Project no. 505328

SustainabilityA-Test

Advanced Techniques for Evaluation of Sustainability Assessment Tools

Instrument: STREP
Thematic Priority: [1.1.6.3] Global change and Ecosystems

D15: Final case study report

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D15: Final Case Study Report

Final case study report
SustainabilityA-Test project: Deliverable 15

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This report includes results from the papers contributed in the course of the case study by all project partners. A list of documents and authors can be found in Annex 1.

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Summary

In this report the results of the case study that has been carried out in the course of the Sustainability-A-Test are presented. The focus of the case study is the increasing governmental support that is given to an expansion of energy crop production. The case study aimed at deepening the preliminary tool evaluation of the first project phase by applying the different tools to the same policy case and thus by facilitating a direct hands-on experience. In the report we will present differences in the theoretical and conceptual basis of the tools as they affect the application in the particular case study, we discuss the practical implications of these differences in terms of assessment outcomes, we examine the ability of different tools to address the different SD aspects and SD impacts, we describe the operational characteristics of different tools and we explore the question of suitable combinations of different tools for the particular policy case. The expansion of energy crop production is particularly interesting in this respect because it has environmental, social and economic impacts as well as clearly recognizable distributional and intergenerational effects.

The starting point for the case study is two policy decisions and the related policy processes and assessments: First, Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport; and second, Reg. (EC) No 2237/2003 on the introduction of an energy crop premium in the Common Agricultural Policy (CAP). The practical implementation of the case study comprised a critical review of existing EU level assessments by tool experts, a review of relevant national level assessments, an illustrative application of the different tools and finally, the planning of a more comprehensive assessment by three researcher groups, presentation of the three assessment plans and final evaluation by a review panel consisting of external experts and European Commission representatives.

In the final section the lessons learned from the case study are presented, structured by three main topics: Coverage (of SD impacts), Combinations (of tools) and Communication. Under the heading 'Coverage' we emphasize the need to take into account the multi-dimensionality of impacts and to keep the 'big picture' in mind while at the same time a sufficient degree of precision is important. We discuss the spatial dimension and the need to deal with diversity and limited data availability as well as the temporal dimension and the need to take into account relevant time frames. Under the heading 'Combinations' we emphasize the need to combine qualitative and quantitative analyses and examine the difficulties to actually achieving this. While a combination of suitable tools can principally help to better address a complex problem by complementing each other and allowing a view closer to reality remains the actual joining of different tools a challenging task: Tools differ in time frames of implementation and results may not be available when integration or combination is supposed to take place. Similarly, tools differ in the spatial scale of their (normal) application. All three consortia proposed an assessment framework in their plans, which reflects the idea that there normally ought to be a more or less comprehensive framework that specifies the boundaries and connections of tools and as well as bringing together different temporal and spatial scales. Finally we discuss 'Communication' related questions and the need to coordinate assessments with the needs and dynamics of policy processes. To find the right level and timing of stakeholder involvement and to communicate assessment outcomes in understandable ways are emphasized as particularly critical questions.

1. Objectives and function of the case study

The case study carried out in the course of the Sustainability-A-Test aimed at deepening the preliminary tool evaluation of the first project phase which was primarily based on literature review and expert knowledge.

The expectation was that the application of the evaluated tools to the same policy case facilitates direct hands-on experience and will make it possible to compare and identify

- differences in the theoretical and conceptual basis of the tools as they affect the application in the particular case study,
- the practical implications of these differences in terms of assessment outcomes,
- the ability of the tools to address the different SD aspects and SD impacts,
- their operational characteristics, and
- suitable (effective, necessary) combinations of different tools for this particular policy case.

Linked with the above, it was expected too, that the results of the case study will improve our assessment of the particular strengths and weaknesses of the different tool(s) (categories). Overall, the case study was to improve the tool information that is to be provided in the handbook and electronic information tool and to illustrate the practical application.

2. Contents of the case study: Governmental support for an expansion of energy crop production

The increasing governmental support given to biofuels and the expansion of energy crop production is part of the strategy to increase the use of renewable sources of energy, particularly to increase their share in total energy consumption. Due to its broad range of possible impacts, the "biofuel case" is an interesting subject for the case study. The expansion of energy crop production has environmental, social as well as economic impacts, and it has clearly recognizable distributional and intergenerational effects. Many of them can be expressed in terms of the EU Sustainable Development Strategy (SDS):

- Climate change goals: Increase the use of clean energy; reduce CO_2 emissions; energy crops are described as CO_2 neutral.
- Decreasing the use of non-renewable resources: Energy crops substitute fossil fuels.
- Manage natural resources more responsibly: Supporting a more sustainable land use; ensure that chemicals are used in such way that they pose no significant threat to the environment. A substantial increase in energy crop production may increase diversity of land use but may also lead to an increase in overall land use intensity (e.g. fertiliser and pesticides use).
- Protect and restore habitats and natural systems and halt the loss of biodiversity by 2010: A substantial increase in energy crop production may increase the cultivation of and pressure on marginal high nature value land.
- Economic and social goals: Reduce disparities in economic activities and maintain the viability of rural (…) communities. An increasing production of energy crops (and non-food crops in general) will provide new income sources to the agricultural sector and rural areas.

The starting point for the case study is two policy decisions and the related policy processes and assessments. The first policy decision is rooted in energy and environmental policy (preservation of finite energy resources; environmental protection and climate change goals) and the second is part of the 2003 CAP reform (integration of environmental goals into agricultural support systems; creation of new markets, sector income and employment).

The two policy decisions and pieces of legislation are:

- **Biofuels Directive (BD)**: Adoption of Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport (OJ L 123, 17.5.2003, p. 42-46).
- **Energy Crop Premium (ECP)**: Introduction of an energy crop premium in the Common Agricultural Policy (CAP) (Reg. (EC) No 2237/2003 of 23 December 2003 (OJ L 339/52-69).[1]

Both, the Directive and the Regulation were already adopted at the start of the case study. The use of the two policy decisions and the examination of the related assessments that have been carried out allows for *broad* assessment of the coverage of different SD concerns by each tool and tool combination, and it will facilitate a better understanding of the strengths and weaknesses that characterize our tools. In addition we will critically examine a policy decision that is more directly related to environmental policy goals (the Biofuels Directive) *and* a piece of legislation that stands for a typical sectoral policy (the Energy Crop Premium in the CAP), where the integration of environmental concerns still is a rather challenging issue. It is expected that the assessment questions that have been asked in the two policy processes and the tools used differ at least partly. This will give us further information on the particular needs of *different* policy processes and contexts on the one hand and on the capacities of the different tools to address them on the other.

At the same time it is clear that the two policy decisions are related to each other because each of them will contribute to an expansion of energy crop production: the Biofuels Directive on the demand side and the Energy Crop Premium on the supply side. The substantial expansion of energy crop production that is expected will change types of land use and land use intensities and it will have implications for important SD concerns. The case study is in this respect closely related with the *broader concerns* of longer term land use perspectives and a sustainable development of rural areas. Land use is a key issue in the SDS and it is of major interest for the European Commission. Nevertheless, it should be stressed that all the expected impacts on SD concerns, mentioned so far, mainly depend on the way how these two pieces of legislation are implemented in the Member States.

3. Design and practical implementation

The case study, work package two (WP2), was designed for a period from December 2004 to February 2006 (see also timetable). During the first three months the case study proposal and the operational description of the case study were developed by the leader of WP2, Karlheinz Knickel, the I&S team and the project partners.

[1] Laying down detailed rules for the application of certain support schemes provided for in Title IV of Council Regulation (EC) No 1782/2003 establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers.

The practical implementation of the case study was divided in the following four steps:

- Steps 0 and 1: Description of existing EU level assessments and critical review by tool experts
- Step 2: Review of national level assessments
- Step 3: Illustrative application of the tools
- Step 4: Planning a more comprehensive assessment

(The four working steps will be described in detail in the following chapters.)

After the distribution of the "operational work programme" to all project partners, a "**case study kick-off workshop**" took place in Berlin, March 3-4, 2005. This workshop was dedicated to the tasks of the tool teams in the first phase of the case study. The aim was to give clarifications where necessary, to address practicalities and to discuss communication and cooperation processes between the teams during the case study.

Table 1 Time schedule

When	Who	What	Comments
December 2004 - January 2005	Leader WP2 + I&S Team	Development of case study proposal	Disseminated to all TTs and project partners for review
February 2005	Leader WP2	Operational description of case study	Operational work programme for the case study distributed to all partners
3-4 March 2005	All project partners	Case study kick-off workshop	Starting the work on a *tool-by-tool* basis; addressing practicalities; discussing communication / cooperation processes during the case study (exchanges between TTs); ensuring that the tool teams start directly with the tasks at hand
April 2005	All TTs and selected „national" teams	TT report on Step 1 and on Step 2	Results Step 1: Critical review of EU level assessments Results Step 2: Description of national level assessments
June 2005	All TTs	TT report on Step 3	Report on the results of Step three (illustrative application)
27-28 June 2005	All project partners	Case study mid-term workshop	Presentation and discussion of the results of Step 3. Aim: Agreeing on the tasks for further work; elaborating *combinations of tools*; forming of assessment teams
October 2005	Assessment teams	Draft report on Step 4	Draft version of detailed assessment plan answering the assessment questions
December 2005	Assessment teams	Report on Step 4	Detailed assessment plan
24-25 January 2006	Assessment teams and review panel	Final case study workshop	Presentation of the three assessment plans and final evaluation by review panel
February 2006	Leader WP2 (KhK)	Draft synthesis report on case study (D15)	Draft synthesis report on the results of the case study (synthesis of TT reports)

4. Steps 0 and 1: Description of existing EU level assessments and critical review by tool teams

4.1. Introduction

Step 0, the description of existing EU level assessments, can be considered as preparatory work and had been made in the course of the preparation and adoption of the Biofuels Directive, prepared by IVM/MNP and provided to all tool experts as input for Step 1. No comparable assessment was, at that time, available for the Energy Crop Premium.

The information given in the description of EU level assessments focused on:

- Tool use,
- Coverage of SD impacts, and
- Assessment questions that had been asked.

Step 1, the critical review of EU level assessments, based on the results of Step 0. The TTs were asked to critically examine these assessments from the perspective of their tools and concentrate the reviews on the following issues:

- Alternative approaches and additional assessment questions that ought have been asked and that could actually be dealt with from the TTs' perspective;
- Possibilities for a better coverage of SD impacts and cross-cutting issues;
- Possibilities for an improved feeding back of results into the policy process.

