

The Executive Summary of the Decarbonisation Roadmap for Bitumen



This document has been developed through a joint work between Eurobitume and Deloitte. Deloitte has supported Eurobitume in developing a transparent decarbonisation pathway for bitumen production in Europe, targeting emissions reduction by 2050 with interim milestones for 2030 and 2040. This roadmap is part of Eurobitume’s integrated Sustainability Roadmap initiative. The findings, interpretations and conclusions expressed herein are a result of a collaborative process facilitated and endorsed by Eurobitume but whose results do not necessarily represent the views of the entirety of its members, partners or other stakeholders.

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List of Acronyms

CCS	Carbon Capture and Storage
CH ₄	Methane
CO ₂	Carbon Dioxide
CO ₂ eq.	Carbon Dioxide Equivalent
EAPA	European Asphalt Pavement Association
EPD	Environmental Product Declarations
EU-ETS	EU Emissions Trading System
GHG	Greenhouse Gas
GWP	Global Warming Potential
HFO	Heavy Fuel Oil
IEA	International Energy Agency
LDAR	Leak Detection and Repair
LNG	Liquefied Natural Gas
OGMP	Oil and Gas Methane Partnership
VRU	Vapor Recovery Units

Executive Summary

This report presents a comprehensive decarbonisation roadmap demonstrating how the European bitumen industry can achieve substantial emission reductions by 2050. This roadmap reflects a data-driven approach across the entire bitumen supply chain, from crude oil extraction through to refinery gate. Rather than focusing on absolute sectoral emissions reductions, which would be highly sensitive to production volume assumptions, the roadmap is structured around emission intensity per tonne of bitumen (kg CO₂ eq. per tonne bitumen).

The analysis reveals that the cradle-to-gate carbon intensity of bitumen produced in Europe can decline by 73 % between 1990 and 2050, from 823 kg CO₂ eq. per tonne in 1990 to 223 kg CO₂ eq. per tonne in 2050. While this represents significant progress toward European climate neutrality, the projected reductions do not yet achieve net-zero emissions or full alignment with Paris Agreement targets, underscoring the need of continued innovation, supportive policy frameworks, and collaborative action to close the remaining decarbonisation gap.

The roadmap identifies specific interventions for each stage of the supply chain, recognising that success requires coordinated action across multiple fronts rather than dependence on any single breakthrough technology. Figure 1 shows the relative contributions of each supply chain step for reducing emission intensity for one tonne bitumen produced in Europe between 2023 and 2050.

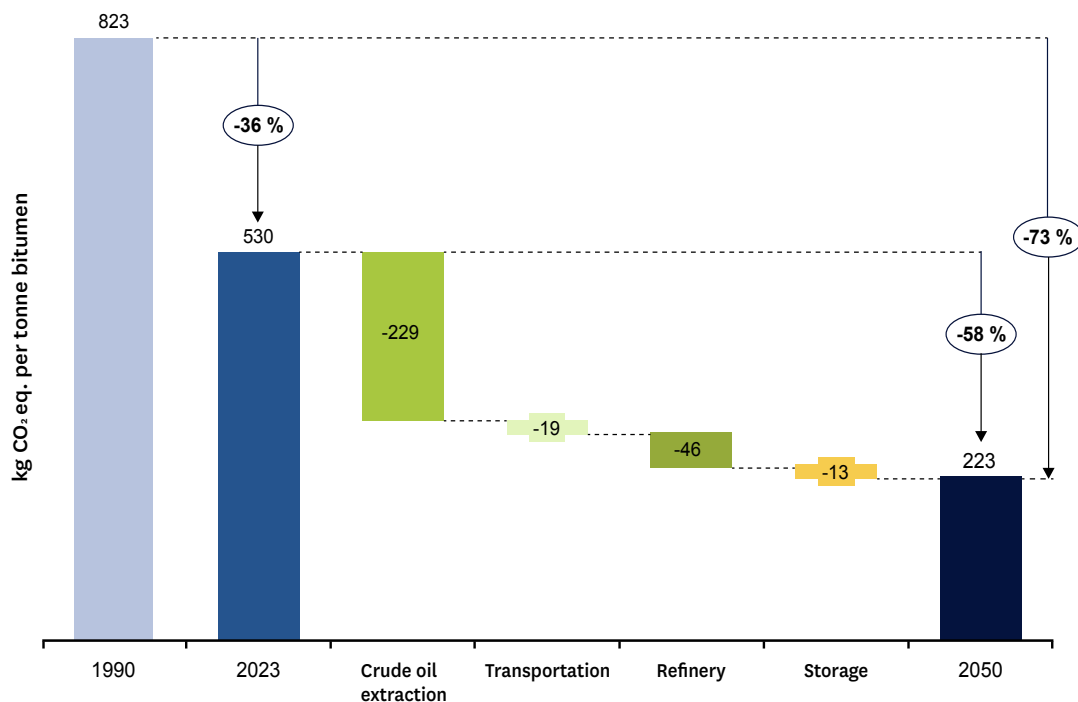


Figure 1. Emissions reductions by step in bitumen's cradle-to-gate supply chain towards 2050

