Stakeholder-based sustainability impact assessment of EU bioenergy policy in the High Tatras, Slovakia

Zuzana Drillet¹, Pavol Kenderessy², Jake Morris³, Zita Izakovičová², John Farrington¹

¹ University of Aberdeen, St. Mary’s, Elphinstone Road, Aberdeen, AB24 3UF, Scotland, UK
² Institute of Landscape Ecology, SAS, Stefanikova 3, 814 99, Bratislava, Slovakia
tel.: +421 2 52494544, e-mail: pavol.kenderessy@savba.sk
³ Forest Research, Alice Holt Lodge, Farnham, Surrey GU10 4LH, UK

Abstract: This paper presents the methods and results of two phases of stakeholder inclusive research aimed at assessing the impacts of bioenergy policy scenarios in the High Tatras, Slovakia; a ‘Sensitive Area Case Study’ within the SENSOR project (Sustainability Impact Assessment: Tools for Environmental, Social and Economic Effects of Multifunctional Land Use in European Regions). The assessment involves the analysis of the impacts of biodiversity policy scenarios using a range of social, economic and environmental indicators that are defined by the stakeholders. Impact scores are compared to sustainability limit values derived for each indicator. The assessment also involves a sustainability criteria ranking exercise, used to elicit stakeholders’ preferences for the scenarios. Taken together, the analysis of sustainability indicators, limits and criteria constitutes a Sustainability Impact Assessment (SIA) of the policy scenarios. The results reveal that all of the assessed scenarios would fail to achieve satisfactory sustainability levels in any of the selected indicators, despite some positive impacts in relation to employment generation and water management. From these results we conclude that stakeholders have serious misgivings about the sustainable implementation of bioenergy in the High Tatras region and that major revisions to current bioenergy policy formulation may be needed if the policy’s potential contribution to sustainable regional land use is to be realised.

Key words: sustainability impact assessment, stakeholder participation, bioenergy, land-use change

Introduction

Sustainable development sets out principles for the wise utilization of human and natural resources to provide for the fundamental needs of society whilst safeguarding the resources that will be needed by future generations. The Integrated Project SENSOR (Sustainability Impact Assessment: Tools for Environmental, Social and Economic Effects of Multifunctional Land Use in European Regions) developed a model-based Sustainability Impact Assessment Tool (SIAT) to carry out ‘quick-scan’ sustainability impact assessments (SIA) of European land use policy impacts. The SIAT tool is designed to inform the design of sustainable land-use policies through the Impact Assessment process (EC, 2009). SENSOR also implemented a programme of stakeholder based research in so-called Sensitive Area Case Studies (SACS) to
reveal sustainability issues at regional level, and to assess impacts of land use policies at regional level in order to inform the design of the SIAT and validate its outputs (Morris et al., 2008). Part of this research involved the development of a ‘Framework for Participatory Impact Assessment (FoPIA) (Morris et al., in press). The participatory research programme and the FoPIA were orientated around a number of key principles: 1) including the general public and key stakeholders in the decision making processes around land use promotes better management of the land itself, as well as increases community capacity (Firbank et al. 2007); 2) participation allows for a direct feedback on the evolution of the situation; more comprehensive understanding of the issues including different perspectives of a scientific, social, cultural and ethical nature (Van den Hove, 2000); 3) Involvement of interested parties potentially brings greater sense of collective responsibility in respect of public becoming part of policy-making process (Scarse and Sheate, 2002).

The renewable energy industry is one of the Europe’s fastest growing sectors. The implications in terms of changes in land-use and their related impacts are likely to be significant (Domac et al., 2005). The paper is largely based on our experience with the bioenergy policy assessment in the Slovakian context, and predictions of the potential land use impacts in the High Tatras SACS. The bioenergy policy case was selected for analysis in the High Tatras even though biomass utilization is not currently significant in the region. However, the High Tatras represents an interesting context for the analysis of bioenergy policy development because:

- the area is of high nature conservation value, with the implication that sustainable technologies for heating or transport should be favoured;
- there are large and diverse sources of wood biomass available;
- old and recently planned hotel and accommodation facilities have a great potential to use renewable energy sources such as wood biomass;
- resident populations concentrated on the foothills of High Tatras represent a potentially significant market for biomass heating and domestic energy production.

