SET Plan Implementation Working Group (IWG)

Action 8: Bioenergy and Renewable Fuels for Sustainable Transport

Bioenergy for a green economy

Position Paper prepared by: Implementation Working Group 8 (IWG8)

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1 Bioenergy as one of the key solutions for the transport sector

Climate change is one of the most significant challenges for humanity today. For this reason, **replacement of fossil fuels with renewables is needed** as a central action. The transport sector is especially dependant on fossil fuels and renewables can play a key role in defossilisation and improved resilience.

The EU aims to be **climate-neutral by 2050** – meaning an economy with net-zero greenhouse gas (GHG) emissions. This objective is at the heart of the **European Green Deal** and in line with the EU's commitment to global climate action under the **Paris Agreement**.

Among renewables, sustainable **biomass will play a major role** in satisfying human energy needs. **Bioenergy** can take the role of a secure and dispatchable source for power, heat and fuel, complementing intermittent renewable sources such as wind and solar.

IWG8 believes that sustainable bioenergy has a key role to play in reducing GHG emissions in the EU energy mix, while at the same time decreasing fossil fuel dependence and building a **circular economy.** The promotion of bioenergy in the EU should be based on **sound sustainability criteria**, including the requirement to reduce GHG emissions significantly without compromising on other environmental impacts. The EU has leadership in innovative bioenergy technologies; however, deployment remains limited for advanced biofuels applications.

Replacing fossil-based energy by 2050 is a very challenging task. Europe will need multiple options for the transition of the transportation system. The most sustainable, cost-efficient, and appropriate technologies and routes need to be identified and developed; for this, investment security as well as stable long-term policies are of utmost importance.

As part of the European Green Deal, the European Commission emphasised in the EU Strategy for Energy System Integration, which was presented on 8 July 2020, that biofuels will have an important role in transport subsectors where electrification is not feasible and which are thus difficult to make net carbon neutral by other means, such as **aviation, maritime or heavy-duty transportation**.

Renewable fuels, and especially biofuels, are key to reducing the fossil carbon footprint in transport segments that will continue to rely on internal combustion engines and complement the significant market impact that new mobility modes are expected to make. Biofuels can contribute to carbon neutrality in transport and other sectors in reducing the use of fossil energy sources, for example **as drop-in fuels in internal combustion engines, as hydrogen carriers in hydrogen fuel cells, as renewable fuels in solid oxide fuel cells and in enzymatic biofuel cells, etc.** offering the advantage of

easy and safe storage, distribution and use . An integrated biobased technology development strategy (paired with exploiting synergies in combining biomass – BtX and electricity/power – PtX based technologies) will encourage processes that allow reaching energy targets.

In order to maximise the potential for carbon-neutrality in the transport sector IWG8 urges a balanced approach where all of the solutions are treated neutrally and based on their sustainability performance in a holistic scope. In order to meet energy and climate targets sustainable biofuels, green electrification, hydrogen and other solutions will need to be developed in harmony. A way forward where technology solutions for sustainable transports are combined and employed at large scale will deliver significant cuts in carbon emissions while creating new jobs in Europe across sectors, which is more important than ever given the COVID-19 pandemic.

IWG8 is focusing on driving the development of bioenergy for sustainable transport. In order to succeed and achieve the ambitions in the SET-Plan, it is essential to put bioenergy in a systemic perspective and find new and innovative ways by combining a wide range of solutions to replace and reduce the consumption patterns of energy in society.

2 Bioenergy and renewable opportunities for sustainable transportation

2.1 Advanced biofuels

Advanced biofuels could play an important role in replacing fossil fuels and cutting down emissions, but many biofuels are not fully established because of technical, economical and infrastructural issues. One of the major challenges is the **cost of sustainable biomass and the readiness of economically viable conversion techniques**. Scale effects are essential factors both in biomass production and conversion. Large-scale biomass production requires large areas, which could be challenging. Relying on sustainable biomass with the best agricultural practices like multiple cropping are crucial requirements, whereby even conventional waste conversion processes could be upgraded significantly for better integration with biofuel synthesis processes, allowing higher-value valorisation of the organic feedstock components.

Biogas production from a wide range of waste and residues (agri-residues, organic fraction of municipal waste, sewage sludge, etc.) and upgrading to biomethane has emerged as an great option, available now, for the use as vehicle fuel in transport and for greening the green gas grid. Biomethane can also be used as a feedstock and as an alternative for natural gas to produce a range of bio-based chemicals. Biomethane could also be stored for future use, as Liquefied BioMethane (LBM) or as compressed biomethane (CBM) using the Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) refuelling infrastructure.

