

Theory and Practice of Sustainable Logistics and Supply Chain Management



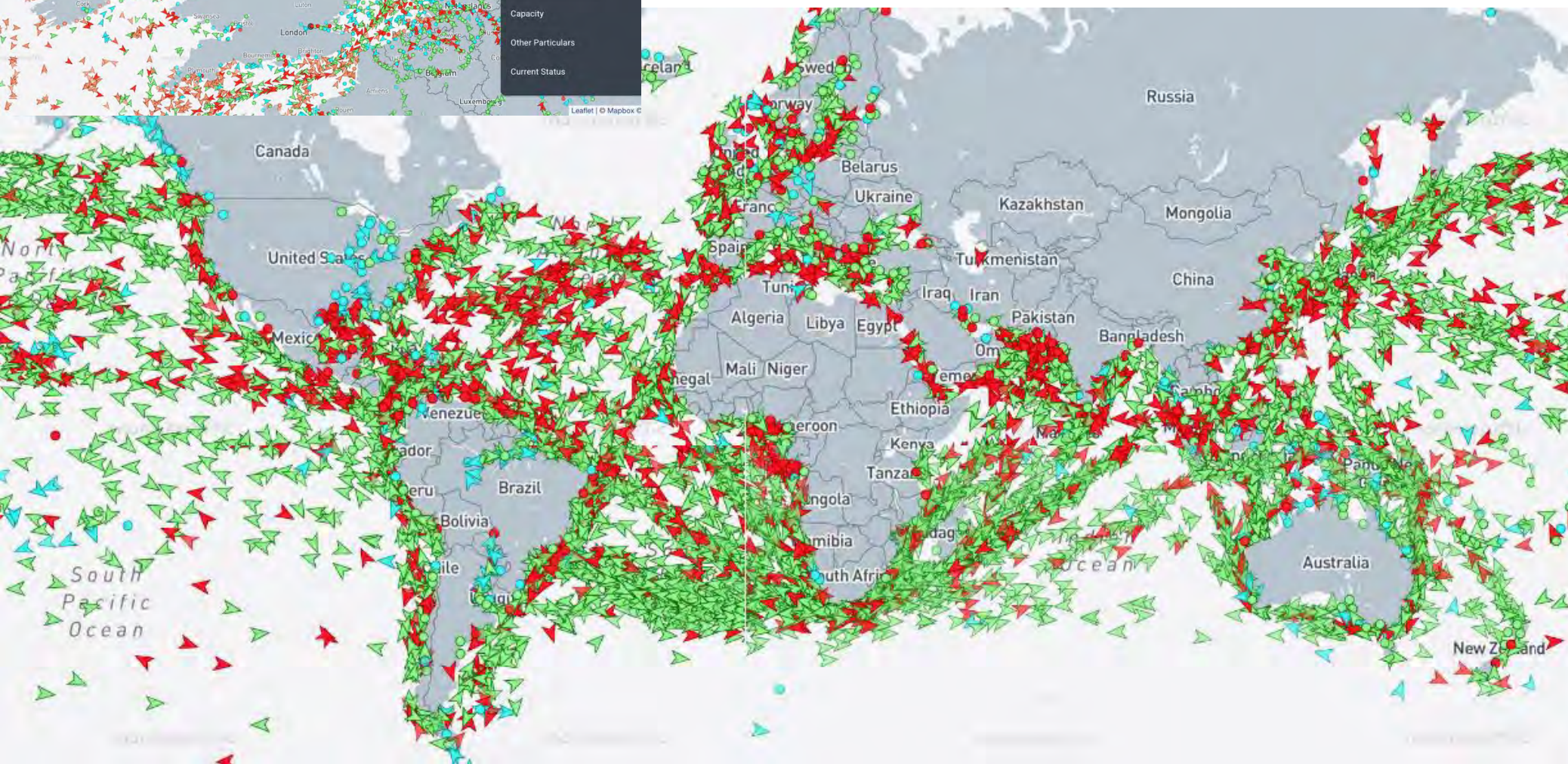
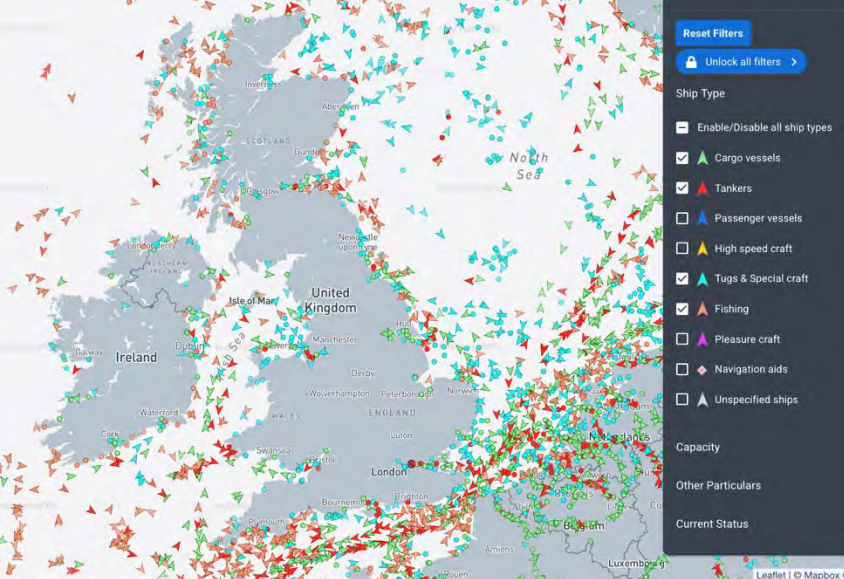
Prof Dr Jacques Leonardi

Inaugural Professorial Lecture

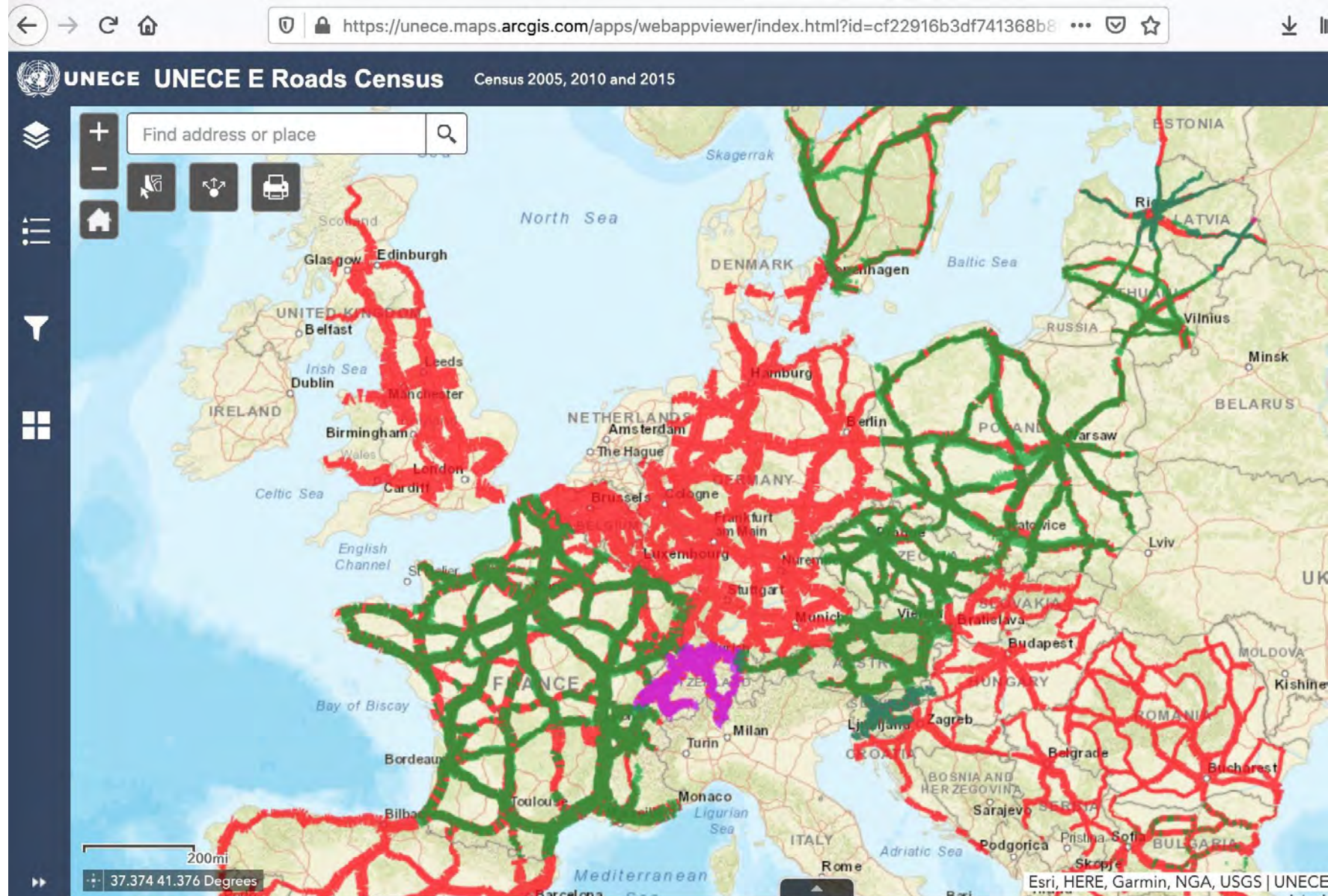
London, 23 March 2026

Global maritime routes: “real” live data 10 March 2026

Source: [Marinetraffic, 2026](#)



Road traffic mapping in Europe



Annual Average Daily Traffic (AADT) figures in the map represent the total number of motorized vehicles passing through each particular segment of E-Road in a given year, divided by the number of days in the year, for the years 2005, 2010 and 2015, to measure of traffic, and potentially congestion (UNECE, 2020)

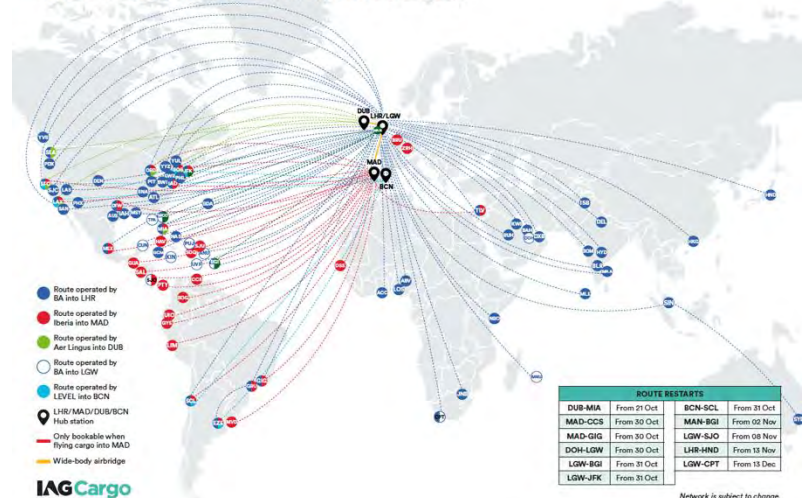
<https://unece.org/traffic-census-map>





Source:
[IAG Cargo](#)
 2023

WIDE-BODY NETWORK WINTER 2022





Trimodal Container Terminal Basel

Gateway Basel Nord, Rhenus AG



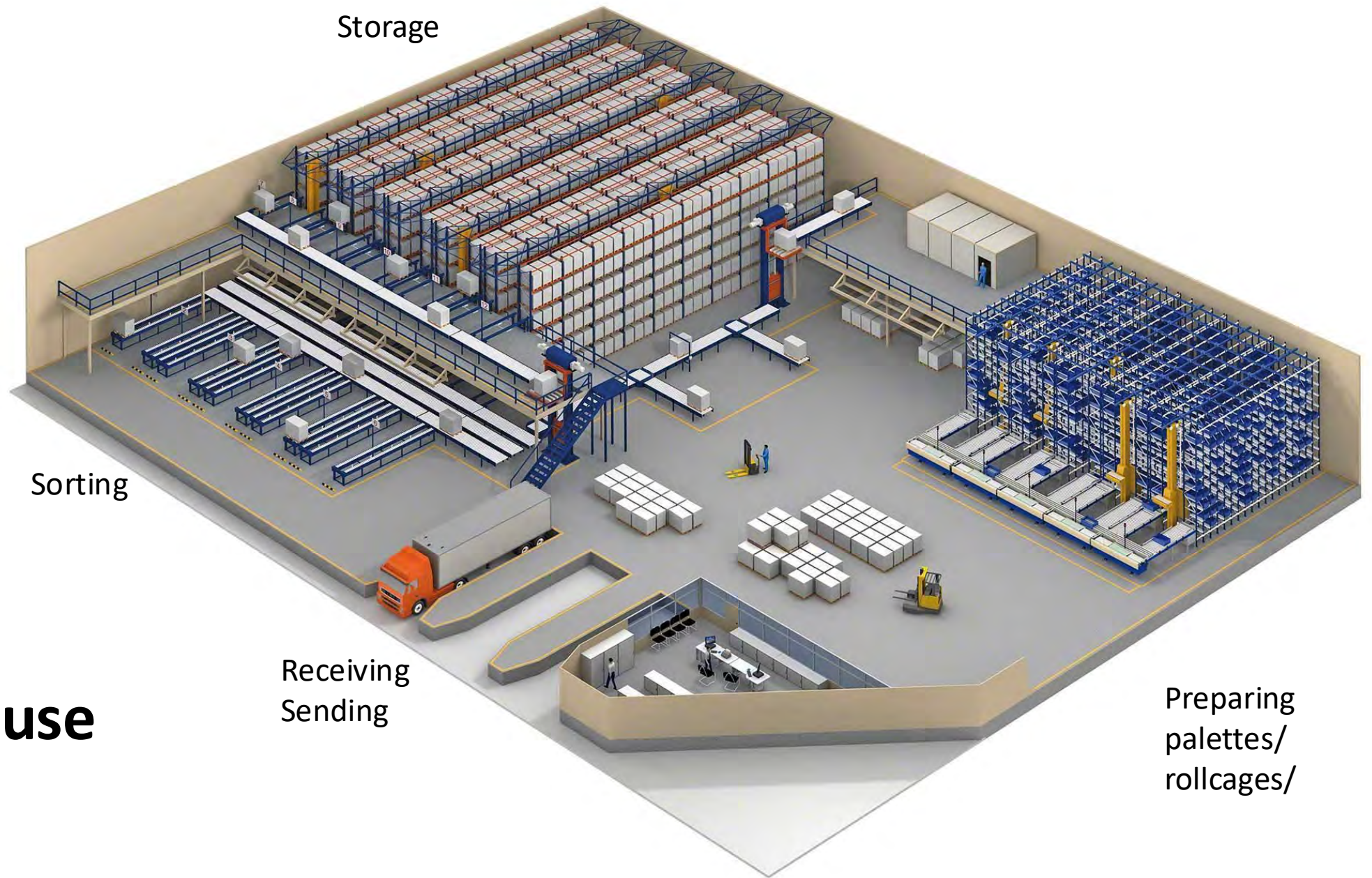
Source: Rhenus Logistics <https://www.heavyliftnews.com/gateway-basel-nord-and-swiss-rhine-ports-plan-road-to-rail-modal-shift-project>

Warehousing, storage, handling, inbound, outbound



Source: [Rhenus Group](#), 2023

Example of warehouse design



Source: <https://www.mecalux.fr/blog/gestion-entrepot-logistique-reussie>

UK charging station network for electric Heavy Goods Vehicles



Source: GRIDSERVE, 2026: Electric Freightway. <https://www.gridserve.com/electric-freightway/>

Sam Clarke, Gridserve



Traffic management: New design of a “CYCLOPS” junction in Manchester August 2020

CYCLOPS = CYCLE Optimised
Protected Signals



*Source: Sarah Wray **UK's first 'CYCLOPS' junction opens in Manchester to boost bike safety***

<https://cities-today.com/uks-first-cyclops-junction-opens-in-manchester-to-boost-bike-safety/>

Causality analysis, problem/issue analysis

Negative externalities = unsustainable effects

- Environmental
 - CO₂ emissions from combustion engines
 - Exhaust emissions of air pollutants NO_x, SO_x, PM₁₀ etc.
 - Noise
- Social
 - Congestion and road space occupancy
 - Accidents involving trucks and vans
 - Acceptance, health etc. (driver life expectancy)
- Economic
 - Congestion and time loss (value of time)
 - Risk of bankruptcy
 - Economic monetisation of env. and social effects via taxes



Limits of the system of observations in logistics and supply chain management: main definition problem

+ infrastructure + vehicle construction + employees
= **transport & logistics sector management**

