



The research leading to these results has received funding from the European Community's Seventh Framework Programme under grant agreement n° 604187.



REFFIBRE NEWSLETTER NOVEMBER 2015



The research leading to these results has received funding from the European Community's Seventh Framework Programme under grant agreement n° 604187.

## REFFIBRE: Maximising the value from paper for recycling

The REFFIBRE project aims at developing tools and knowledge that are necessary to eco-design resource-efficient paper and board production processes. The focus is on paper for recycling as the main raw material in paper and board production. In the multiple-output mill concept, novel bio-based products along with traditional paper and board are produced from recycled waste fractions from production. New processes will be proposed and demonstrated in cooperation with the REFFIBRE industrial partners, and the newly developed tools will be validated based on the trials.

### REFFIBRE workshop and meetings in Valencia, Spain and Munich, Germany

On October 6 and 7, 2015 the project partners met to discuss the progress within the project and coordinate their actions for the upcoming months. ITENE hosted the meeting at their research facility in Valencia, and offered the group the opportunity to take a look around the institute's extensive laboratories and experimentation facilities, which are dedicated to research and development in the fields of packaging, transportation and logistics. The first public workshop took place during the meetings at ITENE, and a few weeks later the second public workshop followed, organised by PTS in Munich on November 3, 2015. In these two events the project partners presented work-in-progress and results to participants from paper producers, paper industry suppliers and trade associations from Spain, Germany, the Czech Republic, Sweden, Finland and the Netherlands. At the workshop in Valencia, the participants were able to learn about the sustainability vision of the Spanish paper industry, as presented by Mr. David Barrio, Recycling Director of ASPAPEL. The presentations given during the two public workshops can be found on the REFFIBRE project website:

<http://reffibre.eu/news/the-first-public-workshop-held-in-valencia> , and  
<http://reffibre.eu/news/the-2nd-public-workshop-in-munich>.

One of the project results presented in these events was the development of a fibre flow modelling tool by PTS. Six European geographical regions with common paper for recycling-related characteristics have been chosen and the interactions between the flows of different types of paper for recycling and the quality of paper for recycling (composition, amount of ash, mean fibre age) were studied. The modelling does not take into account the amount of paper for recycling used for tissue in Europe or exported outside Europe.



The tool allows for forecasts of the future paper for recycling quality within these regions based on different scenarios. These forecasts can inform strategic decision-making at the paper producer level or can guide the preparation of legislation in the fields of, e.g., waste paper collection and sorting.

