Suggestions for topics as input to FP7 WP 2013 resulting from the joint CEPI-EFPRO Task Force Meeting on 17 May 2011 in Brussels

	suggested thematic priority
FTP Strategic Objective 1: Innovative products for changing markets and consumer needs	
Sustainable processes for wood-fibre based textiles and technical fibres	NMP
Utilization of full potential of renewable fibrous raw materials in resource-efficient fibre composites for industrial and customer applications	NMP
Electronic compatible paper and ICT integration	NMP/ICT
Enabling a constant flow of new concepts to the market by introducing the tools of co-creation to printing and packaging value networks	NMP
Self-assembly and biomimetics of lignocellulosic systems	NMP
Re-inventing paper packaging	KBBE
Bridging collaboration between forest-based industry and chemical and material sectors aiming new breakthroughs in bio-based chemicals and materials	KBBE
FTP Strategic Objective 2: Intelligent and efficient manufacturing processes	
New flexible biomass structure opening (deconstruction) technologies	NMP/KBBE
Stimuli-responsive fibre-based biomaterials	KBBE
Low energy pulp and paper manufacture and processing	NMP
Reliable man-machine interface; ensuring the reliability of complex process control systems	NMP
New innovation eco-systems for the transformation of European forest-based industry into bio-economies	NMP
Cascade utilisation of fibre-based biomass by utilize recycling and optimising material loops to secure material base.	ENV
Towards zero waste with novel fractionation technologies in material recycling	NMP/ENV
FTP Strategic Objective 3: Availability of forest-based biomass	
Utilisation of annual fibre plants and agro-waste as fibre source for papermaking	KBBE
Efficient use of forest biomass in novel and added-value bio refinery, pulp and paper products	KBBE/NMP

Proposed Topic
Sustainable processes for wood-fibre based textiles and technical fibres

Justification:

Cotton and polyester (PES) are the major textile fibre currently used. While polyester is oil-based, cotton production has significant environmental drawbacks due need of irrigation, fertilizers and pesticides. Cotton production thus results in drainage and land erosion. Wood contains significant amount of cellulose enabling production of cellulosic textile materials. Utilization of this cellulose in modern regenerated cellulosic products could offer sustainable alternatives for polyester and cotton products provided that the fibre properties could be tailored to resemble or exceed those of cotton. Furthermore, the modern regenerated fibre materials may also replace oil-based and non-bio-degradable polyolefins in technical, hygienic or agricultural textiles. Traditionally regenerated cellulose fibres are made from dissolving cellulose originating from sulphite pulping. High content cellulosic fibres can be manufactured from wood, wood by-products or alternative pulp fibres by combining new and environmental sustainable pulping technologies to novel regeneration processes. Post-processing could also offer means to tailor the fibre properties to resemble cotton properties and enable replacement of cotton and reduce use of oil based polyester and polyolefin fibres.

Scope:

The topic should have whole chain approach combining stakeholders from pulping, wood chemistry and textile technology in a coherent action. New technologies to manufacture dissolving pulp by e.g. organosolv, ionic liquids, bioprocessing should be developed enabling efficient use of wood, wood by-products or alternative pulp sources. Novel sustainable regeneration techniques combined with advanced machineries should be investigated. The fibre characteristics should be analyzed and post-processed to be competitive with cotton or cotton/polyester (CO/PES) in clothing applications or with polyolefin in technical, hygienic or agricultural applications. Novel end-uses with the wood-derived textiles in fashion and technical sector should be developed to improve competitiveness of sustainable European textile production. Environmental impact of the developed processes should be assessed.

Recommended size (instrument) and duration:

Collaborative large scale project, duration 4 years, incorporation of stakeholders from forest and textile sector a necessity.

