

Biomass role in achieving the Climate Change & Renewables EU policy targets. Demand and Supply dynamics under the perspective of stakeholders . IEE 08 653 SI2. 529 241

Deliverable D5.2

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Scenarios for the analysis of biomass use in the EU in the time frame 2010-2030

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Preface

This publication is part of the BIOMASS FUTURES project (Biomass role in achieving the Climate Change & Renewables EU policy targets. Demand and Supply dynamics under the perspective of stakeholders - IEE 08 653 SI2. 529 241, www.biomassfutures.eu) funded by the European Union's Intelligent Energy Programme.

Scenarios and cases that will be conducted within WP 5 of the BIOMASS FUTURES project have been defined. The two main dimensions that frame our scenarios are *accessibility* of biomass and the *sustainability criteria* imposed. We are not at the stage yet to fully define all scenario parameters. Furthermore it is expected that during initial scenario runs some scenario assumptions need to be adapted. For that reason this deliverable is expected to become a *living* document during the coming first months of 2011.

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1 Introduction

In the framework of the project Biomass Futures, it is deemed useful to analyse scenarios and sensitivity cases to address the role bioenergy resources can play to meet the GHG emission reduction targets and the renewable energy targets laid down by the Energy Directive (RED) (Directive2009/28/EC, 2009). More specifically, the modelling work focus on the below ambitions EU is committed to and aim at quantify the likely contribution of bioenergy to those targets.

- The renewable energy targets (specific renewable energy targets for each Member State to ensure an EU 20% renewable energy share in the overall final energy consumption by 2020),
- The road transportation target (10% of the final energy consumption from road transport to be met from renewable resources),
- The GHG emission targets (20% GHG emission reduction target by 2020),

While most renewable energy resources generate one or two energy carriers from a particular source, bioenergy concerns a matrix of processes converting biogenic raw material for heat, electricity or biofuels for the transportation sector. Besides, bioenergy systems also use the same type of feedstock traditionally used for food, fodder, and raw material for industrial processes. However, rising demand for bioenergy might bring about serious socio-economic and environmental impacts, in particularly associated with land use change. These potential negative effects of bioenergy expansion are frequently discussed, in particular competition for feedstock or production resources such as land or water.

In this context the Biomass Futures project aims at addressing the question “*how* and *to what extent* biomass can contribute to a sustainable energy future *without* causing negative impacts”.

WP5 within this project uses modelling tools to quantify the role (sustainable) biomass can play to meet the EU targets on GHG emission reduction and renewable energy. A number of scenarios are conducted to illustrate the likely bioenergy systems in 2020 and 2030. The ECN set of models, as described in D5.1 of this project (van Stralen et al, 2010), quantifies

- The share of biomass deployment in each sector (electricity, heat and transport fuels)
- GHG emission savings
- Generation costs

according to different policy ambitions/strategies on renewable energy deployment

In this deliverable a description is given of scenarios and cases that will be conducted later in the project using the ECN models and the PRIMES model¹.

The next chapter gives a brief description of the scenarios and cases that will be conducted in WP5 of Biomass Futures.

¹ See http://www.e3mlab.ntua.gr/e3mlab/PRIMES%20Manual/The_PRIMES_MODEL_2008.pdf

2 Overview of the Biomass Futures scenarios and cases

2.1 Introduction

The modelling work is built on the EU27 sustainable biomass potential for energy which were analyzed in work packages 3 and 4 of the project.

Our scenarios and cases are constructed to address a number of important questions on biomass deployment to produce energy in Europe. Below, we present the questions and the scenarios and cases conducted to answer them.

2.2 Scenarios

The most important question we want to address in the modelling work is:

Given the recent policy measures to harness the renewable energy potential in EU27, what role will biomass play to reach the 20% renewable energy target and the individual renewable energy targets for each member states in 2020? What will be the impacts in terms of reduced GHG emissions?

To try to answer these questions using our modelling tools, we want to conduct a scenario analysis. Scenarios are often presented in a two-dimensional quadrant, where the two dimensions represent the two most important (groups of) uncertainties. *So where does this lead us with respect to Biomass Futures?*

The most important driving forces influencing future development on the use of biomass in the energy sector will be the accessibility to biomass resources and the sustainability criteria imposed on biomass. Both dimensions will influence the supply of biomass for energy purposes. The accessibility of biomass is much related to mobilization factors, the availability of a collection system, etc. We will assume on one side an accessibility that is more or less in line with the current situation, on the other side we assume that there will be an effort to get accessibility to biomass resource that at currently not used. Sustainability criteria imposed on the use of biomass for energy purposes can significantly influence to total supply of biomass for energy. At the moment only the RED sustainability criteria for biofuels are imposed. It is, however, not unlikely that similar criteria will be extended to the use of biomass for heat and electricity production. Regarding sustainability criteria, we assume on one hand the RED requirements that are in place at the moment. On the other hand we assume more strict requirements, valid for bioheat and bioelectricity as well: RED+.

