Tracking Progress: Key Indicators for Zero-Emission Trucking in Europe

Executive summary – 7 March 2025

Executive Summary

This report

This study, conducted by Ricardo on behalf of European Clean Trucking Alliance (ECTA), uses Key Performance Indicators (KPIs) to assess the progress of selected EU countries towards the Zero-Emission Trucks (ZET) transition and the presence of favourable conditions to support continued adoption, focusing on zero-emission N2 and N3 vehicles.

This report presents an analysis of six KPIs across five EU Member States and suggests policy recommendations to EU Member States. It provides a detailed analysis of each KPI for the five countries, along with a combined score to enable relative comparisons.

The six KPIs were selected to capture the most important factors influencing the adoption of ZETs, while also considering the availability of data to enable measurement and scoring in each country. In some cases, they act as a proxy for the existence or progress of favourable conditions for the transition to ZETs, while also highlighting areas where improved data is needed for a more accurate assessment. Scoring is based on the relative position of each country compared to the top performer.

The five countries were chosen to represent diverse experiences across the EU, considering geographic diversity, country size, relevance of the trucking sector, and the availability and accessibility of information.

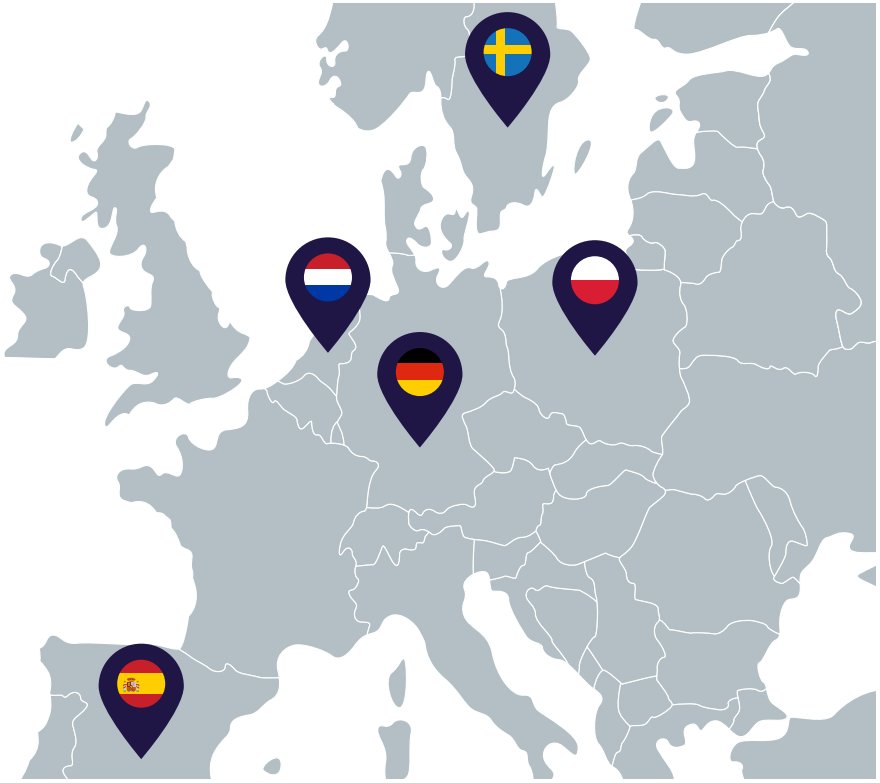
The progress can be tracked over time with future updates to this study. The following are the selected KPIs for this assessment.

Selected countries

The Netherlands Germany Sweden Spain Poland

KPI	Rationale
Charging infrastructure deployment	This KPI assesses the deployment of 'high-powered' public charging points suitable for trucks in each Member State. The availability and ability to deploy suitable charging points is a key factor in encouraging the uptake of ZETs.
ZET trials and pilots	ZET and associated infrastructure trials and pilot schemes reflect current public and private sector efforts to deploy ZETs and are an early indicator of their commercial potential in trial countries.
Purchase incentives	Vehicle cost is one of the main drivers of total cost of ownership (TCO) and a key barrier for adoption of ZETs. Availability and effectiveness of purchase incentives for vehicles and charging infrastructure can address this barrier.
Eurovignette implementation	Road tolling schemes can support progress towards TCO parity between ZETs and diesel counterparts. This KPI looks at Member State implementation of the Eurovignette Directive.
Urban vehicle access regulations	When tied to emissions criteria, urban vehicle access regulations can serve as effective incentives for fleets to switch to ZETs.
Transparency of grid capacity	Constraints in the grid and a lack of transparency around load capacity are key factors affecting the feasibility of charge point deployment. This KPI considers the transparency of grid capacity information published by system operators or national authorities, the national ambition and investment commitments for grid development, and the countries position in GLOBESEC's grid transition index.

Executive summary I (showing the summary of the 5 countries for each of the KPI)



1 Charging infrastructure deployment

2 ZET trials and pilots

3 Purchase incentives

4 Eurovignette implementation

5 Urban vehicle access regulations

6 Transparency of grid capacity

Netherlands

Combined Score: 71%

Ranked: 1

KPIs assessed (score)

81% 55% 76%

50% 100% 62%

Germany

Combined Score: 63%

Ranked: 2

KPIs assessed (score)

54% 100% 60%

100% 40% 33%

Sweden

Combined Score: 48%

Ranked: 3

KPIs assessed (score)

54% 33% 67%

25% 54% 33%

Spain

Combined Score: 38%

Ranked: 4

KPIs assessed (score)

37% 27% 50%

0% 63% 50%

Poland

Combined Score: 20%

Ranked: 5

KPIs assessed (score)

14% 30% 20%

25% 20% 17%

Main takeaways

The Netherlands are actively advancing truck charging infrastructure and are making strong progress towards its 2030 Alternative Fuel Infrastructure Regulation targets. Strengths include an extensive charging network, ambitious public charging expansion plans and innovative hydrogen trials that support the transition to zero-emission freight. The country also offers substantial purchase incentives for ZETs and targeted subsidy schemes for charging infrastructure. However, challenges remain, including low average charging power per charging pool, significant grid congestion issues and the need for better load forecasting. While the country is moving forward with road toll reforms and the expansion of Low Emission Zones (LEZ), nationwide rollout of zero-emission zones was delayed. Despite a low ranking in the Grid Transition Index, efforts are underway to improve grid management and investment.

Germany ranks second in charger density on the TEN-T network and leads in absolute numbers of truck-suitable chargers, but it falls short of AFIR 2030 targets due to insufficient charging power per site. ZET purchase subsidies were discontinued at the end of 2023. While the country has strong toll reforms, including CO_2-based charges and distance-based tolls, its LEZ have lenient entry rules, limiting their impact. Grid capacity challenges persist due to fragmented procedures among over 500 DSOs and the absence of a national capacity map. However, Germany continues to advance sustainable mobility through extensive pilot projects, public-private collaborations, and its ambitious Power to the Road initiative, which aims to expand high-power truck charging and support long-term decarbonisation goals.

Sweden has made strong progress toward AFIR 2030 targets, with a well-developed charging network and a high average power supply per charging pool. Sweden offers generous purchase incentives and subsidies for charging infrastructure, including Klimatklivet and Ladda bilen grants. However, challenges remain, including the absence of CO_2-based road tolls – though upcoming reforms may address this – and the lack of a national load capacity map. While Sweden has implemented LEZs in eight cities and recently launched its first Zero Emission Zone in Stockholm, its congestion charges do not exempt ZEVs. The country ranks highly on the grid transition index, benefiting from full smart metering penetration, but rising electricity demand poses a future challenge.

Spain is making progress in developing its charging infrastructure for electric trucks, but deployment remains geographically dispersed and falls short of the AFIR requirement. While Spain offers tax exemptions and infrastructure subsidies, the discontinuation of the MOVES Mitma subsidy limits financial support for electric trucks. Additionally, its toll system is limited and does not yet take CO_2 emissions into account and planned reforms remain uncertain. Implementation of LEZs has been slow, with only a fraction of the required cities having introduced them, although major urban centres are already enforcing truck access restrictions. Spain ranks highest on the grid transition index due to strong load forecasts, but challenges remain in the permitting and connection processes.

Poland's charging infrastructure for electric trucks is still developing, with only three truck-suitable charging pools. While domestic trials are ongoing, participation in major cross-border demonstrations has been limited. A forthcoming €480 million subsidy program for ZETs and charging infrastructure could be a game changer, though its implementation timeline remains unclear. The road toll system has yet to incentivise clean trucks, and Poland is addressing EU requirements for tolling reforms. LEZ development is progressing, with Warsaw's Clean Transport Zone being the first in Eastern Europe. Infrastructure expansion would benefit from a national load capacity map and a clearer power classification process. While the National Recovery and Resilience Plans (NRRP) prioritises grid investments, mobility-related enhancements remain limited, influencing Poland's ranking on the grid transition index.

Policy recommendations

The following recommendations, derived from our analysis and evaluation of countries' performance, are aimed at policymakers:

Deployment of charging infrastructure

- Establish standardised and mandatory reporting mechanisms that clearly differentiate between chargers suitable for heavy-duty vehicles and those that are not. This approach, as demonstrated by Germany, facilitates infrastructure planning
- These databases should indicate relevant information for truck operators such as if there is charging space for truck and trailer or space available to park the trailer, and whether there are facilities for the drivers' rest breaks
- Finalise the harmonisation of charging standards and speed up its implementation across the EU to ensure interoperability, especially for high-power charging systems for trucks
- Prioritise the deployment of charging infrastructure along critical transport corridors and hubs to meet AFIR targets by 2030
- Further recognition of the importance of depot charging as a means to supplement AFIR related infrastructure goals and the need for financial support to support its implementation

Purchase incentives for the adoption of ZET

- Combine purchase subsidies, infrastructure grants, and tax incentives into an integrated policy framework to maximise impact and adoption rates
- Enable regional and municipal governments to offer additional incentives
- Ensure visibility and predictability for ZET support schemes by making them easily accessible to operators, with clear budgets and well-defined timelines
- Regularly assess the effectiveness of subsidy and incentive programmes, adjusting funding levels and eligibility criteria to meet evolving market demands and technology advancements
- Provide an EU overview of Member States' subsidies and incentives to enable greater uptake by the private sector

Implementation of Eurovignette

- Exemption for ZETs in tolling systems should be considered to further incentive their uptake
- Collaborate with private concession holders, when appropriate, to implement flexible tolling agreements that include CO_2-based charges

ZET trials and pilots

- Document and share insights from advanced pilots, such as the Netherlands' hydrogen infrastructure development and Smart Energy Hubs, to serve as benchmarks for other Member States
- Trials/pilots should include case studies or best practices to be shared more widely with authorities and industry through workshops, roundtables, reports
- Facilitate partnerships between shippers, carriers, freight forwarders, OEMs, policy makers and energy sector players to ensure development of ZETs and their infrastructure

Policy recommendations

Transparency of grid capacity

- Develop and maintain national load capacity maps, as seen in the Netherlands, to improve visibility and planning for grid expansion
- Promote the full deployment of smart metering systems, as seen in Sweden, to enhance grid flexibility and optimise electricity consumption
- Data should be digitalised and made available in a transparent way
- Significant investment is needed in the grid infrastructure, along with streamlining approval processes for new connections and reducing waiting times for grid upgrades

Implementation of urban vehicle access policies

- Expand the coverage and stringency of LEZs to include more cities and towns, following the model set by Spain, which has mandated LEZs in cities with populations over 50,000
- Provide clear timelines and phased rollouts to allow industries to adapt, while ensuring the zones are well-enforced and widely communicated
- Introduce specific exemptions for ZETs

Additional transversal policy recommendations:

- Availability of key indicator data to ensure transparency and enable tracking of progress over time
- Predictability and visibility in the regulatory environment
- Ensuring the growing availability and use of renewable energy

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Final report – 7 March 2025

Contents

Glossary

Acronym	Full meaning
AFIR	Alternative Fuels Infrastructure Regulation
BEV	Battery Electric Vehicle
CNG	Compressed Natural Gas
DSO	Distribution System Operator
ECTA	European Clean Trucking Alliance
FCEV	Fuel Cell Electric Vehicle
GHG	Greenhouse Gases
ICE	Internal Combustion Engine
KPI	Key Performance Indicator
LEZ	Low Emission Zone
LNG	Liquid Natural Gas
LTZ	Limited Traffic Zones
MS	Member State
NRRP	National Recovery and Resilience Plan
PHEV	Plug-in Hybrid Electric Vehicle
RAG	Red, Amber and Green
SSMS	Sustainable and Smart Mobility Strategy
TCO	Total Cost of Ownership
TSO	Transmission System Operator
ZET	Zero Emission Truck
ZEZ	Zero Emission Zone

Introduction and objectives

Introduction and objectives

The EU is home to one of the largest global trucking industries, representing 7% of the world's road freight activity (OECD, 2021). In the EU, over three-quarters of transport-related greenhouse gas (GHG) emissions arise from the road sector (EEA, 2022). Within this sector, trucks over 3.5 tonnes account for roughly 22% of the road transport CO_2 emissions (EEA, 2022).

Decarbonisation of road freight is a key policy objective, as outlined in the Sustainable and Smart Mobility Strategy (SSMS) and in line with the Green Deal's target of reducing greenhouse gas emissions from transport by 90% by 2050. However, the transition to zero-emission vehicles in this sector presents additional complexities and challenges compared to light-duty vehicles.