Expected impact:

Development of new textile raw materials, development of new business opportunities to forest sector, increasing and boosting the competitiveness of forest and textile industry in Europe

Proposed Programme: NMP

Proposed topic
Utilization of full potential of renewable fibrous raw materials in resource-efficient fibre composites for industrial and customer applications

Justification
The material properties of composites depend on the interactions between fibres, polymers and processing conditions (component properties and proportions, fibre surface manipulations, tension/pressure/temperature during forming), and must be adjusted to match the required properties of the intended product. Current sub-processes used in manufacture of fiber-polymer composites destroy the extremely strong structure of biofibres achieved by nature during evolution. Developing more gentle and tailored fibre producing subprocesses with lower temperatures and/or lower shear stresses would enable wiser exploitation of the achievements of nature. This in turn opens up needs and possibilities to re-engineer the current fibre processes. The interactions between polymers and fibrous particles determine the process conditions to be applied and therefore also the polymers and mixing processes should be re-considered (mixing, flocculation, homogeneity, flow properties).

Scope
The topic is focused on resource-efficient processing of fibrous biomaterials and polymer-fiber mixtures to enable new property combinations for fiber-composite materials to be used in industrial and customer applications.

Several aspect should be addressed
- selection, processing and characterization of fibrous raw materials => novel fibres
- selection, processing and characterization of polymers => novel polymers
- interactions between fibrous materials and polymers during processing, and effect of process conditions => novel processes
- forming process conditions for material properties of composites => new processes or process control tools
- conversion of composite materials into products => novel products.

Recommended size and duration
Large scale collaborative project 3-5 years, including partners from research institutes, universities and industry (both from machine suppliers and composite manufacturers).

Expected impact
The developments undertaken should significantly promote the resource-efficiency of fibrous biomaterials processing and fibre-composite manufacturing by taking into account and utilizing the full potential of natural fibres for industrial applications and customer products.

Proposed Programme:
NMP

Proposed Topic
Electronic compatible paper and ICT integration

Justification:

The global market for printed media on paper is still growing in emerging markets but has slowed down or is even declining in mature markets. E-media is quickly growing as a communication channel with Internet, social media, e-books, e-papers etc. Besides striving to remain in existing markets the forest industry in the printed media sector meets new challenges and needs to reposition itself in a world becoming more and more influenced by electronic media. Studies have shown that printed paper media from an environmental perspective shows performance well in line and even better than electronic media. It could be believed that electronic media could be more environmentally justified if integrated with printed paper media in a consumer and customer preference mix.

For the forest industry in the printed paper sector there is a need for both new business models and new technology development to meet the challenges.

Scope:

The objective is to develop the printed paper media technology and position it at the crossroads between conventional printed media and electronic media. Several aspects should be addressed to raise the attractiveness of printed paper media, including development of:

- materials: a) conducting polymers, semi-conductors, organic and inorganic, b) functional inks reactive to their environment c) printing techniques, coating and surface treatments techniques, drying-reticulation techniques for materials,
- systems fitted with electronic components, chip-less UHF communication, sensors, memories, displays, connectics, to be produced with printing techniques and taking advantage of the 3D fibres based structure, thanks to the use of embedded energy sources (photovoltaic, batteries, energy harvesting),
- printed electronics design tool kit. The aim is to define technical specifications for printing and converting operations of discrete components: transistors, resistors, displays,…
- printing and converting processes dedicated to printed electronic.
- business models to outline the ways for the forest industry to interact with the e-media

Special attention should be paid to the cost efficiency, life cycle of the printed paper media and e-media concept, recyclability of new prints and conformity with regulations in force.

Moreover special attention should be paid to the following fields: Security, and Logistics.

Recommended size (instrument) and duration:

Large scale collaborative project - 3 to 4 years

Expected impact:

The developments undertaken should significantly facilitate the move of traditional printing-based industries towards new added value fibre based materials. They should create new markets for the European knowledge-based economy and fulfil or anticipate new consumer needs in this area.

Proposed Programme: NMP/ICT

Proposed Topic
Enabling a constant flow of new concepts to the market by introducing the tools of co-creation to printing and packaging value networks

Justification:

Printed media has been losing its share in the changing media landscape. Media industry's focus is on novel digital media offering measurability and interactivity. Instead of bringing new consumer driven products and services to the market the printing industry has concentrated on cost-efficiency. Development of novel print and packaging concepts requires collaboration through the value network and involvement of consumers in the innovation processes. The collaboration and innovation needs have earlier been addressed in the "Communication from the commission to the council and the European Parliament on innovative and sustainable forest-based industries in the EU - A contribution to the EU's Growth and Jobs Strategy"{SEC(2008) 262}.