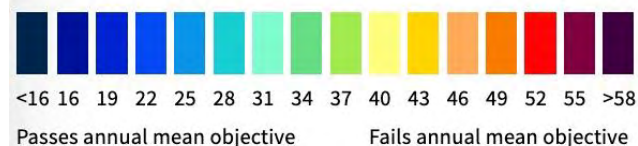
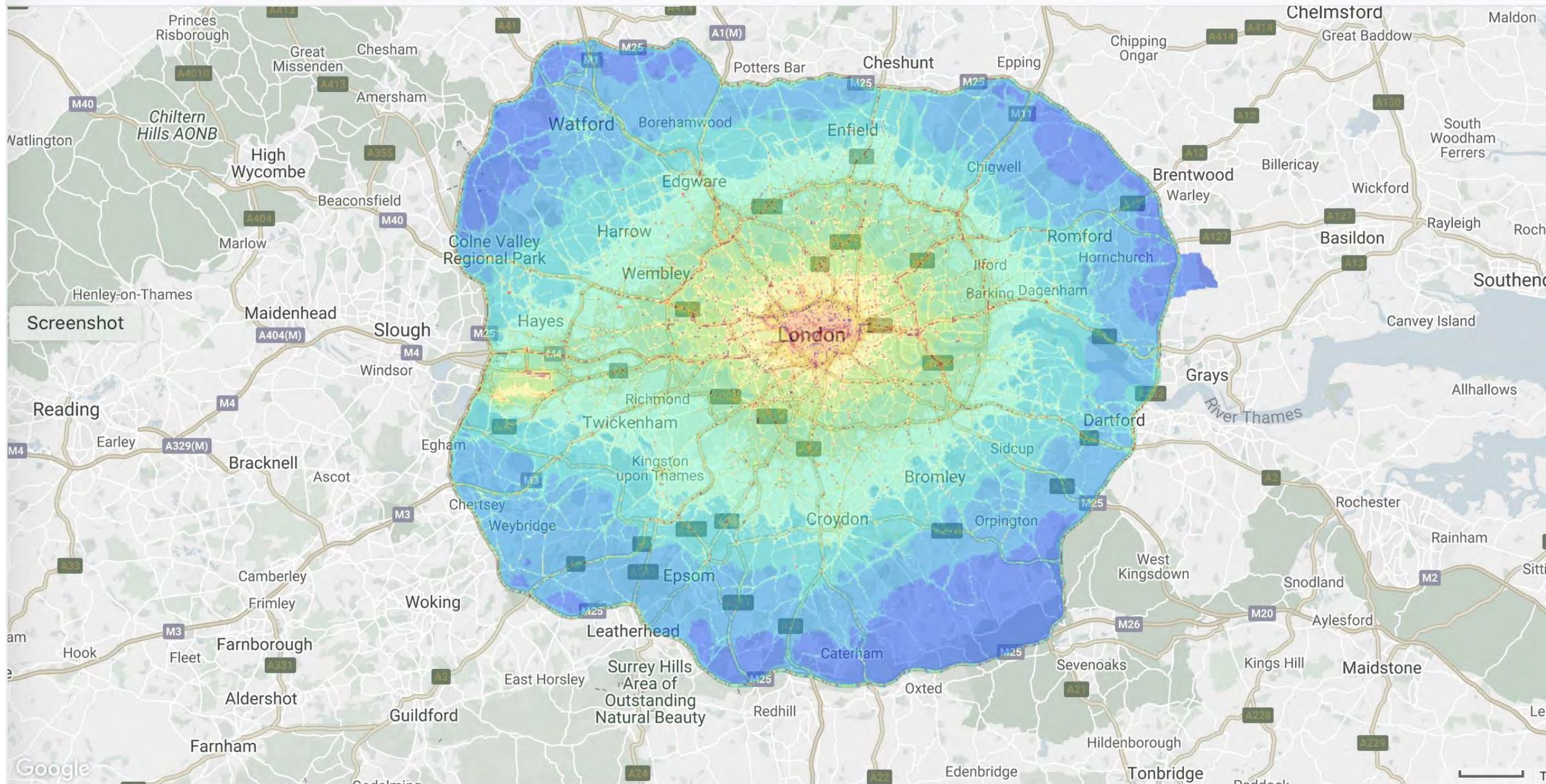
+ upstream and downstream suppliers' and customers' chains
= **logistics & supply chain management**

+ warehouse & logistics services = **logistics**

+ vehicle maintenance and repair =
freight and fleet management

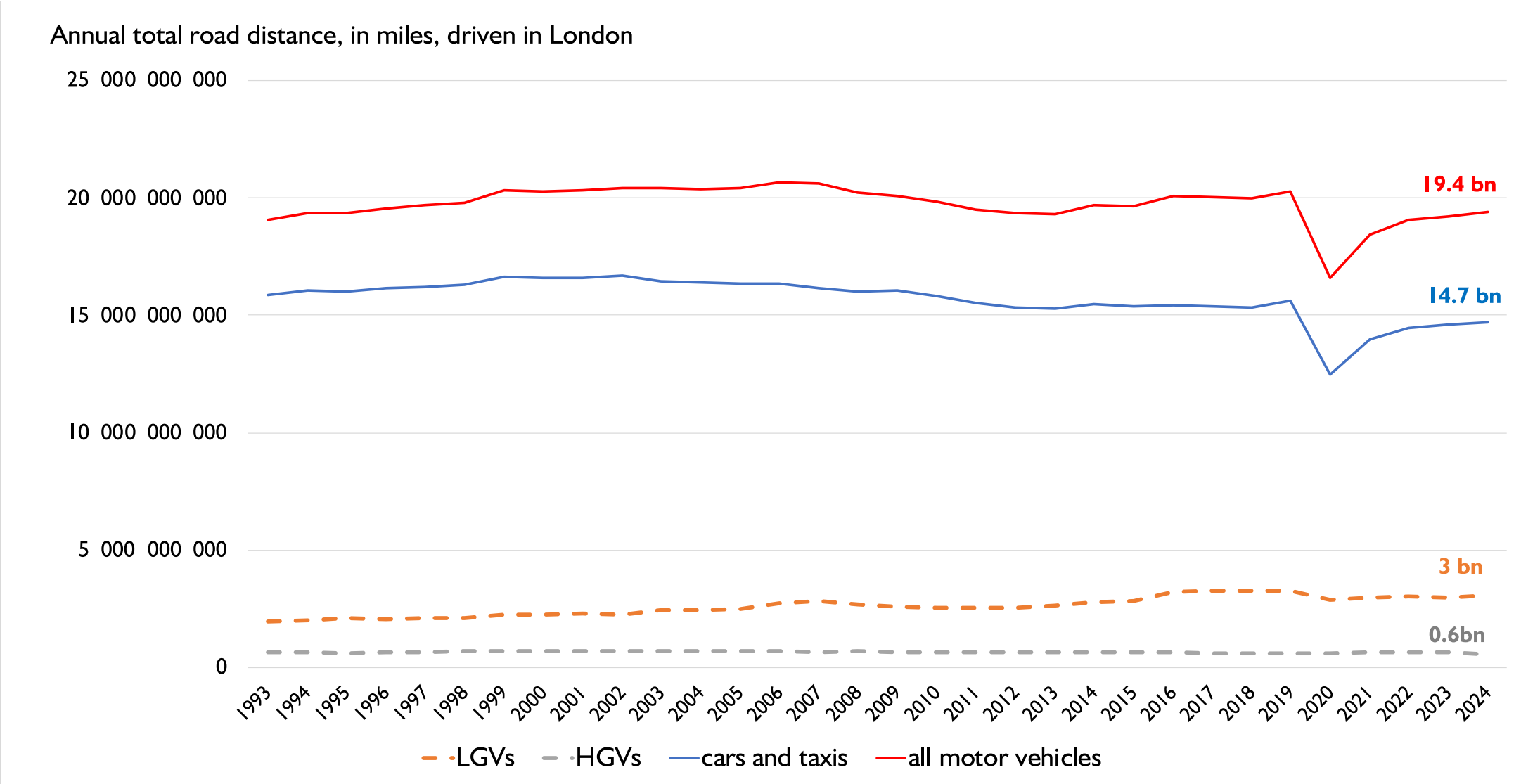
+ fuel supply = **freight energy**

Vehicle + load = **freight transport**



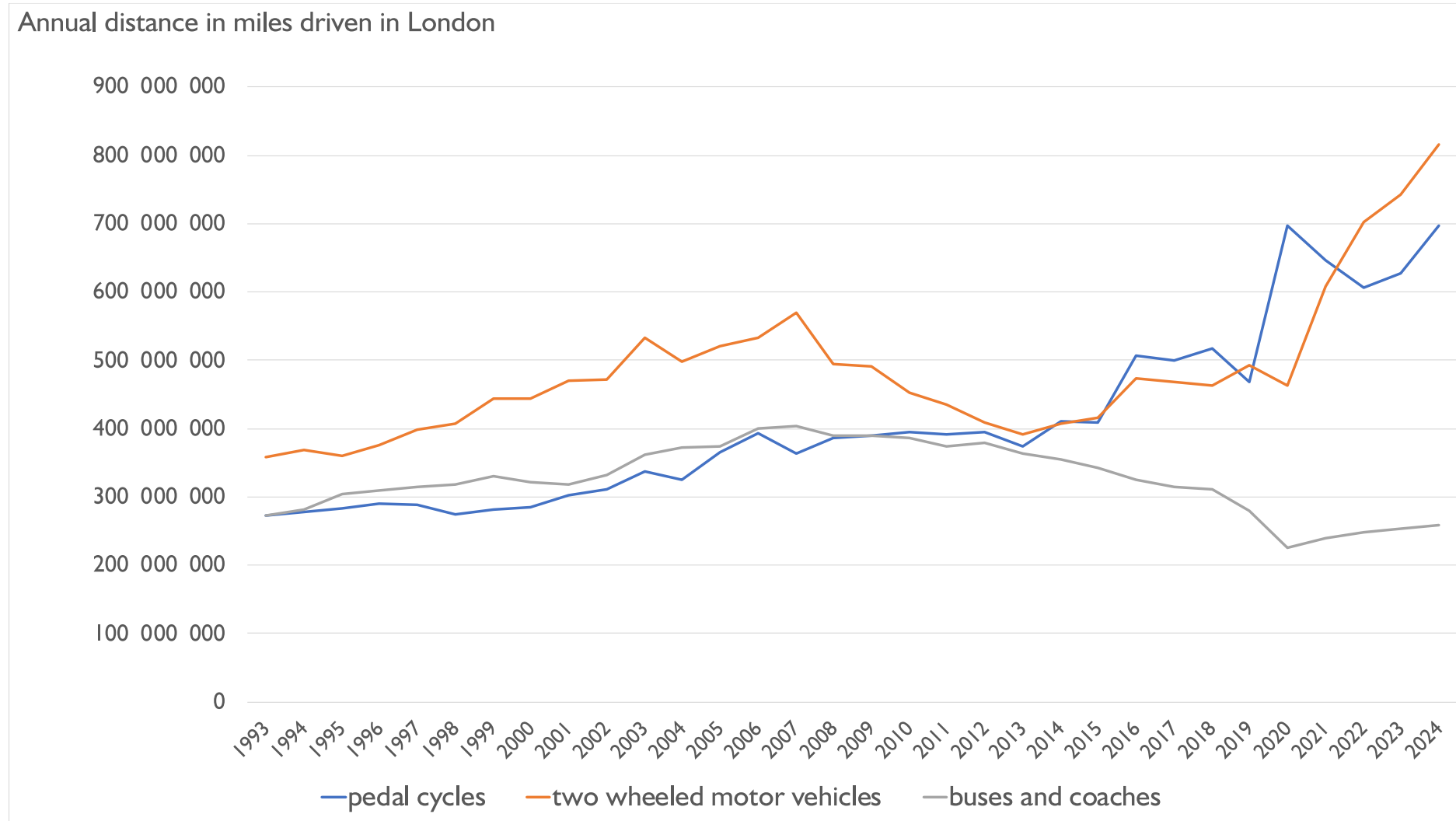
Annual average NO₂ emissions in London 2016
in microgrammes per cubic metre (ug/m³), Source: <http://www.londonair.org.uk/>

Road traffic count data in London 1993-2024



Source: <https://roadtraffic.dft.gov.uk/>

Road traffic count data in London 1993-2024

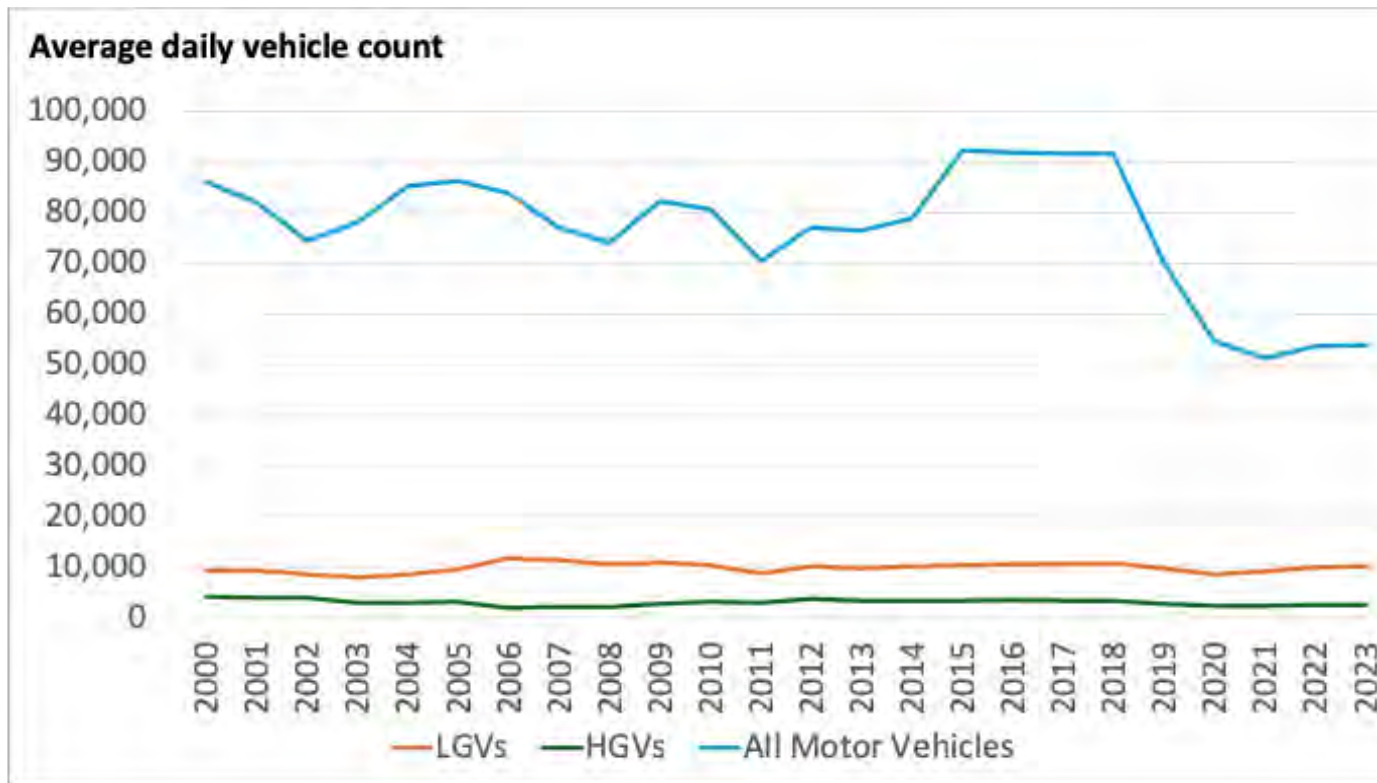


Note: Data include passenger movements. Source: <https://roadtraffic.dft.gov.uk/>

Traffic count data

Manual count points

In front of Marylebone Campus, UoW



GOV.UK

[Road traffic statistics](#) [Map](#) [Local authorities](#) [Regions](#) [Data](#) [About](#) [FAQs](#)

[Count points](#) > 27236

27236

Details

AADF latest year	2024
Region	London
Local authority	Westminster
Road name	A501
Road type	Major
Start junction road	Baker St
End junction road	Park Crescent (mid-junction)
Link length	0.80km (0.50 miles)
Easting & Northing	528000,182004
Latitude & longitude	51.52246,-0.1564

Location

[Streetview](#) [Map](#)

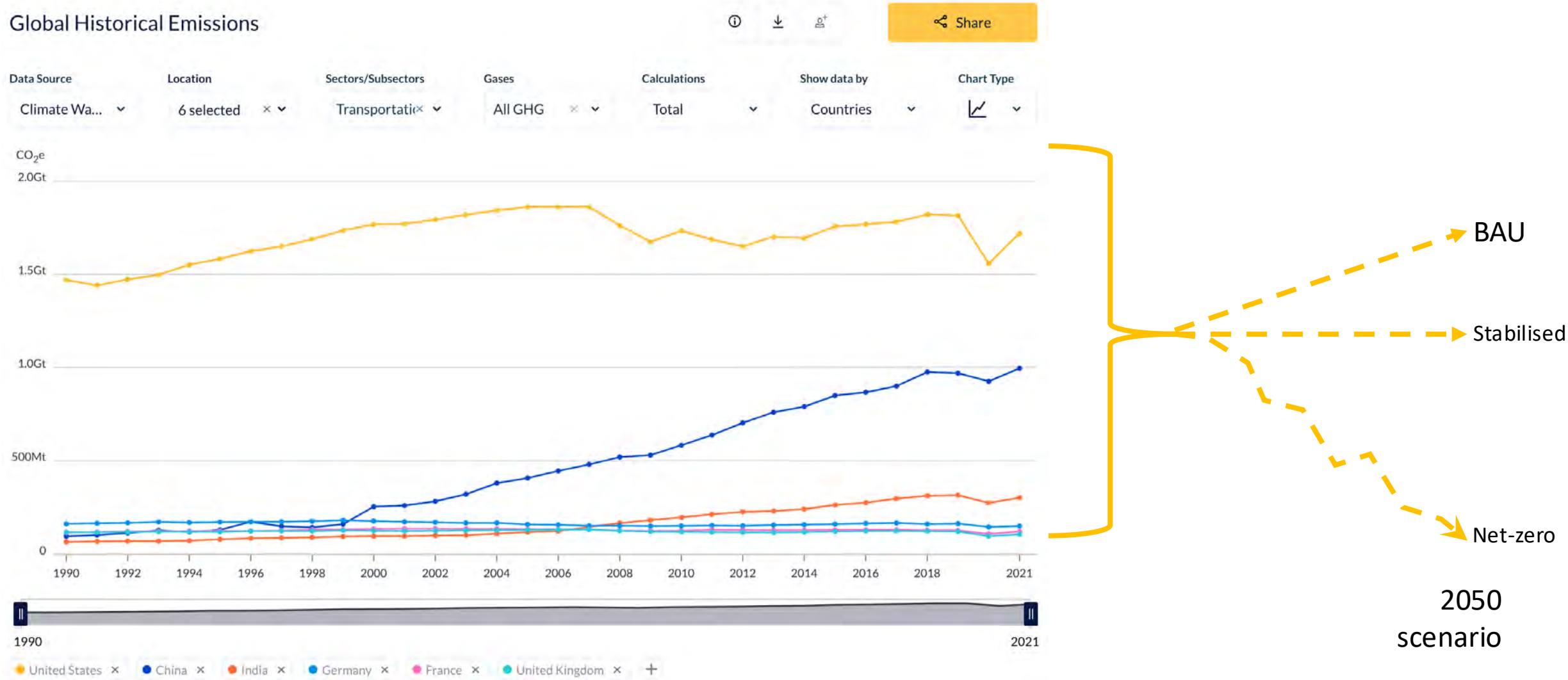
35 A501
London, England
[View on Google Maps](#)

Google Keyboard shortcuts © 2026 Google Terms Report a problem

Source: <https://roadtraffic.dft.gov.uk/manualcountpoints/57537>

Trend Analysis of Emissions in Transportation: Where are we (going)?

