frontier economics

POWERING THE LOW-CARBON ECONOMY: HOW AMAZON'S INVESTMENTS BOOST EUROPE'S GROWTH AND COMPETITIVENESS

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1 Executive summary

Europe has set some of the most ambitious climate and energy targets globally. Under the European Climate Law, the European Union (EU) is committed to reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels and achieving climate neutrality by 2050. These objectives are reinforced by sector-specific measures, including the Renewable Energy Directive (raising the 2030 renewables target to at least 42.5%), mandates for sustainable aviation and maritime fuels, binding CO_2 standards for vehicles, and accelerated deployment targets for electric vehicles and charging infrastructure. The UK has adopted similarly ambitious targets, including a legally binding net zero goal by 2050 and a zero-emission vehicle mandate.

Meeting these targets calls for rapid scaling of new technologies, large volumes of private investment, industrial adaptation and coordinated action across supply chains. For European industry, this transition presents both a structural challenge and a significant economic opportunity: to innovate, manufacture and deploy low-carbon technologies at scale.

This report, commissioned by Amazon and produced by Frontier Economics, provides independent analysis of the economic impact of Amazon's investments and initiatives aimed at reducing the carbon emissions generated by its own operations in Europe, and to support decarbonisation of the value chains in which Amazon operates.

Amazon's low-carbon investments in Europe represent a material contribution to Europe's transition. Through large-scale renewable energy procurement, electrification of transport, circular packaging innovation and early-stage climate technology investment, Amazon is contributing to Europe's decarbonisation pathway while supporting competitiveness and industrial development. Between 2021 and 2025, we estimate that Amazon invested between €14 and €17.5 billion in low-carbon technologies and solutions across energy, transportation and packaging in Europe (including the EU and the UK).

These investments are expected to support significant employment and gross value added (GVA) – with some of these impacts already tangible on the ground, while others will materialise over the next few years as investment projects are delivered, supply chains respond and assets become operational. In Germany, France, Italy, Spain and the UK, our modelling estimates that Amazon's low-carbon investments are expected to support between c. 80,000 and 102,000 jobs and contribute between c. €6.3 billion and €8 billion in GVA to the economy.

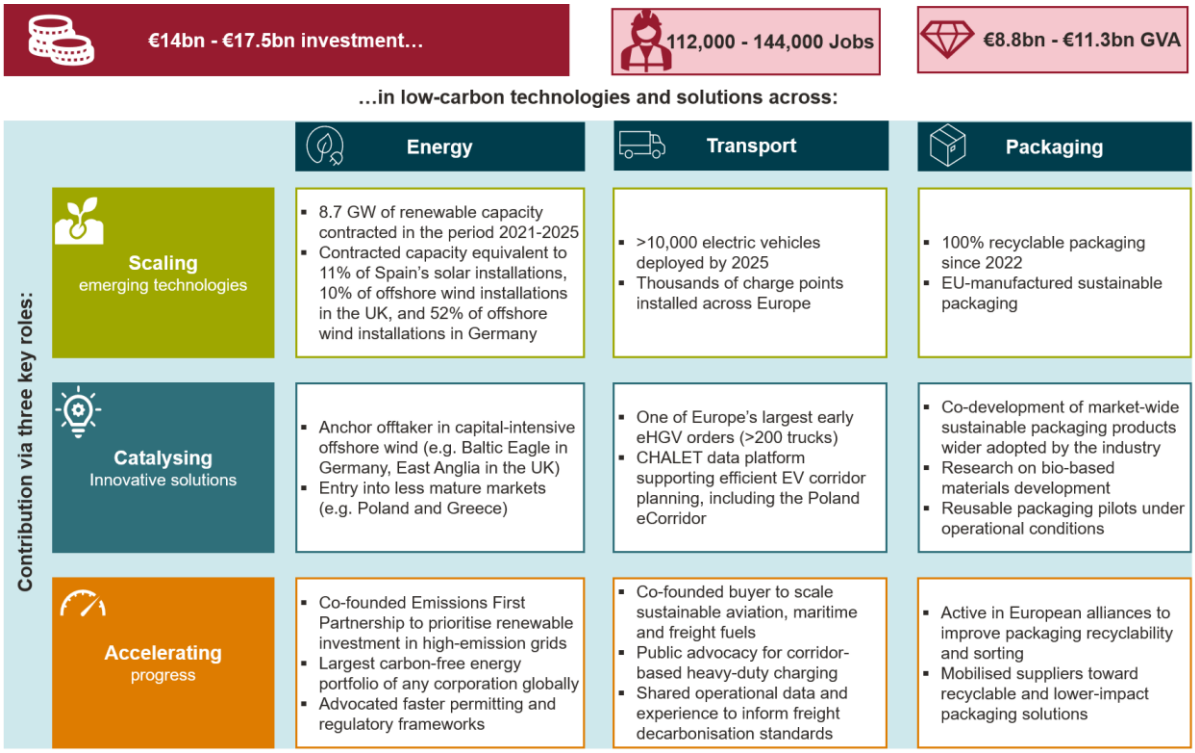
Beyond these five countries, Amazon's activities are linked to broader European supply chains. While impacts outside the core countries have not been modelled with the same level of granularity, indicative analysis suggests that the cumulative impact across the EU and UK could be substantially larger, potentially amounting to between c. €8.8bn and €11.3bn in GVA and supporting 112,000 to 144,000 jobs across Europe.

These outcomes reflect more than capital deployment alone. They stem from how Amazon combines scale, early deployment and coordination to shape markets and enable decarbonisation across sectors. Amazon plays three complementary roles that help deliver competitiveness and decarbonisation across Europe and that go beyond a "business as usual" contribution:

1. **scaling** emerging low-carbon technologies by creating sustained demand and reducing market risk;
2. **catalysing** technologies by enabling innovation and early deployment of cutting-edge decarbonisation solutions; and
3. **accelerating** progress through leadership, alliances and policy engagement.

Across these roles, Amazon's impact stems from the combination of scale, early deployment and coordination, which together support value creation, employment and operational learning across European low-carbon supply chains. These impacts are summarised in Figure 1 below, discussed briefly here and in detail in the main report.

Figure 1 Amazon's impact on Europe's low-carbon economy (2021-2025)



Source: Frontier Economics

1.1 Scaling low-carbon solutions through sustained demand at scale

Amazon's scale and long-term procurement commitments have played a material role in accelerating the deployment of low-carbon technologies across Europe. Across energy, transport and packaging, Amazon's impact reflects the credibility and persistence of its demand, which has reduced market and financing risk for suppliers, supported investment decisions and generated spillover benefits across European low-carbon supply chains.

1.1.1 Scaling renewable electricity generation

Amazon's long-term power purchase agreements (PPAs) have increased revenue certainty and reduced financing risk for renewable energy developers. Under these agreements, Amazon commits to purchasing electricity from a renewable energy project at an agreed price over a defined period, which in turn provides developers (such as Iberdrola, Engie, Scottish Power or Ørsted) with the predictable income needed to secure financing and proceed with construction. Between 2021 and 2025, Amazon contracted over 8.7 GW of new renewable capacity in Europe. To put this into context, the renewable capacity contracted by Amazon in Spain between 2021 and 2025 is equivalent to around 11% of total solar capacity installed and 7% of total onshore wind capacity installed in the country over the same period. Similarly, in Germany, the offshore wind capacity contracted by Amazon is equivalent to around 52% of new offshore wind capacity installed over 2021-2025.

1.1.2 Scaling low-carbon transport

At the end of 2025, Amazon and its delivery partners had more than 10,000 electric delivery vans in their fleet across Europe. To enable electrification at scale, Amazon has invested in charging infrastructure across fulfilment centres and logistics sites. Infrastructure and software providers such as Spirii reported that Amazon's multi-country deployments had accelerated the development of scalable operational processes, platform capabilities and installer networks, which are now reused across other fleet and corporate customers.

1.1.3 Scaling sustainable packaging solutions

Amazon's large-scale procurement of recyclable and paper-based packaging, underpinned by its commitment to 100% recyclable packaging since 2022, has provided suppliers with predictable, long-term demand. This has supported investment in new production technologies and capacity, with packaging suppliers such as Mondi reporting that working at Amazon's scale incentivises continued investment in innovation, production processes and manufacturing capabilities.

1.2 Amazon as a catalyst for early deployment of low-carbon solutions

Amazon has acted as a catalyst for the early deployment of low-carbon solutions in contexts where alternative routes to market were limited or immature. Evidence of this role is observed most clearly in renewable energy PPAs, middle-mile transport electrification and packaging innovation.

1.2.1 Catalysing renewable electricity deployment through anchor PPAs

Amazon has played a catalytic role in European renewable electricity markets by acting as an anchor offtaker in PPAs that enabled projects to reach deployment. Examples include offshore wind projects such as Baltic Eagle in Germany (with a total capacity of 476 MW, where Amazon's offtake is 40%) and East Anglia in the UK (with a total capacity of 1,397 MW, where Amazon's offtake is 11%). In Ireland, Amazon's 91.2 MW Donegal wind farm PPA was an early landmark in the corporate PPA market: it was the first unsubsidised corporate PPA project in Ireland, supporting Amazon Web Services (AWS) infrastructure and being developed without public subsidy or cost to Irish energy consumers. Amazon was also the sole offtaker of large-scale wind projects in Greece such as Vermio (292 MW) and Mesokorfi and Koukouras (67 MW) and of some of the first wind and solar PPAs in Poland such as Milkowice (87 MW), Jastrowie (30 MW) and Okonek (22.8 MW). This has supported projects led by smaller or less experienced developers in markets where long-term renewable energy contracts are still relatively new.

1.2.2 Catalysing electrification middle-mile transport operations

Amazon has acted as an early mover in the electrification of middle-mile transport.[1] This is a segment characterised by high upfront costs, limited vehicle availability and underdeveloped charging infrastructure. Amazon has placed one of the largest orders of Mercedes-Benz battery electric trucks in Europe to date, ordering 202 vehicles from Daimler Truck. Such orders provide an early demand signal to manufacturers that this market is viable and contribute to the electrification of this transport segment.

Amazon has complemented vehicle deployment with early investment in enabling infrastructure, data and deployment models to accelerate heavy-duty electrification. This includes CHALET, an open-source platform that aggregates and anonymises carrier data to support efficient planning of charging infrastructure for commercial vehicles, as well as the Poland eCorridor, a deployment-focused pilot planned for 2027 launch with Smart Freight Centre.

[1] Amazon's middle-mile is the transportation of products between its own warehouses and logistics facilities, before packages reach local delivery stations for final delivery to customers.

Catalysing new low-carbon freight investment

In Poland, Amazon is helping establish the eCorridor – a multi-stakeholder initiative to lower carbon emissions in heavy-duty freight transport, delivered in collaboration with PragmaCharge, the Smart Freight Centre and the Polish New Mobility Association. The eCorridor is designed to combine electric truck leasing, public charging infrastructure along high-volume freight routes and coordinated demand from carriers operating on Amazon's network to generate real-world operational data and reduce financial risk for those transitioning to battery electric vehicles. Charging hub locations across Poland were identified using Amazon's open-source CHALET tool (Charging Location for Electric Trucks), which applies logistics demand modelling to prioritise where infrastructure should be built – supporting more efficient planning not only for Amazon's own operations but for the wider freight industry.

1.2.3 Catalysing packaging innovation and sustainable materials

Amazon has been at the forefront of packaging innovation, helping to reduce the need for additional packaging, investing in right-size packaging technologies where it is required and leading the transition from single-use plastic to paper. A key element of this approach is Ships in Product Packaging (SIPP), through which eligible items are shipped in the original manufacturer's packaging with only a customer address label added. Where product integrity can be maintained, avoiding additional packaging altogether reduces material use, lowers shipment weight, reduces recycling needs for customers and can contribute to lower delivery emissions per package as more packages per vehicle mean fewer trucks on the road.

Alongside SIPP, Amazon has helped establish paper as a scalable alternative to plastic in e-commerce packaging. Working with packaging specialists such as Mondi, Amazon co-developed new paper-based packaging products which are now widely used across the market. One example of this is a recyclable paper-padded envelope with integrated cushioning that replaces traditional plastic bubble packaging for online deliveries.

Alongside this, Amazon is continuing to invest in forward-looking research and innovation in sustainable packaging materials. Material suppliers such as Novamont highlighted that Amazon's technical input and testing capabilities had accelerated the development of bio-based and compostable materials, helping solutions reach commercial readiness sooner than would otherwise have been the case.

Amazon has deployed technologies to identify and select the most efficient, sustainable and appropriate container for an item to minimise waste while ensuring that product quality and safety are maintained. These technologies include AI-enabled tools such as the Packaging Decision Engine. Together, these initiatives have reduced cardboard box use, lowered packaging weights and enabled the scalable deployment of lighter, recyclable packaging

solutions that have subsequently influenced wider industry practices. Today, more than 50% of Amazon's European shipments come in reduced, recyclable delivery packaging, including a paper bag, cardboard envelope or no added packaging at all. Since 2015, Amazon's packaging programmes have avoided more than 4 million metric tonnes of packaging materials globally.

1.2.4 Investment in research and development (R&D)

Amazon has also played a catalytic role in supporting early-stage climate innovation through the Climate Pledge Fund, its dedicated venture investment fund to back companies developing low-carbon technologies.[2] In Europe, the fund has invested tens of millions of euros in European start-ups including 14Trees (Switzerland), Sunfire (Germany) in green hydrogen, Paebbl (Netherlands) in carbon mineralisation, CMC Machinery (Italy) in automated packaging technologies and Redwood Materials, which operates a major battery-recycling facility in Germany. These investments have accelerated the deployment of practical low-carbon solutions across Europe by helping young companies test, refine and scale their technologies more quickly.

In parallel, through the Amazon Sustainability Accelerator, Amazon has supported start-ups such as HT Materials Science (Republic of Ireland), which helps reduce heating and cooling energy requirements in fulfilment centres, and reusable packaging innovator Re-Zip (Denmark), which tested reusable cardboard boxes for customer orders across Europe.

1.3 Accelerating decarbonisation progress through leadership, alliances and policy engagement

Beyond its own investments, Amazon has accelerated progress in decarbonising energy, transport and packaging sectors across Europe, by shaping enabling conditions and reducing coordination challenges such as fragmented demand and regulatory gaps. Through collective initiatives, technical engagement and policy advocacy, Amazon can use its size and credibility in the low-carbon transition to strengthen demand signals, improve standards and accelerate progress in areas where individual firm-level action alone is insufficient.

1.3.1 Aggregating pre-commercial demand to unlock investment in hard-to-abate sectors

Amazon participates in buyers' alliances that provide clearer demand signals to producers and investors, reducing first-mover risk and increasing revenue certainty for suppliers. For

[2] The Climate Pledge is a global corporate initiative co-founded by Amazon and Global Optimism in 2019. Signatory companies commit to reaching net zero carbon by 2040 – ten years ahead of the Paris Agreement – and collaborate to accelerate decarbonisation across sectors. The Climate Pledge Fund is Amazon's investment vehicle supporting companies whose technologies can help deliver that transition.

instance, Amazon co-founded the Sustainable Aviation Buyers Alliance (SABA), which aligns corporate demand for sustainable aviation fuel, and the Sustainable Freight Buyers Alliance (SFBA), which coordinates demand for electric vans, battery electric trucks and charging infrastructure.

1.3.2 Shaping standards, accounting frameworks and implementation rules

Amazon has engaged in cross-sector alliances to support the development and refinement of system-level frameworks, standards and technical approaches. In energy, Amazon has co-founded initiatives such as the Emissions First Partnership to support the development of procurement and accounting approaches that place greater emphasis on renewable investment in carbon-intensive grids. Amazon is also a signatory of the Climate Neutral Data Centre Pact, a self-regulatory initiative launched in Europe focused on establishing measurable targets for data centres to achieve climate neutrality.

In packaging, Amazon has contributed to collaborative efforts focused on recyclability, sorting and circular design, such as 4evergreen or CEFLEX. Through these platforms Amazon shares technical and operational expertise with policymakers and industry peers.

In transport, Amazon engages in buyer- and data-led collaborations such as the Global Logistics Emissions Council and the First Movers Coalition, sharing data and operational experience from fleet electrification and alternative fuels to inform wider freight decarbonisation efforts.

1.3.3 Advocating for enabling infrastructure and regulatory frameworks

Amazon has complemented its operational investments with policy engagement and joint public advocacy to address systemic barriers to decarbonisation.

In transport, for example, Amazon has publicly advocated for corridor-based charging infrastructure for battery electric trucks alongside Daimler Truck, Scania and Volvo, calling for "needle-moving targets"[3] under the Alternative Fuel Infrastructure Regulation.[4] Amazon has also supported regulatory frameworks for sustainable fuels, including ReFuelEU Aviation and FuelEU Maritime, and initiatives to reduce non-financial barriers to renewable deployment, such as faster permitting.

In energy, for example, Amazon has collaborated with WindEurope and Accenture to develop digital tools to accelerate the permitting process for new wind farms. Amazon also collaborates with other industry associations such as SolarPower Europe and Eurelectric, and it has

[3] 2022, The Parliament Magazine, *Parliament is at a crossroad and should stand for ambitious charging infrastructure targets*

[4] The Alternative Fuels Infrastructure Regulation is an EU regulation establishing minimum targets for the deployment of charging and refuelling infrastructure for zero-emission vehicles across the EU, including electric heavy-duty trucks.

recently co-founded the Green Industry for Grids Association, which brings together large electricity users and technology providers operating across Europe to support the expansion, modernisation and digitalisation of electricity grids.

