

10 RECOMMENDATIONS FOR STIMULATING BIO-BASED BUILDING MATERIALS

12th August 2015

De Mey V. ¹, Verhoeven J. ², Thoelen P. ³, van Dam J.E.G. ⁴, Meyskens S. ⁵, Schik W. ⁶

¹ Inagro vzw, Roeselare, Belgium

² Wageningen UR, PPO, Lelystad, The Netherlands

³ VIBE vzw, Antwerpen-Berchem, Belgium

⁴ Wageningen UR, DLO, Wageningen, The Netherlands

⁵ BASbouwen, Veurne, Belgium

⁶ Saxion, Deventer, The Netherlands

This note was established through the Interreg IVB project 'Grow2Build', funded by the European Union and the Province of West-Flanders.



10 RECOMMENDATIONS FOR STIMULATING BIO-BASED BUILDING MATERIALS (FLAX AND HEMP)

1	Introduction.....	3
2	Outlines of the situation	4
3	Flax and hemp in Europe.....	5
4	Applications	6
5	Ten recommendations	8
5.1	Cascading approach of biomass.....	8
5.2	Support awareness raising campaigns	9
5.3	Change Public procurements.....	9
5.4	Overview of existing research data	10
5.5	Chain development/cooperation	10
5.6	Standardisation/certification	11
5.7	Sequestered CO ₂	11
5.8	Stimulate innovation in biobased building materials	12
5.9	Tax incentives for bio-based/natural materials	13
5.10	Stimulate cultivation of biomass (flax and hemp) for materials.....	13
6	Conclusions.....	15
7	Sources	17



I INTRODUCTION

The objective of the Northwest European project Grow2build is to support the supply chain of flax and hemp building materials from production of raw material to the production and implementation of end products. Up until now, 11 organisations from Belgium, France, the UK, Germany and the Netherlands have formed a consortium with a wealth of expertise in construction and bio-based building materials. The consortium aims to contribute to the integration of bio-based materials eg. hemp and flax in the construction industry and to improve the product value chain. This note “10 recommendations for stimulating biobased building materials (based on hemp and flax)” is one of the instruments to reach the aim.

Bottlenecks in the chain were identified in a survey of farmers, industrial actors and stakeholders from the public sector in Northwest Europe and on a policy event organised by Grow2Build. The list with recommendations linked to the bottlenecks is not restrictive and the priority differs from country to country in Northwest Europe. This document is a work in progress, though the project consortium has currently identified the 10 recommendations as the most essential.

The document has been structured as followed: Chapter 3 describes background information about the transition of the building industry towards a bio-economy; Chapter 4 and 5 give an overview of the importance of flax and hemp in Northwest Europe and along with the most common applications; Although, Grow2Build project focusses on the use of flax and hemp in building materials, the recommendations in chapter 6 are valid for all bio-based building materials. Flax and hemp are after all only a small part of all bio-based building materials.

The ten recommendations are given here for stimulation of the bio-based building chain in Europe. These recommendations are addressed to politicians (local, national and EU) and all stakeholders in the biobased building chain. The aim is to raise awareness about the existing issues and to advise on possible solutions for all stakeholders.

The last chapter contains all the advises listed in separate paragraphs for politicians and other stakeholders. It contains an overview of the challenges within the sector and how a framework can be emerged in which biobased building materials (based on hemp and flax) can come to a sustainable existence.

2 OUTLINES OF THE SITUATION

Construction activity continues to increase worldwide, and so does demand for building materials and raw materials as a result. The current construction industry contributes significantly to global greenhouse gas emissions. In 2012, 10% of global greenhouse gas emissions originated in Europe (European commission, 2012). With a share of 36% of all CO₂ emissions in Europe, the construction industry contributes significantly to greenhouse gas emissions. The construction industry is Europe's largest energy user, with around 40% of total consumption. The construction industry could therefore play a key role in the European target for a low carbon economy by 2050 (European Commission, Directorate-General for Research & Innovation, 2013).