**Materials and methods**

Sustainability at the systemic level can be assessed, through these procedural elements: analysis of deeper lying structures of the system, projection into the future, and assessment of sustainable and unsustainable trends, evaluation of the effects of sustainable policy and the design of possible solutions through sustainable strategies (Kemp and Martens, 2007). The development of the FoPIA was projected alongside these steps: analysis of the policy background in the member state under investigation; building possible scenarios of policy options into the future; assessment of those with help of stakeholders/experts and common effort in designing the possible solutions.

Sustainability impacts of policies at regional level are in SENSOR assessed with help of novel concept of Land Use Functions (LUFs). The LUFs express in a compressed way the impacts caused by a policy options on the functionalities of the main land uses in a region (Pérez-Soba et al., 2008). Due to the fact that LUFs approach allows for a flexible selection of indicators depending on the regional characteristics, it has been used in the stakeholder-based sustainability criteria analysis, guiding the interpretation of the impact assessment of the policy under investigation (Morris, Tassone, 2006).

The research was undertaken during period of September 2006 – June 2007 in the High Tatras, Slovakia. Our work with stakeholders was divided into two phases: Defining policy scenarios (Phase 1), and
conducting an SIA of each scenario (Phase 2). Phase 1 involves the use of semi-structured interviews with individual stakeholders, and in Phase 2 these stakeholders are brought together to participate in an SIA workshop (Morris et al., 2008):

**Phase 1: Policy implementation** was focused on how Slovak Republic meets the national indicative targets of EU bioenergy policy and which policy instruments are implemented in order to fulfill EU policy goals. The research involved the analysis of relevant national policy documents and conducting semi-structured expert interviews with stakeholders (representatives of ministries, sectoral organizations, NGOs and research and development organizations). Existing policy documents and barriers to RES utilisation were then evaluated. Semi-structure interviews were also used to analyze the regional land-use change implications of bioenergy policy. Selected stakeholders represented sectors with direct land-use claims (primarily agriculture, forestry, tourism), together with those organizations responsible for regional policy and planning activities.

**Phase 2: SIA workshop** brings together all the stakeholders from Phase 1. During the workshop the stakeholders carry out an analysis of sustainability criteria and an assessment of the changes in the corresponding social, environmental and economic indicators that would result from implementing the proposed policy scenarios. New indicator values are then compared with sustainability limits set by the stakeholders.

In the High Tatras the workshop activities consisted of:
- Presentation of 3 policy scenarios concerning the possible futures of bioenergy utilization in Slovakia, together with the policy instruments, based on the findings of the Phase 1 interviews and analysis of the policy documents. Experts were asked to comment on scenarios and select one which represents the most realistic option of bioenergy policy implementation in the case study area.
- Assessment of sustainability criteria: presentation, discussion and analysis of selected land-use functions criteria (LUFC) i.e. a list of key factors that are needed to be taken into account in any consideration of the sustainability impact of the scenarios. These were based on the Land Use Functions concept (Pérez-Soba et al., 2008) and adjusted by the stakeholders so they fit the context of the High Tatras and the existing policy instruments. Stakeholders then scored each LUFC (Scores ranged from 0 to 10; score 10 means the function was regarded as ‘very important’).
- Definition of sustainability indicators for each criterion and the assessment of impacts of the policy scenarios. Stakeholders were asked to base their predictions of the impacts on a timescale of 25 years; given scores in range of −3, signifying strong decrease to +3 signifying strong increase. Average impact score for each scenario on each LUFC were calculated.
- Proposal of minimum standards (sustainability limits) for each indicator. Stakeholders performed a simple scoring exercise to determine minimum acceptable standards (sustainability limits) for each of the indicators.