Even though the media use habits are changing fast, the values of the consumers do not. By involving the users (consumers) in the innovation process it is possible to lower the risks in the market entry, find new concept opportunities and also to increase the image of paper and printing industries. Living Lab-concept commonly used in other industries is suitable for developing and testing new print and packaging products and services.

By creating new models of operation and actively demonstrating new product concepts, positive buzz is created in the industry. New business is in many cases local and due to increasing share of services it also has a large effect on employment and thus it is of interest of the EU as well.

Scope:

The research should have two focus areas that together will enable the industry to multiply the number of new product introductions.

1) Co-creation of novel product and service concepts among print media and fiber-based packaging within the value networks. The paper and printing industries lack of the tradition of actively bringing new product and service concepts to the market. A European Living Lab for developing new product and service concepts together with the value network incl. the consumers is needed to boost the development.
2) Development of flexible and efficient processes for integrating the value adding functions in printed products. There are numerous technologies that can be used as part of the novel print concepts including augmented reality technology, sensors, optical effects like holograms, touch and feel effects etc. Many of them can be used already today, but in order to broaden their application area, the technology needs to be developed to be more efficient and flexible

Recommended size and duration: Large scale collaborative project - 3 to 4 years with strong demonstration emphasis

Expected impact:

In addition to new product and service concepts created in the project, it introduces a new consumer driven approach. New business both compensates the decreasing market of current products and also improves the image of the print media as a whole. For all companies in the value chain the development opens the opportunity to move downwards in the value chain and adapt the role of service provider. Printing business will be able to take the inevitable step towards the Long Tail –business model.

Proposed Programme: NMP

Proposed Topic
Self-assembly and biomimetics of lignocellulosic systems
Justification:

Much has been learned by studying the naturally occurring nanostructures found in forest biomass. Further research on how they self-assemble and developing methods that use this self-assembly will be critical to manufacturing new products from this renewable resource. Using the natural systems of woody plants as either the source of inspiration or template for developing or manipulating unique nano-, micro-, and macro-scale polymer composites via bio-mimicry and/ or direct assembly of molecules, has become of most promising field of investigations towards innovative products. Recent research showed that self-assembly of glycopolymers in nanoparticles or nano-structured films leads to inter-domain distances of 10nm far beyond the current limits of 25nm achieved with oil-based building blocs.

Scope:

The objective is to exploit the possibilities of natural forest resources in order to the elaborate new innovative materials for a range of added value products from wood-based building blocs, such as glycopolymers and nanocrystals. These materials will, after self-assembly at nano-scale and functionalization, present high added value properties, e.g. for flexible organic electronics, smart papers and surfaces, nanocomposites, glycosensors, etc. Research has to focus on the development of new materials through mastering the self-assembly of the elementary bricks at the nanoscale level, their properties at meso-scale and further their processing at macro-scale towards the elaboration of final products with controlled properties.

The project should target green processes and demonstrate the industrial feasibility of the new materials and/or new products with special attention on cost effectiveness with respect to the application market, from large volume sectors such as composites and surface treatments to niche markets and high added value sectors, like bio-active or stimuli responsive products for pharmaceuticals and health and safety applications.

Moreover proposals should include LCA and risk assessment and address recyclability aspects as far as large volume applications are concerned.

Recommended size (instrument) and duration:

Small scale collaborative project - 3 years

Expected impact:

The project should exploit nano-scale self-assembly of lignocellulosics and develop green processes until the demonstration of new materials and/or products to provide the industry with new solution to create more value for forest resources through new high added-value products meeting societal needs.

Proposed Programme: NMP

Proposed Topic
Reinventing paper packaging

Justification:

The objective of the supply chain is to serve its customers in a sustainable way. From being focused on reduction of cost and availability of products in store focus has widened. The old values remain but now carbon footprint, resource efficiency, energy etc must be taken into account when designing Key Performance Indicators. Packaging is a vital part of the value chain and paper packaging can have an important influence on all indicators. One of the main streams to follow towards a sustainable society is the bio based economy. This goes also for the supply chains. Part of the concept, looking at raw material resources, sees the inbuilt benefits of bio-based materials. The composition of the tree incorporates all resources needed to fulfil a truly renewable packaging. From the tree we can get resources to build strength, incredible strength thru nano cellulose, barrier through the hemicelluloses, intelligence through the modification and activating of fibres. By reinventing the paper packaging and stimulating it built on a fibre platform we have a secure raw material base and can rebuild the forest industry towards a knowledge based one and support a sustainable supply chain.

