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Knowledge brokering on emissions modelling in Strategic Environmental Assessment of Estonian energy policy with special reference to the LEAP model

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ABSTRACT

Strategic Environmental Assessment (SEA) serves as a platform for bringing together researchers, policy developers and other stakeholders to evaluate and communicate significant environmental and socio-economic effects of policies, plans and programmes. Quantitative computer models can facilitate knowledge exchange between various parties that strive to use scientific findings to guide policy-making decisions. The process of facilitating knowledge generation and exchange, i.e. knowledge brokerage, has been increasingly explored, but there is not much evidence in the literature on how knowledge brokerage activities are used in full cycles of SEAs which employ quantitative models. We report on the SEA process of the national energy plan with reflections on where and how the Long-range Energy Alternatives Planning (LEAP) model was used for knowledge brokerage on emissions modelling between researchers and policy developers. Our main suggestion is that applying a quantitative model not only in *ex ante*, but also *ex post* scenario modelling and associated impact assessment can facilitate systematic and inspiring knowledge exchange process on a policy problem and capacity building of participating actors.

1. Introduction

SEA is a type of impact assessment to integrate environmental concerns into strategic decision-making with the aim to promote sustainable development. In a decision-making process, impact assessments can serve various and simultaneous functions: information generation, debate and deliberation, attitude shifting and complexity structuring (Hugé et al., 2011). Farrell et al. (2001) also emphasise the communicative role of assessment processes as bridges between science and policy. In the energy sector, where impact assessment deals with complex technical and structural issues, uncertainties and multiple impacts, quantitative models are widely used as planning and analysis tools for addressing these challenges. While modelling itself is not driving the policy, nor deciding the political feasibility of targets, quantitative models can offer structured insight into areas of uncertainty (Strachan et al., 2009; Mundaca et al., 2010), help understand the interactions and promote discussion (Jebaraj and Iniyan, 2006) and support various approaches to future studies (Finnveden et al., 2003). Van Daalen et al. (2002) have summarised four contributions of quantitative models to the environmental policy-making life cycle: 1) eye-opener, 2) visualiser of alternative future scenarios, 3) vehicle for inspiring political consensus, and 4) assistant in identifying concrete policy decisions and potential policy outcomes. However, the use of models in policy development is not always self-evident. Brugnach et al. (2007) suggest that both the modelling and the policy-making communities should contribute to the integration of modelling information into policy formulation. For modellers, this involves promoting models as tools of communication, learning and exploration, and for policy-makers, this suggests a need to view modelling as a tool for informing the public and scientific community in an uncertain world.

SEAs can serve as platforms for enhancing such knowledge exchange, where information is not simply transferred from researchers to decision-makers, but developed and co-produced interactively with actors involved (Sheate and Partidário, 2010; Fazey et al., 2012). Assessments are also more likely to influence decision-making if the decision-makers are sharing and acquiring not just information but knowledge (information that has been processed through learning) (Sheate and Partidário, 2010). Similarly, model generated output alone may not be enough for decision-making. However, knowledge exchange is often conducted on an ad-hoc basis, based on 'what seems to work' (Reed et al., 2014). In impact assessments, Partidário and Sheate (2013) suggest not simply hope that the process of facilitating knowledge generation and exchange, i.e. knowledge brokerage, will happen, but explicitly design it in order to support constructive and collaborative planning

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processes and ultimately more sustainable outcomes. At the same time impact assessors need to adopt a flexible, adaptive and learning approach themselves too, as the decision-making processes are often long and unpredictable (Kørnøv and Thissen, 2000). This is supported by Runhaar and Driessen (2007) who argue that SEA studies will obviously have a greater impact when they are flexible and tailored to the actual evolvement of policy processes, rather than adhering to strict, standardised and detailed procedures. Likewise, knowledge brokering activities in SEA should also depend on the needs and expectations of actors involved.

Knowledge brokering has been categorised in several ways. For example, Ward et al. (2009) identify three models of knowledge brokering: knowledge management, linkage and exchange, and capacity building, which represent common roles performed by knowledge brokers. In environmental modelling, Krueger et al. (2012) highlight the convening, communicating, mediating and translating roles of knowledge brokers. Turnhout et al. (2013) differentiate three knowledge brokering repertoires: supplying, bridging and facilitating, illustrating the relation between knowledge production and use. Michaels (2009) specifies six knowledge brokering strategies to environmental policy problems and settings and based on her work, Jones et al. (2013) set out six functions of knowledge intermediaries. These strategies/functions are listed in order of increasing intensity of relationship building and commitment of resources:

- *informing* (disseminating research results to policy developers, limited exchange between the producers and users of the knowledge);
- *consulting/linking* (advising on problems delineated by parties seeking counsel, linking policy developers with the expertise needed for a particular policy area);
- *matchmaking* (bringing together individuals who can contribute to policy-making and who would not otherwise meet, e.g. from another discipline or with different types of knowledge);
- *engaging* (involving other parties in discussions that are framed by one party, to provide knowledge on an as-needed basis);
- *collaborating* (parties jointly frame the process and negotiate the substance of issues, may need significant resources of time and money);
- *building adaptive capacity* (parties jointly direct interactions and discussions of problems with multiple dimensions in which learning is considered, to improve the ability of parties in handling multiple and emerging issues).