**Results**

**Define policy scenarios (Phase 1)**

Policy goals of the EU stated in the Green Paper (EC, 2006) emphasize the environmental benefits of reducing greenhouse gas emissions, and the importance of energy independence by reducing both energy imports and dependency on fossil fuels. In the Slovakian context additional positive aspects of bioenergy promotion are seen in terms of increasing regional employment, creating new markets for agricultural and forestry products and lowering the costs of production at regional level.
Beyond the various European framework conditions, the success of renewable energy policy within individual EU Member States is significantly influenced by the precise nature of the national policy instruments adopted (Reiche, Bechberger, 2004). Main directives and policy instruments currently adopted into Slovak legislation are:

1.) Directive 2001/77/EC (EC, 2001) for the support of electric energy produced from renewable energy sources. Indicative target of the EU is 22% of overall share of electricity production to come from RES by 2010. Official act on conditions of Slovakia accession (chapter 12) had set the national indicative goal for electricity production from RES to 31% by 2010. This national target was afterwards updated by Document proposal for development of renewable energy sources including a statement of indicative goals for utilization of renewable energy sources (Resolution number 667-2004) and decreased to 19% by 2010 (Ministry of economy of SR, 2004a). The national specification is that the majority of energy produced by RES (almost 90%) is generated by large Hydro-Electric Power stations especially the biggest one in Gabčíkovo on Danube river. Considering the effect of major hydro-power stations on total electricity production, the RES cover only 1% of total production. The target is to increase the share of RES to 4% by 2010 and 7% by 2015.

2.) Indicative target set by the EC White Paper (EC, 1997) is 12% overall share of energy production to come from renewable sources by 2010 (proportion of 15% of this is to come from biomass). A new Act on support of renewable energy from high efficiency combined production n. 988/2009 represent necessary core document for RES support in Slovak Republic, which resulted to adoption of Strategy for higher utilization of renewable resources in the Slovak Republic (resolution number 383/2007) (Ministry of economy of SR, 2007).

3.) Directive 2003/30/EC on the promotion of biofuels, specifies that 5.75% of all petrol and diesel should be biofuels by 2010. Slovak Republic elaborated a document proposal for the implementation of the Directive 2003/30/ES indicating national goal of 5.75% in 2010 for Slovak Republic (EC, 2003a). Currently, production incentives are not being provided due to the fact that the biofuels market is being considered by Slovak government as a profitable one. Production and distribution of concentrated corn alcohol for ETBE and its addition to gasoline started in December 2006 in the Slovak refinery Slovnaft (Government of Slovak Republic, 2004a).

4.) Directive 2003/96/EC (EC, 2003b) on taxation of energy which provides reduced rates on energy from RES. It has not been implemented in its full extend. Decree of the Regulatory Office for Network Industries (2/2005) gives a fixed price guarantee for electricity produced from RES for the period of 1 year. Moreover, Act on energy n. 656/2004 states that “The Ministry of Economy may, in the interest of the general economy, declare the obligation for priority access, priority connection to the system, priority transfer of electricity and priority distribution of electricity and priority supply of electricity produced from RES on the certain area” (Government of Slovak Republic, 2004b). By ordinance 124/2005 which lays down rules for operation of the electricity market, are runners of distribution systems obliged to cover electricity losses preferentially from RES (Government of Slovak Republic, 2005).

According to policy documents analysis and interview results, the main obstacles for RES utilization in Slovakia could be summarized to following points:

– lack of policy harmonisation between ministries in competence of RES support in Slovakia (Ministry of Environment, Ministry of Economy and Ministry of Agriculture),

\[\text{Policy instruments are the means by which the policy objectives are achieved.}\]
– insufficient legislation support (bioenergy support is rather market driven than policy driven) and low promotion of renewable energy in general,
– unstable prices and market environment (only one year price guarantee for electricity produced from RES),
– low interest of investors (cost of renewable energy facility equals the cost of conventional facility and the environmental benefits are not considered),
– very good natural-gas supply network (lack of government support for transition to biomass heating)
– undeveloped market for renewable energy technology,
– lack of sufficient know-how e.g. for fast growing wood cultivations.