4.2. Results of Steps 0 and 1

4.2.1. Tool use in EU assessments

In the available studies only few information of tool usage in the course of the EU assessment(s) was available. This is due to partly a lack of documentation and due to the fact that only a small number of tools were actually applied. However, the following tools could be identified (the corresponding tool teams are in brackets):

- Cost Benefit Analysis (CBA)
- SAFIRE scenario building and planning tool
- PRIMES modelling system
- Scenario and sensitivity analysis
- Ad-hoc stakeholder group
- Surveys

4.2.2. Coverage of SD topics and cross-cutting issues

In terms of coverage of SD topics and cross-cutting issues Table 2 and Table 3 illustrate the issues which have actually been covered by the EU assessments (first column), and those which, in principle, could have been covered by the different tools (based on the views expressed by the tool experts).

Table 2 SD topics (1)

	SD topics		Physical Assess-ment	Mone-tary Assess-ment	Models	Scenar-ios	MCA	SEA	Partici-patory Tools
1. Economic	1.1 Economic growth								
	1.2 Effects on public authority budgets								
	1.3 Human capital formation and employment								
	1.4 Economic cohesion								
	1.5 Innovation								
	1.6 International performance								
	1.7 Market structure								
	1.8 Microeconomic effects on enterprises, non-profit organi-sations etc.								
	1.9 Effects on households								
	1.10 Global partnership								
2. Environmental	2.1 Air, water, soil or climate								
	2.2 Renewable of non-renewable resources								
	2.3 Biodiversity, flora, fauna								
	2.4 Land use								
	2.5 Natural and Cultural heritage								
	2.6 Waste production/generation or recycling								
	2.7 Human safety or health								
	2.8 The likelihood or scale of environmental risks								
	2.9 Mobility (transport modes), or the use of energy								

Table 3 SD topics (2) and cross-cutting aspects

	SD topics		Physical Assess-ment	Mone-tary Assess-ment	Models	Scenar-ios	MCA	SEA	Partici-patory Tools
3. Social/societal	3.1 Social Cohesion								
	3.2 Employment Quality								
	3.3 Public health								
	3.4 Health systems and security								
	3.5 Social Protection and Social Services								
	3.6 Consumer interests								
	3.7 Education								
	3.8 Social Capital								
	3.9 Liveable communities								
	3.10 Equality of opportunity and entitlement								
	3.11 Culture								
	3.12 International co-operation								
	3.13 Governance and participation								
	3.14 Fundamental human rights								
	3.15 Security, crime or terrorism								
	3.16 Ageing of society and pensions								
Cross-cutting aspects	Inter-generational effects								
	(De-)coupling								
	Adaptability								
	(Ir-)reversibility								
	Distributional effects								
	Global dimension								
	Spatial scale								

4.2.3. Alternative approaches and additional assessment questions

In comparison with the EU assessment questions and supplementary to them the different tool teams formulated alternative and additional assessment questions as well as possible answers from the tools' perspective.

From the view of **physical assessment experts** (**TT1**) the EU assessments could have been improved by taking into account the physical impacts on land use in and outside the EU. These impacts include the amount of occupied land surface, physical properties of the soil when producing biomass and implications for other land-use functions.

As additional or alternative assessment aspects the **monetary assessment experts (TT2)** suggested to

- estimate welfare effects of consumers on higher prices (of biofuels relative to fossil fuels),
- quantify reduction in mortality and morbidity effects on human health associated with reduced emissions (CO, NOx),
- attach a monetary value to potentially created jobs by biofuels policy, and
- calculate benefits of CO_2 emissions reductions.

The modelling team (TT3) proposed a combined approach of different models. In this mode, a multi-sectoral model could assess macroeconomic effects first and feed the results into a more detailed sector model for deriving more structural effects. The combination of socio-economic models with models from different domains, f. ex. biophysical models can further cover important environmental aspects (air quality, soil erosion etc.), whereas "integrated" models (which are less detailed) can provide longer-term trends of the entire integrated society-environment-system.

In case of the applied scenario tools (SAFIRE) in the EU assessment(s) the **scenario and simulation experts (TT4)** noticed a lack of transparency concerning hypotheses and quantitative figures. More variety of the driving forces (e.g. the demand vectors) should be added to the anticipatory approaches. Furthermore, the sustainability criteria were not chosen on a basis of an explicitly systematic approach covering the relevant dimensions and aspects. Consequently, a more detailed analysis of sustainability requirements may lead to an extended scenario definition (with possible bifurcation points).

The **MCA tools** (**TT5**) require the input from other tools (such as modelling, scenarios a.o.) and can be applied afterwards in order to support selection of a policy option (by comparing the different options and identifying their strengths and weaknesses). MCA helps assessing different policy goals, structures possible impacts and criteria of each goal accordingly. Depending on available data, there are no restrictions of SD-impacts and cross-cutting issues for MCA application.

SEA (**TT6**) eases environmental policy integration through presenting a clear framework with adaptability possibilities. To enhance the EU-assessments' outcome within a role model SEA, the integration of further tool use would be one possibility. Within SEA evaluation all SD-impacts and cross-cutting issues can possibly be included. The assessors and clients decide on the coverage.

Participatory approaches (**TT7**) have to be combined with input from other tools. So far, social science expertise has hardly been used in assessments carried out for EU policies and research projects. One positive example is the Viewls project which addresses the implementation of the BD and which

is explicitly focussing on stakeholders. A questionnaire was intended to get a first glance at the relevant topics (stakeholder priorities) for the Viewls project. Especially regarding the Biomass Action Plan, stakeholder involvement was improved during the last four years.

4.2.4. Improving the feedback of results into the policy process

Relevant assessment results need to be fed in an appropriate form into the policy process. In terms of, for example, structuring complex information or revealing 'hidden 'impacts the tools can contribute in different ways to reflect on policy options. From the perspective of each tool type the following modes of improving the feedback of results have been identified:

Physical assessment tools cannot directly improve the feeding back of results, but they can indicate relevant ecological problems for stakeholders that might not have been considered before.

Modelling tools can, in principle, clarify complex interactions and can help to demonstrate far-reaching implications of policy measures. But the models mentioned are not primarily for feeding results into the policy process. (Modelling activities often seem to be quite detached from actual policy processes.)

Scenario development and evaluation in combination with participatory elements can significantly support the feeding back of results.

MCA can help to structure large amount of information provided and can help to improve the assessments. MCA-matrices can make assumptions and implicit reasons of different policy goals more transparent and explicit. MCA helps identifying good/bad points of each option.

During a **SEA** an environmental report shall be prepared and mandatory taken into account. This report (describing and evaluating likely significant environmental effects and taking reasonable alternatives into account) might add additional value, at least for environmental consideration. SEA can provide guidelines and a useful framework for stakeholder consultation during the policy process. SEA offers an additional output through its mandatory information of authorities and the public on policy processes, assessment results and the related information.

Participatory assessments help to articulate insights on the range of options that are explored, it supports a sharing of experiences/information and a discussion of the pros and cons of different policy options. It may inform government agencies on relevant experiences of stakeholders and can contribute to a demand-driven assessment agenda (for biofuels). It offers recommendations for the EU, Member States. Overall, participatory approaches may also increase the assessment's transparency.

5. Step 2: Review of national level assessments

5.1. Introduction

Step 2, the review of national level assessments, extended the overview of EU level assessments to national assessments that have/had been made in the context of the preparation of the Biofuels Directive and the Energy Crop Premium. The objective was to facilitate a more complete overview of actual assessment practice and to ensure that all relevant tools have been covered within the project. In case,

no national assessments were available, also assessments from research institutes, NGO's etc. could be taken for the review.

"National teams" covering all countries presented in the project, were built for this working step. The countries are: Netherlands (NL), United Kingdom (UK), Czech Republic (CZ), Spain (ES), Sweden (SWE), Italy (I), Latvia (LV) and Germany (DE).

The national reviews centred on the following topics:

- Clients and contractors of the national assessments
- Assessment questions and topics addressed in the assessments
- Coverage of SD impacts and cross-cutting issues
- Tool use in the national assessments
- Policy relevance of the assessments' outcomes (based on the judgement of the national teams)
- Available information on required resources (time frame, costs, data needs and availability)

5.2. Results of Step 2

5.2.1. National assessments: Clients, contractors and issues addressed

Sweden and Latvia have been the only two nations of our review, which have carried out national level assessments directly relating to the national implementing legislation of biofuels. Most of the reviewed assessments were carried out by public research institutes and on behalf of the government.

The Swedish assessment was conducted by an investigator commissioned through the Swedish government. Such assessment is part of the Swedish system of "Committees of Inquiry" that the government commissions to shed light on and develop proposals for different issues on the policy agenda. The investigator was supported by several governmental officials, experts from different fields and an additional reference group (industry, NGO a. o.). The leading question of the Swedish assessment is about the potential development (green certificates, tax relief), which would be necessary in order to achieve the 5.75% goal by 2010.

In Latvia a National Programme was adopted to start the implementation of the BD. A supervision group (representatives of ministries, led by the Ministry of Agriculture) and a working group (including representatives from science, agriculture, biofuels, processing enterprises, banking sector, NGOs, municipality, one political party) were installed. The assessment related to the impacts of an increasing production and consumption of biofuel crops.

In Spain the reviewed assessments were carried out by public research institutes, relating mainly to basic research, but not targeted to specific clients. Feasibility, potential and difficulties with the development and market penetration of biofuels were the main issues addressed.

In the Netherlands none of the studies were institutional in the actual development of the BD itself. A supervisory committee consisting of representatives from industries, various ministries and environmental organisations guided the reviewed assessment. The assessment examines the available options of introducing biofuels in the NL and contributing to the BD.

In United Kingdom exist a variety of assessments of the potential for biofuel crops on behalf of a wide range of organisations (national-regional, agricultural, environmental lobby groups etc.). The assessments have examined the energy and CO_2 implications of different uptake of liquid biofuels in road transport and associated costs. The environmental and wider rural impacts of biofuel production in the medium and long-term in the UK have been considered as well as energy, emissions and socio-economic costs and benefits of producing biodiesel from oilseed rape in UK. In the review one study has been chosen, which was developed by the UK Government Department for Transport. It bases its assessment on several technical studies carried out by public research institutes.

In the Czech Republic no assessment has been carried out evaluating the BD and Energy Crop Premium; all assessments carried out have examined national legislation and funding programmes, most of them ex-post. The two reviewed assessments were conducted by research institutes on behalf of the Czech government. The main issues addressed are the costs of funding programmes and national legislation; administrative issues, employment, sustainable rural life and impacts on local ecosystems playing a minor role.

The Italian team reviewed a report of the Ministry of Environment, which had not carried out an assessment but reported and summarized the results of a corresponding project. The main assessment issues have been the environmental impacts of biomass-produced energy and biofuels.