New zero-emission trucks taking the roads

Members of the European Clean Trucking Alliance (ECTA) and other logistic companies have started deploying zero-emission trucks (ZETs) on European roads. In 2022, the EU saw a strong increase in electrically chargeable truck sales (+32.8%), with 1,656 units registered. However, this growth has decelerated, with a more modest increase of 3% in the first half of 2024 compared with same period in 2023 (ACEA, 2024). The number of ZETs on the road remains marginal compared to traditional diesel-powered trucks, which represented 95.7% of new truck registrations in 2023 (ACEA, 2024).

The uptake of Fuel Cell Electric Vehicles (FCEVs) has so far been limited to pilots, with six in the Netherlands (FCHO, 2022). In early 2024, it was reported that FCEV registrations are flatlining in EU (Hydrogen Insight, 2024).

This report

This study, conducted by Ricardo on behalf of ECTA, uses Key Performance Indicators (KPIs) to assess the progress of selected EU countries towards the ZET transition and the presence of favourable conditions to support continued adoption, focusing on zero-emission N2 and N3 vehicles.

This report presents an analysis of **six KPIs** across **five EU Member States** and suggests policy recommendations to EU Member States. It provides a detailed analysis of each KPI for the five countries, along with a combined score to enable relative comparisons.

The six KPIs were selected to capture the most important factors influencing the adoption of ZETs, while also considering the availability of data to enable measurement and scoring in each country. In some cases, they act as a proxy for the existence or progress of favourable conditions for the transition to ZETs, while also highlighting areas where improved data is needed for a more accurate assessment. Scoring is based on the relative position of each country compared to the top performer.

The five countries were chosen to represent diverse experiences across the EU, considering geographic diversity, country size, relevance of the trucking sector, and the availability and accessibility of information.

The progress can be **tracked over time** with future updates to this study.

Approach and methodology

Approach and methodology

Ricardo assessed the readiness of selected EU countries for the transition to ZETs.

Ricardo developed a set of ZET-related indicators, then identified and collected the relevant data to calculate a score, ranking each country on their relative progress towards the ZET transition.

Key elements of the methodology:

Identify and define KPIs and metrics that track the ZET transition

Research KPIs and collect data to score each country

Present scoring and ranking with detailed explanations

Provide policy recommendations based on the analysis

Please refer to a more detailed explanation of the methodology in the Annex

Selected countries and KPIs

Selected countries

Country	Rationale
Germany (DE) 	• Leading trucking market • Leader on e-mobility adoption • Large number of pilots and demonstrations of new technologies
Netherlands (NL) 	• Leading position on e-mobility and a good example of innovation • Similar to Germany in terms of pilots
Poland (PL) 	• Unique location at the crossroads between countries of Western and Eastern Europe • Relatively large trucking market and high concentration of trucking and logistics firms
Spain (ES) 	• Largest country in Mediterranean Europe • Relatively large trucking market in the region and presents favourable conditions for the transition (e.g. availability of renewable energy)
Sweden (SE) 	• Part of the Scandinavian region • Connection to trucking operations in Baltic countries

Selected KPIs

KPI	Rationale
 **Charging infrastructure deployment**	This KPI assesses the deployment of 'high-powered' public charging points suitable for trucks in each Member State. The availability and ability to deploy suitable charging points is a key factor in encouraging the uptake of ZETs.
 **ZET trials and pilots**	ZET and associated infrastructure trials and pilot schemes reflect current public and private sector efforts to deploy ZETs and are an early indicator of their commercial potential in trial countries.
 **Purchase incentives**	Vehicle cost is one of the main drivers of TCO and a key barrier for adoption of ZETs. Availability and effectiveness of purchase incentives for vehicles and charging infrastructure can address this barrier.
 **Eurovignette implementation**	Road tolling schemes can support progress towards TCO parity between ZETs and diesel counterparts. This KPI looks at Member State implementation of the Eurovignette Directive.
 **Urban vehicle access regulations**	When tied to emissions criteria, urban vehicle access restrictions can serve as effective incentives for fleets to switch to ZETs.
 **Transparency of grid capacity**	Constraints in the grid and a lack of transparency around load capacity are key factors affecting the feasibility of charge point deployment. This KPI considers the transparency of grid capacity information published by system operators or national authorities, the national ambition and investment commitments for grid development, and the countries position in GLOBESEC's grid transition index.

How to read this report

This report evaluates enabling conditions for the adoption of ZETs in selected European countries.

Report Structure

1. KPI-by-KPI analysis: This section explains the rationale behind each KPI, describes what it measures, and offers a comparative analysis of the selected countries' performance for each KPI.
2. Country snapshots: This section provides an overview of each country's trucking market, followed by a summary of its performance across the selected KPIs.

Scoring Methodology

The percentage score and ranking given to each country reflect its relative position compared to the top performer in this analysis. This enables comparisons between the selected countries but does not always reflect the progress each country still needs to make to fully support ZET adoption.

Most KPIs aggregate multiple factors or metrics. For example, the KPI on charging infrastructure deployment considers AFIR compliance as well as the total number of chargers and their average power. More information about the methodological approach is presented in the annex.

Based on each country's percentage score for each KPI, a RAG (Red-Amber-Green) label is assigned:

- Red (Weak): <40%
- Amber (Medium): 40% - 70%
- Green (Strong): >70%

These thresholds are consistently applied and ensure clear distinctions between countries to enable relative comparisons[1].

Combined Scoring

The overall score (Combined Score) for a country is calculated as a weighted average of the individual KPI scores. The weightings reflect findings from previous research on the key drivers of ZET adoption, including Ricardo's study for ECTA, *"Financing Instruments for the Adoption of ZET"*.

- **25% Weight:** KPI 1 (Charging infrastructure deployment) and KPI 3 (Purchase incentives)
- **15% Weight:** KPI 4 (Eurovignette implementation) and KPI 6 (Transparency of grid capacity)
- **10% Weight:** KPI 2 (ZET trials and pilots) and KPI 5 (Urban access restrictions)

Policy Recommendations

The complete analysis, including the KPI scoring and supporting commentary, forms the basis for a series of policy recommendations to support the transition to ZETs in the EU.

The analysis and recommendations are valuable for transport and energy policymakers at all levels of government. The findings also contribute to the body of evidence that transport operators and industry associations can use to address barriers and capitalise on opportunities to accelerate ZET deployment.

[1] This analysis offers a relative comparison. Weaker performers in this analysis may still be better in absolute terms compared to countries not included in this analysis.

Notes on the selected KPIs I

The selected KPIs represent key factors influencing the adoption of ZETs and, in combination, provide an overview of whether the national environment is favourable to the adoption of ZETs. For practical reasons, the availability of data to assess each KPI was a key element that determined the inclusion or definition of the KPI. In some cases, the KPI (and its metrics) act as a proxy for the existence or progress of favourable conditions for the transition to ZETs, while also highlighting areas where improved data is needed for a more accurate assessment.

Long-haul vs urban logistics

The information on charging infrastructure suitable for trucks was fragmented and dispersed across various maps and datasets. Currently, data is mostly available for public charging stations, with limited sources for depot chargers.

Public chargers are predominantly beneficial for long-haul routes, which represent only a portion of the total tonne-kilometres covered by trucks. The KPI on urban access restrictions complements this aspect, providing more information on decarbonisation of logistics routes within urban road networks.

Complexity of purchase incentives

Assessing the status of subsidies and grants provided by governments is complex: they tend to vary significantly across countries, evolve rapidly (e.g., can be discontinued) and depend on the effectiveness of their implementation. The KPI developed for this report attempts to capture the most important elements in a simplified manner. These elements are: availability of purchase incentives for trucks and charging infrastructure, average vehicle subsidy amount across firm sizes, and total budget available according to size of the country's fleet, presence of acquisition and ownership tax incentives for vehicles.

Assessment period for purchase incentives

This assessment includes only government purchase incentives that were active as of December 1, 2024, when the analysis for this study was completed. Programmes that ended before this date were not considered. This approach ensures the use of reliable, up-to-date information from officially advertised programmes and maintains consistency with other KPIs, which also rely on current data.

Notes on the selected KPIs II

Ownership of the load capacity map

The existence and accessibility of load capacity maps vary by country. While in some cases generation capacity maps are commonly integrated into energy assessments, it might be unclear whether equivalent load capacity maps are available or which entity is responsible for their management. In many cases, such maps, if they exist, are not publicly accessible and are typically overseen by system operators rather than regulatory authorities. For this reason, our analysis relies on publicly available and transparent information published by relevant operators or authorities.

Charge power threshold and truck compatibility

The charger power threshold for KPI on Charging infrastructure deployment is set at 300kW, slightly below the 350kW minimum required by the Alternative Fuel Infrastructure Regulation (AFIR), as this lower threshold is commonly used in datasets focused on heavy-duty vehicle charging.

Our analysis also tracks the deployment of AFIR-compliant chargers, combining different metrics into a balanced KPI. Charging points vary in their suitability for trucks - some accommodate trucks with trailers, while others require trailers to be disconnected during charging. Many sites offer a mix of both configurations, but all sites identified are truck compatible.

Charging points in this analysis accommodate different electric truck sizes for easy manoeuvring and parking, with space for both truck and trailer or parking for detached trailers. They commonly have facilities including rest areas for drivers during charging. Analysed stations typically avoid physical barriers, such as height restrictions, that hinder access to charging bays.

Innovation-focused analysis for the KPI on trials/pilots

This analysis evaluates the number of trials and pilots in each country, with greater weight given to larger initiatives (based on the number of ZETs or charging points involved) and to initiatives of longer duration. The goal is to highlight each country’s innovative efforts and commitment to advancing sustainable trucking solutions. However, this methodology does not consider differences in sizes of countries or truck fleets.

KPI analysis

Deployment of public charging infrastructure suitable for trucks

The deployment of charging infrastructure is a critical enabler for the adoption of ZETs. Without a robust and accessible network of charging stations, the operational range and efficiency of electric trucks are severely limited, hindering their viability as a replacement for diesel-powered vehicles. This KPI considers a number of metrics including availability (and spread) of charging hubs, number of chargers and average power provided.

Long-haul routes require the establishment of public charging infrastructure. In this KPI, both AFIR-compliant charging pools (those with at least two chargers over 350 kW) per kilometre of TEN-T network, and charging pools with at least one charger over 300 kW are considered. This is because in some corridors 300 kW is a common standard for chargers which are currently serving trucks. They are considered even if they are not AFIR-compliant.

In addition, this KPI also takes into account average powered offered at each hub. Due to their larger battery capacities, trucks require fast charging solutions to ensure that the batteries can be fully charged in a reasonable time to meet the demands of logistics operations.

High charging power alone is insufficient; the infrastructure must also meet accessibility needs. Charging stations should accommodate electric truck sizes for easy manoeuvring and parking, with space for both truck and trailer or parking for detached trailers. Facilities should include rest areas for drivers during charging. Stations must avoid physical barriers, such as height restrictions, that hinder access to charging bays. Additionally, charging points must be strategically placed along major routes to ensure convenient access and minimise detours. Only charging stations and hubs suitable for trucks are considered for this KPI.

EU countries assessed (ranking)

1 **Relative score: 81%**
Strong

2 **Relative score: 54%**
Medium

3 **Relative score: 54%**
Medium

4 **Relative score: 37%**
Weak

5 **Relative score: 14%**
Weak

Even if charging points are widely deployed and accessible, they must be supported by sufficient grid capacity. This consideration is particularly relevant when assessing the strong deployment of charging infrastructure in the Netherlands, where significant grid congestion issues exist and are not quantified within this KPI.

To provide a more comprehensive assessment, this KPI should be complemented by an additional indicator on grid capacity. The KPI on transparency of grid capacity provides an important initial step.