Focusing on those two dimensions would give us the scenario setting as indicated in Figure 2.1:

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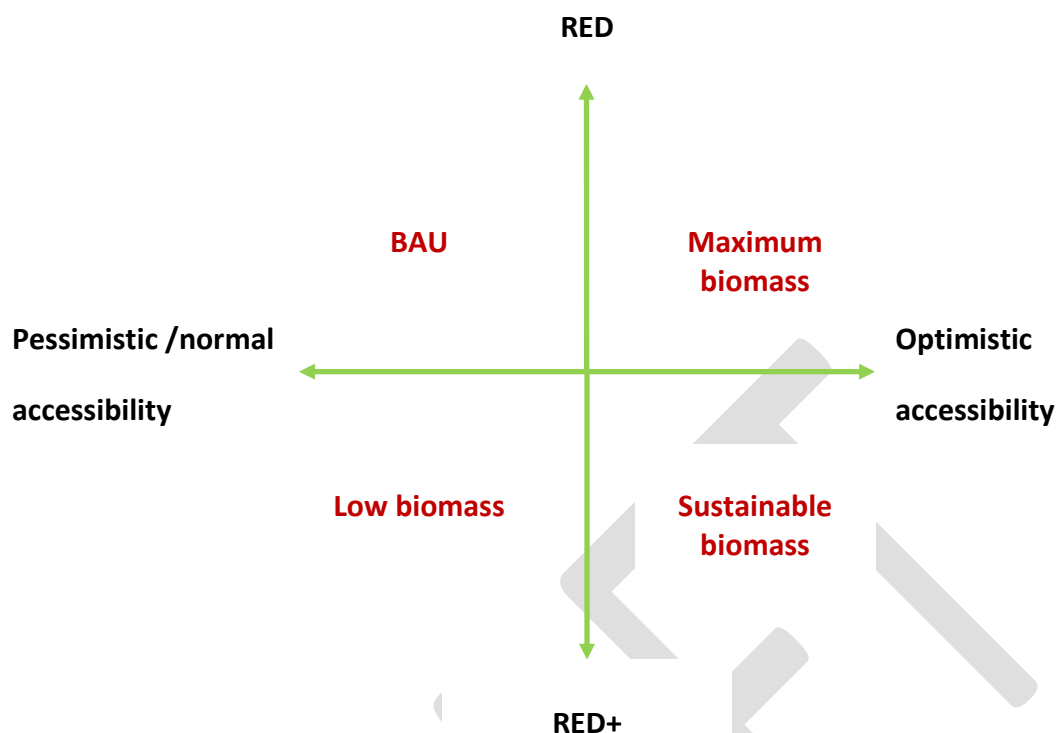


Figure 2.1: Scenario settings. On the horizontal axis is the accessibility of biomass, on the vertical axis the sustainability criteria applied.

Based on this logic, scenarios for Biomass Futures could be:

1. **BAU scenario:** The sustainability criteria as they are described in the RED are kept as they are. No specific measures towards gathering unexplored biomass will be undertaken.
2. **Low biomass scenario:** In this scenario also no specific measures towards gathering unexploited biomass will be undertaken, but on the other hand more strict sustainability criteria will be kept in place resulting in a low availability of biomass.
3. **Maximum biomass scenario:** It will be assumed that more effort will be undertaken to get access to unexplored biomass resources, furthermore biomass sustainability criteria will be kept as they are at the moment. These assumptions result in a scenario where a maximum amount of biomass is available.
4. **Sustainable biomass scenario:** In this scenario the most will be made out of biomass but in a sustainable way, so like in the *Maximum biomass scenario* it will be assumed that more effort will be undertaken to get access to biomass, but sustainability criteria will be more strict: they will also apply to the use of biomass in the electricity and heat sector (RED+).

All scenarios will include the policy measures indicated in the NREAPs of the EU Member States as much as possible. Where needed they will be modified to follow the NREAP pathways unless other constraints, like the RES potential, learn us that the some NREAP pathway for a certain technology in a particular country are not feasible. It might, for example, well be that degression rates for Feed In Tarrifs are assumed to be too optimistic, if needed corrections will be applied. Futhermore, we will assume that the RES developments between 2020 and 2030 will in large lines be similar to the PRIMES reference scenario update 2009 (Capros, 2010a) .

In the next section we will discuss how some questions that can be addressed in some more detail using specific cases.