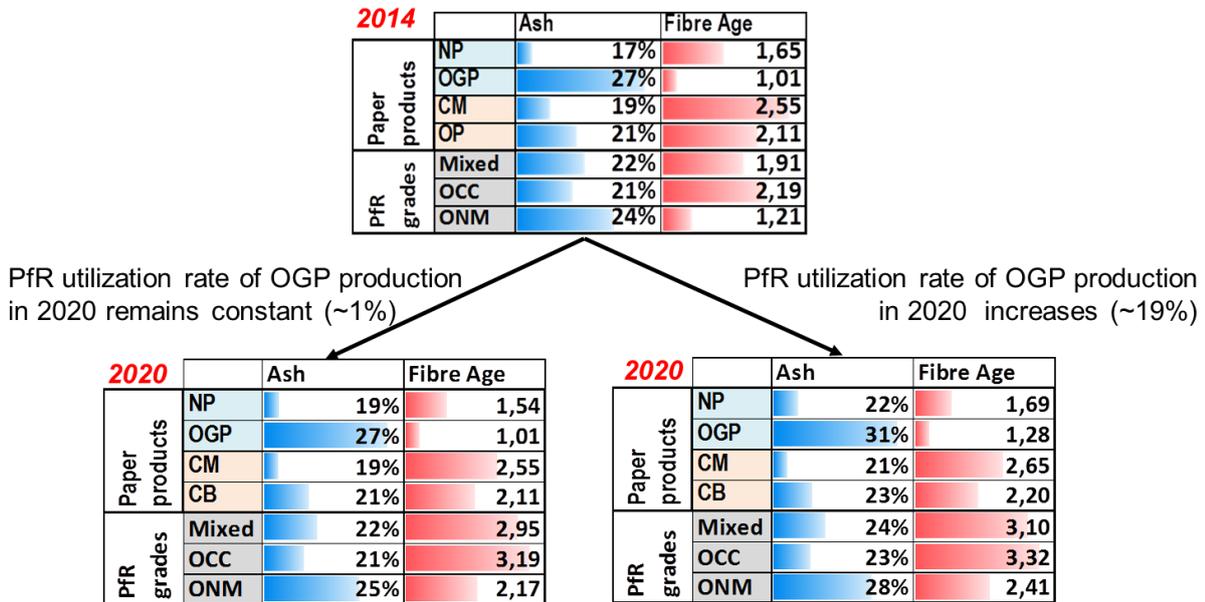


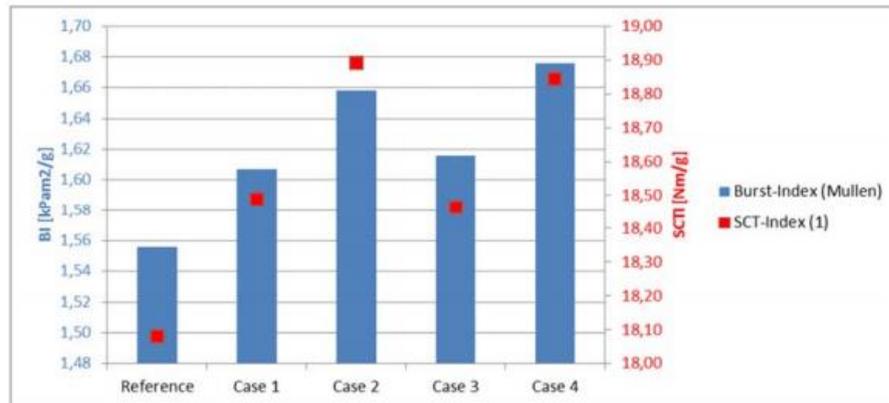
Figure 1. Ash Content and Mean Fibre Age in Spain & Portugal in the year 2020 under a specific scenario, with a regional paper for recycling utilization rates in the production of Other Graphical Papers set at 1% and 19%. **Note: the paper for recycling used for tissue in Europe and exported outside Europe excluded.**

PTS also presented a tool for the prediction of paper properties (structural, mechanical, optical) based on pulp characteristics that correlate with paper properties. Raw material selection and stock preparation processes influence pulp properties. Given that the ash content of paper for recycling will be one of the main challenges for the paper industry in the years to come, the presented modelling work concentrated on the impact of fillers on paper properties.

VTT presented their work on the fibre integrity number as an approach for evaluating the strength potential of fibres and assessing the quality of paper for recycling. The integrity number can potentially be defined with the help of in-line equipment and, when combined with paper density, correlates well with various paper strength properties (e.g. SCT index, tensile index).

The REFFIBRE project focuses also on modelling various stock preparation processes and adjustment of their process parameters. During the Munich workshop TUDA showed the progress of their work on process models. By modelling selected processes, e.g., flotation deinking, based on actual process data, both paper properties and raw materials consumption can be predicted under specified scenarios. This information can be used as input for both the sustainability analysis and the determination of the quality of a mill's end products. The example of increasing the reject rate in flotation deinking was used to demonstrate how such process models can be applied in practice.





**Reference:** 100% paper for recycling

**Case 1:** about 4% inorganics are separated from the pulp

**Case 2:** about 7.5% inorganics are separated from the pulp

**Case 3:** about 4% of the recycled pulp is substituted by virgin fibres

**Case 4:** about 7.5% of the recycled pulp is substituted by virgin fibres

} Possible options if *PfR* quality becomes worse

Figure 2. Example of modelling the influence of pulp ash content on certain paper characteristics; the model indicates that removing an amount of inorganic fillers from the pulp or substituting part of the recycled fibres by virgin ones can substantially improve the burst- and SCT indices.

