# Executive summary

This report focuses on relieving pressures on land from agriculture and forestry by enlarging the bioeconomy to include alternative sources of bio-based carbon to complement biomass. In climate policy, most attention and resources has gone into energy and transportation, while much less attention has been given to industry. Yet, reaching net-zero greenhouse gas (GHG) emissions by 2050 requires the action of all countries and all sectors. The IPCC has warned that unless deep greenhouse gas (GHG) emissions cuts occur within the coming decades, limiting global warming to well below 2°C or 1.5°C, as stated in the Paris Agreement, will not be possible.

Energy and transportation can be decarbonised through electrification. Decarbonisation can also happen with hydrogen as a renewable energy carrier, one which can be stored more easily than electricity. For many industrial sectors, however, the term 'decarbonisation' can be misleading: industries such as plastics, cement and chemicals cannot do without carbon. In addition, aviation, maritime, and off-road transport have no immediate pathways to net-zero other than sustainable, carbon-based liquid fuels.

In this respect, 'defossilisation' would be a more appropriate term, which implies leaving fossil reserves in the ground and exploiting other sources of carbon. This mirrors the 'renewable carbon' concept which "*entails all carbon sources that avoid or substitute the use of any additional fossil carbon from the geosphere*". Renewable carbon can circulate between biosphere, atmosphere or technosphere, creating a circular carbon economy.

## Main policy messages

### *Public policies that balance GHG reduction goals with other sustainability priorities can help meet the demand for sustainable carbon-based products*

Carbon from sustainably grown biomass has an important role to play in meeting net-zero targets. However, this carbon source is insufficient to meet the likely demand for carbon-based fuels, chemicals and materials even in a highly electrified future. It is vital that all sustainable carbon sources including waste solids and gas are considered and appropriately incentivised.

### *Selection criteria should go beyond innovation excellence*

Granting and public investment bodies need to judge the economic realism and impact potential of renewable carbon projects. Selection criteria have to go beyond excellence of science and engineering to include techno-economic assessments, technology maturity, social impact assessment and environmental credentials (not just GHG emissions reduction).

### *De-risk private investments in technology maturation*

Many OECD countries' innovation strategies rely on private investments to complement public investments. This may be accomplished through public financial support to de-risk private investments in demonstration projects, including via novel public-private financing mechanisms.

### *Public policies can help building markets for renewable carbon*

Public supply-side investments to build the new infrastructure are not enough if market conditions are not favourable. Competing with fossil-derived products is difficult in a world without full carbon pricing. Exemplar options for demand-side and regulatory policy include public procurement, production mandates, incentives, and setting new technical and business standards in the marketplace.

### *Innovation policies may benefit from sequencing*

Innovation policies will be most effective if implemented in a logical order. A jumble of policies without direction and a progression path invites confusion. Hence, carbon management policies should be sequenced to optimise the effectiveness of each and all policy elements.

### *Policies can stimulate multi- and interdisciplinarity and hybrid technologies*

Hybrid processes that involve multiple technologies can be more carbon, energy, and cost-efficient than single technologies. This complexity can be a challenge for government agencies responsible for grants and investments.

### *Technology deployment may benefit from industrial symbiosis*

Industrial symbiosis can assume many functions, notably energy optimisation, reducing overall cost, and supporting the interplay between multiple applications of the same feedstock, reducing resource as well as business risk in the whole supply chain.

### *Policies should address opportunities across sectors*

Because the driver of the policies supporting biofuels are similar to the driver for sustainable chemicals and materials, similar structures should apply to sustainable carbon resources regardless of end use sector. To achieve that, reliable calculations of GHG reductions for materials and chemicals are needed.

### *Complexity sets the scene for policy dilemmas and unintended consequences*

For policy makers, the questions posed and the policy dilemmas are complicated and will inevitably result in compromises and trade-offs, and potentially unintended consequences.

### *Advancing climate and sustainability goals while maintaining a focus on living standards*

Combining fossil fuel subsidy reform with a realistic carbon price, or consistent and well-designed incentives, are the ways to encourage investment in renewable carbon technologies. Meanwhile, in order to address potential social dilemmas, there is a need to include meaningful, deliberative public dialogue.

## Holistic policy formulation and implementation

Without a holistic approach and understanding of the complex interactions of technologies, value chains, etc., innovation policies may fail. With this in mind, a holistic policy framework has been designed for this report. It may help policy makers construct a strategy connecting supply- and demand-side drivers, and sequence policy implementation. Specifically, this matrix may guide different ministries and agencies as to when and where they need to engage.

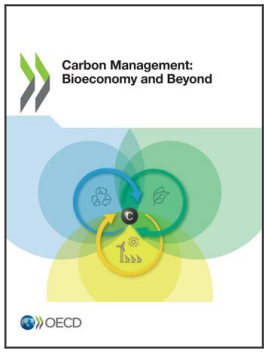
## Case studies revealed hybrid technology approaches

This report reflects learning from a series of workshops and 16 case studies. Most of the case studies are not reliant on a single technology and typically illustrate the interplay of chemical and biotechnological solutions. This demonstrates the importance of a multi-disciplinary approach in innovation policies for carbon management.

Some of the case studies address the industries that are considered to be the hardest to abate, in particular chemicals, cement, steel and aviation.

Renewable energy is frequently used as the energy source, and several of the countries that submitted case studies are planning for hydrogen to fuel these technologies. Thereby, the net-zero carbon future will go hand in hand with hydrogen, resulting in the need for high levels of investment in both manufacturing and energy technologies.

Biomass features in thirteen case studies, either directly or indirectly. Meanwhile, alternative feedstocks like waste gases and chemically recycled plastics are being developed to complement biomass as sources of renewable carbon.




From:
**Carbon Management: Bioeconomy and Beyond**

**Access the complete publication at:**
https://doi.org/10.1787/b5ace135-en

**Please cite this chapter as:**

OECD (2023), "Executive summary", in *Carbon Management: Bioeconomy and Beyond*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/92beb7cb-en