Greenhouse gas (GHG) emissions from transportation in 6 selected countries, 1990-2021



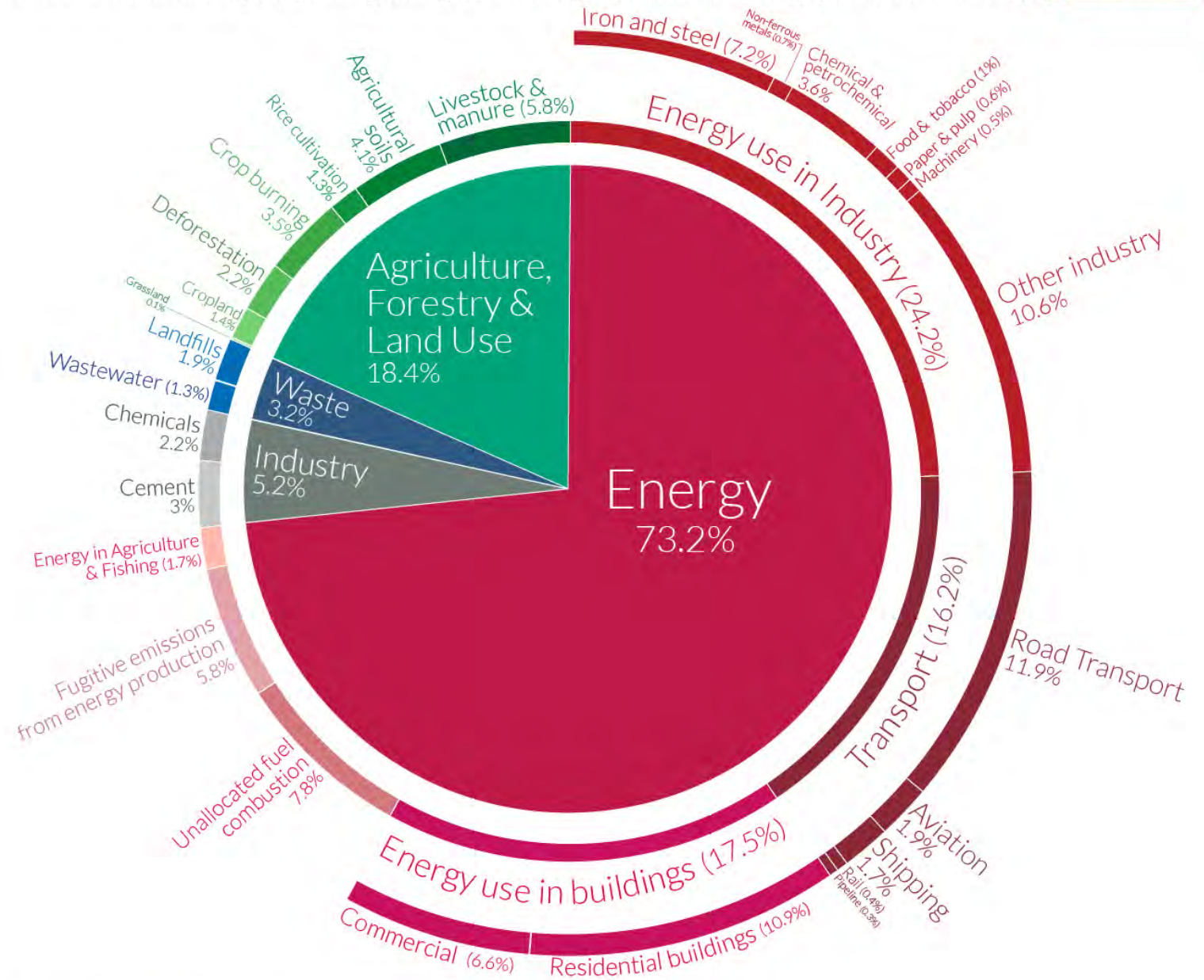
Source: Climatewatch, 2026. [Climatewatch Data](#)

Global greenhouse gas emissions by sector

Our World
in Data

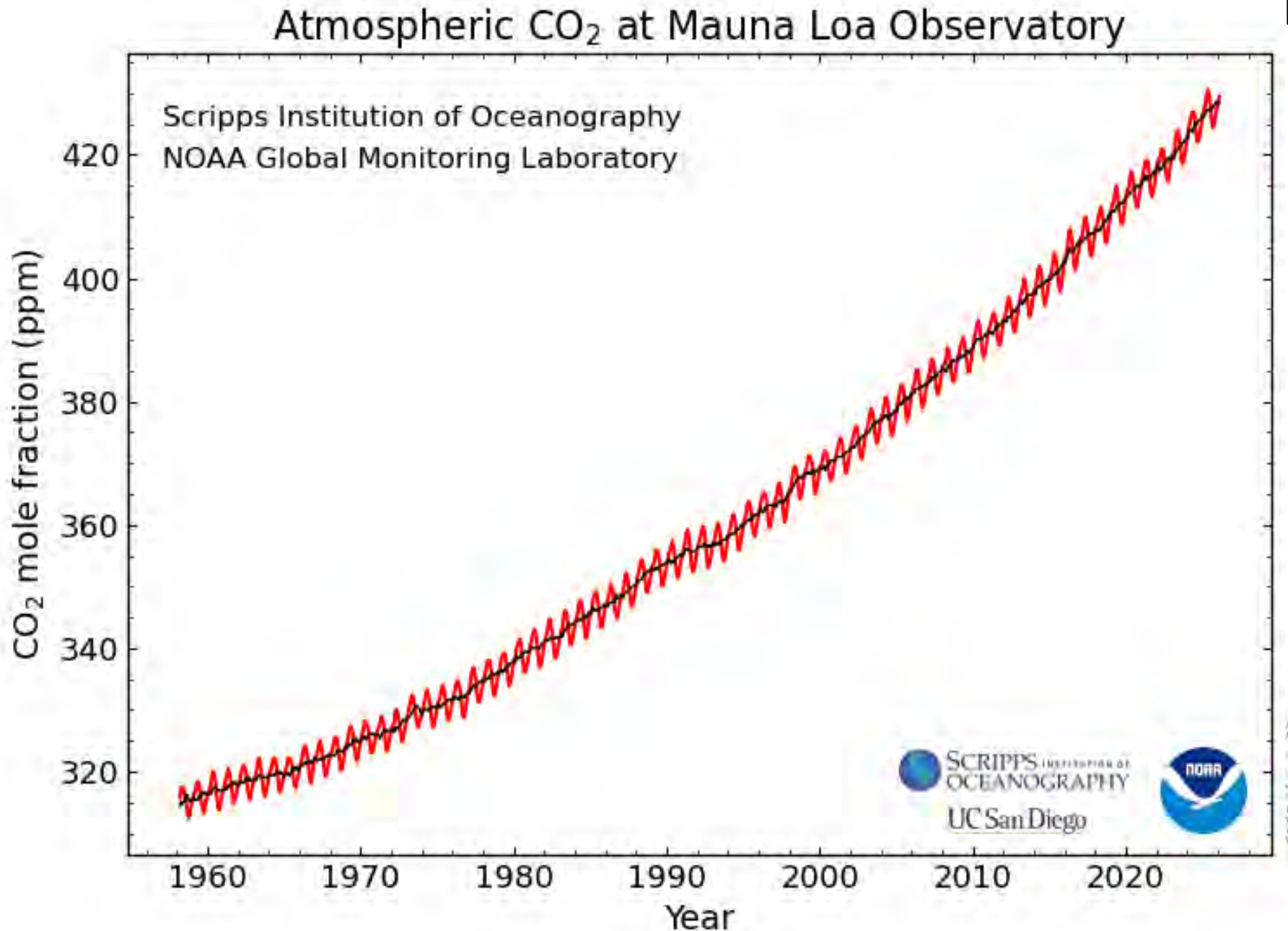
This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.

Carbon emissions come from many sectors: we need many solutions to decarbonize the economy



Source: Hannah Ritchie (2020) - "Sector by sector: where do global greenhouse gas emissions come from?". Published online at [OurWorldInData.org](https://ourworldindata.org/ghg-emissions-by-sector).
<https://ourworldindata.org/ghg-emissions-by-sector>

The Keeling Curve



Unit

Monthly Average CO₂
concentration at Mauna
Loa, Hawaii, USA, updated 5
March 2026: 429.35 ppm
(parts per million)

Source: Global Monitoring Laboratory
(2026). Trends in Atmospheric Carbon
Dioxide

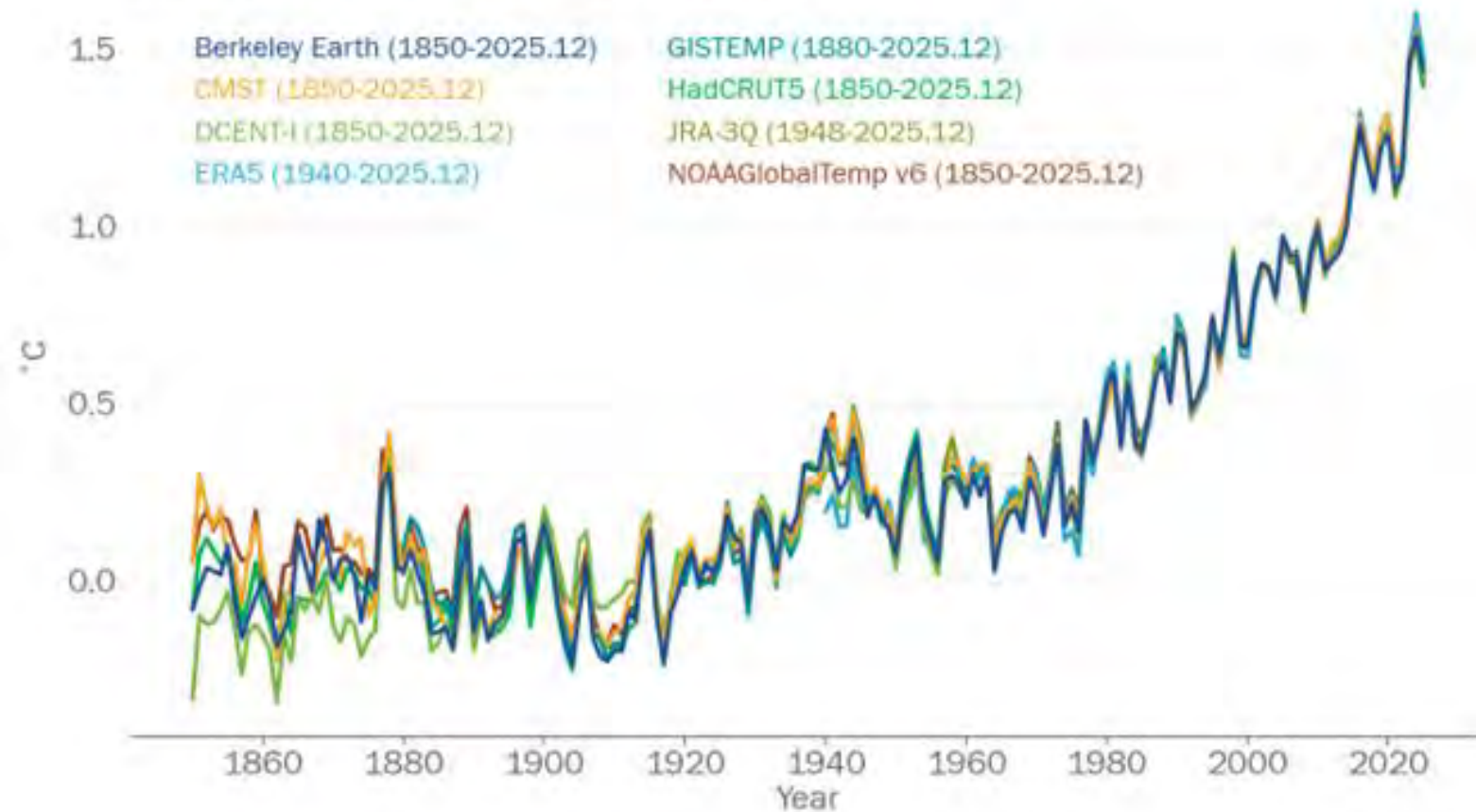
<https://gml.noaa.gov/ccgg/trends/>

Initial Sources:

Keeling, C.D. (1960). *The concentration and isotopic abundances of carbon dioxide in the atmosphere*. Tellus, **12(2)**, 200–203.

Arrhenius, S., 1896. *On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground*. Philosophical Magazine and Journal of Science, Series 5, Volume 41, April 1896, pages 237-276.

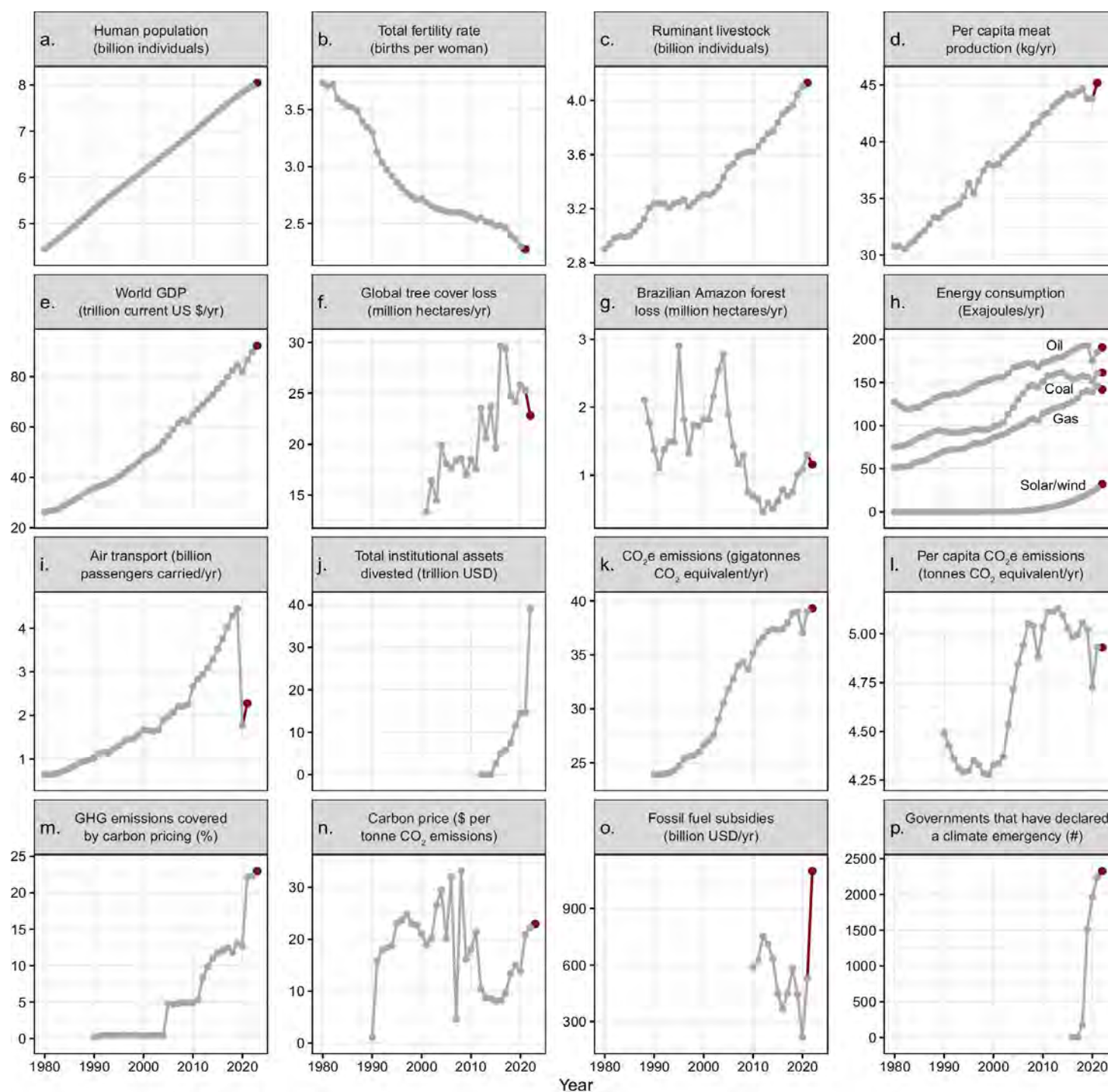
Global Mean Temperature Difference (°C) Difference from 1850-1900 average



