ADVANCEFUEL

Towards Sustainable Advanced Biofuels

Take a tour of the biofuels industry and learn what's at stake for market roll-out an sustainability criteria in the transport sectors around Europe.

Dr. Ric Hoefnagels is a jr Assistant Professor at the Copernicus Institute of Sustainable Development, Utrecht University. He is involved in multiple bioenergy research projects with a main focus on biomass supply chains including, cost structures, greenhouse gas footprints and future supply, demand and trade projections in the context of existing and emerging biobased economy markets.

What is essential for the market roll-out of advanced fuels in terms of biomass feedstock for the related but different markets of aviation, maritime and road transport?

The most prominent barrier to the market roll-out of advanced biofuels is its high production cost compared to fossil fuels and also conventional biofuels. Technical innovations and economies of scale can still substantially reduce the production cost of advanced biofuels, but feedstock cost remain prominent and often contribute to well over half of total fuel production costs. Furthermore, erratic feedstock supply, in terms of volume and quality, reduces capacity utilization and increases the operational and financial risks of the production plant. Reliable, consistent and cost-effective feedstock supply chains that are resistant to inclement weather, regional price volatilities and risks of impurities are therefore essential for developing advanced biofuels at commercial scale.

What role does sustainability criteria play in the market roll-out?

The market for advanced biofuels is still in its infancy but might grow substantially if climate targets – as agreed upon in Paris in 2015 – are pursued. Similar to the existing markets of bioenergy (conventional biofuels, heat and power), increasing efforts are required to ensure sustainability is implemented over the whole supply chain when these markets develop. These efforts are needed regardless if it is sourced and produced domestically from within the EU or imported from third countries. Policy-makers and investors need the assurance that environmental, social, and economic risks are properly addressed to support the development of credible and accepted advanced biofuels. Institutional frame-

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N.°764799

works with strict criteria and independent third-party certification are both important instruments to ensure sustainability along the whole supply chain.

What are the most important existing standards and certifications, and which ones do we need for the optimization of biomass feedstock?

Transport biofuels are subject to EU-wide mandatory sustainability criteria that have been implemented in the 2009 Renewable Energy Directive (RED) and Fuel Quality Directive. These criteria cover greenhouse gas (GHG) saving requirements, biodiversity and land use. Criteria to mitigate the risk of indirect land use change (ILUC) were implemented with the ILUC Directive in 2015. Advanced biofuels generally out-perform conventional biofuels in terms of life-cycle GHG savings and they avoid direct competition with food and feed that could lead to adverse price effects, scarcity issues and land use change. However, they are not per definition more sustainable compared to conventional biofuels. If improperly managed, they can still lead to adverse sustainability impacts such as competition with other fiber and material markets and GHG emissions from changes in carbon stock from slow growing forest systems or high carbon soils.

Sustainability criteria for biofuels used in transport are mainly tailored to current markets that are dominated by conventional biofuels such as biodiesel from rapeseed and recycled vegetable oils and ethanol from cereals and sugar crops. The recast Renewable Energy Directive (RED II) has broadened its scope to electricity, heating and cooling and includes new criteria for forest and agriculture biomass. The new rules of the RED II need to be implemented in updated national legislation and sustainability certification schemes for the period after 2020. This is an important moment to recognise and implement the sustainability aspects of advanced biofuels as well as bio-based chemicals and other novel materials that will become more prominent in the future.

How to develop sustainable biomass and advanced fuels on regional levels?

Sustainable biomass sources could be available, but that does not necessary mean that they are readily available to produce advanced biofuels at commercial scale. Production requires a well-functioning infrastructure and the engagement of all actors in the supply chain, including farmers, foresters and other feedstock suppliers, biomass traders and logistics, certifiers, governments and NGOs. The required actions to develop reliable, consistent and cost-effective feedstock supply chains are location and context specific. A forest-based supply system in northern Europe is very different from a system based on agricultural residues in central Europe or an import-oriented supply chain in western Europe.

What are the implications of deploying sustainable biomass for advanced biofuels?

Today, liquid biofuels and solid biomass are individually embedded in different sectors of the economy. Liquid biofuels are produced from agriculture commodities such as rapeseed and residues such as used cooking oil. Solid biomass fuels are largely sourced from forests and forest industries and supplied to electricity and heat sectors. With the development of advanced biofuels, we expect a convergence of these markets. Solid biomass could partly shift from heat, electricity and non-energy end-use markets towards advanced biofuels. Secondly, advanced biofuels will likely be produced in multi-output facilities with cogeneration of heat or electricity. Thirdly, the growth of solid biomass demand could lead to a convergence of agriculture and forest biomass supply markets by an increased mobilization of agricultural residues and the cultivation of lignocellulosic woody and grassy crops. And finally, the development of advanced biofuels could further stimulate the internationalization of bioenergy market due to the growth of renewable fuel demand in international marine and aviation sectors and international trade of solid biomass and advanced biofuel commodities.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N.°764799

These converging trends increase the need for harmonized and internationally-recognized standards and certification schemes. The principles and criteria should remain flexible enough to accommodate for the environmental and socio-economic conditions of different producing countries and supply chains.

How does ADVANCEFUEL assess the environmental and socio-economic performance of renewable fuels supply chains?

The ADVANCEFUEL project has a dedicated work package on sustainability. On the one hand, the research aims at quantifying the possible environmental and socio-economic performances and impact of advanced biofuels; and on the other hand, the research identifies actions needed to safeguard more sustainable production of advanced biofuels with effective criteria and certification. To meet these objectives (amongst others), a spatial explicit modelling tool is being developed, stakeholder interviews are being conducted and workshops are being organized to identify sustainability concerns and options to develop harmonized sustainability criteria and their application in standards and certification systems.

How are advanced fuels going to develop by 2030 in the different end-use markets of aviation, road and maritime transport?

The development of advanced fuels is likely to be shaped by the sub-target for advanced fuels introduced in the RED II. By 2022, 0.2 % of final energy consumption in road and rail transport should be supplied from advanced biofuels or biogas increasing to 3.5% by 2030. Actual supply will effectively be half of the target due to double counting rules. No blending requirements are set for the maritime and aviation sectors. Nevertheless, renewable fuel consumption is stimulated by a multiplier of 1.2 times the energy content towards the road and rail target if renewable fuels are used in these sectors. An analysis by ECN part of TNO and Utrecht University has demonstrated that such a multiplier could shift significant amounts of biofuels towards aviation despite the more strict fuel quality requirements and associated production cost if used in aviation. The ADVANCEFUEL project will provide more detailed and up-to-date analyses of possible deployment pathways of advanced biofuels and associated end-use markets.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N.°764799