



UNIVERSITY OF
BIRMINGHAM

WM-NET ZERO SHOWCASE EVENT

24th – 25th September 2026

Birmingham Botanical Gardens

WM-NET ZERO

A Health-centred Systems Approach Towards Net-Zero:
Transforming Regional Climate Mitigation Policies



UNIVERSITY
of York



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SURREY



West Midlands
Combined Authority



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The WM-NetZero project is supported by Wellcome Trust (227150_Z_23_Z) under the
Advancing climate mitigation policy solutions with health co-benefits in G7 countries
scheme.



Housekeeping

- Tea breaks 11:15am and 2:15pm
- Lunch 12:30pm
- Tour (limited numbers – indicated with a coloured dot) / poster session – 2:15pm
- Toilets are located to the right of the stage area
- No fire alarms test due – if it goes off leave via nearest exit and meet at the bandstand in the main gardens.
- No smoking/vaping venue
- Flip charts, post-its and pens available for workshops.
- Inclusivity is key – everyone's view is welcome!

The Health Challenge

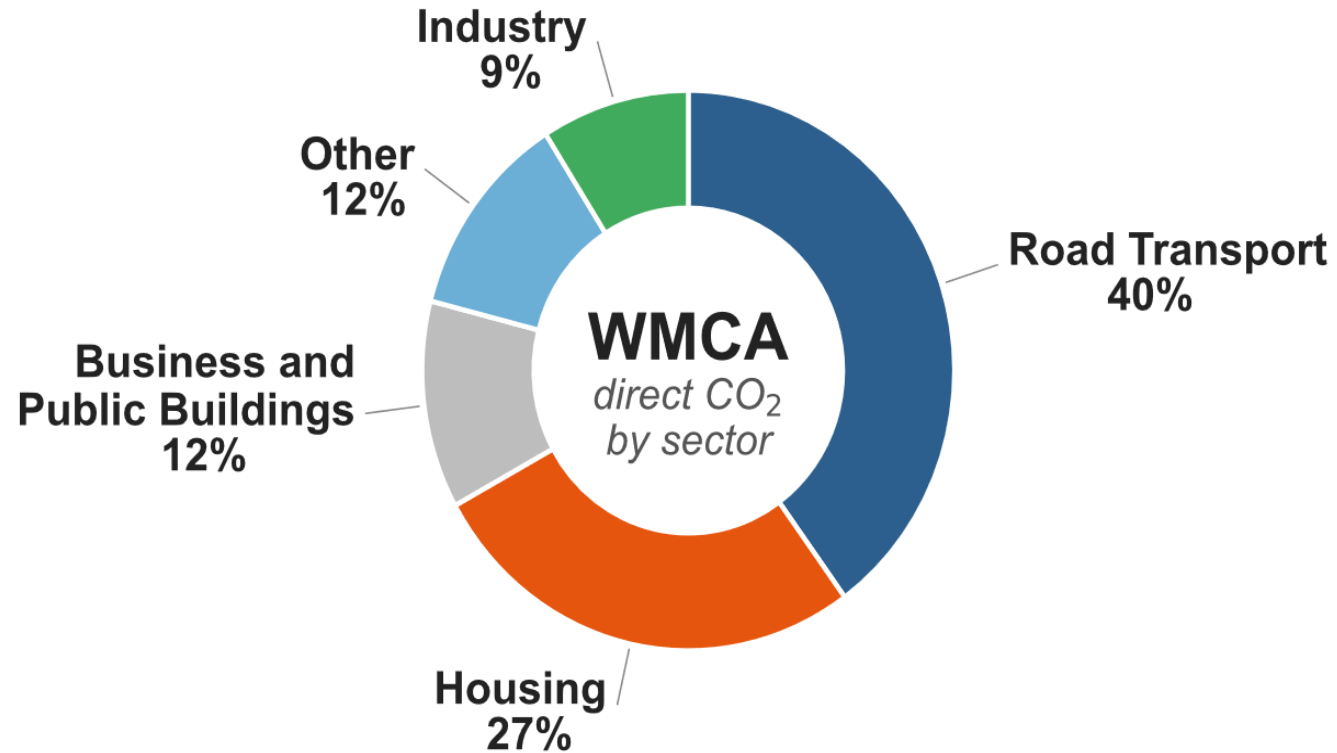


- ~80% of our health is determined by wider determinants: examples

- **The air we breathe**
- **The housing we live in**
- **The way we move**

The Climate Challenge

WM-NET ZERO

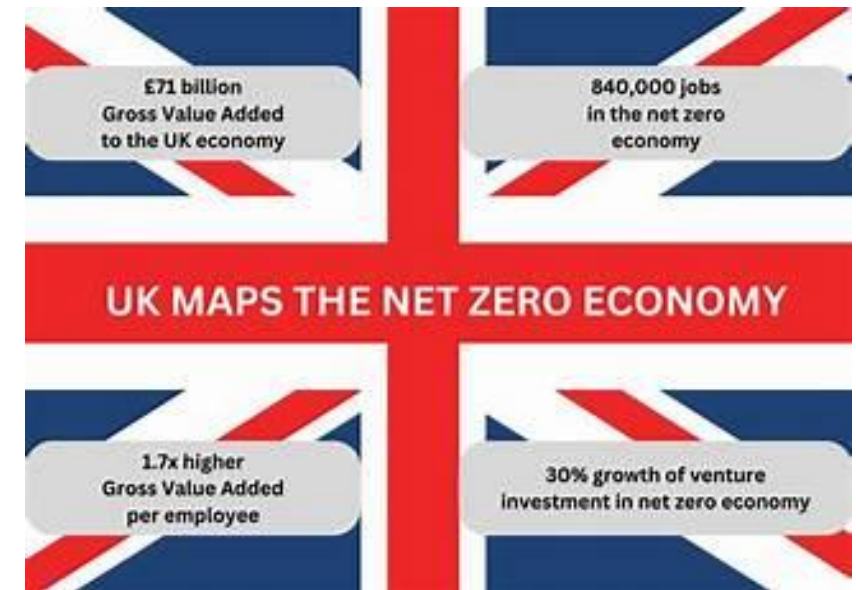


Total carbon dioxide emissions: 8.6 million tonnes (2024)

Net Zero: global action, local benefits

WM-NET ZERO

- Cutting CO₂ emissions helps combat climate change
- Net zero actions change wider determinants of health
- Different pathways have different health and inequality outcomes



Aim of WM-NetZero project

- To support regional net zero policymaking and delivery, spanning transport and housing sectors by adopting a whole systems health-centred approach.
- We will use health outcomes mediated by air pollution, noise and physical inactivity due to net zero policies to demonstrate the health co-benefits of climate action.

“The pathway to net zero and climate resilience in the West Midlands optimises health and equity outcomes”

Launch event (October 2023)

WM-NET ZERO



- Centre for Alternative Technology – Powys, Wales.
- Opportunity for the interdisciplinary team (researchers and stakeholder leads) to meet each other, explore areas of expertise, develop initial plans and explore our impact plans

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Mid-term away days (March 2025)

WM-NET ZERO

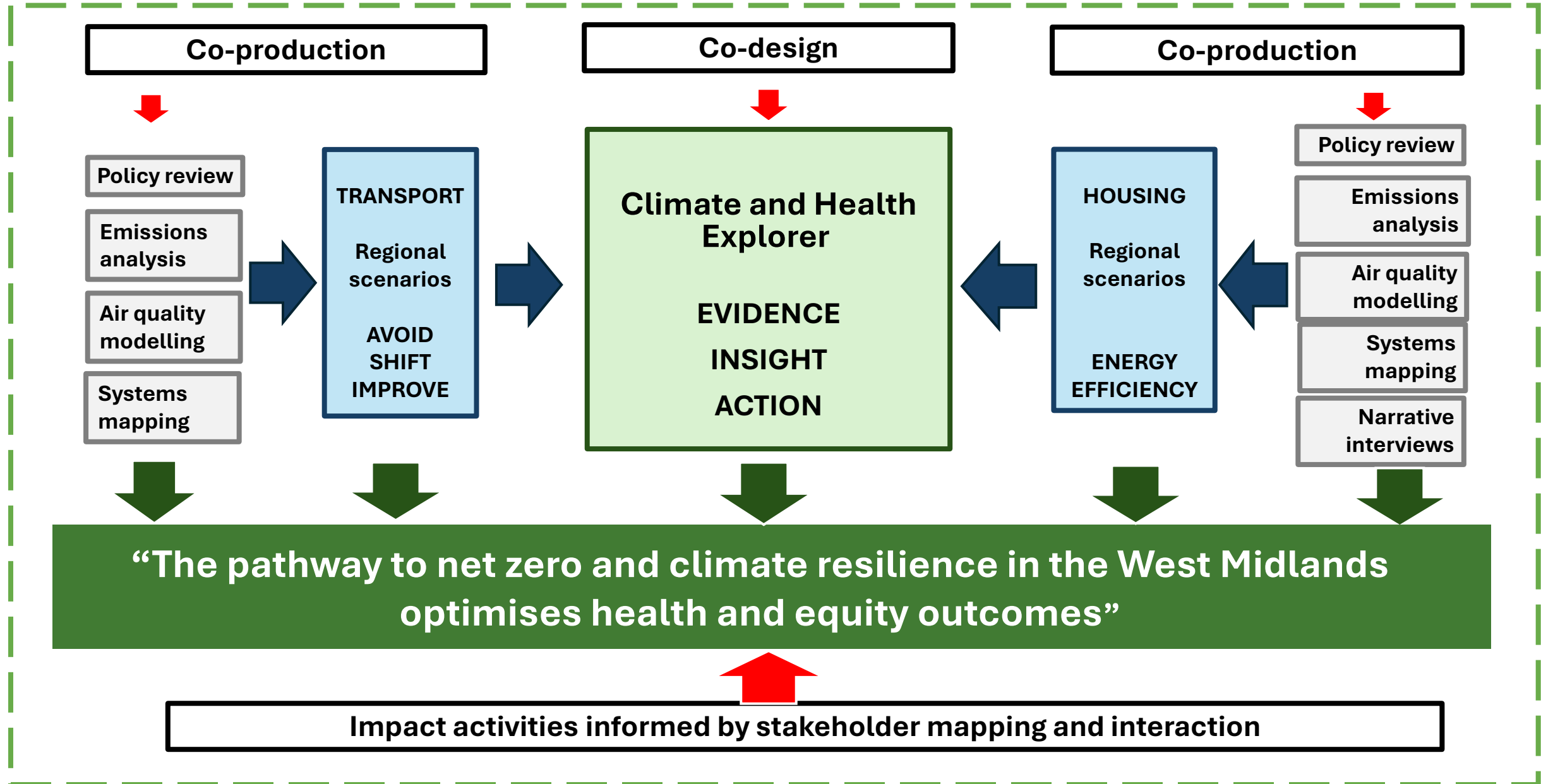


- Kidderminster
- Reviewing progress
- Redefining priorities
- Refining goals
- Focusing on impact

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WM-NetZero Theory of Change



Climate Health Explorer Launch (June 2026)

WM-NET ZERO



170+ attendees
Guest speakers
Chaired by UK100

www.climatehealth-explorer.org.uk

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WM-Net Zero Showcase Event (24-25 September 2026)

- Thank you to our partners
- Showcase what we have discovered
- Seek input, feedback and recommendations from our partners
- How can we help you? Explore further real-world impact opportunities
- Network
- Have fun!

WM-NET ZERO



Agenda

WM-NET ZERO

Time	Session/Topics
9:30	Coffee/Tea + Registration
10:00	Welcome + WM-Net Zero introduction / Overview
10:30	Climate Health Explorer
11:15	Tea/Coffee
11:30	Outputs and Achievements to-date
12:30	Lunch + photo
13:30	Project Partner Insights - policy applications/case studies
14:15	45min tour of Botanical Gardens (<i>limited numbers</i>) Poster session with Tea and Coffee
15:15	Workshop: Pathways to Impact
16:30	Next steps, future plans and ongoing projects
16:50	Reflections Close to formalities and note about this evening and Day 2
17:00	Networking and drinks reception
18:30	Meal

SESSION 1: CLIMATE HEALTH EXPLORER

WM-NET ZERO

CLIMATE HEALTH EXPLORER DEMONSTRATION



James Hall



Sophie Morris

The WM-NetZero project is supported by Wellcome Trust (227150_Z_23_Z) under the Advancing climate mitigation policy solutions with health co-benefits in G7 countries scheme.