**World
Meteorological
Organisation
(WMO) earth
temperature data
record 1850-2025**

Source: WMO, 2026

<https://wmo.int/news/media-centre/wmo-confirms-2025-was-one-of-warmest-years-record>



Recent trends in planetary vital signs 1980 to 2023

Source:

William J Ripple, Christopher Wolf, Jillian W Gregg, Johan Rockström, Thomas M Newsome, Beverly E Law, Luiz Marques, Timothy M Lenton, Chi Xu, Saleemul Huq, Leon Simons, Sir David Anthony King, *The 2023 state of the climate report: Entering uncharted territory*, *BioScience*, 2023, <https://doi.org/10.1093/biosci/biad080>

Global Poverty at a Glance

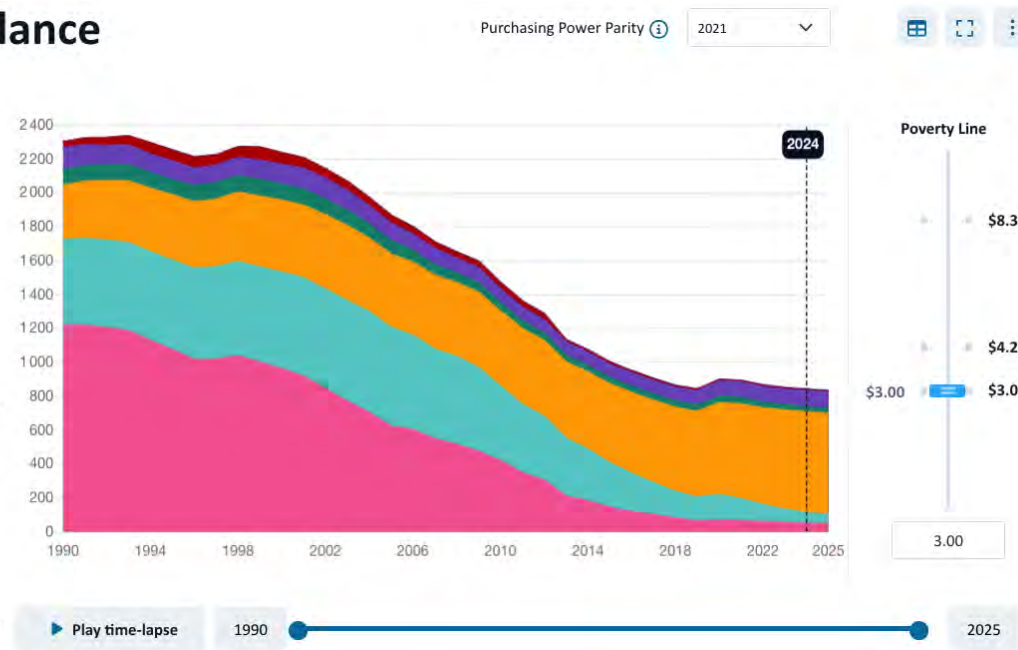
DID YOU KNOW

831
MILLION

people live below the **\$3.00** per day poverty line in **2025**

(2021 purchasing power parities)

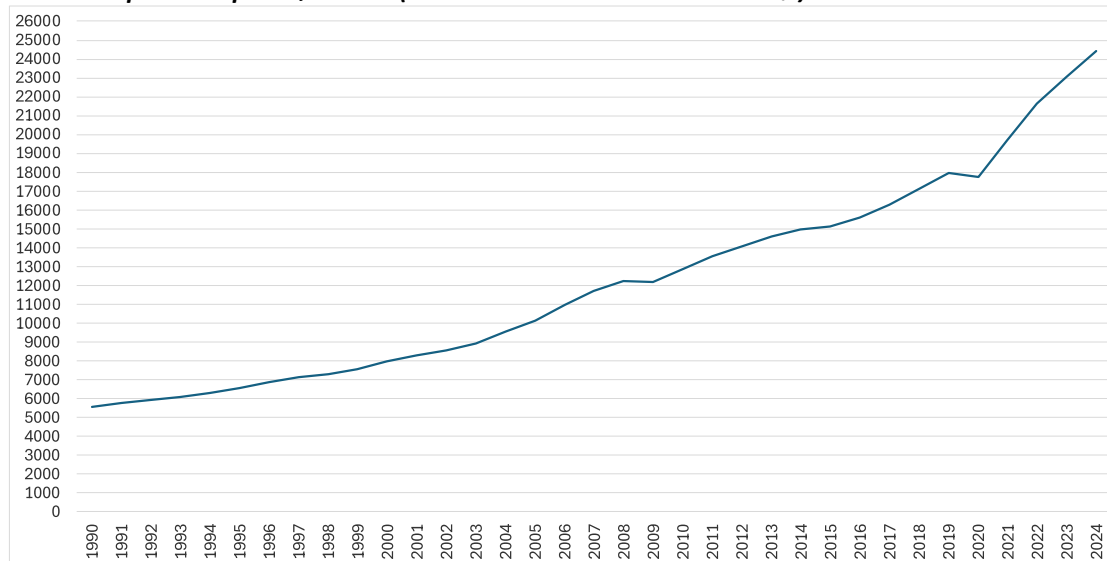
Source: World Bank (2026), Poverty and Inequality Platform (version 20250930_2021_01_02_PROD) [data set].
pip.worldbank.org. Accessed on 2026-03-21
Note: Estimates after 2024 are nowcasts. For more details visit the [Nowcasts page](#).



**Last 35 years:
Poverty decline
Real income growth**

Source: The Worldbank 2026
<https://pip.worldbank.org/>

GDP per capita, PPP (current international \$)



**24,525 US\$
in 2024**

**GDP purchasing power parity per
capita, the Worldbank indicator
of global income**

GDP = Gross Domestic Product
ppp – index of product prices, see [calculation method](#)

Source: Worldbank 2026 <https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>

What means SUSTAINABLE supply chains and logistics?

Objectives, no proof that this would be enough to obtain a truly sustainable world:

- Zero emission transport
- Zero emission warehousing and fulfilment
- Zero emission production, manufacturing and trade
- Clean air, water and soils
- “Near-natural” ecosystems and recovered, high biodiversity
- Regenerative resources and energy sources
- Limited congestion, accidents, noise or other negative external effects of transport
- Good salaries for staff and drivers, high HDI
- Profitable businesses, no bankruptcies
- Good data, information and reporting, CSR

The “fathers” of sustainable logistics

- Prof Alan C. McKinnon, Edinburgh & Hamburg: first paper in 1994, invented it!

McKinnon A.C. & Woodburn, A. 1994. The Consolidation of Retail Deliveries: its Effect on CO₂ Emissions. Transport Policy, 1, 2, 125-136.



- Prof Eiichi Taniguchi, Kyoto: first paper on city logistics in 2001
 - *Taniguchi, E., 2001. City logistics. Infrastructure Planning Review, 18, pp.1-16.*



Sustainable Freight, Logistics & Supply Chain Science

Typology

- Facilities
- Road Transport
- Rail
- Maritime
- Aviation
- Pipelines
- Information

Approaches

- Supply Chain
- Logistics
- Business model
- Trade activity
- Solutions
- Public sector

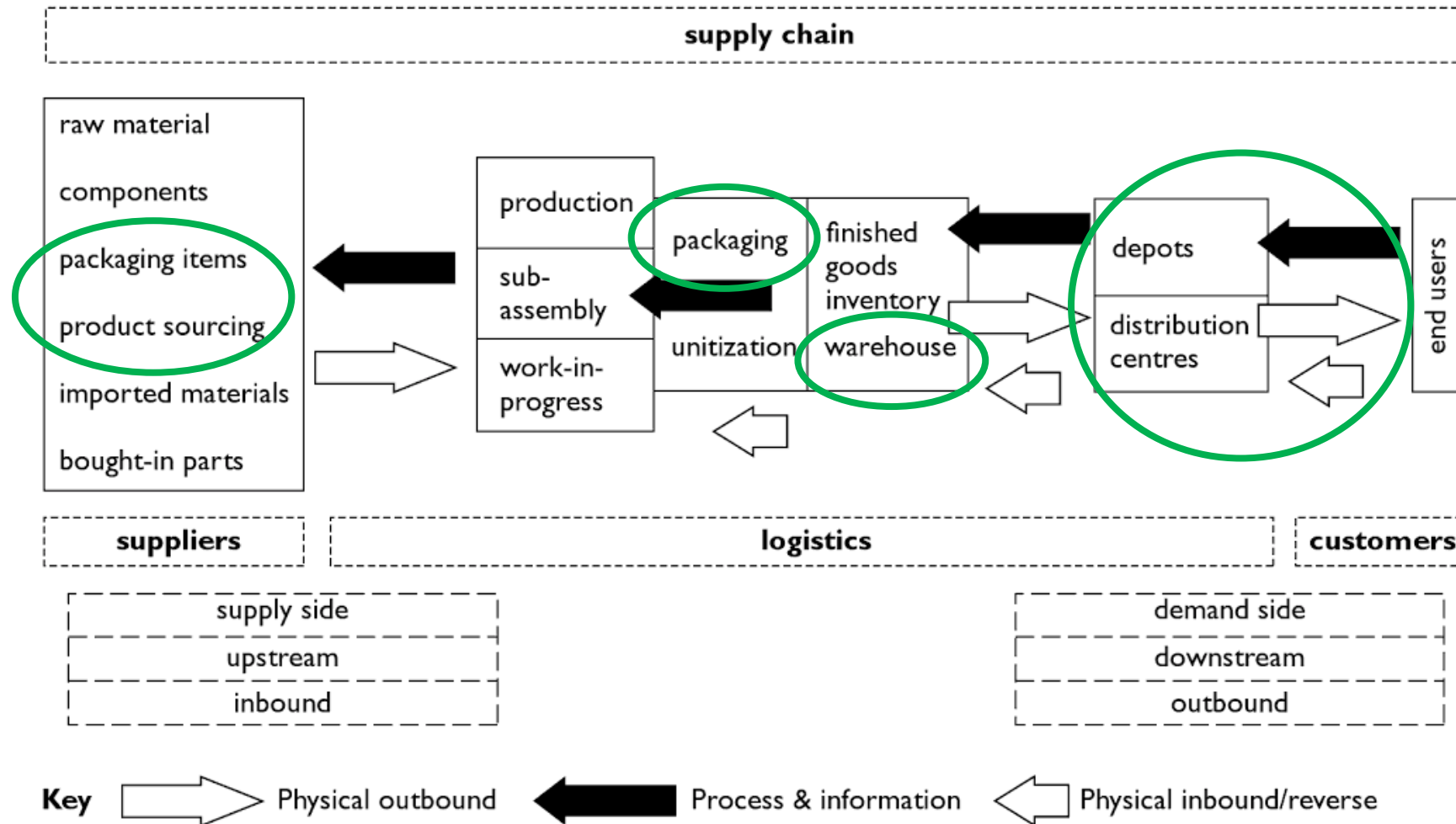
Strategic objectives

- Reduce risks
- Better efficiency
- Decarbonise & depollute
- Cooperate
- Knowledge & data

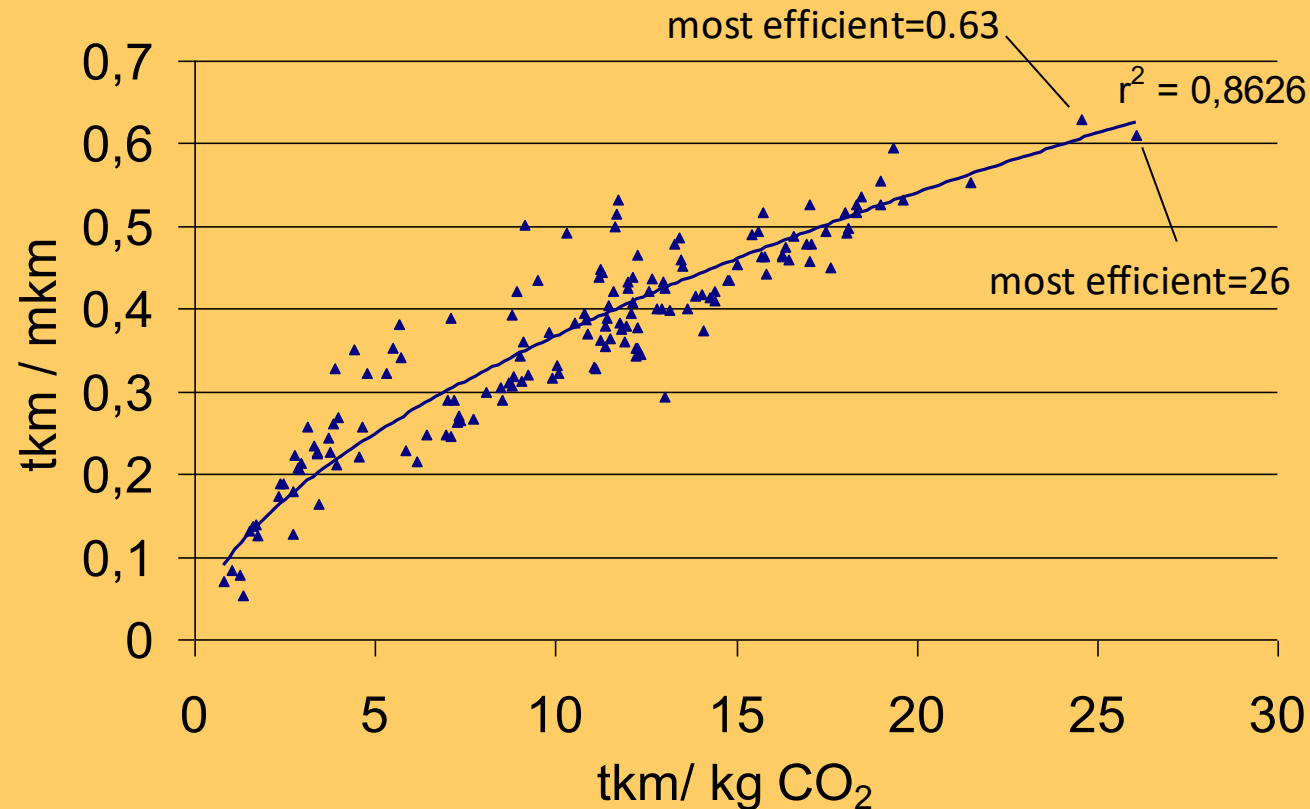
Methods

- Top-down (deductive): Strategy applied by global decision
- Inductive: prototypes, tests, applications in real conditions

Where did we develop few sustainable logistics, supply chain and transport operations?



Efficiency of vehicle use (measured in tkm/mkm) correlates with CO₂ efficiency (measured in tkm/kg CO₂)



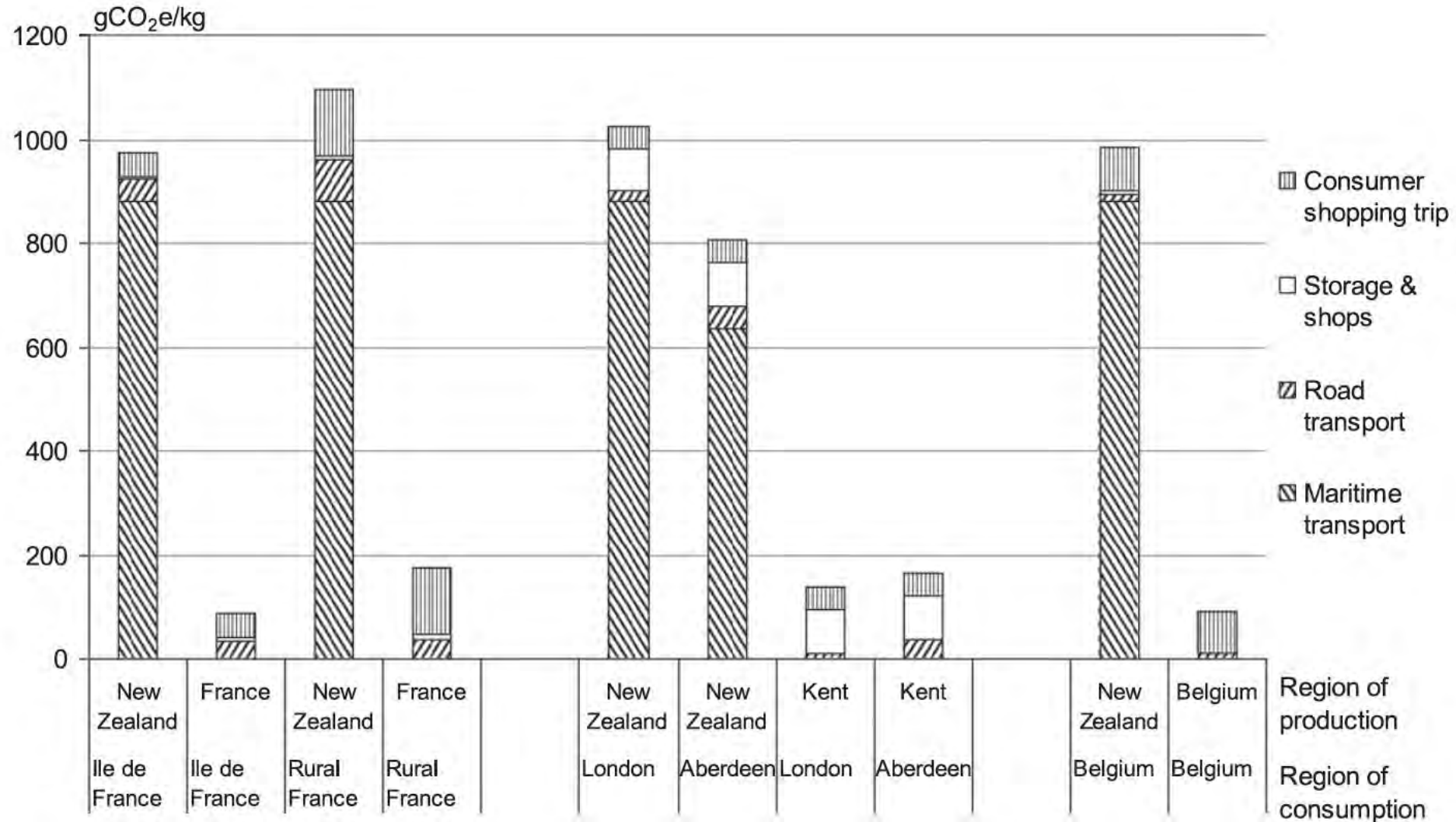
Surveys 2002-2003

53 German operators long and short distance road freight transportation responded for 152 truck trips between two tank fillings.