Scope:

The objective is to reinvent paper packaging as part of the supply chain and develop the fibre based packaging concept. This could involve development in several areas

a) Nano-cellulose as built in strength or barrier properties
b) Intelligent fibres incorporated into sensors
c) Converting and forming of paper sheet
d) Hemi cellulose barriers
e) Fibre based composites for three dimensional forming
f) Supply chain and packaging concept integration

Special attention should be paid to the cost efficiency, life cycle of the packaging, recyclability and conformity with regulations in force. Cooperation between material and packaging development and supply chain design is anticipated, especially the expected future supply chain with increased collaboration and differentiated delivery channels.

Recommended size (instrument) and duration:

Large scale collaborative project 4 years

Expected impact:

The developments undertaken should significantly facilitate the move of traditional fossil based packaging solutions into a renewable option. They should create new markets for the European knowledge-based economy and fulfil or anticipate new consumer needs in this area.

Proposed Programme: KBBE

Proposed Topic:
Bridging collaboration between forest-based industry and chemical and material sectors aiming new breakthroughs in bio-based chemicals and materials

Justification:
The forest-based sector is investing considerable time and resources in research for biorefinery applications considering that chemicals and polymers fractionated from wood will be used in the chemical sector as building blocks of commercial chemicals traditionally produced using oil refinery. At the same time, the chemical sector is investing considerable time and resources in research involving the utilisation of fermentation strategies to generate bio-based chemicals using different routes. The strategy of the chemical sector may result in production of bio-based chemicals without the need of forest biorefinery. The limited collaboration and synergy between the different sectors is causing delays in new commercial breakthroughs for bio-based chemicals because each sector is striving to work independently without taking the advantage of strategic collaboration.

Scope:
A collaboration initiative has to focus in combining experts and companies representing the forest sector and chemical industry towards systematic innovation for production of commercial bio-based chemicals and polymers. Research has to focus on utilisation of bio-based molecules and polymers fractionated by the forest sector and incorporated for replacement of current platform chemicals used in the chemical industry. Research shall result in commercial products with large application, joint ventures, small and medium scale enterprises which are able to act on the interface business between different sectors.

Recommended size (instrument) and duration:

Collaborative Project (small or medium scale focused research project)

Expected impact:

Proposed Programme: KBBE

Topic:
New flexible biomass structure opening (deconstruction) technologies

Justification:
Biomass structure opening is the key step needed in fibre or chemical production from biomass. Biomass is a very complex matrix structure containing mainly lignin, hemicellulose and cellulose. Current structure opening technologies, i.e. pulping processes are high volume processes with heavy capital costs. Future biorefineries need, however, flexible and modular processes which can be integrated with existing pulp mill representing an enormous infrastructure and also be easily changed to be suitable for different biomass streams. Future bioeconomy will also require efficient use of lower quality raw materials for fibre and chemical production. The economical feasibility of the processes depends very strongly on the efficiency of the first unit operation, i.e. structure opening technology.

Scope:
The project should focus on development of a toolbox of matrix opening technologies for different raw materials (agro and wood). The processes should combine the best (capital, energy, water, flexibility, reliability are important factors) available mechanical, biotechnical and chemical unit operations to achieve efficient matrix opening. Analytical technologies to follow up the process efficiency should be developed and their suitability to process control should be assessed. Combination of suitable solid-liquid or solid-solid fractionation processes should also be combined to the matrix opening technologies. Logistic issues (partial on-site processing) should be carefully assessed. The project should combine experts from manufacturing technologies, engineering, wood chemistry, analytical chemistry and pulping, agro sector and industries in the energy, chemical and material areas.

Recommended size (instrument) and duration:

Large or medium scale collaborative project 4 years

Expected impact:

Development of business opportinities for bioeconomy. Improved competitiveness of European manufacturing, agro and forest industry. generation of new value-chains from biomass.

