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Energy projects in Iceland – Advancing the case for the use of economic valuation techniques to evaluate environmental impacts

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HIGHLIGHTS

- Current risk of sub-optimal decision-making by licensing body, Orkustofnun.
- OECD call for monetary valuations of environmental impacts linked to Icelandic energy projects.
- Lessons to be learned from US regulatory approach to advance cost-benefit assessment practice in Iceland.
- Practice of conducting non-market valuation techniques limited in Iceland, but now growing.

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ABSTRACT

Decision-making in Iceland has occurred without reference to economic valuations of the environmental impacts of energy projects. Environmental Impact Assessments, a legal requirement for nearly all energy projects in Iceland since 1994, have played an important role in identifying the environmental impacts of energy projects, and proposing mitigation measures. However, a purely qualitative description of enviroadvancing the case for the use of economic valuation techniques to evaluate environmental impactsnmental impacts is insufficient to ensure that they are accounted for equivalently with all of the other costs and benefits of a proposed project. Instead, as monetary information concerning the welfare gains or losses of proposed projects is not currently required to be provided to the licensing body, Orkustofnun, there is the potential for sub-optimal decision-making to occur. As this paper sets out, a broad variety of non-market valuation techniques already exist and could be applied to estimate the value of environmental benefits sacrificed to accommodate such developments. These methods and their outcomes could be incorporated within mandatory cost-benefit assessments for proposed Icelandic energy projects, communicating an estimate of the full welfare implications of approvals to decision-makers and the public alike, and fulfilling an OECD demand for the country to commence such processes.

1. Introduction

The objective of public policy is to improve or correct components of social welfare, from economic conditions to health to the quality of the environment (Lazo and McClain, 1996). Approving development projects with significant environmental impacts implies that the forgone benefits are expected to be less than a project's financial gains. A broad variety of non-market valuation techniques exist for estimating derived environmental benefits, yet in the absence of such valuations to guide decision-making, projects may be approved which result in a net loss in social welfare (Pearce, 1998; Dixon et al., 2013). This risk is evident in the case of Iceland, where neither the cost-benefit assessments (CBA) for renewable energy power plants nor industrial works reliant on their generating capacity have been required to incorporate such non-market considerations.

Iceland has become a world-leader in terms of harnessing renewable energy, with its abundant hydropower and geothermal sources together now supplying almost 100% of electricity generation and 85% of primary energy use (Orkustofnun, 2014). The availability of highly competitive energy prices and a secure supply of electricity have led to an expansion in the number of power plants and the role of energy-intensive industries, particularly aluminium smelting, which consumes 68.40% of the nation's annual electricity consumption (Orkustofnun, 2014). Unable currently to export Iceland's renewable energy abroad, this focus has been effective in drawing in foreign investment and diversifying

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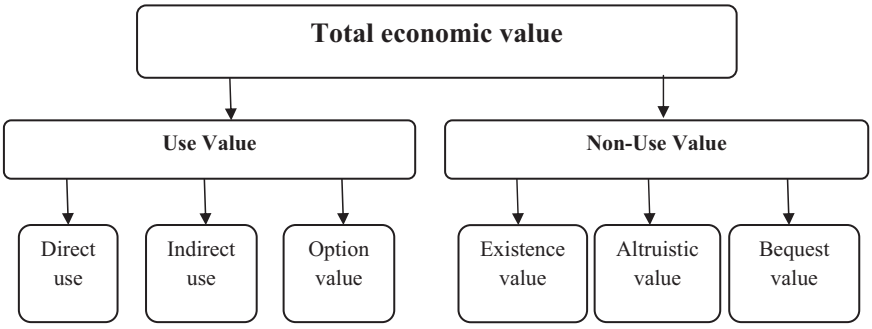

Fig. 1. Total economic value framework.

the export industry (Kristófersson and Cosser, 2009), but has also led to burgeoning environmental impacts such as a 178% increase in the leakage of sulphur hexafluoride (SF_6) emissions from electrical equipment in the period 1990–2013 (NIR, 2015). The Global Warming Potential of SF_6 emissions is around 3400 times greater than an equivalent volume of carbon dioxide.

