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EFORWOOD

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Development and selection of M3-specific key scenarios for ToSIA at case study level:
Description of Bio-Energy Scenario within BW case study against the background of Reference Future A1 and B2

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1. Background and used documents

It has been decided by the IP Board that within the case study Baden-Württemberg the Bio-energy scenario shall be modelled in two directions: on top of a world within the framework of A1 reference future and on top of a world within the framework of B2 reference future, in both cases as a high-impact scenario. Those reference futures are described in detail in "D1.4.7 Reference Futures and Scenarios for the European FWC" by Eric Arets et al. (2007).
In both cases the starting point for the scenarios as well as for the reference futures is 2005, calculations are done for 2015 and 2025 (see Fig. 1), as well as for 2050 only for M2.

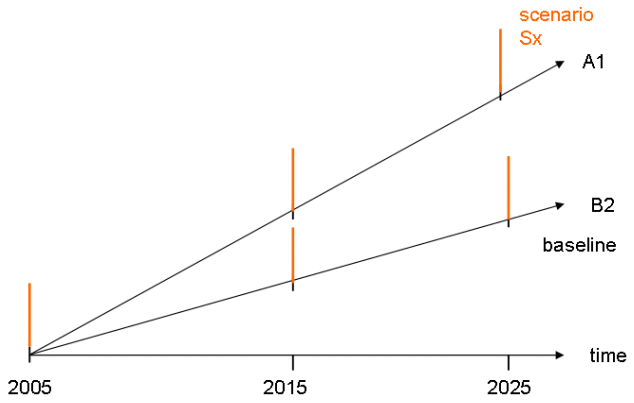

Fig 1: Data collection points for case studies: base line (2005), reference future A1 (2015, 2015), reference future B2 (2015, 2015), high scenario bio-energy A1 (2015, 2015), high scenario bio-energy B2 (2015, 2015)

2. Bio-energy Scenario in BW

The bio-energy scenario only deals with the increased use of bio-energy with consequences for production. On the production side, biomass from the forest (e.g. harvest residues, stumps, industrial wood) and from the industry (sawdust, chips, bark, black liquor, rejects and downgraded assortments) are covered.
Basis for the "storyline" of this scenario are from M2 the documents "doc 4 BM - draft module 2 scenarios December 2007.doc" from Forest Research, UK presented by Bill Mason at the Scenario Task Force Meeting in Amsterdam, on 11th Dec 2007, as well as for M3 the documents "Scenarios M3_Vergleich_101107.xls" which has been developed during the M3 Scenario Meetings in Freiburg on 9th of September 2007, presented by Diana Vötter also during the Scenario Task Force meeting in Amsterdam in December 2007 and updated during an M3 Scenario meeting in Uppsala, 10-11th April, 2008, and finalised during a BW Bio-energy scenario meeting between M2 and M3 in Freiburg, 11th July 2008, with "Kommentare zu Bioenergy Scenario_14072008". The outline of the bio-energy scenario in industrial production (M4) and the consumption/recycling (M5) is not yet fully developed until to date (Sept 2008). This deliverable has been updated after the EFORWOOD Week in Bordeaux (Oct 2008).

Bio-energy Scenario

Before the bio-energy scenario is described, a short citation from the reference future A1 (Arets, 2007) shall bring basic assumptions back into mind, as this scenario will be placed on top of this reference future:"The A1 future world can be characterised as consumer oriented with diluted national governance and highly developed global trading systems. World economic growth is high and globalisation is rapidly accelerated, with China, India and Russia (amongst others) now fully-fledged economic powerhouses, competing head-to-head with the US and Europe on all fronts. International best practice in technology and management is adopted quickly and global standards emerge for many products and services. Social values are materialist. There are high levels of consumption, expectation, entitlement and mobility. Because of low fertility rates that are driven by rapid income development, population growth is relatively low resulting in an aging society, in which families become smaller. Subsequently, labour participation of women will increase.

