TBP01x - 1.5 - Benefits for society & sustainability

Hello everyone! In this unit we will discuss the benefits of the biobased economy for society and sustainability.

“Once a photograph of this earth, taken from the outside, is available, a new idea as powerful as any in history will be let loose”. These words were spoken in 1948 by Fred Hoyle. Indeed, when Apollo 8 astronauts pointed their cameras at the earth, this was the first time that people saw Earth as an isolated ball of life hanging in space, separated from the emptiness around it by only a thin veil of atmosphere. Frank White named it the “Overview Effect” – the realisation that we are all on ‘Spaceship Earth’, and thus responsible for our own survival. How can a biobased economy help to create a more sustainable world?

Looking back at the drivers for a bioeconomy, of course there are the challenges of decreasing reserves of fossil resources and increasing price volatility. A biobased economy can improve energy security and lower greenhouse gas emissions. An important reason is also to add value and sustainability to the food chain. This could be reached by improving sustainability of agriculture, and also by looking at the coproduction of biobased products.

So let’s look at the definition of sustainable development. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This definition was formulated in a commission led by Brundlandt in 1987. Another definition that was made by the United Nations World Commission on Sustainable Development is: looking for a balance between what one desires and what is possible, between human activity and the carrying capacity of the system “Earth” and the repairing capacity of this system.

Oxfam, an international non-governmental organization, made this diagram. You can see that a ‘safe and just space for humanity’ actually includes many factors: food, health, gender equality, jobs, and many others.

So sustainability is quite complex. For some people, it is durability, creating products that last very long. For others, it is related to biodegredation to avoid plastic waste mountains. There are many different interpretations of sustainability. Each one of these is important to a certain extent, but it is the whole picture that counts. Some factors are measurables, while others are more value oriented and much more difficult to quantify, these are general concepts. Sometimes, they even compete.

When looking at sustainability we usually take three components into account: all economic, ecological and social impacts are considered. When we wish to know the ‘sustainability’ of our bioproduct we have to measure the impact of this product for all three categories. Normally we compare this to its fossil’s equivalent.

So how to measure sustainability? For environmental impact, Life Cycle Assessment methodology is often used. In a life cycle assessment, you consider the process as a whole or

separate parts of it, depending on what you want to compare and therefore how you set your boundary limits. Assessing the entire process, including the initial capture and final release of CO_2, is referred to as a 'cradle-to-cradle' assessment.

The most important driver for innovation is whether the business case is viable. Is the proposed production design profitable? Is the investment earned back in a limited number of years? Only then will banks and other investors be willing to provide finance to build the process plant. There are many factors that influence the overall costs and returns; the choices in each of the separate parts of the biobased production process have an effect on the overall economic performance. Because economic viability is so important, there will be attention to financial aspects throughout this course.

In evaluating the overall finances of the production process the 'hardware' investment , for example the costs of the land, building, equipment, etc is added up under the category 'Capital Expenditures' or CAPEX. These costs are related to purchasing the necessary capital to set up the process facility. These Capital Expenditures are separated from all the costs associated with operating the facility, the Operational Expenditures or OPEX. In OPEX we include all variable costs spend over a year, such as the purchase of raw materials, the auxiliary costs like energy and water, operating personnel, transportation costs, interest, etc. Additionally, there are costs resulting from legislation and taxes. Here, it is important to realise that there is often a trade-off between costs: installing more sophisticated machinery could increase capital expenditures while saving money on operating the process.

Selling the final products at a certain price generates annual revenues. The revenues minus the OPEX costs are the gross profits. Deducting depreciation, other expenditure and taxes will give a 'net profit' or equity, Now you can calculate the pay-back time of the overall investment in the start up of the facility. The overall economic performance of a process over time can then be assessed using well-known economic indicators such as the Net Present Value and the Internal Rate of Return, which you will see later on in the course.

Social sustainability is the most difficult aspect of sustainability. It is much more difficult to MEASURE what the social impact of a novel technology or product is and there are many different perceptions. You may be familiar with cartoons such as this one that address the use of food crops for, for instance, biofuels production.

So, properly assessing social sustainability requires some more thought. This involves assessing employment along the value chain, the effect on food security in urban and rural local areas or on a global scale, and social wellbeing in local communities. Technology itself can also be analyzed, if and how technologies are safe, acceptable in, or beneficial to a community. And, whether the benefits of the new production of biobased products are equally distributed.

So what are now the desired benefits of biobased production for a society? This would include: less pressure on climate change, improved recycling of elements, better §quality products and use of all the biomass components, a safer environment and production chain,

improved economic development including employment options, and increasing the opportunities for improved well being in local communities.

So let's work on this TOGETHER! Join us in the next unit!