Primary data collected: fuel use, load weight/vol, unloading stop, leg distance, vehicle type, empty weight, load factor by weight and by volume

CO₂ efficiency can be influenced by other factors, such as driver behaviour, road gradient, vehicle category, but mostly it's the relationship between GVW, empty weight and average cargo load by weight, not volume.

Apple supply chains of supermarkets: carbon intensity of transport in gCO₂e/kg



Methods: Solution analysis, case studies, examples

1. Main methodologies in sustainable logistics theory and practice
2. Solution is a technology or a management method to improve the situation towards sustainable logistics and supply chains
3. Solution presentation and analysis:
 - Definition means explaining who is doing what, when, where and how?
 - Why is it successful, sustainable, profitable, competitive? causes & consequences
 - How to compare with other solutions? Real life business case, before/after, with/without data
4. Case study: approach to describe and to analyse company actions
 - Examples of how companies are using the solution in daily operations
 - Presentation of the company's main activities, specific applications
 - Understanding and explaining how it works, why it's a success, what are the remaining issues etc.

Interporto Padova: Consolidation and Clean Vehicles



- Cityporto transit point is located inside the freight village area of Interporto Padova
- 2 miles outside the City Centre, close to the major highways
- Urban delivery of goods with a fleet of hybrid and CNG vehicles

Key facts on CITYPORTO PADOVA

- 60,000-100,000 deliveries/year for 60 clients
- 4 parcels per delivery instead of 1.3 industry average
- 1000 m² Urban Consolidation Centre



Market Analysis: Barriers, success factors and transferability

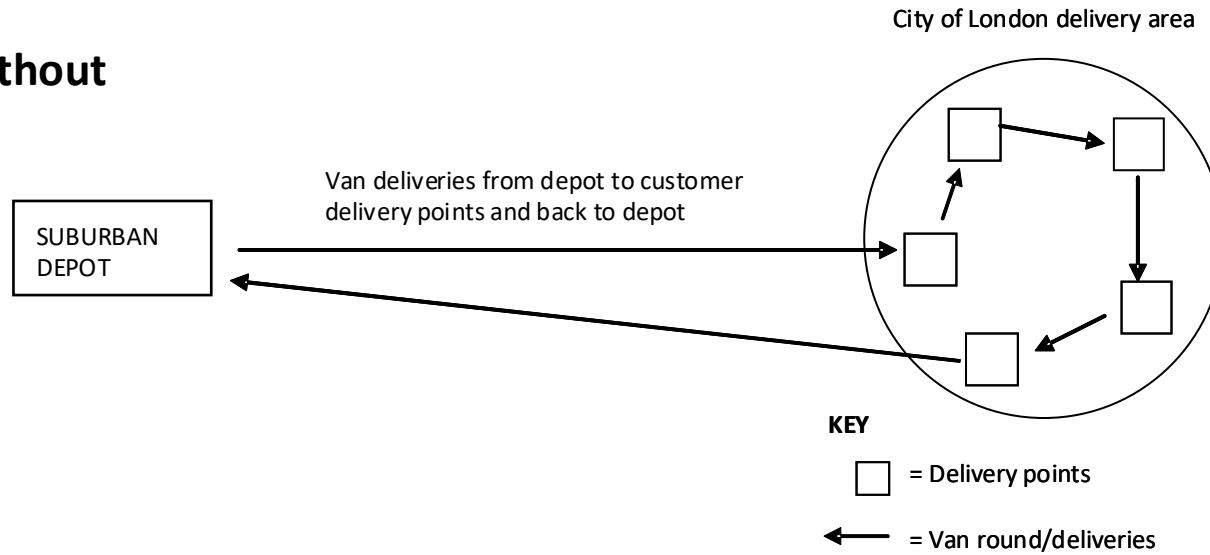
Market barriers removed:

- Key success factors:
 - a special regime for Cityporto CNG & e-vans: no time windows for loading/unloading in the Limited Traffic Zone of Padova
 - independent manager enabling trustful cooperation with new customers
 - excellent stakeholder involvement/ participation / communication at city level

Transferability:

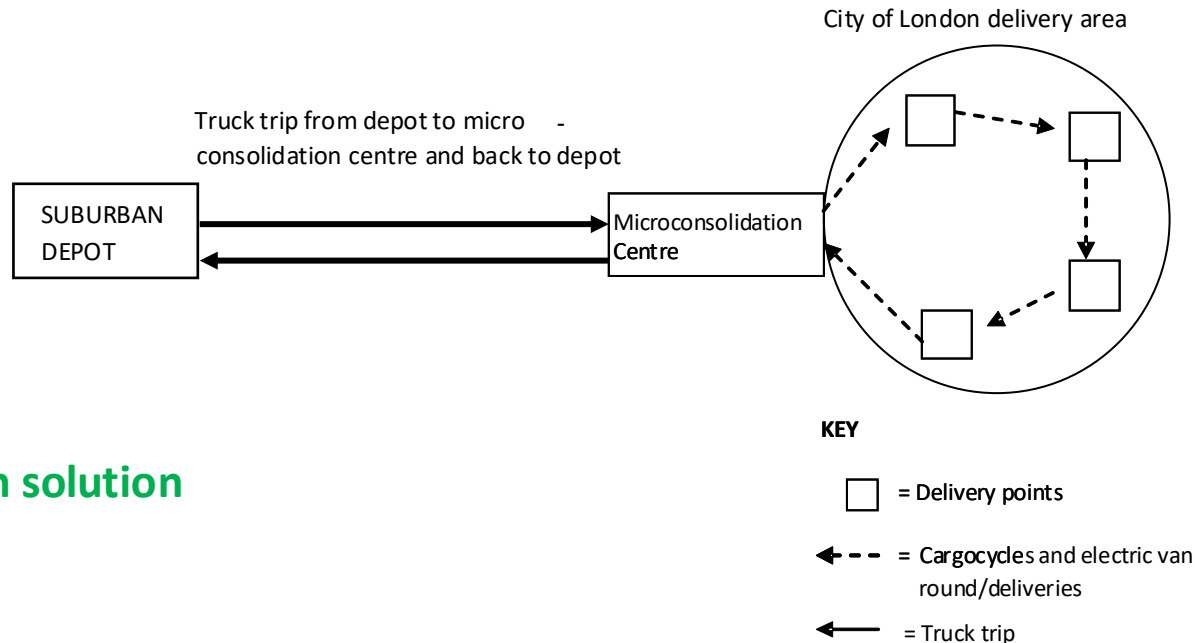
- MSc Dissertation Ludovica Mazzocchi 2024: business is still active; model was replicated in Italy and worldwide
- Gnewt Cargo in London; Best Practice projects

BEFORE / without



**City of London
Logistics system for
deliveries
by diesel vans**

AFTER / with solution



**Logistics system for
deliveries by
Cargocycles and
electric vans
via
Gnewt micro-hub**

Gnewt Cargo urban delivery operations

Morning loading of parcels B2B and B2C for deliveries in London.

London Barking depot,
Dec 2018

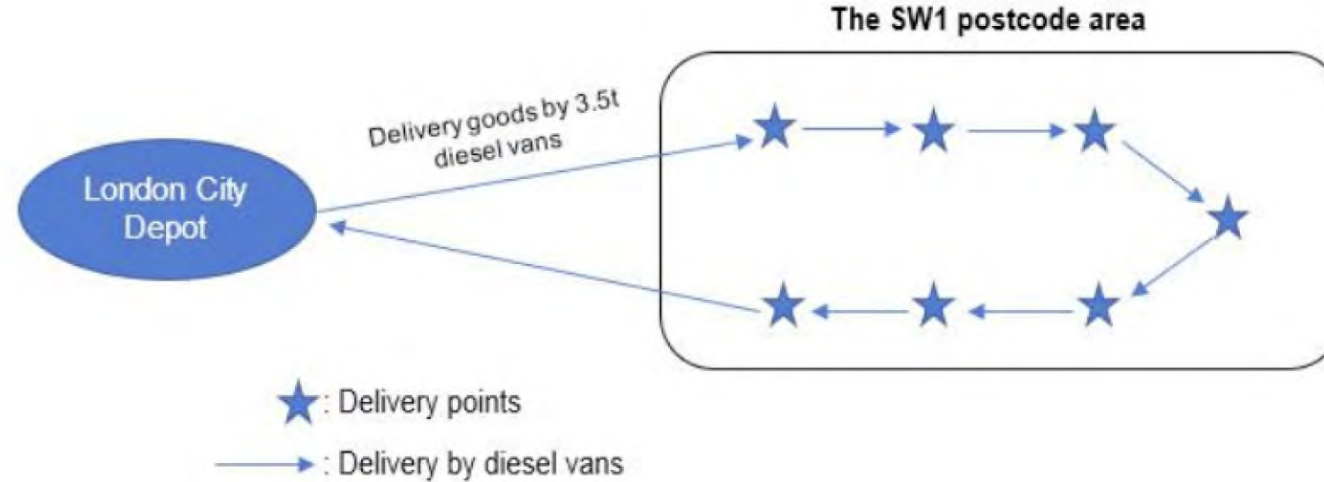
Purchased 2019 by
Menzies, which was then
purchased 2024 by InPost
(260 million parcels in UK
in 2025), planning zero
emission by 2040

(Source: [InPost 2026](#))

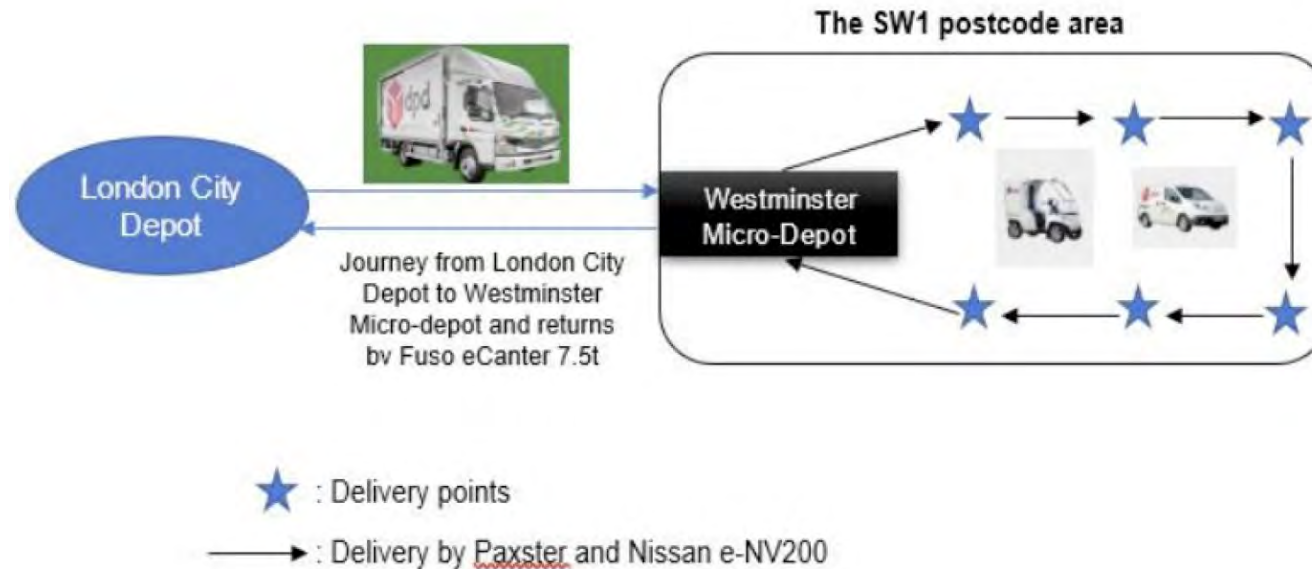


Parcel logistics distribution model of DPD in London

Before 2018



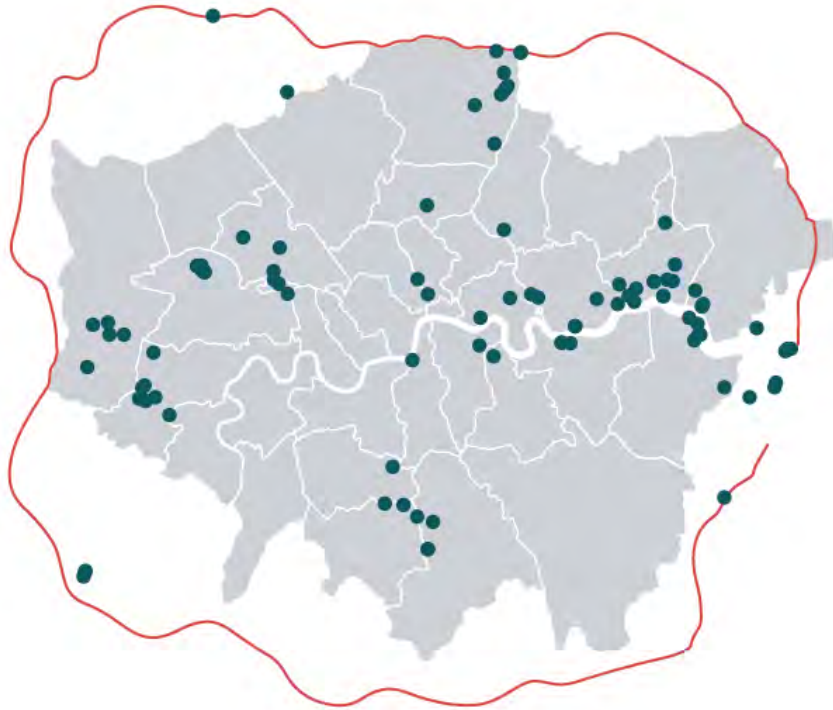
After 2018



Public Policy and Planning solutions

TfL Freight and Servicing Action Plan 2018

- Started with the first London Freight Plan in 2004, with FORS, LEZ; 2019 ULEZ

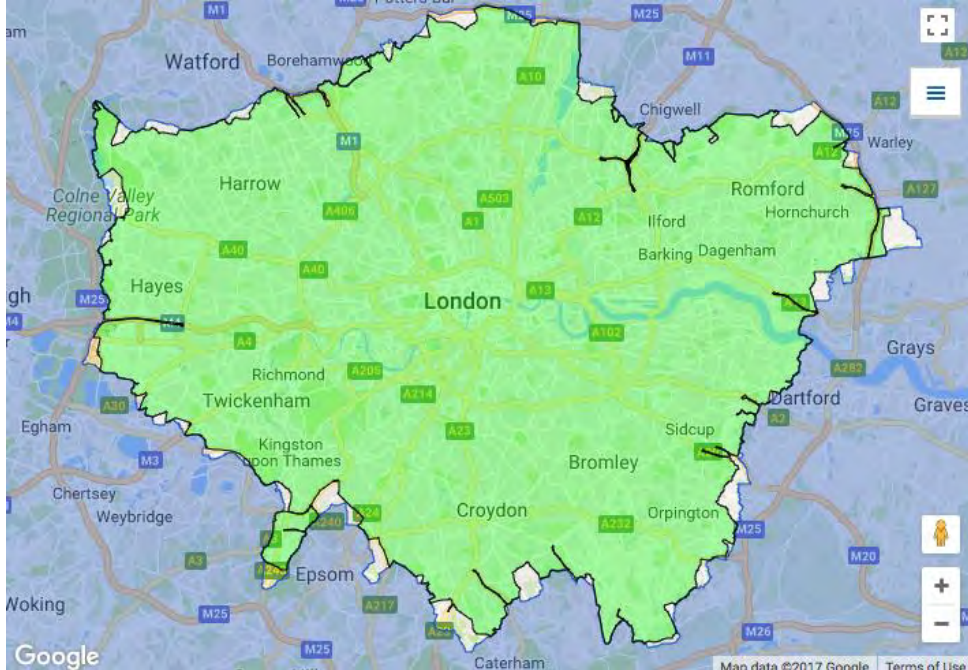


Location of logistics facilities in London 2018



- Planning, legislation, access regulation to reduce accidents, traffic and emissions
- Promote rail and barge, lockerboxes, consolidation, information exchange
- Good data about London freight