An important characteristic of this A1 world is the availability of relatively low cost energy[1] and material resources to underpin strong economic performance. There is little room for environmental concerns and fossil fuels still dominate."

Also the reference future for B2 is characterised by a short citation from Arets, 2007:

"This is a world in which more emphasis is given to social cohesion and to maintaining environmental integrity. In the B2 world the greater effectiveness of global institutions is manifested through stronger collective (EU) action. Characteristic for this storyline is that solutions are found locally; i.e. within Europe. Because of this, and because of slower economic growth, the global North-South difference remains relatively large.

The global population grows faster and higher than in the A1. Markets are less open than in A1 (China and Brazil rise, but do not impact Europe so much). Energy prices are high, leading to high priority being given to energy efficiency improvements and the rapid development and deployment of renewable energy sources. This enables everybody to afford bio-based power and heating, which now even may be the cheapest option. Both households and industrial consumers reduce their energy consumption, but with an increasing share of bio-energy.

The 3P principle – people, planet, profit is fully embraced. People care about the way products have been produced, and the way they are disposed of. They have a preference for renewable and recyclable products, and use e-communication more. As a result of market processes (people ask for it) corporate social responsibility principles are fully incorporated in most enterprises. This is a well-informed world with high labour market mobility within Europe. The lower wealth leads to a large demand for lower quality products. "

These reference futures serve as a basis on top of which the following bio-energy scenario will be placed and described within the boundaries of M3 as follows:

- More roundwood will go to bio-energy. This will be 10% of the total harvested roundwood volume in 2015 and 20% in 2025. As of 2005 there is a large potential of beech, especially in older forests. In the Scenario + A1 2015/ 2025 the share of cuttings in beech will increase more than in spruce. But in Scenario + B2 2015/2025 the share of cuttings in spruce will increase more than in beech[2]. This has an effect on roundwood

[1] Energy prices will be high under an A1 ref future, but because the income and GDP development is high as well, the energy prices are relatively modest in real terms.

[2] There will be an increase which results in plus 13,7% of the total volume in beech and plus 8,7% of total volume in spruce in Scenario+ A1 2015 compared to 2005.

Plus 14,7% of the total volume in beech and plus 16,4% of total volume in spruce in Scenario + B2 2015 compared to 2005.

Plus 15,7% of the total volume in beech and plus 10,1% of total volume in spruce in Scenario + A1 2025 compared to 2005.

Plus 17,3% of the total volume in beech and plus 22,6% of total volume in spruce in Scenario + B2 2025 compared to 2005. The total cutting volume as defined by reference futures A1 and B2 remains unchanged.

which goes into bio-energy. As due to its high density and thus related higher energy potential, as well as its tendency to crookedness and discolourations, more beech roundwood (x %) will go into bioenergy than spruce roundwood (y %) (table 1).

- The use of harvest residues will increase. This applies for softwood branches with needles and to hardwood branches without leaves (winter harvesting). In 2015 this will be 50% of all harvest residues and in 2025 70% of all harvest residues. Due to above stated effect of increased use of beech roundwood, this will also result in x% beech and y% of spruce harvest residues in 2015 and in x% beech and y% of spruce harvest residues in 2025 (table1).
- Stumps harvesting: As hazards like storms increase, there will be increased storm throw-volume. Of 10% of this storm-thrown volume, 50% go into stump harvesting in 2015 and in 2025 (that means 5% of total storm-thrown volume).
- Energy plantations will also be established on agricultural land and provide woody biomass from the agricultural sector. This "import" from agriculture into the forest-wood sector will be modelled as an import from outside Europe so that it does not alter the area and volumes of forest and wood at the M2-M3 boundary. The total available area for those energy plantations in Baden-Württemberg would be 40.000ha; we assume 75% of those (=30.000ha) as production area in 2015 and 2025.
- Transport: The share of the wood which is transported from the forest to the mill by truck is 80%, 15% by rail and 5% by water in 2005. In 2015 and 2025 a slight reduction of road transport to 75% is assumed. This is due to the fact that the long-distance trade and exchange of material will increase. Consequently rail transport will be 10% and ship transport will be 15%, which means both in 2015 and 2025, an increase compared to 2005.