Aims of the Climate Health Explorer

WM-NET ZERO

- Support evidence-based policy decisions
- Promote a whole-systems approach to climate policy
- Increase climate change and health awareness



www.climatehealth-explorer.org.uk

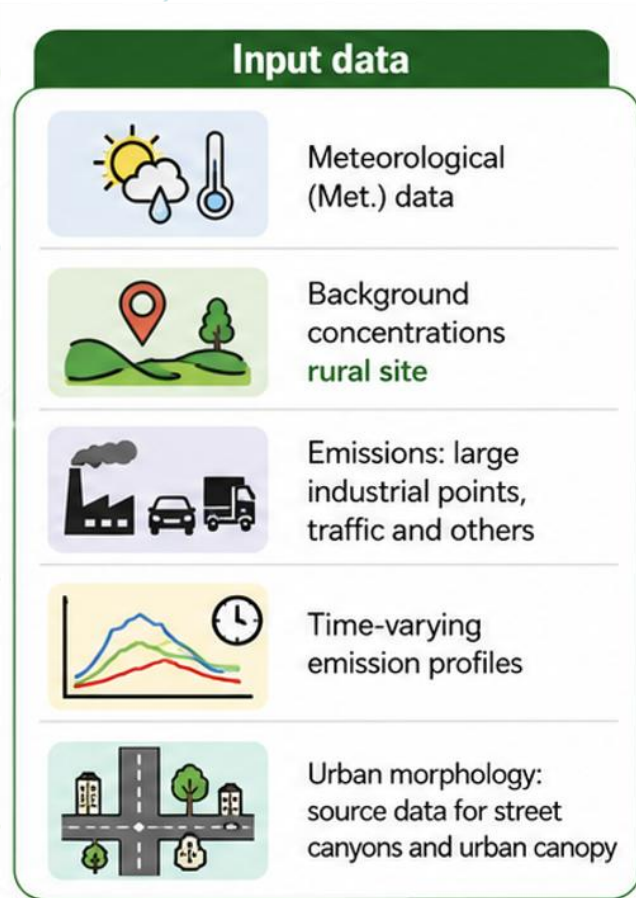


PRESENT (2024) AND FUTURE (2036) AIR QUALITY MODELLING

Nana Wei

ADMS-Urban is used to model present and future air quality for WM

Input data → dispersion and chemistry calculations → predicted concentrations across the city



Present 2024:

1. Observed Met. data
2. Measured Background
3. Calculated Emissions



ADMS-Urban



Present 2024:

1. Hourly air pollution levels at each monitoring site (for **model evaluations**)
2. Air pollution distributions at 10x10m resolution.

Future 2036:

1. 2024 Met. data
2. Predicted Background from **Defra**
3. Projected Emissions based on **NAEI**



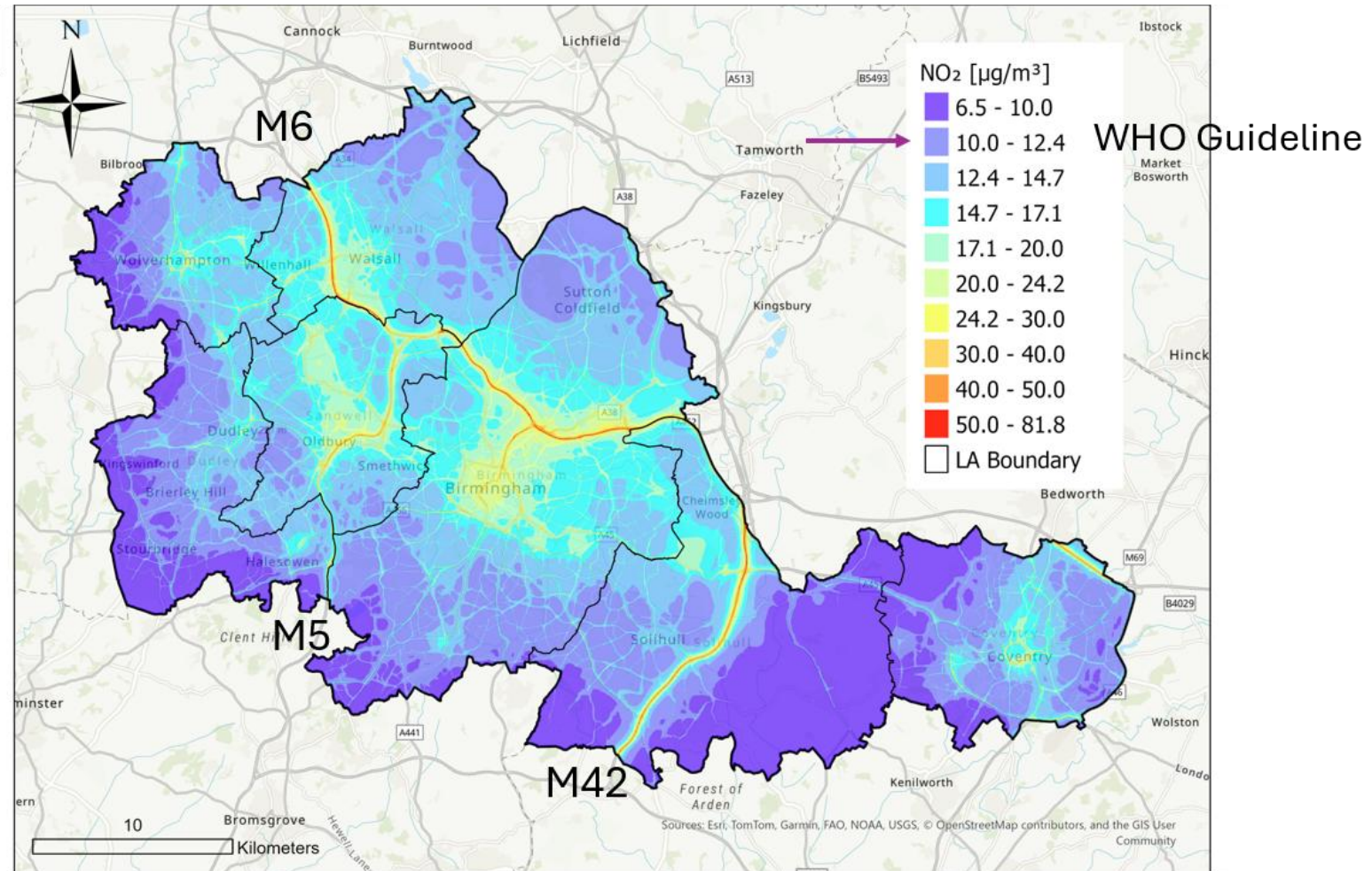
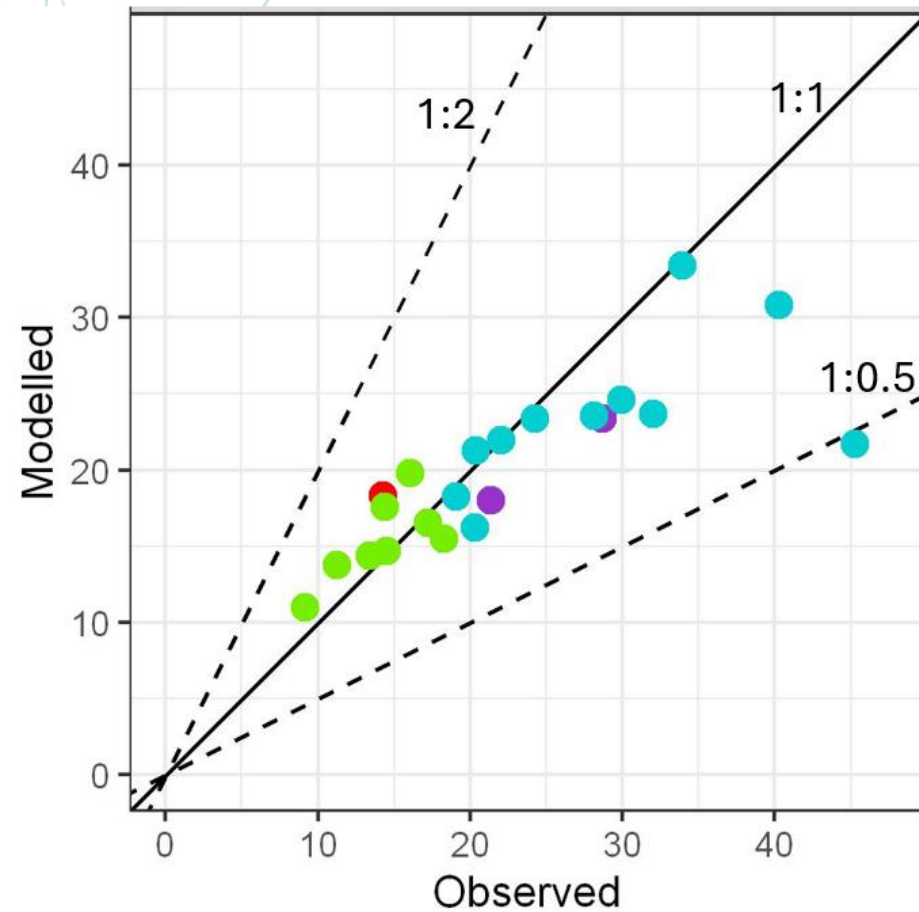
Future 2036:

- Air pollution distributions at 10x10m resolution in 2016

Modelled Nitrogen Dioxide in 2024

WM-NET ZERO

WM 2024 NO₂ (µg/m³)

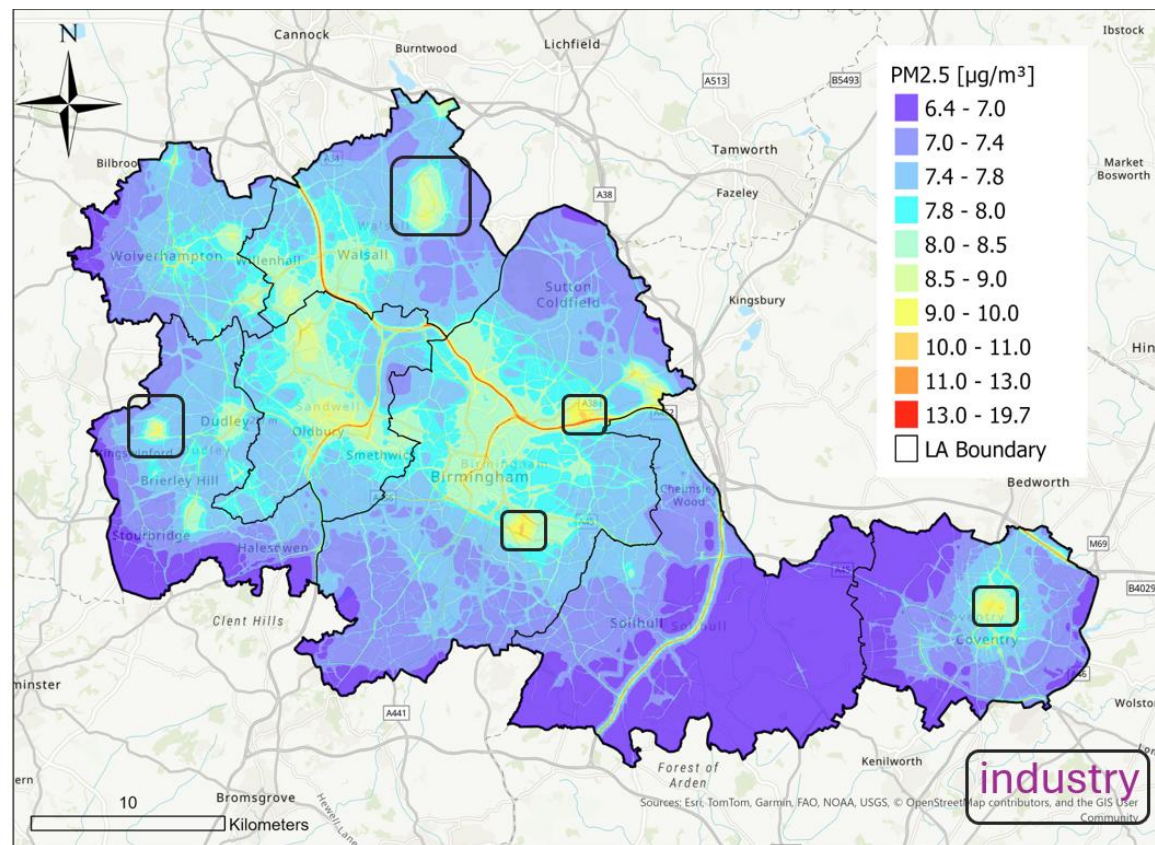
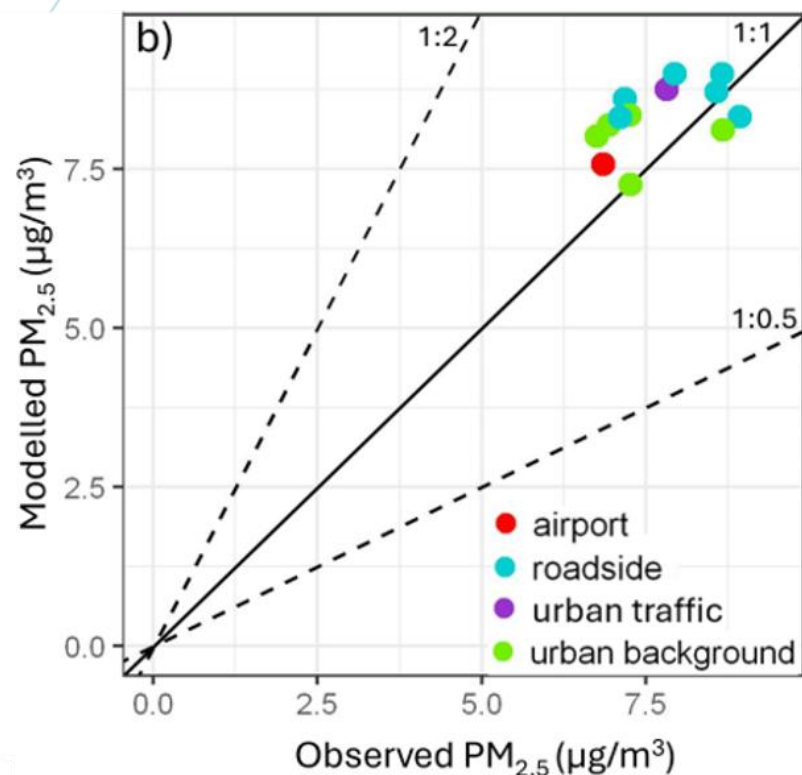