In Germany no national level assessments have been made that are *directly* and explicitly related to either the EU or national implementing legislation. However, several assessments have been reviewed that were carried out by public research institutes on closely related questions, and some have been made on behalf of the government. In the studies the main issues covered have been the environmental impacts of biofuels, their contribution to reduce climate relevant emissions, their market situation, economic aspects and production. In the case of biomass, the material flows connected to its energetic use have been examined.

5.2.2. Coverage of SD impacts and cross-cutting issues

In almost all reviewed national assessments have the economic and environmental SD-impacts been covered fairly well. This is in contrast to social SD impacts, which have been comprehensively included only in the Swedish and the Latvian assessment (each covering five social impacts), followed by the UK assessment (four social impacts). Noticeable is also, that the Swedish study has covered six from seven cross-cutting issues, whereas only two other studies from UK and Germany include at least one respectively two cross-cutting issues. For an overview of the different SD impacts covered in the national assessments see Table 4 and Table 5.

5.2.3. Tool use in national assessments

A total of 13 different tools have been used in the national assessments. The most prominent tools have been LCA (Life Cycle Assessment, 5x), Scenario Analysis (5x) and Literature review (4x) as well as CBA/CEA and economic accounting (4x). Expert/Stakeholder consultation has been applied in two assessments. Tools like Physical Assessment, Modelling, Sensitivity Analysis, Transition Management, Public poll, Visioning, SWOT-Analysis, Input-output Analysis and Indicator Based Assess-

ment have been used each only once. MCA (Multi Criteria Analysis), for example, has not been applied in any of the studies.

Remark: In case of the Dutch assessment, various research-based reviews have been less reliant upon the use of specific tools to gather relevant information.

For an overview of the national tool use please see Table 6.

Table 4 SD topics (1)

	SD topics	SWE	CZ	ES	NL	GB	DE	IT	LV
1. Economic	1.1 Economic growth								
	1.2 Effects on public authority budgets								
	1.3 Human capital formation and employment								
	1.4 Economic cohesion								
	1.5 Innovation								
	1.6 International performance								
	1.7 Market structure								
	1.8 Microeconomic effects on enterprises, non-profit organisations etc.								
	1.9 Effects on households								
	1.10 Global partnership								
2. Environmental	2.1 Air, water, soil or climate								
	2.2 Renewable of non-renewable resources								
	2.3 Biodiversity, flora, fauna								
	2.4 Land use								
	2.5 Natural and Cultural heritage								
	2.6 Waste production/generation or recycling								
	2.7 Human safety or health								
	2.8 The likelihood or scale of environmental risks								
	2.9 Mobility (transport modes), or the use of energy								

Table 5 SD topics (2) and cross-cutting aspects

	SD topics	SWE	CZ	ES	NL	GB	DE	IT	LV
3. Social/societal	3.1 Social Cohesion								
	3.2 Employment Quality								
	3.3 Public health								
	3.4 Health systems and security								
	3.5 Social Protection and Social Services								
	3.6 Consumer interests								
	3.7 Education								
	3.8 Social Capital								
	3.9 Liveable communities								
	3.10 Equality of opportunity and entitlement								
	3.11 Culture								
	3.12 International co-operation								
	3.13 Governance and participation								
	3.14 Fundamental human rights								
	3.15 Security, crime or terrorism								
	3.16 Ageing of society and pensions								
Cross -cutting aspects	Inter-generational effects								
	(De-)coupling								
	Adaptability								
	(Ir-)reversibility								
	Distributional effects								
	Global dimension								
	Spatial scale								

Table 6 Tool use within national assessments

Tools	SWE	CZ	ES	NL	GB	DE	IT	LV
LCA (life cycle assessment)	X*		X		X	X	X	
Physical assessment			X					
CBA/CEA		X				X		
Input-Output analysis				X				
Economic accounting			X					X
Scenario analysis		X	X	X		X		X
Modelling					X			
Sensitivity analysis						X		
Expert/stakeholder consultation					X	X		
Public poll			X					
Transition management				X				
Literature review	X			X	X	X		
SWOT analysis		X						

* LCA were evaluated from reports and literature

5.2.4. Policy relevance of the outcomes

In this chapter we will not document the individual results of the studies since they are less relevant for the main objective of this project, the tool handbook. However, some of the conclusions of the "national teams" round up the picture of the assessments and give a good insight in the outcome and relevance of the studies and therefore, shall be presented here.

In the case of Spain, all the reviewed studies contribute significantly to the understanding of the specific aspects of the development and market penetration, but so far there has not been an effort for an integrated approach, which embraces in a more holistic way SD impacts.

In Germany no central co-ordinated impact assessment on an increased use of biofuels and cultivation of energy crops has been made. Nevertheless, the different studies carried out draw a fairly comprehensive picture of the potential impacts. The environmental impacts of biofuels have been assessed critically in some of the studies.

Some of the studies contained either such a degree of uncertainty that made it difficult to use the results for political decision-making or had no direct link to policy making at all. The studies may, however, have raised the sensibility of decision-makers about crucial problems, but are expected to have no direct consequences in the Ministry's acting.

The Italian studies have devoted much attention to the environmental and land use consequences of biomass crops and biofuel production, and have examined competitiveness and economic feasibility issues. But they have not estimated the environmental and other economic benefits associated with biofuels, nor have they attempted to estimate the private and social costs of growing biomass crops and producing biofuels.

The UK assessment produced a fairly comprehensive assessment on economic and environmental consideration of biofuels. While there are benefits in some reduction of GHG, there is much uncertainty about the wider sustainability impacts. Very little has been done to explicitly address the social and governance issues surrounding biofuels. Social problems of small farmers as well as the political agenda to boost UK agriculture, the implications of security of supply as a driver of policy, and the more overarching SD issues such as intergenerational equity are not thoroughly assessed, if mentioned at all.

The outcome of the assessment of the Latvian National Programme was a concrete Action Plan for the implementation of the programme, adopted by the government. The analysed issues and conclusions drawn provide the basis and informative background for the state support schemes for biofuel production in Latvia.

In most cases, with the exception of Latvia, the political relevance of the assessments' results are uncertain. For those studies funded by government, in principle, they are supposed to be used as input in policymaking, but whether they will be actually used in practice remains to be seen.

5.2.5. Information on required resources

With regard to the required resources for the assessments such as person month needs, time needs, data needs, data availability and reliability as well as technical equipment there have been no informa-

tion available in most of the studies. At least with respect to time needed some information could be found. The Swedish assessment took a total of six months, but this was mainly due to limited financial resources. Both, the UK study and the Latvian National Programme required approximately 12 months. Furthermore, data availability was a problem, especially noted in the six German studies.

6. Step 3: Illustrative application of the tools

6.1. Introduction

The basic idea of Step 3 was to ask the tool teams to elaborate an own *illustrative* application of their tools' type in order to assess the policy decisions and the more general question of the increasing governmental support that is given to energy crop production. Within the given project framework it was not feasible to implement a full-fledged assessment with all the necessary data collection. Therefore, in this step only 'illustrative' data was asked for (i.e. using readily available real data and guessed data). It also fulfils the goals of the case study and puts the concentration of the work on assessing and not on data gathering. The idea was that the illustrative application would allow to track and specify the limitations of tools as well as to define necessary linkages. For the application the experts for Physical Assessment, Monetary Assessment, Models, Scenarios and MCA selected a typical / representative tool of their particular tool type.

Framing Step 3 of the case study

In order to frame this exercise, general assumptions and three alternative development paths were provided:

- Path 1: BAU (business as usual) taken from conventional wisdom scenario by the COM (1996).
- Path 2: Biofuels Directive reached by means of a taxation of fossil fuels; production of energy could be possible outside EU.
- Path 3: Biofuels Directive reached by means of energy crop premium and a significant expansion of energy crop production: production of energy crops only within EU.

The tool experts should concentrate their application on the following assessment issues:

1. The goals set by BD and ECP and their possible progress towards the EU SDS;
2. Expected effects on land use and agriculture;
3. Main factors related to the implementation of BD and ECP and the way they are addressed in the assessment;
4. Key parameters of the particular tool and assumptions made;
5. Main strengths and weaknesses of the assessment.

Before starting the actual assessment the tool teams were expected to acquaint themselves with the relevant particularities in agriculture and land use situations and trends at national levels. In order to support the implementation of Steps 3-4, the paper "Background information for the case study" was provided by the WP leader.

Particular roles for TT6-TT8

For the more "up-stream" tool types it was difficult to apply their tools directly to the case study without using substantial input from other tools. Therefore, particular roles for SEA, Participatory tools and Transition Management were defined: SEA (TT6) looked at current tool use practice in the impact assessments already carried out by the Commission and should combine the desk analysis with targeted interviews with EC officials. Participatory Tools (TT7) assisted the project coordinating team and the case study coordinators in the preparation and facilitation of the final case study workshop. Transition Management (TT8) examined the role each tool (type) can play in a Transition Management framework.

6.2. Results of Step 3

The reports of the illustrative applications covered the following items:

- Description of the scope of analysis
- Description of the tool application (assumptions made, definition of system etc.)
- Presentation of "results"
- Critical self-evaluation of the strengths and weaknesses of the assessment
- Discussion of the combinations and links with other tools
- Detailed breakdown of the required resources

In this final case study report we will present only the results of the last three items since they are the most relevant for the tool handbook. (For the detailed Step 3 outcomes of each TT please see the respective reports).

6.2.1. Main strengths and weaknesses of the assessments

On the basis of the illustrative application the following strengths and weaknesses of the assessments and tool uses were identified.

Physical Assessment Tools (TT1)

For the illustrative application two tools have been chosen, the Material Flow Analysis (MFA) and the Global Land-use Accounting (GLUA). MFA is a useful tool in policy process to get an overview of potential sources of problems connected to the production and consumption of material goods, mainly from an environmental perspective. Whereas economy-wide MFA can cover economic aspects partially, it is not suitable to cover social aspects. Furthermore, it can be used to reveal the physical performance of international trade.

GLUA considers total resource flows and total land-use associated with the activities of a national economy, region or product chain for agricultural products such as biofuels. It detects the shift of environmental burden between regions and describes the land balance of an economy. GLUA cannot evaluate sufficiently the quality of an impact in terms of different modes of land cultivation, but it contributes to its quantification. GLUA describes the land balance of an economy and offers to reveal possible inequalities. It may be able to cover different spatial scales from local to global.

Monetary Assessment (TT2):

In the illustrative exercise, the Cost-Benefit-Analysis (CBA) has been applied. The main strength of CBA is to aggregate various effects and make them comparable by expressing them in one common, monetary indicator. CBA deals with aggregated costs and benefits, but cannot handle distributional issues and social impacts such as exclusion, health impacts of poverty etc.

