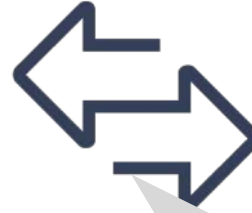


Team 4
In search of unused residues

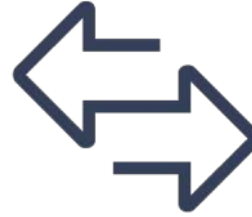


The total energy demand in the Netherland is approx. 2 -3 thousand PJ (excl. \pm 750 PJ bunkering fuels)
It is estimated that around 700 PJ of renewable energy could be provided in the form of biomass
However, only \pm 200 PJ can be sourced locally in the Netherlands, so the Netherlands will have to look beyond its own border to ensure a switch from fossil to renewable feedstocks

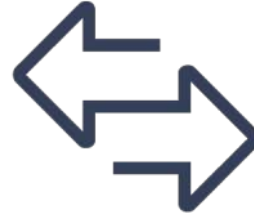
Numbers mentioned here still need to be valid by team members



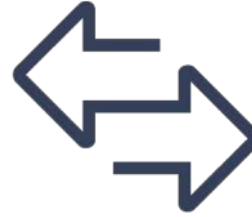
The need to search for sustainable biomass feedstocks beyond our own country borders offers the great opportunity to play on our country strength as an important logistic hub, with large volumes of imported and exported products going through our ports, airports, roads and railways. At the same time it creates new possibilities to export our knowledge and expertise about agriculture



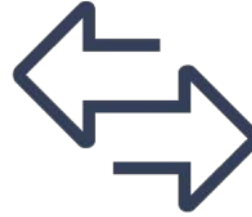
Thus offering the Dutch economy the opportunity to actually take responsibility and become a true global leader in the field of sustainable biomass rather than just talking about it



The Netherlands has been in a global leadership position before, during the days of the VOC, better known as the Golden Age. But where the Golden Age was a time of domination and trade was very much a one way street....

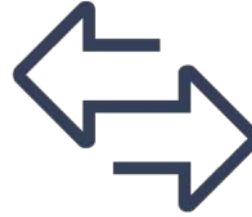


...we are now at the dawn of the Green Age. The start of something new. An Age where international biomass trade means equal partnerships, shared values and benefits, and making the Social Development Goals an integral part of doing business



But doing business the right way, does not yet answer the question how to increase the availability of sustainable biomass? Before one starts thinking about generating more biomass, one first has to look at what can be done within the boundaries of the existing system. This means looking at both the supply as well as the demand side of the business

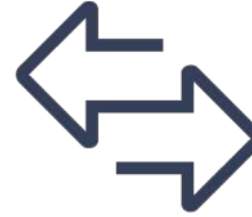


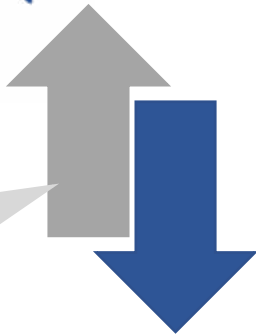
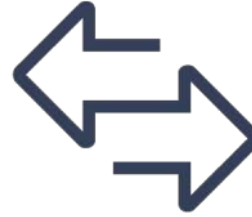


The first fundamental step that needs to be considered is to re-evaluate how we use biomass today. Improving energy efficiency, reducing food waste, and changing our diets all have the potential to contribute to a shift in the demand for biomass, without the need to produce more. Instead biomass is made available and used for other applications like chemicals and energy without the need to produce more



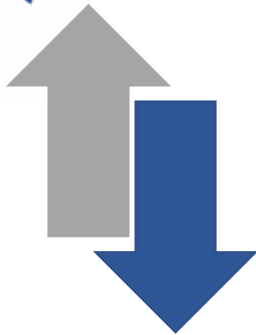
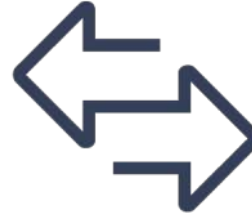
The next step in improving the yield from existing biomass feedstock is the introduction of so-called hybrid systems. Existing biofuel and biogas processes convert approx. half of the available carbon to useful products, because of the lack of sufficient amounts of hydrogen in biomass. When combining biomass conversion processes with additional hydrogen generated through the electrolysis of renewable electricity and water, the carbon conversion efficiency improves significantly. This result in a larger supply of biobased fuels and products from the same amount of biomass





And even before new land is needed to produce additional biomass, there are still additional amounts of biomass available which are not used today thus increasing the available supply further

One such example comes from Ivory Coast. Ivory Coast is one of the worlds leading producers of cocoa. The country produces approx. 2 million metric tons of cocoa pods which are not used for anything today (source: ECN-TNO)



Because cocoa pods contain a lot of moisture it is recommended to pretreat the pods locally. The dried pods can then be shipped to the Netherlands by dry bulk carriers, whilst the wet fraction can be converted in Ivory Coast to biogas through anaerobic digestion. The effluents can be used as fertilizer to grow more cocoa

One of the conclusions of the working group is that an increased demand for biomass means a more varied supply, and in order to be able to process these different feedstocks more flexible and versatile conversion technologies are a 'must have'. This is another area where the Netherlands can become a global leader by developing new processes and licensing the relevant IP thus closing the circle