It should also be noted that intermediate biomass energy carriers offer an interesting and cost-effective way for storage of energy in combination with green hydrogen (chemically bound to for instance liquid carriers) for both the short as long term.

2.2 Electrification

The power sector already has a high share of renewables [1]. EU-targets aim at increasing electricity use where possible: for example, for electric vehicles in transport. **Bioenergy** can take the role as secure and dispatchable source for power, complementing intermittent renewable sources such as

[1] https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1259

wind and solar contributing to a fossil free power production in Europe while safeguarding the stability of the electric grid and power supply for all citizens.

2.3 Power to X in transport

Power to X technologies allow for decoupling of power from the electricity sector for use in other sectors such as transport. Green hydrogen and synthetic fuels produced from renewables can power sectors that are not suitable for electrification and provide storage to balance variable renewable energy flows. Hydrogen is well-established in applications like advanced biofuel production but also proposed in new areas such as steelmaking or the production of sustainable chemicals and fuels. New networks among incumbent actors, formed around electro-hydrogen, are central to several of these developments. Institutional conditions, a lack of infrastructure and competing technology platforms however constitute challenges that influence the role of pure hydrogen in applications like transport[2].

2.4 CO_2 capture and utilisation

In its Fourth Assessment Report, the IPCC stated that in order to keep global warming below 2°C and avoid most dangerous consequences of climate change, GHG emissions must be reduced by 50-85% by 2050. In short, there is now an urgent need for carbon-negative solutions, i.e. systems that remove CO_2 from the atmosphere. Bio-CCS has already entered the European policy debate: the EU Energy Roadmap 2050[3] not only confirms that "For all fossil fuels, Carbon Capture and Storage will have to be applied from around 2030 onwards in the power sector in order to reach decarbonisation targets", it also recognises that Carbon Capture "combined with biomass could deliver "carbon negative" values".

Both CO_2-capture and utilisation offer interesting opportunities, especially in case it concerns CO_2-from sustainable biomass and in combination with the production of synthetic fuels (using captured CO2 and renewable hydrogen). This is also particularly important considering the EU-wide potential for biogas upgrading to biomethane, where the separated CO2 from biogas in plants of relevant size can be combined with electro-hydrogen to generate further, 100% renewable methane (or other synthetic fuels). In this context it is of paramount importance that this technology pathway – already mature and set to provide consistent contributions to net zero carbon emissions – is adequately supported across Member States to enable further large-scale valorisation of biogas.

In combination with advanced biofuels a comprehensive portfolio for the petrochemical industry is available, facilitating specific interests of the oil majors and member states serving the requirements of flexibility, long term investment perspective (up to 2050 and beyond), scalability, cost-effectiveness, reliability and independency of imports.

2.5 New technologies

It is expected that new technologies and new hybrid combinations will be developed towards 2030. IWG8 will keep a close eye on these new developments that could play a significant contribution toward a carbon neutral Europe in 2050.

3 Challenges

One challenge is to tighten cooperation among stakeholders in the fuel supply, distribution and infrastructure sectors, as well as with the heavy industry and associated investors and shareholders,

[2] https://lup.lub.lu.se/student-papers/search/publication/9017624
[3] https://ec.europa.eu/clima/policies/strategies/2050_en

who will be the main investors towards 2050. Hundreds of billions of Euro´s will need to be invested to green the industry and supply chain, including the (petro)chemical industry.

4 Research, development and commercialisation

IWG8 will focus on the R&D efforts needed for technologies that are still too far away for market implementation and too risky for the industry to invest in. For the lower TRLs the share of public funding will be high, for the higher TRLs the industrial share of financial participation will be higher. IWG8 will strive towards close cooperation with the industry, taking into account the specific interest industry may have. For example, at some stages very promising technologies or/and value chains may offer interesting positions restricting the readiness of industry for open innovation. Public-private partnerships based on mutual added value and trust will be of critical importance for a successful cooperation and cost-effective carbon neutral deployment.

IWG8 strives towards a close cooperation with other IWGs to increase integral and cost-effective approaches and deployment. Monitoring of the critical success and fail factors on the pathway to innovation within the framework of portfolio-management will be crucial. This will be an integral part of the IWG8 working procedures.

Please get in contact with IWG8 to discuss specific questions with regard to bioenergy for transport as well as the synergies with other areas.

Either through the SET4BIO[4] webpage; www.set4bio.eu or directly via info@set4bio.eu

[4] The SET4BIO project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 884524