Consequences of this M3 bio-energy scenario storyline for M4/M5:

In M4, Chemical pulp mills are already self-sufficient in terms of heat and steam, in many cases even electricity. The electricity self-sufficiency is likely to increase due to technological development. Pulp mills can also contribute more to the local electricity supply to households. Paper mills can increase the self-sufficiency in heat and electricity by having their own CHP plants and purchasing dendro-biomass instead of refined forms of energy, i.e. electricity and heat. Combined chemical pulp and paper mills may, and probably will, increase their self-sufficiency both in terms of fuels and purchased electricity. This is due to the development of energy efficiency at paper mills and improved fuel efficiency at the pulp mill.

There will be more combined heat and power (CHP) plants and power plants to use the increased amount of energy wood in both reference futures. Depending on the increase, the relative share of power plants may grow due to limited need of heat. Small-scale use of wood for heating also increases along the availability of wood for energy.

For the bio-energy scenario it is assumed that the prices for fuelwood follows the price development of the oilprice.

3. Conclusion

The bio-energy scenario as it will be applied in BW against an A1 background as well as against a B2 background takes into account increased production of bio-energy from dendro-biomass.

In the scenario under the A1 and B2 reference future the volume produced from the forest will not change, but a greater part of the harvested volume of small round wood will be reallocated to bio-energy, and by this shift increase the competition for raw material with pulp and paper industries. Additionally harvest residues will be utilised for bio-energy production and agricultural land is converted to short rotation plantations that will be used for dendro-bio-energy production.

The detailed assumptions for M3 are stated in the table below (see Table 1) for the reference futures A1 and B2 as "high bio-energy level scenario". All relative values are based on those of the case study Baden-Württemberg in 2005.

Bio-energy Scenario in BW (Status Quo= 2005) absolute figures come from M2 and M1 calculations for reference futures A1 and B2. Stated relative amounts (here) refer to those.	**Scenario** **high level for A1 and B2**
More roundwood for bioenergy (share)	2015: 10% of harvested volume, thereof beech roundwood: A1: 0.70 %; B2: 0.71% spruce roundwood: A1: 0.30 %; B2: 0.29% 2025: 20% of harvested volume, thereof beech roundwood: A1: 0.41 %; B2: 0.40% spruce roundwood: A1: 0.59 %; B2: 0.60%
Increased use of harvest residues Softwood: including needles [%] Hardwood: including leaves (Winter)	All harvestings: 2015: 50% of residues thereof beech harvest residues: A1: 0.61 %; B2: 0.59% spruce harvest residues: A1: 0.39 %; B2: 0.41% 2025: 70% of residues thereof beech harvest residues: A1: 0.66 %; B2: 0.60% spruce harvest residues: A1: 0.34 %; B2: 0.40%
Stumps harvesting	From 25% of the storm-throw-volume, thereof 2015: 50% stump harvesting (all species) 2025: 50% stump harvesting (all species)

Dendro-bio-energy plantations from agriculture land (modelled in ToSIA: import of energy; chipping and heating) available area: 40.000ha	2015: 75% (¾=30.000ha) 2025: 75% (¾=30.000ha)

Tab 1: Overview of M3 assumptions for the bio-energy scenario for A1 and B2.

4. References:

Eric Arets et al: "D 1.4.7. Reference futures and Scenarios for the European FWC", 2007
Bill Mason et al: "BM - draft module 2 scenarios December 2007.doc", Edinburgh, 2007
Diana Vötter et al: "Scenarios M3_Vergleich_101107.xls", Freiburg, 2007
Franka Brüchert: „mail_Scenarios.ppt", Freiburg, 2008
Janine Fischbach et al: "Kommentare zu Bioenergy Scenario_14072008 ", Freiburg 2008