Since 1994 the qualitative nature of environmental impacts related to proposed energy projects have been outlined within mandatory Environmental Impact Assessments, but no effort has been made to quantify these effects in monetary terms to be compared against the economic gains of projects. This is despite 'Welfare for the Future – Iceland's National Strategy for Sustainable Development 2002–2020' setting out a strategic objective for the country to *"introduce more economic instruments in the field of environmental protection and resource utilisation in the near future"* (Ministry for the Environment in Iceland, 2002, p. 13). Moreover, the OECD has repeatedly requested that Iceland commences accounting for environmental impacts within decision-making (OECD, 1993; OECD, 2001; OECD, 2014). Most recently, the OECD's (2014) assessment reiterated that it was important for Iceland to *"develop some cost-benefit analysis process which gives appropriate consideration to all dimensions of power development (environment, tourism, social and regional development, project profitability)"* (OECD, 2014, p.115).

The aims of this paper are to review the current decision-making basis in Iceland in relation to energy projects, in so doing setting out the rationale for conducting valuations of the environmental benefits sacrificed as a consequence of developing Iceland's energy resources. Section 2 begins by discussing environmental benefits in terms of the broad concept of ecosystem services. This concept is then linked to the total economic value framework, before a review is carried out concerning the strengths and weaknesses of the various non-market valuation techniques that can be applied to estimate the various value components. Section 3 provides a summary of the national policy, regulatory and legislative context in Iceland relevant to energy projects, before delineating the changes necessary to ensure that environmental impacts are properly accounted for in decision-making, as per the OECD's clarion call. Finally, Section 4 outlines the methodology pertaining to the upcoming contingent valuation studies concerning two of Iceland's geothermal areas (Hverahlíð and Eldvörp), in so doing highlighting one possible approach to valuing the environmental implications of a future Icelandic energy project.

2. Total economic value and economic valuation techniques

2.1. Introduction to ecosystem services and the concept of total economic value

2.1.1. Ecosystem services and utilitarian conceptions of value

The value of the many benefits deriving from natural resources – their ecosystem services – can be expressed in different ways according to cultural conceptions, philosophical perspectives, and schools of thought (Goulder and Kennedy, 1997). Ecosystem services are commonly classified into four categories: (1) provisioning, such as the production of food or reaping of a timber harvest; (2) regulating, such as climate control or water filtration; (3) supporting, such as pollination and nutrient recycling; and (4) cultural, such as spiritual and recreational benefits (MEA, 2005). One of the main endeavours of the Millennium Ecosystem Assessment was to evaluate the importance of ecosystem services to human welfare, so as to help promote more informed decisions concerning the management of natural resources (MEA, 2005). From a purely anthropocentric perspective, ecosystems have value because they provide services to sustain life and satisfy the consumption demands of human beings (Costanza et al., 1997). Such a perspective relies on a utilitarian conception of value, whereby human beings source utility from ecosystem services either directly or indirectly. The overall level of utility from an ecosystem service requires the aggregation of individual preferences and an indirect form of estimation using the metric of money. That is not to say that only ecosystem services generating monetary benefits are considered in economic valuation techniques. Rather, the majority of economic assessments are focused on non-market valuation techniques that estimate utility indirectly using this metric.

2.1.2. Ecosystem services and the total economic value framework

A commonly used framework for examining the utilitarian value of ecosystem services is the concept of total economic value, an all-encompassing measure of the economic value of any environmental resource. Economists have typically split the total economic value of natural resources into two main constituent parts: use and non-use value (Tietenberg, 1988; Hanley, Shogren and White, 2013), as summarised in Fig. 1.

Use value includes direct use, indirect use and option value (Bateman and Willis, 2001). In the case of direct use value, individuals undertake a planned demand for an ecosystem service. This may take the form of consumptive use, whereby individuals extract provisioning services from an ecosystem. Alternatively, direct use may be non-consumptive in character and not involve a drawing down on resource stocks, such as during the receipt of cultural, spiritual and recreational benefits. Consumptive forms can generally be traded in a market while non-consumptive cannot.

Indirect use value broadly relates to the MEA's depiction of regulating and supporting ecosystem services. Although they are frequently ignored as individuals do not receive direct benefits,