During the workshops, VTT and ITENE presented their progress with regard to developing environmental indicators for whole paper value chains based on paper for recycling as the raw material. The target of this work is to determine at a value chain level the impact of measures aimed at an optimised use of recycled fibres. The researchers showed how Life Cycle Analysis has been used as the basis for modelling the impact of specific scenarios on sustainability along the value chain, as well as how they have been dealing with the complexities of allocating the burdens between different life cycles. Furthermore, VTT showed during the Valencia workshop their work on determining the effect of certain scenarios on economics, next to the impact on sustainability. The example of utilising sludge from the Holmen Madrid mill for the production of Wood Plastic Composites has been used for demonstrating how the economic aspects of efforts for more efficient recycled fibre use can be calculated.

Production of innovative bio-based products from specific fractions of the paper industry's raw materials that are now seen as waste is part of an integrated and more efficient utilisation of paper for recycling. Bumaga has presented the work done in the project to identify such new products that are relevant for the REFFIBRE industrial partners. The underlying logic of sidestream valorisation has been discussed, together with a shortlist of such sidestream valorisation routes that can be demonstrated on a pilot scale within the project so as to provide actual data for the validation of the models created by the other partners. During the Munich workshop, VTT went into more depth regarding one of these options, the production of Wood Plastic Composites out of sidestreams of the industrial partners, showing the results obtained in laboratory scale trials (Figure 3).





Figure 3. Wood Plastic Composite sample produced by VTT with the use of fly ash from the Utzenstorf mill

## Demonstrations

Several demonstrations on a pilot scale with the participation of the REFFIBRE industrial partners will to be carried out in order to test and validate the models that are currently under development.

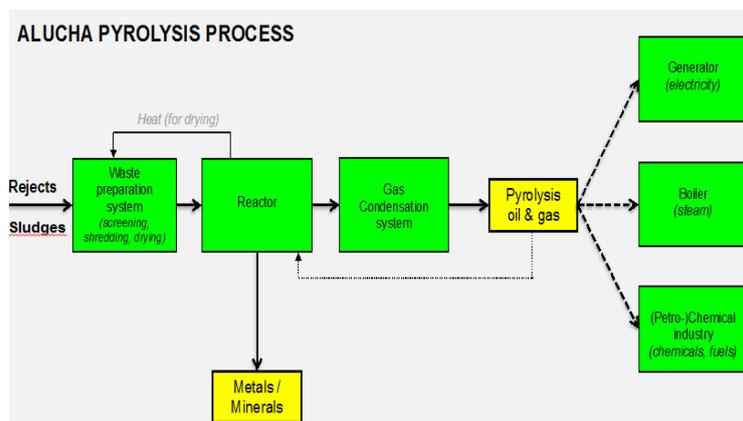


Figure 4. A sidestream valorisation process to be demonstrated on pilot scale: pyrolysis. The process, applied for either mixed rejects or paper sludges, produces pyrolysis oil and gas, a part of which covers its own energy needs. The rest can be used in the paper mill or externally for heat and power generation or as an input for the production of other fuels and chemicals. Clean reclaimed metals or fillers (depending on the pyrolysed stream) are a secondary product of the process.

By now the industrial partners have evaluated the shortlist of potential valorisation options that was compiled earlier on and have been making decisions regarding demonstration cases that they find attractive for their companies. Such demonstration cases that have drawn the industrial partners' attention include the production of Wood Plastic Composites out of fly ash and deinked pulp available at Utzenstorf and the production of pyrolysis oil and Wood Plastic Composites out of mixed sludge available at Holmen Madrid.

The progress and results of both the modelling work and the pilot tests will be published on the REFFIBRE webpage ([www.reffibre.eu](http://www.reffibre.eu)).

