers' preferences, many studies have been carried out. Recent studies about renewable energy are summarized in Table 1.

There are several studies which concentrated on the valuation of renewable energy. Most of the studies have used the CV method and only Bergmann et al. [8] applied Choice Experiment (CE) which is flexible in terms of modeling complex trade-offs between attributers. Wiser [3] explored WTP for renewable energy by using the method under collective and voluntary payment vehicles and the result could offer practical insight into US household preferences for how to support renewable energy. Zarnikau [4] examined the WTP for electric utility investment in renewable energy and energy efficiency resources. Some of CV studies focused on a specific source of renewable energies. Soliño et al. [5] applied the method to assess a program whereby 10% of the electricity produced from coal, fuel oil and gas would be replaced by electricity generated in biomass power plant. The results showed that households of Spain are willing to pay 38 Euros per year. Montis and Zoppi [6] also used the CV method to investigate the level of social consensus on an energy plant based on the use of vegetal biomass in Italy. Although many studies have been conducted on renewable energy sources, case studies for ocean energy cannot be found as far as the authors are concerned.

3. Methodology

3.1. Measurement method: The CV method

The cornerstone principle in measuring the benefits from a proposed policy is the concept of the consumer's WTP for the policy [9]. This concept represents the amount people would be willing to pay to enjoy a specific improvement in environmental quality, or to receive supply of a public good [10]. In this study, we focused on measuring the economic benefits of ocean energy technology. This objective is carried out using a survey approach called the contingent valuation (CV) method. CV is a survey-based value elicitation approach and it queries consumers in systematic ways to estimate a willingness to pay for a proposed policy or environmental management.

CV is enormously flexible in that it can be used to estimate the economic value of various things. By applying CV method, it is possible to recover non-use or existence values which are unable to be assessed through market mechanism. The fact that the CV method is based on asking people questions, as opposed to observing their actual behavior is the source of its greatest strengths and its greatest weaknesses. Although there can be some controversies, the blue-ribbon National Oceanic and Atmospheric Administration (NOAA) Panel concluded that the CV method can produce estimates reliable enough to be the starting point for administrative and judicial determinations and presented several recommendations [11]. The validity and accuracy of a CV study will be enhanced if people are familiar with the good to be valued, if professional interviewers are used, and if other conventions suggested by the NOAA Panel are followed. Our study meets the conditions, which will be discussed below in detail.

3.2. Sampling and survey methods

The data on household WTP for developing ocean energy technologies and characteristics used in this analysis come from a 2010 survey of households of Republic of Korea. The study area of this research was the whole country. The total number of

Table 1
Studies on the valuation of renewable energy.

Sources	Countries	Methodology	Goods to be valued	Main results
Wiser [3]	USA	CV	Renewable energy	Higher WTP with a collective payment mechanism
Zarnikau [4]	USA	CV	Renewable energy	Higher WTP with age, education, income and information
Davis and Owens [7]	USA	Real options	Renewable electric technologies	USD 30.6
Bergmann et al. [8]	Scotland	CE	Renewable energy investments	Positive WTP
Soliño et al. [5]	Spain	CV	Biomass	EUR 38 per year
Montis and Zoppi [6]	Italy	CV	Vegetal biomass	EUR 47 per year

Note: CV and CE denote the contingent valuation and choice experiment, respectively.