In addition, other elements to assess progress on infrastructure deployment should be considered (not quantified in this KPI):

- As well as public charging, there is also a need for depot charging
- During the day, fast charging is required, but when the truck is stationary, usually at night, slow charging may be sufficient
- In both cases, the price and source of electricity (preferably renewable) are critical

Deployment of public charging infrastructure suitable for trucks

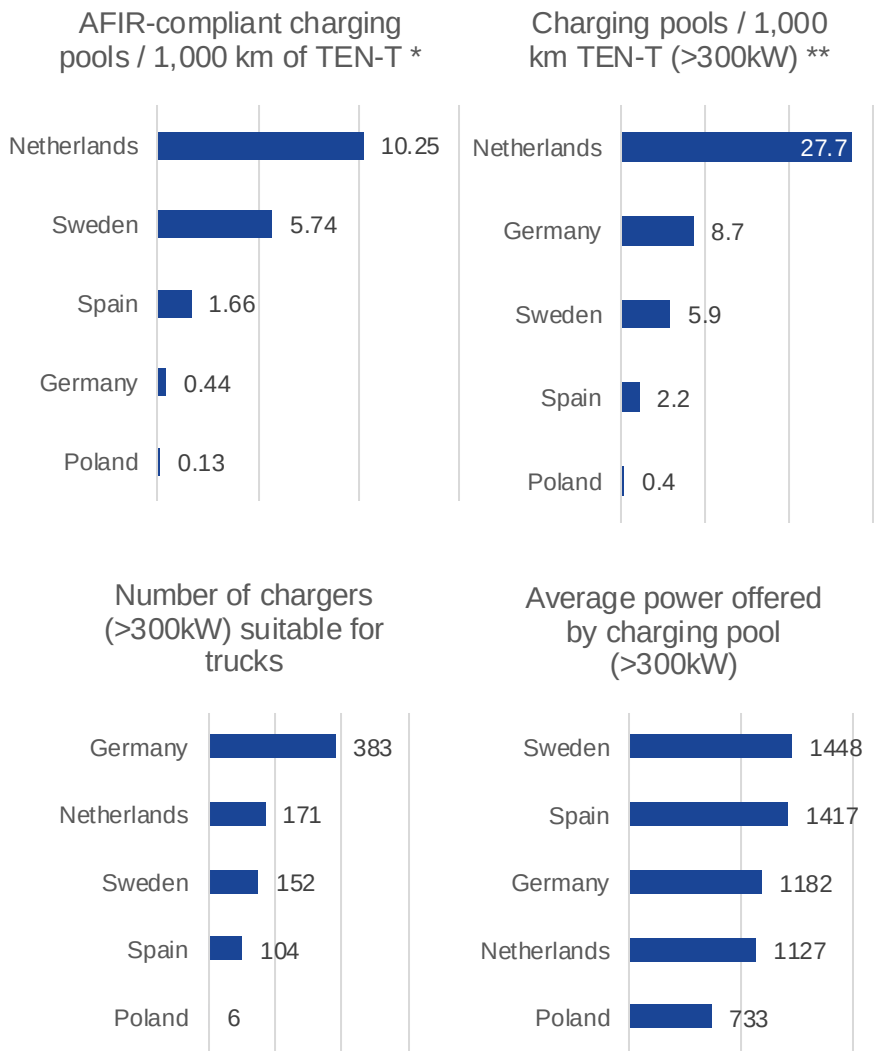
Although trucks have different requirements for charging infrastructure compared to passenger cars, most of the datasets on charging stations in EU, such as the one of EAFO, tend not to differentiate between chargers suitable for trucks from those which are not.

Based on an analysis of multiple sources, the current analysis focuses on the availability of charging infrastructure which is suitable for heavy-duty vehicles.

Netherlands is the most advanced country in terms of charging infrastructure deployment for ZETs. It is the country with the greatest progress towards the target set by AFIR by 2030 (this is, at least one charging pool with at least two chargers of 350 kW every 60 km of the core TEN-T network and every 100 km of the comprehensive network).

If considering chargers of 300 kW or above, which are the standard in many locations, mainly in Germany, the **Netherlands** is still by far the leading country with 27.7 charging pools per 1,000 km of TEN-T network, followed by **Germany** with 8.7 charging pools per 1,000 km and **Sweden** with 5.9 charging pools per 1,000 km.

When considering the average power offered by each charging pool, all countries have yet to meet the AFIR requirement of offering at least 3,600 kW per charging pool by 2030. The most advanced is **Sweden** with average per pool of 1,448 kW, followed by **Spain** with 1,417 kW and **Germany** with 1,182 kW. This suggests that the current deployment efforts are not only geographically scattered but involve a low number of chargers per site. **Sweden** and **Spain** have an average of four chargers per hub, Germany has an average of 3.87 chargers per pool, and the rest of the countries even less. The deployment efforts of Circle K in Sweden, and Ionity and Zunder in Spain are consistent with this number of four chargers per pool. Meanwhile, in the Netherlands and Germany, there is a higher diversity in the number of chargers installed by pool. **Poland** only has three charging pools with limited supply.



* A charging pool with at least two chargers >350 kW suitable for trucks. We assumed that all identified sites have access from both sides of the highway which is set in the AFIR target
** A charging pool with at least one charger >300 kW suitable for trucks.

Progress on ZET trials and pilots

This KPI assesses the presence of ZET and infrastructure-related trials and pilots which provides an indication of the level of ambition and progress made by each Member State to deploy ZETs and the associated infrastructure. The purpose of running a trial or pilot is to test and validate new technologies, processes, or ecosystems in a controlled setting. By implementing these initiatives, countries demonstrate their commitment to addressing barriers and creating opportunities for early adopters of zero-emission technologies. Pilots strategically support market development by fostering collaboration among stakeholders, including operators, OEMs, and energy sector players. These trials provide valuable insights to advance zero-emission transport adoption, such as integrating trials with other freight modes, developing grid management solutions, scaling up and retrofitting stations, and leveraging secondary benefits from hydrogen infrastructure.

This KPI assesses the number and size of trials/pilots (taking into account the number of vehicles or charging/refuelling points tested), together with the duration of the trials/pilots. It should be noted that the KPI does not account for differences in country size. These trials/pilots can be a private, public or public-private initiative.

Of those considered in this study, **Germany** is the most advanced country in terms of trials, with large projects involving production of green hydrogen and development of the regional infrastructure for hydrogen supply, the reliability of refuelling stations network across four countries and its supply. **Netherlands** is moving in a similar direction to Germany, although with a smaller number of trials.

Sweden is committed to a large-scale pilot of a reservation system and fast charging options, which strengthens the country's capacity to support the electrification of heavy transport, demonstrating a commitment to cutting-edge solutions.

In the next page, a comprehensive analysis of the major trials and pilots run in these countries and their reported benefits is provided.

EU countries assessed (ranking)

1 **Relative score: 100%** Strong	3 **Relative score: 33%** Weak
2 **Relative score: 55%** Medium	4 **Relative score: 30%** Weak
	5 **Relative score: 27%** Weak

Number of trials / pilots of ZET or their charging / refuelling infrastructure according to size*

Country	Small	Medium	Large
Germany	5	8	4
Netherlands	2	2	4
Poland	4	3	0
Sweden	3	1	2
Spain	3	0	2

*The number of trials is then weighted by size of the trial/pilot. Small: less than 5 vehicles or refuelling/recharging pools; Medium: between 5 and 20; Large: over 20

Progress on ZET trials and pilots*

The main benefits arising from the major pilots are:

Trial name	Leading partners	MS	Additional qualitative benefits
HyTrucks	Hyzon Motors, Air Liquide and DATS 24	DE, NL	The pilot is testing the creation of a reliable hydrogen refuelling network for zero-emission trucks, enabling sustainable freight transport between key European ports and reducing emissions in international road freight. It explores cross-border integration and high scales
Smart Energy Hubs	Volvo Group, Daimler Truck and Volkswagen Group's Traton Group	DE, ES, NL	It will use on-site batteries and renewable energy generation at charging stations as part of Smart Energy Hubs to enable trucks to utilise stored green energy and to decrease peak energy demand. Introducing MCS chargers to their stations to enable 40-min charging during driver breaks (pending CCS extension and trials)
Daimler-Total	Daimler Truck, TotalEnergies	DE, NL	Development of a hydrogen supply chain that supports the deployment of hydrogen trucks, reduces total ownership costs, and contributes to the decarbonisation of both industrial processes and the mobility sector
Cooperative truck charging network	Nimbnet, Kempower, Virta, Swedish Energy Agency Energimyndigheten	SE	The pilot increases efficiency by minimising waiting times and maximising electric fleet benefits through a reservation system, while ensuring that even the longest HDVs have easy access to the charging infrastructure. It explores slot management systems
Circle K	Swedish Energy Agency, Circle K	SE	This pilot increases availability of fast charging options for HDVs, allowing them to charge electricity in under 1 hour. It explores avant-garde fast charge technologies
Pilot of Advanced Refuelling Tech	Air Liquide, Daimler, Hyundai, Linde, OMV, Shell and TotalEnergies	DE	The pilot benefits trucks by testing advanced hydrogen refuelling technologies, including pre-cooling for Type IV tanks, improved compressors and 350 bar compression systems tailored for heavy-duty vehicles and larger parking spaces.
Meditaranean Corridor	Iberdola, Disfrimur, Power Electronics	ES	The pilot is creating a 450 km charging corridor with smart grid integration to enhance energy efficiency, serving as a model for expanding freight corridors across Spain and Europe. It explores cross-border integration and smart grid solutions
H2Accelerate	Daimler Truck AG, Iveco Group, Linde, Shell, BP, TotalEnergies, and Volvo Group	Not stated (9 MS)	The pilot is testing the development of high-capacity hydrogen refuelling stations enabling a sustainable, reliable hydrogen infrastructure along major transport corridors in Europe. It explores ultra-high levels of availability through the use of redundancy in station design (key pieces of refuelling equipment are duplicated to minimise downtime if one component fails)

* For synthesis, this table shows large trials / pilots. Medium and small trials / pilots were included in the scoring but are not shown in this table.

Purchase incentives

This KPI considers the purchase incentives available for ZETs in each country, including vehicle and infrastructure subsidies and acquisition and/or ownership tax incentives.

While the total cost of ownership (TCO) over the lifetime of a ZET can be lower than the TCO of ICE trucks, the upfront cost of ZETs is a key challenge for truck operators due to the high price premium of ZETs compared to ICE trucks and the high purchase and installation costs of charging infrastructure. The greater the availability of purchase incentives and tax benefits, the greater the financial support available to fleets to accelerate the transition to ZET.

The Netherlands has ZET purchase incentives and has recently launched two subsidy schemes for infrastructure for private owners: the Subsidy Scheme Private Charging Infrastructure at Companies (SPRILA) and the Subsidy Scheme for Public Charging Infrastructure for Heavy Transport (SPULA). Netherlands offers subsidies up to 29% of the purchase cost (up to €115,200), behind Sweden on this aspect.

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EU countries assessed (ranking)

3 **Relative score: 60%**
Medium

1 **Relative score: 76%**
Strong

4 **Relative score: 50%**
Medium

2 **Relative score: 67%**
Medium

5 **Relative score: 20%**
Weak

Sweden has a ZET purchase incentive with the highest percentage of the vehicle cost covered, on average. Sweden also has subsidies for the acquisition of charging / refuelling technology and a tax reduction for installation of green technology from the Swedish Tax Agency. However, tax exemptions for the acquisition or use of ZETs are not in place.

Germany does not have ZET purchase incentives (the KsNI programme was phased out in February 2024, funding applications were no longer accepted since 31 December 2023). There is charging infrastructure funding at federal and state level. Only limited tax incentives are available, an ownership tax exemption is granted for ZETs until 31 December 2030.

Purchase incentives

Currently, there is no purchase subsidy available in **Spain,** as the plan MOVES Mitma for trucks (with support from Next Generation funds) was discontinued in April 2024 and the MOVES III programme does not include N2/N3 vehicles. However, the country offers subsidies for infrastructure according to the size of the firm. ZETs are also exempted from 'special acquisition tax' for vehicles emitting ≤ 120g CO_2/km and there is a 75% reduction in the ownership tax for each BEV in major cities such as Barcelona, Madrid, Valencia, Zaragoza, and others. Additionally, early amortisation is available for BEVs, PHEVs, FCEVs, and infrastructure investments.

Poland: Poland is not currently providing incentives to the purchase of ZETs or their charging equipment**.** The country only provides an exemption on the acquisition tax which applies to BEVs and FCEVs, and to PHEVs with an engine capacity of up to 2,000cc, until the end of 2029. In addition, the ownership tax allows for depreciation write-offs.

However, there is a proposed support scheme for purchase of ZETs by the Ministry of Climate and Environment. This is not yet operational, and its implementation timeline remains uncertain. In addition, a new support programme, exclusively for truck charging infrastructure, has also been proposed. It is expected to become operational in 2025, likely by the end of the first quarter.

Summary of Purchase incentives offered by countries

	Vehicle subsidies			Infrastructure subsidies	Taxes (ownership / acquisition)	
Country	Purchase incentive?	Total funding available (EUR)	Average % of cost covered*	Infrastructure subsidies?	Acquisition tax?	Ownership tax?
Germany	N	0	0	Y	N	Y
Netherlands	Y	45 M	29	Y	N	N
Poland	N	0	0	N	Y	Y
Spain	N	0	0	Y	Y	Y
Sweden	Y	Not stated	41	Y	Partial	N

* Different schemes offer different % of acquisition cost covered, depending on the category of the vehicle and the size of the firm that requests the economic support. For each scheme we calculated the average % of coverage, across categories and firm sizes.

Eurovignette implementation

The Eurovignette Directive governs road tolling in the EU. While it does not mandate tolls, it sets rules that Member States must follow if they choose to implement a tolling system. The 2022 reform of the Eurovignette Directive is crucial for encouraging the adoption of ZETs.

Key features include a full transition to distance-based tolling, rather than time-based, and a mandatory framework for adjusting infrastructure and external cost rates based on energy efficiency and CO_2 emissions of the vehicle. By 2026, over half Member States are expected to implement tolls adjusted by CO_2 emissions, creating a significant incentive for truck operations across 63% of EU territory to transition to ZETs.

- **CO_2-Based Tolling**: The Directive mandates that Member States with distance-based tolls vary charges based on CO_2 emissions of the vehicles. This measure creates a financial incentive for hauliers to transition to ZETs by reducing or eliminating tolls for these vehicles while increasing charges for higher-emitting trucks
- **External Cost Charging**: The Directive encourages Member States to implement external cost charges that reflect the environmental impact of trucking, including CO_2 and air emissions, and noise pollution. This additional charge on higher-emitting trucks further incentivises the adoption of zero-emission alternatives

The KPI considers these two elements, as well as the **implementation of distance-based road tolling** over time-based vignettes. Distance-based tolling better reflects actual road use and therefore provides a more effective incentive to adopt cleaner vehicles.

