FRAUNHOFER TWIN TRANSITION SERIES – IMPULSE

»Carbon removals for climate neutrality: A pathway to Europe's decarbonization«

In a nutshell:
- Europe's climate neutrality requires the utilization of all available NETs.
- NET development necessitates R&D funding for groundbreaking projects and a regulatory framework for fast development and optimized infrastructure planning.
- Monitoring, reporting and verification methods and standards for the whole value chain must be implemented.
- NETs need to be an integral part of the renewable energy system, observant to the whole NET value chain and life cycles as well as to the sustainability of biomass.

Negative Emission Technologies (NETs) enable Carbon Dioxide Removals (CDR) from the atmosphere for extended periods, resulting in "negative emissions". The 2023 IPCC Synthesis Report emphasized the importance of negative emissions to limit global warming to well below 2°C or 1.5°C by 2100. Simultaneously, the EU recognizes CDR as essential for climate neutrality in its Green Deal policies, e.g., Union Certification Framework for Carbon Removals (CFCR).

»Negative Emission Technologies (…) would need to be scaled up massively to cover even a modest share of emissions. «
Tiemo Wölken, Member of the European Parliament

The 9th edition of the Fraunhofer Twin Transition Series focused on the challenges and potential associated with NETs, examined their technological readiness and their integration in policy-making processes. Given the wide range of available technologies with varying readiness levels, permanent sink potential, and degrees of impact, Fraunhofer experts emphasized the importance of combining, further developing and deploying NETs. Tiemo Wölken, Shadow rapporteur for the CFCR, highlighted the need for industry cooperation to facilitate a significant upscaling of available technologies and a targeted approach, as there is no "one size fits all" solution to address emissions effectively.

Development and investment in NETs

This webinar discussed Biochar Carbon dioxide Removal (Biochar/BCR), Bioenergy Carbon Capture and Storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS). Peter Schossig (Fraunhofer Institute for Solar Energy Systems ISE) stressed the need for growth rates of NETS to offset positive emissions, surpassing PV growth rates in the past decade. Commercially available technologies from the BECCS ecosystem, as elaborated on by Martin Meiller (Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT), must be enhanced and implemented to fully utilize them in various application areas, such as plant nutrition, building materials or oil and gas recovery. Development and deployment demand a systemic approach to deliver on political goals, such as 30 billion m³ of biomethane by 2030 (REPowerEU) or 50 million tons of annual CO_2 storage capacity (Net Zero Industry Act). This will only be possible with further R&D funding and support for groundbreaking projects, like the Horizon Europe projects NET-Fuels, demonstrating the potential of combining NETs.

European regulatory framework for NETs

Vicki Duscha (Fraunhofer Institute for Systems and Innovation Research ISI) outlined a regulatory framework, which allows for fast NET development by covering i.a.: i) clear definitions of relevant terms; ii) optimized EU-wide infrastructure planning and support for CCUS infrastructure build-up; iii) clear strategy at EU and national level; and iv) viable business models. Options such as the use of negative emission certificates for compliance under the EU ETS and ESR should be explored and a better incentive structure for carbon cycles under the EU ETS are needed. Monitoring, reporting and verification methods and standards are key to the economic and ecological success of NETs, e.g., sink standards to ensure quality.

»Standards for evaluating sustainability of biomass and accounting of biomass related GHG emissions are central. «
Saskia Kühnhold-Pospischil, Fraunhofer ISE

Tiemo Wölken raised concerns about the current definition of sustainable biomass in the Renewable Energy Directive, suggesting that it may have unintended consequences for emission compensation potential. Saskia Kühnhold-Pospischil (Fraunhofer ISE) and Martin Meiller underscored that biomass as a valuable, limited resource needs to be used in a smart, efficient, and circular approach based on residuals. Taking a holistic approach through life-cycle assessments will evaluate the environmental footprints of NETs and their final CO_2 sink capacity.

NETs in the renewable energy system

As BECCS, BCR and DACCS produce or require electricity and heat, their role needs to be understood and defined, resulting in their effective integration into the future renewable energy system. Fraunhofer experts model energy systems to optimize development, technology trends and sector-coupling strategies (REMod model), thus supporting evidence-based decision-making.

Overcoming challenges and fragmentation in the NETs ecosystem requires political support and industrial commitment as well as investment in research and innovation activities to close research gaps, develop a common understanding and deploy viable technologies and business models.