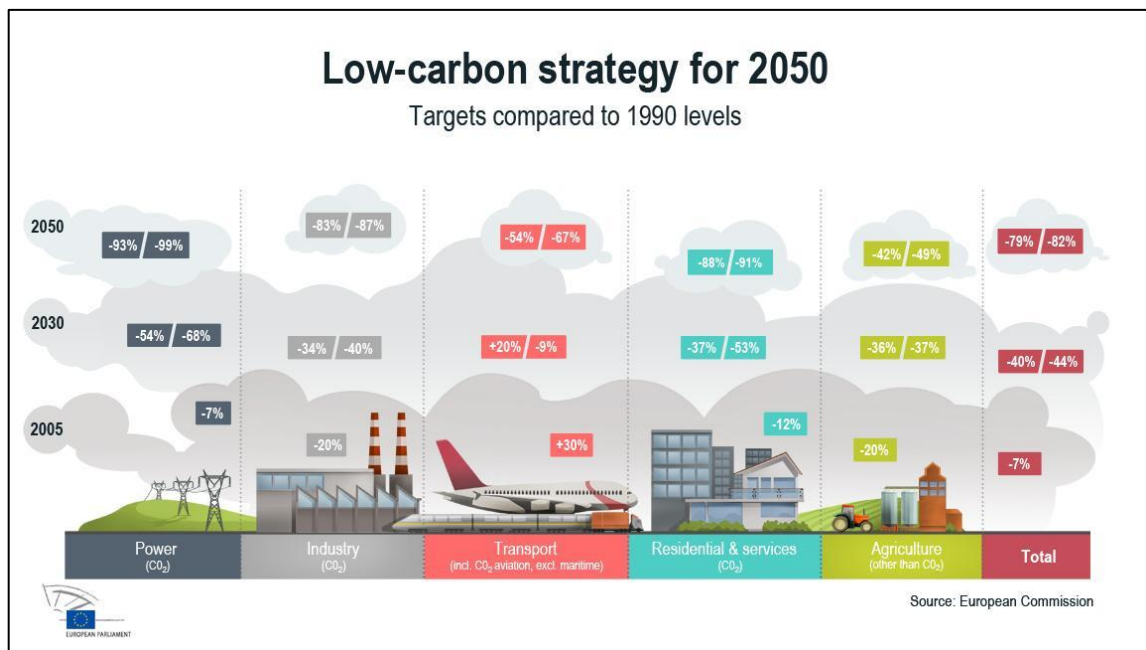


Figure 1: Comparison of low-carbon strategy.

To make the transition towards the bioeconomy¹ in the construction industry, the focus should be on the use of renewable raw materials. As a result, fibre crops such as flax and hemp can play a key role. The use of fiber crops enable CO₂ to be captured in materials, contributing to the European CO₂ targets. This is also consistent with the European strategy aimed at converting an oil-based economy into a bio-based economy. The Commission's action plan entitled "Innovating for sustainable growth: a bioeconomy for Europe" (2012b) adopted a strategy aimed at increasing the use of renewable resources in economy, and using them in a more sustainable manner. The bioeconomy also plays an important role in two of the seven Europe 2020 flagship initiatives: "Innovation Union" and "A Resource-Efficient Europe".

¹ The definition of the bioeconomy is broad, but it covers all activities that are related to the production of renewable resources, as well as the economic use of those resources and residuals.

3 FLAX AND HEMP IN EUROPE

Northwest Europe has a long and rich tradition around the cultivation of flax and hemp for the production of linen, canvas, sailcloth and ropes. The region is famous for the best flax linen fibers of the world because of the appropriate soil, favourable climate conditions and the knowledge and experience of the growers. Hemp also grows extremely well in moderate climates such as those of Northwest Europe. At the beginning of the 20th century, both hemp and flax were supplanted by cheaper imported fibers and later by synthetic fibers. Hemp fiber crop was in many countries even prohibited for a while because of its inaccurate link to marijuana². However, industrial hemp is nearly free of THC, the hallucinogenic constituent of marijuana (Klemens *et al.*, 2004). Currently in Europe the cultivation of around 40 varieties of industrial hemp are permitted.

The acreage of **hemp** in Europe was in 2014 an estimated 17.000 hectares (European Industrial Hemp Association [EIHA], 2015). France is the leader in the production of fiber hemp, with a constant production, followed by smaller, annually changing areas in the other countries such as the Netherlands, Germany, the UK.