Further restrictions follow from the fact that the core area of High Tatras region is represented by the oldest Slovak National Park TANAP (established in 1949) and High Tatra Biosphere Reserve (established in 1993) implying territorial restrictions from the Act on Nature and Landscape protection n. 543/2002 (Government of Slovak Republic, 2002). Due to this fact there are several restrictions which could influence the successful realization of bioenergy policy:

– banned dissemination of non-native species of plants and animals (this may imply to plantations of not native fast growing woods,
– banned terrestrial application of chemicals and fertilizers, especially pesticides, herbicides, toxic substances, industrial fertilizers and ensilage in agriculture, forestry and other activities,
– banned clear cutting (only selective logging or undergrowth way of forest management are currently supported).

Due to above stated reasons; utilization of bioenergy in High Tatra region is rather insignificant. There are few small companies using biomass for the community or private heating e.g. SEMENOLES in Liptovský Hrádok (biomass heating greenhouses for the seedlings) or Alcatel in Liptovsky Hrádok (biomass community heating and factory heating). In addition, within several villages of Podtatranska basin, households exchanged conventional boilers for biomass boilers due to economic reasons. However actions resulting in land-use change due to bioenergy utilization are very few.

When estimating impacts of bioenergy policy on land-use change, alternation of land-use comes with plantations of fast growing woods. Project for Revitalization of High Tatras in the foothill area is aimed at plantations of anti-erosion wood vegetation, utilized also for bioenergy. The project involves the creation of public-private associations comprised of farmers and village representatives who all share a „stake“ in biomass utilization. Furthermore, in the foothill area was realized project of fast growing plantations of Swedish willow (6 ha) as part of the test site for a company Dalkia interested in bioenergy utilization. Other projects are in the state of the future plans, from which the most significant would be the realization of biomass heating plant in Poprad.

Semi-structured interviews with regional stakeholders elaborated a clear picture of the key sustainability issues/problems within the case study area which could be linked with potential impacts of bioenergy policy. The main factors and key sustainability issues underlying current land use change to emerge were:

– Tourism pressure in the alpine and subalpine area and recreation pressure mainly on the foothill area (new developers), uncontrolled construction of new accommodation facilities.
– Lack of employment opportunities and ex-migration of young people from the High Tatra region. According to study Izakovičová and Imrichová (2006) the average unemployment of the study area in 2006 reached 12.6%. Considerable differences exist among the settlements, ranging from the 5% unemployment up to 25%.
– Low forest stability due to unsuitable forest management and air pollution in the past. Forest in the buffer zone planted with nonindigenous spruce seeds forming monoculture forests. On November 2004 High Tatras were struck by the wind storm calamity. As a consequence 12 600 ha of forest fell down, represented mainly by susceptible spruce monocultures in the elevation between 850 m.s.l – 1100 m.s.l. (Due to small state support and insufficient technology for processing the wood locally, 80% of biomass was exported from the Tatra region, mainly abroad. Residual biomass was burnt in-situ, causing wildfire outbreaks).
– Soil erosion on large blocks of agricultural fields in the Podtatranská basin and accelerated surface water flow on cleared land after the windstorm in 2004.
– Restricted rights of the land owners. The owners are obliged to follow the obligatory forest plan and are restricted in their decision rights due to the High Tatras NP. The law compensating the private owners for management restriction exists but isn’t well enforced. The same applies for the villages, where development is lacking due to the restrictions posed by the NP.
– Abandonment of agricultural land. Restitution of land after 1989 caused changes to farming and forestry practices, resulting to abandonment of unfavorable areas, especially remote grassland areas.

**Phase 2: SIA workshop**

**Policy scenarios selection and definition**

Policy scenarios were drafted on the basis of the Phase 1 interview findings and with reference to existing EU and national policy documentation. Experts were asked to comment on scenarios; particularly whether they represent reasonable interpretation of bioenergy policy implementation within the case study area. Draft policy scenarios are presented in the table below (table 1).