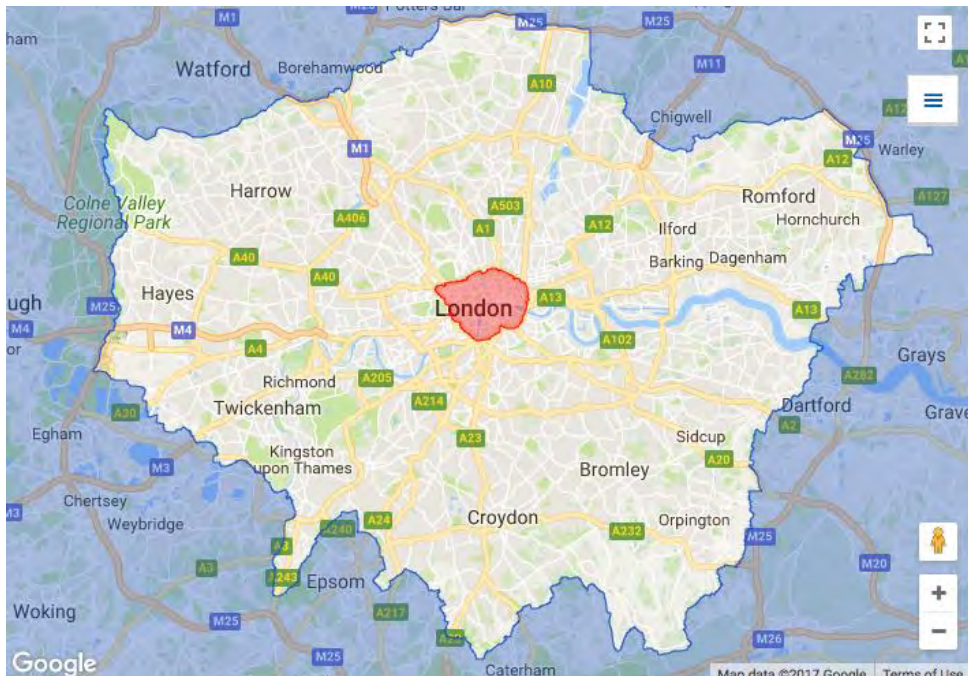
Source: TfL (2018) [Freight and Servicing Action Plan](#)



Low Emission Zone (LEZ) and Ultra Low Emission Zone (ULEZ) Regulation and specific rules 2019-2021

Heavy goods vehicles & specialist heavy vehicles

Applies to HGVs and specialist heavy vehicles over 3,500kg gross vehicle GVW, such as: lorries, motorised horse boxes, breakdown & recovery vehicles, snow ploughs, gritters, refuse collection vehicles, road sweepers, concrete mixers, fire engines, tippers and removals lorries.



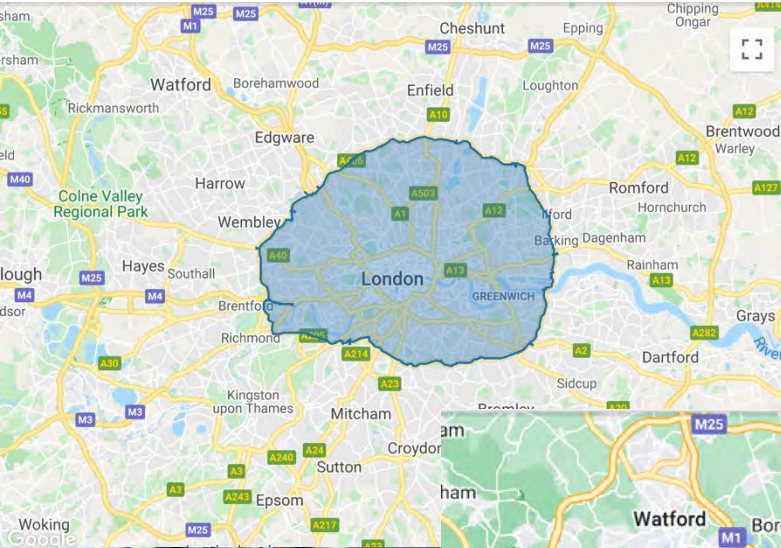
screenshot

	Congestion Charge	Ultra Low Emission Zone	Low Emission Zone
Area	Congestion Charge zone (central London)	Congestion Charge zone (central London)	Low Emission Zone (most of Greater London)
Time	Mon-Fri, 07:00-18:00	At all times	At all times
Daily charges	£11.50 (£10.50 Auto Pay)	£100 if Euro VI standard not met	£200 if Euro IV diesel standard not met

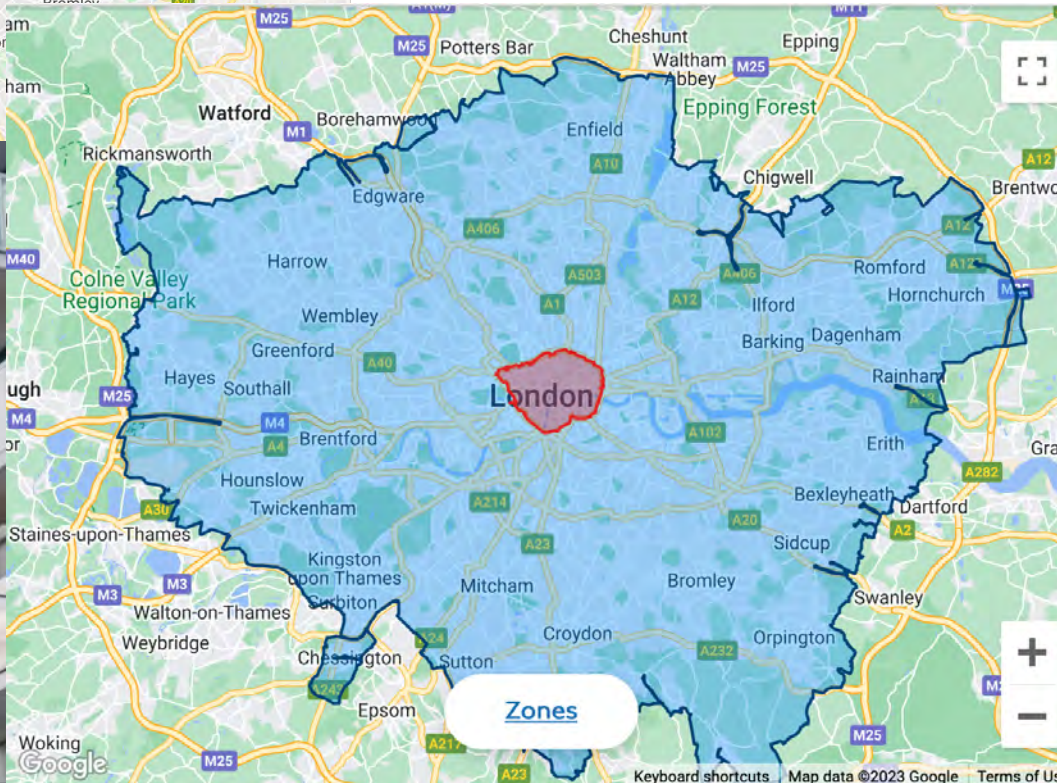
Source: TfL 2022. Charges for driving in London
<https://tfl.gov.uk/modes/driving/charges-for-driving-in-london?intcmp=45541>

Ultra Low Emission Zone (ULEZ)

1st expansion since 25 October 2021



2nd expansion Aug 2023



ULEZ expanded to the whole of Greater London

New ULEZ limits don't apply to Congestion Charge zone:
New charge: £15/day,
07:00-22:00, every day

No extra ULEZ fee for HGV Euro 6



Source: TfL 2023 Ultra Low Emission Zone
<https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/ulez-where-and-when#on-this-page-1>

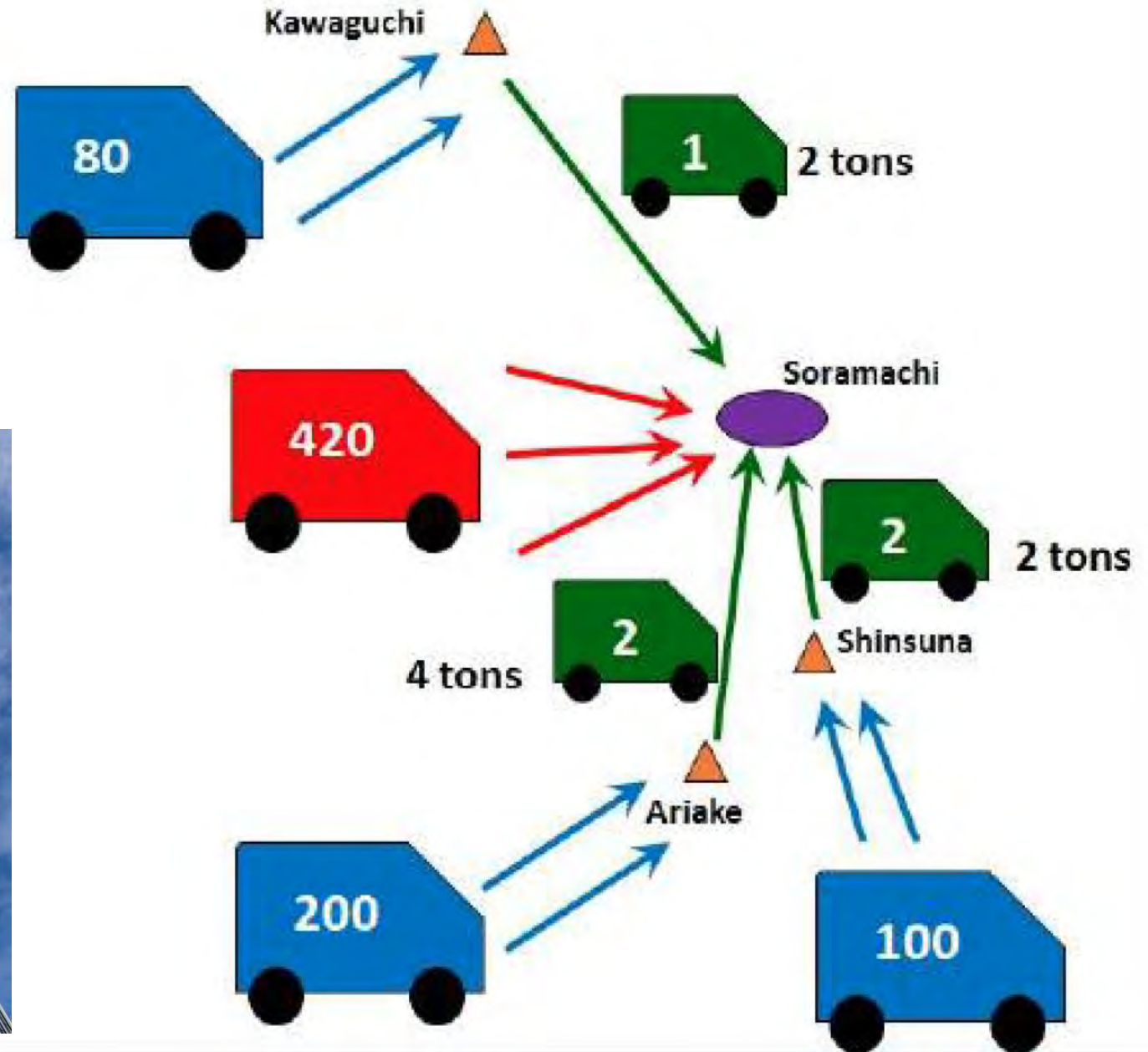
London LEZ and ULEZ:

Verify (proof with data series) that regulation triggers beneficial effects



Source: Londonair 2020
<http://www.londonair.org.uk>

Deliveries to high rise buildings Skytree and Soramachi in Tokyo



Sources:
<https://www.aretilaw.com/tokyo-sky-tree-and-tokyo-soramachi/>

Taniguchi and Qureshi, 2019. Urban consolidation centres

Dr Sarah Wixey Consultant:

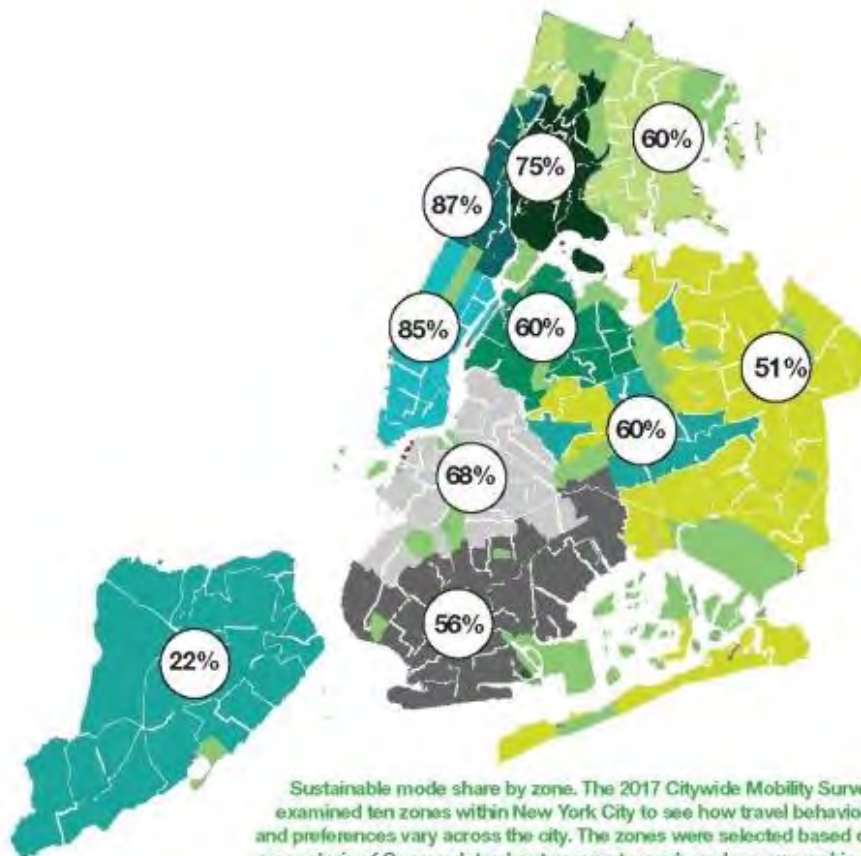
Market analysis low and zero emission business models



Business Model	Upfront Cost (CapEx)	Ongoing Cost (OpEx)	Risk Level	Benefits	Challenges	Best for
1. Direct Purchase (CapEx Model)	High (£150k–£400k per electric HGV)	Low (EVs have lower maintenance costs)	Medium (technology risk, resale value)	Long-term cost savings, full control, government grants available	High initial investment, infrastructure needed	Large fleet operators with long-term sustainability goals
2. Leasing or Hire Purchase (OpEx Model)	Low (no upfront cost or deposit)	Medium (fixed lease payments, battery degradation risks)	Low	Lower initial financial burden, predictable costs	Higher lifetime cost than purchase, lease terms may be restrictive	SMEs, growing fleet operators, risk-averse companies
3. Subscription & Pay-Per-Use (TaaS, FaaS)	None (no ownership costs)	High (per-mile or per-hour cost)	Low	No maintenance costs, flexibility to scale	High OpEx, may not be cost-effective for heavy mileage	Last-mile delivery, urban fleets, new adopters testing EV viability
4. Third-Party Logistics (3PL , 4PL Collaboration)	None (outsourced)	High (per-shipment or contract fee)	Low	No fleet investment, access to low-emission logistics networks	Less control over fleet operations and emissions	Small businesses, retailers, e-commerce
5. Depot-Based Charging (Private Investm.)	High (£50k–£200k per depot)	Low (cheaper electricity vs. public charging)	Medium (grid upgrades may be needed)	Long-term cost savings, independence from public networks	Upfront investment, site constraints, grid capacity limits	Large fleet operators, logistics hubs, regional depots
6. Public Charging and Battery Swapping	None (no infrastructure cost)	Medium-High (£0.50–£1 per kWh for rapid charging)	Medium (availability risks)	Avoids depot investment, quicker deployment	High energy costs, charging downtime, limited HGV infrastructure	SMEs, long-haul logistics without depot flexibility
7. Shared Charging Hubs	Medium (joint infrastructure investment)	Low-Medium (shared operational costs)	Medium (requires coordination)	Reduces individual cost burden, maximised asset utilisation	Scheduling conflicts, dependency on partners	Regional logistics operators, urban fleets, freight consolidation centers
8. Green Logistics & Carbon Offsetting	None-Low (offset purchases)	Medium (ongoing offset costs)	Low	Enhances sustainability credentials, meets ESG targets	Does not reduce actual fleet emissions	Corporate logistics, international freight, brand-conscious companies
9. Government & PPP Grants (Public-Private Partnerships)	Low-Medium (government funding can reduce CapEx)	Low (subsidies for infrastructure, vehicles)	Low	Financial support, policy alignment, cost reduction	Application complexity, reliance on government policy changes	All fleet operators, particularly SMEs needing financial support
10. On-Demand & Micro-Fleet Models	None (no ownership required)	High (per-delivery fees, fleet service contracts)	Low	Highly scalable, no fleet investment, flexible routes	Limited availability, cost-per-mile can be high	Urban last-mile delivery, startups, gig economy logistics

Source: Dr Sarah Wixey, 2025, Low Emissions and Electrification, UoW lecture

New York night-time deliveries (off-hours)



Sustainable mode share by zone. The 2017 Citywide Mobility Survey examined ten zones within New York City to see how travel behaviors and preferences vary across the city. The zones were selected based on an analysis of Census data about commute mode and car ownership at the neighborhood tabulation area level.