NO₂ is strongly shaped by traffic. The highest concentrations occur around Birmingham and the M6, M5 and M42 corridors

Modelled PM_{2.5} in 2024

WM-NET ZERO

WM 2024 PM_{2.5} (µg/m³)

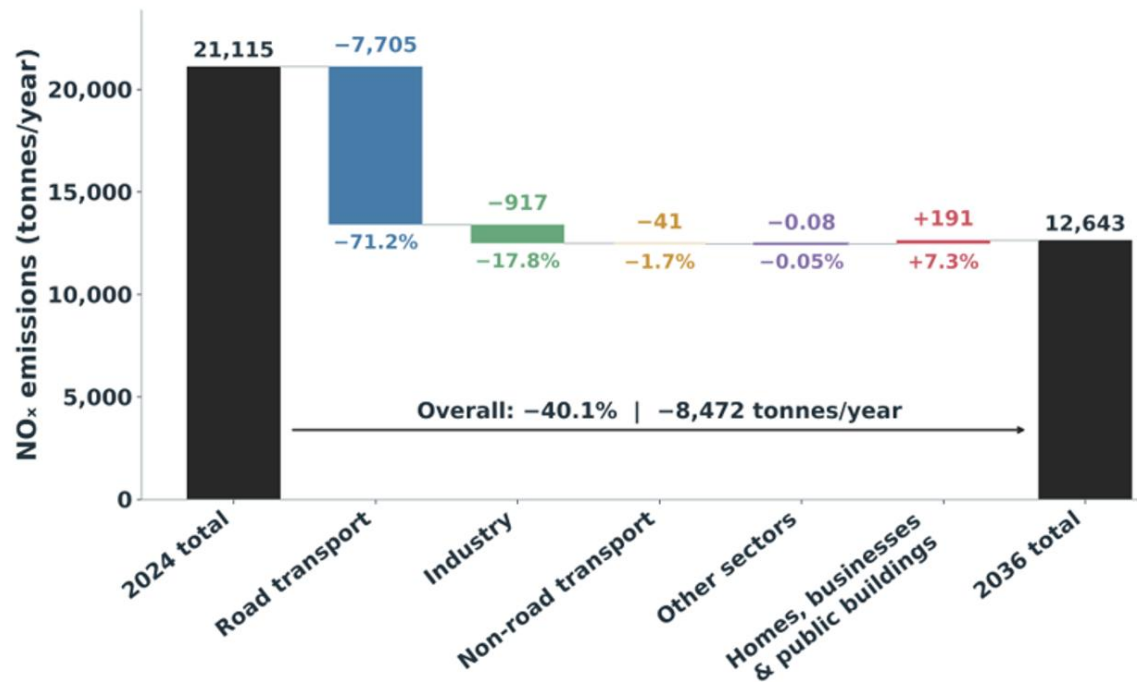


PM_{2.5} is less tied to individual roads than NO₂ because it comes from multiple sources and can travel over wider areas.

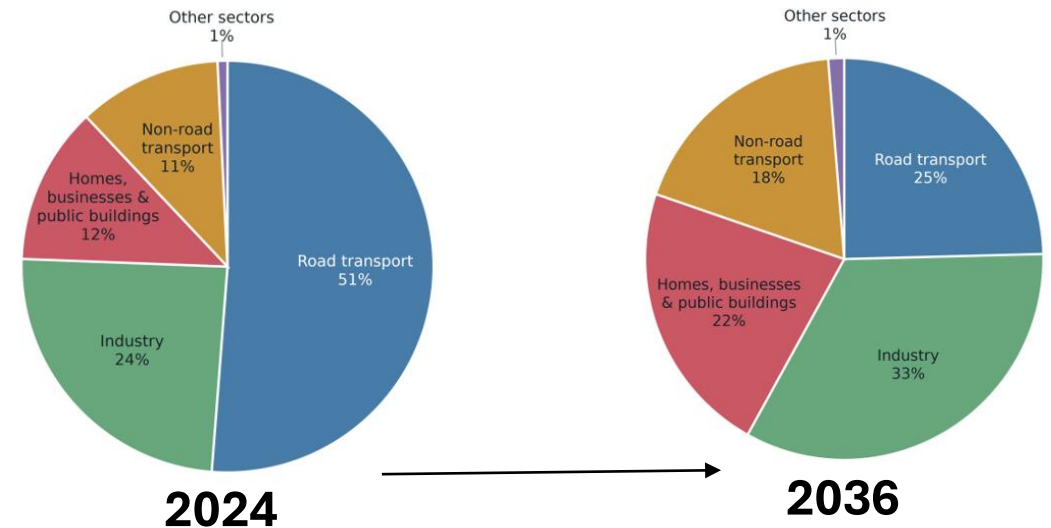
Updating NO_x Emissions from 2024 to 2036

WM-NET ZERO

2024 NO_x emissions updated by sector to represent 2036 levels



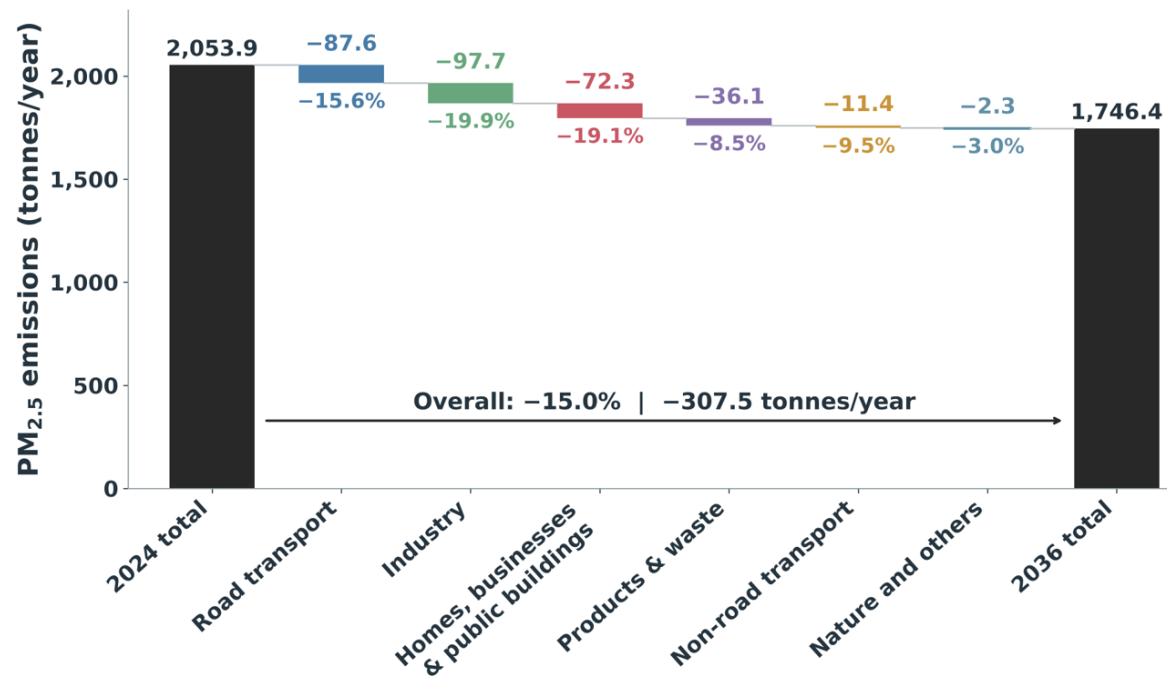
NO_x emissions by sector



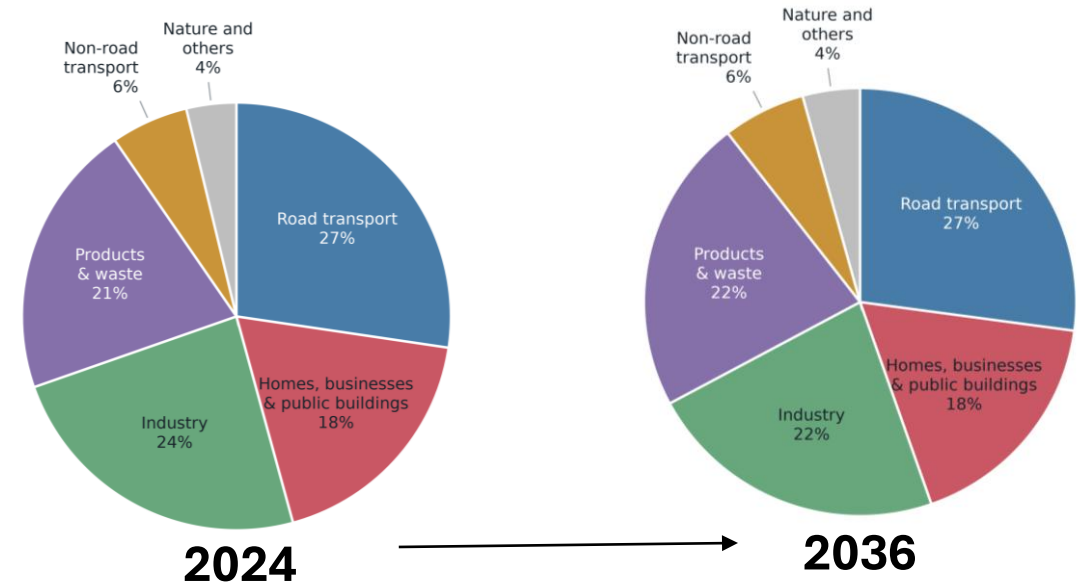
Updating PM_{2.5} Emissions from 2024 to 2036