In 2014 in Europe approx. 80.000 ha of fiber **flax** were cultivated (Confédération Européenne du Lin & du Chanvre [CELC], 2014). France, Belgium and the Netherlands are the most important flax producers in Europe.

² a usually illegal drug made from the dried leaves and flowers of the hemp plant, which produces a pleasant feeling of being relaxed if smoked or eaten.



4 APPLICATIONS

The fiber crops have a wide range of applications: the stem with its fibers and the wood-like core (shives) as well as the seeds can be used.

Historically, fiber flax was cultivated for linen textile applications. Fibers for technical applications have, to date, been derived as residue from those intended for textile applications (namely the tow or short fibers). Figure 2 provides an overview of the applications for flax fibers in 2003. The recent market data compiled by CELC (2014) has shown a significant trend in Europe of technical applications (building materials and composites) slowly increasing in volume. The flax shives (hurd) can be used as animal bedding, soil cover, oyster mushroom substrate, chipboard, etc.

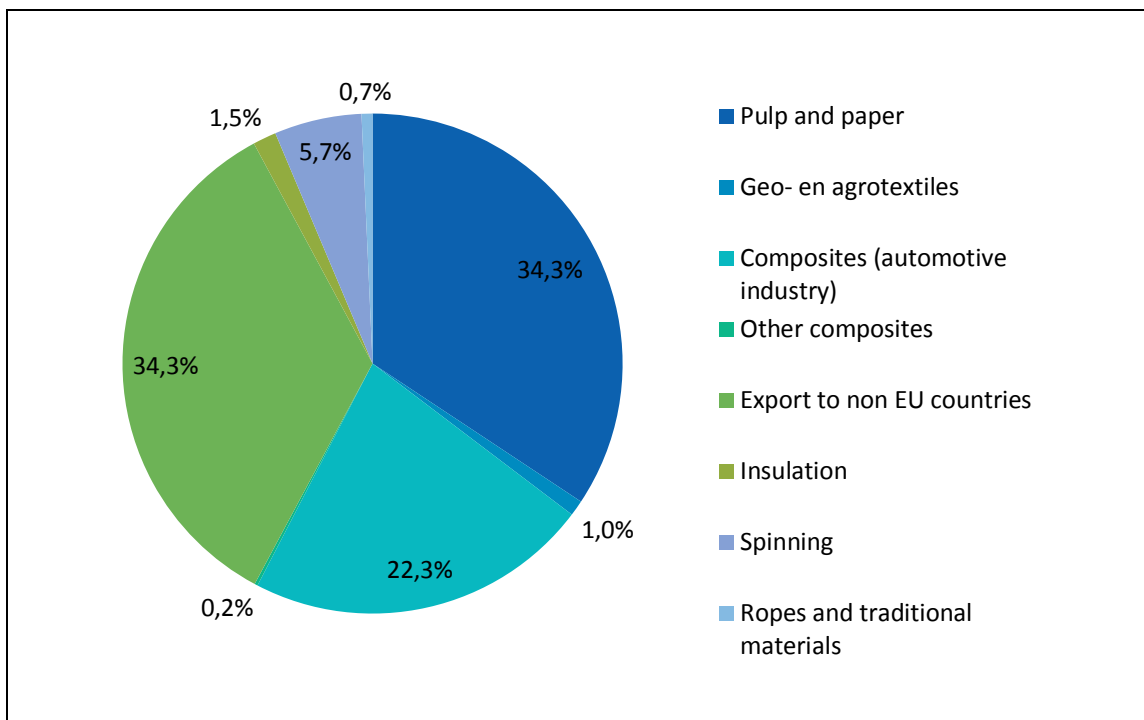


Figure 2: Markets for European short flax fiber in 2003 (op basis van sales quantity) (Carus, 2010)

The paper industry is the largest consumer of industrial hemp fibers (figure 3). Smaller shares go to the insulation industry and fiber reinforced plastics (i.e. the automotive industry) (Carus, 2013). Long fiber applications of hemp are limited.

