Factsheet – The Sustainability of Eco-fungicidal Moulded Fibre Part Production

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Introduction

Dendromass4Europe demonstrates the establishment of short-rotation wood Cropping in Western Slovakia and its complete dendromass-material use for bio-based materials. Innovations are seen as drivers of economic and social progress as well as environmental degradation. Anticipating the potential impacts of innovations—already during their development—is essential for sustainable development. The objective of this task is to anticipate critical environmental and socio-economic hotspots and derive measures for improvement together with the project partners. In this poster, the focus lies on the results of the production of eco-fungicidal moulded fibre parts only. The results of the total D4EU impacts as well as of each product system are presented in separate posters.

Production System

The investigations of the eco-fungicidal moulded fibre parts (NBBM2), produced mainly by Pulp-Tec in Łódź, Poland and partly in Polenz in Eastern Germany. Łódź is a city of nearly 700,000 people in the centre of Poland. The production processes carried out at Pulp-Tec are building the foreground system and form the system boundaries including all production activities carried out at the site (with Łódź as the main production site). All inputs from outside Pulp-Tec Łódź build the background system. The retail is outside the scope of the study, as it is not part of the project.

People

The results of the social risk analyses for the moulded fibre part production show a low or medium risk level for most indicators analyzed (Fig. 3). A low-risk potential was found regarding non-fatal accidents, unemployment among people with basic and advanced education, fair wage potential, and percentage of unemployment in Poland. Still, 18 out of 27 indicators yield a value equal to or higher than 0.5 – which means that the situation is worse than the performance reference point and special attention should be paid to these aspects. Especially, 3 indicators with a high-risk potential were identified i.e., higher levels of fine particulate matter in Poland as the threshold recommended by the WHO. Another high-risk potential was identified regarding collective labor rights in Poland where violations of internationally recognized labor rights by governments and employees are regularly reported. For the companies located in Poland, no documents on agreements to sustainability issues nor sustainability reports could be found which implies that the organization does not publicly commit to sustainability standards and is therefore not engaged in reducing its sustainability impacts. A more detailed presentation and discussion of these results can be found in the publication from Fürtner et al. (202X) and in deliverable 5.6).

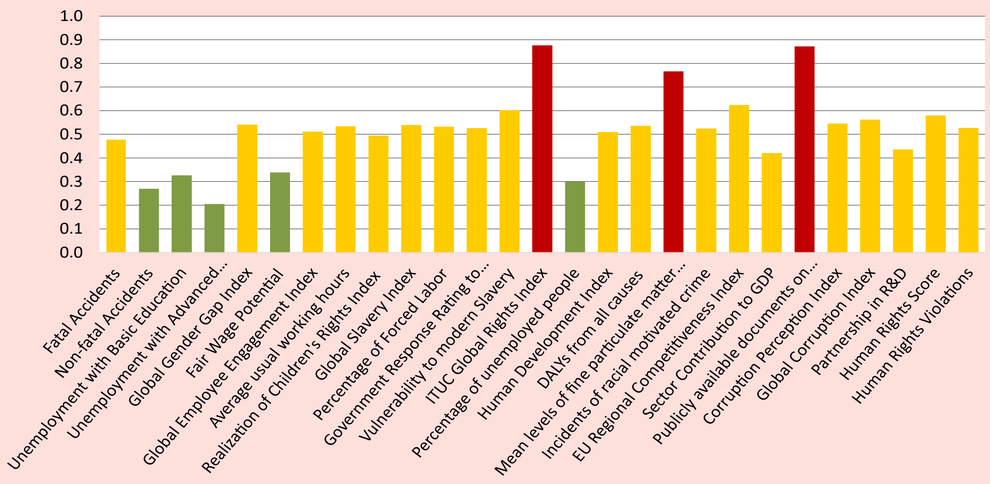

Figure 3: Selected social risks of the moulded fibre part (green=lower risks; yellow=medium risk; red= higher risk)