1.3.4 Scaling ambition through implementation and supply chain mobilisation

Amazon's visible efforts and performance have positioned it as a benchmark for corporate decarbonisation performance for peers and suppliers. Amazon is a co-founder of the Climate Pledge, with the goal to become net zero carbon by 2040. Amazon was one of the largest corporate purchasers of renewable energy globally for the past six years. According to BloombergNEF data, it was the largest corporate purchaser of renewable energy for the fifth consecutive year in 2024 globally and the largest in Europe in 2025. It has built the world's largest portfolios of carbon-free energy, comprising more than 700 projects across multiple geographies and totalling over 40 GW of capacity. This leadership has also driven behavioural change across Amazon's supply chain and beyond. As of the end of 2025, 67% of Amazon's top suppliers (which represent 70% of Amazon's supply chain carbon emissions) had shared decarbonisation plans with Amazon. This is a significant milestone because it shows Amazon's climate strategy extending beyond its direct operations and engaging with major suppliers' plans for emissions reductions. It reflects Amazon's sustained efforts towards embedding decarbonisation expectations across its wider value chain. Through co-founding initiatives like the Climate Pledge, now with over 680 signatories, Amazon has helped lower barriers for other companies to engage in credible decarbonisation efforts. The evidence collected suggests that Amazon's leadership has helped catalyse the participation of others in these initiatives.

2 Introduction

2.1 Context and motivation for this study

The European Union (EU) aims to be climate neutral by 2050. By 2030, the EU has a target to reduce net greenhouse gas emissions by at least 55% as compared to 1990 levels.[5] These objectives are at the heart of the European Green Deal and have become a legally binding target thanks to the European Climate Law. The UK has adopted comparable ambitions. This includes a legally binding goal to reach net zero greenhouse gas emissions by 2050 under the Climate Change Act.[6]

Meeting these objectives requires all economic sectors and social actors including the energy and transportation sectors to play a role:

- In Europe the revised Renewable Energy Directive raises the EU's 2030 mandatory renewable energy target to at least 42.5%, encouraging all countries to collectively reach 45%[7].
- The EU has set a 100% CO_2 emission reduction target for new passenger cars and vans from 2035 onwards.[8] The UK has introduced a zero-emission vehicle mandate, which sets annually increasing minimum targets for the proportion of new zero-emission cars and vans sold, reaching 100% by 2035.[9]
- Sectoral regulations in the EU such as ReFuelEU Aviation and FuelEU Maritime establish binding mandates for increasing shares of sustainable fuels in aviation and maritime transport.[10] The UK has also set out an aviation fuel mandate starting in 2025 which requires 2% of all UK jet fuel demand to be sustainable aviation fuel. This requirement increases linearly to 10% by 2030.[11]

Amazon's low-carbon initiatives take place within this policy framework and are aligned with Europe's decarbonisation objectives. Amazon has made ambitious plans in relation to

5 2021, European Parliament and Council of the European Union, *Regulation (EU) 2021/1119 – European Climate Law*

6 2019, UK Government, *The Climate Change Act 2008 (2050 Target Amendment) Order 2019*

7 2023, European Parliament and Council of the European Union, *Directive (EU) 2023/2413 – Renewable Energy Directive (RED III)*

8 2023, European Parliament and Council of the European Union, *Regulation (EU) 2023/851 amending Regulation (EU) 2019/631 on CO_2 standards for cars and vans*

9 2025, UK Department for Transport, *Updates to the Vehicle Emissions Trading Schemes (VETS) Order 2023*

10 2023, European Parliament and Council of the European Union, *Regulation (EU) 2023/2405 – ReFuelEU Aviation*; and *Regulation (EU) 2023/1805 – FuelEU Maritime:* ReFuelEU mandates a minimum share of sustainable aviation fuels starting at 2% in 2025 and rising to 70% by 2050; FuelEU Maritime sets greenhouse gas intensity reduction requirements for maritime fuels used by ships calling at EU ports.

11 2024, UK Department for Transport, *UK Sustainable Aviation Fuel (SAF) Mandate*

decarbonisation, circularity and resource efficiency across its European operations, including a goal to reach net zero carbon by 2040. These efforts translate into concrete investments and operational changes in transport, energy and packaging, as well as cross-cutting investments in innovation, digitalisation and AI.

This report, commissioned by Amazon and produced by Frontier Economics, provides independent analysis of the economic impact of Amazon's investments and initiatives aimed at reducing the carbon emissions generated by its own operations in Europe, and to support decarbonisation of the value chains in which Amazon operates.

The geographic scope of the report includes the EU27 as a whole and includes deep dives into five European countries (UK, Germany, France, Italy and Spain). The low-carbon initiatives analysed in this report include:

- investments to decarbonise the energy used in Amazon's e-commerce and Amazon Web Services (AWS) operations such as the impact of Amazon's role procuring renewable electricity via power purchase agreements (PPAs) and installing on-site solar generation facilities;
- investments to decarbonise Amazon's logistics and transport operations, including support for independent delivery partners to transition to electric fleets, deploying charge points and micromobility assets, as well as participation in buyers' alliances; and
- investments in sustainable packaging, including investments to move away from plastic, finding light and flexible paper-based material alternatives as well as in smart technology and workcells to reduce the total volume of packaging required.

In each area, the focus is on the wider *additional* effects of these actions: impacts that extend beyond Amazon and that go above what would occur anyway under existing legal or other sector requirements.

Evidence from desk research and our conversations with stakeholders indicates that Amazon's contribution operates through three distinct channels.

- First, it helps to **scale emerging technologies** and low-carbon markets at stages where cost and coordination barriers would otherwise constrain uptake.
- Second, it **catalyses innovation** by supporting the development and early deployment of solutions that are not yet commercially mature.
- Third, it exerts **industry leadership** by shaping standards, coordinating actors and advocating enabling conditions for system-wide decarbonisation.

Amazon's scale means it can invest in areas that are particularly difficult to decarbonise because of high upfront capital costs, immature technologies, limited infrastructure or fragmented demand. The analysis shows that its investments have focused on sectors where

cost, infrastructure or coordination barriers are most significant. In some cases, projects might not have moved forward at the same speed or scale without Amazon's involvement; in others, its participation appears to have accelerated deployment and broadened market adoption.

2.2 Methodology

To assess the contribution of Amazon's low-carbon investments to the European green economy, evidence is assessed qualitatively and, where possible, quantitatively, recognising that some impacts are embedded in operations and not always captured through discrete investment figures.

2.2.1 Evidence sources

Our analysis draws on Amazon-provided data, a structured review of public sources, and in-depth interviews with suppliers, partners and internal Amazon teams.

Primary evidence for this study was gathered through formal data requests to Amazon and a programme of structured interviews. The primary data collected through these requests and interviews were then contextualised using country-level and sector-level evidence drawn from public sources, including industry reports, regulatory disclosures and policy documents. This allowed us to assess not only the scale of Amazon's investments but also their significance relative to market trends and national benchmarks.

Interviewees included senior representatives from Amazon's internal teams as well as external organisations that collaborate with Amazon across sustainable energy, transport and packaging initiatives. These conversations provided targeted insights into Amazon's role, its additionality and the extent to which its investments influenced wider market outcomes. Selected quotes are included in the report and were validated with stakeholders to ensure they accurately reflect the views expressed during interviews.

2.2.2 Qualitative framework

The study adopts a contribution narrative approach to assess whether and how Amazon's initiatives contributed to observed outcomes. This approach involves triangulating the multiple sources of evidence set out above in section 2.2.1 to understand the extent of Amazon's initiatives and build a credible counterfactual (i.e. what would have happened without Amazon's investments).

Stakeholder interviews were particularly helpful to build the counterfactual and understand whether Amazon's low-carbon investments were likely to replace higher-carbon alternatives, reducing emissions, improving efficiency and driving innovation in the low-carbon economy. Targeted questions were aimed at understanding whether similar investments would have happened at the same scale and time absent Amazon's investments. For example, suppliers

were asked whether they would have been able to secure alternative contracts and what Amazon was doing differently to others in the industry. They were also asked whether Amazon's efforts had influenced their investment decisions, such as hiring, expanding production capacity or accelerating research and development (R&D) activities and whether Amazon's participation reduced perceived commercial risk, enabled earlier financial close of projects or facilitated entry into less mature markets.

The list of organisations interviewed is set out in Table 1.

Table 1 List of organisations interviewed for this report

Company	Description
Iberdrola	Large energy developer in Europe
Enerland	Spanish solar engineering and installation company operating across Europe and Latin America (LATAM)
Mercedes-Benz Trucks	German trucks manufacturer
Spirii	Leading provider of electric vehicle charging platform solutions
Mondi	Leading global packaging and paper group
Novamont	European biodegradable bioplastic manufacturer
Winiw Delivery	Spanish delivery service partner operating in Spain and providing last-mile delivery services for Amazon
Smart Freight Centre	International non-profit organisation working with businesses and governments to accelerate the decarbonisation of freight transport

Source: Frontier Economics

2.2.3 Quantitative analysis

This section outlines the methodology followed to estimate the value of investment as well as the impact on jobs and GVA. Annex A provides further detail around this methodology.

Total value of investment

To derive an aggregate investment figure for Europe over the 2021-2025 period, monetary values for the low-carbon initiatives analysed in this report[12] were compiled using information provided directly by Amazon. Where detailed investment data were not available, independent estimates were constructed using publicly available benchmarks and industry averages. In these cases, benchmark investment values were applied to Amazon-supported activity levels to derive indicative figures. All assumptions, benchmark sources and calculation methods are set out in Annex A.

Impact on jobs and value added (GVA)

To estimate wider gross economic impacts[13] on jobs and value added, the study applies OECD input-output tables to trace how Amazon's direct spending circulates through European supply chains. When Amazon invests in renewable energy, electric vehicles, charging infrastructure or sustainable packaging, that spending generates activity not only in the immediate project but also in upstream industries such as manufacturing, engineering, construction, logistics and professional services. This ripple effect is measured in terms of GVA, which represents the economic value created across the economy, and employment supported both directly and indirectly along the supply chain.

Where available, Amazon-provided information was used to determine the value of investment in each of the five focus countries. Where such information was incomplete, conservative country-level assumptions were applied based on public sources and supplier interviews. To derive an indicative Europe-wide estimate (EU27 + UK), the GVA and employment results calculated for the five focus countries were proportionally scaled using the ratio between total European investment and the investment in the five focus countries over 2021-2025. This rule-of-three estimation assumes that similar levels of spending in other European countries would generate broadly comparable economic effects. As production structures and import shares differ across countries, the Europe-wide figure should be interpreted as indicative, providing an overall sense of scale rather than a fully modelled result for each country.

Given the inherent uncertainty in estimating indirect and supply chain effects, key assumptions and data limitations are reported and sensitivity ranges are provided to illustrate how results vary under alternative scenarios. The full modelling methodology, industry mappings and domestic content assumptions are described in Annex A.

12 The total investment figures include (i) procurement of renewable electricity via PPAs, (ii) installation of on-site solar generation facilities, (iii) procurement of electric vehicles, (iv) procurement and installation of charge points and (v) procurement of sustainable packaging.

13 The estimated impact on jobs and GVA does not account for deadweight, displacement, leakage and substitution.

2.3 Structure of the report

The report is structured around three cross-cutting themes that capture how Amazon's investments are generating economic and social impact:

- Amazon's role in scaling emerging technologies by creating sustained demand and reducing market risk;
- Amazon's role in catalysing low-carbon technologies by enabling innovation and early deployment of cutting-edge decarbonisation solutions;
- Amazon's role in accelerating progress through leadership, alliances and policy engagement.

Each theme brings together evidence from Amazon's initiatives in transport, energy and packaging at the European level together with relevant country-level analysis. As such, the remainder of the report is structured as follows:

- Chapter 3 presents the role of Amazon in scaling low-carbon technologies by creating sustained demand and reduced market risk.
- Chapter 4 presents the role of Amazon as a catalyst for driving innovative low-carbon solutions and early movers in less mature markets.
- Chapter 5 presents the role of Amazon as an industry leader, coordinating industry alliances, engaging with policy leaders to drive change and setting stretching targets and efforts that partners and peers can aspire to.

3 Amazon scales emerging low-carbon technologies by creating sustained demand and reducing market risk

Amazon's investments influence the scale and maturity of low-carbon markets. Through large, sustained procurement and operational deployment, Amazon has helped expand renewable energy capacity, accelerate fleet electrification and increase demand for sustainable packaging solutions. By providing predictable demand and deploying solutions at scale, Amazon has supported market growth and reduced commercial uncertainty for project developers and suppliers across multiple sectors.

3.1 Amazon's investment in PPAs and on-site solar generation projects have supported Europe's renewable electricity market

Amazon has contributed to scaling renewable electricity markets in Europe by providing sustained, long-term demand at scale through PPAs. These PPAs increase revenue certainty for developers and help incentivise investment in renewable capacity. Amazon has further supported the expansion of renewable capacity by investing in on-site solar generation above and beyond legal requirements.

3.1.1 Amazon's PPAs have driven substantial renewable capacity growth

Key findings

- Amazon contracted over 8.7 GW of new renewable capacity in Europe over the 2021-2025 period through PPAs. For example, between 2021 and 2025, the renewable energy capacity contracted by Amazon was equivalent to around 11% of solar installations and 7% of onshore wind installations in Spain, 10% of offshore wind installations in the UK[14] and 52% of offshore wind installations in Germany.
- Large-scale developers highlighted that Amazon's long-term demand commitments formalised in PPAs has supported investment in renewable energy projects that would not have gone ahead otherwise.

Investment in renewable generation is exposed to several industry-wide risks that can slow deployment at scale. These include uncertainty over future electricity prices; exposure to market downturns when large volumes of renewable generation come online simultaneously; and challenges in securing financing for capital-intensive assets. These challenges affect the

[14] UK installed capacity data for 2025 are based on provisional Q4 2025 Department for Energy Security and Net Zero (DESNZ) Energy Trends statistics and may be subject to revision.

renewable sector as a whole and have been a constraint on the pace and scale of renewable capacity deployment across Europe.[15]

Amazon's role as a PPA counterparty, providing long-term demand at scale, has helped address these challenges by providing developers with stable and predictable revenues.

> *"PPAs provide certainty of revenues when intensive capital investment is required, and they are a great route to market for projects across Spain, Portugal, the UK and Germany." – Iberdrola, a large energy developer in Europe*

Amazon's PPAs have not only supported individual projects but have also materially influenced the timing and scale of investment decisions. Developers also indicated that a share of Amazon-enabled projects would not have reached financial close at the same time, or at the same scale, in the absence of Amazon's upfront commitments, and some would likely have been delayed or restructured without that revenue certainty.

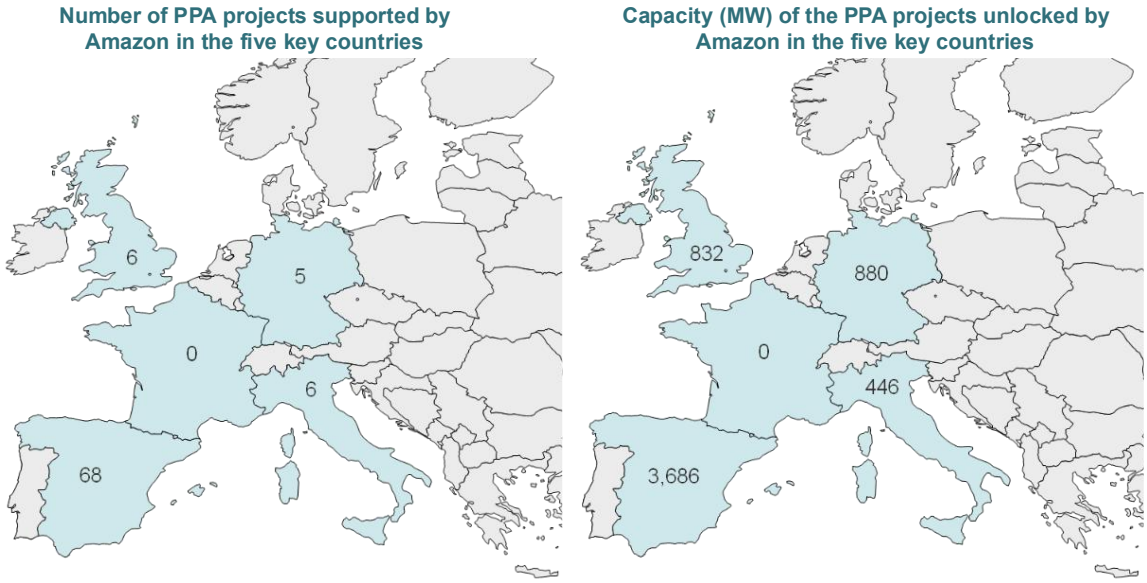
> *"Amazon has been one of the biggest supporters for the deployment of renewable capacity in Europe. PPAs have been a very important complement to public support mechanisms such as Contract for Differences (CfD) auctions."[16] – Iberdrola, a large energy developer in Europe*

Over the 2021-2025 period, Amazon contracted **over 8.7 GW** of renewable capacity via PPAs across Europe. These commitments supported **123 renewable generation projects**, representing **16.5 GW of new renewable capacity in total**. The location of these projects reflects Amazon's objective of investing in renewable energy in countries where it operates data centres. Figure 2 presents, for the five countries considered in detail in this study (the UK, Germany, France, Italy and Spain), the number of renewable energy projects supported by Amazon and the renewable capacity contracted through Amazon's PPAs.