Proposed Programme: NMP/ KBBE

Proposed Topic:
Stimuli-responsive fibre-based biomaterials

Justification:
Wood and plant fibres are renewable resources extensively available in nature and represent an important market share in Europe. Traditional technologies of fibre separation and functionalisation such as pulping, bleaching and papermaking are used to produce paper and composite materials. However, the functionality of fibres remains limited to brightening, enhancement of mechanical properties and controlled interaction with water. Most of the current functionalities were developed aiming papermaking and compatibility with hydrophobic matrices for composites. However, the demand for new materials based on renewable resources to replace oil based ones opens new opportunities for utilisation of fibres, requiring new functionalities which can be added in current process conditions, e.g. during fibre separation, bleaching or refining.

Scope:
Research has to focus on creation of stimuli-responsive fibre-based materials for applications in different value chains. Stimuli responsive materials shall have specific and smart interaction with light, heat, chemical probes or other physical or chemical stimuli and have the capability to change chemical and physical properties, e.g. enhancement of fibre-to-fibre bonds via photo excitation or switch from hydrophilic to superhydrophobic character via ion exchange. Biomimetics can be used as inspiration to design stimuli-responsive properties for new fibre-based materials. Research shall result in efficient technologies for fibre functionalisation using existing fibre operations installed in Europe and new fibre-based materials with smart properties for application in packaging, electronics, medicine, biocomposites and other high-added value areas.

Recommended size (instrument) and duration:
Collaborative Project (small or medium scale focused research project)

Expected impact:

Proposed Programme: KBBE

Proposed Topic
Low energy pulp and paper manufacture and processing

Justification:

As one of the most energy-intensive branches the pulp and paper industry has a particular obligation – far beyond their intrinsic economic interests - to contribute to the industry's efforts to reduce their impact on the climate change by reducing their CO_2 footprint through more energy efficient processes. The chemical pulping process is in the most recent installations operating with an energy excess coming from biomass. This surplus is exported to society as electricity, heat and solid fuel. This excess can be significantly increased with further development.

The state of the art of their processes is the result of a long-lasting and very successful evolutionary development aiming at better performances and improved economics rather than energy efficiency. In particular stock preparation techniques, quite some of which were adopted from other industries long ago, have been systematically adapted to the specific needs of the paper industry and further developed over many decades. Such mature technologies, though, usually do only bear very limited potentials for further improvements and virtually no potential at all for real break-through innovations. In view of the urgency of the climate change menace incremental improvements, however, would not be sufficient to meet the objectives and expectations from society and governments in Europe with respect to climate change mitigation.

Scope:

Significant improvements or even breakthrough developments for more energy efficient stock preparation techniques for paper manufacturing will in many cases require entirely new research approaches – and the ability to look outside the many traditional paper-makers' boxes. Corresponding activities should in all cases be based on thorough definitions of the specific objectives of traditional processes or parts of process chains and to which extent and at what specific energy input they are currently met. Simultaneously theory-based studies should give a clearer picture concerning the minimum energy consumption which - irrespective of any existing process and irrespective of any feasible process in the short or medium run – might lead to the desired results. The comparison of the results achieved by these different approaches should allow for setting up of a list of priority processes which deserve particular attention in terms of energy efficiency. This list should then be used as a basis for further investigation aiming at

- assessing the potential of techniques employed in other industries for similar objectives
- developing entirely new process solutions.

Recommended size (instrument) and duration:

Large scale collaborative project - 3 to 4 years

Expected impact:

The results would address urgent needs of the whole industry. A successful project work would require joint activities between research partners (universities as well as public and private research organisations) and industrial companies from both the paper industry and the supplying industry. It would in particular provide important contributions to improve the environmental compatibility of paper based, i. e. renewable raw material based products and to maintain and strengthen their competitiveness.

Proposed Programme: KBBE

Proposed Topic

Reliable man-machine interface; ensuring the reliability of complex process control systems

Justification:

Advanced process control systems, containing up to several thousands of control loops are well established in the modern process industry. Based on these control systems, numerous statistical and mathematical models and even neuronal networks for controlling and steering these processes have been developed and implemented in the last decade. A lot of these tools have also been implemented in the last years in real control systems in the process industry in order to optimize the processes. After initial success in process control improvement, most of these systems failed and have no longer been used in the industry. The main reason for the failure of the systems was not the new system itself, but a lack of reliability of the delivered information from the sensors in the numerous control loops. Keeping all these control loops reliable, results in an unaffordable high effort of manual maintenance of sensors and single control loops. Substantial progress in the accuracy and efficiency of process control and processes can only be achieved by reliable control loops and based on this, reliable control systems.