Planet

The environmental impacts of one ton of moulded fibre parts in different impact categories (global warming potential (GWP), terrestrial acidification potential (TAP), ozone depletion potential (ODP), freshwater eutrophication potential (FEP), fossil depletion potential (FDP)) and cumulated energy demand (CED) are listed in Tab. 1. The production of one ton of moulded fibre parts in D4EU potentially causes 3.4 t CO_2eq. (Tab. 1), which is almost half of the per capita emissions for the EU-27 (i.e., 7.4 t CO_2eq). In the contribution analysis (Fig. 1) five hotspots could be identified which contribute most to the potential environmental impacts of NBBM2. The contribution analysis further indicates that the material input (e.g. cardboard and poplar bark) has just a minor influence on the total environmental impact in all impact categories considered. A major influence in all impact categories are electricity and natural gas inputs. This can be explained by the natural gas needed for drying and the high share of fossil-based energy carriers in Poland's electricity mix. The high contribution of cardboard can be explained by the high amount of cardboard in the fibre parts (800kg/fibre parts). Three scenarios tested the influence of input changes to the results: 1) renewable electricity instead of the country-specific electricity mix; 2) reduced energy input (-20%); and 3) use of 100% recycled cardboard with longer transport distance. The results of the scenario analysis for in Fig. 2. The highest reductions can be achieved with changing the energy mix (scenario 1) followed by increasing the energy efficiency of the production processes (scenario 2). But also by using recycled cardboard (scenario 3) considerable reduction could be achieved in all impact categories. More detailed information in the results can be found in D5.8.

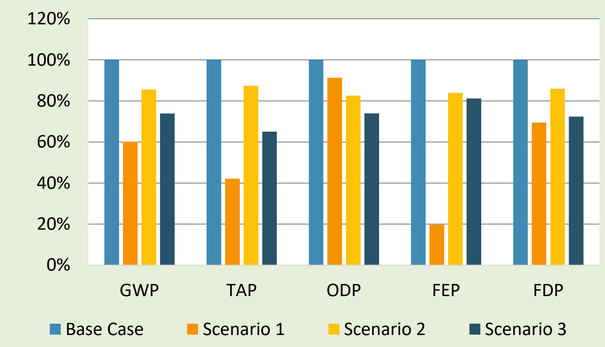

Figure 2: Scenario Analysis of NBBM 2 in different impact categories

Table 1: Potential nvironmental impacts of producing 1t of moulded fibre parts.

Impact category	Value/1 ton NBBM2
GWP (kg CO_2-Eq)	3 389.25
TAP (kg SO_2-Eq)	13.69
ODP (kg CFC_{11}-Eq)	0.00023
FEP (kg P-Ep)	2.18
FDP (kg oil-Eq)	1 254.37
CED (MJ)	20 696.83

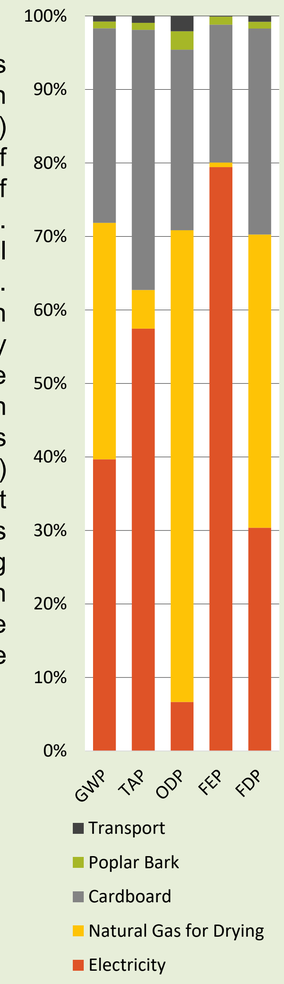

Figure 1: Contribution analysis for NBBM 2 in different impact categories

Actions for Improvement

Sustainability assessments during R&D help to generate actionable knowledge for all involved stakeholders, especially for companies. The moulded fibre part producer of D4EU have now the opportunity to improve their sustainability performance by taking action like:

- Preparation and provision of publicly available documents like sustainability reporting, corporate social responsibility communications ("do good and talk about it");
- reduce fine particulate matter by implementing sustainable managing practices (e.g. reduction of vehicle use, transportation distances or emissions through incineration) ;
- ensure compliance with freedom of association and collective bargaining standards to reduce risks of violating collective labour rights;
- increase the share of regional available inputs for the production processes to increase value creation for the region;
- decrease energy intensity of producution process to decrease potential environmental impacts in all categories and combine with use of renewable energy mix;
- moulded fibre parts are ideal for using secondary materials, which also improves the environmental performance;
- transportation now plays a minor role due to the very low poplar bark content. In case the increase of poplar bark is considered, attention to the potential impacts from transportation should be paid;
- increase efficiency in energy and material input e.g., through the implementation of innovative products which can increase the revenues.

