

**Session Biosphere: April 13th 09.00 hrs**

**1s5 Nature-based solutions for circular food systems under climate change**

## **Circular waste management**

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The global pursuit of sustainable development is an irreversible social trend, also in engineering our future. This has an effect on the work of engineers. New insights resulting from new research and developments can change the situation for which an engineer is developing a solution. Innovation, through research and development, continuously provides new insights. These can be used to develop the best engineering solution. As engineers, we are able to adjust our solutions to the changing situation. One of the most important tools we use to find comprehensive sustainable solutions is our sustainable design principles. Witteveen+Bos developed several analytical, consultancy and engineering methods to accelerate the transition towards a circular and bio-based society. With the increasing depletion of finite natural resources as the world further advances and progresses, circular economy and climate resilient measures have become a crucial topic for which used streams from one party could be re-used as a valuable resource by another party. Symbiosis between these parties to create circular opportunities in our projects is the basic principal. Our aim is to strengthen the robustness of the current system and further optimize the scarce resources by exploring integrated innovative solutions.

A first step in this transition is the scan of streams by material flow analysis (MFA) and identification of sustainable and cost effective circular measures. For different projects, Witteveen+Bos executed environmental, technological and economical impact analysis to determine hotspots, recommendation and engineering solutions to accelerate the circular economy. By not only quantifying the substance flows, but also mapping the overall CO2 impact of these substance and energy flows we can determine their impact and importance: where are the largest and therefore also the greatest opportunities for integrated sustainability and closing cycles?

Based on data analysis of operational flows for water, energy, residual streams and related building materials and chemical use and the carbon emissions we map the use and emissions of these streams to identify hotspots with losses and interactions. From this moment we link parties and/or streams for the development of (biobased) products/service. To solve these hotspot we make recommendations for interventions and develop the technical measures focusing on existing and developing technologies for

renewable energy, water and resources reuse and biobased solutions. These technologies can be; various treatment options for solid wastes, sludges, waste oils and sewage waters; but also green chemicals and building materials and carbon capture and utilization. For organic waste streams we make use of our tool, called the Biobased Atlas<sup>TM</sup>. The Biobased Atlas is a tool from W+B where we bundle experiences from previous projects in the field of useful and circular applications of residual flows, techniques and processors. Besides various treatment options for solid wastes, sludges, waste oils and used waters were assessed for implementation to increase the circularity.

Witteveen+Bos will contribute to the session at circular@WUR presenting their experiences and knowledge gained during the Material Flow Management at WUR, the Circular Industrial Parks Symbiosis and circularity studies for waterboards.

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*Keywords: circular design, material flow analysis, MFA, data analysis, impact measurement*