EU countries assessed (ranking)

1 **Relative score: 100%** Strong	3 **Relative score: 25%** Weak
2 **Relative score: 50%** Medium	4 **Relative score: 25%** Weak
	5 **Relative score: 0%** Weak

Eurovignette implementation

Germany is the only country in this assessment that has fully implemented the Eurovignette reform, introducing CO_2-based tolling and external cost charges in December 2023. Germany has also extended tolling to all vehicles from 3.5 tonnes earlier than the legal deadline and have removed exemptions for LNG and CNG vehicles.

The figure shows annual toll charges incurred by Euro VI trucks, which can reach up to €40,000. Until December 2025, all commercial zero emission vehicles (Class 5) are fully exempt, and the figure shows the future charge for ZETs from 2026.

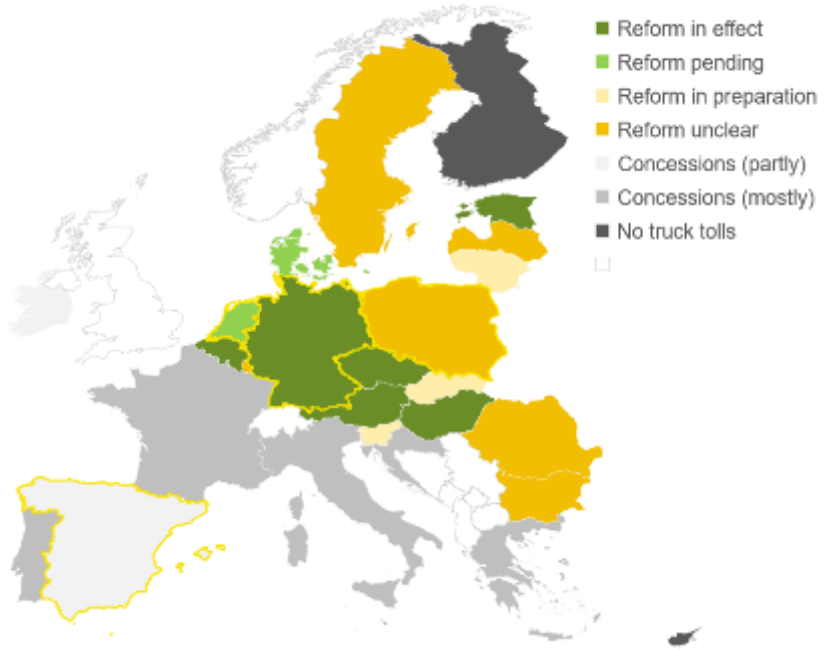
The Netherlands has passed legislation to introduce CO_2- and distance-based tolling, with implementation planned for July 2026. This measure aligns with the Directive, which sets a framework for how EU Member States can implement road charging schemes, including tolls, for heavy goods vehicles.

Poland, along with several other countries with government-controlled tolls, missed the March 2024 deadline to implement CO_2-based tolling. Currently, it is not clear what the concrete plans or timelines for Poland to comply with the Directive are. In addition, the current toll system does not incentivise cleaner trucks because it sets the lowest fee for Euro V trucks, not differentiating further from Euro VI and ZETs which pay the same than as Euro V truck.

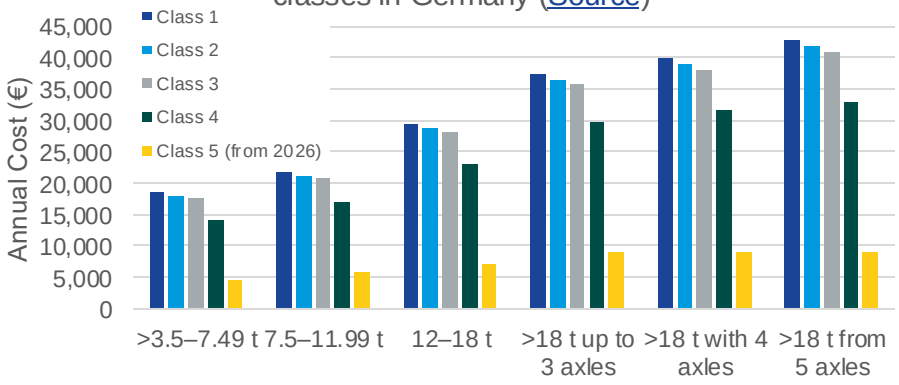
Sweden's progress is less advanced compared to Germany and the Netherlands. It will implement CO_2-based tolling for its time-based charges from 2025 and an external cost charges for heavy goods vehicles will be introduced on 25th March 2026. The toll will extend to all vehicle above 3.5 tonnes from March 2027.

Spain's highway network is partly concession-controlled, meaning the government can only vary toll charges by agreement with the concession holder. However, its toll roads are becoming free to use as contracts expire, with no information available on whether they will introduce CO_2-based tolling in the future.

Overview of reform progress in EU member states.
(Data from T&E Eurovignette briefing update, 2024)



Annual toll charge cost comparison across Euro VI emission classes in Germany (Source)



Based on 530km daily average distance (source) and 232 operating days (source)

Implementation of urban vehicle access regulations (UVAR)

UVAR describe a range of schemes that control vehicle access to cities, typically based on size, emissions class, or payment of a fee. They are primarily introduced to help cities comply with air quality standards and manage congestion, but they can also improve road safety, generate revenue for the administration, and enhance urban liveability.

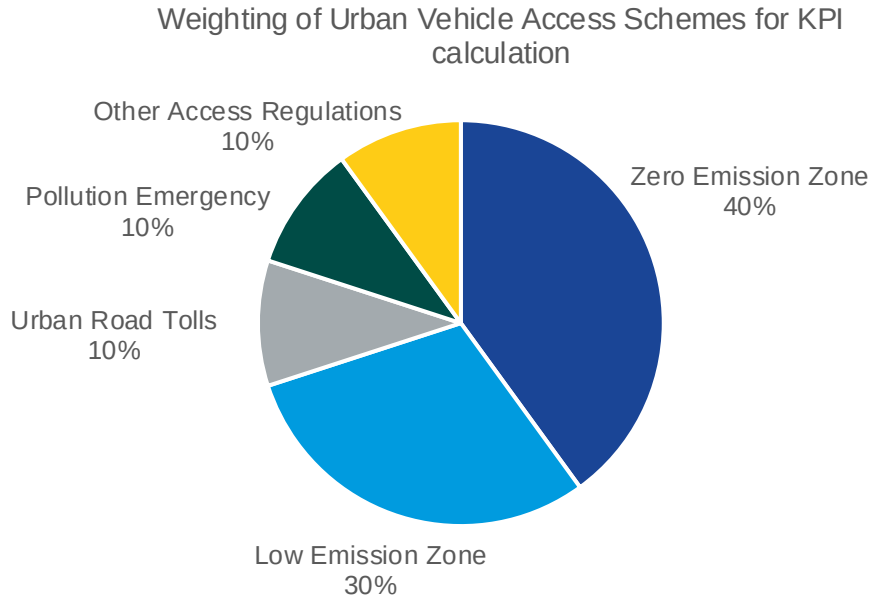
Another important effect of these measures can be to encourage fleet renewal towards cleaner and zero emission vehicles. The potential of each scheme to promote the uptake of ZETs is summarised below, while the weighting of each scheme for the KPI developed for this study is displayed in the pie chart.

- **Zero-Emission Zones (ZEZs):** Provide the strongest incentive for operators to adopt ZETs by mandating zero-emission compliance for access, also supporting long-term infrastructure investment
- **Low-Emission Zones (LEZs):** Compliance typically requires meeting Euro 6/VI emission standards. While this pushes fleets toward cleaner vehicles, it may delay full ZET adoption by allowing incremental upgrades rather than a shift to zero-emission
- **Urban Road Tolls:** These can incentivise ZET adoption by reducing operational costs, although their effectiveness depends on toll structure, such as fee level and stringency
- **Emergency Pollution Zones:** These temporarily restrict or ban polluting vehicles during pollution spikes, but fleet operators may not prioritise ZETs solely to address these infrequent restrictions
- **Other Access Regulations:** Measures like pedestrianisation and limited traffic zones (LTZ) often focus on traffic volumes or vehicle types, providing minimal incentive for ZET adoption

The effect of each individual scheme is dependent on several factors, including level of enforcement and fee/toll amount. These are not considered in the scoring.

EU countries assessed (ranking)

1 **Relative score: 100%** Strong	3 **Relative score: 54%** Medium
2 **Relative score: 63%** Medium	4 **Relative score: 40%** Medium
	5 **Relative score: 20%** Weak



Implementation of urban vehicle access regulations (UVAR)

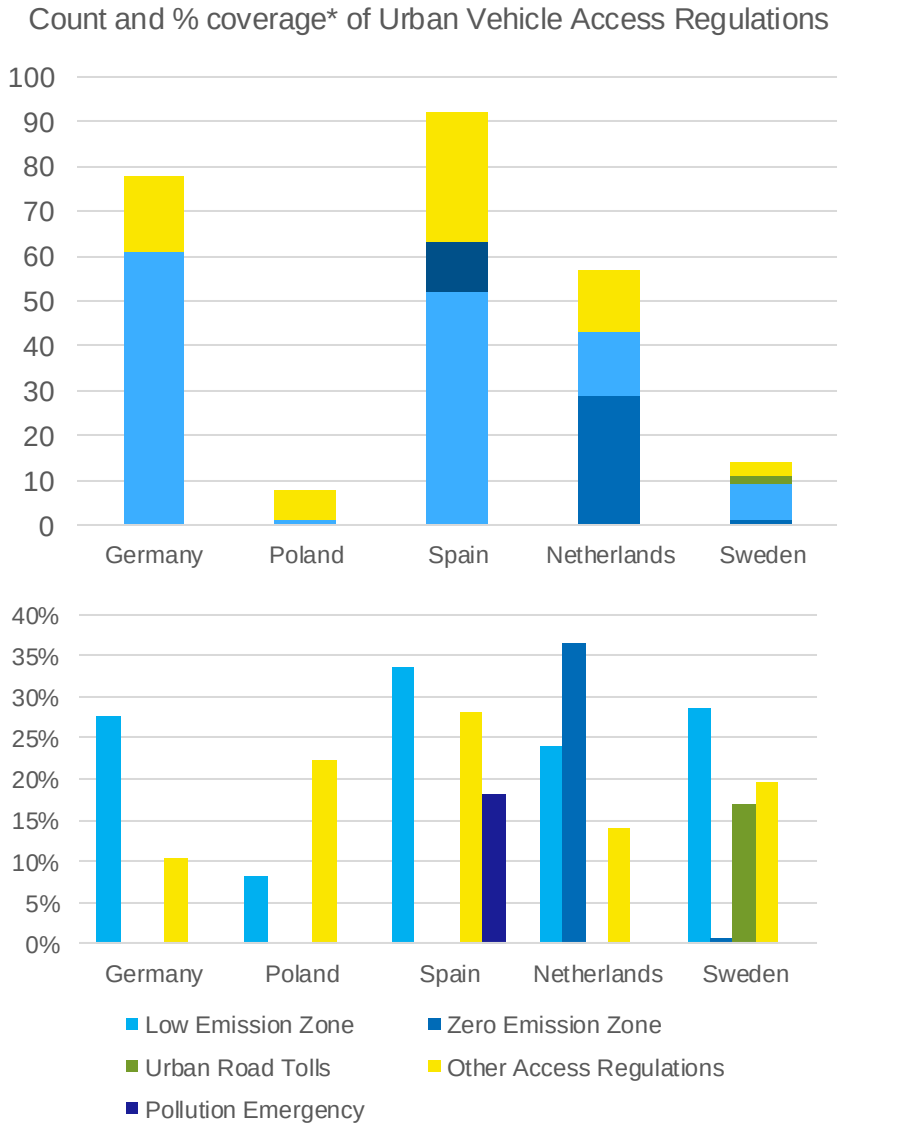
The Netherlands stands out for its plans to introduce ZEZs targeting vans and trucks nationwide. Although these zones will not take effect until some point in 2025 and local authorities have faced some late opposition from the Dutch government, around 30 cities remain committed (representing 35% of the urban population). Overall, 14 LEZs encourage cleaner vehicles but currently only incentivise adoption of Euro VI trucks. Other regulations include car-free zones, which lack emissions criteria.

Spain scored second highest due to the number of LEZ and pollution emergency zones across the country. Since 2021, laws have required cities with populations over 50,000 to introduce LEZs. Although many cities have complied – particularly the Catalonia region, which has introduced more stringent requirements - the majority are yet to implement.

Sweden has a balanced range of schemes in place. LEZ cover around 30% of the urban population but restrict access only up to Euro VI. Road tolls are present in the two largest cities but do not exempt ZEVs, though Stockholm briefly offered exemptions for energy efficient vehicles in 2008. Other regulations include studded tyre bans and lorry restrictions, but neither is linked to emissions criteria.

Germany has many LEZs (61), but their coverage in terms of urban population is moderate (28%), and Euro IV have access to all. An E-sticker system allows cities to grant privileges for all EVs, such as free-short term parking or bus lane use. However, promotion and awareness of these benefits are limited. Other regulations include transit bans based on vehicle weight, with no exemptions for ZETs.