New York Dept of Transport (2017)
[Strategic Plan 2016 progress report](#)

IT for joint logistics function at shopping mall Emporia Malmö, Sweden



- 75 000 sqm shops & restaurants
- 200 tenants
- 300 deliveries/day
- 500 internal transports/day to/from tenants
- Highly valuable goods
- 20 tons waste/day
- Dedicated freight elevators and gangways to access shop backdoors

250 sqm joint logistics function space in basement

Goods handling process in Emporia



4. Goods are delivered and signed for by the tenant, in the store



3. Internal deliveries are made by adjusted equipment



2. Joined transport

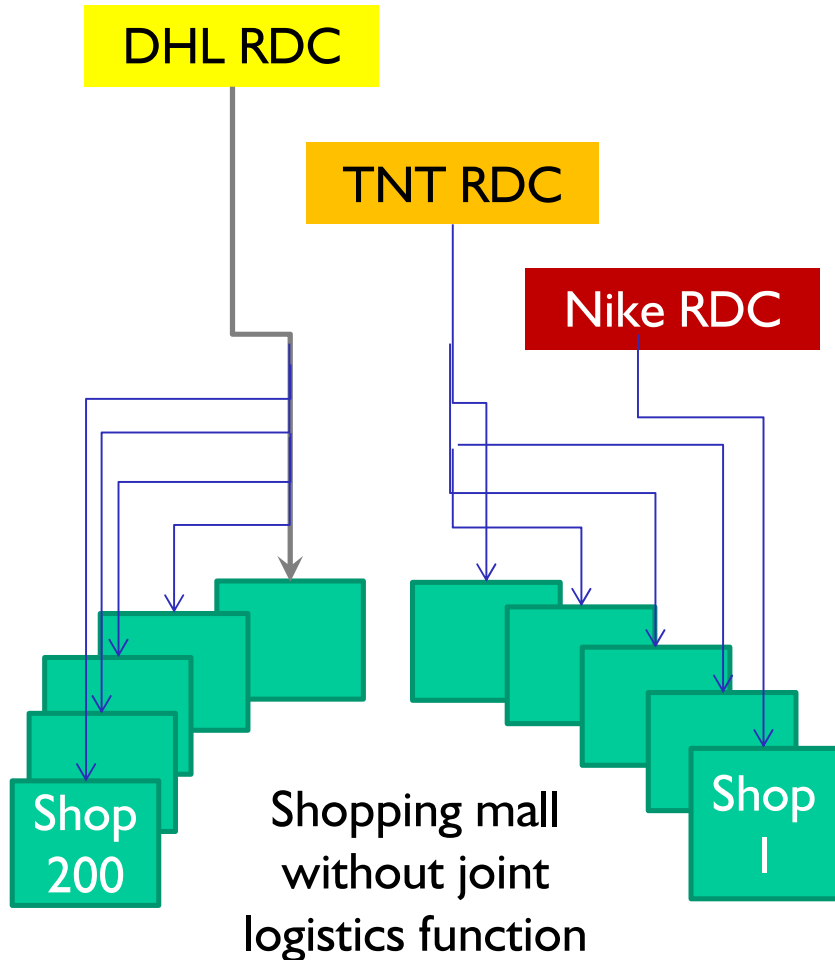


1. Control, receipt, sorting and registration of the goods in our goods management system. Automated info to the tenants via e-mail/sms

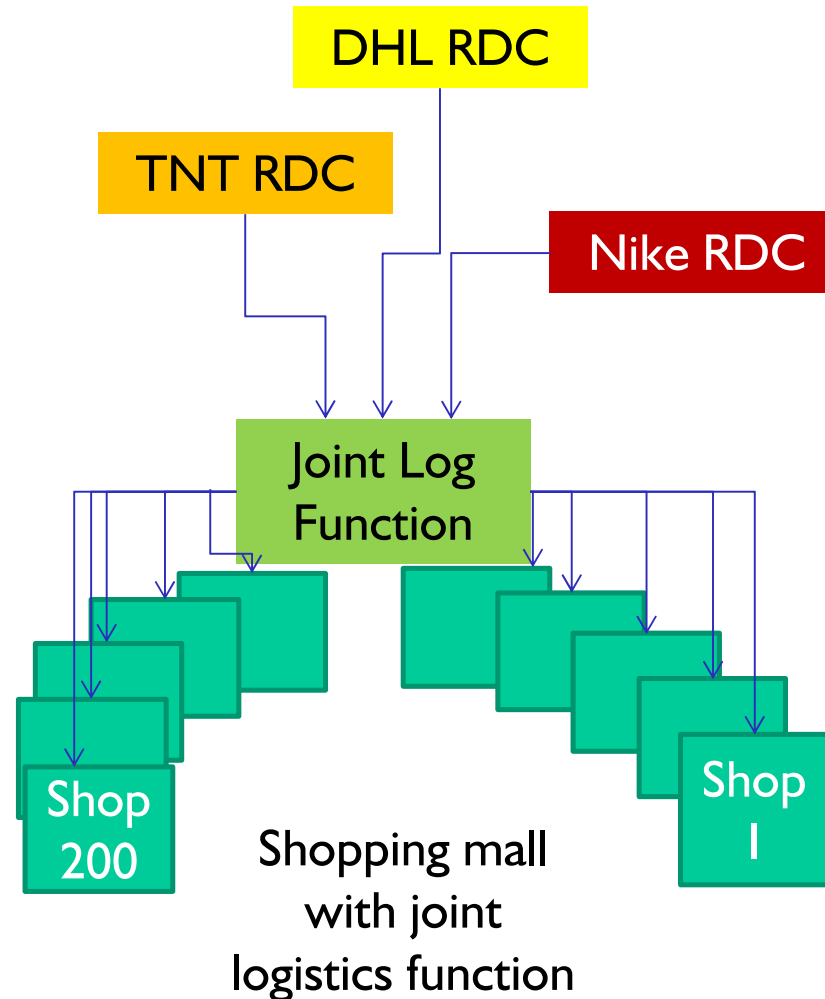


Benefits of shopping mall consolidation

Emporia retail network configuration
BEFORE



Emporia retail network configuration
AFTER



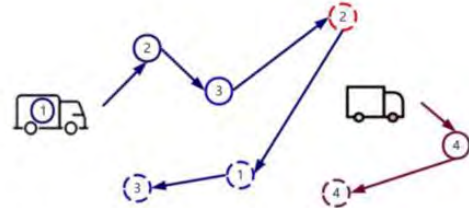
Sustainability benefits
achieved:
30-50 less trucks/day

Urban last mile logistics, efficiency solutions, consolidation centres and clean vehicles

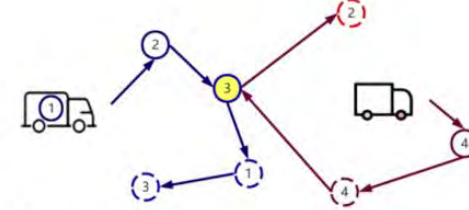




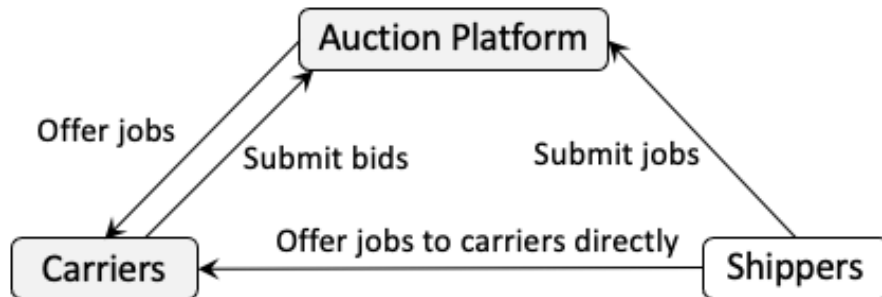
Russell Thompson: Hyperconnected City Logistics



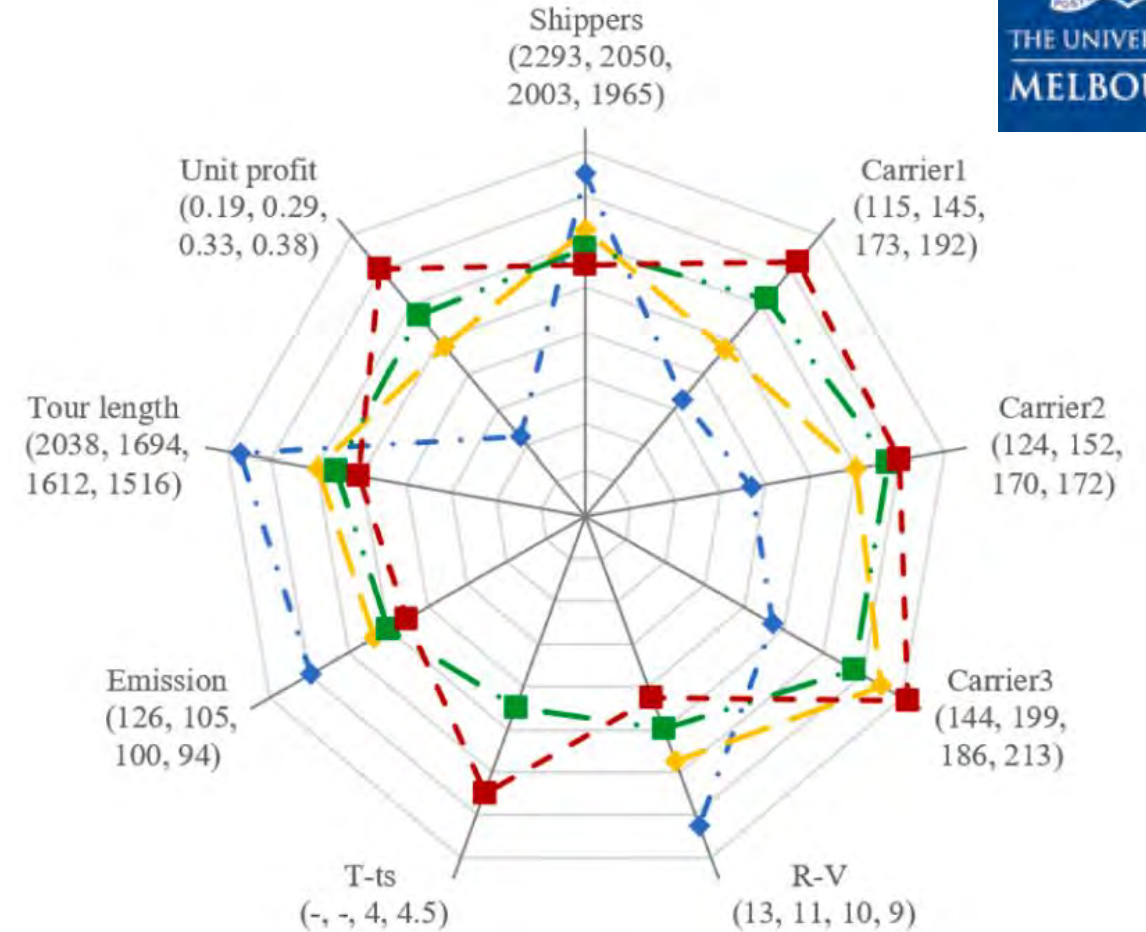
Before sharing



After sharing



—♦— Random —▶— AS1 —■— AOT —■— AOTT



Carrier: profit (\$) Shipper: payment (\$) Unit profit: profit per length (\$/km)
 Tour length: (km) Emission: (kg) R-V: real number of vehicles used
 T-ts: times of outsourcing between carriers

Train

Electric vehicles



2.2t Van, 300 kg quadricycle, 5t truck



Barge

Cycles

Source: DfT UK 2020



Category	Type	No. wheels	Image	Payload (kg)	Purchase cost range
Cargo bikes	Bike	2		50 ¹⁰	£1,000 – £3,000 ¹¹
	Trike	3		50 ¹⁰	£2,000 – £4,000 ¹⁰
eCargo bikes	Bike	2		100 ¹²	£3,000 – £6,000 ¹⁰
	Trike	3		250 ¹²	£4,000 – £10,000 ¹⁰
	Quadracycle	4		250 ¹²	£8,000 – £12,000 ¹⁰
	Trailer	—		300 ¹²	£2,000 – £5,000 ¹⁰

Waterloo rail-cargobike mini-hub trial in Central London

Demonstrating Innovation



Creative Use of Underutilised Space



Tests and Trials with New Stakeholders



Supporting Retrofit First Policies & Approaches



Delivering Infrastructure for Long-Term Rail Opportunities



Encouraging Long-Term Modal Shift



Use of New Technologies



Implementation to achieve Additional Efficiencies within the Freight Sector



Enabling Collaborative Approaches across Public and Private Sectors





Automated
full electric trucks at
Port of Felixstowe
2025

Automatization of maritime Terminal operations

Port of Shanghai, world leader for container handling automatization

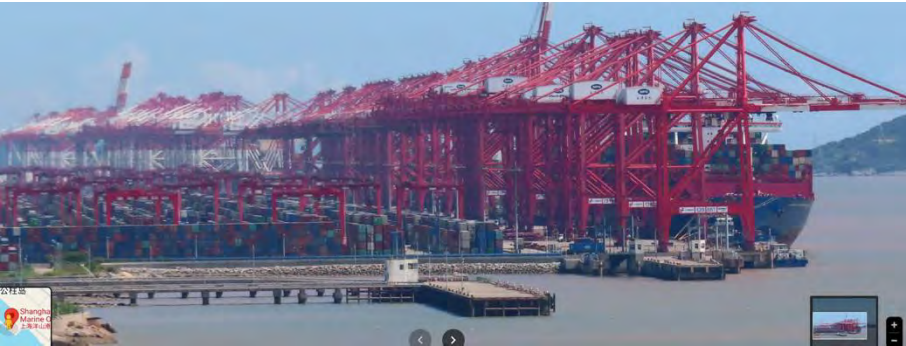
storage parallel to shoreline, using much lighter, energy saving crane design, 4 years ROI

Port of Shanghai
junior mwiinga
Photo - Oct 2024



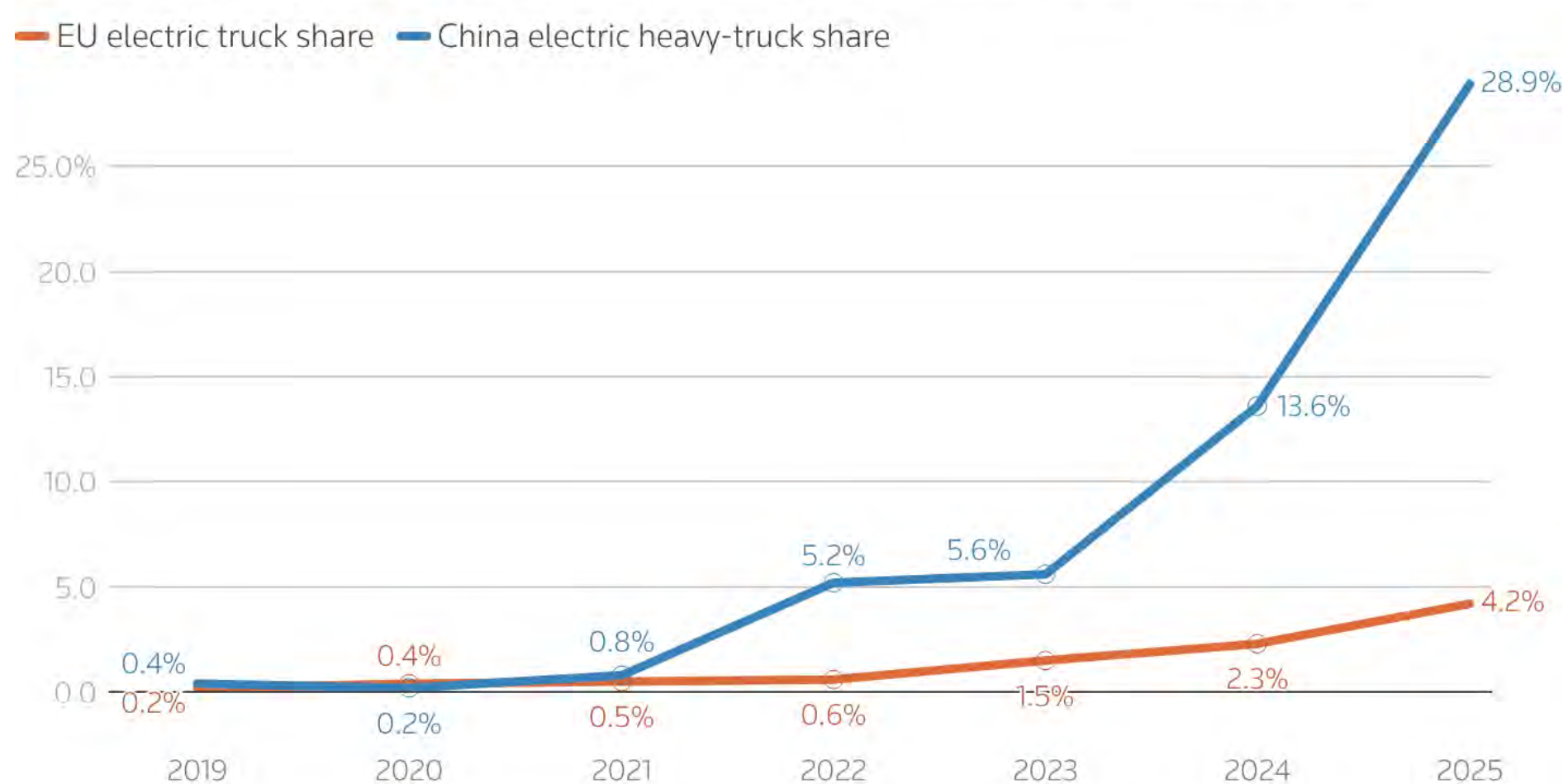
Port of Shanghai, use of “Automated Intelligent Vehicles”

Not anymore “guided” by tags on the floor
automated battery swap
Shanghai Yangshangang Terminal



China: battery-electric heavy truck is reaching industry scale

Annual market share of new HGVs sold in China and Europe



Note: Chinese numbers also include hydrogen fuel cell and hybrid models, but battery electric trucks make up the vast majority.