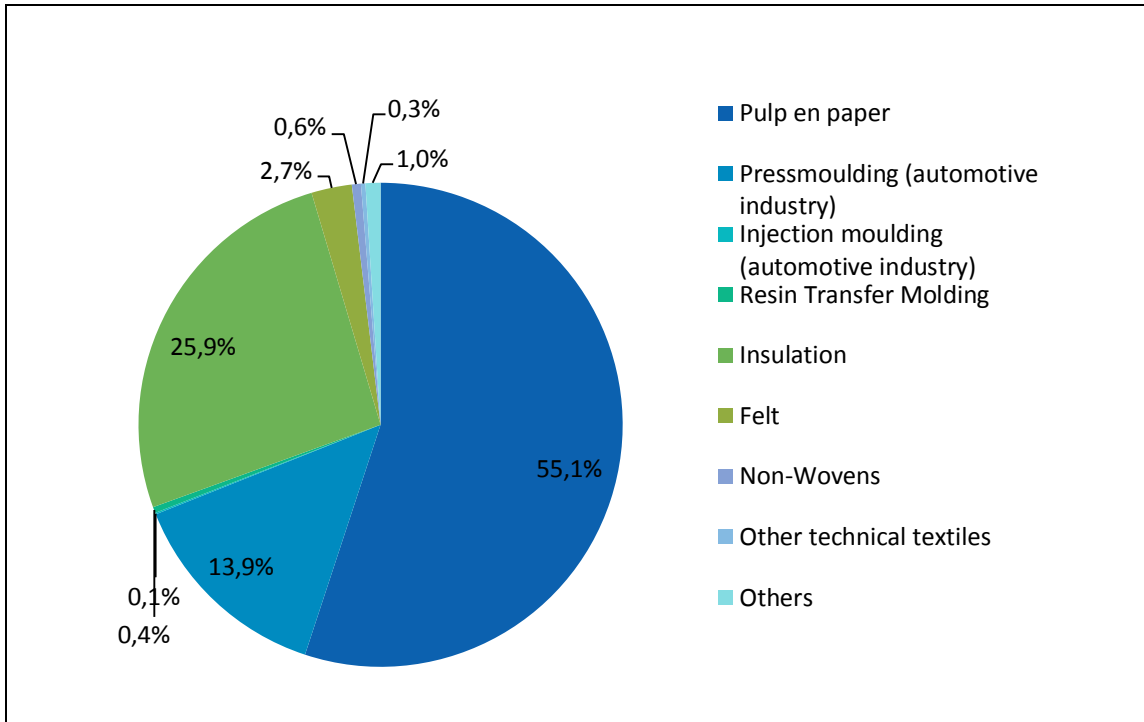


Figure 3: Applications of European hemp fiber (Carus, 2013)

The hemp shives are used as high-quality animal bedding. This application is currently (dd 2012) the largest market for hemp shives (figure 4). The shives can be used as a loose insulation material or as granules in construction blocks (light and insulating) or plaster.

