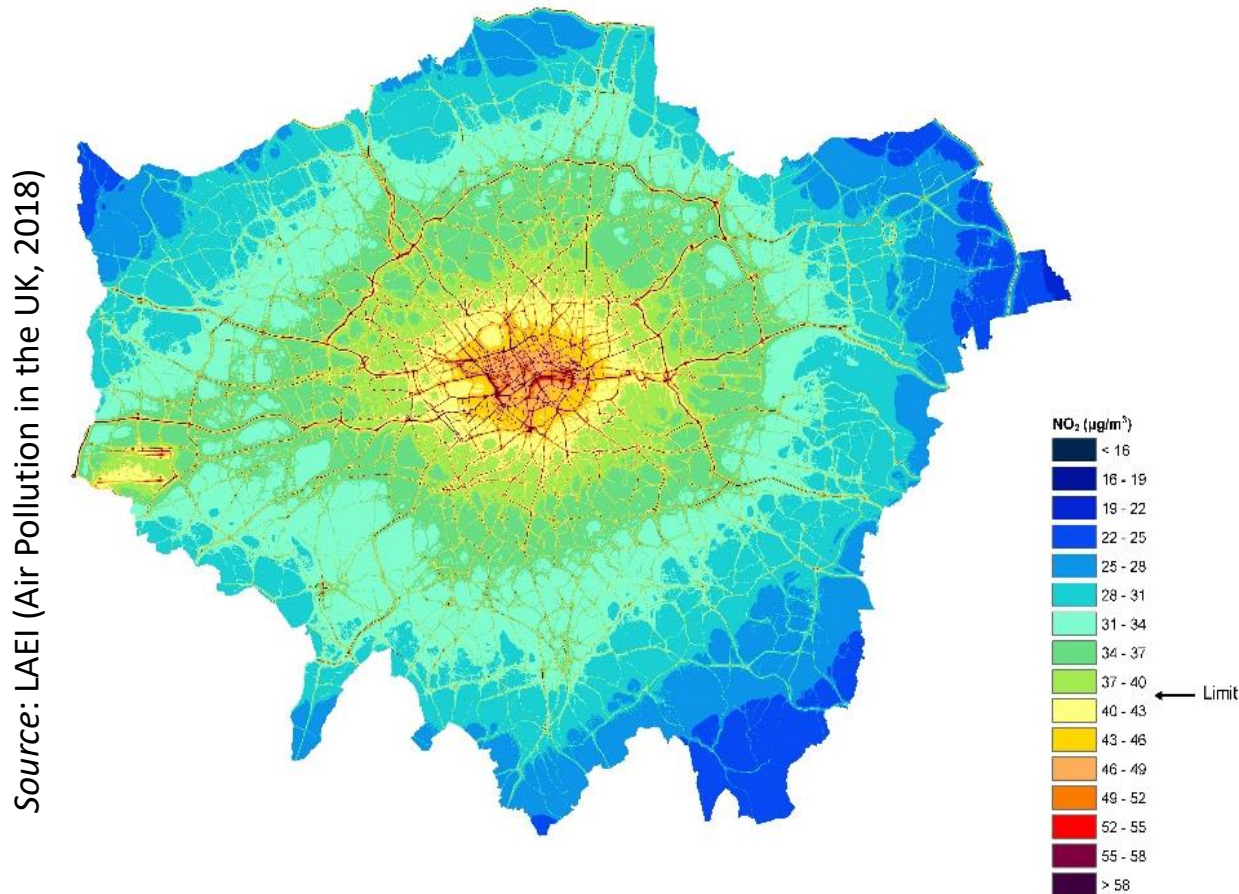


The London ultra-low emissions zone (uLEZ)

Benjamin Heydecker
Hajar Hajmohammadi



Annual average NO₂ concentrations in London 2016



The London uLEZ (April 2019)

Requirements (Cars, MCYs, Vans ...)