Source: First Commercial Vehicle Network, ACEA | By Marie Mannes

Source: [Mannes, March 2026, Reuters](#)

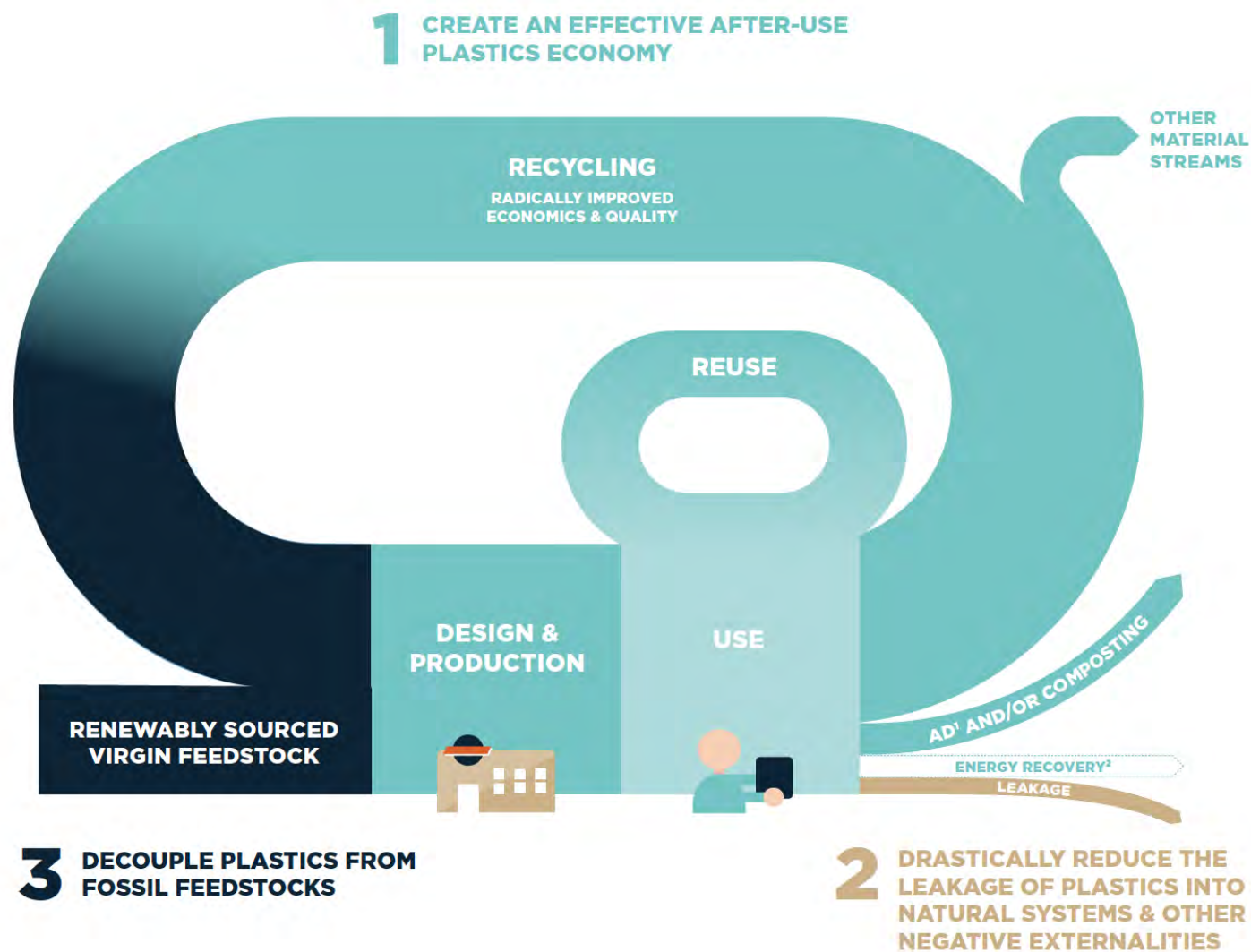
Geofencing use in urban micro-mobility



Table 2. Estimates of e-scooter parking spaces and parking zone utilisation for 2020 - 2023.

	2020	2021	2022	2023
Legend	• 1 within parking zone • 2 outside parking zone • 3 near boundary • 4 parking zone • 5 enlarged parking zone • 6 Old Town Area			
Total number vehicles	32.686	51.026	39.928	28.004
Within parking zone (black)	18,1%	19,6%	71,0%	88,2%

Solutions targeting plastic waste



Source: Ellen MacArthur Foundation, 2017. *New Plastics Economy*

https://www.ellenmacarthurfoundation.org/assets/downloads/New-Plastics-Economy_Catalysing-Action_13-1-17.pdf

Evaluation of performance: Example of John Lewis

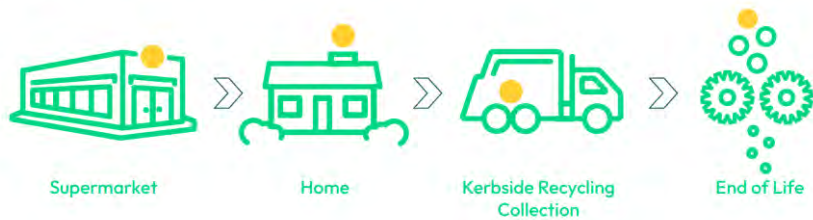
Circularity & Waste ¹² Target	2024	2023
85% of all operational waste across the Partnership will be recyclable by 2028 ¹³	70.8%*	73.9% [◇]
All own-brand primary product packaging across our two brands will be widely recyclable, reusable or home compostable by 2025 ¹⁴	John Lewis: 95.0% Waitrose: 96.7%	John Lewis: 93.1% [◇] Waitrose: 96.9% [◇]
John Lewis: all product categories will have a buy back or take back solution by 2025	Seven out of ten categories ¹⁵	Seven out of ten categories
Waitrose: by 2030, reduce operational food waste by 50% against a 2018 baseline (6,969 tonnes)	-28.2%* ¹⁶	-27.5% [◇]

Source: John Lewis Partnership, 2025: [Ethics & Sustainability Performance Data](#)

Nick Gazzard: 30% reuse in UK retail is achievable



1 Single-Use – the current scenario (SU)



Sustainability benefits

£314m - £577m (12-22%) saving per year

- in end-to-end system costs¹⁶

95% reduction

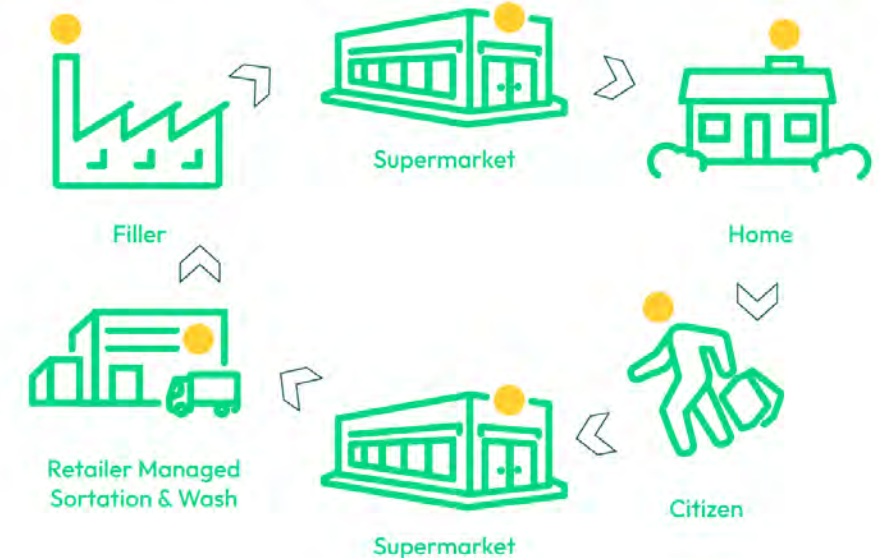
- in CO₂e emissions

95% reduction

- in packaging materials and waste

13,000 net new jobs

3 Reusables – citizen return to store (Citizen Return)



+ three other circular scenario

Source: GoUnpackaged: [A 30%+ REUSE FUTURE FOR THE UK](#)

Bruce Carnaby

Saving food from going to waste



THE WORLD'S LARGEST B2C MARKETPLACE FOR SURPLUS FOOD

Saving food from going to waste in 19 countries

SOME OF THE UK PARTNERS



Since launching
in 2019...

B2C Audience

>120M 

Marketplace Partners

>180,000 

FMCG Partners

600 

Good food saved from going to waste

>500M KG 

Saving
4 meals every
second

Source: UoW lecture, 12 March 2026

EMISSIONS

Direct (Scope 1) GHG Emissions (2022 & 2021) ^{(4) (5) (6) (7) (8)}

MOBILE SOURCES	CO ₂ emitted by aircraft	3.15 t CO ₂ /t fuel	Tonnes	N/A	4,639,145.26	4,743,199.52
	CO ₂ emitted by GSE vehicles	2.66 kg CO ₂ /L (industrial machines and Diesel road) 2.40 kg CO ₂ /L (unleaded gasoline)	Tonnes	N/A	227.51	210.56
STATIONARY SOURCES	Co ₂ emitted by gas & fuel oil used in facilities management	Fuel: 2.66 kg CO ₂ /L (industrial machines and natural gas)	Tonnes	N/A	311.93	414.77
TOTAL			Tonnes		4,639,684.7	4,743,824.85

Direct (Scope 1) GHG Emissions (2023)

MOBILE SOURCES	CO ₂ equivalent emitted by aircraft	DEFRA Database	Tonnes	4,238,362.96	N/A	N/A
	CO ₂ equivalent					

Air cargo sustainability challenges, and how to overcome them

Source: Cargolux CSR Report 2023 www.cargolux.com/about-us/Corporate-Responsibility/CSR-Report

Problems and possible sustainability solutions

- Too much CO₂ → Purchase of new B777 with better environmental performance (2024)
- Develop Sustainable Aviation (Bio-)Fuels
- Low loading rate → Logistics efficiency → Choice of better routes
- Delays, traffic disruption → Ground coordination
- Strong growth in e-commerce (bubble?) -> Hub network optimization

Drone technology for logistics and supply chains: Zipline – an example of adapting drones to hospital supplies & deliveries in Rwanda



Sources:

Greenbank, C. (2026). [Zipline: Rwanda launches world's first nationwide drone delivery system](https://www.flyzipline.com/)

Zipline (2025). Mark Rober visits Zipline <https://www.flyzipline.com/>



swiss connect Bike-rail solution

- Courier deliveries using cars, bikes and trains
- Network of 500 bike couriers (vélocité etc.) 200 cars, vans and lorries in Switzerland
- 10 Swiss railway companies (SBB, BLS, etc.) using existing train services, for 80 cities
- Access to passenger rail platform by bike
- Passenger train with cargo compartment, stopping at the same spot, separate door away from passenger doors, ½ day delivery

<https://swissconnect.ch/en/>

<https://www.velocite.ch/en/>

 SBB CFF FFS





John Manners Bell: Contribution to the Covid-19 Pandemic Inquiry



- Asked to provide recommendations as to how supply chain performance could be improved to mitigate the impact on healthcare operations in future crises.
 1. There should be a single authority responsible for ensuring the resilience of the UK's PPE and healthcare equipment supply chains. Its remit should include visibility of all inventories held in the UK including those of NHS Supply Chain; the devolved administrations' centralised procurement organisations; Health Trusts; Primary and Social Care providers; government departments as well as private sector manufacturers, wholesalers and distributors.
 2. The authority would act as a "Control Tower", identifying risks; monitoring orders; tracking shipments and assessing inventory levels.
 3. The authority would also be responsible for developing a single model to forecast demand and usage rates of PPE which would inform more accurate order policy.
- The evidence assists the Inquiry report due in summer 2026.

Transaid - Emergency transport systems

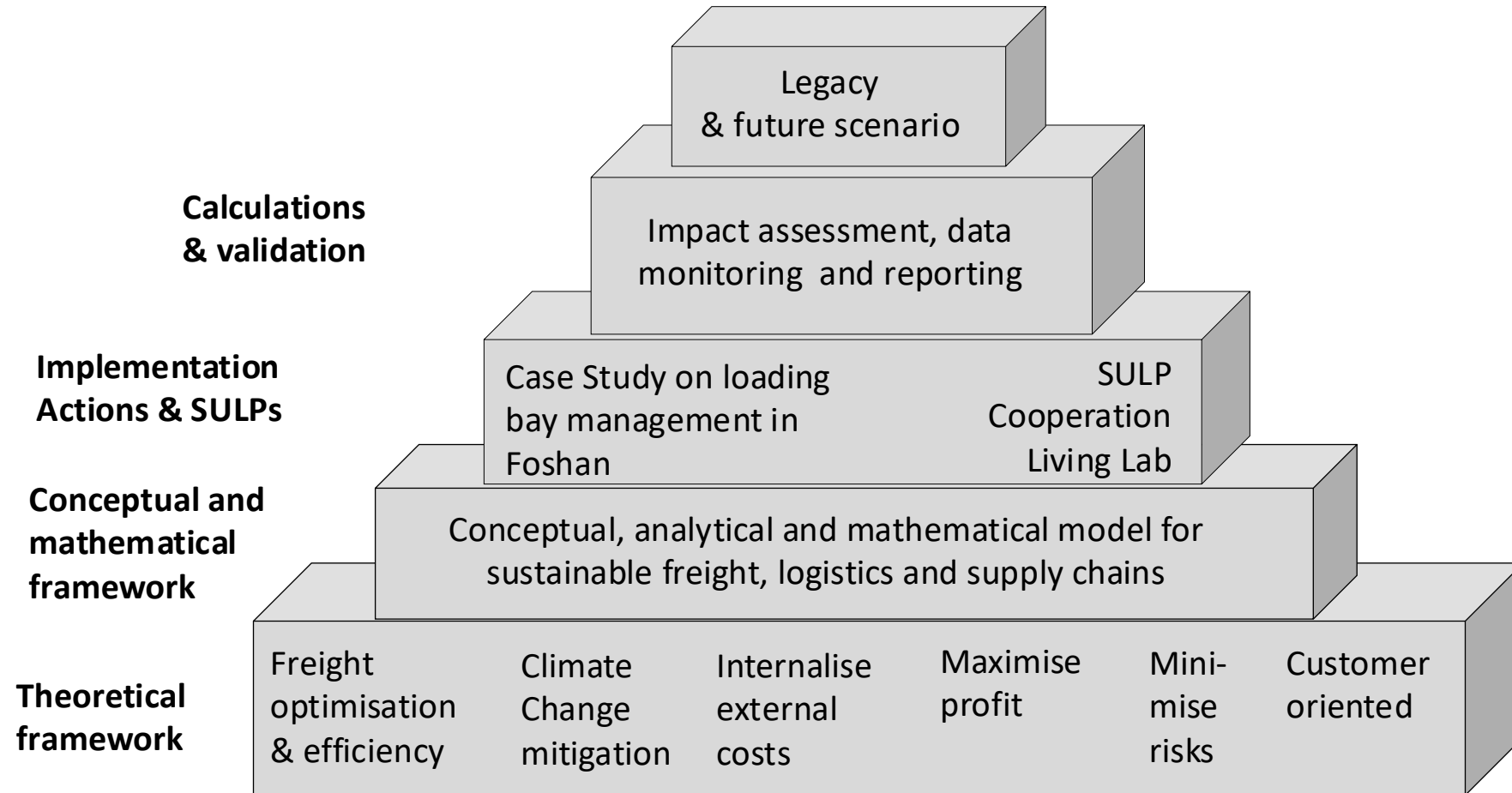


- Increased access to essential health services, reduced travel times and costs, and improved patient outcomes
- Adapting existing context appropriate transport systems
- Building community capacity to manage emergency transport systems
 - Trained driver/riders
 - Basic maintenance skills

- Incentivising long term sustainable participation
 - Community ownership
 - Locally affordable solutions
 - Public Private partnerships



Generic methods for conducting case studies in sustainable freight, logistics and supply chain operations



Concluding remarks

- Innovations: Diverse solutions, slight dominance of consolidation hubs, automatization, electrification
- Transferability: Few large scale transfer
- Impacts and Benefits: Very high benefits, but difficulty with quantification of robust impacts estimates
- Data availability: Biggest difficulty is with data on the 'Before' situation, in order to obtain the business case information out of the trials and tests
- Rare assessment (zero research project) of a live up-scaling of innovation:
Prototype → Trial → Industry Scale

Thanks to all !

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