

IEA BIOENERGY TECHNOLOGY COLLABORATION PROGRAMME (IEA BIOENERGY TCP)

STRATEGIC PLAN 2025-2030

Introduction: Originally established in 1978, the IEA Bioenergy TCP is the leading global network on research and implementation of bioenergy, with 24 members across five continents.

Vision of IEA Bioenergy: IEA Bioenergy's vision is that modern bioenergy is, and will continue to be, an essential source of renewable energy, making an important contribution to energy security and achieving international climate goals. Bioenergy is an integral part of developments towards a clean energy system and a circular biobased economy. By accelerating the sustainable production and efficient use of biomass, the contribution to the Sustainable Development Goals will be optimized. This will result in more cost-competitive bioenergy and other bio-based applications; and reduced, or even net-negative, greenhouse gas emissions; while respecting planetary boundaries. As an authoritative voice on sustainable bioenergy, IEA Bioenergy supports the fulfilment of this vision by providing scientific facts and analysis backed by experts and scientists from all over the globe.

Context for Strategic Plan: Modern bioenergy is the main source of renewable energy today, and it is one of the main pillars of the energy transition, playing a key role in all sectors (heat, power, industry and transport). In the IEA Net Zero Emissions by 2050 Roadmap (NZE), bioenergy meets between 15% and 20% of total energy needs. This implies that modern bioenergy would need to triple from now to 2050, while at the same time traditional (inefficient and high-polluting) uses of biomass are phased out.

The importance of bioenergy can be explained by the following key features of this energy source: it is readily available and applicable in all energy sectors (electricity, direct heat, transport). Solid, gaseous and liquid bioenergy carriers can be easily integrated with existing infrastructure; they are storable and dispatchable and can therefore support the expansion of intermittent renewables. Moreover, bioenergy combined with CO₂ capture and storage (BECCS) can enable carbon dioxide removal (CDR) from the atmosphere. The captured CO₂ could also be utilized, e.g., in the production of food, e-fuels and chemicals. Bioenergy is also an integral part of a circular biobased economy, often valorising the waste or residues of other biobased production processes and of agricultural and environmental practices.

If good governance is in place, modern, sustainable bioenergy can contribute significantly to a number of Sustainable Development Goals and Targets in addition to climate change mitigation / climate action (SDG 13), e.g., the provision of good health and well-being (SDG3), clean water and sanitation (SDG6), affordable and sustainable energy (SDG 7), economic development and growth (SDG 8), technological progress and promoting sustainable industries (SDG 9), resource-use efficiency (SDG 12) and life on land (SDG15).

To enable the necessary acceleration in the deployment of modern bioenergy technologies across all sectors, a number of barriers (technology, economic, logistics and policy-related) need to be removed. This needs to be coupled with stronger demand policies, diversifying supply chains and expanding advanced biofuels.

Strategic Objectives of the Plan: Given the context described above and following an extensive consultation process among ExCo Representatives and Task Leaders, a set of Strategic Objectives (SOs) and related Priority Research Areas (PRAs) were identified.

The Strategic Objectives of the IEA Bioenergy TCP for the 2025-2030 Term are to realize our Vision by:

- 1. Providing science-based information to support technology innovation, policy development and deployment.**
- 2. Improving understanding of key features of sustainability in bioenergy systems, including biomass resources, biodiversity linkages, climate effects, and socio-economic impacts, such as contribution to local energy security.**
- 3. Exploring synergies of sustainable bioenergy systems with other clean energy technologies and bio-based sectors.**
- 4. Demonstrating how sustainable bioenergy, within the broader circular economy, can contribute to international climate targets and other Sustainable Development Goals.**

The development of these SOs and PRAs was informed by the following key documents: the Paris climate accord within the United Nations Framework Convention on Climate Change (UNFCCC), the UN Sustainable Development Goals, the IEA *Technology Roadmap: Delivering Sustainable Bioenergy* (2017), and the IEA *Net Zero Emissions by 2050: A Roadmap for the Global Energy Sector* (2023). In addition, the following drivers were taken into account in the preparation of the Strategic Plan: the continuing importance of the security of energy supply, sustainable economic development, and the deployment of modern renewable energy in emerging and developing economies.

The IEA Bioenergy TCP intends to strengthen its role as an authoritative voice on sustainable bioenergy, by further increasing its communication efforts (via webinars, press releases, website, social media, etc.), thus maximizing the impacts of its dissemination and outreach to policy makers, decision makers, and the wider stakeholder community, across its member countries and beyond. We will engage relevant stakeholders in a dialogue to help shape the actions of the TCP. We will further strengthen our collaboration with other TCPs (e.g., AMF, Hydrogen, ETSAP, IETS, etc.), especially in the context of the TCP Coordination Groups, and with international organizations (e.g., FAO, UNIDO, Global Bioenergy Partnership, CEM Biofuture Platform Initiative, Mission Innovation, etc.). We will also expand our outreach to emerging and developing countries.

Priority Research Areas: Under the four Strategic Objectives listed above, a set of Priority Research Areas has been identified, namely:

1. **Biomass Supply:** we will be working on sustainable biomass availability and its link to sustainable landscape management, restoration of degraded and contaminated lands, biomass mobilisation and setting up supply chains. Relevant actors are in the fields of waste management, agriculture and forestry, aquaculture, environmental protection, etc.
2. **Conversion Technologies:** we will focus on advanced technologies that are capable of using a broader range of feedstocks; in terms of conversion technologies, we aim for a further reduction of the carbon footprint and emissions of pollutants, as well as an increase of the cost-efficiency, through efficiency improvements, biorefining technologies, carbon capture, integration with renewable hydrogen, hybrid concepts with wind and solar, etc. Relevant actors are biofuel producers, bioenergy industries and research institutions.
3. **Markets and Deployment:** in order to stimulate the deployment of sustainable bioenergy options in the energy transition, we aim to: analyse barriers/problems faced by industrial actors and how these can be mitigated; show opportunities of bioenergy solutions in different markets (heat, power, gas, transport fuel markets, but also biobased chemicals and products); and support the deployment of (close to) market-ready technologies. We will also consider how sustainability can be safeguarded through market mechanisms. Relevant actors are biofuel / bioenergy industries, energy suppliers and end-use sectors, policy makers, financing institutions, etc.
4. **System aspects:** we will consider methods and quantify impacts of bioenergy at the system level, such as GHG emissions, carbon management and climate impact, land and water use, biodiversity, socio-economics or the resilience of the energy system, including energy system integration and flexibility. This will show conditions for bioenergy to provide a sustainable solution, and to maximize its system-level positive impacts. Relevant actors are policy makers, research institutions, civil society, the general public, biofuel / bioenergy industries, energy suppliers and end-use sectors, etc.

The work programme of the IEA Bioenergy TCP is delivered through Tasks, which are well-established networks of world-leading experts. They work in three-year periods and regularly revise their work programmes to deliver on the Strategic Objectives and contribute to one or more of the Priority Research Areas. The work programme for the new triennium starting 2025 is currently under development.

Outcome of Strategic Plan: Fulfilling the Objectives of the Strategic Plan will result in increased knowledge and understanding of bioenergy systems, as part of clean energy portfolios and of the circular biobased economy. This will support informed, evidence-based decision-making at both policy and investment levels, facilitating the commercialisation and market deployment of environmentally sound, socially acceptable, and cost-competitive, low-carbon bioenergy systems and technologies. The contribution of modern bioenergy to climate change mitigation, economic development, energy security and sustainable development more broadly will thus be maximised.