15 Source: 2025, IEA, *Renewables 2025*

16 CfD auctions are government-run schemes that guarantee renewable energy producers a stable price for the electricity they generate. This reduces financial risk and makes it easier to invest in new wind and solar projects.

Figure 2 Click or tap here to enter text.



Fuente: Frontier Economics using Amazon's data

The scale of Amazon's impact is visible in national markets, **indicating a contribution to overall market growth** rather than isolated projects. For example, between 2021 and 2025, Amazon-contracted capacity represented around **11% of solar installations and 7% of onshore wind installations in Spain**. **In the UK**, Amazon-contracted capacity accounted for around **10% of offshore wind installations** and 6% of onshore wind installations over the same period, while **in Germany** Amazon-contracted offshore wind capacity was equivalent to approximately **52% of new offshore wind capacity** installed in the country.

France does not appear in the 2021-2025 figures because some of Amazon's key renewable investments in the country pre-date the reporting period. For example, Amazon supported the 15 MW Préchac solar park through a PPA signed in 2020.

Amazon's contribution to market scaling reflects not only the size of individual PPAs but also the persistence, credibility and geographic breadth of its demand, which reduces perceived risk at the portfolio level rather than on a project-by-project basis. Iberdrola highlighted that Amazon is its largest corporate energy purchaser, with PPAs spanning multiple technologies and countries.

> *"Amazon is the largest PPA purchaser of energy for Iberdrola. We have agreements in Spain, Portugal, the UK and Germany, covering projects such as East Anglia 3, Baltic Eagle, Windanker, Ciudad Rodrigo and Tâmega." – Iberdrola, a large energy developer in Europe*

Amazon has been one of the largest corporate purchasers of renewable energy globally for the past six years. According to BloombergNEF data, it was the largest corporate

purchaser of renewable energy globally for the fifth consecutive year in 2024, and the largest in Europe in 2025.[17] This breadth of demand, combined with Amazon's repeated delivery against public goals, has strengthened confidence among developers and financiers that demand will persist over time.

3.1.2 Amazon's on-site solar investments go beyond legal requirements, strengthening supplier capability and accelerating industry learning

Key findings

- Amazon's investment in on-site solar energy generation has been above and beyond legal requirements, reflecting Amazon's efforts for decarbonisation.
- Amazon's investments in on-site solar unlocked 129 MW of extra capacity over the 2021-2025 period.
- Amazon's efforts to expanding solar energy capacity and high standards have strengthened the operational capabilities of its suppliers, generating positive spillovers in the market.

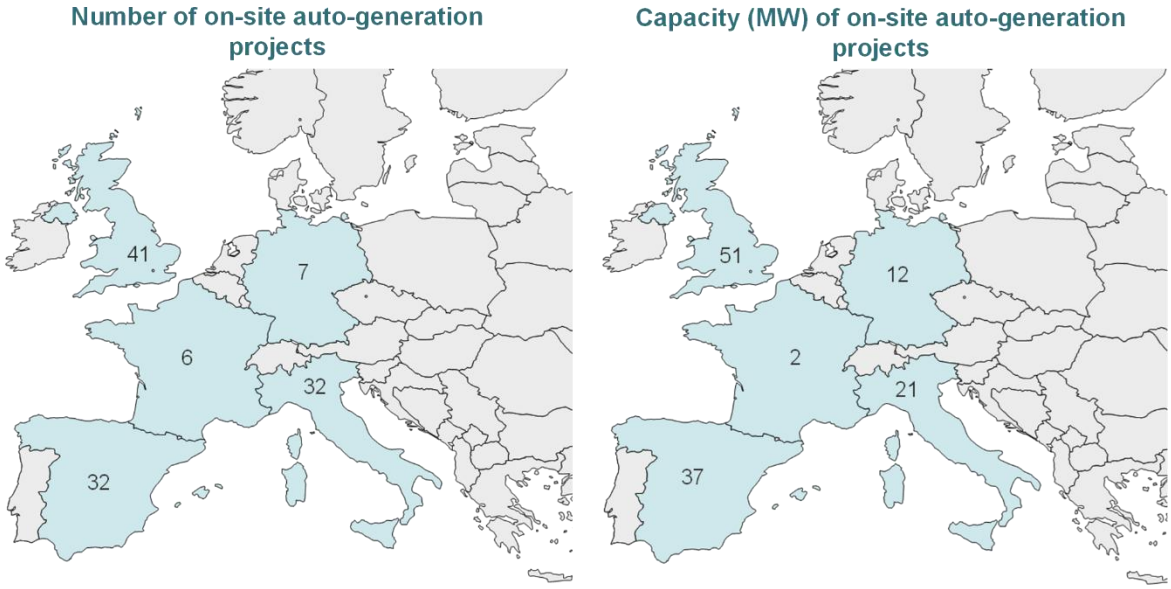
Amazon's on-site solar investments have consistently exceeded minimum regulatory requirements. This has resulted in larger installations and materially higher levels of distributed renewable capacity than standard commercial practice.

> *"Some companies just aim to comply with regulation. Amazon was not interested in that. They were always focused on doing much bigger installations and exceeding minimum requirements." – Enerland, a solar engineering and installer partner of Amazon in Europe*

As of January 2026,, Amazon had installed 122 on-site rooftop solar systems across Europe, unlocking 129 MW of extra capacity. These installations are typically larger than standard commercial rooftop projects, often in the 2-4 MW range per site, driven by full utilisation of available roof space. Figure 3 presents the number and installed capacity of Amazon's on-site solar projects for the five focus countries (UK, Germany, France, Italy and Spain).

[17] 2024, BloombergNEF, *Amazon Is Top Green Energy Buyer in a Market Dominated by US* & 2025, BloombergNEF, *Corporate Clean Energy Buying Fell in 2025 After Nearly a Decade of Growth*

Figure 3 Number and capacity of Amazon's on-site solar projects in the five focus countries, 2021-2025



Source: *Frontier Economics using Amazon's data*

Note: *In Europe (EU27 + UK), 122 on-site auto-generation projects, mainly on-site rooftop solar installations, had been funded as of 2025, unlocking 129 MW of extra capacity.*

Dos Hermanas site: Amazon's largest on-site solar installation

Amazon's largest on-site solar installation in Europe, located at its fulfilment centre in Dos Hermanas (Seville), has more than 13,300 solar panels with a combined renewable energy capacity of 5.26 MW. This mixed rooftop and car-park solar system illustrates the upper end of Amazon's on-site deployment and the scale achievable when installations are designed to maximise site potential rather than meet minimum requirements.

Rather than sizing installations to meet compliance thresholds, Amazon has systematically maximised the technical potential of its sites, prioritising long-term performance and quality. This reflects a strategic effort towards decarbonisation.

> *"Amazon does not see sustainability as a cost. They see it as an investment and a key differentiator. They were three or four steps ahead of other clients." – Enerland, a Spanish solar engineering and installation company operating across Europe and LATAM*

Amazon's ambition has an impact on supplier capabilities

This sustained programme of large and technically demanding installations has strengthened supplier capabilities, with spillover effects beyond Amazon projects.

Enerland, a Spanish solar engineering and installation company, noted that many of the capabilities developed to meet Amazon's requirements, including enhanced safety procedures, tighter quality controls and improved coordination between design and operations, are now applied across its wider client base.

> *"Working with Amazon required us to upgrade safety, quality and coordination on site, and those practices are now embedded in how we work more broadly." – Enerland, a Spanish solar engineering and installation company operating across Europe and LATAM*

Similarly, Solnet, a European solar and energy storage provider,[18] described Amazon as one of its largest and most exacting customers. It noted that Amazon's internal technical, safety and environmental and social governance standards went beyond minimum regulatory requirements to minimise health and safety risk and operational downtime, which is key for 24/7 operations, and have since been embedded as standard practice across Solnet's European operations for customers with similar needs.

> *"Amazon's extensive guidelines and quality requirements have shaped our internal processes and are now applied across all our operations, not just Amazon projects." – Solnet, a European solar and energy storage provider*

Amazon is increasingly investing in batteries to address curtailment issues

Amazon is working to bridge the gap between when renewable electricity is produced and when it is consumed. Battery storage allows excess renewable energy generated at one time to be stored and used later, reducing energy waste and enhancing the resilience and flexibility of operations.

In November 2025, Amazon commissioned its first battery energy storage system in the EU at its Murcia fulfilment centre in Spain. The project pairs a 1 MWh battery system with a 4.13 MWp rooftop solar installation, enabling excess solar energy generated during the day to be stored and used later when demand is higher.

This project builds on Amazon's broader deployment of solar-plus-storage systems globally. By the end of 2024, Amazon had eight solar projects paired with battery storage, representing 2.1 GW of capacity. In 2024, Amazon powered nearly 4,000 hours of operations using energy stored in these batteries.[19]

[18] Solnet operates in Germany, Austria, Switzerland, Benelux, the UK and Southern Europe.

[19] 2024, *Amazon Sustainability Report*

3.2 Amazon's large-scale procurement of low-carbon transport solutions has created demand certainty and reduced supplier risk

Decarbonising transport requires coordinated deployment of vehicles and charging infrastructure, alongside sufficient grid capacity to operate electric fleets at scale. By supporting delivery partners to electrify their fleets, coordinating deployment across multiple countries and investing in associated charging infrastructure, Amazon has provided clearer demand signals to manufacturers and infrastructure providers.

3.2.1 Procurement of electric vans at scale creates demand certainty for vehicle manufacturers and the wider European supply chain

Key findings

- At the end of 2025, Amazon and its delivery partners had more than 10,000 electric delivery vans in their fleet across Europe.
- Amazon's delivery partners' electric vans operate in routine last-mile delivery across multiple markets, with a significant share manufactured in Europe, supporting European vehicle assembly and supply chains.
- Amazon's daily operation of electric vans across Europe has increased confidence in commercial electrification and supported replication by other logistics providers.

The deployment trajectory of Amazon's delivery service partners' electric van fleet demonstrates a transition from experimentation to operational integration. By the end of 2024, Amazon and its delivery partners operated more than 3,500 electric vans across Europe, including over 1,000 in the UK and more than 1,500 in Germany.

Deployment accelerated further in 2025. By year-end, the fleet had grown to more than 10,000 electric vans across Europe, including over 1,500 in the UK and over 4,500 in Germany.

Between 2018 and 2026, more than 80% of these electric vans were manufactured in Europe, meaning that Amazon's delivery partners' fleet expansion has supported the European automotive industry and strengthened regional supply chains for electric vans, from components to vehicle integration and maintenance services.

The impact on other logistics providers

The scale at which electric vans have been deployed in Amazon's operations has helped logistics providers in building confidence around electric fleet integration under commercial conditions. This has allowed them to replicate Amazon's low-carbon transport model. This is

the case of Winiw Delivery,[20] a Spanish last-mile logistics provider, which expanded its electric fleet after operating electric vehicles for Amazon.

> *"Daily operation of electric vans across Europe has increased confidence in commercial electrification and supported replication by other logistics providers and the investment felt much less risky." – Winiw Delivery, a Spanish delivery service provider*

3.2.2 Amazon's strategy for charge point deployment allows for fleet electrification at scale

Key findings

- Amazon has installed thousands of electric vehicle charge points for electric vans across its European facilities.
- Delivering charging at this scale has driven electric vehicle charging providers to scale their capabilities, now leveraged across other customers.

Fleet electrification depends on reliable charging infrastructure. Coordinating charging operations across routes and depots can be complex for logistics operators, involving planning around charging times, power availability and depot layouts. Regulatory and planning differences across European countries add further layers of complexity for fleet electrification projects.

Amazon has addressed these barriers within its own network by investing in large-scale charging infrastructure across fulfilment centres, delivery stations and logistics sites. Across Europe, Amazon has installed thousands of electric vehicle charge points in Germany and the UK, and hundreds more in France, Italy and Spain.

These installations allow delivery to Amazon's customers, but their scale reflects sustained investment rather than isolated site upgrades. All charge points procured by Amazon for its European operations are manufactured within the EU and sourced from a portfolio of EU-based vendors, with manufacturing in countries including Austria, Italy, Finland and the Netherlands. This procurement model directly supports European charging hardware manufacturing, system integration and associated engineering supply chains, and reinforces regional production capacity in the electric vehicle infrastructure market.

Diffusing capabilities across the wider market

Amazon's multi-country rollout has required electric vehicle charging providers to upgrade and standardise their operational capabilities. Deploying and operating charging infrastructure

[20] Winiw Delivery is a Spanish delivery service partner operating in Spain and providing last-mile delivery services for Amazon.

across multiple countries requires coordination across grid operators, installers, hardware suppliers and software platforms, alongside compliance with diverse regulatory and technical standards.

> *"Amazon is one of our largest and most complex customers in Europe, requiring coordination across thousands of chargers and many regulatory contexts." – Spirii,*[21] *a leading provider of EV charging platform solutions*

Capabilities developed to meet Amazon's requirements have subsequently been applied beyond Amazon's operations. Spirii explained that the processes and platform enhancements developed for Amazon were now embedded as standard practice and applied across its wider customer base. These include capabilities for managing large charging estates, supporting multi-country deployments and integrating charging operations with fleet requirements.

> *"The capabilities we developed to support Amazon are now reused across other large fleet and corporate customers." – Spirii, a leading provider of EV charging platform solutions*

3.3 Amazon's large-scale procurement of sustainable packaging has created demand certainty and reduced supplier risk

Key findings

- Amazon was one of the first corporates to move away from single-use plastic in delivery packaging and, since 2022, 100% of packaging used across Amazon's fulfilment centres has been recyclable and paper-based.
- Amazon's demand for easily recyclable packaging has supported the European supply chain for paper-based and recyclable packaging, as most delivery packaging is locally sourced from European-based manufacturers.

Packaging is essential for product protection and distribution, but it also generates environmental impacts through material use, transport and end-of-life treatment. In Europe, policy initiatives such as the EU Green Deal and the Circular Economy Action Plan are increasing the emphasis on recyclable, reusable and lower-waste packaging solutions, and are therefore creating pressure for the packaging industry to scale alternatives to single-use plastics.

Amazon's long-term efforts to eliminate single-use plastics and reduce packaging volumes have reshaped its packaging portfolio. Since 2022, 100% of packaging used for orders fulfilled through Amazon's European logistics network has been paper based and recyclable. This

[21] Spirii is a European charging platform provider that develops future-ready electric vehicle charging software and solutions.

transition has been accompanied by broader efforts to reduce packaging per shipment, including increased use of paper envelopes, flexible packaging solutions and shipments delivered without additional Amazon delivery packaging. The combined effect is **a material substitution and a reduction in the total amount of packaging used per shipment**.

Amazon's delivery packaging procurement is supplied predominantly by EU- and UK-based manufacturers, meaning that demand for recyclable formats is largely anchored within the regional supply chain. Suppliers highlighted that Amazon's scale provides commercial security and predictable volumes. Mondi[22] highlighted that Amazon's size as a customer provides financial stability.

> *"Financially, Amazon provides the security of being a large-scale account. The scale itself gives confidence." – Mondi, a leading global packaging and paper group*

Meeting this demand has required suppliers to scale operations. This has translated into tangible expansion of production and engineering capacity among firms supplying packaging materials and equipment. For example:

- **CMC,**[23] **Clevertech**[24] **Fameccanica**[25] have expanded their manufacturing and technical operations beyond Europe following collaboration with Amazon. In both cases, technologies initially developed to meet Amazon's requirements, such as machines that reduce the amount of packaging needed for each shipment, have subsequently been scaled for wider commercial use.
- Amazon has expanded capabilities originally developed by **Cloostermans,**[26] a formerly independent company acquired by Amazon, to support next-generation warehouse and packaging technologies

22 Mondi is a large European packaging and paper group.

23 CMC is an Italian company that designs and builds machines used in warehouses to create right-sized cardboard boxes.

24 Clevertech Group is an industrial automation company specialising in packaging, palletising, depalletising, intralogistics and product handling systems for sectors including food, beverage, personal care, chemicals and e-commerce.

25 Fameccanica is a European manufacturer of automated equipment used in packaging and materials handling.

26 Cloostermans was a European engineering company specialising in automated logistics and packaging systems that was acquired by Amazon in 2022.

3.4 Amazon's low-carbon investments have generated economy-wide supply chain impacts

Key findings

- Amazon's low-carbon investments over the 2021-2025 period in Europe are expected to support between approximately €8.8 billion and €11.3 billion in GVA and support between 112,000 and 144,000 jobs across Europe's green economy.

Amazon's large-scale investments in low-carbon technologies generate economic effects beyond the immediate projects. Each time Amazon signs renewable PPAs, procures electric vehicles, installs charging stations or deploys automated packaging systems, that spending flows through European supply chains. For example:

- Developing renewable energy facilities requires engineering services, turbine or solar panel manufacturing, grid connection works and construction labour.
- Expenditure to support the electrification of Amazon's delivery partners' fleets supports vehicle assembly plants, component suppliers, logistics providers and maintenance networks.
- Installing charging stations generates demand for hardware manufacturing, electrical installation, civil works and software services.
- Sustainable packaging procurement supports paper mills, material converters and recycling-linked industries.

Each of these activities contributes to economic output and employment across multiple sectors. In economic terms, this impact is measured using GVA – which represents the additional economic value created through production – and employment supported directly and indirectly along the supply chain.