Euro 4 (Petrol: NO_x)

Since 2005

Euro 6 (Diesel: NO_x and PM)

Since 2015

(otherwise £12.50 daily charge)

22 km² in central London

Travellers' responses:

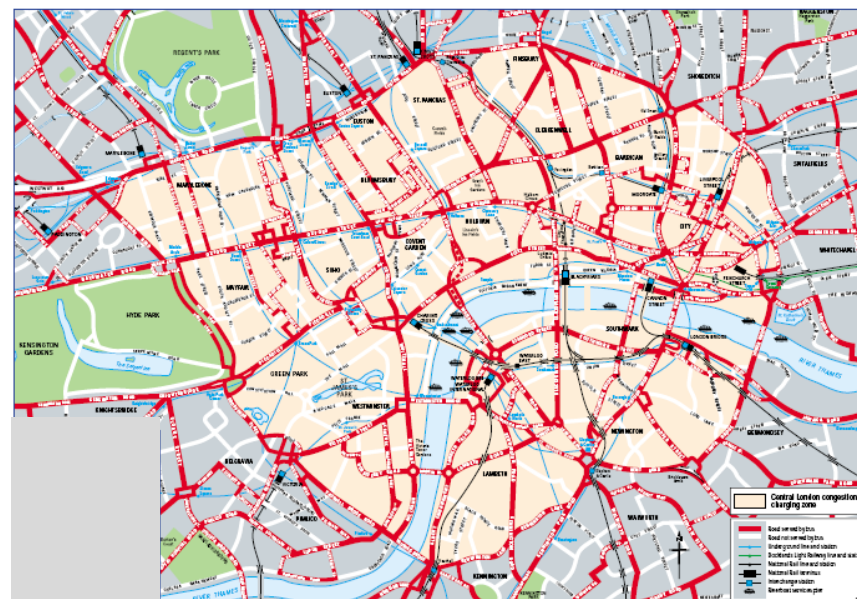
Upgrade vehicle

Switch mode (public transport)

Reduce frequency

Change route (avoid the zone)

Alter destination (go elsewhere)



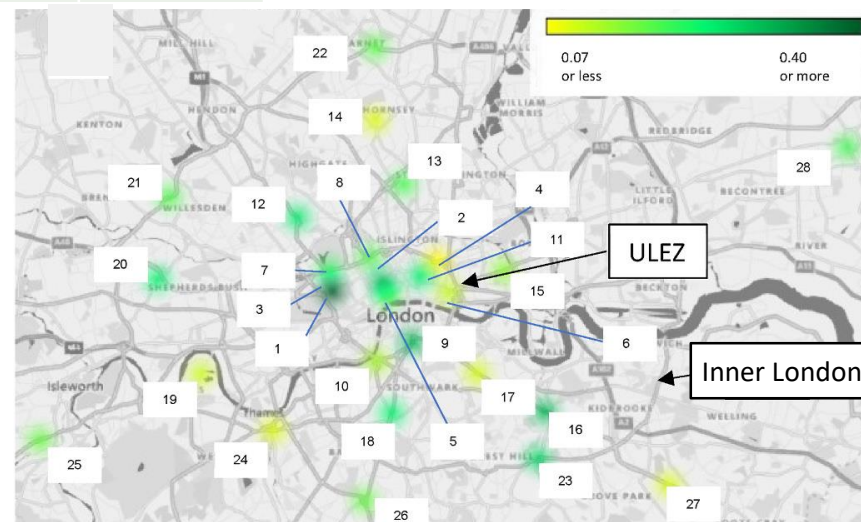
The 2019 London uLEZ: Results

Measurements (London Air Quality Network)		
Zone	Area (km ²)	Stations
uLEZ	22	11
Inner London	110	9
Greater London	1,400	8

Improvements
in air quality beyond trend:

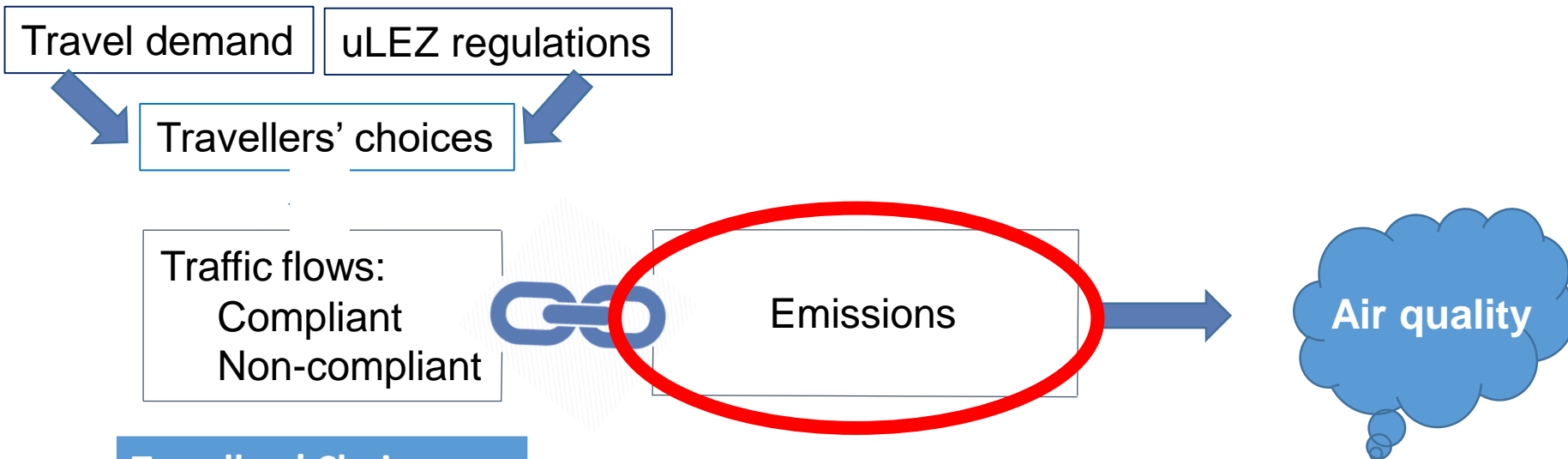
Reductions (%)	NO	NO ₂	NO _x
uLEZ	19.0	11.6	20.2
Inner London	17.9	11.4	17.1
Greater London	10.6	13.4	15.1

(Source: Hajmohammadi and Heydecker, 2022)



Benefits extend beyond implementation area

How regulation affects air quality



Travellers' Choices

Destination
Route
Public or own vehicle
Frequency
Vehicle type
Origin

- Direct influence on individual choices
- Reinforce societal trends
- Continuing developments

Compliance:

Emissions standards required for newly registered vehicles:

Euro 6 (**Diesel**) since 2015

Euro 4 (**Petrol**) since 2005

Proportions non-compliant (%)
(Greater London)

Date	Cars	Vans
February 2017	56	88
June 2023	7	20
February 2024	3	11

(Source: GLA, 2024)



(Source of data: www.gov.uk, FOIR4919, 2015)

The 2019 London uLEZ: other influences

Hourly measurements of NO, NO₂ NO_x at 28 sites
12 months before ↔ 11 months after (Covid19 affected March 2020)

Weather (wind speed, relative humidity, temperature)

Drift across the region

Persistence at each location

Differences among:

- Station

- Hour of the day

- Day of the week

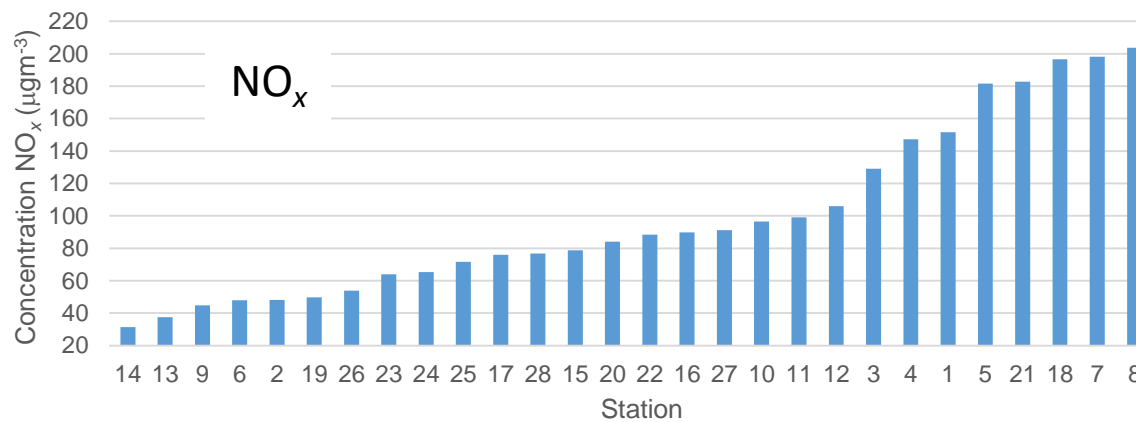
- Month of the year

Underlying longer-term trend

Summary of measurements:

	NO	NO ₂	NO _x
Number	445,451	445,446	445,447
Mean (µgm ⁻³)	34.33	44.83	97.48
Standard deviation	48.5	28.7	98.3
SD (Station)	23.7	16.3	52.1

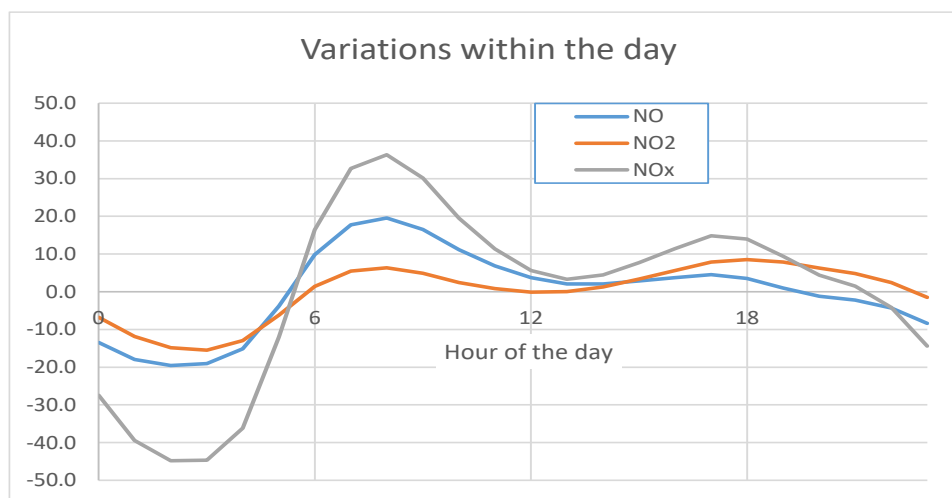
Variation (µgm⁻³)



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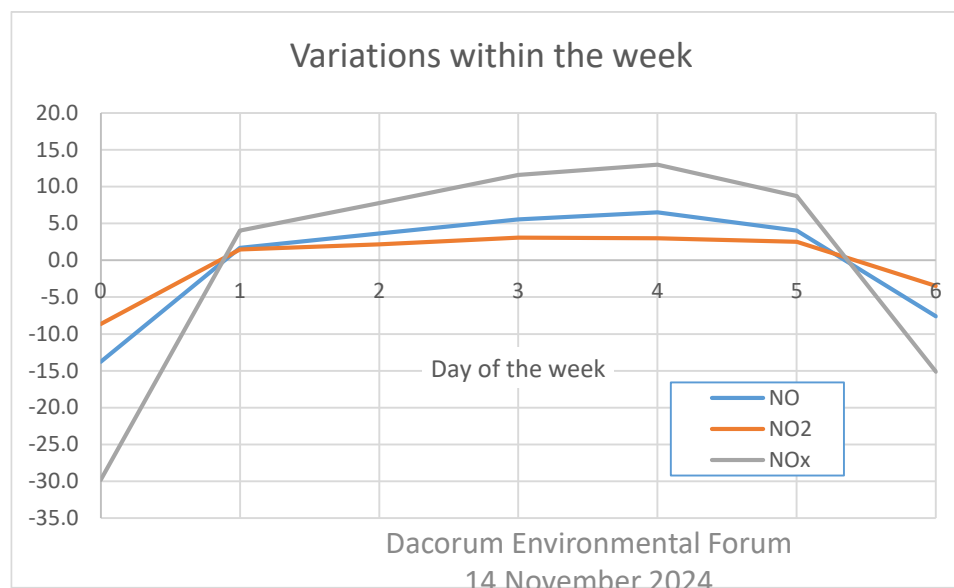
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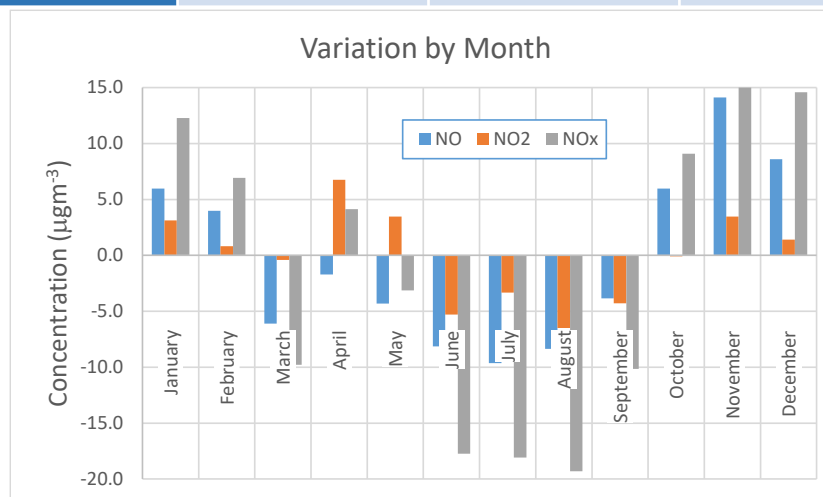
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SD (Hour)	11.0	7.3	23.1
SD (Day)	7.11	4.12	15.00
SD (Month)	7.42	3.89	14.03