Depending on the decision-making issue, all or some of these strategies may be appropriate at different points of the policy cycle. For instance, Jacobson et al. (2005) have shown that consulting can be an effective strategy for interactive knowledge transfer to enhance the use of research-based knowledge in decision-making. Sheate and Partidário (2010) demonstrate the role of engagement and capacity building in strategic planning and assessment.

In order to distinguish between different knowledge brokerage strategies related to environmental policy problems, we take the typology of Michaels (2009) as a starting point and examine the knowledge exchange process on emissions modelling between researchers and policy developers in the national energy plan SEA. In our study the model is LEAP (Long-range Energy Alternatives Planning model) which is a software tool for energy-environment policy analysis and impact prediction, developed at the Stockholm Environment Institute (Heaps, 2008; www.energycommunity.org). LEAP can be used for both demand and supply side energy modelling, including for building and comparing scenarios to meet the energy demand in all sectors of an economy and account for energy and non-energy sector greenhouse gas (GHG) emission sources and sinks. The literature shows that most of the LEAP-model applications have been at the national level, primarily driven by policy requirements: for developing low-carbon economies, future sustainable energy and climate policies, and renewable energy development scenarios or to reduce CO_2 emissions (e.g., Tao et al., 2011; Yophy et al., 2011; Roinioti et al., 2012; Özer et al., 2013; Park et al., 2013). At the city level LEAP has been applied for urban energy saving and emissions reductions (e.g., Lin et al., 2010) and globally for developing forward-looking assessments of energy challenges (Nilsson et al., 2012). In Estonia, the LEAP model has been used for the national level *ex ante* SEA of Energy Plan 2020 and in *ex post* scenario modelling and associated impact assessment for the preparation of Energy Plan 2030+. The paper is structured as follows. Section 2 describes the knowledge needs in the context of Estonian energy policy and knowledge generation with LEAP in the national energy plan. Section 3 describes the study methodology. In Sections 4 and 5, the study results are presented and discussed, respectively. The final section draws conclusions based on the study findings.

2. Test case context

The knowledge needs for formulating a national development plan for the energy sector (hereinafter: *national energy plan*) primarily include information on available resources and policy measures needed to meet European Union (EU) and national climate and energy policy targets and to ensure energy security. Information on environmental, economic and social impacts of energy policy measures as well as impact assessment procedural knowledge is also essential. In Estonia, the energy sector is dominated by one primary energy source: oil shale. As a domestic fossil fuel, oil shale provides for approximately 70% of the country's total primary energy supply. Although oil shale increases energy security of Estonia (the country's overall level of energy import dependence is approximately 15%), the energy sector is Estonia's most environmentally impactful sector. The majority of the country's GHG emissions come from oil shale extraction and combustion, which are the main drivers behind the national economy's high carbon intensity values (OECD/IEA, 2013). The national energy plan is the highest-level strategic document on the Estonian energy sector which elaborates on development visions and objectives and describes measures for achieving them. As such, the document formulates national energy policy, and its targets and measures have to be reflected down to the lower level development plans that implement this policy. The authority responsible for national energy plan preparation is the Ministry of Economic Affairs and Communications (MoEAC, hereinafter: *policy developers*). The first Estonian energy sector national development plan was approved by the Estonian Parliament in 1998 and has now been reviewed three times, combined with SEA according to the EU Directive SEA Directive 2001/42/EC. The second and third authors of the current paper together with other energy experts (hereinafter: *researchers*) from the SEI Tallinn Centre (SEIT, a non-governmental research institute) carried out the SEA for Energy Plan 2020 upon being selected by the MoEAC through public procurement. The guidelines for SEA on the website of the Ministry of the Environment do not outline specific requirements on SEA tool choice or application (Ministry of the Environment, 2009). However, there has been a certain history of the use of quantitative models in SEAs for national energy plans since Energy Plan 2020 (Table 1).

2.1. The use of LEAP model in the SEA of the national energy plan

In the Energy Plan 2020, the application of LEAP – a new model for Estonian national energy planning – was proposed by the SEA researchers who had the LEAP modelling expertise. In particular, we proposed to model the most important emissions of energy sector and to find out which electricity and heat production scenarios have the lowest level of carbon dioxide (CO_2) and sulphur dioxide (SO_2). Since LEAP is a scenario-based modelling system, it was possible to work closely with the policy developers responsible for the preparation of the national energy plan throughout the development of alternative scenarios. Issues regarding how detailed the model should be, what sectors should be modelled, and which parameters and input data to use were negotiated