However, many of the drawbacks of a CBA are related to the difficulty in assigning monetary values to goods that are not traded on a market, as in the case for most environmental goods and services. This is a very difficult task relating to biodiversity with many knowledge gaps or also for placing a value on landscape changes (which will always remain a rather subjective issue).

Modelling (TT3):

The illustrative application has been conducted with PRIMES-transport, a simulation model of the energy markets in the European Union with a focus on the transport sector. Key parameters of PRIMES are the price and income elasticity, i.e. how strongly different sectors react to exogenous and/or endogenous changes in prices as well as income change due to economic growth. For an in-depth understanding of the importance of these parameters and their significance for model outcomes, a well designed sensitivity analysis should be included. The sensitivity analysis could be combined with stakeholder feedback, as this can provide some hints about the more critical parts of the model in comparison with real-world reactions and adaptation processes.

An important point is how the actual policy case is translated into a model-based scenario. Usually, there are several ways available how to map a policy scenario like the Biofuels Directive in the model structure. In almost all cases strong simplifications have to be made, as most models cannot capture the complexity and detail of the political process. Therefore, the way how a policy case is expressed in a model could potentially have a significant impact on the outcome of the analysis. Because the Biofuels Directive provides no details on how the targets could be reached the modeller has a wide range of choices of how to model different paths.

The PRIMES-transport model gives a good representation of energy and transport sectors of the real world. Nevertheless, the wider issues of a sustainability impact assessment are neglected. Therefore, this rather specialised model needs to be linked to other tools, covering for example the issues of agriculture and land use change. Increasingly, stakeholders are getting involved in modelling exercises. For a fruitful stakeholder interaction it is necessary to provide that the model is supplemented by a simple user interface and a clear presentation of the structure and the major functions.

Scenario Analysis (TT4):

During this exercise, the approach “Application of Existing Scenarios” has been used. This means to adopt scenarios from another research activity and to apply these scenario descriptions (storylines, parameters and analysed branching points) to the biofuel case. The tool itself establishes a framework for analysis and a kind of communication platform. However, in order to allow an explicit and grounded discussion and evaluation of the various and numerous aspects, a pretty cost intensive and time consuming series of activities must be started and operated. Scenario Analysis is depending in many ways on the supply of data and assessment results from other tools, such as models and simula-

tion, and physical assessment tools. Therefore, most applications are restricted to the most crucial aspects and only a small fraction of the whole framework and system of criteria and aspects is taken into consideration. That "restriction mode" may be estimated as a strength, because it allows a quick and efficient analysis of consequences, upcoming problems, or options. On the other hand, that might be also a weakness, because of the incompleteness and in part arbitrariness of the included information.

Multi Criteria Analysis (TT5):

The tool experts have presented an illustrative application of the MCA-tools NAIADE and Weighted Summation. NAIADE is used in an approach of a Social Multi Criteria Evaluation where, stakeholders are selected and the stakeholders' objectives, and available resources are explored.

MCA (multi-criteria analysis) tools are mainly *analytical* tools and depend on the way the problem at stake is defined. The two MCA methods which have been depicted in this illustrative application are able to combine both qualitative and quantitative information and in this regard can overcome some of the limitations which face other tools, such as MFA or CBA, which often reduce all environmental dimensions to one sole unit of analysis. The different types of information can be classified according to their degrees of uncertainty. For a sustainability assessment of the BD, economic, environmental and social indicators may be used as criteria to assess the different alternatives in an integrated manner. MCA methods offer a more powerful way to structure and communicate policy relevant information than any other assessment method.

The use of MCA tools in environmental policy related assessments is often met with scepticism since they include elements of subjectivity. MCA uses aggregated evaluations on several criteria to recommend a decision. The claim of adequacy of the recommended solution bases usually on the assumption that the interests of the decision-makers are sufficiently assessed by the MCA model. Criteria may reflect not only the interests but possibly all values stemming from normative arguments of the decision-makers and/or stakeholders.

During the process of distributed decision making, the decision alternatives are usually assessed from technical, ecological, social and financial viewpoints by expert committees and lower authorities, but the weighing of the criteria and the may remain in the hands of a decision making authority or relevant stakeholders. However, the application of those tools demand a notable degree of professional expertise and the assumption and internal logic from which their outcomes derive may remain outside of the understanding and comprehension of the policy makers and relevant stakeholders. Non-experts often cannot understand the intricacies of the internal algorithms and mathematical equations needed for the optimisation of the different policy alternative functions. Therefore, 'trust' either in the tool or the modeller needs to be build when applying such methods. In case of Weighted Summation, the mathematical equations are very simple and can easily be explained to non-experts.

6.2.2. Possible tool combinations

The illustrative application enabled the tool experts to better identify the limitations of "their" tools and to think about dependencies and supplementing linkages with other tool categories. With regard to the example of the assessment of the BD and ECP the following tool linkages have been identified individually by the tool teams. *Table 7* provides an overview of tool combinations mentioned in the

illustrative applications. The first column in the table lists the tool types of the illustrative application, whereas the first row shows all tool categories represented in *SustainabilityA-Test.* In each row the arrows in the cells indicate whether input from a particular tool type is necessary and/or whether input can be provided for another tool type in order to make the illustrative application more comprehensive. Blank cells indicate that linkages have not been mentioned. Possible mismatches of the tools' interactions are caused by different recognitions of the tool experts.

Table 7 Overview of tool combinations for the 'biofuels case'

	Physical Assess-ment	CBA/ CEA	Models	Scenarios	MCA	SEA	Participa-tory Tools	TM
Physical Assess-ment	*							
CBA/CEA								
Models			*					
Scenarios				*				
MCA								
TM								

= needs input (from), = provides input (to), = provides and requires input

*Remark: Depending on the subject of the assessment, also a supplementing combination of tools of the same type, as indicated here for Physical Assessment, Models and Scenarios can be useful and necessary.

MFA and GLUA (TT1):

MFA and GLUA provide data input for all the tool categories mentioned in the table. Some of the Physical Assessment tools even base on each other. For example, if GLUA is directly based on MFA biomass flow into and from an economy can be accounted and related to the overall land-use of an economy. The combination of MFA and LCA in the examination of the impacts of different energy crops results in a more comprehensive assessment of physical impacts and land requirements. Related to monetary assessments, economy-wide MFA has been developed as a biophysical complement to economic accounts. Modelling tools could add further aspects such as modelling the biofuels' eco-

nomic value and employment effects or, in the case of scenario analysis, the long term soil cultivation effects.

CBA (TT2):

The use of CBA can result in a more comprehensive assessment if combined with input from, for example, dispersion models (for predictions about CO_2 emissions saved by biofuel usage and changes in the emissions of air pollutants) and models that consider soil quality, irrigation, land prices etc. Additionally, output from MFA and LCA is needed.

PRIMES (TT3):

Other modelling tools such as general-economy models (macro-economic background and price development), specific climate and health models (output of emissions and resource requirements), land use models (changes in input use), specific models (hydrological impacts and changes in carbon cycles) are perceived as necessary in order to make the PRIMES based assessment more comprehensive. Additionally, the input from MFA (input data and parameters as well as effects on emissions and waste generation), scenario analysis (refining reference and policy scenarios), application of models in interactive stakeholder sessions should be considered as possible extensions and combinations. The results of models could be fed into a cost-benefit analysis and may function as a starting point for a transition management approach.

Applying Existing Scenarios (TT4):

Many of the framework conditions used in the scenario analysis are dynamic ones. Input from modelling and simulation tools is particularly important for dynamic issues and therefore increases the transparency and reliability of certain assumptions necessary for defining scenarios. A more comprehensive assessment would need to consider different energy crop species and different framework conditions. Physical Assessment Tools calculate costs of these different options and produce data on possible GHG emissions, other forms of emissions, acidification potentials and land requirements. Those data are then used in the discussion of the consequences of different scenarios. Additionally, a LCA contributes data about the consequences of the production of the various energy carriers and also interesting data for interpretation and evaluation of scenario consequences. Nearly all tools might be more or less closely integrated with or influenced by scenario analysis. Of particular importance are participatory approaches in the creation, analysis and monitoring of scenarios.

NAIADE and Weighted Summation (TT5):

MCA critically depends on inputs from other tools. In order to further improve the application of MCA methods additional tools like CBA, MFA and modelling should be employed. To confirm the selection of alternatives and criteria as well as the final MCA matrix stakeholders views should be considered. The following tools are often used in conjunction with MCA:

- Cost Benefit Analysis.
- Biophysical assessment indicators and Material Flow Analysis.
- Modelling.
- Participatory methods.

Transition Management (TT8):

TM (Transition Management) provides an overall management framework within which other tools can be applied. TM provides a frame for a longer term implementation and assessment process. A wide range of specific assessment components and tool uses can be integrated into this process. The formation of a stakeholder arena is a starting point. End-visions can are created through a participatory scenario exercise as well through the use of other relevant tools. The monitoring, comparison and adaptation of experiences with transition experiments is important. It is here where other tools come in.

Physical assessment tools such as MFA and GLUA will be supportive to developing transition pathways and realistic end visions, by adding quantitative information about resource flows and associated land-use. Later in the process, updated GLUA and MFA data can help for possible adaptation of paths and visions.

With regard to **simulation and modelling tools** a number of potential virtues in the context of TM can be identified. In the phase of problem structuring, for example, Cognitive Mapping techniques and QSA can be used to improve communication among the transition arena members and facilitate the development of a shared problem formulation. For developing end-visions and transition paths the use of more quantitative simulation tools seems in place. A new research development focuses on the use of Agent Based Models (ABM) to actually simulate the transition dynamics as the outcome of the dynamic interaction amongst stakeholders and the environment. These models have a high potential for exploring and reflecting upon different possible transition paths.

The use of **scenarios** in transition experiments can help dealing with uncertainties. The scenarios are a combination of the foreseen occurrences, hypothetical occurrences and surprises. Using scenarios, an estimate can be made of the way the examined system, as well as the societal actors operating in this system, would react to these changes. The concept of transitions can be used to explore development paths, or scenario groups, as can scenarios be used to support the further research of transitions.

6.2.3. Required resources

During the case study, especially in the review of national assessments (Step 2), we experienced that information about required resources (manpower needs, time needs, data needs etc.) was almost not existent. Therefore, the tool teams were asked to estimate the required resources for the illustrative application in order to obtain at least a rough estimate with regard to the tool handbook.

MFA and GLUA (TT1):

For a comprehensive MFA one (expert) person month per biofuel type is necessary. A prerequisite is that basic data requirements are met. The technical equipment needed to carry out the assessments is limited to usual PC equipment and software.