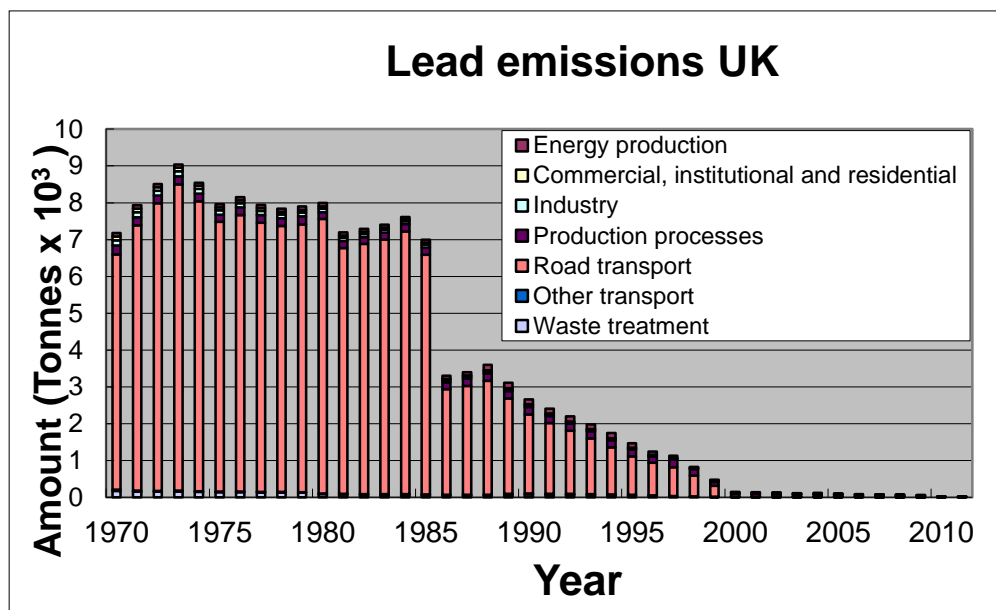
Variation (µgm⁻³)



Existing and future opportunities

Emissions and air quality

Unleaded petrol (1985): necessary for catalytic converters



(Source: AEA, 2013)

Existing and future opportunities

Emissions requirements and air quality

Unleaded petrol

EURO standards for vehicle emissions

London LEZ (2007): Euro 3

London uLEZ (2019, 2023): Euro 4(Petrol) 6(Diesel)

Clean air zones:

(Source: DEFRA, 2024)

Class	Vehicles	Location	Area (km ²)
B	Buses, coaches, taxis, PHV, HGV	Portsmouth	3.0
C	B + Vans, minibuses	Bath	3.1
		Bradford	10.1
		Sheffield	2.3
		Tyneside	2.4
D	C + Cars (+MCYs)	Bristol	3.0

Conclusions

- uLEZ in London has been effective
- Changes in travellers' choices: encouragement
- Acceleration of trends
- Benefits extend beyond implementation zone

Challenges

- Adopt emissions regulations elsewhere
- EVs still generate particulates (PM_{2.5}):
 Brakes, tyres, road surface, additional mass (batteries)
- Other sources of gaseous emissions

Thank You !



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