Between 2021 and 2025, Amazon invested between €14 and €17.5 billion in low-carbon technologies in Europe. Using OECD input-output tables to trace how this spending flows through the European economy, these investments are expected to support between approximately €8.8bn and €11.3bn in GVA and support between 112,000 and 144,000 jobs across Europe.

4 Amazon acts as a catalyst in early-stage commercialisation of low-carbon solutions in Europe

In several sectors, Amazon has acted as an early investor in low-carbon projects, helping to provide the revenue certainty needed for large-scale deployment while also absorbing risk and supporting research, innovation and the commercialisation of emerging technologies.

4.1 Amazon's role as an anchor offtaker in PPAs has helped renewable energy projects reach deployment

Key findings

- Amazon contracts projects at development stage, providing the early revenue certainty required to reach final investment decision.
- Amazon's PPAs have complemented and, in some cases, replaced public support mechanisms, reducing reliance on public funding and providing alternative routes to market.
- Amazon's PPAs in less mature markets such as Poland and Greece demonstrate demand credibility and reduce perceived market risk, helping attract additional corporate buyers.

Providing early revenue certainty

Renewable energy projects require substantial upfront capital investment. Before construction can begin, developers must secure longer-term revenue certainty. This typically comes either from government-backed schemes – such as CfDs, which guarantee a fixed price for electricity – or from corporate PPAs, under which a company commits to buying power for a defined period. Iberdrola emphasised the importance of this certainty in unlocking investment.

> *"When intensive capital investment is required, we need certainty of revenues – PPAs provide that certainty and are a great route to market for projects." – Iberdrola, a European renewable energy developer*

Amazon has positioned itself as a key early-stage corporate offtaker, meaning it commits to buying electricity from a project before it is built, providing the revenue certainty required to secure financing and, as such, helping bring new capacity onto the grid.

> *"Where possible, we aim to get involved with projects at development stage… these are not projects which are operational… that's not always the case in terms of green reporting (…) What we are trying to do with our PPAs is provide that route to market and the security for developers to take those investment decisions and actually build these projects." – Daniela Fitzpatrick, Amazon Energy Procurement*

Opening less liquid PPA markets

"Less liquid" markets – meaning those with fewer active corporate buyers – present greater uncertainty for developers seeking private offtake agreements compared to more established markets.

Amazon's size, experience and credibility allow it to enter regions where the corporate PPA market is not yet well established, such as Poland and Greece.

> *"With our size and scale and experience… [we're able] to go into regions that may not have as liquid a PPA market and be able to make some sort of headway into enabling some contracts and PPAs to be signed in those regions (...)." – Daniela Fitzpatrick, Amazon Energy Procurement*

Amazon's participation has helped expand corporate PPA activity and provide developers with an additional commercial pathway.

> *"Since then, we've seen an increase in the pipeline in these countries… and other buyers coming in to execute PPAs, which is great to see that sort of momentum coming into those countries." – Daniela Fitzpatrick, Amazon Energy Procurement*

Miłkowice solar farm in Poland

One example of Amazon's participation in a less liquid market is Poland, where corporate PPA activity has historically been less developed than in Western Europe. In 2022, Amazon signed one of Poland's largest deals for renewable energy from a solar farm in Miłkowice, boasting an installed capacity of 87 MW. Once operational, the solar farm is expected to produce over 120,000 megawatt-hours of clean energy annually, enough to meet the annual energy needs of approximately 57,000 Polish households.

Complementing or replacing public support mechanisms

Amazon has played a particularly strong role in offshore wind, including in the UK, Germany and Nordic markets. In several cases, Amazon has acted as the sole offtaker, or an anchor offtaker, enabling projects to move forward. Some projects such as East Anglia THREE and Baltic Eagle wind farm were supported without government subsidies, demonstrating that large infrastructure can proceed on a corporate-backed basis. In Ireland, Amazon's 91.2 MW Donegal wind farm PPA was an early landmark in the corporate PPA market: it was the first unsubsidised corporate PPA project in Ireland, supporting AWS infrastructure and being developed without public subsidy or cost to Irish energy consumers.

East Anglia THREE and Baltic Eagle wind farms in the UK and Germany

Amazon acted as the key offtaker when it signed long-term PPAs for portions of two major capital-intensive offshore wind farms: East Anglia THREE in the UK and Baltic Eagle in Germany. In the UK, Amazon agreed to procure 159 MW of capacity from the 1.4 GW East Anglia THREE offshore wind farm. In Germany, Amazon has contracted clean energy from Baltic Eagle, a 476 MW offshore wind farm in the Baltic Sea, with a commitment to offtake 189 MW of capacity.

Amazon has also stepped in as a corporate offtaker in cases where public schemes alone have not delivered. In some European markets, renewable projects have cleared government CfD auctions[27] at prices that have later proved too low to cover rising construction and financing costs. In these cases, projects risk delay or cancellation despite having secured formal support. Amazon has stepped in as a corporate offtaker in such situations to allow projects to proceed under revised commercial arrangements. Examples include the Vermio and the Mesokorfi/Koukouuras wind projects in Greece, together representing the largest corporate PPA signed in the country to date.

Vermio and Mesokorfi / Koukouuras wind farms in Greece

In Greece, Amazon signed PPAs supporting the Vermio (292 MW) and Mesokorfi / Koukouras (67 MW) wind projects in 2024, at a time when Greece's renewable sector was still heavily reliant on public mechanisms. Together, these wind farms represent the largest corporate PPA signed in the country.

The Vermio project had initially secured a government auction contract in 2020, but due to supply chain and cost pressures, the developer stepped out of its government contract in favour of a long-term corporate PPA with Amazon. Amazon's offtake agreement enabled the developer to secure €469 million in project financing from the National Bank of Greece, allowing construction to proceed.

These projects form part of Greece's 2030 renewable energy strategy and mark Amazon's first utility-scale wind investments in the country. In total, the three wind farms are expected to generate enough carbon-free energy to power the equivalent of nearly 200,000 Greek homes annually.

[27] As mentioned above, CfD auctions are government-run schemes that guarantee renewable energy producers a stable price for the electricity they generate. This reduces financial risk and makes it easier to invest in new wind and solar projects.

4.2 Amazon's early efforts have accelerated the electrification of middle-mile and last-mile operations

Key findings

- Amazon has placed one of the largest orders of Mercedes-Benz battery electric heavy-duty trucks in Europe to date, ordering 202 vehicles from Daimler Truck.
- Amazon has contributed to the more efficient placement of charging infrastructure across European freight corridors by sharing insights beyond its own operations. For example:
  - Amazon has developed CHALET, a public charging infrastructure planning tool; and
  - Amazon is helping establish an eCorridor in Poland which is expected to generate operational and infrastructure insights that can inform future electrification across Europe.
- Amazon has accelerated independent fleet electrification decisions among third-party delivery partners by leasing electric vans and providing operational learning.

The electrification of heavy-duty trucks in Europe remains at an earlier stage of technological and commercial maturity than light-duty vehicles. Battery electric heavy goods vehicles (HGVs) involve higher upfront costs than diesel alternatives, require high-capacity charging infrastructure and operate under tighter operational constraints, particularly around charging times and route predictability. Charging infrastructure for heavy-duty fleets is also less developed, and grid capacity can present additional barriers. As a result, large-scale commercial adoption has historically been more limited than for passenger vehicles.[28]

Amazon is sending early and credible demand signals that support the electrification of middle-mile operations

In January 2025, Amazon placed an order for 202 Mercedes-Benz battery electric heavy-duty trucks to join its European transportation network, **one of the largest orders in Europe at the time**. By the end of 2025, more than 100 electric heavy trucks were operational across Europe. Daimler Truck confirmed that Amazon's order stood out in terms of scale and timing.

> *"Amazon was one of our first customers to order electric trucks at scale and the confirmed order of more than 200 Mercedes-Benz eActros 600 was on the upper end compared to other early fleet orders." – Daimler Truck, a German truck manufacturer*

[28] Source: 2025, United Nations Economic Commission for Europe (UNECE), *Electrification of Mobility: Lessons Learnt from the ECE Region*

Amazon was seen by manufacturers as relatively fast and flexible in deployment and that it had contributed to the transition from demonstration to operational deployment of electric HGVs.

> *"What we can say about Amazon's deployment of the vehicles is that they are fast and flexible." – Daimler Truck, German trucks manufacturer*

Amazon is exploring innovative solutions for fleet decarbonisation, helping establish a corridor to electrify middle-mile operations in Poland

Electrification of HGVs is also constrained by the availability of high-capacity charging infrastructure along freight corridors. One-off vehicle purchases are insufficient if trucks cannot reliably recharge along major routes.[28]

Amazon is at the forefront of innovation for the electrification of middle-mile operations. For example, Amazon is helping establish the Poland eCorridor, a pilot initiative intended to launch in 2027 by the Smart Freight Centre.[29] The corridor is designed to aggregate demand for zero-emission freight along high-volume logistics routes so that electric trucks and high-capacity charging infrastructure can be deployed in a concentrated and coordinated manner rather than in isolated locations.

The initiative is deployed collaboratively with PragmaCharge,[30] alongside the Smart Freight Centre and the Polish New Mobility Association. It is structured as a pilot and is aimed at generating operational and infrastructure insights that can inform future corridor-based electrification across Europe.

> *"What the corridor approach does is concentrate demand, infrastructure and operations in a defined geography, allowing us to test and scale electric trucks in a way that can be replicated elsewhere." – Asad Jafry, Director - Amazon Worldwide Operations Sustainability*

Smarter infrastructure planning

In parallel with deploying charging infrastructure for vehicles delivering to Amazon's customers, Amazon has supported broader planning of public charging networks through CHALET, a data-driven infrastructure planning tool.

29 The Smart Freight Centre is an international non-profit organisation working with businesses and governments to accelerate the decarbonisation of freight transport.

30 PragmaCharge is a UK-based provider of battery electric trucks charging infrastructure and fleet support services.

CHALET: Amazon's infrastructure planning tool

CHALET is a data-driven tool that aggregates and anonymises freight movement data to identify high-utilisation locations for battery electric trucks charging. Rather than relying solely on theoretical corridor mapping, CHALET uses real operational data to pinpoint priority freight routes.

- Fraunhofer ISI[31] used CHALET to conduct a study that found that placing charging infrastructure at around 100 high-priority locations could cover approximately 90% of commercial freight traffic flows in Europe.
- CHALET has also informed national planning exercises, including identifying priority locations for battery electric trucks charging in Italy.

Amazon has enabled third-party carriers to electrify their last-mile operations by leasing electric vans and providing operational learning

Unlike some operators, Amazon does not run all last-mile vehicles directly. Part of its last-mile operations are operated by third-party delivery service partners. Recognising that smaller carriers face financing constraints and higher perceived risks, Amazon has in some cases procured electric vans directly and leased them to carriers operating on Amazon routes. This has absorbed upfront capital risk and accelerated deployment.

> *"We are stepping in to provide the financing challenge for carriers and then leasing the vehicles to them… We are taking on the risk of the asset." – Andreas Marschner, Amazon's Vice-President of Worldwide Sustainable Operations*

Operating electric vans within Amazon's logistics network has also generated practical experience in areas such as route planning, charging coordination and vehicle performance under commercial conditions. This hands-on exposure has reduced uncertainty around real-world performance and operational integration.

> *"We would likely have electrified our fleet eventually, but our experience working with Amazon significantly accelerated our plans and reduced the uncertainty around deployment." – Winiw Delivery, a Spanish delivery service provider*

[31] Fraunhofer ISI (Fraunhofer Institute for Systems and Innovation Research) is one of Europe's leading applied research institutes, specialising in energy systems, sustainability and industrial innovation.

4.3 Amazon has led the deployment of smaller electric vehicles and micromobility hubs to achieve lower-emission urban delivery

Key findings

- In 2025, Amazon had more than 70 micromobility hubs in more than 50 cities across Europe, deploying electric cargo bikes, mopeds and push carts at scale to reduce urban emissions, noise and congestion.

Urban delivery in dense city centres faces constraints that limit the efficiency of conventional van-based models. Growing freight volumes contribute to traffic congestion, which increases delivery times and fuel consumption. Limited kerb space and insufficient loading zones make legal parking difficult, often leading to double-parking and traffic disruption. In addition, pedestrian zones, low-emission zones and time-based access restrictions require route adjustments and operational flexibility. These combined pressures make last-mile van delivery slower, more costly and environmentally inefficient in dense urban environments without alternative delivery models.[32]

Smaller electric vehicles – including electric cargo bikes, electric mopeds and push carts – provide an alternative solution. These vehicles are lighter than vans, can access narrow streets and pedestrian zones, operate with zero exhaust emissions and at lower noise levels than delivery vans. Their use supports continued service in pedestrian zones and historic centres while reducing local air pollution and traffic pressure in dense urban neighbourhoods.

These vehicles operate from micromobility hubs, which are small urban logistics sites where parcels are sorted locally, and vehicles are charged and dispatched for final delivery in areas where vans are less practical.

Amazon began electric cargo bike deliveries in Strasbourg in 2017 and progressively expanded the model. By 2025, Amazon delivery partners operated in more than 70 hubs spanning over 50 cities, including deployments in the UK, Germany, France, Italy, Spain, Austria, Belgium and the Netherlands.

Between 2021 and 2025, Amazon and its delivery partners made over 100 million deliveries in Europe using electric cargo bikes, electric mopeds and push carts for on-foot deliveries. In 2025, more than 30 million packages were delivered using electric cargo bikes, electric mopeds and push carts, contributing to over 265 million electric and manual deliveries across Europe. Uptake is particularly high in dense urban markets: in Paris more than 40% of

[32] Source: 2020, World Economic Forum, *The Future of the Last-Mile Ecosystem*; *2024, World Economic Forum, Transforming Urban Logistics*

deliveries were completed using micromobility deliveries, including cargo bikes, electric mopeds and push carts.

While some operators trialled electric cargo bikes in isolated locations, **Amazon was among the first to support scale smaller electric vehicles across multiple European cities**.

> *"In micromobility, we've moved beyond pilots to operating at real scale across Europe – electric cargo bikes, mopeds, and on-foot deliveries are now a core part of how we serve customers in cities. We're proud to be among the frontrunners in making this work programmatically within a large logistics network." – Andreas Marschner, Amazon's Vice-President of Worldwide Sustainable Operations*

4.4 Amazon has invested in research and innovation (R&I) to develop and deploy more sustainable packaging solutions

The transition away from single-use plastic packaging presents a technical trade-off. Plastic packaging is lightweight but difficult to recycle at scale. On the flip side, paper-based alternatives are more widely recyclable but can be heavier and less durable. This has implications both for transportation emissions and customer satisfaction. Addressing this trade-off requires not only replacing materials but also redesigning packaging systems to ensure that recyclable alternatives remain lightweight, resistant and suitable for high-volume e-commerce logistics.

Section 3.3 described how Amazon's large-scale demand for paper-based and recyclable packaging has supported European suppliers and created sustained market demand. This section focuses on a complementary dimension: Amazon's catalytic role in working directly with suppliers to develop, test and refine new paper-based and bio-based packaging formats suited to e-commerce logistics before they are widely available at scale.

4.4.1 Amazon invests in innovative sustainable packaging products

Key findings

- Amazon transitioned from plastic to paper packaging at a time when scalable, logistics-ready paper alternatives for e-commerce were not yet widely available.
- Amazon has co-developed and piloted new paper-based and bio-based packaging formats tailored to different national waste systems.
- Supplier partners indicate that Amazon's technical input and testing have accelerated product development.

Amazon moved away from single-use plastic packaging at a time when paper-based alternatives suitable for high-volume e-commerce logistics were not yet widely available.

Rather than relying on standard retail formats, Amazon worked directly with suppliers such as Mondi to develop new paper-based formats, including padded envelopes and a recyclable paper-padded envelope with integrated cushioning that replaces traditional plastic bubble packaging for online deliveries and designed specifically for e-commerce operations.

These formats were designed to perform reliably in Amazon's automated fulfilment centre packing systems and long-distance transport while remaining recyclable. Mondi emphasised the catalytic nature of this collaboration.

> *"With Amazon, the discussion is not just about replacing plastic, but about redesigning packaging systems. That pushes innovation forward." – Mondi, leading global packaging and paper group*

Paper-based padded envelopes and similar formats are now widely adopted beyond Amazon's own operations. Mondi highlighted that packaging formats and processes co-developed with Amazon, including paper-based envelopes, protective envelopes and right-sized packaging solutions, are not bespoke to a single customer but designed to be scalable beyond a single buyer relationship.

> *"When you develop solutions that work at the scale and complexity of Amazon, those solutions can then be applied to many other customers." – Mondi, a leading global packaging and paper group*

Following the initial transition to paper-based packaging, Amazon continued investing in research to identify bio-based and compostable alternatives, in collaboration with biodegradable bioplastic manufacturers such as Novamont, who described the starting point of the collaboration as a fundamental shift in approach.

> *"The basic principle we started with Amazon was to move away from traditional plastics and to develop new solutions that could offer better end-of-life options for packaging." – Novamont, a European biodegradable bioplastic manufacturer*

This collaboration goes beyond material substitution and focuses on improving performance, circularity and recyclability at the same time. More specifically, Amazon supported the development of new bio-based formulations, including applications using Mater-Bi designed to meet specific mechanical and transparency requirements for e-commerce packaging, such as tear resistance, puncture resistance and durability during transport.