Scope:

After having developed complex neuronal networks, research has to focus on developments, which are capable to observe control loops and to check their integrity. Research shall result in solutions which are able to detect failures of control loops or sensors in order to alert the staff, to do maintenance on the specific control loop or sensor which is no longer reliable.
Interactions of control systems will need to be analyzed for this detection, as well as self-learning systems need to be developed.
Beside statistical analysis, mathematical, chemical and physical know-how and natural laws will need to be combined in the new artificial intelligence, in order to let the system analyze main malfunctions of the network.
Interaction and learning from industries and techniques requiring highest reliability, like aircrafts or nuclear power plants, should be considered.

Recommended size (instrument) and duration:

Large-scale collaborative project – 3 to 4 years

Expected impact:

The results will meet the demands of the process industry for reliable control systems. This break-through in reliability will result in a major step in the energy and resource efficiency of the European process industry. By increasing energy and process efficiency, as well as minimizing raw material input, the process industry will achieve substantial improvements in sustainability and environmental friendliness. Furthermore, the gain in knowledge and capability in the fields of artificial intelligence will be transferable into all kinds of production technologies and also in information technologies. Finally, both the scientific community and the industry will gain a competitive advantage in the field of artificial intelligence.

Proposed Programme: NMP

Proposed Topic
New innovation eco-systems for the transformation of European forest-based industry into bio-economies

- Business models
- Value networks with other industries

Justification:

Lignocelluloses will play a major role when it comes to sustainable chemistry. Some by-products from chemical pulp mills are already sold to the chemical industry. The paper industry is for the time being not very interested in this deals, as burning of the chemicals brings often more profit than selling. After identifying products and adjusting business models the chemical pulp mills and some pulp and paper mills can be upgraded to real bio refineries.

Scope:

Research has to focus on materials which can be used for producing green chemicals. It should also show in which direction the current processes should be adapted to maximize the output of high added value products (Pulp, paper and refined chemicals). The second focus must be on business models. For the time being, the pulp and paper industry has no business models to deal with by-products. There is also no paper- or pulp-mill refining such products to such extend that it brings value to the mill.

On the other hand is the chemical industry looking for bulk volumes of cost effective raw materials. There is no place in their business models to buy limited amount of specialities which can be used as raw material to produce green high value products. The project has to identify the potential of refining in the forest.based industries which can maximize the benefits for forest-based and chemical industries to sell and buy such materials and to develop business models for implementation .

Recommended size (instrument) and duration:

Collaborative Project (small or medium scale focused research project) - 3 to 4 years

Expected impact:

The results will meet the consumers´ demands for green chemicals. It will enable forest-based industries fostering their competitiveness by creating more added value from utilizes biomass. It will reduce the dependency of Europe´s industry on fossil fuels for the production of chemicals and reduce the Carbon footprint of such chemicals dramatically.

Proposed Programme: ENV

Proposed Topic
Cascade utilisation of fibre-based biomass by utilize recycling and optimising material loops to secure material base.

Justification:

Cascade utilisation is a well-developed process in pulp & paper industry. Working with natural substances is always in touch with separating the raw material from fractions that cannot be used for production. This segregation is necessary to achieve stabile quality levels in technical and hygiene & safety reasons. As this fractioning processes are as good as techno-economically reasonable some valuable substances remain still in these fractions. Higher raw material costs caused by more and more insecurity of raw material supply and the EU-policy create the necessary of further developments. To use the potential of various substances in bio-based materials a raised differentiation enables the development of by-products. A future target is to receive a number of materials that are optimised for its further purpose (e.g.: every class of fibre its specific product). Cascade utilisation is the basis for biorefinery concepts as it focuses on the isolation and use of small scale materials and molecules components after pulp and paper processing.