Crude oil extraction can achieve a 75 % reduction in emission intensity from 1990 to 2050. The primary lever is electrification of auxiliary equipment such as pumps and compressors, which can reduce both carbon dioxide (CO₂) and methane (CH₄, i.e., avoiding “bleed”) emissions. Implementation of vapour recovery units, gas utilisation technologies, blowdown capture systems, and replacement of gas-venting pumps and controllers with instrument air systems can capture otherwise vented emissions. Leak detection programmes, including the use of infrared cameras and monitoring systems, accelerate the identification and repair of fugitive leaks. Improved flaring practices contribute additional gains. Carbon capture and storage technologies provide a supplementary pathway for addressing residual CO₂ emissions. It is important to acknowledge that bitumen producers exercise limited operational control over crude oil extraction. Nonetheless, the industry can support these improvements through supplier engagement and collaboration with upstream operators.

Crude oil transportation can achieve a 79 % reduction in CO₂ emissions intensity by 2050. The dominant lever is the adoption of alternative fuels for ship propulsion, which drives most of the transportation emissions reduction potential. This includes switching from heavy fuel oil (HFO) to liquefied natural gas, as well as replacing fossil fuels with low-carbon fuels such as green hydrogen, methanol, and ammonia. The latter is contingent on the development of sufficient supply and supporting infrastructure. Hybrid propulsion systems for deep-sea tankers provide additional but more modest contributions. In addition, a minor reduction is foreseen related to electrification of pipeline operations, due to limited applicability (i.e., regions with established infrastructure) and limited relative contribution of pipelines to transport emissions. As mentioned above, European bitumen producers exercise limited operational control over transportation.

Refinery operations can achieve a 61 % reduction in CO₂ emission intensity by 2050, though decarbonisation pathways vary materially depending on refinery configuration, complexity, and local infrastructure conditions. The dominant lever is associated with general improvements of process efficiency, including optimisation of heat recovery systems, process integration, and operational improvements, which are tailored to each refinery’s specific configuration. Other key levers focus on fuel substitution, through either electrification of furnaces or using low-carbon fuels. These are the main levers where bitumen producers have the most direct impact. Both are considered long-term initiatives that need increased maturity of both technology and markets. Some emission reductions could still be achieved by transitioning from HFO to natural gas. Carbon capture and storage technologies address residual emissions that cannot be eliminated through efficiency or fuel switching.

Bitumen storage can achieve a 51 % reduction in CO₂ emission intensity by 2050 through process efficiency measures (e.g., reduced storage temperature) and electrification of storage heating. Replacing fossil-fuel-fired heaters with electric systems powered by low-carbon electricity is the key decarbonisation lever within the bitumen storage stage where bitumen producers have direct control.

The roadmap is not prescriptive but represents a collective realistic but ambitious objective for the European bitumen industry, recognising that individual actors within the supply chain will have different starting points and opportunities depending on their current processes, technologies, and geographic location. Furthermore, many of the most significant emissions reductions occur at stages of the supply chain where bitumen producers exercise limited direct control. Achieving the full potential of this roadmap therefore requires collaboration across the entire supply chain, including engagement with crude oil producers, shipping companies, refinery operators, and regulatory authorities.

This collaborative approach reflects the reality that climate action in complex global supply chains cannot be achieved through unilateral action.

Regulatory implementation is the linchpin of this roadmap's success. Without clear, consistent, and supportive regulatory frameworks, the decarbonisation measures outlined herein will remain insufficient to achieve the projected reductions. Beyond this critical foundation, the successful implementation of this roadmap depends on several external enablers that are beyond the direct control of bitumen producers. The potential of several measures will be dependent on the availability of sufficient low-carbon supply (e.g., low-carbon electricity, biomass, low-carbon fuels) and supporting infrastructure (e.g., electricity grid, pipeline connections). In addition, the industrial investments will only be realistic if policy makers provide sufficient supporting measures to create demand for low-carbon products, incentivize and derisk adoption of low-carbon technologies.

Importantly, this roadmap focuses exclusively on cradle-to-gate emission intensity and does not assess the full life-cycle climate performance of bitumen-based infrastructure. While decarbonising bitumen production is a necessary foundation, it is not sufficient on its own to minimise the overall climate impact of roads and other applications. Meaningful assessment of climate performance ultimately requires a life-cycle- and performance-based perspective at infrastructure level, accounting for service life, maintenance strategies, material efficiency, and end-of-life practices.

[Find the full report here](#)

Eurobitume

Avenue des Nerviens 85

1040 Brussels

Belgium

info@eurobitume.eu



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