<table>
<thead>
<tr>
<th>Scenario 1: Low promotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid biofuel obligation remains at 5.75% of all transport fuels</td>
</tr>
<tr>
<td>No increase in funding for bioheat and bioelectricity production</td>
</tr>
<tr>
<td>1 year guaranteed fixed price for bioelectricity production</td>
</tr>
<tr>
<td>No increase in subsidy for energy crops</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 2: Medium promotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid biofuel obligation rises to 10% of all transport fuels</td>
</tr>
<tr>
<td>Small increase in funding for bioheat and bioelectricity production</td>
</tr>
<tr>
<td>5 years guaranteed fixed price for bioelectricity production</td>
</tr>
<tr>
<td>Small increase in subsidy for energy crops</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 3: High promotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid biofuel obligation rises to 15% of all transport fuels</td>
</tr>
<tr>
<td>Large increase in funding for bioheat and bioelectricity production</td>
</tr>
<tr>
<td>10 years guaranteed fixed price for bioelectricity production</td>
</tr>
<tr>
<td>Large increase in subsidy for energy crops</td>
</tr>
</tbody>
</table>
In general all stakeholders agreed with the presented policy scenarios, but some policy instruments were given higher priority than others. The main issues concerning the selection of policy scenarios addressed by stakeholders were following:

- a need for single law concerning RES where the fixation of the prices for electricity production from RES should be of high priority,
- a new policy instrument – “land tax” should be adopted to facilitate land utilization for energy production purposes,
- improve harmonization of various policies between ministries of competence,
- the 3rd Policy Instrument: Fixed price for bioelectricity production. Lowest support = 1 year and highest = 10 years.

**Analysis of the criteria (no trade-off)**

In general, all the stakeholders agreed that the proposed LUFCs were an adequate reflection of the key sustainability issues faced by the region. The LUFCs were subsequently evaluated by the stakeholder group and the results of the evaluation were discussed and agreed (table 2). The final scores reflected the preferences of individual LUFCs by stakeholder group (fig. 1).

Table 2. Land Use Functions (LUFs) and Land Use Function Criteria (LUFC) for High Tatras

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Land Use Functions (LUF)</th>
<th>Land Use Function Criteria (LUFC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOC1</td>
<td>Cultural</td>
<td>Landscape aesthetic quality</td>
</tr>
<tr>
<td>SOC2</td>
<td>Health and Recreation</td>
<td>Health and Recreation</td>
</tr>
<tr>
<td>SOC3</td>
<td>Provision of work</td>
<td>Employment generation</td>
</tr>
<tr>
<td>ECO1</td>
<td>Residential &amp; non land-based industries and services</td>
<td>Urbanisation</td>
</tr>
<tr>
<td>ECO2</td>
<td>Land based production</td>
<td>Land based production</td>
</tr>
<tr>
<td>ECO3</td>
<td>Infrastructure and mobility</td>
<td>Infrastructure and mobility</td>
</tr>
<tr>
<td>ENV1</td>
<td>Provision of abiotic resources</td>
<td>Abiotic function</td>
</tr>
<tr>
<td>ENV2</td>
<td>Provision of Habitat</td>
<td>Provision of habitat</td>
</tr>
<tr>
<td>ENV3</td>
<td>Maint. of ecosystem processes</td>
<td>Maint. of ecosystem processes</td>
</tr>
</tbody>
</table>

The highest priority was given to aesthetic quality and habitat provision. According to stakeholders opinion both of these functions are important and strongly interrelated. Both of them were considered as primary functions of the SACS area and could not be replaced by any other functions. They were also considered to support other highly prioritized functions, such as maintenance of ecosystem functions and health and recreation which subsequently generates the employment (in sector of tourism and recreation). If the ecological processes are well maintained, e.g. climate cycle, water cycle, this goes hand in hand with abiotic resources quality.
Fig. 1. Analysis of relative importance of individual LUFC (preference scores).

**Impact assessment**

The final stage of the workshop was the impact assessment of the bioenergy policy scenarios on each of the LUFC. The results are summarized in figures below (fig. 2, 3).