The development of GLUA database is a demanding task which takes ca. one year for an expert. Additional updates and extensions of the database will take about one expert month per year; an in-depth GLUA for one major biofuel about three (expert) person months each.

CBA (TT2):

Required resources for a comprehensive CBA include four people and 12 person months each (total 48) plus consultations with experts in public health, hydrogeology, soil conservation, access to spreadsheet software and statistical software. A shorter literature-based desktop study could reduce the costs by 30-50%.

Modelling (TT3):

Main resources will have to be spent on the development of plausible reference and policy scenarios as well as gathering of additional data. Especially, data availability and quality of data is in general very low. For a standard application 3-6 person months are necessary, for further model development 6-12 (expert) person months. Additional data collection will cost 5-20.000 EUR.

Applying Existing Scenarios (TT4):

Application of existing scenarios is not as time and resource consuming as the building of new scenarios. We assume that it can be done within two (expert) person months. Financial demand will increase when costly combinations with other tools are necessary or an attractive documentation of the scenarios and the results of analysis are desired. Involvement of external "key actors" also increases the budget.

NAIADE and Weighted Summation (TT5):

A standard application of a MCA can be carried out in a period of 4-10 person months, provided that the most relevant data is already available or can be easily obtained. The application of the MCA tools is relatively easy, and therefore the most time-consuming activity regards the structuring of the necessary information. Both in the case of NAIADE and Weighted Summation an expert who understands the logic, the meanings of the outcomes and the procedure to be followed for the application of such approaches is needed. If Social Multi-Criteria Evaluation (SMCA) is carried out, the use of MCA tools should be complemented with consultation of stakeholders which would extent the time and the costs needed for the assessment.

For the specific case of the implementation of the BD in Europe, it can be expected that 12-24 person months are needed to obtain the relevant information to construct the MCA matrix containing the most relevant criteria and selected policy options. During this time, also stakeholder participation could be employed to further specify the design of the different alternatives, criteria, and units of measurement. Once the matrix is filled, applying the software and obtaining the results can be done in one day. A consultation exercise for the case of the BD may involve around 30-60 stakeholders aimed at representing the maximum diversity of perspectives relevant for the implementation of this regulation.

Transition Management (TT8):

TM (Transition Management) crucially depends on the establishment of a stakeholder group (the transition arena). The time available and commitment of participants is a key factor. Only a small group of facilitators will usually be on the pay-roll of the facilitating government (local, regional, national or European). Transition experiments might require a lot more financial resources. This is difficult to

predict, since it depends on the type of experiments that are needed. Normally these experiments will be co-financed by the involved stakeholders and the facilitating government.

6.2.4. Results of TT6

The SEA team has analysed the current tool practice in the extended Impact Assessments already carried out by the Commission in case of the Biofuels Directive and the TEN (Trans European Networks) Guidelines.

For the Biofuels Directive tool combinations strongly varied from country to country, no single country used the same combination as another country. Scenarios were used in combination with nearly every other tool. It was also the tool, which was used most frequently, followed by life-cycle analysis and calculations. All other tools were used only twice or less. The coverage of SD impacts strongly concentrated on environmental and economic aspects, whereas, mainly social aspects were neglected in the assessments.

The TEN Guidelines extended Impact Assessment report refers to 11 studies, which made use of a broad range of tools, but most of them were very specific. Combinations of tools varied widely, and no similar combinations were found. Certain tools were used more frequently, i.e. scenarios, modelling, indicators, CBA. The tools combined most frequently with other tools were modelling, scenarios and indicators. Taking all the studies within the TEN Guidelines together, all aspects of Sustainable Development were covered. None of the studies went deep into detail concerning the environment. Economic aspects were better covered and in much more detail analysed than environmental and social aspects.

In part two of the case study it was planned to conduct targeted interviews with EU officials involved in the biofuels assessments. The aim was to fill in the gaps identified during the desk analysis and to obtain further information from the potential 'end-users' about the reason for choosing certain tools and the experienced advantages and disadvantages of the tool use. The results of the interviews were planned to function as preparatory information for Step 4 of the case study, the planning of a comprehensive assessment. This second part of the TT6 work was not conducted in the course of the case study. The results will however be fed into the Integration & Synthesis Report.

Mid-term case study workshop in Amsterdam (27-28 June 2005)

The workshop was to present and discuss the results of Step 3. It should provide a platform for communication between tool teams, examining the needs and opportunities for efficient combinations of tools. Step 4, the planning of a more comprehensive assessment, was prepared during the workshop and new groupings, the so-called assessment teams or consortia were established.

7. Step 4: Planning a more comprehensive assessment

7.1. Introduction

This step consisted of the preparation of a plan for a full-fledged integrated sustainability assessment. Step 4 built on the results of Step 3. The basic idea was that the needs of a sustainability assessment could only partially be covered by individual tools, and therefore particular attention should be paid to the development of suitable and creative tool combinations. The assessment issues were the same as given for Step 3 (see Section 6.1.). Particular emphasis in Step 4 was on an effective coverage of relevant aspects, the creation of efficient linkages between tools and on the development of a convincing assessment procedure which is also cost efficient.

Participants/protagonists

Step 4 of the case study was carried out by three assessment teams (consortia) and one review team. Each assessment team consisted of (approximately) eight persons (tool experts from all tool types) and the review team of five persons (recruiting from I&S team). The line-up of the assessment teams was determined randomly by a stratified lottery, which ensured a good distribution of tool experts for each tool category over the three teams.

Procedure

Each consortium was asked to prepare a comprehensive assessment plan ('tender'), having the European Commission as a 'client' in mind. The assessment was to support the policy process during the relevant steps (from start till end) and should, as much as possible, cover the relevant social, environmental and economic SD aspects. Step 4 was carried out as a "creative competition", which means that the three consortia worked separately and competed for the most convincing assessment plan.

7.2. Results of Step 4

The assessment plans, prepared by the consortia, were provided as a written document and presented to a panel of external experts comprising researchers and representatives of the European Commission during the final case study workshop. In this report we only present a summary of the three assessment plans which centres on the approach, SD coverage and tool use as well as on the strengths and weaknesses of the approach as perceived by each consortium (self-evaluation). For a detailed description please see the assessment plans prepared by the three consortia.

7.2.1. Consortium 1: Plan for a comprehensive sustainability assessment of EU biofuel policies

Consortium 1: Benjamin Görlach, Dirk Günther, Nadja Kasperczyk, Jan Mertl, Mita Patel, Tiago Pedrosa, Angela Pereira, Hana Svejdarova and John Turnpenny

Approach

The assessment approach is based on a **Transition Management framework** which is to structure and guide the use of different methodologies and tools in a more coordinated and integrated approach. A 'transition towards a sustainable Europe' is the focus of the assessment plan.

In line with the transition management framework is the assessment divided into four separate 'phases':

- The establishment and organization of a multi actor network or 'transition arena' (Step 1).
- A selection of participants, referred to as innovators and visionaries are chosen to form the transition arena. Together they develop long-term visions and images around the issue of biofuel production and use in Europe. These images form the basis for the development of transition-agendas (Step 2).
- Based on these transition-agendas are transition-experiments carried out (Step 3), involving growing numbers of actors.
- The whole process is then evaluated and monitored (Step 4), facilitating a learning process.

The Transition Management framework is dependent upon a long time frame (at least 25 years) including the realisation of practical experiments, and the opportunity to incorporate lessons learnt from these experiments back into the transition loop. Due to time and resource restrictions the proposed assessment procedure goes only as far as step 2 of the four transition steps. The outcomes of the assessment shall provide sufficient information from which interim policy suggestions and short term actions can be produced in order to better support the implementation of the Biofuels Directive and the Energy Crop Premium. The long term perspective (including steps 3 and 4) goes further than that. It offers the opportunity to continue the assessment using the useful outcomes collected from the various tool components for longer term structural change and system innovation.

The assessment plan evaluated the policies using **four regional case studies** at widely differing locations: southern Italy, Latvia, eastern England and central France. Those Member States have been selected since they encapsulate many of the issues surrounding sustainability of agriculture, such as subsidies, water supply, new EU-membership, rural poverty and climate change. The case-study approach has been chosen in order to depict European diversity and to cover more context-specific aspects such as social impacts.

SD Impacts

In order to make the assessment more focused and tractable, consortium1 decided to focus the assessment on the following priorities of the SDS and the relating variables:

- Limit Climate Change
  - Reductions in CO_2 emission
- Natural Resources management
  - Groundwater and surface water quality and quantity
  - Biodiversity
  - Air quality
  - Land use
- Poverty and social exclusion
  - Employment

- Income distribution and income level

Table 8 illustrates the assessment procedure including the involved tools and tool combinations.

Table 8 Overview of assessment procedure and tools use

Assessment procedure			Tools
Transition Management		**Stakeholder identification**	Institutional analysis, Internet search, in-depth interviews
		Scenario building	Visioning, Scenario analysis, Focus groups
	SD Impacts	**Climate Change**	EW-MFA + Modelling
		Land use	GLUA + Land use change model
		Water quantity and quality	Physical Assessment + Modelling
		Biodiversity	Land use change model
		Air quality	EW-MFA + Modelling
		Poverty and social exclusion	Literature review
		Indicators Tuning	Repertory Grid Methodology
		CBA	Market methods, equilibrium models, input-output models, non-market valuation methods
		MCA	NAIADE, TIDDD
		Extending the audience	TIDDD, Internet survey

Strengths and weaknesses

The consortium sees the main strength of the proposed assessment in the use of an integrated approach to assess the impacts in a multi-dimensional manner. Combined with a strong involvement of stakeholders the assessment plan will in the view of the consortium guarantee the relevance and quality of the assessment for European policy makers and relevant stakeholders.

The EU assessments carried out so far, covered some of the priority areas, but in the view of the consortium lacked to evaluate others such as public health, land-use management and social development. Furthermore, a lack of transparency concerning the underlying assumptions as well as quantitative figures used is pointed at. Both in the case of the SDS priorities and in terms of the impacts on land use and agriculture, it is thought that the proposed assessment will deliver quantified estimates of the expected impacts. On the basis of a set of scenarios, possible transition paths will be modelled and described in terms of their impacts, both in monetary and physical terms. It is stressed that the chosen

approach does not stop at describing the impacts, but also delivers transition pathways that depict possible ways of implementing both directives.

The main weakness is in the view of the consortium the limited data availability and quality for some indicators. Often required data are not available on a European scale or too aggregated to be useful for an integrated impact assessment like the present. The current proposal tries to solve this problem by combining data from four regional case studies with EU wide data. Furthermore, some data, e.g. social issues, can only be described qualitatively and hence with a subjective bias. However, the participatory approach of this assessment plan tries to overcome this problem by involving stakeholder wherever possible.