WM-NET ZERO

2024 PM_{2.5} emissions updated by sector to represent 2036 levels



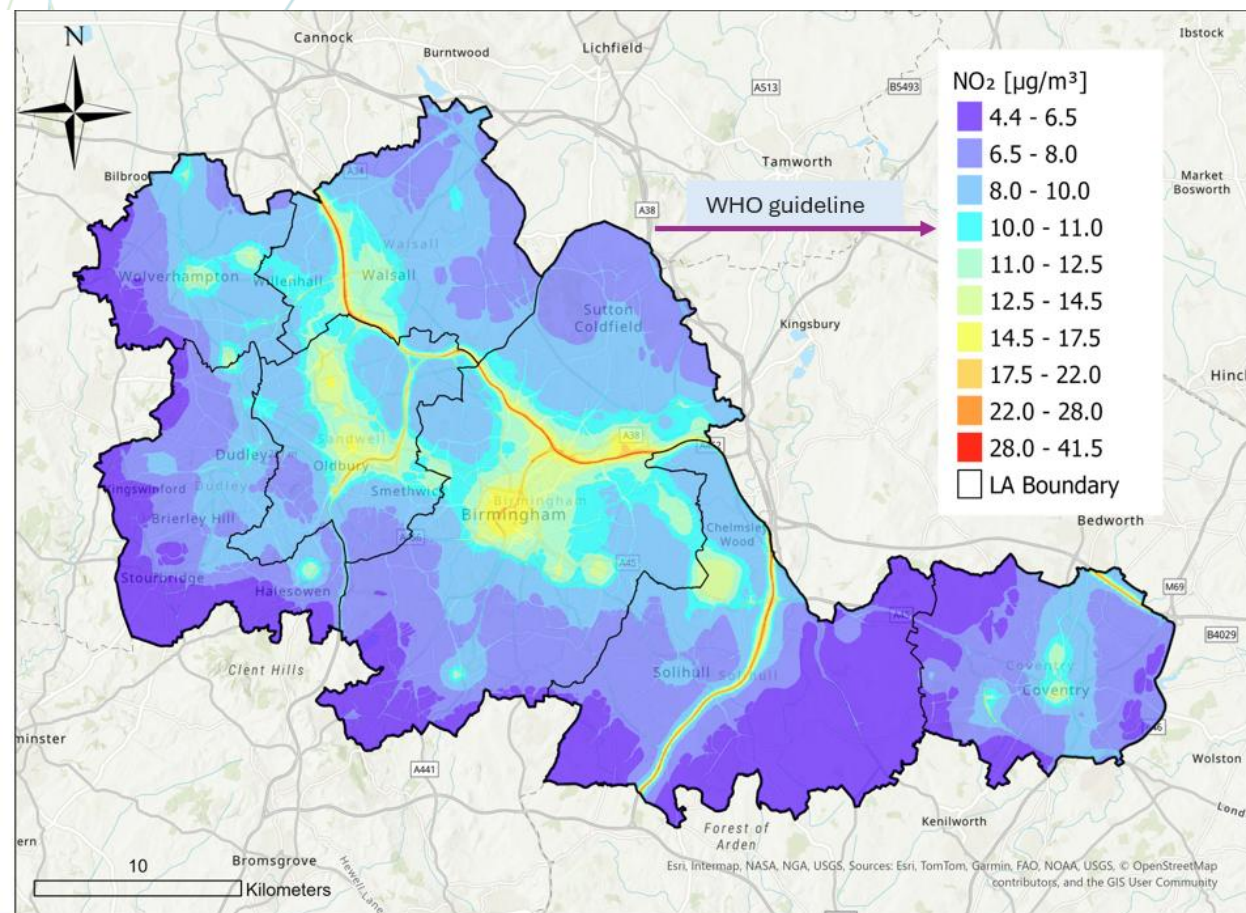
PM_{2.5} emissions by sector



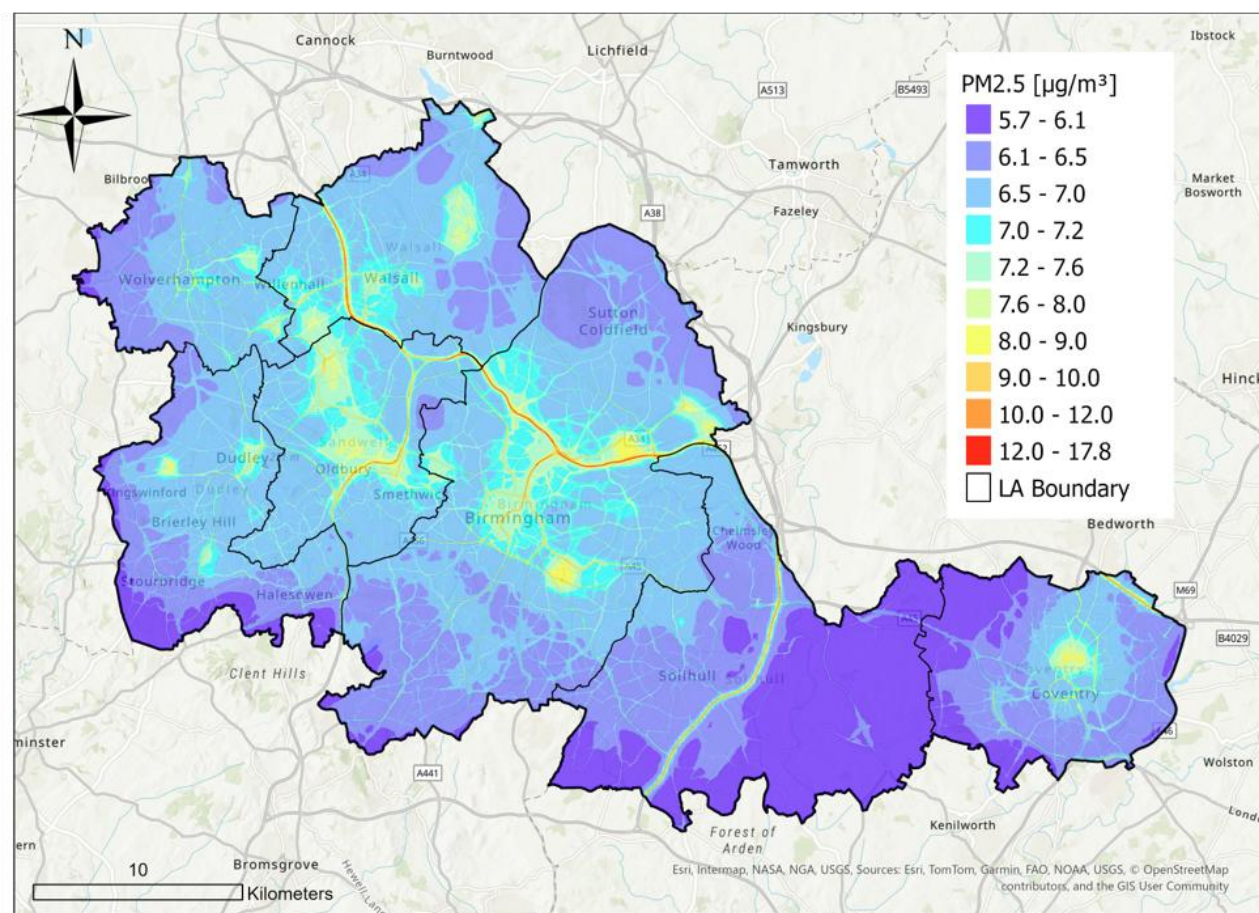
2036 annual average NO₂ and PM_{2.5}

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NO₂ in 2036



PM_{2.5} in 2036



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Key Insights

1. NO₂ is concentrated **near major roads**, while PM_{2.5} is more **evenly distributed** across the region.
2. Reducing air pollution from **road transport** is key to **improving local air quality** – notably NO₂. **Heating and industry** are important PM_{2.5} sources.
3. Achieving cleaner air requires **coordinated action on transport, heating and solid-fuel burning**.

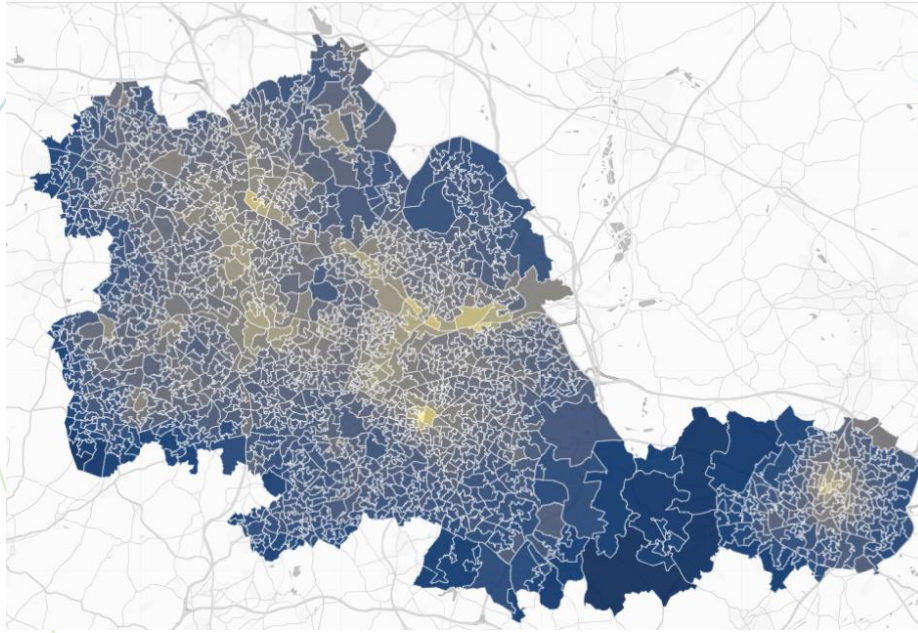


ENVIRONMENTAL RISKS TO HEALTH IN THE WEST MIDLANDS

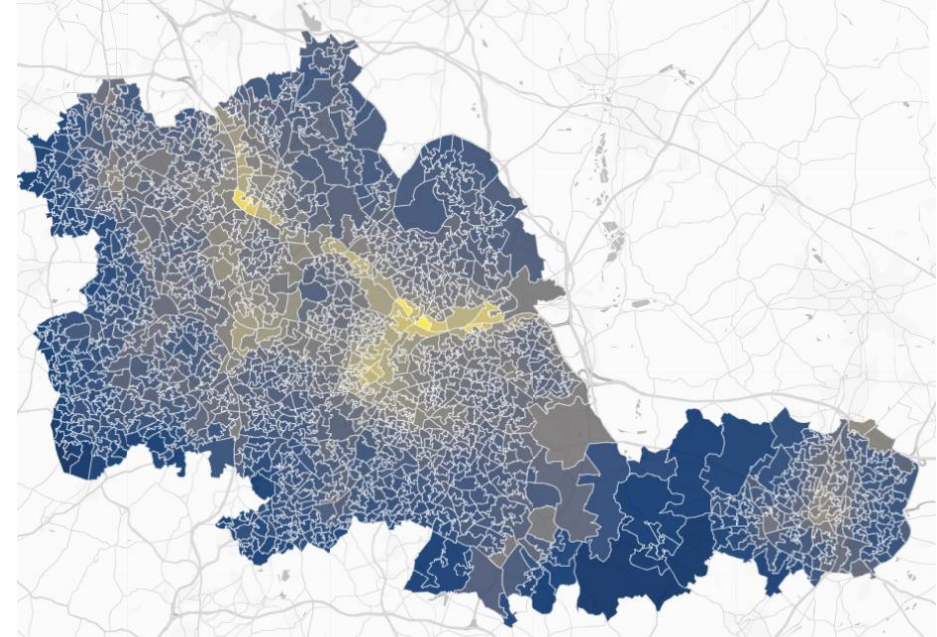
Suzanne Bartington

Air pollution in the West Midlands (2024)

WM-NET ZERO



Annual average $\text{PM}_{2.5}$ = **$8 \mu\text{g}/\text{m}^3$**
WHO Guideline = **$5 \mu\text{g}/\text{m}^3$**

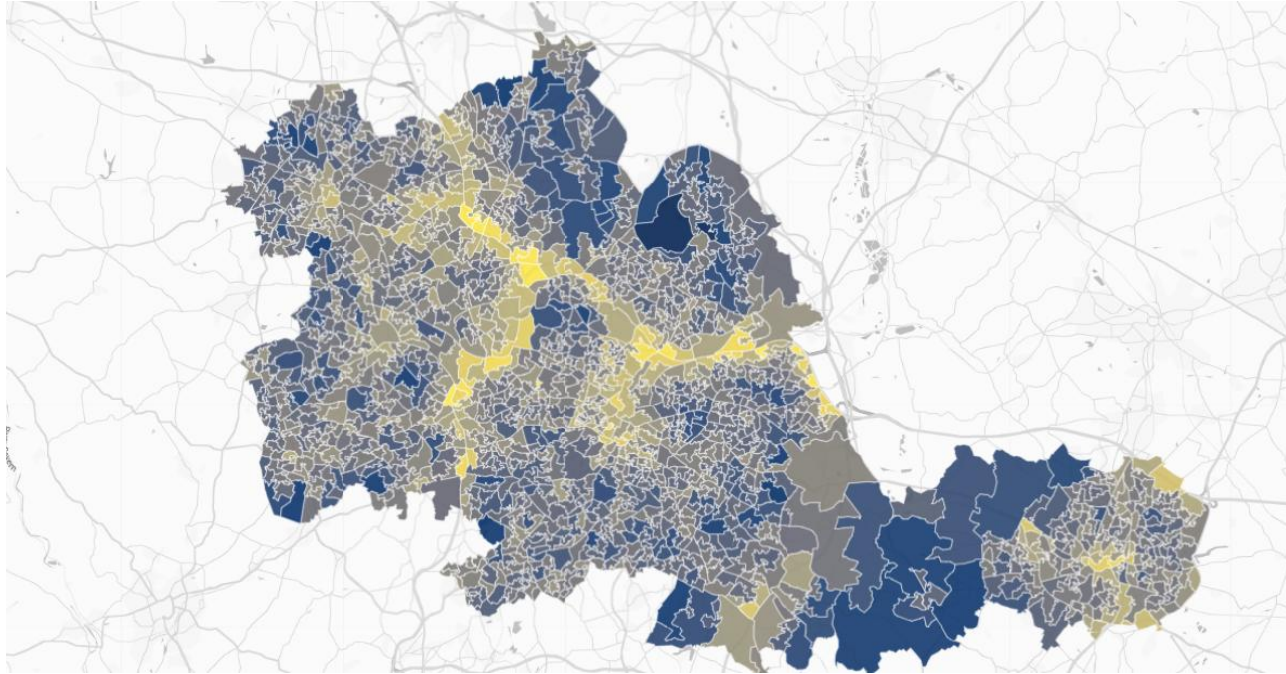


Annual average NO_2 = **$14 \mu\text{g}/\text{m}^3$**
WHO Guideline = **$10 \mu\text{g}/\text{m}^3$**

Everyone experiences harmful levels of air pollution which causes asthma, heart disease, stroke and early death.