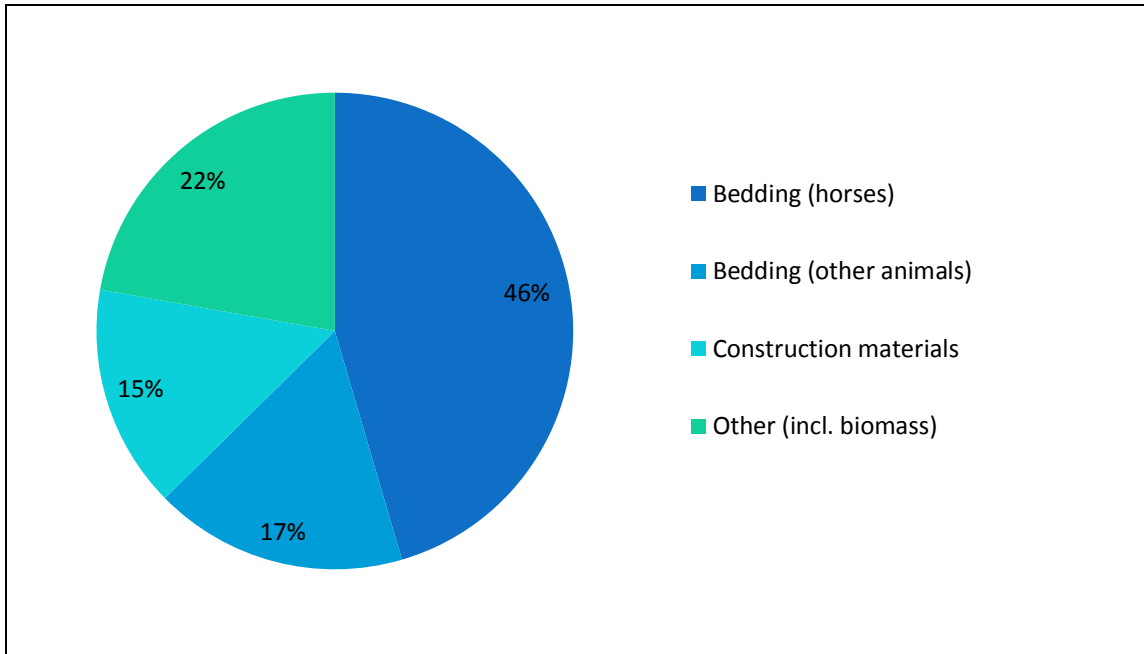


Figure 4: Applications for European hemp shives (Carus, 2013)

5 TEN RECOMMENDATIONS

The dependency of the building sector on fossil and mineral resources can be reduced significantly. In principle, almost complete construction with renewable alternatives is possible. Despite growing interest to use fiber crops in biobased building materials, the supply chain development is a complex process. The current challenges are identified at different levels: there is a need for developing technologies and product innovation; much effort is needed to bring partners together to develop new business and, most importantly, raise the market demand. A robust policy framework is needed to encourage companies to invest in biobased building materials. The issues in the chain were identified by a survey of farmers, industrial actors and stakeholders from the public sector in Northwest Europe and on a policy event organised by Grow2Build. Ten recommendations are given here for stimulation of the biobased building chain in Europe. The aim of the recommendations is to create a robust framework in which biobased building materials (based on hemp and flax) can emerge to a sustainable existence.

5.1 CASCADING APPROACH OF BIOMASS

Products from renewable resources emit less greenhouse gasses as replacements of fossil resources, as well as, when they fix carbon for a long period during their lifecycle. The lifecycle of products (and therefore the storage of carbon) can be extended through a cascading approach of biomass (Van Dam *et al.*, 2005; Thoelen, 2011; Essel *et al.*, 2014). The order of sustainable use of biomass should be food, feed, fiber and fuel. By using fibers (like hemp and flax) in biobased building materials carbon can be stored for years. But biobased materials can be in competition for resources with bioenergy. In contrast to bioenergy and biofuels, there is no policy frame, which supports biobased materials. Bioenergy not only gets a lot of support in the form of R&D, pilot and demonstration plants, but also a strong and ongoing support during commercial production (import quotas, tax incentives, green energy regulations and more) (Nova-institute, 2014). To obtain a level playing field, production of fiber based materials should therefore get equal or even more support than bio based fuel. Stimulation of the use of biomass for energy interferes with the development of biobased materials.

Develop a robust policy framework to stimulate the cascading approach for the use of biomass, favouring the product use over the energy use.

5.2 SUPPORT AWARENESS RAISING CAMPAIGNS

Often the public is not aware of the existence of biobased materials, as those based on flax and hemp. Awareness through examples promoted by experienced people are encouraging and could be served as foundations for further development and support. More active marketing, communication and promotion of sustainable building materials (based on flax and hemp) are prerequisite, as it is an essential step towards a growing market. By informing consumers and users of (products of) renewable resources about intrinsic qualities and environmental advantages, hesitations for purchasing these products can be minimised. Architects and entrepreneurs have openness towards working with renewable building products, but the fact that these are unknown and ignorant of their technical properties and behaviour, slows their market success (Thoelen, 2011). Workshops and visits to (demonstration) biobased building sites for stakeholder (e.g. architects and contractors) should be frequently organised for the building sector. More active promotion for biobased building is necessary. Inclusion of sustainable building in the curriculum of schools of practice must be promoted.

