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Energy models from a strategic environmental assessment perspective in an EU context—What is missing concerning renewables?

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ABSTRACT

Climate change and security of energy supply are main sustainability issues today and an energy systems shift towards renewable energy sources is therefore urgent. However, unless environmental impacts of such a shift are carefully taken into account, imposed resource and land use changes may counteract other sustainability goals, such as preserving biodiversity and ecosystem services. Strategic Environmental Assessment (SEA) provides a comprehensive framework for assessment of policies and plans where a full range of environmental issues are addressed. The aim of this article was to find possibilities for comprehensive sustainability assessment among published energy–environment models and the linking of renewable energy analysis to landscape and biodiversity issues through land use concerns. Based on the review of relevant energy, environmental and linking models, a survey on publications and a case study on the EU Energy Roadmap 2050, the results show that existing energy models and research have low concerns on land use, landscapes and biodiversity. Consequently, it would be difficult to provide comprehensive decision support by using only these tools. However, suitable energy models, ecological assessment models and multi-criteria approaches exist with great potential for inter-linking. The development of energy models could thus have new orientations, connecting them to involve renewable energy options with land use, landscape and biodiversity concerns, which could be advanced into powerful SEA tools for integrated policy assessment. This will enable the development of more comprehensive decision support tools for assessing future energy scenarios, integrating main policy concerns when assessing renewable energy options.

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1. Introduction

Climate change and security of energy supply are main sustainability issues today and an energy systems shift towards renewable energy sources is therefore urgent. However, unless environmental impacts of such a shift are carefully taken into account, imposed resource and land use changes may counteract other sustainability goals, such as preserving biodiversity and ecosystem services (e.g. [1–6]). Since both climate change and biodiversity are increasingly seen as being of highest priority [7,8], there is a need for an integrated approach for addressing these issues that can take both energy and environmental impacts into account.

To counteract climate change by reducing greenhouse gas emissions and to promote security of energy supply, increased use of energy from renewable sources is an important part of the measures needed, which is supported by e.g. the EU Renewable Energy Directive (2009/28/EC). With a view of achieving the commitment within EU of reducing greenhouse gas emissions to 80–95% below 1990 levels by 2050, several scenarios have been built and analysed in order to explore the challenges and opportunities of possible future development alternatives. Firstly, in the Roadmap for moving to a competitive low-carbon economy in 2050 [9], the implications of this commitment were analysed. This Roadmap seeks to develop a long-term European technology-neutral policy framework to modernize energy supply. Secondly, in the Energy Roadmap 2050 [10], according to the scenario analyses, a secure, competitive and decarbonized energy system in 2050 is possible. On the way to this goal, the energy system would be transforming together with a number of structural changes, such as decarbonisation of the energy system, a substantial rise of renewables, energy savings, and other. In all scenarios, which were built on different combinations of these structural changes, the share of renewable energy sources would rise substantially, achieving at least 55% in gross final energy consumption in 2050 [10].

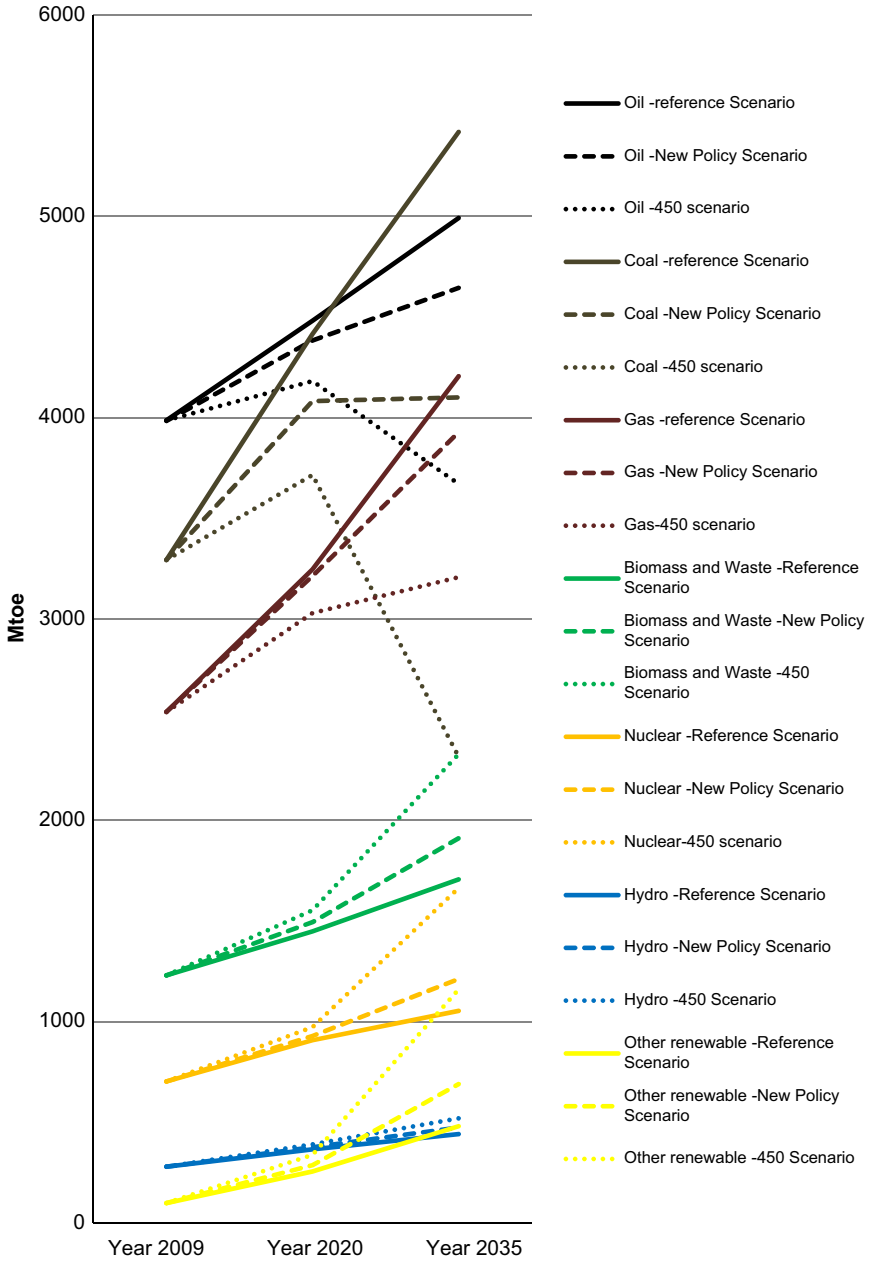

Fig. 1. Energy demand projected by World Energy Outlook 2011 (International Energy Agency [12]).