Prosperity

Value creation happens through D4EU operations and upstream processes (Fig. 4). With the production of NBBM2, an annual value-added potential of € 2,371,624 per year can be achieved (Tab. 2). As the cardboard, which is the main input parameter, can be sourced from a regional supplier the value creation within the region is relatively high (58% of the inputs and services are considered to come from the defined region) and thus generates a value-added for the region by upstream processes. The higher the share of regional supplied inputs the higher the value creation for the region. The potential to increase the share is indicated with grey coloring in Fig.4. It is estimated that the market potential for the produced eco-fungicidal molded fiber parts could reach € 3,201,121 per year (Tab. 2). Tab. 3 summarizes the eco-efficiency calculations in different impact categories and the two bars in Fig. 5 show the eco-efficiency results illustrated as revenue (RE) and the value added (VA) per global warming potential (GWP). The higher the value the better, which means that more value can be created by less environmental impact. More information can be found in deliverables 5.6 and 5.7.

Table 2: Potential of value creation for NBBM 2 in absolute numbers.

NBBM	TEUR/a*192.07 t
Value Added	2 371.62
Potential Revenue	3 201.12

Table 3: Eco-efficiency based on revenue (RE) and value added (VA) of NBBM 2 per ton of product

NBBM 2	VA (€) / env. impact	RE (€) / env. impact
GWP (kg CO2-Eq)	3.64	4.92
TAP (kg SO2-Eq)	901.96	1 217.43
ODP (kg CFC11-Eq)	53 686 463.36	72 463 782.61
FEP (kg P-Ep)	5 664.17	7 645.26
FDP (kg oil-Eq)	9.84	13.29
CED (MJ)	0.60	0.81

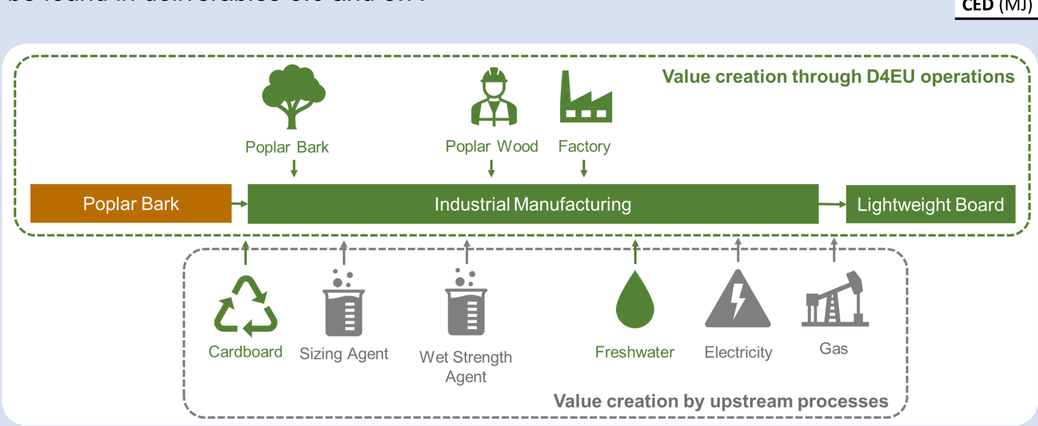

Figure 4: Processes considered for the value-added calculations

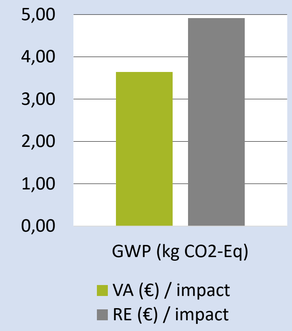

Figure 5: Revenue (RE) and value added (VA) per global warming potential (GWP)

Further reading

Deliverables 5.5; 5.6 & 5.7 of tasks 4 in Dendromass4Europe
Fürnter, D., Mair-Bauernfeind, C., Hesser, F. (202X). Proposing a multi-level assessment framework for social risks of bio-based value chains and its contribution to the Sustainable Development Goals. Progress in Life Cycle Assessment

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