7.2.2. Consortium 2: An integrated sustainability assessment plan for the EU Biofuels Directive

Consortium 2: J. David Tàbara, Marc Dijk, Onno Kuik, Hermann Lotze Campen , Alexa Matovelle, Måns Nilsson, Anne van der Veen:

Approach

This assessment is articulated as an iterative process consisting of four main phases of *policy definition*, *policy description*, *policy implementation*, and *policy evaluation*. Continuous improvements of each of these phases are achieved by confronting analysis derived from the use of particular tools with the results of institutional action, and by engaging networks of policy makers, experts and stakeholders in a mutual, adaptive and cyclical learning experience. The team defines the four phases as follows:

- The *definition phase* entails the *scoping* task during which the main goals of the assessment and boundaries of the system at stake are defined.
- The *description phase* is concerned with exploring the interrelationships between the causes and effects of the systemic persistent problems to be addressed, to describe the existing policies (baseline) and explore the possible alternatives to be applied and their possible impacts. In this phase, a transition agenda, possible end-visions and transition paths are also developed.
- The *policy implementation* phase entails the deployment of actual resources and measures to achieve the proposed goals. Transition experiments can be executed and networks are being mobilised.
- In the *evaluation phase*, the information generated is valued and weighted through different deliberative and analytical approaches, and decision recommendations are given about the most beneficial course of action.

SD Impacts

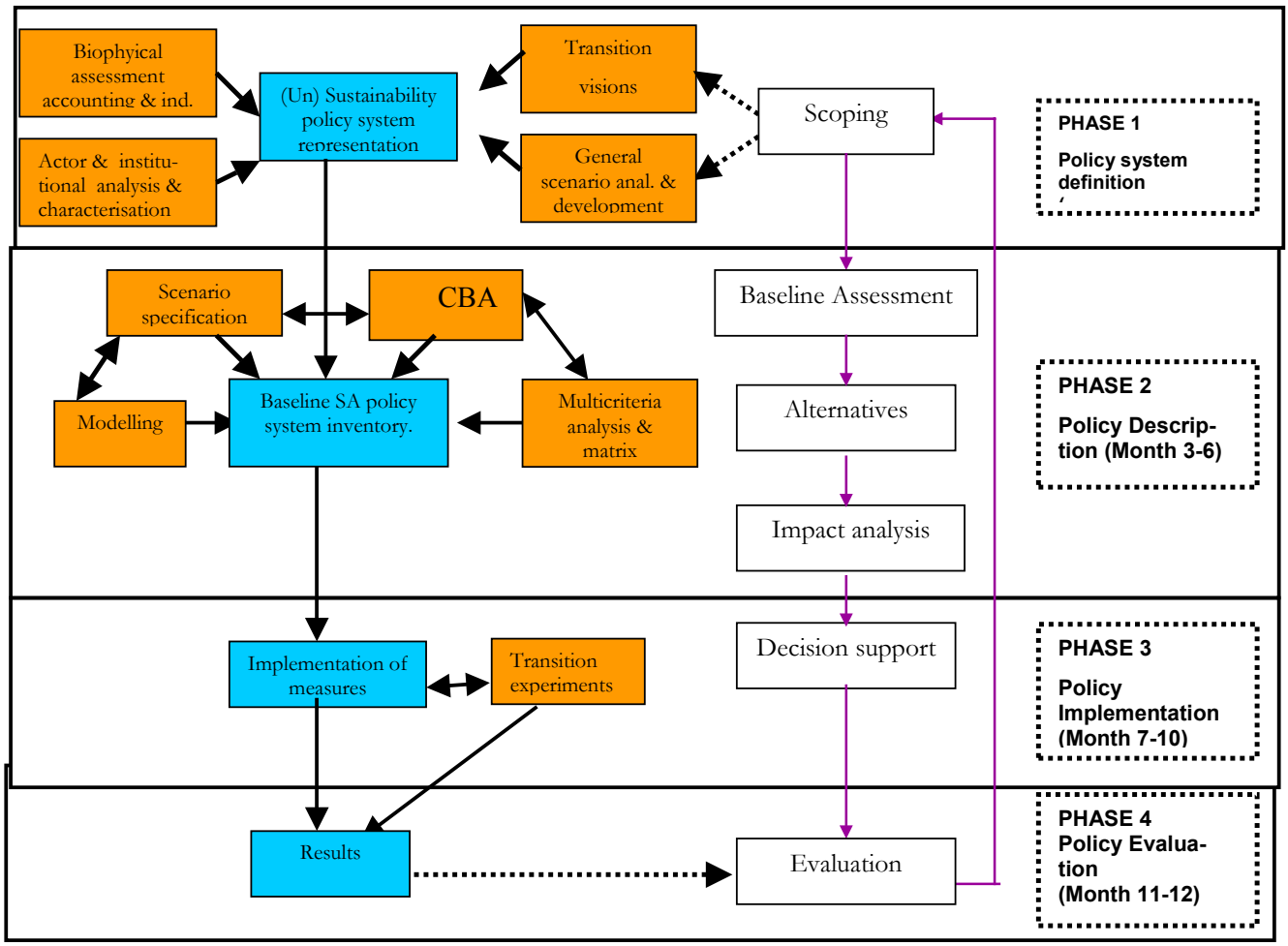
Table 9 shows the choice of indicators related to the SDS priorities which could be used in the assessment plan as starting point to feed and frame the use of the selected tools.

Table 9 SDS, indicators and possible tools to be used

SDS Priority	Indicator	Possible tools to be used
1. Limit climate change and increase the use of clean energy	CO_2 emissions	Modelling, biophysical indicators.
2. Address threats to public health	NO_x emissions	Modelling biophysical indicators.
3. Manage natural resources more responsibly	Energy productivity Resource productivity	
4. Improve the transport system and land-use management	Rate of the area used for transport from total area Transport system (freight and persons) Rate of ecological agriculture	Modelling, biophysical indicators.
5. Combating poverty and social exclusion	Restructuring of rural landscape	Transition visions, scenario analysis,
6. Dealing with the economic and social implications of ageing society (Lisbon)	--	--
7. Harnessing globalisation: Trade for sustainable development (ensure that globalisation contributes to sustainable development)	Share of biofuel imports from developing countries. Increase of economic and energy decentralisation.	MCA, CBA.
8. Fighting poverty and promoting social development	Share of biofuel imports from developing countries	Scenario analysis and development.
9. Sustainable management of natural and environmental resources	Primary energy consumption. Rate of RES Rate of natural protected areas	Transition experiments.
10. Improving the coherence of EU policies	Effectiveness of energy crop premium	Transition experiments.
11. Better governance at all levels	--	Transition visions
12. Financing sustainable development	Private and public investments for R&D Tax revenues/expenditures	CBA.

The sustainability assessment recipe - i.e. assessment sequence, algorithm, and possible tool combinations - is shown in Figure 1.

Figure 1 Sustainability Assessment Recipe



Strengths and weaknesses

The consortium sees the overall structure of the assessment plan as oriented towards "transition governance". It is a 'multi-level governance approach based on multi-actor participation processes aiming at long-term sustainability through the creation of a joined problem perception and long-term vision, innovation networks and experimental playgrounds'. The approach has according to the consortium the following *strengths*:

- The approach is focused on a broad participation of stakeholders. As all tools will profit from this participation, it will save costs and time instead of using participation only for one tool.
- It provides a clear combination of qualitative and quantitative methods that complement each other and prove the consistency.
- It can improve the credibility and plausibility of the BD implementation.

- The combination of tools permits to structure the problem and identify the criteria and thus allows a view close to reality (including uncertainties, problems etc.).
- The approach enhances the understanding and framing of a policy problem by structuring and aggregating data in a more robust way.
- It allows to carry out a more open and transparent process of assessment and management of the policy process.

The following weaknesses can be foreseen:

- The approach assumes the involvement of a lot of different stakeholders.
- In terms of invested time and financial investments for experiments it assumes the sustained commitment of a group of stakeholders over a longer period (at least 5-10 years).
- It aims at integrating different tool assessment which need different time frames to be delivered and may not be available when such integration is going to take place.
- The assessment plan is unable to comprehensively cover the twelve priorities of the EU SDS, due to a lack of social assessment tools in the portfolio.

7.2.3. Consortium 3: Proposal for an impact assessment on the introduction of biofuels in the EU related to Biofuels Directive and CAP Energy Crop Premium

Consortium 3: Anneke von Raggamby, Philipp Schepelman, Anna Alberini, Ivars Kudrenickis, Karl-Heinz Simon, Marjan van Herwijnen, Marleen van de Kerkhof

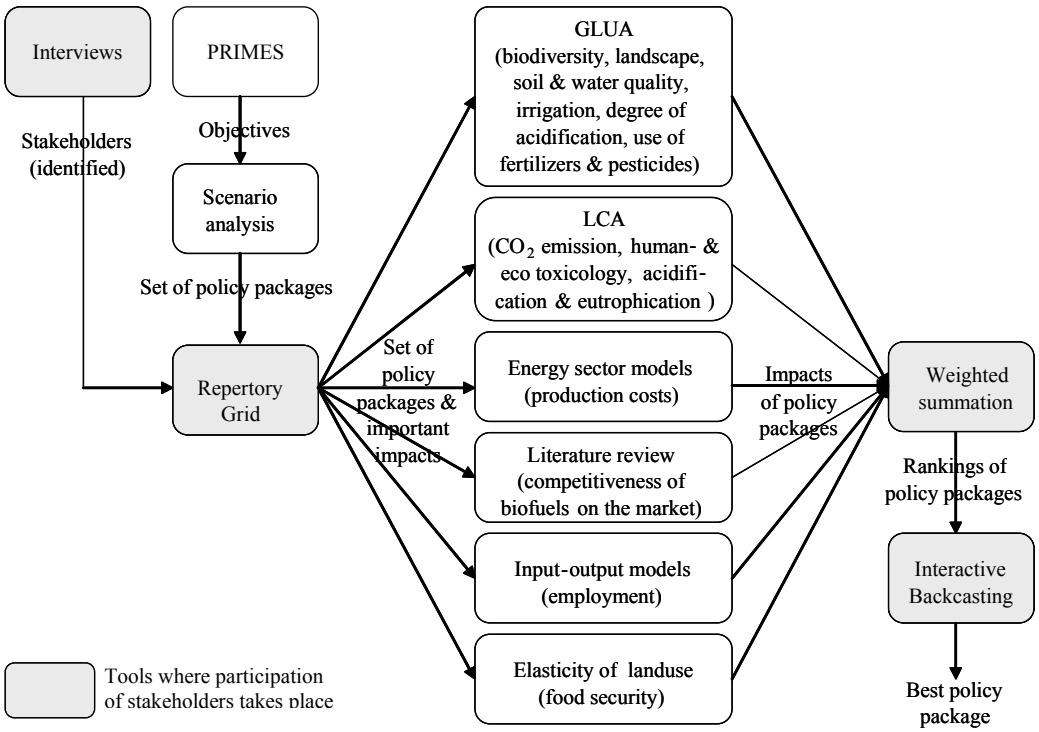
Approach

With reference to the impact assessment guidelines established by the European Commission the assessment approach consists of the following phases:

1. Identification of problems and their causes
2. Quantification of parameters necessary to achieve the objective (increasing share of biofuels)
3. Identifying policy packages as combinations of policy goals plus the instruments to reach the objectives
4. Defining the impacts of each identified policy package with regard to SD concerns
5. Comparing Options and Presenting Results
6. External Consultation
7. Monitoring and Evaluation

Figure 2 illustrates the different assessment steps and indicates the tools with stakeholder participation.