The TERRIFIC Project

An example of this innovative collaboration is the TERRIFIC project, which is a major EU-funded initiative focused on developing new bio-based packaging materials that are durable, recyclable and designed for a circular economy. The project's objective is not only to design and test these new materials but also to demonstrate their feasibility at industrial scale and prepare them for market deployment. As a partner in this project, Amazon helps define the performance requirements for new packaging materials, tests prototypes in its fulfilment centres and evaluates how these materials perform in real delivery conditions.

Novamont also highlighted that Amazon had accelerated the development and readiness of these solutions because it provided early access to operational testing environments, technical validation in Amazon's labs, and connections to recycling partners that would otherwise have taken significantly longer to secure.

> *"Amazon allows us to test new materials in a real operating context, which is essential before thinking about wider application. We might have reached these solutions eventually, but Amazon significantly accelerated the process and opened doors earlier than would otherwise have happened." – Novamont, European biodegradable materials producer*

Amazon also worked directly with Novamont to develop sustainable packaging solutions tailored to national waste-management infrastructures: compostable pathways in Italy and Spain, mechanical recycling solutions in Germany, France and the Netherlands, and mixed organic and mechanical solutions in the UK.

> *"We worked with Amazon country by country, adapting packaging to the local waste-management infrastructure. What works in Italy does not necessarily work in Germany." – Novamont, European biodegradable materials producer*

4.4.2 Amazon has accelerated packaging innovation through automation and artificial intelligence (AI)

Key findings

- Amazon has invested in packaging automation and AI technologies in Europe and the UK to optimise packaging processes through automation and AI.
- Automated packaging machines create custom-sized, 100% recyclable paper packaging, reducing average packaging weight by more than 26 grams per shipment.
- AI systems such as the Package Decision Engine have reduced cardboard box use by more than 35% over five years.

Reducing packaging waste and minimising transportation emissions also requires reducing the total amount of packaging used per shipment. Amazon's strategy combines automation and AI to ensure each product is packed in the smallest appropriate container while maintaining product protection and delivery quality.

Amazon operates an R&D lab in Vercelli, Italy, as part of a global network of innovation labs including Seattle and Boston. These facilities test and refine operational technologies before they are deployed at scale across fulfilment centres. Over the past five years, Amazon has invested approximately €700 million globally in automation and robotics, leading to the deployment of new technologies, including packaging systems designed to reduce material use and improve operational efficiency, such as automated packaging machines.[33]

Automated packaging machines measure products in real time and create packaging tailored to the exact dimensions of each item, rather than relying on standard box sizes. By eliminating excess empty space, they reduce material use and shipment weight. As part of this transition, Amazon re-engineered machines originally designed for plastic packaging so they could operate with recyclable paper materials, enabling the company to scale right-sized paper packaging without replacing its entire infrastructure. Amazon is now installing these adapted automated systems across European fulfilment centres, with more than 70 operational in Germany, the UK, France, Italy and Spain by the end of 2025 and further expansion planned by 2027. On average, these machines have reduced packaging weight by more than 26 grams per shipment.[33]

> *"Amazon is on the front line in the e-commerce industry disrupting the model of developing custom-made packages. We're developing cutting-edge technologies in made-to-fit packaging, and creating new collaborations with several companies, start-ups, and universities to push the boundaries of sustainable automation – turning lab concepts into scalable solutions that reach customers faster." – Stefano LaRovere, Director, Global Robotics at Amazon*

Beyond physical automation inside fulfilment centres, Amazon has also introduced upstream design programmes and AI tools such as Ships in Product Packaging (SIPP) and the Packaging Decision Engine, which reduce packaging before it even reaches the packing bench.

33 Source: https://www.aboutamazon.eu/news/innovation/amazon-announces-over-700-million-investment-in-robotics-and-ai-powered-technologies-across-europe

Ships in Product Packaging (SIPP)

Amazon's SIPP programme reduces unnecessary outer packaging by shipping products in their original manufacturer packaging whenever it is robust enough for delivery. SIPP shifts packaging optimisation upstream in the supply chain rather than addressing it only at the fulfilment stage, as it encourages manufacturers to design products that are "ready to ship" without additional Amazon boxes or padding. This reduces material use, eliminates excess packaging and lowers transport emissions by decreasing overall shipment weight and volume.

AI-driven Package Decision Engine

Alongside physical automation, Amazon developed the Package Decision Engine, an AI-based system that determines the most efficient packaging option for each product. The system analyses product dimensions, fragility and shipping conditions to balance material efficiency, waste reduction, and the product quality and safety. Over the past five years, these algorithms have reduced cardboard box usage by more than 35%, contributing to material savings at scale.

4.5 Amazon's early investment in innovation has supported innovative start-ups and accelerated emerging solutions

Key findings

- Amazon has invested tens of millions of euros in early-stage climate innovation in Europe through the Climate Pledge Fund and the Amazon Sustainability Accelerator.
- Between 2022 and 2025, the Amazon Sustainability Accelerator supported more than 70 start-ups across Europe.
- Since 2023, Amazon has invested in the UK and EU through the Low-carbon Energy and Asset Programme (LEAP) Operations Sustainability Accelerator for transport-related sustainability innovation.
- Amazon's R&I support extends beyond funding to include access to operational sites, technical expertise and testing facilities.

Direct funding and acceleration programmes

Amazon supports early-stage innovation through structured investment and acceleration initiatives. Through the Climate Pledge Fund, Amazon has invested hundreds of millions of dollars globally over the past five years in companies developing low-carbon technologies,

including into European-based start-ups such as Sunfire in Germany and Paebbl in the Netherlands.

Sunfire: Clean hydrogen for industry

Sunfire is a German company backed by the Climate Pledge Fund that develops equipment to produce green hydrogen – a clean fuel made using renewable electricity instead of fossil fuels. Hydrogen is widely used in heavy industries such as steelmaking, chemicals and refining, where it is traditionally produced using natural gas, generating significant carbon emissions. Sunfire's technology uses electricity from renewable sources, such as wind or solar, to split water into hydrogen and oxygen. This produces hydrogen without the associated carbon emissions. The company also supports the production of synthetic fuels (e-fuels) that can replace fossil fuels in certain industrial and transport applications.

Paebbl: Turning carbon into building materials

Paebbl is a Netherlands-based company backed by the Climate Pledge Fund that develops technology to permanently store CO_2 by turning it into solid materials. Instead of releasing CO_2 into the atmosphere or storing it underground, Paebbl captures and converts it into a stable mineral powder that can be used in products such as cement and other cementitious materials. Because cement production is highly carbon-intensive, replacing a portion of conventional materials with carbon-based minerals can significantly reduce emissions in the construction sector.

Since 2023, **Amazon has also invested in the UK and EU through the LEAP** Operations Sustainability Accelerator. LEAP supports the development and testing of sustainable technologies relevant to Amazon's transport and logistics operations, helping establish collaboration between start-ups and Amazon's operational teams.

In parallel, Amazon established the **Amazon Sustainability Accelerator (ASA)** – a programme designed to help early-stage climate and sustainability start-ups move from concept to commercial deployment. What distinguishes the ASA from traditional grant schemes is the combination of financial support, mentoring and direct access to Amazon's operational environments for pilot testing and scaling their solutions.

Access to operational environments for testing was described as critical for both start-ups and established innovators.

> *"Amazon provides access to labs and operational testing environments in Europe and the US. This allows us to validate materials much earlier and under real logistics conditions." – Novamont, European biodegradable materials producer*

Since launching in 2022, the ASA has supported more than 70 start-ups across the UK and Europe, **provided over €1 million in grants and credits**.[34] In 2024 and 2025, the ASA ran dedicated ClimateTech cohorts, focused specifically on technologies addressing energy, packaging, waste and water efficiency challenges.

The supported companies include start-ups improving energy efficiency in buildings, such as HT Materials Science (Republic of Ireland), and start-ups reducing single-use packaging through reusable delivery models, such as Re-Zip (Denmark).

HT Materials Science: Reducing heating and cooling energy use

In the buildings domain, HT Materials Science (Republic of Ireland) piloted its nanofluid additive in Amazon fulfilment centres in Coventry, Daventry and Doncaster. The technology increases the cooling and heating capacity of typical heating, ventilation and air conditioning systems without requiring additional energy input, helping to reduce energy requirements by up to 14%. By improving the efficiency of existing heating and cooling systems, the solution can lower operational energy use and associated emissions without major equipment replacement. The pilot allowed HT Materials Science to test the performance, maintenance needs and scalability of its technology in real fulfilment centre conditions.

Re-Zip: Reusable packaging pilots

Amazon piloted reusable packaging models as part of the 2024 ClimateTech cohort. Re-Zip (Denmark) supplied 45,000 reusable cardboard boxes across five European countries. Reusable packaging aims to replace single-use shipping materials with boxes or mailers that can be returned, cleaned and reused multiple times. Testing this model at Amazon's scale allowed Re-Zip to evaluate logistics performance, customer returns, cross-border collection systems and durability under high-volume e-commerce conditions. The pilot also tested whether returned packaging could be collected, cleaned and sent back for future fulfilment

[34] Source: https://www.aboutamazon.eu/news/sustainability/winning-sustainability-start-ups-earn-chance-to-pilot-their-innovations-with-the-amazon-sustainability-accelerator

4.6 Amazon has implemented schemes that improve the energy and water efficiency of its cloud computing operations

Key findings

- Amazon Web Services (AWS) data centres operate at materially greater energy and water efficiency levels than industry averages.
- AWS has developed its own energy-efficient processors that reduce emissions both for its own operations and its customers. As the time of writing more than 90,000 customers have adopted AWS computing services using highly efficient Graviton chips.

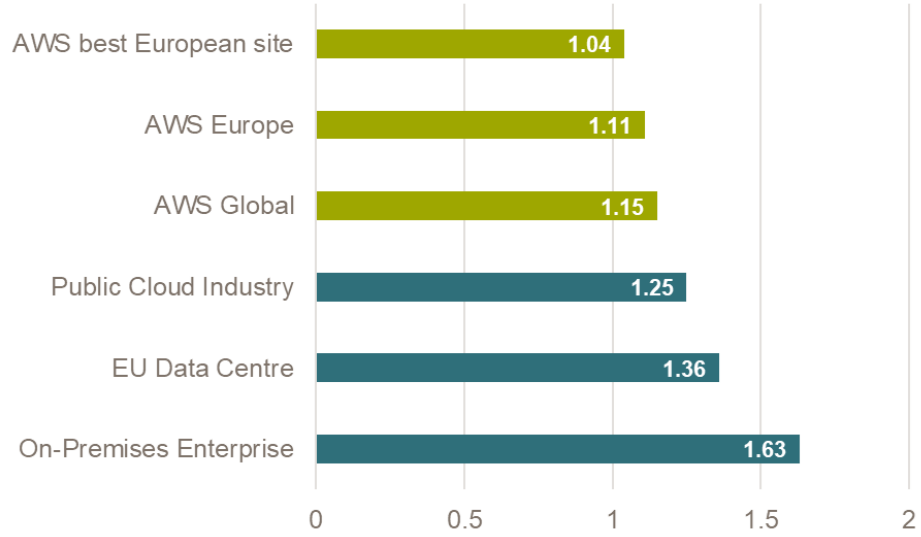
Growing demand for digital services, cloud computing and AI is driving rapid expansion of data centres, which are inherently energy and water intensive. In response to this rising demand, Amazon embeds energy efficiency improvements into the core design and day-to-day operations of its AWS data centres. As a result, AWS data centres are comparatively more resource efficient than many European counterparts. All of Amazon's data centre and IT infrastructure in Europe is certified to ISO 50001 energy management standards.

> *"We are always inspecting how our design can be optimised to deliver the most efficient, most sustainable operations possible." – Ross Campbell, Director Data Centre Planning and Delivery at AWS EMEA*

A common measure of data centre efficiency is power usage effectiveness (PUE).[35] A PUE closer to 1 indicates higher efficiency, meaning less energy is lost to cooling and overhead systems. As shown in Figure 4 below, AWS facilities in Europe operate more efficiently than typical data centres.

[35] PUE is calculated as the ratio between total facility energy use and the energy used directly for computing.

Figure 4 Energy efficiency comparison (PUE, 2024)



Source: *(i) AWS sustainability page, (ii) Assessment of the energy performance and sustainability of data centres in EU, first technical report and (iii) International Data Corporation*

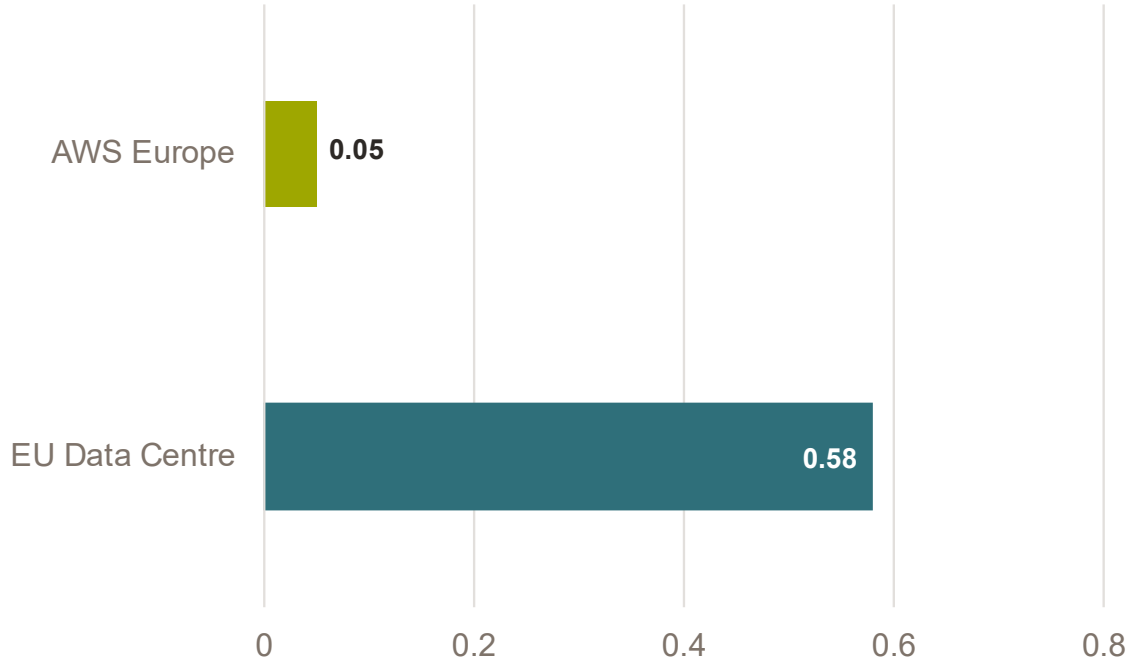
Note: *"On-Premises Enterprise" refers to privately operated data centres run by individual organisations for their own use. "EU Data Centre" reflects the average PUE of data centres in the EU. "Public Cloud Industry" represents the average PUE of large commercial cloud providers. AWS figures show the average efficiency of Amazon Web Services facilities globally and in Europe, with the "best European site" indicating the highest-performing individual facility. A PUE closer to 1.0 indicates higher efficiency, meaning less energy is lost to cooling and overhead systems.*

Water efficiency is also critical because data centres may use water for cooling, and reducing water consumption helps minimise pressure on local water supplies, especially in water-scarce areas.

Amazon is working towards becoming water positive by 2030, meaning it aims to return more water to communities and the environment than it uses in its direct operations. By 2025, Amazon had achieved 75% of this target.

Water use efficiency (WUE) measures how much water is used per unit of computing delivered (litres per kilowatt-hour). Lower values indicate more efficient water use. As shown in Figure 5 below, AWS facilities in Europe are 95% more water efficient than the EU data centres average.

Figure 5 Water efficiency comparison (WUE, 2025)



Source: *(i) Amazon internal data and (ii) Assessment of the energy performance and sustainability of data centres in EU, first technical report*

Note: *A WUE closer to 0.0 indicates higher efficiency, meaning less water is lost per unit of computing delivered. Amazon's WUE data is updated as of 2025 whereas EU Data Centre average data is updated as of 2024.*

Amazon has developed and deployed energy-efficient computing technologies that their customers can use

Beyond improving the efficiency of its data centre buildings, Amazon has focused on improving the efficiency of the computing equipment itself. AWS designs its own computer processors – the small but powerful components that carry out calculations and run software. These processors sit inside the servers that store data and power websites, apps and digital services.

One example of efficient processors designed by Amazon is the AWS Graviton processor family. These chips are designed to do the same computing work as traditional processors but using much less electricity. In some cases, **Graviton-based services use up to 60% less energy to deliver the same performance**. In simple terms, this means customers can run their websites, applications or data systems while using significantly less power.

By the end of 2024, **more than 70,000 AWS customers were using Graviton-based services globally.** This helped reduce customer-related emissions by an estimated 12,000 metric tonnes of CO_2e. Amazon's own use of these processors reduced its emissions by

approximately 71,000 metric tonnes of CO_2e in 2024.[36] As of today, **the number of customers has risen to over 90,000.**[37]

AWS has also developed specialised processors such as Trainium and Inferentia2, designed specifically for AI tasks. These chips are more energy efficient, delivering up to 50% more computing output for each unit of electricity used. In practice, this means AI systems can perform the same tasks, such as analysing images or processing language, while consuming less power.