Establish awareness by raising campaigns/organisations in order to promote building products from renewable resources amongst the conventional building product merchants and traders. Governments can stimulate the use of biobased building materials by supporting (local) partners in the chain: (building) pilots, design contests, etc.

5.3 CHANGE PUBLIC PROCUREMENTS

Governments can stimulate biobased materials by integrating them in their procurement policy. Governments could make a difference as launching customer for biobased materials; through their public procurement, they can help to make biobased materials accessible and accepted by the general public.

Encourage contracting authorities in all European member states to adopt products from renewable resources through procurement details.

5.4 OVERVIEW OF EXISTING RESEARCH DATA

A lot of knowledge and experience with biobased building materials is already available. But there are still some issues:

- The available knowledge is very fragmented and dispersed.
- There is not enough (scientific) research about technical performance of biobased building materials, i.e. effects on indoor climate, moisture control, thermal insulation, along with research on health, safety and recycling issues of bio-based materials compared to traditional materials.
- In many places biobased building materials are investigated but mostly the research is a duplicated.

By collecting all objective product data at one central place and by making this information publically available, researchers and innovators can consult the database to verify the leading technologies. The market demand for biobased building products could increase significantly when the commercial sales statements can be properly substantiated. Huge amount of work is necessary to convince actors in the chain to use alternative biobased building materials because established building products are known, easily available and considered reliable. Product specifications of biobased building materials are not yet easily or comprehensively accessible. Motivated people are convinced of the advantages, but because of the lack of certified evidence it is difficult to convince bigger groups of consumers.

An open central knowledge database with all available product specifications in the field of biobased building materials should be established. An international organisation could maintain the database.

5.5 CHAIN DEVELOPMENT/COOPERATION

Companies focussing on innovative biobased materials are not sufficiently organised as compared to the traditional building industry. Often these are small scale innovative companies who operate in niche markets. In order to develop biobased buildings from niche to mainstream, it is prerequisite to cooperate and institutionalise. Cooperation offers more opportunities (financial, promotion, technical support, knowledge transfer) than individually acting companies. This cooperation initiates competition with the current traditional building industry. This leads to a reduction in competition amongst the innovating companies, though this does not create new market, since new (or bigger part of the) markets must arise from traditional market.

Encourage a favourable context for small companies to organise themselves in producer organisations.

Introduce a mutual agreement amongst companies involved in bio-based products. Competition is good for innovation and price fixing but in start-up phase, small companies should collaborate for R&D rather than compete with each other.

5.6 STANDARDISATION/CERTIFICATION

The provision of objective information on the performance (and guarantee of performance) of available biobased technologies by product certifications can boost customers' acceptance and accelerate deployment (European Commission, 2013).

Harmonised and standardised national/international testing and evaluation procedures for specific biobased products and technologies increases understanding among developers, architects and installers and accelerate the maturity of the industry more broadly (European Commission, 2013). The current standardised tests are not always sufficient enough to be applied for bio-based materials (e.g. moisture regulating effect of biobased materials).

Establish wider markets for innovative biobased building products through better coordination of product related issues for various European regulations, standardisations and certification bodies.

5.7 SEQUESTERED CO₂

The carbon footprint of building materials is composed of 2 components: The embodied CO₂ and the sequestered CO₂. The embodied CO₂ is the quantity of CO₂ emitted as a result of a product. This stems from both direct CO₂ emissions from the production of a material as well as indirect emissions, such as CO₂ emitted from burning fossil fuels to produce heat, electricity or transport required to make certain products (kg CO₂ equiv. / product) (Norton, 2012). Most of the overall embodied CO₂ (85-95 %) of construction materials used in the construction of structural parts, build up prior to leaving the factory gates (European Commission, 2013).

On the other hand, sequestered CO₂ is only relevant to renewable materials. It is the quantity of CO₂ that has effectively been removed from the atmosphere by photosynthesis, i.e. by turning CO₂ and water into sugars and oxygen. The quantity of atmospheric CO₂ has thus, been reduced and so is an environmental benefit, not an impact. The longer the CO₂ is stored, the greater the environmental benefit (-kg CO₂ equiv./product) (Norton, 2012).