Noise pollution in 2024

WM-NET ZERO

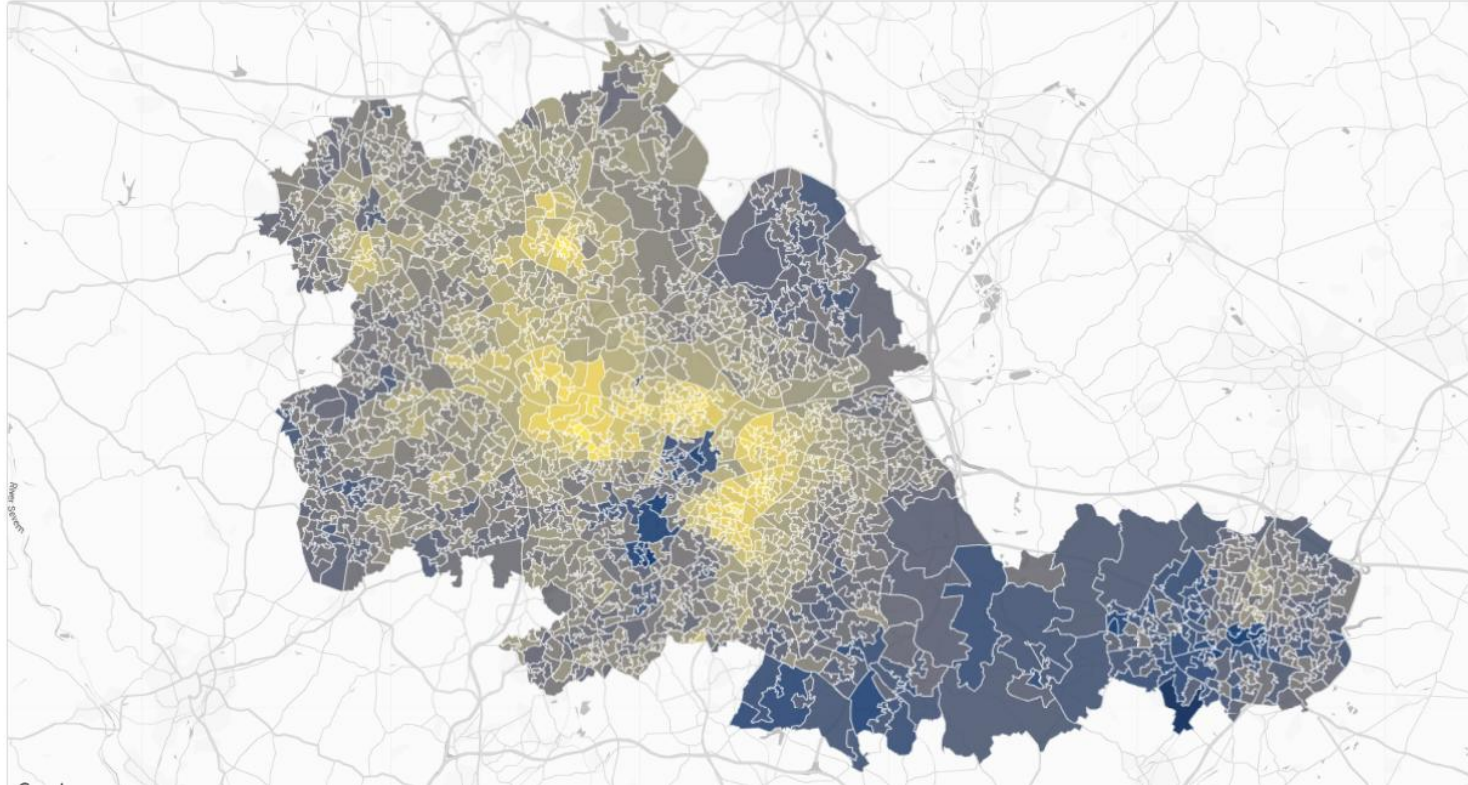


Annual Average Road Traffic Noise = **51 dB L_{den}**
WHO Health Guideline = **53 dB L_{den}**

1 in 4 people experience harmful road noise which causes heart disease, stroke and Type 2 diabetes.

Physical Inactivity in 2024

WM-NET ZERO



1 in 3 adults are physically inactive which causes early death.

Environmental risks for early death (2024)

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1000 early deaths



1600 early deaths

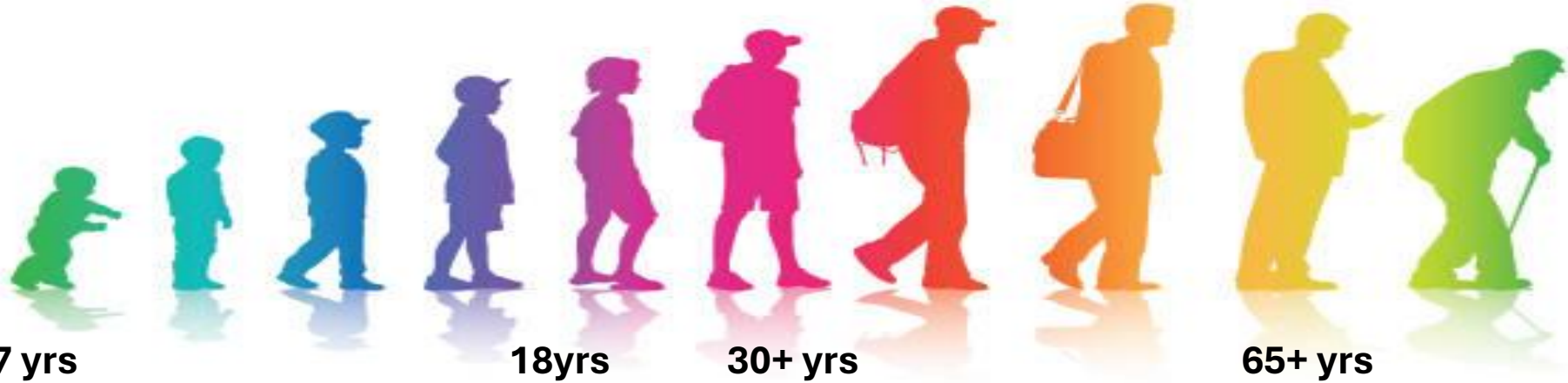


2700 early deaths

**Over 5000 early
deaths due to
environmental
risks**

Environmental risks for disease (2024)

WM-NFT 7FRO



800 asthma cases



600 asthma cases



- 400 first strokes
- 400 heart disease cases

800 dementia cases

- 100 first strokes
- 30 heart disease cases
- 300 Type II diabetes cases



ROAD TRANSPORT AND HEALTH

Ye Hang

Road Transport – Scenarios (2036)

WM-NET ZERO

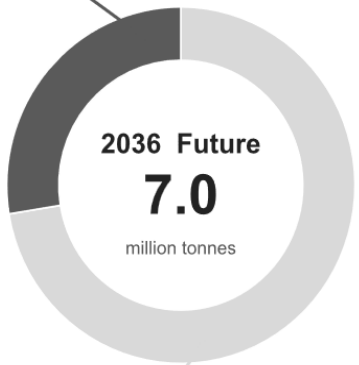
Scenario	Category	Description
2036 Future	-	Road transport follows national projections with no regional action.
2036 GoDutch	SHIFT	Cycling to work equivalent to the Netherlands.
2036 GoDutch-Plus	SHIFT	Cycling equivalent to the Netherlands and more walking.
2036 GoBus	SHIFT	Double bus trips.
2036 GoBus-Plus	SHIFT & IMPROVE	Double bus trips and all electric buses.
2036 GoElectric	IMPROVE	More electric vehicles.
2036 GoElectric-Plus	IMPROVE	All electric vehicles.

Which actions deliver the greatest benefits for climate, air quality and health?

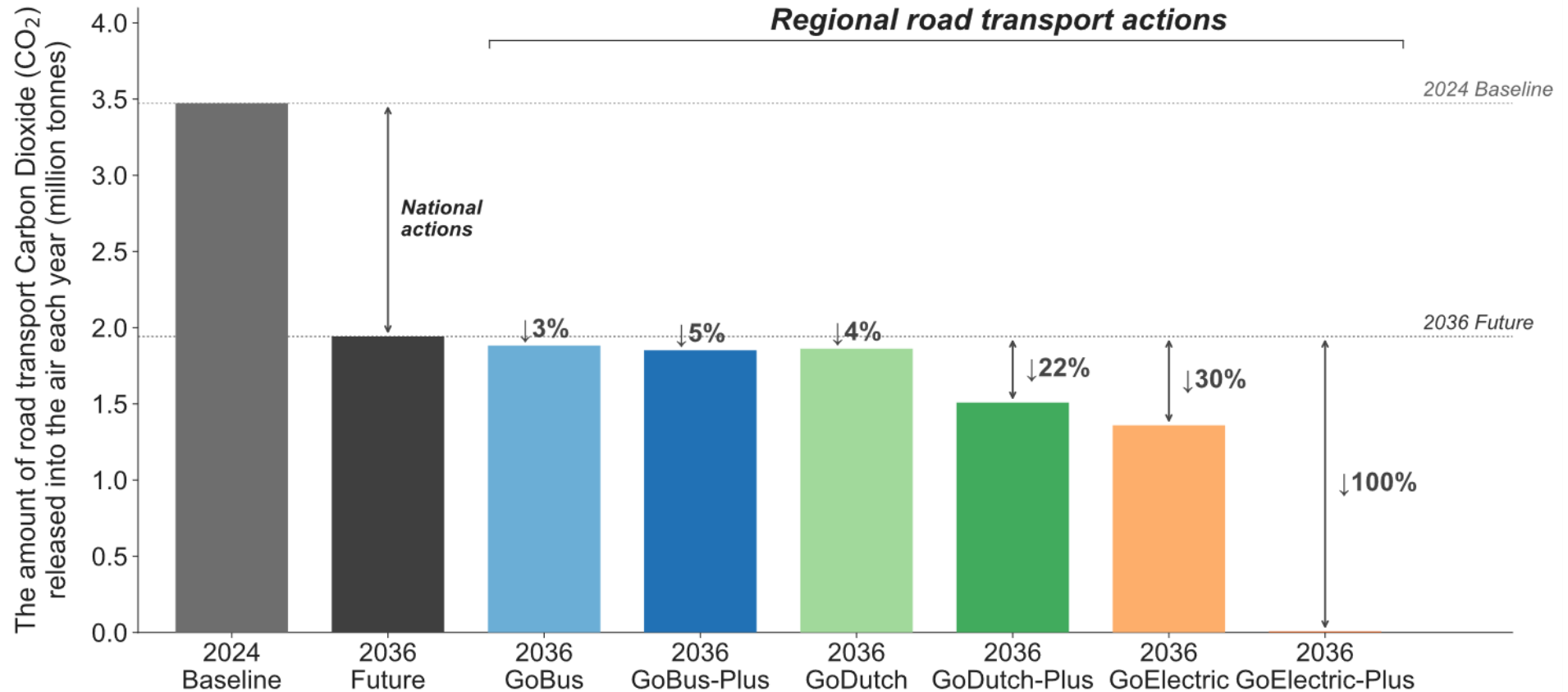
Road Transport – CO₂ Emissions

WM-NET ZERO

Road transport (28%)