36 2024, *Amazon Sustainability Report*

37 2026, *What is AWS Graviton? How Amazon's custom chip powers the cloud*

5 Amazon accelerates progress through leadership, alliances and policy engagement

Amazon's actions extend beyond its own operations by shaping markets, standards and enabling conditions for low-carbon technologies. Through collective initiatives, policy engagement and visible leadership, Amazon has accelerated progress beyond what individual firm-level investments could achieve alone.

5.1 Amazon is aggregating pre-commercial demand to unlock investment in hard-to-abate sectors

Key findings

- Amazon participates in buyers' alliances to overcome the classic "chicken-and-egg" barrier in hard-to-abate sectors – where supply and demand must scale simultaneously – by reducing market fragmentation and providing clearer demand visibility to producers and investors.
- In 2024, SABA announced multi-year sustainable aviation fuel (SAF) purchase agreements globally, which is expected to help avoid around 500,000 tonnes of CO_2e emissions.

Low-carbon fuels are essential for decarbonising hard-to-electrify sectors such as aviation and maritime shipping as well as middle-miles on the road. However, their expansion is sometimes constrained by high upfront capital costs, limited production capacity, infrastructure bottlenecks and a lack of coordinated long-term demand signals needed to unlock investment at scale.

In fragmented markets, individual corporate efforts are often insufficient to trigger large-scale capital investment in new fuel production or vessel and aircraft redesign. Producers require credible, long-term offtake visibility to justify investments in new refining capacity, while buyers require assurance that supply will scale and costs will decline.

> *"The scale that is required to make it attractive for any provider of low-carbon fuels goes very quickly beyond what an individual player is able to bring up." – Andreas Marschner, Amazon's Vice-President of Worldwide Sustainable Operations*

Amazon has sought to address this coordination challenge by aggregating demand through buyers' alliances, providing pre-commercial demand signals that reduce first-mover risk and increase revenue certainty for suppliers. In particular:

- Amazon was a founding member of the **Sustainable Aviation Buyers Alliance (SABA)**, which aligns corporate demand for SAF and supports scaling production capacity. In 2024, SABA announced multi-year SAF purchase agreements globally, covering nearly 50 million gallons of fuel – representing around 500,000 tonnes of CO_2e emissions reductions – providing some long-term demand visibility needed for suppliers to finance new SAF production.[38]
- Amazon co-founded the **Sustainable Freight Buyers Alliance (SFBA)**, which coordinates buyer demand for medium- and heavy-duty battery electric vehicles and charging infrastructure, including in European freight corridors. SFBA aims to support up to 100 million tonnes of CO_2e in emissions reductions by 2030 globally by bringing freight buyers together and pooling demand for zero-emission logistics solutions.[39]

> *"Amazon is playing an important coordination role in addressing a key barrier to zero-emission middle-mile freight: charging infrastructure will not scale without clear demand for battery electric trucks, while carriers are less likely to invest in electric vehicles without confidence that charging will be available where they need it. Through the Poland eCorridor, Amazon is helping bring together shippers, carriers, charging providers, and operational data to reduce that uncertainty and support a more sustainable model of freight transport." – Smart Freight Centre*

Rather than waiting for mature markets to develop, Amazon and its partners are engaging early in the investment cycle to catalyse production capacity and infrastructure build-out. Coordinated demand, paired with early procurement commitments, supports infrastructure development and contributes to cost reductions over time. This model is particularly relevant in Europe, where regulatory frameworks such as ReFuelEU Aviation and FuelEU Maritime establish binding decarbonisation targets that depend on parallel growth in sustainable fuel supply capacity.

> *"We're going really early into the investment cycle and trying to send a demand signal there to be able to increase the capacity of production." – Asad Jafry, Director –- Amazon Worldwide Operations Sustainability*

Alongside coalition-based aggregation, Amazon has entered into commercial agreements with European suppliers to support the displacement of fossil fuels. This includes contracts with companies such as Neste (Finland) and FincoEnergies (Netherlands) for sustainable aviation and maritime fuels.

38 2024, Sustainable Aviation Buyers Alliance, *SABA announces historic agreements to purchase sustainable aviation fuel certificates*

39 2023, Smart Freight Centre, *Sustainable Freight Buyers Alliance general introduction deck*

5.2 Amazon is shaping standards, accounting frameworks and implementation rules

Key findings

- Amazon co-founded the Emissions First Partnership (EFP), helping shape how decarbonisation impact is measured and accounted for.
- Amazon provides technical, data-backed input to improve regulatory implementation to the European Commission and industry peers.
- Amazon promotes harmonised standards and cross-industry coordination to reduce fragmentation and unlock investment.

Decarbonisation at scale requires clear standards, credible accounting methodologies, and implementation frameworks that reduce uncertainty for investors, regulators and supply chain partners. In several sectors, ambiguity around carbon accounting rules, recyclability definitions and measurement frameworks can delay investment and create fragmented market signals.

Amazon has engaged in cross-sector alliances to support the development and refinement of these system-level rules and ensure that emerging standards reflect operational realities.

In energy, Amazon contributes to carbon accounting reform and procurement standards

Amazon co-founded the EFP to advance a shift in how the power sector accounts for greenhouse gas emissions. The approach prioritises renewable investment in carbon-intensive grids, where additional supply can deliver greater marginal emissions reductions, rather than concentrating procurement in already highly decarbonised markets.

> *"It's about where does our investment actually make the biggest impact… it's into those dirty grids." – Daniela Fitzpatrick, Amazon Energy Procurement*

Through this engagement, Amazon supports discussions around Scope 2 accounting frameworks and how corporate renewable procurement is measured, particularly in relation to geographic impact.

Amazon also participates in Beyond the Megawatt, an initiative of the Clean Energy Buyers Association, which promotes results-oriented clean energy procurement strategies that incorporate grid resilience, social equity and environmental protection alongside capacity deployment.

In packaging, Amazon contributes technical expertise to EU circularity standards

Amazon participates in several European industry alliances that are shaping standards for recyclability, material innovation and regulatory implementation. These include 4evergreen, CEFLEX and the Ellen MacArthur Foundation.

Through these platforms, Amazon shares operational experience from large-scale e-commerce packaging deployment and contributes technical input to improve fibre-based packaging recycling rates, harmonise flexible packaging standards and advance digital watermarking technologies that improve sorting accuracy within European recycling systems.

In the context of the EU Packaging and Packaging Waste Regulation, Amazon has been consulted by policymakers and trade associations on implementation detail, including methodologies for measuring void space and recyclability thresholds.

> *"Amazon contributes technical expertise and data-driven insights to support the development of effective packaging standards." – Thais Blumer, Amazon*

By grounding regulatory discussions in operational experience, Amazon supports the development of standards that are both ambitious and practically implementable within complex supply chains.

In transportation, Amazon supports common measurement frameworks and freight coordination

Amazon engages in collaborative initiatives aimed at improving data transparency, harmonising emissions measurement methodologies and accelerating zero-emission freight adoption. This includes engagement with the Global Logistics Emissions Council Framework, a globally recognised methodology for measuring freight transportation emissions, and participation in coalitions such as the First Movers Coalition, which seeks to align corporate demand for emerging decarbonisation technologies across aviation, maritime and heavy industry.

Beyond participation, Amazon has emphasised the importance of cross-industry coordination in overcoming structural barriers to freight decarbonisation.

> *"Players that might have traditionally never talked to each other… need to start coming together." – Andreas Marschner, Amazon's Vice-President of Worldwide Sustainable Operations*

By contributing operational learning and participating in shared measurement and coordination platforms, Amazon supports the development of common frameworks that reduce uncertainty for carriers, infrastructure providers and policymakers.

5.3 Amazon advocates for enabling infrastructure and regulatory frameworks to decarbonise transport and energy operations in Europe

Key findings

- By raising challenges publicly and engaging with EU institutions, Amazon has contributed to shaping policy debates around corridor-based charging, grid readiness and long-haul electrification, areas where private investment alone is insufficient.
- As such, Amazon positions itself not only as a deployer of low-carbon solutions but also as an advocate for the regulatory and infrastructure conditions required to enable system-wide decarbonisation.

Decarbonisation of transport and energy systems depends not only on corporate investment and market coordination but also on enabling regulatory frameworks and infrastructure build-out. Amazon has been an early and active advocate for regulatory frameworks that enable the deployment of low-carbon infrastructure at scale.

In heavy-duty transport, Amazon supported the development of the EU's Alternative Fuels Infrastructure Regulation and associated CO_2 standards for trucks, including through joint advocacy with industry peers.

Together with Daimler Truck, Scania and Volvo, Amazon publicly advocated for ambitious Europe-wide targets for zero-emission long-haul truck charging infrastructure,[3] arguing that private investment in vehicles and depot charging must be matched by corridor-scale infrastructure and sufficient grid capacity to make long-haul electrification viable across the EU. The signatories argued that, while companies can invest in vehicles and depot charging, corridor-based infrastructure and grid capacity are essential for long-haul electrification to become operationally viable across the EU.

Amazon has also supported the development of EU sustainable fuel frameworks, including ReFuelEU Aviation and FuelEU Maritime, which establish long-term decarbonisation trajectories and provide greater demand certainty for low-carbon fuel producers.

In addition, Amazon has supported efforts to reduce non-financial barriers to the energy transition, including initiatives focused on speeding up administrative processes for renewable deployment, including faster permitting processes and improved transparency around grid capacity. For example, AWS collaborated with WindEurope and Accenture to develop EasyPermits, a digital permitting solution designed to streamline administrative processes and support faster renewable deployment across the EU.

5.4 Amazon is scaling ambition through implementation and supply chain mobilisation

Key findings

- Amazon's contribution is not limited to reducing its own emissions. By combining large-scale implementation, structured supplier engagement, and knowledge-sharing platforms, Amazon helps normalise ambitious climate standards and extend decarbonisation practices across sectors.

Amazon has a goal to reach net zero carbon across its operations by 2040 and, for the past six years, has been **one of the largest corporate purchasers of renewable energy globally**. It has built the world's largest portfolio of carbon-free energy, comprising more than 700 projects across multiple geographies and totalling over 40 GW of capacity. This sustained scale of deployment provides operational credibility to Amazon's climate efforts and demonstrates implementation at a level that few corporate actors have achieved.

Relative to publicly announced efforts in e-commerce and cloud services, Amazon's climate targets were adopted early, apply across core operations and have been accompanied by large-scale deployment of renewable energy, logistics electrification and packaging transformation. The scale and integration of these efforts suggest that Amazon's approach goes beyond signalling ambition and reflects systematic implementation across its operational footprint.

Amazon's leadership extends beyond its direct operations into its supply chain

Amazon has embedded decarbonisation expectations within its supplier engagement. The company works with suppliers to strengthen carbon measurement and reporting, improving the accuracy of emissions data and enabling both suppliers and procurement teams to manage carbon performance alongside cost and delivery metrics. As of the end of 2025, 67% of Amazon's top suppliers (which represent 70% of Amazon's supply chain carbon emissions) have shared decarbonisation plans with Amazon. This is a milestone that reflects years of sustained engagement across business units, geographies and sectors. Beyond direct supplier engagement, Amazon co-founded the Climate Pledge in 2019, which now includes over 680 signatories across sectors. The Climate Pledge establishes clear expectations around regular reporting, meaningful decarbonisation and credible neutralisation. By setting defined criteria for participation, the initiative contributes to raising the bar for corporate climate efforts and creates a shared framework for accountability.

Amazon also makes tools and operational learning available to other companies. Through initiatives such as the Amazon Sustainability Exchange, Amazon shares methodologies, data

tools and best practices that were developed internally. By lowering informational and technical barriers – particularly for smaller firms with limited internal capacity – Amazon supports broader uptake of credible decarbonisation strategies. Amazon has also embedded sustainability guidance directly into its selling partner tools, enabling third-party businesses to access packaging redesign support and decarbonisation resources through its fulfilment operations.

> *"There's very limited point in being an echo chamber… we want to engage and share the knowledge that we're developing." – Daniela Fitzpatrick, Amazon Energy Procurement*

6 Conclusion

Amazon's low-carbon investments, operational initiatives and public engagement have contributed to strengthening Europe's green economy in several interconnected ways, supporting between 112,000 and 144,000 jobs and between €8.8 billion and €11.3 billion in GVA to the green economy.

Amazon's scale, paired with its credible efforts to decarbonisation, uniquely positions it to provide sustained, significant and long-term demand. This demand plays an important role in de-risking investment across key sectors of the green economy, including renewable energy capacity, fleet electrification and sustainable packaging materials and products.

In addition, Amazon's drive for innovation and its willingness to operate in less mature markets have helped emerging low-carbon technologies move from early-stage development to deployment at scale. This is reflected in the development of innovative packaging materials and right-sizing technologies, the push for middle-mile electrification and activity in less mature PPA markets, where corporate demand can act as a catalyst for new renewable capacity.

Finally, Amazon's engagement with industry peers and policymakers has helped to accelerate progress beyond its own operations. By leading and participating in alliances that coordinate demand signals for alternative sustainable fuels, and by sharing operational and technical knowledge, Amazon has helped bring other actors on board and strengthen momentum toward sector-wide decarbonisation.

- Amazon's decarbonisation efforts are ongoing, with continued investment planned across energy, transport and packaging in Europe. Current plans include two major projects in Germany, with further potential projects under consideration in the UK, Italy, Finland, Ireland and Spain.

- In **energy**, Amazon is expected to further expand its portfolio of renewable PPAs, with continued focus on offshore wind in Germany, the Netherlands and the UK, alongside expansion into emerging and more carbon-intensive markets such as Portugal, Poland and Greece. This aligns with its approach to prioritise grids where additional renewable capacity can have the greatest decarbonisation impact. Greater integration of solar and battery storage is also anticipated, supporting grid resilience and reducing curtailment as electricity demand grows.

- In **transport**, Amazon is scaling battery electric trucks and building the collaborative frameworks and infrastructure needed to deploy them – including the Poland eCorridor, which is designed to demonstrate how coordinated action across the freight ecosystem can accelerate corridor electrification. In urban logistics, further expansion of micromobility hubs is expected, with 25 new European hubs planned for 2026, adding to the more than 70 hubs already operating across over 50 European cities, including Berlin,

Paris, Milan, Barcelona and London. In parallel, sustainable fuels are becoming an increasing focus, with additional investment expected as Amazon explores further decarbonisation of transport segments where electrification is not yet feasible.

- In **packaging**, Amazon is deploying hundreds of packaging technologies such as universal robotic labellers[40] and automated packaging machines to reduce material use, right-size parcels and improve operational efficiency.

[40] Universal robotic labellers are automated systems that apply shipping labels directly to manufacturer packaging, enabling products to be shipped without additional outer boxes where appropriate.

7 Annex A: Quantitative analysis

7.1 Total value of investment

This section sets out the methodology we followed to estimate the monetary value of Amazon's low-carbon investments in Europe (including EU27 and the UK) over the 2021-2025 period. The total value of investments is also broken down for each of the five countries of focus of this study: France, Germany, Italy, Spain and the UK.

The investments monetised include the following six categories: (i) installed capacity of renewable energy facilities (i.e. wind and solar) financed by Amazon's power purchase agreements (PPAs); (ii) installed capacity of on-site solar generation facilities; (iii) procurement of electric vehicles; (iv) procurement and installation of charge points; (v) procurement of sustainable packaging; and (vi) research and innovation (R&I) activities in low-carbon technology.

For investments (ii) to (vi), we used Amazon's financial data representing the value of electric vehicles purchased, installed charge points, sustainable packaging procured and the value of R&I activities in low-carbon technology.

For category (i), installed capacity of renewable energy facilities (on-site or PPA supported), granular financial data was not available. Therefore, we derived the monetary value of this investment based on Amazon's information on installed capacity (in MW) as set out below. In addition, Amazon shared aggregate information on the total committed spend associated with publicly announced PPAs in Europe over the period from January 2021 to December 2025. This figure was used as a high-level cross-check to validate the order of magnitude of our bottom-up estimates.

7.1.1 Value of Amazon-enabled renewable energy capacity

We estimate a range for the value of Amazon-enabled renewable energy capacity as follows. We multiplied the total Amazon-enabled installed capacity (MW)[41] per technology by a range of average capital costs per technology (€ per MW). Average capital costs refer to the total upfront investment required to develop and commission a renewable energy asset. These costs typically include equipment (e.g. solar modules, wind turbines, inverters), balance-of-system components (e.g. mounting structures, cabling), civil works and construction, grid connection, development and permitting costs, as well as engineering, procurement and project management. They therefore go beyond pure construction costs and capture the full investment required to bring a project to operational status. We use the following sources:

[41] This includes projects that have been executed and projects that are already operational.

- Amazon's self-reported information on total installed capacity (MW) in renewable generation per country and technology over the 2021-2025 period; and
- Publicly available information on average capital costs of installed capacity per technology in Europe as of 2024 and 2025 (€ per MW):
  - Renewable power generation costs in 2024 on global and country-level capital cost data by technology published by the International Renewable Energy Agency (IRENA).[42] IRENA provides technology-specific estimates of total installed capital costs for renewable energy projects across countries based on a consistent methodology and standardised cost boundaries. These estimates capture the full upfront investment required to bring projects to operation, including equipment, engineering, procurement and construction (EPC), grid connection and development costs.
  - Solar photovoltaic (PV) projects. We use the values included in the Hec Solar presentation for utility-scale solar as a proxy for both PPA-supported and on-site solar PV projects:[43] Solar PV Deployment in Europe: Cost Trajectories and Market Dynamics in 2025.[44] These benchmarks reflect all-in investment costs for utility-scale PV systems, including modules (typically the largest cost component), inverters, mounting and racking systems, electrical infrastructure (cabling and grid connection), and installation and engineering costs.
  - Onshore and offshore wind. We use Delfos Energy analysis of wind energy investment costs in Europe.[45] These benchmarks incorporate the full capital cost of wind projects, including turbine supply (the largest component), foundations and support structures, electrical infrastructure (including interconnection), transport and installation, as well as development and financing-related costs.