Scope:

Main efforts can be done at the separation of waste material flows in the mill. Seperation technology and integration in the production process have to be studied intensively:

- Mapping of available resources regarding properties relevant for more efficient production of such products. Methods for efficient characterization of such properties
- Identification of best access point to isolate by-products
- Solutions for efficient handling/processing at the mill for supply of uniform and suitable materials for production of different types of products. Process control and information support.
- Process solutions for separation/enrichment and processing of materials and chemical compounds of particularly beneficial properties for use in different types of products
- Cooperate with others sectors to develop products based on side streams

Recommended size (instrument) and duration:

Collaborative large scale project, duration 4 years, incorporation of stakeholders from engineering sector could be necessary.

Expected impact:

Increased resource efficiency, development of new qualities by better separation, higher energy efficiency because of optimised raw material properties, reduction of costs for waste treatment

Proposed Programme: ??

Proposed Topic
Towards zero waste with novel fractionation technologies in material recycling

Justification:

With a recycling rate of more than 70% in Europe, the pulp & paper sector has developed a most effective circular economy based on the recovery of fibres while most of the non-fibre material is still dismissed as low-value waste streams. This applies in particular to mineral pigments and fillers (increasingly used in graphic papers) which are mainly rejected during the deinking process, together with other organic materials like inks, latex, cellulose fines and chemicals, and lead to 10 to 50% solid losses, depending on the final paper product. With more than 3Mt deinking sludge and as much effluent sludge produced yearly in Europe, the development of cost effective solutions for the reuse of the valuable components of such sludge would lead to huge savings and help to restore profits in the paper sector as well as in other industrial sectors where the recovered secondary raw material could be used.

Scope:

A main objective is to develop new solutions for the valorisation of mineral and organic mater containing waste streams, i.e. papermaking sludge. The research should focus on new or improved separation technologies and processes in order to selectively recover and recycle the different fractions, i.e. the minerals, fibres and fine organic components and the chemicals. Research should provide new knowledge and develop innovative techniques in the relevant fields of physical-chemical extraction/separation by size (e.g. ultrasound boosted membrane filtration), density and surface properties (e.g. controlled flotation). Combined process steps like bio-and thermo-chemical pre-treatments, atomization and drying should also be considered as it is not expected to reach high separation selectivity on all valuable components in one single step.

Special attention should be devoted to the evaluation of the cost effectiveness of different process solutions, including post-treatments (e.g. bleaching) with respect to the added value to be gained through the reuse of the separated secondary materials, i.e. their recycling in the paper product, or in other sectors like paints, plastics and added value construction materials.

Moreover proposals should include a Life Cycle Assessment to evaluate the environmental and societal benefits of the new technologies, namely in terms of resource efficiency.

Recommended size (instrument) and duration:

Small scale collaborative projects - 3 years

Expected impact:

The project should demonstrate the efficiency of the new fractionation processes and their feasibility and profitability for the paper recycling industry. The environmental gains in terms of resource efficiency should be assessed in an industrial ecology approach and the potential transfer of the new technology to other sectors should also be addressed as appropriate.

Proposed Programme: NMP/ENV

Proposed Topic

Utilization of annual fibre plants and agro-waste as fibre sources for papermaking

Justification:

Although the demand for some types of paper might stagnate or slightly decrease in Europe in the medium term many other uses for wood will effect dramatic overall increases in global wood demand according to a recent report from PwC. And it is no longer only the traditional wood based industries which make this demand grow. The climate change menace has motivated the European Union to set rules with respect to the generation of electrical power which require a 20 % share generated through renewable resources by 2020. As it is fairly unrealistic that other "alternative" energy sources will significantly contribute to meeting this challenge on such a short notice a far more intensive use of wood based fuels e.g. wood pellets is likely. This will inevitably result not only in increasing wood prices but - even worse - in shortages in wood supply, also outside Europe. Basically the same applies to the availability of recovered paper. Here it is not (yet) the energy issue but the rapidly increasing demand of the paper industries in emerging economies in particular in East-Asia which cannot be satisfied through local resources. Against this background the EU paper industry should thoroughly analyse the applicability of alternative raw materials e.g. those which had been used before wood became an accessible raw material or which are already used successfully (though with questionable environmental compatibility) elsewhere in the world.

