

## **Bio4Energy: A Swedish initiative connecting photosynthesis research to bioenergy and biofuel production from forest products**

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Sweden possesses large forest resources and consequently wood, pulp and paper form an important base for Swedish industry. Recently we have seen an increased interest in new technology to convert low-cost biomass from the forest into high-value products such as transportation fuels and fine chemicals. The Bio4Energy program was initiated in 2010 as a combined initiative from Umeå University, Luleå Technical University and the Swedish University of Agricultural Science. The program consists of seven research platforms that together will encompass a complete system with all tools needed to achieve environmentally and climatically sound energy biorefineries based on non-food biomass.

The **feedstock platform** is built on the competence at Umeå Plant Science Centre, a world leading research centre in plant and forest biotechnology formed in collaboration between Umeå University and the Swedish University of Agricultural Science. The platform will use modern biological and biotechnological tools to improve the quality and quantity of the biomass produced as raw material for the following processes. In the **biochemical platform** enzymatic routes and fermentation processes will be developed, and in the **thermochemical platform** processes based on gasification and catalysis will be developed for the conversion of raw materials to products. For maximum efficiency and yield of the processes developed in these platforms, the **pretreatment and fractionation platform** will design procedures to make cell-wall polymers maximally available for thermal and/or enzymatic processing and the **catalytic and separation platform** will develop efficient catalysts and separation processes needed for the biochemical and thermochemical platforms. The overall efficiency of the process will be optimised in the **process integration platform** and the research in the **environmental platform** will ensure that the whole process is environmentally friendly and sustainable.

The research in the feedstock platform will aim to exploit modern biology and biotechnology tools to supply increased quantity and quality of plant biomass suited for biorefining towards energy, biofuels and other biomaterials. A basic understanding about the allocation of assimilated carbon by photosynthesis to both soluble and insoluble products in the plant will lay the basis for metabolic engineering to control fluxes of carbohydrates and other metabolites with the aim of producing high-value end products that can be utilized as extractives in the biorefinery applications within the biochemical and thermochemical platforms. We will also develop our knowledge on carbon/nitrogen interactions in the boreal forest ecosystem aiming to develop efficient fertilization in close connection with the environmental platform.