Table 2 below presents the capital expenditure values applied in the estimation.

Table 2 Benchmark construction costs for renewable energy projects, 2025

Renewable technology	Low estimate *(€ per MW)*	High estimate *(€ per MW)*
Utility-scale PV	€ 450,000	€ 650,000

42 2025, IRENA, *Renewable Power Generation Costs in 2024*

43 We note that on-site installations may exhibit different cost structures than large utility-scale projects. However, average capital costs of installed capacity for on-site solar PV facilities were not available. PPA-supported solar facilities are likely to benefit from economies of scale and present lower costs per MW. As such, assuming the same benchmark value is a conservative assumption.

44 2025, Hec solar, *12th Solar Finance & Investment Europe Summit*

45 2025, Delfos, *Cost of Wind Energy in Europe: Investment and Financial Returns*

Renewable technology	Low estimate *(€ per MW)*	High estimate *(€ per MW)*
Onshore wind	€ 1,200,000	€ 1,500,000
Offshore wind	€ 3,000,000	€ 4,000,000

Source: Frontier Economics analysis based on Solar PV Deployment in Europe (2025) and Delfos Energy wind cost estimates.

7.1.2 Procurement of electric vehicles (vans and battery electric trucks)

The value of Amazon's investment in electric vans and battery electric trucks is directly based on Amazon's self-reported value of expenditure in its own electric vehicles in Europe over the 2021-2025 period.

7.1.3 Procurement and installation of charge points

The value of Amazon's investment in the procurement and installation of charge points is directly based on Amazon's self-reported value of expenditure in charge points in Europe over the 2021-2025 period. This includes charging infrastructure deployed across Amazon's operational logistics sites (e.g. delivery stations and fulfilment centres) to support electric delivery fleets, as well as charging points installed at corporate sites for employee use. The figures also cover associated investment required to enable electrification, such as site-level power upgrades and related infrastructure.

7.1.4 Procurement of sustainable packaging

The value of Amazon's investment in the procurement of paper-based and fibre-based packaging formats that are recyclable packaging for the 2024-2025 period is directly based on Amazon's self-reported value of expenditure. This includes categories such as paper envelopes (including padded mailers), paper bags, corrugated boxes and other fibre-based packaging materials, as well as dunnage used for protection during shipping.

Financial data was not available for the value of procurement of paper-based and fibre-based packaging formats that are recyclable for the 2021-2023 period. We approximated this value using:

- Amazon's data on total value of expenditure in paper-based and fibre-based packaging formats that are recyclable for 2024-2025; and
- Amazon's data on volume of packaging (measured as the number of shipments using these packaging formats) covering the full 2021-2025 period.

First, we estimated an average unit price (in € per shipment) based on 2024-2025 information. We then multiplied the average price to the total volume purchased over the 2021-2023 period to estimate a total value of investment for the whole period.

7.1.5 R&I activities in low-carbon technology

The value of Amazon's investment in R&I is directly based on Amazon's self-reported value of expenditure in R&I in Europe over the 2021-2025 period and, by nature, cannot be split across countries. This includes R&I investment in the Climate Pledge Fund, Low-carbon Energy and Asset Programme (LEAP) fund, packaging R&I activities and the Amazon Sustainability Accelerator (ASA).

7.2 Impact on jobs and value added (GVA)

7.2.1 Conceptual framework

When Amazon invests in renewable energy, electric vehicles, charging infrastructure or sustainable packaging, that spending does not only affect the immediate supplier; it also generates demand in the supply chain. For example, construction of renewable energy projects requires engineering services, fabricated metal products, electrical equipment and financial services. Procurement of electric vehicles supports machinery production, component manufacturing and maintenance services.

To quantify these wider economic linkages, we apply a standard supply chain (input-output) approach, which traces how initial investment spending flows through interconnected industries and supports economic activity across multiple sectors and stages of production. In practice, this requires allocating Amazon's investment across industries and identifying the share of that spending which occurs domestically. Section 7.2.3 provides a detailed description of how investment is mapped to OECD sectors and how domestic expenditure shares are derived.[46]

These inter-industry linkages create multiplier effects across the economy, which can be measured in terms of:

- Gross value added (GVA), supported, both directly and indirectly along the domestic supply chain. GVA represents the value of goods and services produced in the economy net of intermediate inputs (i.e. the contribution of labour and capital to production). At a national level, GVA excludes the value of imported inputs and is closely related to gross domestic product (before taxes and subsidies on products are applied); and
- Employment supported, both directly and indirectly along the domestic supply chain.

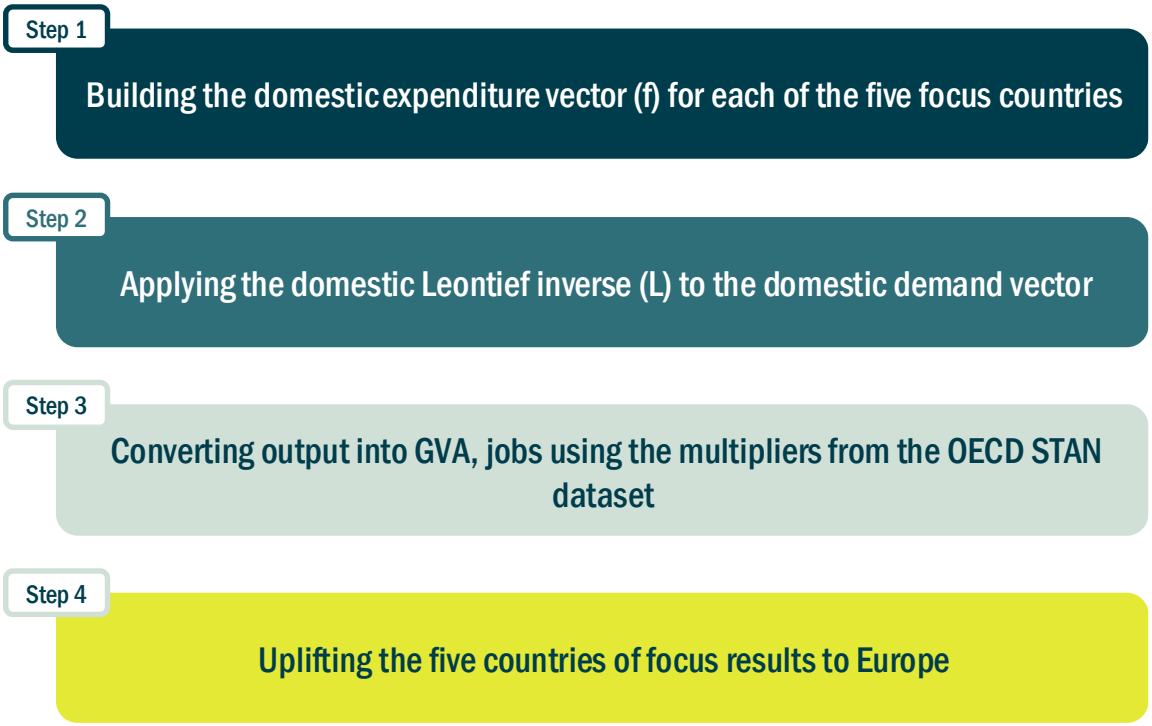
[46] See the OECD *Handbook on Extended Supply and Use Tables and Extended Input-Output Tables* for a detailed exposition of the OECD input-output framework.

This analysis estimates the economic activity supported by Amazon's investment across the domestic supply chain.[47] It does not measure net additional economic activity relative to a counterfactual scenario. Instead, the results show how Amazon's investment supports economic activity within the low-carbon economy, including by shifting spending away from more carbon-intensive alternatives. Some of this impact on jobs and GVA has already materialised, while further impacts are expected to emerge in the short term as investments continue to support economic activity over the next few years. For example, executed PPAs may enable the development of renewable energy projects that are not yet operational.

7.2.2 Modelling framework

The estimation follows four main steps, summarised below. At a high level, the approach allocates Amazon's investment across sectors, isolates the share of spending that occurs domestically and then traces how this spending propagates through the economy using input-output relationships. Section 7.2.3 provides further detail on sectoral allocation and domestic content assumptions.

Figure 6 The four main steps of the OECD input-output framework



Source: Frontier Economics based on the OECD input-output framework documentation

[47] The analysis does not account for induced effects, such as additional economic activity generated through increased household consumption resulting from higher incomes.

Step 1: Building the domestic expenditure vector

In order to estimate supply chain effects accurately using the OECD input-output framework, it is necessary to allocate total investment spending across economic sectors. This is because the Leontief model does not operate on a single aggregate investment value; rather, it requires spending to be assigned to specific industries (e.g. construction, electrical equipment, machinery, professional services). The way in which capital expenditure is distributed across sectors determines how the model captures upstream production linkages and multiplier effects.

After allocating total investment across sectors, it is then necessary to determine how much of that expenditure occurs domestically within each country. The OECD input-output framework captures linkages within the domestic economy. Only spending that takes place within a country contributes to its domestic GVA and employment effects. Expenditure on imported components generates economic activity abroad and therefore does not create domestic multiplier effects.

Therefore, for each of the five focus countries (France, Germany, Italy, Spain and the UK) and each investment category (renewable energy, electric vehicle procurement, charge points and sustainable packaging), we constructed a local sectoral expenditure profile, i.e. we decomposed total investment into the specific industries that receive spending and isolated the portion of that spending that occurs domestically.[48]

This involved:

1. mapping Amazon's investment activity to OECD input-output industry classifications;
2. estimating the share of spending that occurs domestically (i.e. within the country); and
3. aggregating investment over the 2021-2025 period to estimate the total impact supported over the period.

This produces a country-level domestic expenditure vector (f), which represents local spending by sector.[49] Further detail on the allocation of investment across sectors (including cost decomposition for renewable energy projects) and the assumptions used to estimate domestic expenditure shares is provided in Section 7.2.3**Error! Reference source not found.**.

[48] The level of detail in sectoral allocation and domestic expenditure shares varies by investment type due to differences in cost structure and data availability. Renewable energy projects involve multiple identifiable cost components spanning several industries, allowing for a more granular allocation. By contrast, transport and packaging investments are primarily associated with a single dominant product category and are therefore mapped to their primary industry. See section 7.3 for more details.

[49] See the *Input-Output Tables OECD page* for the OECD industry classification and Leontief inverse matrices.

Step 2: Applying the Leontief inverse

The analysis uses domestic Leontief inverse matrices from the OECD input-output tables. These matrices capture how industries purchase from each other and therefore allow us to estimate total output supported across the economy.

Using the domestic version of the Leontief matrix means that only transactions between industries located within the same country are included. As a result, the estimated impacts reflect production taking place domestically, while purchases of imported intermediate goods are excluded from the multiplier effects.

For each country, we estimate the total output supported by Amazon's investment as:

$$x = L \cdot f$$

Where:

- L= domestic Leontief inverse matrix
- f= domestic expenditure vector
- x= total output generated (direct + indirect effects)

OECD input-output tables are available up to 2022. Therefore, the 2022 domestic Leontief inverse was used as the structural representation of inter-industry relationships for the entire 2021-2025 period. Ideally, year-specific matrices would be used; however, production relationships between industries typically evolve gradually over time. Therefore, using the 2022 matrix as a proxy for the 2021-2025 period is not expected to materially affect results.

Indirect effects can be isolated using the following equation, where I is the identity matrix:

$$x_{indirect} = (L - I) \cdot f$$

Step 3: Converting output into GVA and employment

We calculated GVA and employment impacts from the above sector-level output estimates using GVA-to-output and employment-to-output ratios.

We computed GVA-to-output and employment-to-output ratios using country-level data on output, value added and employment for each OECD sector from the OECD STAN statistics.[50]

[50] https://www.oecd.org/en/data/datasets/structural-analysis-database.html

The ratios were computed by sector for each of the five focus countries using the most recent available data (2019 for France, Germany, Italy and the UK and 2018 for Spain).[51]

Step 4: Uplifting the five countries of focus results to Europe

Country-level modelling was conducted for the five focus countries. To derive an indicative Europe-wide estimate, results were scaled proportionally using the ratio between total European domestic investment and the level of investment in the five countries of focus over 2021-2025.

This scaling assumes that, on average, one euro of domestic investment in other European countries generates similar GVA and employment effects to one euro in the five countries of focus.

Given differences in industrial structure and import dependence across countries, this Europe-wide estimate should be interpreted as indicative rather than a fully modelled country-by-country result. However, as most investment occurs within the five focus countries, the uplift primarily provides an order-of-magnitude estimate of total European impact.

7.2.3 Sectoral and local allocation of investment

The following sections set out in detail how sectoral allocation and domestic production shares were determined for each investment stream.

Renewable energy investments

Cost decomposition

Renewable energy projects involve a wide range of cost components, including equipment manufacturing, civil works, grid connection, engineering services, development activities and financing etc., which span across several OECD sectors. Allocating all renewable expenditure to a single industry would risk misrepresenting how spending is distributed across the economy and would distort multiplier effects.

For this reason, investment associated with procurement of renewable electricity via PPAs and installation of on-site solar generation facilities is first decomposed into its main cost components using benchmark cost shares, and each component is then mapped to the corresponding OECD sector.

[51] In some cases, sector classifications differ between OECD STAN data and the input-output framework. In these cases, concordance assumptions were applied to map the STAN data to the Leontief inverse data. For example, where STAN combines two industries into a single category and the Leontief matrix separates them, proportional allocation assumptions were used to allocate value added and employment across these two sectors.

The cost splits for this investment are derived from the following sources:

- IRENA (2025) *Renewable Power Generation Costs in 2024* report for utility-scale solar PV and offshore wind;
- European Institute of Innovation and Technology, *Onshore Wind Anticipated Innovations Impact* (2025), for onshore wind.

These sources provide technology-specific breakdowns of capital expenditure by cost component. Table 3, Table 4 and Table 5 present the decomposition of capital costs for utility-scale solar PV, onshore wind and offshore wind respectively.

Table 3 Capital cost split of utility-scale solar PV in the five countries of focus, 2024

Cost component	Germany	Italy	Spain	France	United Kingdom
Modules	35%	43%	35%	37%	23%
Inverters	5%	6%	6%	6%	3%
Racking and mounting	9%	6%	8%	8%	6%
Grid connection	11%	7%	8%	9%	7%
Cabling/wiring	6%	3%	6%	5%	7%
Safety and security	2%	2%	0%	1%	2%
Monitoring and control	1%	1%	1%	1%	0%
Mechanical installation	8%	11%	10%	10%	11%
Electrical installation	6%	5%	8%	6%	10%
Inspection	1%	1%	1%	1%	6%
Margin*	11%	8%	9%	10%	10%
Financing costs	1%	2%	2%	2%	1%
System design	1%	1%	1%	1%	1%
Permitting	2%	3%	4%	3%	6%
Incentive application	0%	0%	0%	0%	5%
Customer acquisition	1%	1%	1%	1%	3%

Source: *IRENA Renewable Power Generation Costs in 2024*

Note: *(i) France's figures were calculated as an average of Germany, Italy and Spain because no France-specific capex decomposition was publicly available in the IRENA data used for the analysis. This assumption only affects the distribution of solar PV investment across cost components (e.g. modules, inverters, installation) within the input-output model and does not affect the overall investment figures or results, as cost shares across the available European countries were already relatively similar. (ii) *Margin for EPC company and/or for project developer for*

development and construction of solar PV system. This includes profit, wages, finance, customer service, legal, human resources, rent, office supplies, purchased corporate professional services and vehicle fees.

Table 4 Capital cost split of onshore wind in Europe, 2025

Parameter	Share of total costs
Development	6%
Turbine	56%
Support structure	28%
Array electrical	5%
Construction	5%

Source: European Institute of Innovation and Technology
Note: Shares calculated based on reported low and high cost estimates by category.

Table 5 Construction cost split of offshore wind in Europe, 2016

Parameter	Share of total costs
Contingency & other	12%
Development	3%
Electrical interconnection	17%
Foundations	13%
Installation	25%
Turbine	30%

Source: IRENA Renewable Power Generation Costs in 2024

Mapping cost components to OECD sectors

Once cost shares are established, each cost component is assigned to the OECD industry that most closely reflects the underlying economic activity. This is done by aligning the functional description of each cost component with the closest OECD sector category used in both the STAN database (used to compute the multipliers) and the input-output tables (used to compute the supply chain effects).

Table 6, Table 7 and Table 8 below present the mapping between renewable energy cost components and OECD sectors.