By using renewable materials the CO₂ is captured in buildings for a very long time, reducing the carbon footprint significantly.

Adapt existing LCA tools, standardisations/regulations in order to include and display sequestered carbon calculations.

5.8 STIMULATE INNOVATION IN BIOBASED BUILDING MATERIALS

Often it is too complicated for (small) companies to develop a chain of biobased materials. It is too expensive for them to perform R&D needed for new biobased product implementation. Support to get access to R&D by providing research vouchers are known to be effective as means of innovation encouragement. Too much and too complex rules hinder the implementation of new innovative products in the market. Therefore novel stimulation tools should become available. For example, in the Netherlands there are the 'Green deals'. 'Green deals' are arrangements between companies and non-governmental organisations and the government. A 'green deal' can only be arranged when companies or NGO's have plans for a sustainable product or process. The government helps in this way to eliminate the issues that (small) companies or NGO's encounter. Through these 'green deals' it is possible to diminish legal obstacles, develop new markets, reduce production cost by using new varieties and develop more efficient techniques in processing and manufacturing.

Introduce specific innovative methods and R&D programmes for building products from biobased materials.

5.9 TAX INCENTIVES FOR BIO-BASED/NATURAL MATERIALS

Today, worldwide chemical industries pay no taxes on the use of crude oil or natural gas as feedstock. Taxing fossil-based carbon used by the chemical industries would be a strong method to make biomass sources attractive. However, this approach can only be implemented on a global level, since considerable market distortion would otherwise result, with negative effects for Europe (Carus, Dammer & Essel, 2014).

Various types of tax incentives for bio-based products are available in the member states and have been investigated in different reports. In some member states this method was already used, such as for packaging materials (Belgium, The Netherlands). The EC could enable the member states to use tax incentives, with the responsibility of implementation on the member states. The current discussion regarding the applicability of reduced VAT for environmentally advantageous products is leaning towards this approach (Carus, Dammer & Essel, 2014). Currently in Brussels consumers receive extra bonuses above the normal energy bonuses when they choose natural, environmentally friendly building materials (Leefmilieu Brussel, 2015).

Develop a subsidy and/or tax programme that stimulates the use of building products from renewable materials.

5.10 STIMULATE CULTIVATION OF BIOMASS (FLAX AND HEMP) FOR MATERIALS

Bio-based economy can only flourish when local access to feedstock at a reasonable price can be guaranteed – otherwise investments will be restricted to a few harbours, where biomass can be imported from abroad. Biomass is not scarce in the EU, but allocating it properly has its issues. Mainly because of the existing incentives of the Renewable Energy Directive, a number of biomass sources are only accessible for bioenergy and biofuels, but not for bio-based chemicals and materials (Carus, Dammer & Essel, 2014).

Farmers, the suppliers of raw materials, will only continue to choose to cultivate flax and hemp if the price that they receive is fair. The European union's Common Agricultural Policy (CAP) is a useful instrument to support the cultivation of flax and hemp: through direct payment and rural development policy member states can stimulate flax and hemp cultivation (Kasse, 2015). Furthermore, it is necessary to develop intensive cooperation between farmers and producers in order to align needs and requirements as much as possible.

Guarantee the supply security of high value industries by stimulating farmers to cultivate multipurpose crops like flax and hemp and by allocating the available biomass appropriately.



6 CONCLUSIONS

During the Grow2build project the project team came across several issues that stakeholders encounter today. These issues were identified during specific policy events, during study trips and informal contacts with stakeholders. It became clear that most stakeholders facing the same problems and challenges. In this policy note the issues are listed with suggestions provided for politicians and other stakeholders, as summarised below:

1. Politicians:

- Develop a robust policy framework to stimulate the cascading approach for the use of biomass, favouring the product use over the energy use.
- Establish awareness by raising campaigns/organisations in order to promote building products from renewable resources amongst the conventional building product merchants and traders. Governments can stimulate the use of biobased building materials by supporting partners in the chain: (building) pilots, contests, etc.
- Encourage contracting authorities in all European member states to adopt products from renewable resources through procurement details.
- Encourage a favourable context for small companies to organise themselves in producer organisations.
- Establish wider markets for innovative biobased building products through better coordination of product related issues for various European regulations, standardisations and certification bodies.
- Adapt existing LCA tools, normalisations/regulations in order to include and display sequestered carbon calculations.
- Introduce specific innovative methods and R&D programmes for building products from biobased materials
- Develop a subsidy and/or tax programme that stimulates the use of building products from renewable materials.
- Guarantee the supply security of high value industries by stimulating farmers to cultivate multipurpose crops like flax and hemp and by allocating the available biomass properly.