Figure 2 Overview of assessment approach



Two main considerations related to the assessment of an increasing share of biofuels are identified: 1) the identification of an appropriate set of variables, and 2) the aim to involve stakeholders in the process. Critical variables identified are i) financial support and incentives that are provided to grow certain crops, ii) the location of growing the energy crops (i.e. inside or outside the EU), and iii) the particular energy crop species used. By combining these variables different "policy packages" are developed. The impacts of each policy package are estimated in such a way that the pros and cons of the policy package, and the variables can be examined. Stakeholder involvement is to ensure that the most important aspects are taken into account and that the people having a stake are made partly responsible.

SD Impacts

The approach covers the following SD impacts indicated in Table 10.

Table 10 Overview of coverage of SD Impacts

Social Impacts	Economic Impacts	Ecological Impacts
• employment growing crops	• opportunities for rural development	• land requirement
• employment producing biofuels	• costs for transport sector	• CO_2 emissions
• affects food security	• degree of competitiveness of fossil fuels	• acidification (NOx, SO_2)
• global justice		• fertilizers, pesticides
• **...**		• biodiversity
		• landscape
		• soil
		• water quality (groundwater)
		• irrigation
		• waste from production of biofuels
		• air quality due to changed user patterns
		• Changed use of renewable and non-renewable resources

Strengths and weaknesses

The consortium sees the strength of the assessment plan in the overall framework of the assessment, defining the assessment questions, developing and finally choosing "policy packages". It is stressed that a modification of the assumptions made would certainly change the outcome of the assessment.

The plan is still experimental in character where it comes to identifying and assessing actual impacts. However, this is partly due to the fact that these impacts strongly depend on many factors which will become more clearly once the assessment process has actually started and the proposed tools are actually applied. It is also due to the fact that the nature of many impacts means that they are difficult to address by standardized tools.

The strengths of the proposal are the following:

- A limited set of key factors was identified that represents the crucial success parameters;
- these factors are varied systematically and plausible combinations are fed into the evaluation process;
- the dependency of the biofuel strategy on factor combinations is clearly stated;
- stakeholder involvement is ensured at several stages of the assessment process;
- the data and information basis is enlarged through that involvement;
- the selection of stakeholders to be involved is carried out in a transparent and open procedure.

The main weaknesses of the approach are is that the more comprehensive framework conditions are not taken into consideration, e.g. by using overall scenarios reflecting dynamics in economy, energy technology, or developments in international trade regimes.

Final case study workshop in Brussels (24-25 January 2006)

The workshop was to present the three assessment plans and to evaluate the proposals by the Expert Panel. Especially the following issues should be addressed:

- The potential of different tools and combinations in EU sustainability assessment,
- specific difficulties related to the design of such assessments, and
- general conclusions with respect to sustainability assessment.

7.3. Evaluation of the three plans by the Expert Panel

Members of the Expert Panel: Cees Midden (TUE), Notis Lebessis (EU), Steven White (EU), Julia Hertin (Univ. of Sussex), Ian Hodgson (EU), Winfried von Urff (IfLS)

The following summary is based on the separate reviews given by the expert panel to each of the consortia as well as on the discussion during the final case study workshop.

Overall, the assessment plan of **consortium 1** is difficult to understand mainly due to much jargon. The approach itself is difficult to follow, since only the first two steps of the Transition Management framework can be covered during the assessment. This raises the question, whether Transition Management with its long term approach is an appropriate tool or frame for the assessment in question. The underlying assumptions and the framing of the assessment remain unclear. The comparison of different situations (with and without policy) as well as the link to implementation is missing. Furthermore, there is no differentiation of the BD and the ECP. The application of four case studies in different Member States in order to cover European diversity is seen as a distinctive advantage in comparison to the other two proposals. But it remains open how the local results are translated in general conclusions relevant for EU-level. There are many ways of implementing the BD in the member states and the effectiveness and impacts will be very different. In order to avoid that case studies stand alone, a clear definition of general assumptions is necessary.

The assessment plan of consortium 1 is a truly participatory approach, and covers the important SD aspects, even fairly well relevant social aspects. Attention is drawn to the combination of multiple tools but the linkages are not elaborated. It is not clear what "product" the assessment plan delivers in the end. The calculated required resources are quite high but seem to be appropriate for the proposed plan.

The approach of **consortium 2** has all the elements of a classical policy assessment, but the core sequence of steps needs clarification. For example, how will the policy description in the first stages of the assessment be 'implemented' in the later stages of the assessment? The terminology differs sometimes from the wording used by the Commission and therefore, causes some misunderstanding. The proposal does not include precise specifications of the options and the consideration between imple-

mentation and adoption of policy measures is missing. There is a good coverage of SD impacts, except that the coverage of social aspects seems to be rather weak. A positive feature is the use of Multi- Criteria Analysis (MCA) as an umbrella where different other tools can come in (participatory tools, willingness to pay etc). Some clarifications could be added on the use of quantified weights and social factors. How can for example willingness to pay data play a role in MCA?

Though the involvement of stakeholder participation is highlighted in this proposal, some open questions remain, for example: What does consortium 2 want to get from the stakeholders? How to choose representative stakeholders? How is the engagement of the stakeholders ensured during the whole process? The estimated required resources seem to be underestimated for the proposed plan.

The assessment plan of **consortium 3** is transparent and includes the clearest framework and description of how the analysis is to be undertaken of all three proposals. The team has chosen to focus on variables that differ for three policy packages, i.e. the level of EU financial support (high –medium-none), the location of production (in EU – imports) and the crop varieties (sugar beet, rape seed, sugar cane). The term "policy package" causes misunderstanding, because in actual fact its more scenario type assumptions rather than policy variations. All important SD aspects are covered, but the different conditions across Europe (diversity) are not considered. The stakeholder involvement during the whole process seems to be very ambitious and idealistic. It should be explained in more detail. There is a big variety of tools to be used in this approach, but their linkages remain rather vague. Especially information on which scale the tools work, the required data as well as possible linkages are largely missing or insufficient. The estimated costs and resources seem to be unrealistic for the ambitious and seemingly arbitrary use of tools.

Overall, the following conclusions can be drawn from the results of Step 4:

- Stakeholder involvement was a major element in all assessment plans, and the innovative aspect was that this participation passed through the whole process instead of being added at the end. While emphasis has clearly been on involving stakeholders already in problem structuring, the kind of involvement and the precise feedback mechanisms remained rather unspecific. The question why and where precisely stakeholder participation is meaningful and how best to link stakeholder inputs with the actual assessment were left open.
- A good and balanced coverage of SD impacts could be found in all proposals. In many respects it was however not clear how precisely impacts are assessed. Whereas all consortia proposed a variety of tools, the logical links from problem structuring to reasoned tool selection, the specification of tool use and tool combinations, and the actual assessment of impacts remained rather vague.
- The perspective and the requirements of the potential user is a fundamental aspect of a proposal and needs to be considered accordingly. The focus on the principle user was insufficient in all three assessment plans. Related to that, the plans were not communicated well to potential 'clients' (in this case represented by the expert panel). A good communication between researcher and (potential) user and between disciplines is critically important.

8. Synthesis: Lessons learned from the case study

The description of EU level assessments relating to the Biofuels Directive has shown that from a big variety of existing tools only a small number was actually applied. (For the Energy Crop Premium, no comparable assessment was available at that time.) In spite of a lack of documentation, the following tools could be identified: CBA, SAFIRE (a scenario building and planning tool), PRIMES (a modelling system), surveys as well as ad-hoc stakeholder analysis and consultation. In terms of the coverage of SD impacts economic aspects (economic growth, human capital formation and employment, international performance and market structure), environmental (air/water/soil and climate, renewable of non-renewable resources and use of energy) and one social aspect (international co-operation) had been addressed. The most prominent tools used on national level were LCA, Scenario Analysis, CBA/CEA and literature review. Almost all reviewed national assessments covered the economic and environmental SD impacts fairly well in contrast to social aspects, which were comprehensively included only in two assessments. Information of required resources such as person months, required data, time needs, data availability etc. was not available in most of the reviewed material.

After having explored the practice of the Impact Assessment relating to biofuels on EU and national level, the case study tried to overcome some of the revealed shortcomings especially with the more 'practical' exercises of Step 3 and 4. The main objective was to develop comprehensive assessment plans with a good coverage of SD impacts and suitable and efficient usage of tools and tool combinations, and thereby, to gain more hands-on experience for the tool information presented in the electronic handbook.

Broad experiences were gained from the case study, besides those made by the tool teams on the capacities of 'their' tools. The final sections summarize these broader lessons learned, which are structured by the following main topics:

- **Coverage (of SD impacts)**
- **Combinations (of tools)**
- **Communication**

8.1. Coverage

Taking into account the multi-dimensionality of impacts

Dealing with the complexity of multi-dimensional problems and the interrelations between natural, economic and social systems still is a major challenge. The planning of an integrated assessment requires keeping the 'big picture' in mind while at the same time a sufficient degree of precision is important. The assessments plans developed in Step 4 revealed that the question of which SD impacts should be addressed strongly influences the outcome of the assessment. As a consequence, in each plan it is foreseen that the selection of SD aspects is enhanced by the engagement of stakeholders. The

involvement of stakeholders in the selection of SD impacts should be understood as a critically important part of an integrated assessment process.

The spatial dimension: Dealing with diversity and limited data availability

One consortium used regional case studies at widely differing locations to depict European diversity and to go into more context-specific SD impacts. The selection aimed at member states and regions (e.g. a community or province) that encapsulate many of the issues surrounding sustainability of agriculture, such as subsidies, water supply, new EU-membership, rural poverty and climate change. Regional case studies can be used to better address the more detailed interrelationships on the one hand and spatial diversity on the other. A critical question is, however, if and how regional level results of context-specific SD impacts can be later translated into conclusions relevant for the analysis at an aggregated level (e.g. EU-level).