Key results from the stakeholders’ SIA of the bioenergy policy scenarios are as follows:

Due to uniqueness of the case study and restriction posed by nature protection (especially in the NP) the impact of policy change on aesthetic quality should only lead to its improvements and therefore isn’t significant under any of the three scenarios. Further expert’s suggestions are that region will under all three scenarios continue to fulfill its primary health and recreation function. With regard to core sustainability issues of the case study area previously mentioned (e.g. higher unemployment, agricultural aban-
Fig. 3. Impact assessment of three bioenergy policy scenarios compared with preference scores

...tionment), impact of all three scenarios on employment generation and land-based production function is significantly positive and leads to substantial increase in the functions. Following the same reasoning as in case of aesthetic quality, the build environment function and infrastructure and mobility function does not give the substantial increase (under “low scenario” there is neither decrease nor increase in functions predicted), however due to rather negative socio-economic development caused by the NP restrictions in the Podtatranska basin area there is a high potential for increase in these functions under Medium and High scenarios. Experts agreed on the bioenergy policy will have a negative consequences on the abiotic function projected mainly through water quality. The explanation was that the deterioration of the abiotic resources locally (e.g. water), can have further implications for case study area as a whole and impact even the highly protected sites. Habitat provision function did increase under Low and Medium scenarios (since bioenergy crops do provide a new type of habitat), however experts considered the High scenario and its impact on the habitat function provision as non-beneficial, therefore did not forecast neither the increase nor decrease in the function.

**Sustainability limits**

During the final session of the workshop stakeholders assessed the acceptability of the impacts of each of the policy scenarios (fig. 4). To that end, minimum standards, or sustainability ‘limits’ were defined for each indicator through a process of individual scoring, followed by group discussion informing changes to average limit scores. The results show that only in a case of built environment, transport infrastructure and land production certain losses in functionality would be acceptable, denoted by negative limit scores. For all other indicators stakeholders gave positive limit scores to convey their opinion that some improvements in functionality would be necessary to achieve sufficient sustainability standards.
The results also show that all three scenarios are predicted to have largely positive impacts, with the exception of ENV1 (water retention), where all three scenarios will impact negatively. Another noticeable result is that all three scenarios fail to meet the (high) minimum sustainability standards set by the stakeholders, particularly in relation to highly valued criteria (Landscape aesthetic quality, Health and Recreation, Abiotic function, and Provision of habitat). Where sustainability standards are met, it is only in relation to economic criteria, which are not highly valued (fig. 5).
**Discussion and conclusion**

The summary results show the impact of individual policy scenarios expressed by the selected social, economic and environmental indicators. The impact scores were compared to sustainability limit values set for each indicator. The scoring exercise was coupled with ranking exercise expressing stakeholder’s preferences for given criteria. As seen from results all social and most of the environmental criteria are highly prioritized in comparison with economic criteria. Perhaps unsurprisingly, the most significant gains are predicted to be in the provision of work (SOC1) and in land based production (ECO2). However, negative environmental impacts are foreseen in provision of abiotic resources (EVN 1). These negative impacts are balanced by positive influences over the maintenance of ecosystem processes (ENV3). When comparing the preference scores with limits it’s clear that most preferred criteria correspond to those most relevant to sustainability standards.

The comparison of sustainability limit values with impact scores shows that none of the assessed scenarios would achieve satisfactory sustainability level in case of any indicators. From these results we can conclude that even though bioenergy policy case could have the positive effect on employment generation and improvement of water retention capacity in the case study area it would not achieve a sufficient sustainability standards with regard to remaining criteria.

**Acknowledgement**

Special thanks to Mr. Emil Bédi, Mr. Ľubomír Polonec, Mrs. Kvetoslava Šoltésová – Slovak Energy Agency, Mr. Juraj Novák, Mr. Jozef Gregor & Mr. Norbert Kurilla, Mr. František Zacharda, Mr. Igor Iliaš, Mr. Židek, Mr. Dušan Hurajt, Mr. Michal Sýkora, Prof. Ivan Vološčuk, Mr. Ľudovít Dorko, Mr. Burda, Mr. Chomjak, Mr. Vagašský, Mr. Ján Julény, Mr. Slovik

**References**