Poland has a limited number of schemes, with only one LEZ and seven other access regulations, covering 8% and 22% of the urban population, respectively.



*Coverage is measured by the share of the urban population from cities with UVARs

Transparency of grid capacity

The growing demand for EV charging locations and events presents challenges for the electrical infrastructure and the processes that manage the deployment of charge points. ZET charge points are especially challenging due to the high-power requirements and often the need for additional approvals or permits. This KPI considers the three metrics: the availability of load capacity maps, a recent grid transition index ranking, and the emphasis on grid investment.

A Distribution System Operator (DSO) manages local and regional energy networks that deliver electricity to end users. The provision of **grid capacity maps** (low-medium voltage) by DSOs is crucial for EV charging infrastructure deployment. They show where new electricity loads, like EV chargers, can be connected without requiring costly grid upgrades, empowering developers to prioritise locations with existing capacity, leading to faster installation, reduced costs and better predictability of outcomes. The revised EU electricity market legislation requires TSOs and DSOs to publish this information, but implementation is currently limited (Source).

Investing in the electricity grid is also crucial for the successful and timely deployment of EV charging infrastructure across EU countries. Proactive grid investment, coordinated with the planned rollout of charging infrastructure, is essential to ensure that the grid can accommodate increasing demand from EVs. The KPI considers the country's **emphasis on grid investments** in their National Recovery and Resilience Plan (NRRP). The **grid transition index**, developed by GLOBSEC (Source), considers several other relevant factors such as load forecast accuracy, peak load and capacity of demand response.

While these metrics cover some key aspects that can support the deployment of charging infrastructure for ZETs, this KPI does not consider all factors relating to the permitting and connections procedure. For example, the complexity of the application process and transparency of costs and connection time.

EU countries assessed (ranking)

1 **Relative score: 62%** Medium	3 **Relative score: 33%** Weak
2 **Relative score: 50%** Medium	4 **Relative score: 33%** Weak
	5 **Relative score: 17%** Weak

Transparency of grid capacity

The Netherlands is the only country with a national capacity map, although it shows limited scope for new transport connections. The National Recovery and Resilience Plan (NRRP) includes reforms to the grid management system to mitigate congestion and recognises the need for Distribution System Operator (DSO) investments in the grid to support demand from EVs. However, the Netherlands ranks low in the grid transition index (24/25) due to poor load forecasting accuracy and grid congestion. Despite great progress in terms of transparency of grid capacity, it should be acknowledged that Netherlands is facing severe grid congestion issues, which could persist until 2033–2035.

The map shows the number of DSOs in each EU country and highlights the challenge some countries face in coordinating national capacity maps. While the Netherlands has only six DSOs, Germany has over 500.

Spain lacks a national load capacity map, though one is being developed by the National Commission for Markets and Competition (Source). Spanish DSO, Iberdrola, has published a country-wide capacity map, but it only covers generation. Spain's NRRP includes several reforms and investments aimed at supporting grid capacity and the country ranked highest on the grid transition index (1/25), with strong load forecasting accuracy.

In **Germany**, load capacity maps are available for some regions. The Energy Industry Act requires DSOs to create these (Source), but no national map exists. Sustainable mobility (fleet electrification, public transport, active mobility) receives the largest share of Germany's NRRP funding, yet grid-related issues are not addressed. This gap is reflected in its moderate grid transition index ranking (17/25), although Germany benefits from a low peak load.

Sweden also lacks a national load capacity map. While its NRRP does not address EV infrastructure grid connections, it includes a reform to expedite grid construction authorisation. Sweden scored highly on the grid transition index (5/25), supported by 100% smart metering penetration, though growing electricity demand remains its primary challenge.

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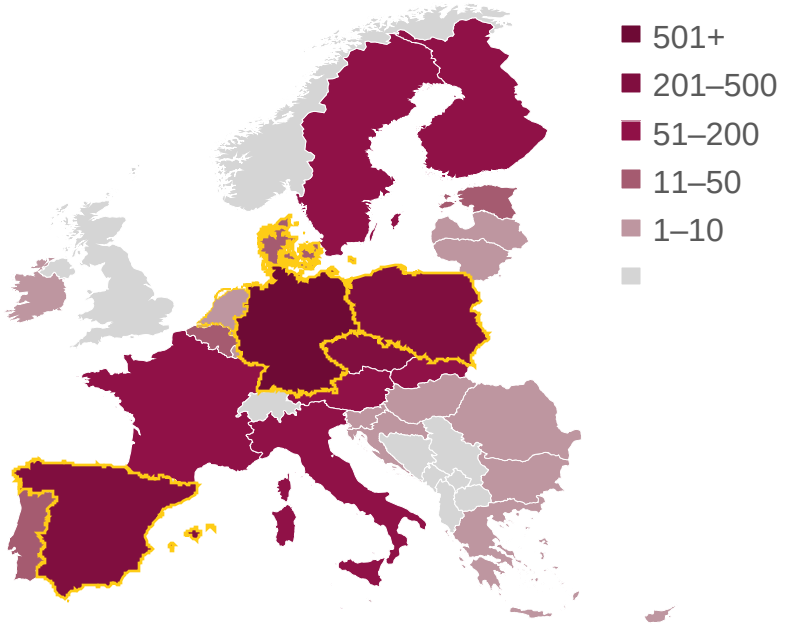
Number of DSOs in each country
(Data from DSO Entity, 2024)



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A national load capacity map is not available in Poland. The NRRP emphasises grid transition, with significant investments in expanding and upgrading transmission and distribution networks, although mobility-related grid enhancements are not mentioned. Although Poland has a low peak load, it ranks poorly on the grid transition index, with limited demand response capabilities. A separate support scheme for DSOs was launched in order to facilitate grid connection construction for AFIR locations.

Country snapshots

The Netherlands: snapshot

Combined score: 71% **Ranked: 1**

KPIs assessed (ranking)

1 Charging infrastructure deployment	81%	2 ZET trials and pilots	55%
3 Purchase incentives for the purchase of vehicles and charging equipment	76%	4 Adoption of Eurovignette and tolling mechanisms favouring ZETs	50%
5 Progress on adoption of urban vehicle access regulations	100%	6 Transparency of grid capacity	62%

"The Netherlands, a European leader in innovation"
The Netherlands plays a significant role in the European trucking market, supported by its strategic location as a gateway to Europe through major ports such as Rotterdam and Amsterdam. The country's extensive logistics network integrates seamlessly with its highly developed road infrastructure, making it a major hub for freight transport. Its trucking sector is characterised by a strong focus on efficiency and sustainability, with increasing use of sustainable technologies, including electric and hydrogen-powered trucks, in line with EU climate targets.

In 2023, 16,139 new trucks over 3.5 tonnes were registered in the country, of which 1,253 were zero emission or use alternative fuels (Source). The Netherlands is also benefiting from progressive policies that encourage low emission zones and the development of charging and refuelling infrastructure, positioning it as a leader in the transition to greener freight transport. Its current truck fleet is relatively small, below other European countries analysed in this report: it has 57,400 trucks over 3.5 tonnes transporting 0.7 billion tonne-kilometres per year approximately (Source).

Snapshot of the the Netherlands performance

KPI 1: Deployment of chargers (81%)

The Netherlands leads in infrastructure deployment for trucks and is making significant progress towards the 2030 AFIR targets. The country has established a strong network of charging stations, having in place 28 charging pools with at least one >300 kW charger every 1,000 km of the comprehensive TEN-T network. The government aims to install 550 new public charging points every day from 2025, a fraction of which will be suitable for trucks (Source). However, the average charging power per site still needs to be improved, with an average of 1,127 kW, well below AFIR's target of 3,600 kW per site by 2030, and problems of grid congestion have been reported.

KPI 2: ZET trials and pilots (55%)

In the Netherlands, there are eight trials/pilots under operation, most of which are run by the private sector. From these, six trials/pilots are focused on testing hydrogen-related technology. The trials offer significant benefits by testing the viability and scalability of green hydrogen infrastructure, improving energy efficiency, and reducing the cost of FCEV ownership. They help identify the optimal locations for refuelling stations, enhance service offerings for heavy-duty vehicles, and demonstrate the potential for integrating renewable energy into transport systems, advancing the transition to zero-emission freight across key European regions.

KPI 3: Purchase incentives (76%)

The Netherlands offers ZET purchase incentives covering up to 29% of the purchase cost (up to €115,200). It has also introduced two subsidy schemes for charging infrastructure: the Subsidy Scheme for Private Charging Infrastructure at Companies (SPRILA) and the Subsidy Scheme for Public Charging Infrastructure for Heavy Transport (SPULA). SPRILA helps entrepreneurs to install charging infrastructure or obtain advice, while SPULA focuses on expanding publicly accessible charging points for heavy electric vehicles, including trucks. Netherlands does not offer tax incentives.

KPI 4: Adoption of Eurovignette (50%)

The upcoming changes in the Netherlands regarding road tolls have been announced but are not yet implemented, with plans set for mid-2026 to move to distance-based charges with toll variations according to CO_2 emissions. Currently, motor vehicles weighing between 3.5 and 12 tonnes are exempt from the Eurovignette, though this exemption will end in March 2027. In addition, the structure of the Eurovignette charges were updated—starting 1 January 2025—when Dutch road toll rates were increased by 19%. The new system adjust charges based on vehicle emission classes (Euro classes), the number of axles, and CO_2 emissions (Source).

KPI 5: Urban access policies (100%)

In the Netherlands, 14 cities have green low emission zones specifically for trucks, including Utrecht, Amsterdam and Arnhem, which allow access for vehicles meeting Euro IV standards or higher. However, the LEZ in the port of Rotterdam enforces stricter Euro VI standards (Source). The Netherlands had planned to introduce Zero Emission Zones (ZEZ) for vans and trucks nationwide by 2025, although some opposition has delayed implementation. Around 30 cities (covering 35% of the urban population) have signed up.
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KPI 6: Grid connections (62%)

It is the only country among the examined with a national capacity map. However, they rank low in the grid transition index (24/25) due to poor load forecasting accuracy and grid congestion – the capacity map is limited for new transport connections. The National Recovery and Resilience Plan (NRRP) includes reforms to the grid management system to mitigate congestion and recognises the need for Distribution System Operator (DSO) investments in the grid to support demand from EVs. Furthermore, in 2022, the country developed a national action plan to address grid congestion while the DSOs and the Transmission System Operator (TSO) have worked together on the *Integrated Infrastructure outlook* out till 2050.

Germany: snapshot

Combined score: 63% **Ranked: 2**

KPIs assessed (ranking)

1 Charging infrastructure deployment	54%	2 ZET trials and pilots	100%
3 Purchase incentives for the purchase of vehicles and charging equipment	60%	4 Adoption of Eurovignette and tolling mechanisms favouring ZETs	100%
5 Progress on adoption of urban vehicle access regulations	40%	6 Transparency of grid capacity	33%

"Electric trucks gaining traction in Germany"

Germany is a key hub in the European trucking market due to its central location, extensive road network and strong manufacturing base. It is one of the largest road freight markets in the EU, supported by its robust logistics and infrastructure systems. The country is home to major truck manufacturers such as Daimler Trucks and MAN, which contribute significantly to innovation in heavy duty vehicle technology, including electric and hydrogen-powered trucks. In 2023, from the 94,820 registered in the country, 3,556 are zero-emission or use alternative fuels. 2,169 of the 3,556 are electric trucks, making it the country with the highest number of ZET registrations among the examined (Source). In addition to the vehicle fleet, trucking is an important economic activity in the country. Germany currently has a fleet of 528,000 trucks over 3.5 tonnes, second only to Poland (which typically exports trucking services). In terms of tonne-kilometres transported, Germany is by far the leading country in the region, with around 3 billion tonne-kilometres (the second country, France, has around half as many) (Source).

Snapshot of Germany performance

KPI 1: Deployment of chargers (54%)

Germany ranks 2nd in chargers per km on the TEN-T network but is behind the AFIR 2030 targets. Most of its truck-suitable charging pools offer 300 kW chargers, falling short of the required two 350 kW chargers per pool based on AFIR. Its average power of 1,182 kW per pool is far below the 3,600 kW target.

Nonetheless, Germany leads in absolute numbers, with 99 charging pools and 383 chargers suitable for trucks. The *Power to the Road* project further underscores its commitment to decarbonising transport, with plans for 350 fast-charging stations to support heavy-duty EVs, aligning with the nation's 2045 climate neutrality goal and EU targets (Source).

KPI 2: ZET trials and pilots (100%)

There are a large number of pilots and demonstrations promoted by public authorities (the Federal Government and regional ministries), technology private firms (such as Siemens, interested in charging parks and smart grid), and consortia including automotive companies (Volvo Group, Daimler, Toyota). Benefits explored in the pilots include the integration of these trials with other freight modes, the development of grid management solutions, the establishment of processes to facilitate the scaling-up and retrofitting of existing stations.

KPI 3: Purchase incentives (60%)

Germany does not have ZET purchase incentives (the KsNI programme was phased out in February 2024). In the past, Germany had a maximum purchase incentive of €25 million per company per calendar year for vehicles, infrastructure, and feasibility studies (subsidised by 50%). Today, there is charging infrastructure funding from the National Centre for Charging Infrastructure, under the "Publicly Accessible Charging Infrastructure for Electric Vehicles in Germany" (programme running from summer 2021 to the end of 2025). An exemption to ownership tax is granted for ZETs until 31 December 2030.

