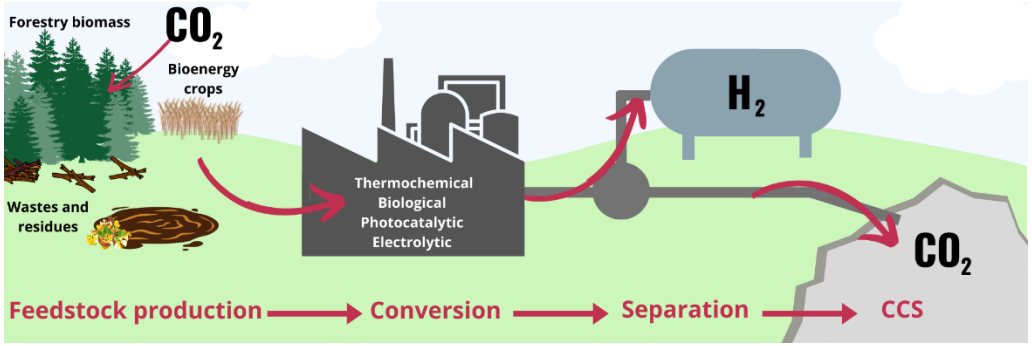
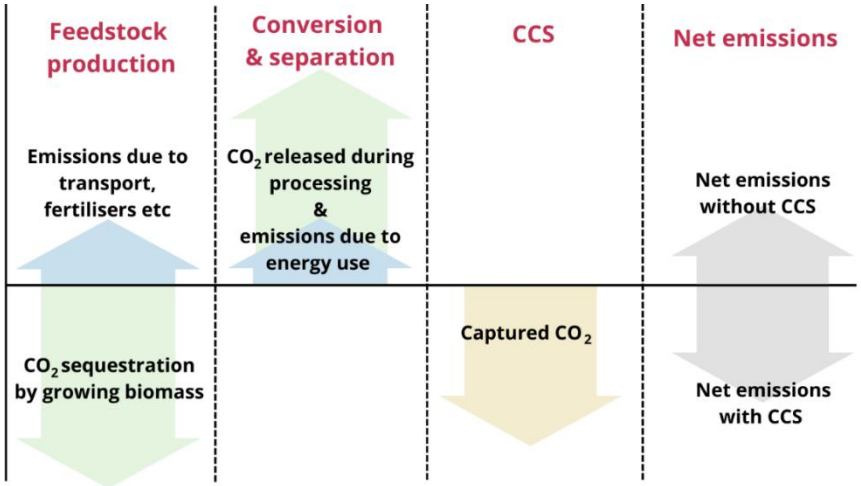
Producing hydrogen from biomass *Explainer*



Routes for producing H_2 from biomass feedstocks, and how this can be linked to carbon capture and storage (CCS).



Lifecycle greenhouse gas emissions associated with biomass-to-H_2 systems. The size of the arrows do not directly reflect measured values but reflect what the overal system might look like. The net emissions depend on the relative sizes of the different positive and negative emissions across the system.

- Hydrogen (H_2) is a versatile energy vector that will play a key role in our future energy system. One of the key strengths of H_2 is that it doesn't produce any emissions at the point of use. There are, however, upstream emissions related to H_2 production, so it is important to know how it is made.
- H_2 production at industrial scale is primarily *via* reforming of fossil feedstocks, which results in significant CO_2 emissions. Therefore, alternative routes which can produce low carbon H_2 must be deployed at scale. While water electrolysis is a well-known example for achieving this, H_2 production from biomass can also contribute towards low carbon H_2 targets.
- H_2 can be produced from biomass feedstocks including crops, forestry biomass, and wastes and residues. Lignocellulosic feedstocks (non-food crops and forestry biomass) along with wastes and residues are of particular interest as they could improve the overall sustainability performance, while decreasing competition with food production.
- Several biomass-to-H_2 technologies have been developed. These include systems based on the conversion of biomass using heat, light, electricity and/or biological systems (bacteria). While some of these technologies are still being developed at lab scale, gasification is an example of biomass-to-H_2 technology that is near commercial deployment.
- As biomass is composed of carbon, oxygen, and hydrogen, both H_2 and CO_2 can be generated during the conversion process. This biogenic CO_2 can be released but if the system is operated alongside carbon capture and storage technology, it can also be sequestered underground. As a result, Hy-BECCS (Hydrogen Bioenergy with Carbon Capture and Storage) systems are unique in providing the potential for negative emissions alongside H_2 production.
- The lifecycle emissions associated with biomass-to-H_2 depend on the technology used, the feedstock, and other details of how the system is operated. Analysis of the lifecycle emissions of biomass gasification and biomethane reforming systems show that they can produce H_2 that meets the UK Low Carbon Hydrogen Standard (i.e. they produce H_2 with associated greenhouse gas emissions of less than 20 gCO2e/MJ-$H_{2(LHV)}$ at point of production) even without the application of CCS, providing the correct feedstock and system configuration are used.

For more information (and referenced data) see our policy briefing on this topic.

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