The limited data availability and quality for some indicators is a major problem in almost any assessment. Many required data are not available or too aggregated to be useful. This lack of data often causes strong simplifications, for example, in modelling. One possibility to overcome this problem is to integrate regional case study analysis with a higher level analysis that is based on more aggregated EU wide data. Another possibility is the involvement of stakeholders as a way of mobilising and channelling knowledge. After all, a well designed sensitivity analysis can improve the understanding of the importance of certain parameters and data. However, in the overall assessment, the relevance of an indicator is more important than accuracy and precision.

The temporal dimension: Taking into account relevant time frames

In an integrated Sustainability Assessment short-term impacts need to be interpreted in terms of a long-term strategy. The Transition Management (TM) framework used by one consortium depends upon a long time frame (at least 25 years) including the realisation of practical experiments, and the opportunity to incorporate lessons learnt from these experiments back into the transition loop. The consortium expects that the outcomes of the assessment during only part of the TM cycle (the proposed assessment procedure goes only as far as step 2 of the four transition steps) shall provide sufficient information for interim policy suggestions and short term actions. But the basic idea is that the long term perspective (including steps 3 and 4) of TM would go beyond that and, in addition, it would offer the opportunity to continue the assessment using the outcomes for longer term structural change and system innovation.

The discussions with the Expert Panel underlined the importance of planning assessments in such a way that relevant outcomes can be taken up at the right time in the policy process. Therefore, the time frame available for the assessment needs to be taken into account. The use of a TM framework is in this respect a strength and a weakness at the same time. The strength is that it introduces a longer term perspective, draws attention to longer term structural changes and emphasizes the need for an evidence-based approach towards policy formulation (incl. the related monitoring and feedback loops). And it is for almost the same reasons a weakness because it requires more time than is normally available for a conventional policy process-related assessment in practice, which often allows only for a snapshot like assessment.

8.2. Combinations

Combining qualitative and quantitative analyses

While there has been substantial progress during the past decades in the field of multidisciplinary work it is still difficult to deal with multi-dimensional problems. Principally, can a combination of suitable tools help to better address a complex problem by complementing each other and allowing a view closer to reality including uncertainties, problems etc.. The joining of different tools which are usually applied in isolated ways is a challenging task for tool experts and there is not much experience available.

The assessment plans of the three consortia included a big variety of tools, representing all tool types from Sustainability-A-Test. Though this variety was rather innovative, the discussions with the Expert Panel stressed that the added value of the use of particular tools needs to be addressed much better and that there needs to be a sound reasoning why and how certain tools are combined. Potential tool users need sufficient information on scale, data requirements, time needs, possible linkages etc. Different tools have different functions and may be needed at different stages of the integrated assessment. Overall it is to be concluded that it might be better to use fewer tools and to combine them in efficient ways. Their use and connections need to be made as transparent as possible.

The 'illustrative application' of the single tool types during Step 3 identified the main strengths and shortcomings of the tools for an integrated assessment. Modelling tools, for instance, can help to address the multi-dimensionality of impacts and, in particular, to clarify complex interactions. What is insufficient so far is the link between modelling activities and actual policy processes. Models tend to be 'black boxes' and the links between model inputs and model outputs are often insufficiently transparent from the perspective of decision-makers. Model-based participatory scenario development and evaluation, in contrast, can increase trust and therefore improve the feeding back of results. MCA can effectively support policy related assessments but needs the outcomes of other tools. On the basis of these results MCA can compare and rank policy options according to the chosen criteria in a transparent way. The MCA procedure can be improved by involving stakeholders as well.

Very little has been achieved in existing assessments to explicitly address the social and governance issues surrounding biofuels. These questions cannot be addressed in quantitative terms (only) and need to be assessed qualitatively. Direct stakeholder involvement may be an efficient way to take care of social issues if integrated carefully into the overall assessment plan.

More generally, the combination of qualitative and quantitative methods in such a way that they complement each other is a critical question. The linking of qualitative and quantitative analyses and the selection of the most suitable criteria and indicators is faced with major challenges: Tools differ in time frames of implementation and results may not be available when integration or combination is supposed to take place. Similarly, tools differ in the spatial scale of their (normal) application. All three consortia proposed an assessment framework in their plans, which reflects the idea that there normally ought to be a more or less comprehensive framework specifying the boundaries and connections of tools and as well as bringing together different temporal and spatial scales.

8.3. Communication

Coordinating assessments with the needs and dynamics of policy processes

A main finding both from our review of existing assessments for the biofuels case and also from the discussions with the Expert Panel (Step 4) is the occurring disconnection of assessment from policy processes. Studies tend to inform decision-makers about certain problems but do not really enter the decision-making process. Overall the experience shows that analysts need to link the assessments more closely with policy making processes.

In order to be able to feed in relevant assessment outcomes at the right time into policy processes there needs to be a sufficient coordination between analysts and decision-makers. The use of an assessment framework (see chapter 5) contributes to the organisation of the assessment and aids to communicate the results into appropriate phases of the policy cycle. Continuous improvements of each phase can be achieved by introducing analysis outcomes into decision processes and institutional action, and by engaging policy makers, experts and stakeholders in a mutual, adaptive and cyclical learning experience.

Finding the right level and timing of stakeholder involvement

Participation took place in the development of the Biofuels Directive and formed a prominent part of the assessment plans developed in the case study. The potential of stakeholder involvement as a way to improve the quality of assessments was clearly acknowledged by the Expert Panel. Nevertheless, the specific aims, the modes of involvement and timing have to be carefully conceived. Important questions are: Why and how involve stakeholders? Where precisely is stakeholder participation meaningful? How to ensure representativeness?

An early engagement of the key decision-makers and stakeholders in a particular policy process will guarantee the relevance of the assessment questions addressed. Similarly, can the feeding back of interim assessment outcomes and its critical review by stakeholders improve the quality of assessments. While in general there tends to be a lack of stakeholder involvement this does not mean that any "multi-level governance approach based on multi-actor participation" is sensible. Not always can "a joined problem perception and long-term vision" be achieved. Furthermore, data-based analyses which are fed into discourses need to be as much as possible independent of particular interests.

Communicating assessment outcomes in understandable ways

Communication starts when preparing the assessment. The discussions between the researchers of the three consortia and the Expert Panel during the final case study workshop showed that integrated assessments put a burden on the involved scientists of different disciplines and with different 'frames of mind'. Researchers have to be good in their own field, and must be able to work in interdisciplinary ways. Furthermore, any assessment is at the boundary of research and practice and therefore has a bridge making function. It follows that communication between researchers and potential users is

critically important with regard to terminology used as well as the orientation of the work. Communication of research results to users is often problematic and there is an urgent need for improvement.

The language and terminology used in research is to a very considerable extent different from communication in the policy and decision-makers sphere. This underlines the importance of communicating the approaches and outcomes of assessments in an understandable way. The fact that research is paying insufficient attention to communication can be illustrated with a quote from one of the assessment plans: *"It is a multi-level governance approach based on multi-actor participation processes aiming at long-term sustainability through the creation of a joined problem perception and long-term vision, innovation networks and experimental playgrounds."*

Annex 1: List of case study papers

All documents can be found in the electronic handbook.

EU assessments (Step 0 +1)

De Ridder, W.: Assessments done in relation to the Biofuel Directive and a short overview of its history

Schepelmann, P.: EU-assessment by TT1: Physical Assessment tools

Alberini, A., Goerlach, B., Bartok, J. & Zanatta, V.: EU-assessment TT2: Monetary tools

Lotze-Campen, H.: EU-assessments TT3: Modelling tools

Matovelle, A. and Simon, K.-H. : EU-assessments TT4: Scenario Analysis

Kasperczyk, N., Tabará, D. & van Herwijnen, M.: EU-assessments TT5: Multi Criteria Analysis

Erhardt, K. & Nilsson, M.: EU assessments carried out on the Biofuels-Directive- seen through a Strategic Environmental Assessment (SEA) perspective (TT6)

Cuppen, E., Fransen, P. & Hisschemoller, M.: Participatory Tools for developing and implementing EU policies for enhancing biofuels (TT7)

Patel, M. & Dijk, M.: Transition Management on a European policy level: an exploration (TT8)

National assessments (Step 2)

Turnpenny, J.: Review of national assessments in United Kingdom

von Raggamby-Klasing, A.: Review of national assessments in Germany

Patel, M., Kuik, O. & van Herwijnen, M.: Review of national assessments in the Netherlands

Tàbara, D., Meerganz, G. & Bartrolí, J.: Review of national assessments in Spain

Erhardt, K. and Nilsson, M.: Review of national assessments in Sweden

Alberini, A. and Zanatta, V.: Review of national assessments in Italy

Bartos, J.: Review of national assessments in Czech Republic

Kudrenickis, I.: Review of national assessments in: Latvia

Illustrative Applications (Step 3)

Schepelmann, P., Schütz, H. & Bringezu, S.: Illustrative application: Global Land-Use Accounting (GLUA)

Schepelmann, P. & Schütz, H.: Illustrative application: Material Flow Analysis (MFA)

Lotze-Campen, H.: Illustrative application: Energy-Transport Model PRIMES

Matovelle, A. & Simon, K.-H.: Illustrative application: Scenario Analysis

Van Herwijnen, M., Tàbara, D. & Kasperczyk, N.: Illustrative application: Weighted Summation

Tàbara, D., Gamboa, G., Russi, D., Bartrolí, J., van Herwijnen, M. & Kasperczyk, N.: Illustrative application: Naiade

Patel, M. & Dijk, M.: Illustrative application: Transition Management

Comprehensive Assessment Plans (Step 4)

Consortium 1: Görlach, B., Günther, D., Kasperczyk, N., Mertl, J., Patel, M., Pedrosa, T., Pereira, A., Svejdarov, H. and Turnpenny, T.: Plan for a comprehensive sustainability assessment of EU biofuel policies

Consortium 2**:** J. David Tàbara, Dijk, M., Kuik, O., Lotze Campe, H., Matovelle, A., Nilsson, M., J.D. and van der Veen, A.: An integrated sustainability assessment plan for the EU Biofuels Directive

Consortium 3: von Raggamby, A., Schepelman, P., Alberini, A., Kudrenickis, I., Simon, K.-H., van Herwijnen, M. and van de Kerkhof, M.: Proposal for an impact assessment on the introduction of bio-fuels in the EU related to Biofuels Directive and CAP Energy Crop Premium