Scope:

Annual plants and agricultural residues (straw) have been serving as raw materials for papermaking since many centuries. The main reasons why they have virtually disappeared with the advent of wood fibres – although they are available in abundance all over the world - include problems with collection and transportation, storage and handling, washing, bleaching, papermaking, and chemical recovery. Many of these problems have not been resolved until today though not because they are physically or chemically unattainable but rather because not much research effort has been put on them. This was largely due to the fact that the raw material wood was far more convenient and economical. As these advantages gradually fade away the paper industry should accept it not only as an economic obligation to take a much closer and more holistic look at the potential of alternative fibre sources. Undoubtedly a broader utilization of non-woods would constitute a fundamental change in the industry's raw material handling and procurement infrastructures. So It is not mainly the question of the general suitability of such fibers – this has been sufficiently proved for a large number of different fibres - which should be in the focus of future research but rather the environmental compatibility of the procurement, pulping and bleaching techniques, residue handling and recycling etc.

Recommended size (instrument) and duration:

Large scale collaborative project - 3 to 4 years

Expected impact:

The results would address needs of the whole industry the true dimension of which is currently underestimated to a certain extent. Successful projects could help to pave the way for the utilization of a virtually inexhaustible renewable raw material source for the paper industry. It would further contribute to strengthen Europe's leadership in papermaking technology in general. Further potentially positive impacts could be the development of economic small-scale pulping operations which could be instrumental in terms of job creation and the development of in particular rural communities in southern and south-eastern Europe as well as in many other parts of the world.

Proposed Programme: KBBE

Proposed Topic
Efficient use of forest biomass in novel and added-value bio-refinery, pulp and paper products

Justification:

The major part of the European forest biomass has for decades been used for production of pulp and paper, boards and sawn products, followed by conversion to packaging, prints, housing, furniture, etc. Minor parts have been used as fuelwood for heating. This is now changing rapidly. Competition from countries with fast-growing plantation forests products and the expanding bio-energy sector creates an increasing need for efficiency and for novel and higher added-value products in the European forest-based industry. Many pulp mills are now also suppliers of electricity and heating. Some are diversifying into bio refineries, adding products as fuels, chemicals and/or materials for novel bio-based products, replacing existing products based on fossil resources. Compared to its most advanced competitors, the European forest-based industries are, however, dependent on a more slow-growing forest resource with other tree species, growth conditions and properties. For strengthening of the development towards green solutions and improved competitiveness of the European industries, there is a need for good knowledge about the properties of regionally available resources and how they are best used for more efficient production of products for both novel and traditional types, as well as solutions for most efficient processing of the materials to meet the target properties for the products.

Scope:

The objective is to create knowledge and process solutions for increased benefits of using existing European forest resources for more efficient production of existing and novel paper and bio refinery products from these resources, in order to reduce climate impact and use of fossil resources, secure energy supply, reduce material use and improve competitiveness. Areas encompassed of the scope are:

- Knowledge about what properties are ideal for novel and further added value bio refinery, pulp and paper products. Relationships between properties of wood and products, need for use of materials, energy, chemicals, etc, as well as the resulting costs.
- Mapping of available forest resources regarding properties relevant for more efficient production of such products. Methods for efficient characterization of such properties
- Measurement facilities for assessment of such properties on wood when delivered to the mill and at the mill. Solutions for efficient handling/processing at the mill for supply of uniform and suitable materials for production of different types of products. Process control and information support.
- Process solutions for separation/enrichment and processing of materials and chemical compounds of particularly beneficial properties for use in different types of products

For sharper focus, this topic does not include forest operations, sawmilling and bio energy. Nor are R&D for the actual production of novel or further added-value products included, but sub-projects illustration what can be achieved are appreciated.

Recommended size (instrument) and duration:

Large scale collaborative project - 3 to 4 years

Expected impact:

The results shall significantly improve the possibilities to take advantage of the special characteristics of European forest resources for production of novel and further added value bio refinery, pulp and paper products. This will contribute to reduced climate impact and use of fossil resources, secure energy supply, reduce material use. This will in turn, result in new and better products to the benefit of users and society, improve the competitiveness of this sector of the European industry and bring economic and social development.

Proposed Programme: KBBE/NMP?