2. Stakeholders

- An open central knowledge database with all available product specifications in the field of biobased building materials should be established. An international organisation could maintain the database.
- Introduce a mutual agreement amongst companies involved in bio-based products. Competition is proven advantageous for innovation and price fixing but in start-up phase, small companies should collaborate for R&D rather than compete with each other.

Governments play a key role in the transition from oil based towards a biobased building industry. In order to make a sustainable transition, cooperation between all

stakeholders is vital: governments, industry, knowledge institutions and social organisations.



7 SOURCES

- Carus, M. (2010). *Hemp fibers for industrial applications*. [Presentation]. EIHA conference on 26-27 mei 2010, Keulen
- Carus, M. (2013). *Market data on Industrial Hemp – fibers, shivs and seeds*. [Presentation]. EIHA conference on 22-23 mei 2013, Keulen
- Carus, M., Dammer, L., Essel, R. (2014). *Options for designing a new political framework of the European Bio-based Economy*. Nova-Institut GmbH. 6p.
- Confédération Européenne du lin & du chanvre. (2014). [Presentations]. European flax and hemp congress on 5-7 november 2014, Budapest
- Essel, R., Breitmayer, E., Carus, M., Fehrenbach, H., von Geibler, J., Biengen, K., Baur, F. (2014). *Discussion paper, Defining cascading use of biomass*. Huerth, 7p.
- European Commission. (2012). *EU greenhouse gas emissions and targets*. Consulted in 2014 through <http://ec.europa.eu/clima/policies/g-gas/>
- European Commission. (2012b). *Mededeling van de commissie aan het Europees Parlement, de raad, het Europees economisch en sociaal comité en het comité van de regio's, Innovatie voor duurzame groei: een bio-economie voor Europa*, Brussel, 10p.
- European commission. (2013). *Energy-efficient building. Multi-annual roadmap for the contractual PPP under Horizon 2020*. Luxembourg. 141 p.
- European Commission, Agriculture and Rural Development DG. (2013). *Area, yield and production of fiber flax and hemp*. Consulted on 20 januari 2014 through http://ec.europa.eu/agriculture/statistics/agricultural/2013/.../d11-1-411_en.pdf
- Kasse, D. (2015). *Wetgeving omtrent de teelt van hennep en vlas*. Nederlandse Vereniging voor Vlas en Hennep, Vlas en Hennep.NL, 21p.
- Klemens Mechtler, Josef Bailer, Karl de Hueber, Variations of $\Delta 9$ -THC content in single plants of hemp varieties, *Industrial Crops and Products*, Volume 19, Issue 1, January 2004, Pages 19-24,
- Leefmilieu Brussel. (2015). *Energiepremies en goedkope leningen om uw woning te renoveren*. Brussel, 20p.
- Norton, A. (2012). *Carbon Footprints*. Renewables. 1p.
- Thoelen, P. (2011). *Onderzoek naar de mogelijkheden van streekeigen grondstoffen uit land- en bosbouw voor de productie van bouwmaterialen in Vlaanderen. Een stand van zaken in binnen- en buitenland, de land- en bosbouwproductie, de andere reststoffen, de industrie, de handel, de aannemers en architecten, de eindconsumenten, relatie met de bio-based economie en beleidsaanbevelingen*. [Eindrapport]. 212 p.
- Van Dam, J.E.G., B. de Klerk-Engels, P.C. Struik, R. Rabbinge (2005) *Securing renewable resources supplies for changing market demands in a biobased economy*, *Ind. Crops and Prod* 21, 129-144.