KPI 4: Adoption of Eurovignette (100%)

Germany excels in this area, achieving a perfect score by implementing CO_2-based charges, government-led distance-based tolls, and air pollution fees. It was the first country to update its MAUT (toll) system, with changes effective from 1st December 2023. As a result, the cost per kilometre for a 4x2 diesel truck nearly doubled, increasing from 19 cents to 34.8 cents (Source).

KPI 5: Urban access policies (40%)

Germany has 61 Low Emission Zones (LEZ), but their coverage is moderate, covering only 28% of the urban population. Euro 4/IV vehicles are still allowed in all LEZs, indicating lenient entry rules. An e-sticker scheme offers EVs benefits such as free short-term parking and access to bus lanes, but limited promotion and awareness reduces its impact. Transit bans based on vehicle weight lack exemptions for ZETs, potentially slowing their uptake.

KPI 6: Grid connections (33%)

In Germany, load capacity maps are available for some regions and while the Energy Industry Act requires DSOs to create these (Source), no national map exists. A key issue relates to the high number of DSOs (>500) that lack unified procedures for connections and capacity information sharing.

Sustainable mobility receives the largest share of Germany's NRRP funding, yet grid-related issues are not addressed. This gap is reflected in its moderate grid transition index ranking (17/25), although Germany benefits from a low peak load.

Sweden: snapshot

Combined score: 48% **Ranked: 3**

KPIs assessed (ranking)

1 Charging infrastructure deployment	54%	2 ZET trials and pilots	33%
3 Purchase incentives for the purchase of vehicles and charging equipment	67%	4 Adoption of Eurovignette and tolling mechanisms favouring ZETs	25%
5 Progress on adoption of urban vehicle access regulations	54%	6 Transparency of grid capacity	33%

"Sweden, a modest trucking market with progressive measures"
Sweden is a leader in sustainable trucking and logistics, driven by its ambitious climate targets and focus on innovation. The country's trucking market benefits from extensive infrastructure for alternative fuels and electrification, including a growing network of fast-charging stations and initiatives to support hydrogen fuel cell trucks. Of the 7,184 new trucks registered in 2023, 1,114 were zero-emission or use alternative fuels, one of the highest proportions among the countries analysed (Source).

Beyond heavy-duty vehicles, Sweden is the third highest country for EV sales in EU in 2023 and incentives for private and public charging infrastructure make the country a hub for green logistics innovation in Europe. Government and industry are working closely together to transform the heavy-duty transport sector to meet its net-zero targets by 2045. However, its trucking industry is relatively small compared to other countries analysed for this report, with a current fleet of 70,800 trucks over 3.5 tonnes and 0.5 billion tonne-kilometres transported in 2022 (Source).

Snapshot of Sweden performance

KPI 1: Deployment of chargers (54%)

Sweden has made good progress towards the AFIR 2030 targets. It has 5.74 charging pools and 23.42 chargers per 1,000 km of TEN-T network, with an impressive average power supply of 1,448 kW per charging pool. Circle K is playing a key role in this progress by leveraging existing truck stops to create 360kW multi-charger hubs. These locations not only provide advanced charging infrastructure, but also amenities such as shops, restrooms and secure parking, ensuring a well-rounded rest and recharge experience for drivers during transit.

KPI 2: ZET trials and pilots (33%)

Sweden is active in conducting trials and pilots led by private companies to advance the development of EV charging infrastructure for heavy-duty trucks. These initiatives include innovative features designed to improve efficiency and usability, such as Nimbnet's reservation system, which allows truck operators to plan reliable delivery routes in advance, reducing overall waiting times and maximising fleet utilisation. Charging sites are designed to accommodate even the longest heavy trucks. Other trials involve Megawatt Charging System (MCS) sites underlining Sweden's commitment to accelerating the adoption of electric heavy-duty vehicles.

KPI 3: Purchase incentives (67%)

The Swedish Transport Administration supports the purchase of BEVs, FCEVs and PHEVs in categories N1, N2 and N3. In addition, the Swedish Environmental Protection Agency offers grants such as Ladda bilen and Klimatklivet to support AC charging infrastructure for organisations. Klimatklivet covers up to 70% of investment costs for public charging stations, while Ladda bilen covers up to 50% of eligible costs for private charging at home or at work. Other incentives include green technology tax rebates from the Swedish Tax Agency and an exemption from vehicle tax for eligible vehicles (Source).

KPI 4: Adoption of Eurovignette (25%)

At present, Sweden uses time-based tolls with no CO_2-based charges or variations based on Euro emission standards. However, the Swedish Parliament approved changes in May 2024 to the country's participation in the Eurovignette agreement to introduce tolls that vary according to a vehicle's CO_2 emissions. The date of implementation of these measures has not yet been decided and there is considerable uncertainty about their eventual introduction (Source).

KPI 5: Urban access policies (54%)

Sweden has implemented LEZs in eight cities, covering around 30% of its urban population. These zones restrict access for trucks and buses below the Euro VI standard. Road tolls in Sweden's two largest cities are part of a national congestion charging scheme but do not exempt ZEVs. Notably, Stockholm briefly exempted energy-efficient vehicles in 2008. In April 2024, Sweden launched its first Zero Emission Zone (ZEZ) in Stockholm, the only one among the country's eight urban vehicle restrictions to only allow zero emission vehicles.

KPI 6: Grid connections (33%)

Although there are some local efforts to identify viable charging locations, including consideration of power, Sweden lacks a national load capacity map. While its NRRP does not address EV infrastructure grid connections, it includes a reform to expedite grid construction authorisation.

Sweden scored highly on the grid transition index (5/25), supported by 100% smart metering penetration, though growing electricity demand remains its primary challenge.

Spain: snapshot

Combined score: 38% **Ranked: 4**

KPIs assessed (ranking)

1 Charging infrastructure deployment	37%	2 ZET trials and pilots	27%
3 Purchase incentives for the purchase of vehicles and charging equipment	50%	4 Adoption of Eurovignette and tolling mechanisms favouring ZETs	0%
5 Progress on adoption of urban vehicle access regulations	63%	6 Transparency of grid capacity	50%

"Challenges in the Spanish trucking market's transition"

The Spanish trucking market is an important sector within the country's transport and logistics industry, with a strong reliance on road freight. Spain is well known for its extended road infrastructure, with 12,000 km of TEN-T road network (the highest in the region). Spain's strategic location in Southern Europe gives it an important role in cross-border transport with France and Portugal, and connections with major Mediterranean ports. Spain has a large truck fleet of 361,000 trucks over 3.5 tonnes, covering 1.6 billion tonne-kilometres annually (Source). However, Spain faces challenges in transitioning to a greener, more sustainable trucking sector. The roll-out of charging infrastructure has been slower than expected. Despite government targets, such as 5 million EVs by 2030, the uptake of electric trucks remains limited. In 2023, 28,685 trucks were registered in Spain, of which 1,639 were zero emission or alternative fuel trucks. From the 1,639, only 341 are electric trucks, reflecting the country's sluggish uptake (Source). The slow rollout of charging stations is a significant bottleneck, especially for heavy-duty trucks, whose operations are dependent on the availability of chargers.

Snapshot of Spain performance

KPI 1: Deployment of chargers (37%)

While the availability of charging infrastructure is growing, it is still geographically scattered. The number of charging pools indicates that the country is making progress, but at a slower pace than required to meet future demands for electric trucks. Spain's charging infrastructure for electric vehicles currently falls short of the AFIR requirement. With an average of 1,417 kW per pool, Spain ranks second after Sweden on power, but is far from the 3,600 kW per pool required by AFIR. A positive figure: Spain has an average of four chargers per hub, consistent with the deployment efforts of firms like Ionity and Zunder.

KPI 2: ZET trials and pilots (27%)

Spain is the host of two major pilot projects by major players in the sector: Iberdrola and Milence. The Spanish energy company is developing the first Mediterranean corridor for 100% electric heavy-duty road transport in collaboration with transport and electricity companies. The project includes the procurement of heavy-duty vehicles, the deployment of electric chargers of up to 1 MW and the development of a smart grid. Milence is testing on-site batteries and renewable energy generation as part of Smart Energy Hubs.

KPI 3: Purchase incentives (50%)

Spain does not currently subsidise the purchase of N2/N3 vehicles, as the program MOVES Mitma for trucks (with support from Next Generation funds) was discontinued in April 2024. However, other initiatives are in place. Subsidies for charging infrastructure vary by company size, and ZETs are exempt from the acquisition tax for vehicles emitting ≤120g CO_2/km. Additionally, BEVs enjoy a 75% ownership tax reduction in cities like Barcelona, Madrid, Valencia, and Zaragoza. Early amortisation is also available for investments in BEVs, PHEVs, FCEVs, and related infrastructure.

KPI 4: Adoption of Eurovignette (0%)

In Spain, distance-based tolling charges are applied only on limited sections of certain motorways with no variation according to CO_2 emissions. These tolls remain a point of contention among policymakers and industry groups. Although the European Commission has pressed for the adoption of the Eurovignette Directive, in May 2024 the Ministry of Transport and Sustainable Mobility has confirmed Spain’s commitment to meeting the EU’s requirements without implementing new tolls or altering the current system (Source).

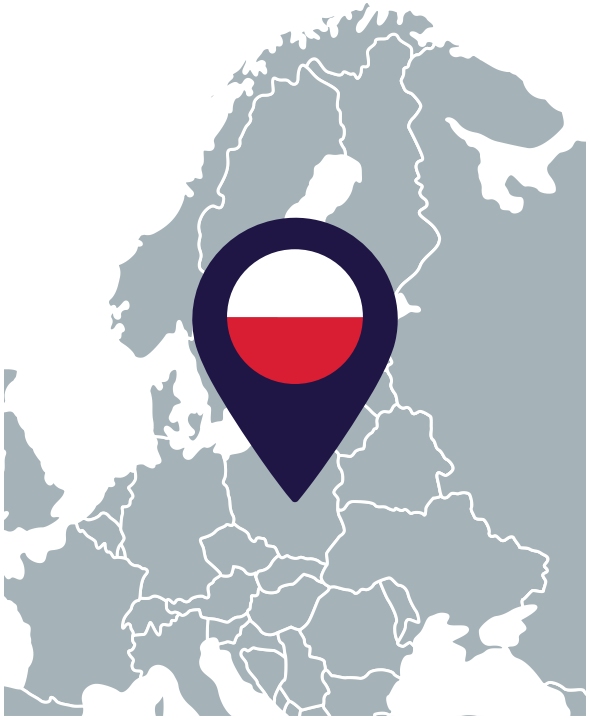
KPI 5: Urban access policies (63%)

From 2021, a law requires cities in Spain with more than 50,000 inhabitants to introduce LEZs. While many cities have complied, particularly in Catalonia where stricter requirements have been introduced, the majority of cities have yet to fully implement these zones. Of the 150 cities required to establish LEZs, 15 had done so by 2024, with a further 39 either implementing them in 2024 or planning to start along 2025. However, major cities such as Madrid, Barcelona, Valencia, Bilbao and Seville already have some form of urban access restriction in place relevant for trucks, ensuring significant coverage of the population.

KPI 6: Grid connections (50%)

Spain lacks a national load capacity map, though one is being developed by the National Commission for Markets and Competition. Iberdrola has published a country-wide capacity map, but it only covers generation. Iberdrola’s DSO, I-DE, also provides a description of the grid connection process on its website, but recognises that the permitting and connection process is challenging. Spain’s NRRP includes several reforms and investments aimed at supporting grid capacity and the country ranked highest on the grid transition index (1/25), with strong load forecasting accuracy.

Poland: snapshot



Combined score: 20% **Ranked: 5**

KPIs assessed (ranking)

1 Charging infrastructure deployment	14%	2 ZET trials and pilots	30%
3 Purchase incentives for the purchase of vehicles and charging equipment	20%	4 Adoption of Eurovignette and tolling mechanisms favouring ZETs	25%
5 Progress on adoption of urban vehicle access regulations	20%	6 Transparency of grid capacity	17%

"Slow electrification with limited policies in place"

Poland is one of the largest freight markets in the region. Polish truck fleets are known for their competitiveness, with a significant number of trucks operating both domestically and internationally. The country has a fleet of 686,000 trucks over 3.5 tonnes, the largest number of any of the countries surveyed (Source). This fleet covers 1.6 billion tonne-kilometres each year within Poland (while the country is known for exporting trucking services to neighbouring countries).

The country has a robust road network, which supports the growth of the sector and makes Poland an important hub for freight transport within the EU. However, the sector faces several challenges on its path to decarbonisation. Electrification is very slow and the installation of charging pools suitable for trucks is very immature and has only recently started. In 2023, 35,472 new trucks were registered in Poland, of which only 425 are zero emission or alternative fuel (and only 85 are electric), which is very limited, barely reaching 1% of new registrations (Source).

Snapshot of Poland performance

KPI 1: Deployment of chargers (14%)

In Poland, the focus of infrastructure development has been on passenger cars. Data from the New Mobility Association (PSNM) illustrates this trend: almost half of the chargers have a capacity of less than 50 kW, only 11% are located along the TEN-T network, which covers the main logistics corridors, and 74% are in locations such as car parks, shopping centres or hotels - places that were not designed with trucks in mind. Our analysis shows that Poland currently has only three charging pools suitable for trucks offering only six chargers and a total power output of 2,200 kW (Source).