Table 6 Mapping of utility-scale solar PV and on-site solar generation cost components to OECD industry classification

Cost component	OECD Industry
Modules	DOM_26: Computer, electronic and optical products – Modules
Inverters	DOM_27: Electrical equipment – Inverters
Racking and mounting	DOM_25: Fabricated metal products
Grid connection	DOM_27: Electrical equipment – Other
Cabling/wiring	DOM_27: Electrical equipment – Other
Safety and security	DOM_26: Computer, electronic and optical products – Other
Monitoring and control	DOM_26: Computer, electronic and optical products – Other
Mechanical installation	DOM_41T43: Construction
Electrical installation	DOM_41T43: Construction
Inspection	DOM_71: Architectural and engineering activities; technical testing and analysis
Margin	DOM_41T43: Construction
Financing costs	DOM_64T66: Financial and insurance activities
System design	DOM_71: Architectural and engineering activities; technical testing and analysis
Permitting	DOM_84: Public administration and defence; compulsory social security
Incentive application	DOM_84: Public administration and defence; compulsory social security
Customer acquisition	DOM_73: Advertising and market research

Source: Frontier Economics analysis based on IRENA and Joint Research Centre report

Table 7 Mapping of onshore wind cost components to OECD industry classification

Cost component	OECD Industry
Foundations	DOM_25: Fabricated metal products
Electrical interconnection	DOM_27: Electrical equipment
Turbine	DOM_28: Machinery and equipment n.e.c.
Installation	DOM_41T43: Construction
Contingency & other	DOM_64T66: Financial and insurance activities
Development	DOM_69T75: Professional, scientific and technical activities

Source: Frontier Economics analysis based on IET 2025 and IRENA

Table 8 Mapping of offshore wind cost components to OECD industry classification

Cost component	OECD Industry
Foundations	DOM_25: Fabricated metal products
Electrical interconnection	DOM_27: Electrical equipment
Turbine	DOM_28: Machinery and equipment n.e.c.
Installation	DOM_41T43: Construction
Contingency & other	DOM_64T66: Financial and insurance activities
Development	DOM_69T75: Professional, scientific and technical activities

Source: Frontier Economics analysis based on IRENA

Estimating domestic production shares

Domestic content assumptions are derived from public sources. For all technologies, domestic production shares are presented as lower and upper bound estimates. These ranges reflect differences across sources, including variations in definitions (e.g. orders versus installations) and methodologies. Using a range allows the analysis to capture data uncertainty. Table 9 below summarises the domestic production share assumptions applied in the analysis, together with the corresponding sources for the lower and upper bound estimates.

For solar PV, domestic production shares reflect the limited manufacturing capacity for modules and inverters within the EU across the value chain. Evidence from the European Commission Joint Research Centre (JRC) and SolarPower Europe indicates that only a small share of EU demand is met through domestic production.

- Modules: reports from SolarPower Europe52 and the JRC (JRC 139297)[53] indicate that EU production accounts for approximately 2% to 4% of local annual demand.
- Inverters: a report from SolarPower Europe54 indicates that EU manufacturers supply approximately 20% of the EU market.

Other activities related to the installation of the solar panels were assumed to be 100% locally sourced.

For wind energy, domestic content is significantly higher due to a well-established European manufacturing base and the strong presence of European turbine manufacturers across the value chain.

- Installation (local supply of deployed capacity), based on the JRC 144260 report,[55] the IRENA publication on renewable power generation costs in 2024 56 and an article from the Global Wind Energy Council (GWEC):[57]
  - onshore wind: 88% to 91%
  - offshore wind 92% to 96%

52 2023, SolarPower Europe, *EU Market Outlook For Solar Power 2023 - 2027*

53 2024, Joint Research Centre (JRC), *JRC139297 – Clean Energy Technology Observatory: Photovoltaics in the European Union - 2024 Status Report on Technology Development, Trends, Value Chains and Markets*

54 2024, SolarPower Europe, *Inverters Explained 2.0: Strengthening Europe's Inverter Industry*

55 2025, Joint Research Centre (JRC), *JRC144260 – The manufacturing landscape of wind turbine components*

56 2025, IRENA, *Renewable Power Generation Costs in 2024*

57 2025, Global Wind Energy Council (GWEC), *Wind Turbine Suppliers deliver new record volume*

- Manufacturing/turbine supply (order proxy), based on the IRENA publication on renewable power generation costs in 2024 and the JRC 135020 report[58]:
  - onshore wind: 79% to 85%
  - offshore wind: 79% to 85%

A simplifying assumption is applied whereby European-level domestic production shares are used uniformly across all countries (including the UK). In practice, manufacturing capacity is concentrated in particular countries and cross-border trade occurs within Europe. Applying a uniform European share at country level overstates domestic production in some countries and understates it in others, but it avoids the need to model detailed intra-European trade flows and introduce speculative bilateral trade assumptions.

Table 9 Domestic production shares in Europe and sources

Technology	Component	Lower bound	Upper bound	Source for lower bound	Source for upper bound
Solar PV and on-site solar	Modules	2%	4%	EU Market Outlook For Solar Power 2023-2027	JRC 139297
	Inverters	20%	20%	Inverters Explained 2.0: Strengthening Europe's Inverter Industry (SolarPower Europe)	
Onshore wind	Wind turbine order	79%	85%	IRENA	JRC 135020
	Wind turbine installation	88%	91%	JRC 144260	IRENA
Offshore wind	Wind turbine order	79%	85%	IRENA	JRC 135020
	Wind turbine installation	92%	96%	GWEC	JRC 144260

Note: (i) The lower bound estimate of 79% for wind turbine orders is derived from onshore wind data (IRENA) and is applied as a proxy for offshore wind in the absence of technology-specific evidence. (ii) The 92% estimate used as the lower bound for offshore wind installation is based on GWEC data, which reports combined onshore and offshore supplier shares for Europe rather than technology-specific values.

58 2023, Joint Research Centre (JRC), *JRC135020 - Clean Energy Technology Observatory: Wind energy in the European Union - 2023 Status Report on Technology Development, Trends, Value Chains and Markets*

Table 10, Table 11 and Table 12 below present the mapping between renewable energy cost components and OECD sectors as well as the local share of production.

Table 10 Mapping of utility-scale solar PV and on-site solar generation cost components to OECD industry classification and local share of production

Cost component	OECD Industry	Europe share of production
Modules	DOM_26: Computer, electronic and optical products – Modules	2-4%
Inverters	DOM_27: Electrical equipment – Inverters	20%
Racking and mounting	DOM_25: Fabricated metal products	100%
Grid connection	DOM_27: Electrical equipment – Other	100%
Cabling/wiring	DOM_27: Electrical equipment – Other	100%
Safety and security	DOM_26: Computer, electronic and optical products – Other	100%
Monitoring and control	DOM_26: Computer, electronic and optical products – Other	100%
Mechanical installation	DOM_41T43: Construction	100%
Electrical installation	DOM_41T43: Construction	100%
Inspection	DOM_71: Architectural and engineering activities; technical testing and analysis	100%
Margin	DOM_41T43: Construction	100%
Financing costs	DOM_64T66: Financial and insurance activities	100%
System design	DOM_71: Architectural and engineering activities; technical testing and analysis	100%
Permitting	DOM_84: Public administration and defence; compulsory social security	100%
Incentive application	DOM_84: Public administration and defence; compulsory social security	100%

Cost component	OECD Industry	Europe share of production
Customer acquisition	DOM_73: Advertising and market research	100%

Source: Frontier Economics analysis based on IRENA and JRC

Table 11 Mapping of onshore wind cost components to OECD industry classification and local share of production

Cost component	OECD Industry	Europe share of production
Foundations	DOM_25: Fabricated metal products	79-85%
Electrical Interconnection	DOM_27: Electrical equipment	100%
Turbine	DOM_28: Machinery and equipment n.e.c.	79-85%
Installation	DOM_41T43: Construction	88-91%
Contingency & other	DOM_64T66: Financial and insurance activities	100%
Development	DOM_69T75: Professional, scientific and technical activities	100%

Source: Frontier Economics analysis based on IRENA, JRC and IET 2025

Table 12 Mapping of offshore wind cost components to OECD industry classification and local share of production

Cost component	OECD Industry	Europe share of production
Foundations	DOM_25: Fabricated metal products	79-85%
Electrical Interconnection	DOM_27: Electrical equipment	100%
Turbine	DOM_28: Machinery and equipment n.e.c.	79-85%
Installation	DOM_41T43: Construction	92-96%

Cost component	OECD Industry	Europe share of production
Contingency & other	DOM_64T66: Financial and insurance activities	100%
Development	DOM_69T75: Professional, scientific and technical activities	100%

Source: Frontier Economics analysis based on IRENA and JRC

Transport and packaging investments

Mapping cost components to OECD sectors

Electric vehicle procurement, charge point procurement and sustainable packaging also involve multiple upstream industries in practice, including electronics, metals and transport services. However, these investments are centred on well-defined final products that align closely with OECD sector classifications. As a result, total expenditure for each category is mapped to a single dominant OECD industry that most closely reflects the primary good being procured, as shown in Table 13 below.[59]

Table 13 Mapping of transport and packaging investments to OECD industry classification

Investment category	OECD Industry
Procurement of electric vehicles	DOM_29: Motor vehicles, trailers and semi-trailers
Procurement and installation of charge points	DOM_27: Electrical equipment
Procurement of sustainable packaging	DOM_17T18: Paper products and printing

Source: Frontier Economics analysis

Estimating domestic production shares

For electric vehicle procurement and charge points, Amazon provided information on manufacturing locations and sourcing shares. These percentages are applied to the total European investment value to estimate a domestic expenditure vector for each of the five focus countries. This reflects spending occurring within the country of manufacture rather than

[59] Note that this represents a modelling simplification rather than a claim that these investments are economically less complex.

where the asset is deployed. Given the commercial sensitivity of this information, detailed sourcing shares are not presented in this report.

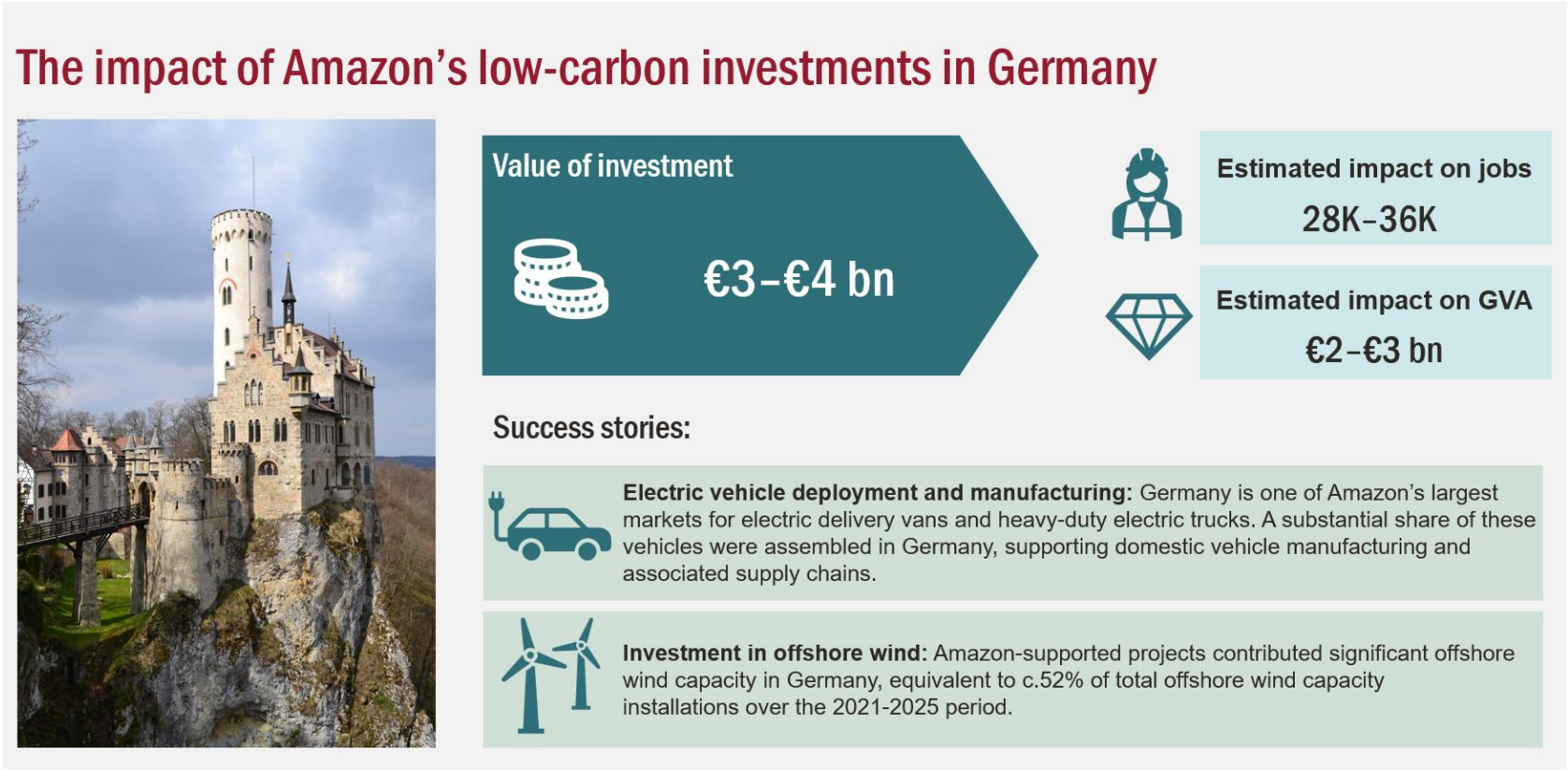
Some limitations apply due to data availability. For example, electronic subcomponents of charge points may be sourced outside the five focus countries, but detailed breakdowns are not available. For sustainable packaging, procurement is assumed to be sourced from the country in which it is deployed, although in practice some cross-border sourcing may occur. Given the nature of packaging materials and the absence of detailed data, this provides a reasonable approximation.

8 Annex B: Country fact sheets

Figure 7 SPAIN

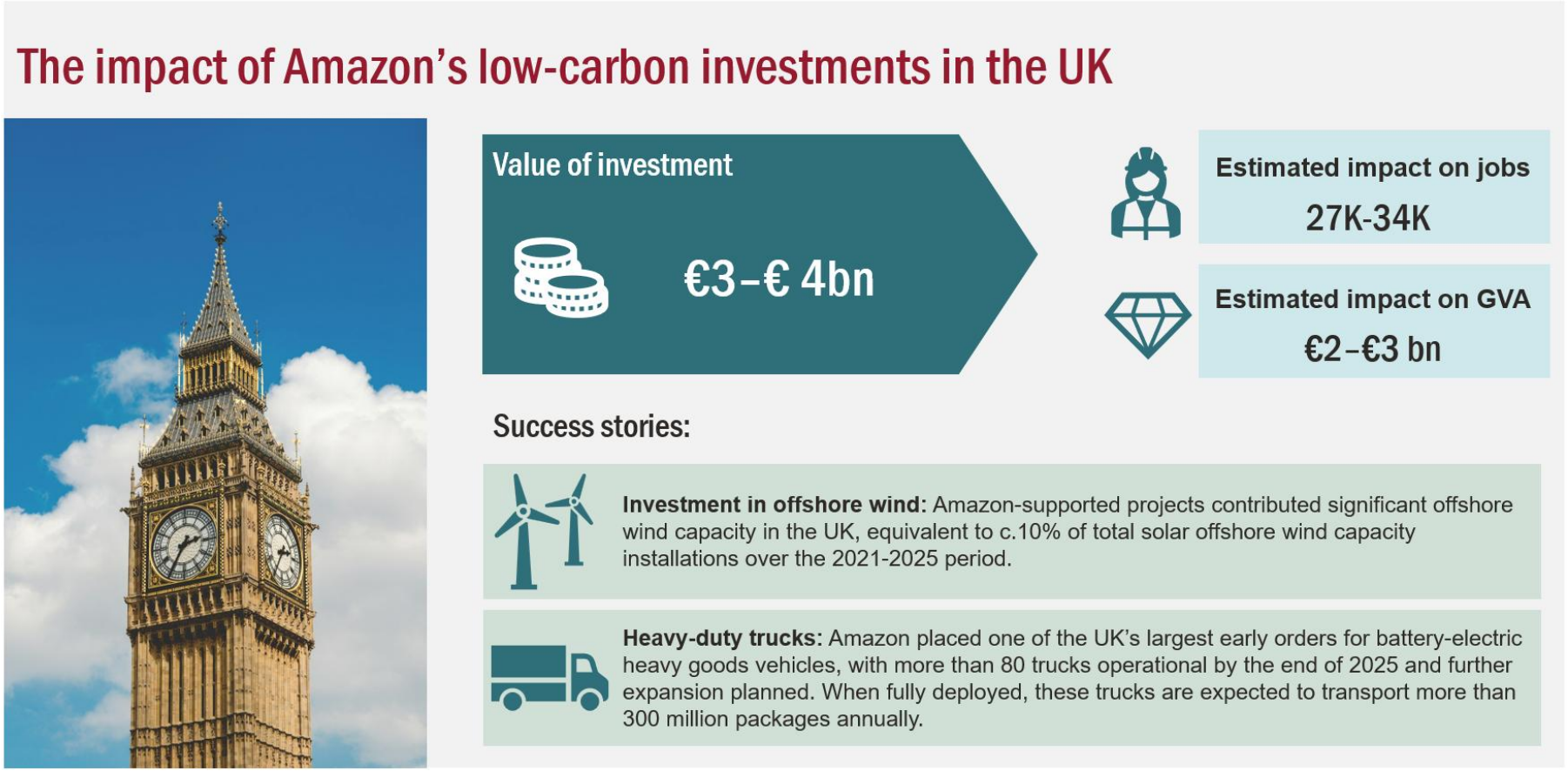
Source: *Frontier Economics*

Figure 8 GERMANY



Source: Frontier Economics

Figure 9 UNITED KINGDOM (UK)



Source: Frontier Economics

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