2.3 Cases

Since it is interesting to know if biomass can play the role as indicated in the NREAPs as well as which type of feedstock and with an application in which sector, it seems useful to zoom into some issues somewhat more and investigate some sensitivities and address some (sub)questions. We want to address these sensitivities and questions via specific cases within the scenarios.

What will be the impact of the “10% road transport from renewable energy sources” policy on other energy sectors (namely heat and electricity) in terms of biomass deployment?

CASE 1: Achieving a maximum biofuel contribution in the transport sector. This case uses assumptions from the maximum biofuel scenario from DG-MOVE

CASE 2: Electrification in the transport sector. This case includes assumptions from the decarbonization scenario from PRIMES.

What are the best ways of using biomass resources to improve its contribution to the EU GHG reduction targets?

CASE 3: Improving the GHG emission saving through excluding the biomass to-energy pathways that produce high GHG emission figures.

- a) Climate and biodiversity first. This (sub)case is based on storyline 2 of the EEA study ... (Reference?). Only highly efficient cropping and conversion systems from the perspective of GHG mitigation are adopted and that high biodiverse areas and/or areas with a high carbon stock are not to be used for dedicated bioenergy cropping. The policies also leave more freedom to regions to contribute to the biofuel target. This means that the 10% is not binding, but the overall 20% renewable target remains.
- b) The wider EU environment first. This (sub)case is based on storyline 3 of the EEA study. It implies the same assumptions as case 3a, but stricter requirements are imposed regarding access to land for dedicated cropping and the type of crop mixes and cropping system to be used.

2.4 Overview of scenario and case assumptions

Regarding developments in the energy sector in the general, the PRIMES reference scenario update 2009 (Capros, 2010a) forms our basis for all scenario runs. Important outputs from the reference scenario that will be used include sector wise energy demand for different energy carriers, fossil fuel prices, CO₂ prices, electricity prices, etc. Note that we will use the PRIMES data for general energy demand. Regarding the contribution RES technologies we might deviate from this. For the RES development in the general we will try to follow the development paths as indicated in the NREAPs as closely as possible, unless these development paths seem not feasible. For this purpose we will use the RESolve set of models. Regarding the assumptions for biomass (potential, cost of technology, biomass prices, etc.) we will deviate from the assumptions made in the PRIMES reference scenario as well and

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use all outcomes from the Biomass Futures where possible. For the analysis of the use of biomass in different sector, besides the RESolve set of models, the PRIMES biomass model will be used as well (Capros, 2010b). This will allow us to compare and discuss outcomes from RESolve and PRIMES biomass. Before running scenarios and analyzed the outcomes of the different models, it is important that biomass technology costs and categories used will be harmonized to a large extent.

Assumptions regarding the import of biomass from outside the EU are also very important. The GLOBIOM model as used in WP3 by IIASA² will provide us with import data of biomass. Similar availability assumptions and sustainability criteria as used in the framing of the scenarios (Fig. 2.1) will be assumed.

Regarding the accessibility of biomass, the main assumptions in the case of *pessimistic/normal* and *optimistic* accessibility are given in Table 2.1

Table 2.1 Assumptions regarding accessibility of biomass

pessimistic/normal accessibility	optimistic accessibility
...	...
...	...

Table 2.2 gives an overview of the sustainability criteria taken in place in scenarios using the RED criteria and using RED+ criteria

Table 2.1 RED and RED+ sustainability criteria

RED	RED+
...	...
...	...

² <http://www.iiasa.ac.at/Research/FOR/globiom.html>

3 Interaction with other work packages

Sustainable biomass potential for energy from work packages 3 and 4 of the project will be used as an input for the RESolve and PRIMES biomass models. However, there also needs to be a feedback loop to WP 3 and 4. The biomass that will, according to the energy modelling, actually be used needs to be used by WP 3 and WP4 to analyze the effect on indirect Land Use Change effects. If these indirect effects will be undesirable it might well be that the sustainable biomass potential needs to be finetuned. For that reason there needs to be an interaction between WP 3, 4 and 5. Note that the sustainability criteria and assumptions regarding accessibility might change during the course of running the scenarios as well. For that reason this document is expected to be updated during that process. Furthermore among partners in WP 3, WP 4 and WP 5 a further harmonization of biomass resource and technology categories needs to take place, as well as regarding costs and characteristics of technologies.

The scenario assumptions as described in chapter 2 will also influence the demand segments as analyzed in WP2. Interaction to more carefully align the assumptions made in WP2 and WP5 are expected.

4 Conclusions

Scenarios and cases that will be conducted within WP 5 of the BIOMASS FUTURES project have been defined. The two main dimensions that frame our scenarios are *accessibility* of biomass and the *sustainability criteria* imposed. We are not at the stage yet to fully define all are scenario parameters. Furthermore it is expected that during initial scenario runs some scenario assumptions need to be adapted.

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