KPI 2: ZET trials and pilots (30%)

Poland is currently involved in medium-sized domestic trials and pilots, but has not participated in the larger cross-border demonstrations taking place across Europe. One notable pilot is led by DHL, which is testing electric vehicles in its Polish operations as part of a broader multimodal strategy. Another initiative is a collaboration with the PSNM - New Mobility Association) focusing on an e-truck laboratory involving over 20 partner companies. There is also a public-private partnership involving the electricity supplier ZE PAK and the telecommunications firm Polsat Plus Group, supported by funding from the National Fund for Environmental Protection and Water Management.

KPI 3: Purchase incentives (20%)

Currently, Poland provides purchase tax exemptions for BEVs, FCEVs and PHEVs (≤2,000cc) until 2029. Ownership tax benefits also allow depreciation write-offs for these vehicles. In addition, the Ministry of Climate and Environment has proposed a support scheme for ZETs but its implementation schedule remains unclear. The new subsidy programme, "Support for the purchase or leasing of zero-emission vehicles in categories N2 and N3", is expected to be launched soon, with two billion zlotys (€480 million) allocated for grants. In addition, funding for public charging infrastructure will be available, covering up to 100% of eligible costs.

KPI 4: Adoption of Eurovignette (25%)

In Poland, heavy-duty vehicles are generally subject to road tolls, with different rules depending on the type of road. However, the country only implements distance-based tolls and has not yet adopted CO_2-dependent charges or those based on Euro emission standards. The present tolling scheme does not promote clean trucks, setting the lowest fees for Euro V trucks. In May 2024, Poland was one of 16 EU Member States facing infringement proceedings by the European Commission for failing to implement necessary reforms to its road charging system.

KPI 5: Urban access policies (20%)

Poland has a limited number of schemes, with only one LEZ (limiting traffic of trucks) and seven other access regulations. On 1 July 2024, Warsaw introduced the Clean Transport Zone, covering 37 square kilometres (7% of the city) and targeting key districts. This is Poland's first such zone and one of the earliest in Eastern Europe. Initially, the restrictions are limited: diesel vehicles older than 18 years (pre-2005) and petrol vehicles older than 27 years (pre-1997) are banned.

KPI 6: Grid connections (17%)

A national load capacity map is not available in Poland and there is a lack of a clear procedure for determining power available or knowing how the application will be classified. The NRRP emphasises grid transition, with significant investments in expanding and upgrading transmission and distribution networks, although mobility-related grid enhancements are not mentioned. Although Poland has a low peak load, it ranks poorly on the grid transition index, with limited demand response capabilities.

Summary of combined scores and key takeaways

INTRO
METHOD
KPI ANALYSIS
COUNTRY SNAPSHOT
SUMMARY
RECOMM-ENDATIONS
ANNEX

Summary of Combined Scores

The Combined Score is derived from a weighted average of the individual scores for each of the six KPIs. The weighting levels assigned to each KPI were determined based on insights from prior research on the key drivers of ZET adoption.

The Combined Score aims to synthesise and provide a concise snapshot of the most influential factors shaping a landscape conducive to the adoption of cleaner truck technologies.

The final Combined Score, reflecting this methodology, is presented below:


Netherlands **71%**


Germany **63%**


Sweden **48%**


Spain **38%**


Poland **20%**

An important observation is that leaders and laggards are not uniform across KPIs. Each country demonstrates clear strengths in certain dimensions while exhibiting weaknesses in others, with no country leading across all dimensions. For example, the Netherlands, the country with the highest Combined Score, performs well in most KPIs but lags behind in progress towards Eurovignette implementation. Germany is very advanced in Eurovignette implementation and is hosting several ZET trials and pilots. However, there is room for improvement in the transparency of grid connections. Sweden shows balanced performance across all KPIs. Spain performs well in urban access restrictions but has yet to adapt its tolling system to incentivise ZET use. Poland has ambitious plans for purchase incentives for ZETs (to start in 2025) but has significant room for improvement across all KPIs.

EACH COUNTRY DEMONSTRATES CLEAR STRENGTHS IN CERTAIN DIMENSIONS WHILE EXHIBITING WEAKNESSES IN OTHERS, WITH NO COUNTRY LEADING ACROSS ALL DIMENSIONS.

Summary of countries' performance and combined score

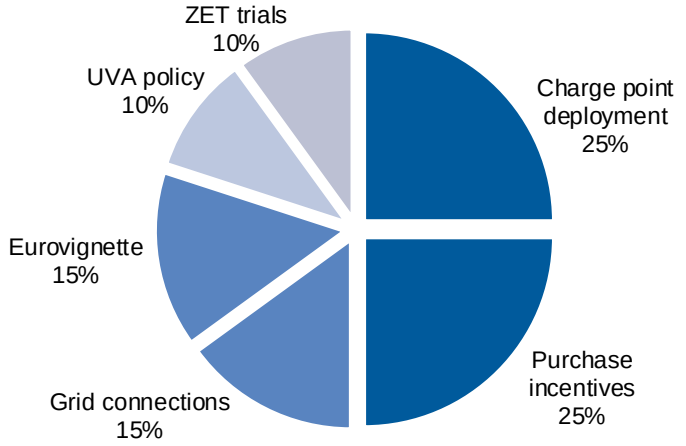
Individual KPI country scores (see previous slides)

Country	Charge point deployment	ZET trials	Purchase incentives	Eurovignette	UVA policy	Grid transparency
Germany	54%	100%	60%	100%	40%	33%
Netherlands	81%	55%	76%	50%	100%	62%
Poland	14%	30%	20%	25%	20%	17%
Spain	37%	27%	50%	0%	63%	50%
Sweden	54%	33%	67%	25%	54%	33%

Individual KPI country classifications (see previous slides)

Country	Charge point deployment	ZET trials	Purchase incentives	Eurovignette	UVA policy	Grid transparency
Germany	Medium	Strong	Medium	Strong	Medium	Weak
Netherlands	Strong	Medium	Strong	Medium	Strong	Medium
Poland	Weak	Weak	Weak	Weak	Weak	Weak
Spain	Weak	Weak	Medium	Weak	Medium	Medium
Sweden	Medium	Weak	Medium	Weak	Medium	Weak

Weighting of each KPI



Final Combined Scores and Country Ranking

Country	Score (%)	Ranking
Netherlands	71%	1
Germany	63%	2
Sweden	48%	3
Spain	38%	4
Poland	20%	5

Policy recommendations

Policy recommendations

The following recommendations, derived from our analysis and evaluation of countries' performance, are aimed at policymakers:

Deployment of charging infrastructure

- Establish standardised and mandatory reporting mechanisms that clearly differentiate between chargers suitable for heavy-duty vehicles and those that are not. This approach, as demonstrated by Germany, facilitates infrastructure planning (Source)
- These databases should indicate relevant information for truck operators such as if there is charging space for truck and trailer or space available to park the trailer, and whether there are facilities for the drivers' rest breaks
- Finalise the harmonisation of charging standards and speed up its implementation across the EU to ensure interoperability, especially for high-power charging systems for trucks
- Prioritise the deployment of charging infrastructure along critical transport corridors and hubs to meet AFIR targets by 2030
- Further recognition of the importance of depot charging as a means to supplement AFIR related infrastructure goals and the need for financial support to support its implementation

Policy recommendations

ZET trials and pilots

- Document and share insights from advanced pilots, such as the Netherlands' hydrogen infrastructure development and Smart Energy Hubs, to serve as benchmarks for other Member States
- Trials/pilots should include case studies or best practices to be shared more widely with authorities and industry through workshops, roundtables, reports
- Facilitate partnerships between shippers, carriers, freight forwarders, OEMs, policy makers and energy sector players to ensure development of ZETs and their infrastructure

Purchase incentives for the adoption of ZET

- Combine purchase subsidies, infrastructure grants, and tax incentives into an integrated policy framework to maximise impact and adoption rates
- Enable regional and municipal governments to offer additional incentives
- Ensure visibility and predictability for ZET support schemes by making them easily accessible to operators, with clear budgets and well-defined timelines
- Regularly assess the effectiveness of subsidy and incentive programmes, adjusting funding levels and eligibility criteria to meet evolving market demands and technology advancements
- Provide an EU overview of Member States' subsidies and incentives to enable greater uptake by the private sector

Policy recommendations

Implementation of Eurovignette

- Exemption for ZETs in tolling systems should be considered to further incentive their uptake
- Collaborate with private concession holders, when appropriate, to implement flexible tolling agreements that include CO_2-based charges

Transparency of grid capacity

- Develop and maintain national load capacity maps, as seen in the Netherlands, to improve visibility and planning for grid expansion
- Promote the full deployment of smart metering systems, as seen in Sweden, to enhance grid flexibility and optimise electricity consumption
- Data should be digitalised and made available in a transparent way
- Significant investment is needed in the grid infrastructure, along with streamlining approval processes for new connections and reducing waiting times for grid upgrades

Implementation of urban vehicle access policies

- Expand the coverage and stringency of LEZs to include more cities and towns, following the model set by Spain, which has mandated LEZs in cities with populations over 50,000
- Provide clear timelines and phased rollouts to allow industries to adapt, while ensuring the zones are well-enforced and widely communicated
- Introduce specific exemptions for ZETs

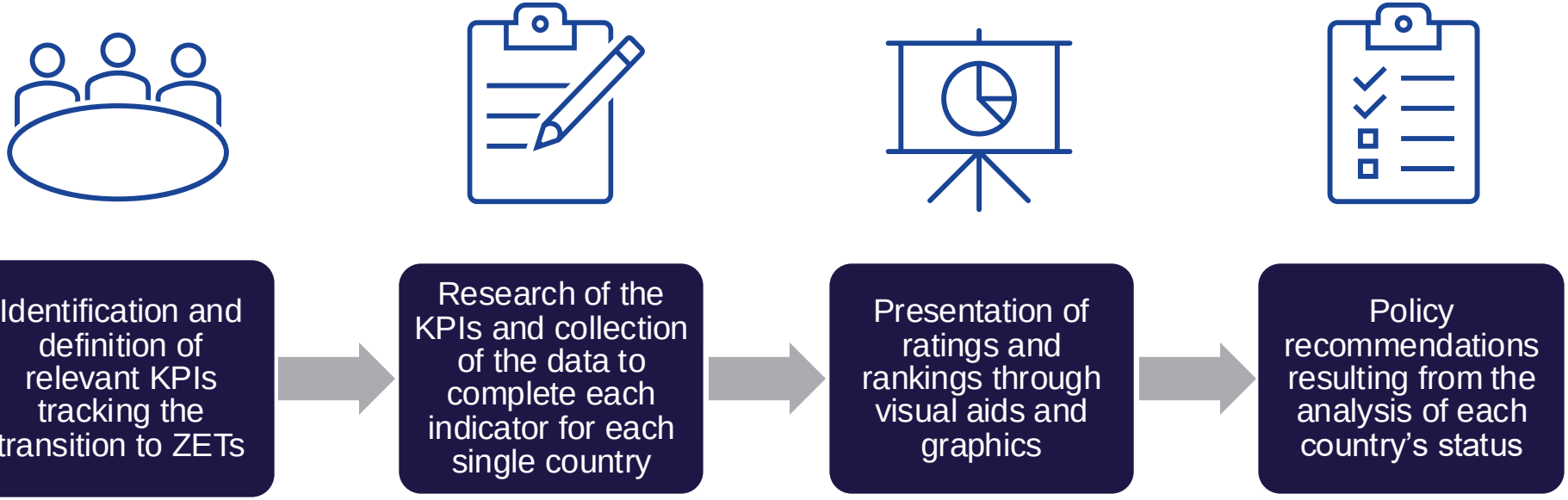
Additional transversal policy recommendations:

- Availability of key indicator data to ensure transparency and enable tracking of progress over time
- Predictability and visibility in the regulatory environment
- Ensuring the growing availability and use of renewable energy

Annex I: detailed methodology

Approach and methodology

Ricardo assessed the readiness of EU countries to transition to ZETs based on the four key steps outlined below.



Measurement and ranking the ZET transition KPIs

Charge point deployment

Description

- This KPI assesses the **deployment of 'high-powered' charging points (above 300 kW) suitable to be used by trucks** in each Member State
- The charger power threshold for this KPI is set at 300kW, slightly below the 350kW minimum set by the Alternative Fuel Infrastructure Regulation (AFIR), as it is commonly used by datasets that capture charging points specifically for heavy duty vehicles. Additionally, we capture also the progress of AFIR-compliant chargers
- Charging points identified vary in their suitability for trucks, some can accommodate trucks with trailers, while others only allow trucks but have a parking area where the trailer can be left while being charged. Some sites have a combination of both types. But all are suitable for trucks
- The KPI considers public charging because of data availability

Key sources

- Nationale Agenda Ladeinfrastraktur, Bluekens, Travis, National Leitsteller Ladeinfrastrktur dataset, Milence, Chargemap, Scania Map, Polenergia, Map created by truck users, Data provided by EcoMovement

Methodology

This KPI was developed considering partial scores for each of the following elements:

- Progress towards AFIR (identified charging pools with at least 2 chargers over 350 kW for trucks per kilometre of TEN-T network)
- Charging pools with at least one charger over 300 kW for trucks per kilometre of TEN-T
- Total number of chargers over 300 kW
- Average power offered for trucks in each charging pool

Each partial score was normalised based on the maximum score. The score for the KPI will be an average of the three normalised partial scores.