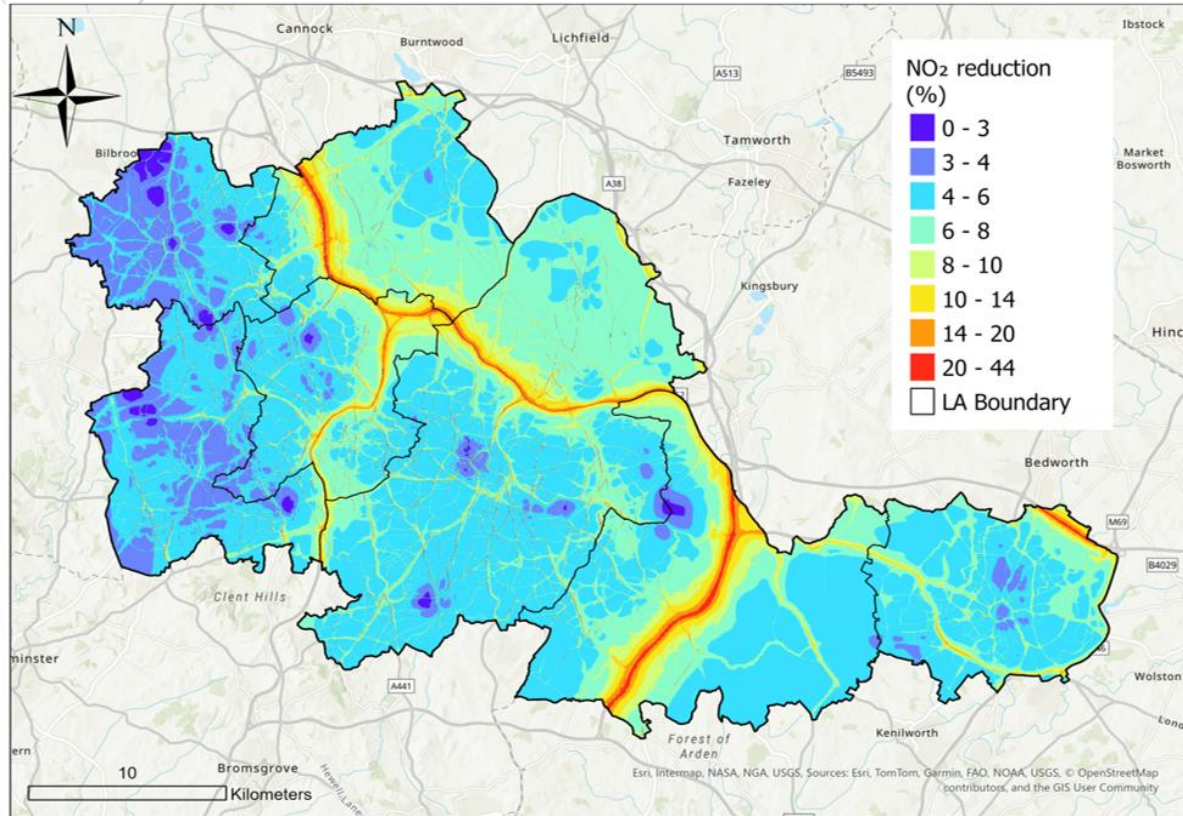
Housing, industry,
business and public
buildings and other (72%)



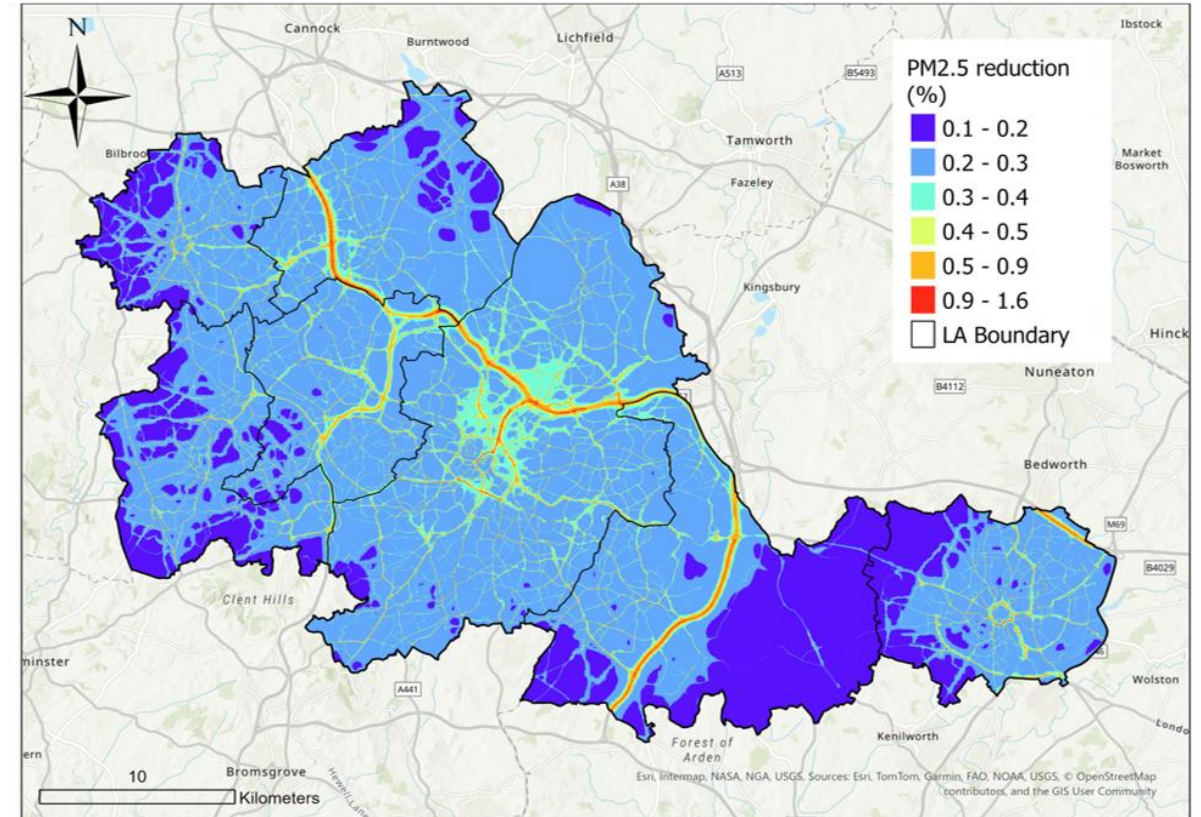
Regional action is still needed: **full vehicle electrification** delivers the largest additional CO₂ reduction.

Example: Air Quality (GoElectric vs 2036 Future) WM-NET ZERO

NO₂ reduction relative to 2036 Future (%)



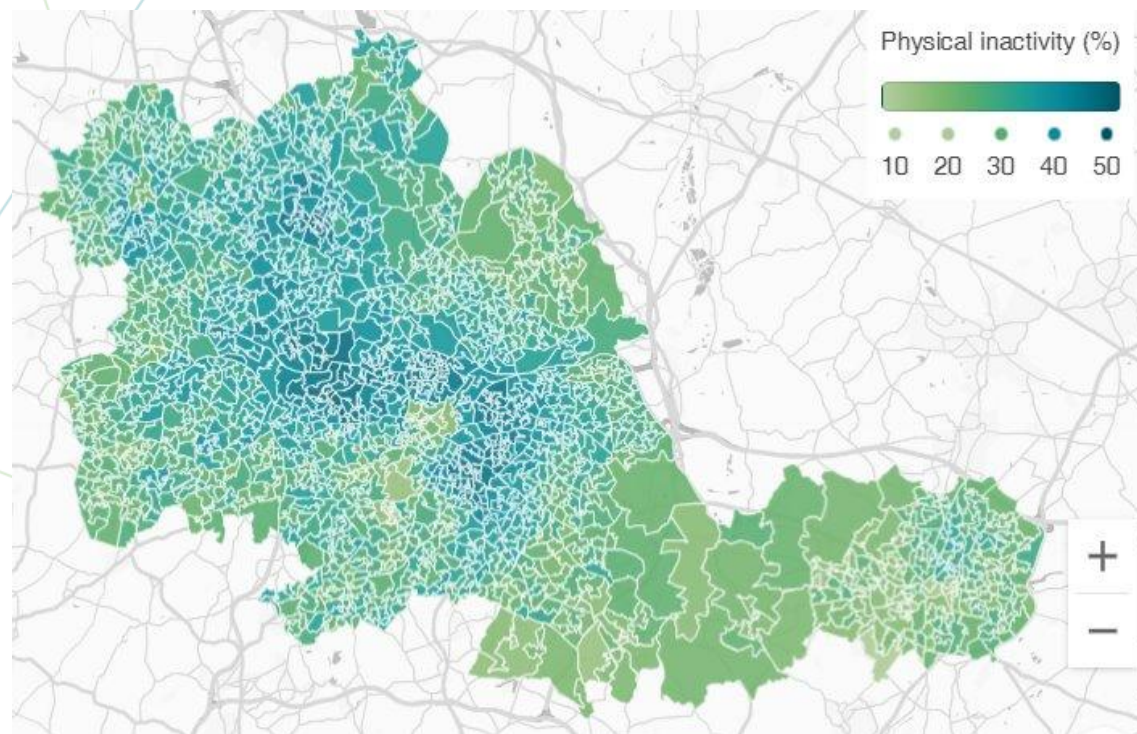
PM_{2.5} reduction relative to 2036 Future (%)



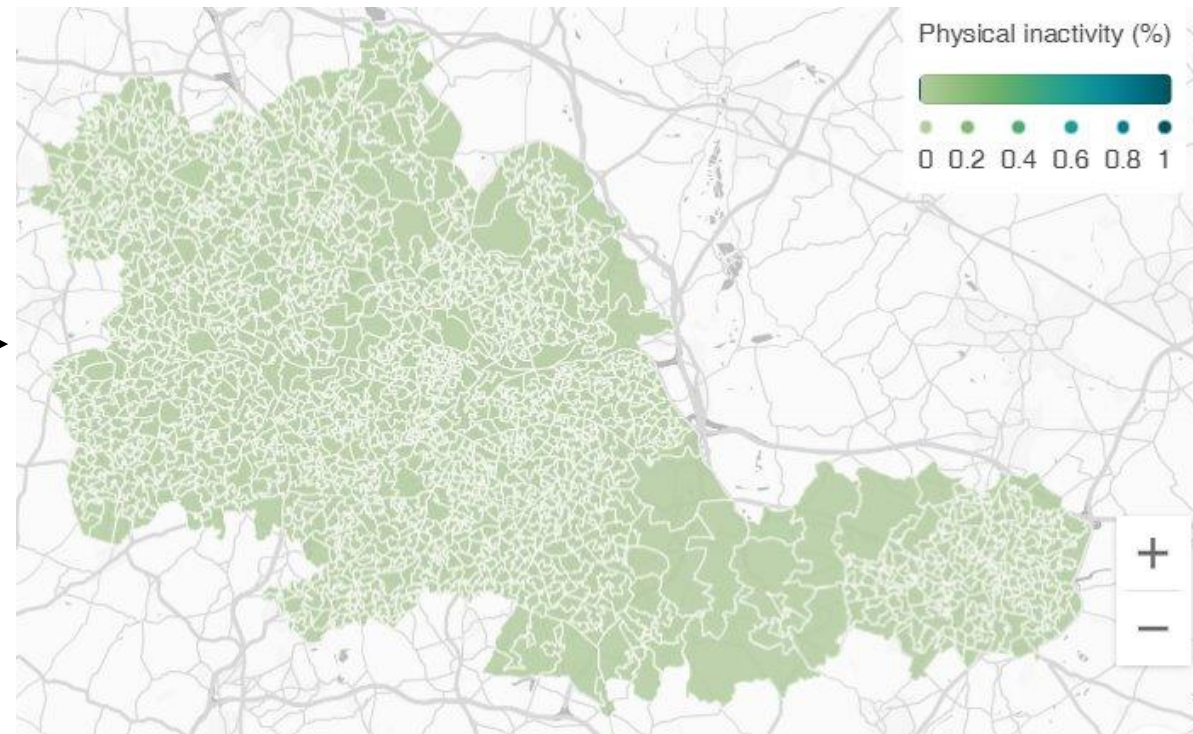
Example: Physical Inactivity

WM-NET ZERO

2036 Future



2036 GoDutch-Plus



Road Transport – Health

WM-NET ZERO

Walking and wheeling so that everyone is physically active will cut 430,000 tonnes CO₂, save 3,500 lives and £3 million health care costs.

“win-win-win”

Regional Actions

Cycling equivalent to Netherlands and more walking

Cycling to work equivalent to Netherlands

All electric vehicles

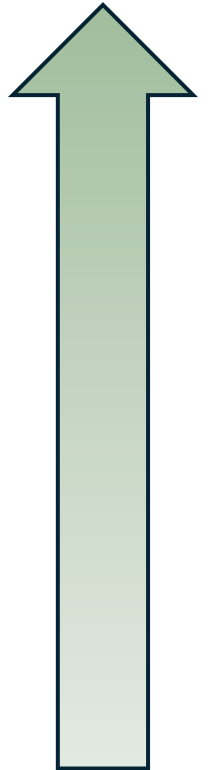
Double bus trips and electrify buses

Double bus trips

More electric vehicles

National Climate Action 2036

Health benefit

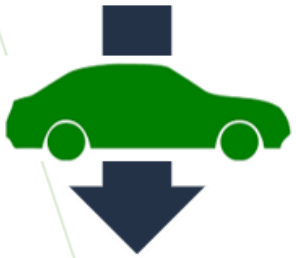


Road Transport – Key Insights

WM-NET ZERO



- Electrification delivers the largest CO₂ and NO₂ reductions.
- Walking and cycling reduce car use and PM_{2.5} emissions.
- Active travel brings the largest health gains.