Overall, a result from 0-40% obtains a RAG score of Weak; a result from 41% to 70% obtains a RAG score of Medium; a result between 71% and 100% obtains a RAG score of Strong.

Country	Progress towards AFIR	Charging pools per km of TEN-T (>300kW)	Total chargers	Powered offered	Final score (%)	RAG rating
Germany	4%	31%	100%	82%	54%	Medium
Poland	1%	1%	2%	51%	14%	Weak
Spain	16%	8%	27%	98%	37%	Weak
Netherlands	100%	100%	45%	78%	81%	Strong
Sweden	56%	21%	40%	100%	54%	Medium

ZET-related trials and pilots

Description

- This KPI assesses the **presence of ZET and infrastructure-related trials and pilots** which provides an indication of the level of ambition and progress made by each Member State to deploy ZETs and the associated infrastructure. The higher the number of large-scale trials, the greater the market-readiness and support for widespread adoption of ZETs is likely to be, at the initial stage of ZET deployment
- In addition to helping demonstrate the benefits of the ZET transition, trials and pilots can help identify knowledge gaps, lack of suitable legislation, excessive administrative burden and other practical barriers to the widespread deployment of ZETs. These insights would allow countries to take more effective action and create a more enabling environment for the uptake of ZETs
- This KPI takes into account both the **number of ZET** and **infrastructure deployed**, as well as the **duration of the trial or pilot**. The size of the truck fleet in each country is not considered when comparing trial deployment

Key sources

- Publicly-available national sources were used as the main source to compile case studies on ZET-related trials and pilots within and between the five selected countries
- National sources reviewed include press releases, project websites and progress reports – the full list of sources will be provided in the Final Report
- The national truck fleet data was extracted from Eurostat for 2022: Statistics | Eurostat (europa.eu)

Methodology

The number of ZETs and charge points deployed during trials and pilots was collected and assigned a level of ambition, ranging from **Small to Large** (see scale matrix below).

The number of pilots/trials in each country was weighted by a factor from 1 to 3 according to the size of the pilot/trial (3 to Large, 2 to Medium, 1 to Small). The resulting score was then normalised to obtain a % score.

Overall, a result from 0-40% obtains a RAG score of Weak; a result from 41% to 70% obtains a RAG score of Medium; a result between 71% and 100% obtains a RAG score of Strong.

Country	Small scale (#)	Medium scale (#)	Large scale (#)	Normalised score	RAG rating
Germany	5	8	4	100%	Strong
Spain	3	0	2	27%	Weak
Netherlands	2	2	4	55%	Medium
Poland	4	3	0	30%	Weak
Sweden	3	1	2	33%	Weak

Scale matrix used to assess the ZET trials and pilots		Deployment (vehicles or infrastructure)		
		<5	5-20	>20
Duration (years)	0-1	Small	Small	Medium
	1-5	Medium	Medium	Large
	>5	Medium	Large	Large

Purchase incentives

Description

- This KPI considers the purchase incentives available for ZETs in each country, including vehicle and infrastructure **subsidies and exemptions on acquisition and ownership taxes**
- Whilst the total cost of ownership (TCO) over a ZET lifetime can be lower than the TCO of ICE trucks, **upfront costs for ZET technology presents a key challenge to truck operators** due to the high price premium for ZETs versus ICE trucks, and the high purchase and installation costs for charging infrastructure. The greater the availability of purchase incentives and tax benefits, the higher the financial support available to fleets to accelerate the ZET transition
- Each Member State is scored based on the **availability** of the different purchase incentive schemes, as well as the **coverage** of the schemes across the different weight classes within the HDV segment

Key sources

1. ACEA (2024). Zero-emission commercial vehicles: Tax benefits and incentives (2024)
2. ICCT (2024). Race to Zero: European Heavy Duty Vehicle Market Development Quarterly (January – March 2024)
3. Ricardo for ECTA (2024). Study on financing mechanisms for zero-emission trucks and their infrastructure
4. ACEA (2022). Tax Guide 2022

Methodology

The purchase incentives and tax benefits available for ZETs in each country, and their coverage, will be collected from identified European and national sources.

RAG scores are assigned for the level of incentives in each country, taking into account:

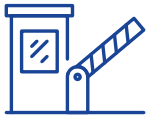
1. Purchase incentive for N2-N3 vehicles (40% weighting). This variable is calibrated by the average percentage of the vehicle cost covered by the subsidy and the total budget for the initiative
2. Subsidies for charging infrastructure (40% score weighting)
3. Tax incentives (20% weighting)

Purchase incentives and subsidies are given a higher weighting than tax incentives, recognising the significant barrier created by the high price premium for ZET technology.

Overall, a result from 0-40% obtains a RAG score of Weak; a result from 41% to 70% obtains a RAG score of Medium; a result between 71% and 100% obtains a RAG score of Strong.

Country	Purchase incentive (calibrated)	Subsidies for charging infrastructure	Tax incentives	Overall scoring	RAG rating
Germany	0%	40%	20%	60%	Medium
Netherlands	36%	40%	0%	76%	Strong
Poland	0%	0%	20%	20%	Weak
Sweden	27%	40%	0%	67%	Medium
Spain	0%	40%	10%	50%	Medium

Implementation of Eurovignette



Description

- This KPI considers the extent to which Member States have implemented the Eurovignette Directive
- The Directive includes a mandatory framework for adjusting infrastructure and external cost rates based on energy efficiency and CO_2 emissions of the vehicle, helping to reduce the cost gap between ZETs and their diesel equivalents
- The implementation of the different elements of the Directive (**distance-based tolling, CO_2 charges and air pollutant charges**) are compared against the mandated timeline for each country
- Where applicable, **the impact of Eurovignette Directive implementation on vehicle road tolls for Diesel and ZEV powertrain technologies** will be calculated using national toll unit rates and a reference vehicle

Key sources

- T&E (2024). Tolling: the highway to green trucking- Eurovignette Briefing
- National sources were used to collect road toll rates for individual countries which have proposed or adopted tolls varying with CO_2 emission class:
  - DE: Toll Collect truck toll rates for 2024 (with CO2 emissions tax) (impargo.de)
  - NL: https://www.vrachtwagenheffing.nl/english/frequently-asked-questions#anker-1-what-is-the-heavy-goods-vehicle-charge
  - PL: Klasyfikator pojazdów (etoll.gov.pl)
  - ES: Transport taxes and charges in Europe - Publications Office of the EU (europa.eu)
  - SE: Time-base vignette (toll rates unavailable)

Methodology

The progress towards adopting each of the Eurovignette Directive's requirements for HDV road tolling in each country will be assessed and given a RAG score weighted according to adoption of:

1. CO_2-based charge variations. Partial scores: Implemented 50%, announced 25%
2. Distance-based tolling. Partial scores: Implemented 25%, announced 12.5%
3. Air pollution (Euro class) charge variations. Partial scores: Implemented 25%, announced 12.5%

CO_2-based tolling is given the highest weighting as this has the greatest effect on incentivising ZET alternatives. Overall, a result from 0-40% obtain a RAG score of Weak; a result from 41% to 70% obtains a RAG score of Medium; a result between 71% and 100% obtains a RAG score of Strong.

Country	Adopted CO_2-based charge variations?	Adopted distance-based, gov-led tolling?	Adopted air pollution charge variations?	Score	RAG rating
Germany	50%	25%	25%	100%	Strong
Netherlands	25%	12.5%	12.5%	50%	Medium
Poland	0%	25%	0%	25%	Weak
Sweden	25%	0%	0%	25%	Weak
Spain	0%	0%	0%	0%	Weak

Implementation of urban vehicle access regulations (UVAR)

Description

- This KPI considers the **national coverage of urban vehicle access regulations (UVARs)**. This includes Zero Emission Zones (ZEZ), Low Emission Zones (LEZ), Urban Road Tolls, Pollution Emergency and Other Access Regulations
- UVARs are designed to **restrict or completely ban vehicles from urban areas** to help cities comply with air quality standards, manage congestion, improve road safety, generate revenue for the administration, and enhance urban liveability. UVAR with strict access criteria linked to emissions will be most effective in incentivising deployment of ZETs
- Each Member State is scored according to the proportion of the total urban population covered by each UVAR type

Key sources

1. List of urban vehicle access policies by country
   - Schemes by Country (urbanaccessregulations.eu)
2. Population sources
   - Germany
   - Poland
   - Netherlands
   - Spain
   - Sweden

Methodology

The implementation of UVARs to support ZET adoption is assessed based on the total urban population coverage of each UVAR type. A weighted average is then taken to account for the effectiveness of each scheme.

ZEZs are the most effective at incentivising ZET deployment, and are given a weighting of 40%. **LEZs** are more widespread across Europe, but typically only restrict up to Euro 6/VI, so are less effective than ZEZs. They are given a weighting of 30%. **Urban road tolls, pollution emergency and other access regulations** can be moderately effective**,** although this depends on the design of the scheme and the use of vehicle emissions as an access / tolling criteria. They are given a weighting of 10% each.

A RAG rating is assigned to each country based the relative score. A result from 0-40% obtains a RAG score of Weak; a result from 41% to 70% obtains a RAG score of Medium; a result between 71% and 100% obtains a RAG score of Strong.

Country	LEZ	ZEZ	Urban road toll	…	Normalised score	RAG rating
Germany	61	0	0		40%	Medium
Poland	1	0	0		20%	Weak
Spain	52	0	0		63%	Medium
Netherlands	14	29	0		100%	Strong
Sweden	8	1	2		54%	Medium

Transparency of grid capacity

Description

- This KPI considers the **transparency of grid capacity information** published by system operators or national authorities, the **national ambition and investment commitments** for grid development, and the countries position in GLOBESEC's grid transition index.
- Publishing of a capacity map allows greater visibility of grid constraints and facilitates planning of mobility charging infrastructure installation, with higher national coverage of load constraints providing greater transparency.
- Commitments to invest in grid networks in revised National Recovery and Resilience Plan (NRRPs) indicates concrete commitments to delivering grid improvements, ensuring grid networks support future adoption of electric vehicle. The grid transition index report captures several relevant factors such as load forecast accuracy, peak load and capacity of demand response.

Key sources

- Capacity maps:
  - NL: https://capaciteitskaart.netbeheernederland.nl/
  - EU: https://eudsoentity.eu/publications/download/112
  - EU: https://alternative-fuels-observatory.ec.europa.eu/system/files/documents/2024-05/sustainable%20transport%20forum-MI0423761ENN.pdf
- GLOBSEC Grid Transition Index: https://www.globsec.org/sites/default/files/2024-10/GLOBSEC%20Grid%20Transition%20Index.pdf
- European Commission publications of the revised NRRP report summaries with revision to include REPowerEU, e.g. Germany's National Recovery and Resilience Plan (europa.eu)

Methodology

This KPI is composed of three weighted elements:

- National sources will be reviewed to collate **grid capacity maps** and determine the coverage of load/feed-in connections. National coverage of load capacity map will receive full scoring (40%), whereas partial coverage will receive 20%.
- **Ranking in grid transition index** will be normalised to a 40% maximum score
- Commitment to grid investment will be assessed by reviewing the **inclusion of funding in the revised NRRPs** (including the REPowerEU plan). Emphasis on grid with reference to mobility receives full scoring of 20%, while mention of grid with no reference to mobility challenges receives 10%.

Country	Capacity map	Normalised Grid transition index	Included grid investment in NRRP	Overall scoring	Action level
Germany	20%	0%	13%	33%	Weak
Netherlands	40%	20%	2%	62%	Medium
Poland	0%	10%	7%	17%	Weak
Sweden	0%	0%	33%	33%	Weak
Spain	0%	10%	40%	50%	Medium

Sources used throughout the report I

Introduction and objectives

- OECD Data Explorer - Annual transport trends
- Greenhouse gas emissions from transport in Europe | European Environment Agency's home page
- Addressing the heavy-duty climate problem | Transport & Environment
- New commercial vehicle registrations: vans +14.6%, trucks +16.3%, buses +19.4% in 2023 - ACEA - European Automobile Manufacturers' Association
- AI-Driven Financial Analytics Blog
- EXCLUSIVE | Hydrogen vehicle registrations are flatlining across most of Europe — with hundreds more filling stations on the way | Hydrogen Insight
- Ackowledgement to ICCT and RAP for their advising role

KPI analysis: Deployment of public charging infrastructure suitable for trucks

- | TRAVIS Road Services
- Public charging for trucks | Scania Group
- Network - Milence
- Ladeinfrastruktur für Nutzfahrzeuge | Nationale Leitstelle Ladeinfrastruktur
- https://www.agendalaadinfrastructuur.nl/monitoring+2021/dashboards/laadkaart+zwaar+vervoer/default.aspx
- https://bluekenstruckenbus.nl/elektrisch/truck-oplaadpunten-in-nederland
- https://es.chargemap.com
- Map created by user: https://www.google.com/maps/d/u/0/viewer?mid=1zReb703wQsGcRTTeI4jvXRuemYvVM3o&ll=53.947812887133544%2C11.304458202049656&z=7
- Data provided by EcoMovement. https://www.eco-movement.com/

KPI analysis: Progress on ZET trials and pilots

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