Walk and cycle more, drive less,
electrify the rest.



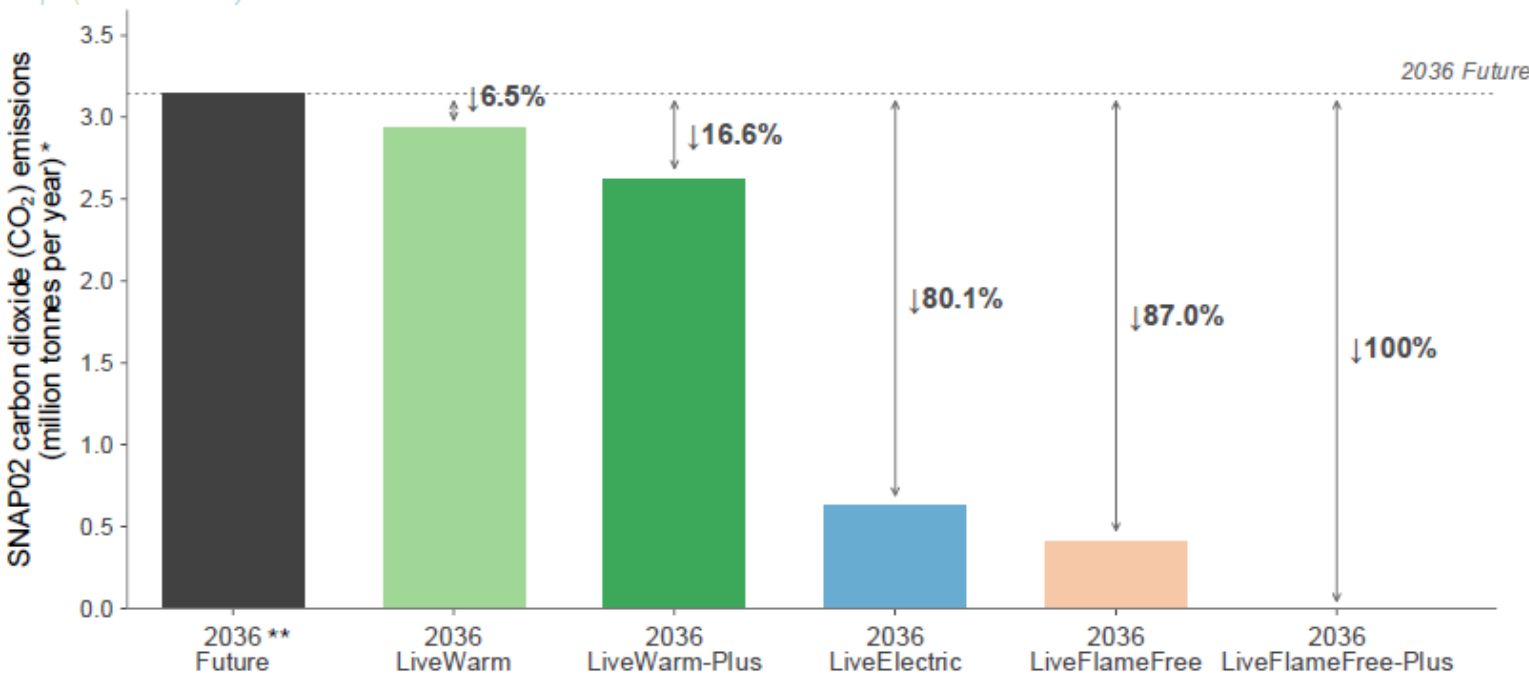
HOUSING AND HEALTH

Joe Day

Housing Scenarios - Introduction

Scenario	Description
2036 Future	More efficient homes
2036 LiveWarm	Insulate older homes
2036 LiveWarm-Plus	Insulate all homes
2036 LiveElectric	Upgrade gas boilers to heat pumps in homes
2036 LiveFlameFree	Clean heating in all homes
2036 LiveFlameFree-Plus	Clean heating in all homes, businesses and civic buildings

Housing Scenarios – Emissions Results



	NO ₂	PM _{2.5}
2036 LiveWarm	3.0%	0.3%
2036 LiveWarm-Plus	7.5%	0.8%
2036 LiveElectric	36.1%	4.0%
2036 LiveFlameFree	40.6%	75.5%
2036 LiveFlameFree-Plus	100.0%	100.0%

Emission reduction relative to 2036 Future (%)

* SNAP02 refers here to residential and commercial/institutional combustion;

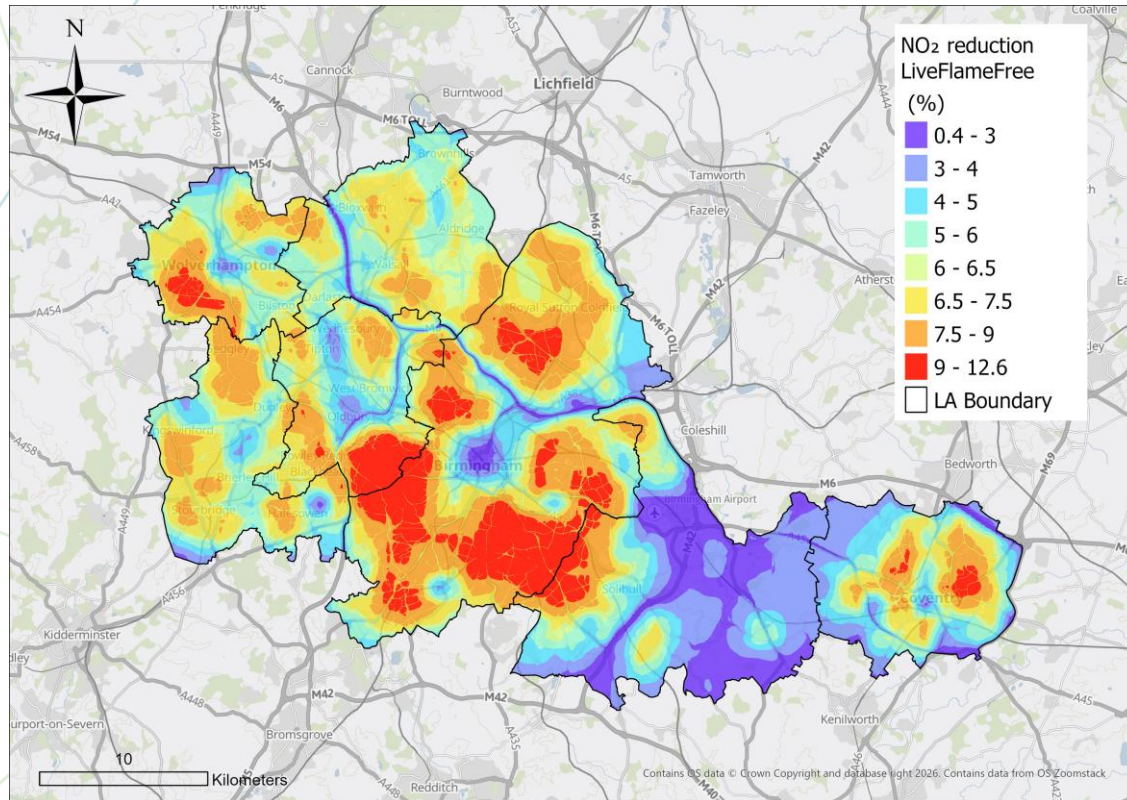
** The 2036 Future SNAP02 projection uses more disaggregated sector-specific scaling factors than road transport scenarios, and housing CO₂ additionally includes residential wood-burning emissions.

- Heat electrification reduces NO₂ more than PM_{2.5}

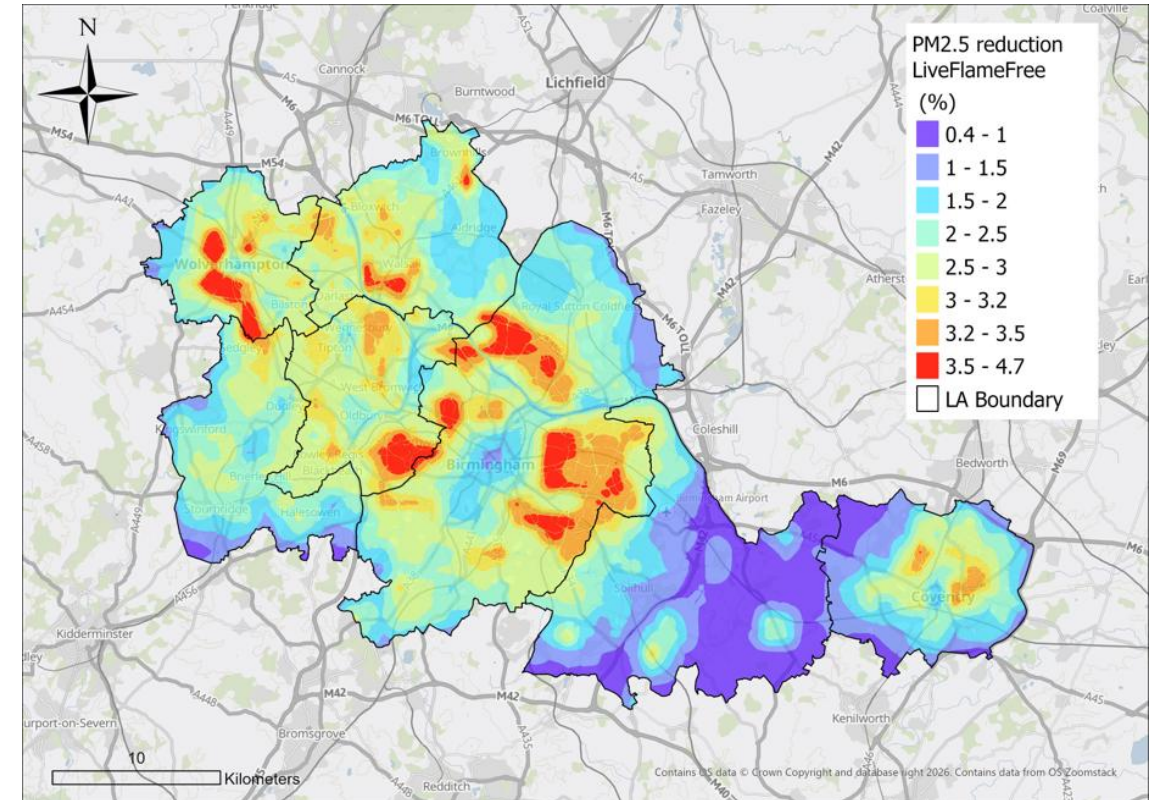
Example: Air Quality (LiveFlameFree vs 2036 Future)

WM-NET ZERO

NO₂ reduction relative to 2036 Future (%)



PM_{2.5} reduction relative to 2036 Future (%)



Housing Scenarios – Health Results

Scenario	Lives Saved vs. 2036 Future	Health Care Costs Saved vs. 2036 Future
2036 LiveWarm	No detected change	No detected change
2036 LiveWarm-Plus	6	No detected change
2036 LiveElectric	45	£0.1 m
2036 LiveFlameFree	95	£4.1 m
2036 LiveFlameFree-Plus	190	£6.6 m

- These numbers are for outdoor air quality (PM_{2.5} and NO₂) exposure pathways only
- FlameFree scenarios have greater health savings as more PM_{2.5} associated morbidities

Housing Scenarios – AQ Health Summary

WM-NET ZERO

Clean heating in all buildings will cut 2.9 million tonnes CO₂, save 190 lives and £6.6 million health care costs.

“win-win”

Regional Actions

Clean heating in all homes, businesses and civic buildings

Clean heating in all homes

Upgrade gas boilers to heat pumps in homes

Insulate all homes

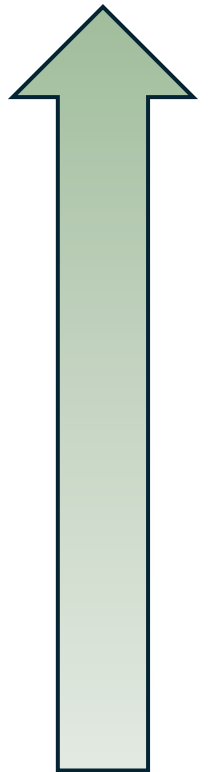
Insulate older homes

More efficient homes

2036

National Climate Action

Outdoor AQ health benefits



Housing and Health – Key Insights

WM-NET ZERO

1. Insulation alone offers limited carbon and outdoor air quality benefits.
2. Heat pumps reduce carbon and air pollution, but people may still struggle to keep homes warm in winter.
3. Insulating homes, installing heat pumps and stopping wood burning will deliver even greater health gains.



**Remove gas boilers, use clean heating,
stop burning wood**



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BIRMINGHAM

WM-NET ZERO

A Health-centred Systems Approach Towards Net-Zero:
Transforming Regional Climate Mitigation Policies

Q & A



UNIVERSITY
of York



UNIVERSITY OF
SURREY



West Midlands
Combined Authority



Sandwell
Metropolitan Borough Council



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OF SUSSEX



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Department
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Food & Rural Affairs

UK:
100

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TEA & COFFEE BREAK

SESSION 2: OUTPUTS AND ACHIEVEMENTS TO-DATE



OVERVIEW: OUTPUTS, OUTCOMES & CASE STUDIES

Suzanne Bartington

WM-Net Zero Outputs

WM-NET ZERO

We have produced:

- Research papers
- Briefing notes
- Datasets
- Toolkits
- Infographics
- Webinars

Article

Delivering 'Thriving Net Zero Communities in the West Midlands'—Insights from a Participatory Systems Mapping Process for Local Authorities

Naomi Bennett-Steele ^{1,*}, Sophie Morris ², Sarah J. Moller ³, James Hall ⁴, Jenny Stocker ⁵, Xinfang Wang ⁶, Suzanne Bartington ⁴, Zongbo Shi ⁷ and Alexandra Penn ^{1,*}

Enhancing Accuracy of Indoor Air Quality Sensors via Automated Machine Learning Calibration

Juncheng Qian¹, Thomas Wynn¹, Bowen Liu², Yuli Shan¹, Suzanne E. Bartington³, Francis D. Pope¹, Yuqing Dai¹, and Zongbo Shi¹

Indoor Air
Article ID 3883472

[Supplementary Materials](#)

Review Article

Impacts of Housing Retrofits on Indoor Environmental Quality and Energy Consumption: A Review

Juncheng Qian ¹, Yuqing Dai ¹, Suzanne E. Bartington ², Aleksandra Čavoški ³, Chee Yap Chung ¹, Omid Ghaffarpasand ¹, Catherine L. Muller ¹, Emily Prestwood ⁴, Chengxu Tong ¹, Xinfang Wang ⁵, Yuli Shan ¹, Bowen Liu ⁶ and Zongbo Shi ¹

Environment International

Date: February 2026

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Full length article

Air quality and health co-benefits of bus electrification: evidence from a UK metropolitan area

Jian Zhong ^{a b}, Tanmay Gojamgunde ^b, James Hall ^c, Ye Hang ^b, Suzanne E. Bartington ^c, Jenny Stocker ^d, William James Bloss ^b, Zongbo Shi ^b [Show more](#) ▼

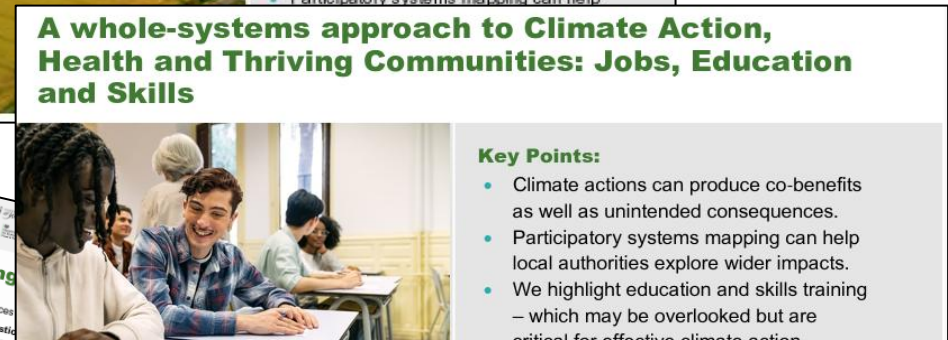
WM-Net Zero Outputs

We have produced:

- Research papers
- Briefing notes
- Datasets
- Toolkits & Guidance
- Infographics
- Webinars



WM-NET ZERO



WM-Net Zero Outputs

WM-NET ZERO

We have produced:

- Research papers
- **Briefing notes**
- Datasets
- Toolkits & Guidance
- Infographics
- Webinars

Planned briefing notes:

- *Introducing the Climate Health Explorer*
- *Clean Air Zones – a missed opportunity for climate action?*
- *Decarbonising transport in the West Midlands*
- *Decarbonising housing in the West Midlands*
- *Governing the net-zero transition: key learning from the West Midlands*
- *Aligning climate mitigation with adaptation and*
- *District heat networks – how do we maximise health gains?*

WM-Net Zero Outputs

WM-NET ZERO

We have produced:

- Research papers
- Briefing notes
- **Datasets**
- Toolkits & Guidance
- Infographics
- Webinars

Open access datasets

- **CO₂ emissions datasets** (baseline and future projections)
- **Transport activity datasets** (vehicle telematics, traffic activity)
- **Air quality datasets** (high resolution modelling)
- **Housing and energy datasets** (housing characteristics, retrofit)
- **Population and health datasets** (demographic/epidemiological data)
- **Health and social care cost datasets** (monetise co-benefits)
- **Indoor environmental monitoring datasets** (temperature, AQ, humidity)
- **Participatory systems mapping datasets** (qualitative data, systems maps)
-

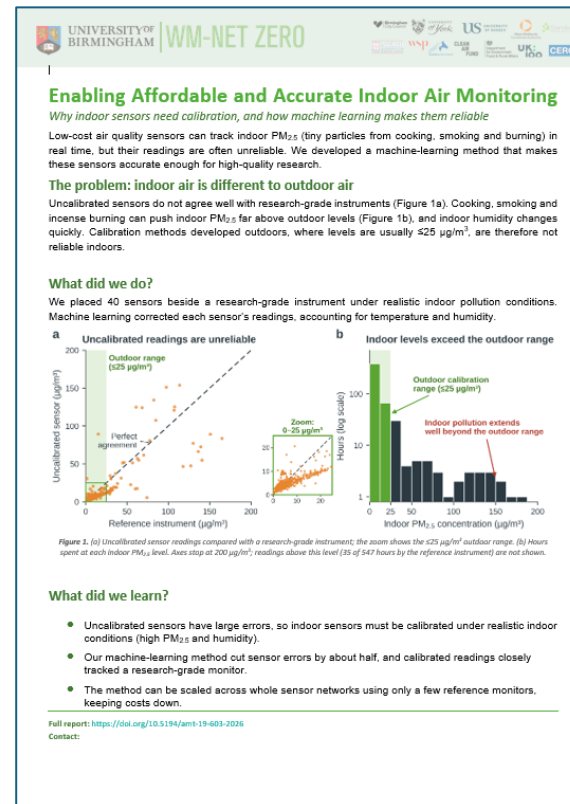
WM-Net Zero Outputs

WM-NET ZERO

We have produced:

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- Webinars

www.climatehealth-explorer.org.uk



Participatory Systems Mapping in Local Government

Tips for designing and facilitating a participatory systems mapping process

WM-Net Zero Outputs

WM-NET ZERO

We have produced:

- Research papers
- Briefing notes
- Datasets
- Toolkits
- Infographics
- Webinars



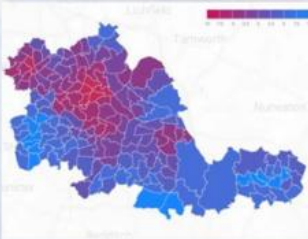
Figure 1: Health impacts of air pollution in Birmingham (2024)

Webinars

WM-Net Zero &  present

West Midlands Climate-Health Explorer

Evidence | Insight | Action



Webinar Launch

Explore how climate action affects health and economic outcomes using regional data.

 **4 June, 10:00–11:30 BST,**

Register here: 

WM-NET ZERO

Decarbonising transport in the West Midlands: win-win-wins for carbon, air quality, and health?

12:30 – 13:15 8th July 2026

Online, free, and open to all



Institute of
Air Quality
Management

The Institution
of Environmental
Sciences



UK:
100 | WM-NET ZERO

LUNCHTIME LEARNING: A BREATH OF FRESH AIR FOR DOMESTIC RETROFIT

Thursday 2 July | 12:00 | Online



SPEAKER

Abi Brown
Housing England



SPEAKER

Professor Rajat Gupta
Oxford Brookes University



SPEAKER

Helen Langley
Dudley Council

WM-Net Zero Quarterly Lunchtime Webinar Series (12:00-13:00)

- 5th November 2026
- 4th February 2027
- 6th May 2027
- 16th September 2027



Carlo Luiu



Suzanne Bartington



Sophie Morris
(Sandwell Council)

BRIEFING NOTES: KEY INSIGHTS

Briefing Note No. 1 Reducing health risks of gas cooking

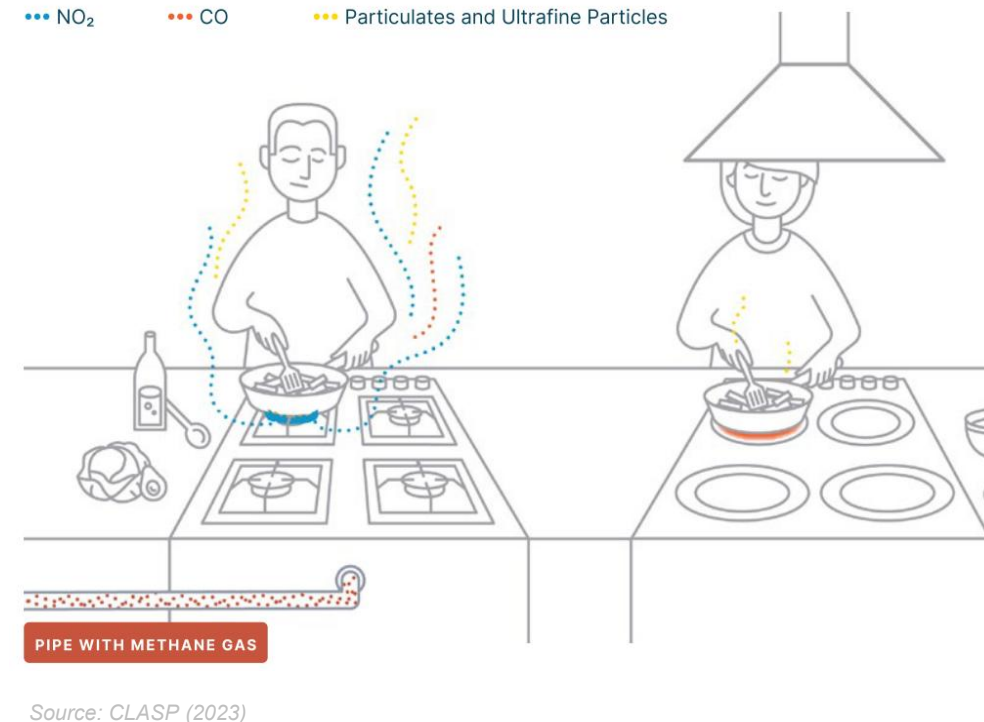
WM-NET ZERO

Gas cooking releases Nitrogen Dioxide (NO₂) – levels in kitchens can exceed outdoor levels and health-based guidelines

People spend 90% of their lives indoors - NO₂ pollution also increases risk of asthma and other heart and lung conditions

What can be done to reduce health harms of gas cooking?

- **Replace gas hobs** with electric or induction alternatives (avoid)
- **Improve ventilation**, where replacement is not possible (reduce)
- **Reduce exposure in kitchens**, particularly among vulnerable people (offset)



Briefing Note No. 2 Accelerating home energy retrofit uptake: actions to overcome social factors

WM-NET ZERO

What stops people from engaging with retrofit schemes, and the actions local leaders can take to change that

Frame it right — non-technical language and wider benefits (warmth, bills, health) can make retrofit more appealing

Work around people's lives — early, tailored engagement that accounts for household routines and vulnerabilities can reduce disruption and barriers to participation

Show, don't just tell — demonstrations and show homes can build trust in unfamiliar technologies

Let communities lead — partnering with local organisations, champions and co-designing with residents can increase trust, confidence and uptake



Image © Yuqing Dai (2025)

Briefing Note No.3: Air Quality and Health in Birmingham

Air pollution is the biggest environmental threat to people living in Birmingham.

In 2024 fine particulate pollution caused up to 740 early deaths and nitrogen dioxide up to 600 early deaths among those living in Birmingham.*

The people hit hardest are often those who contribute the least to the problem.

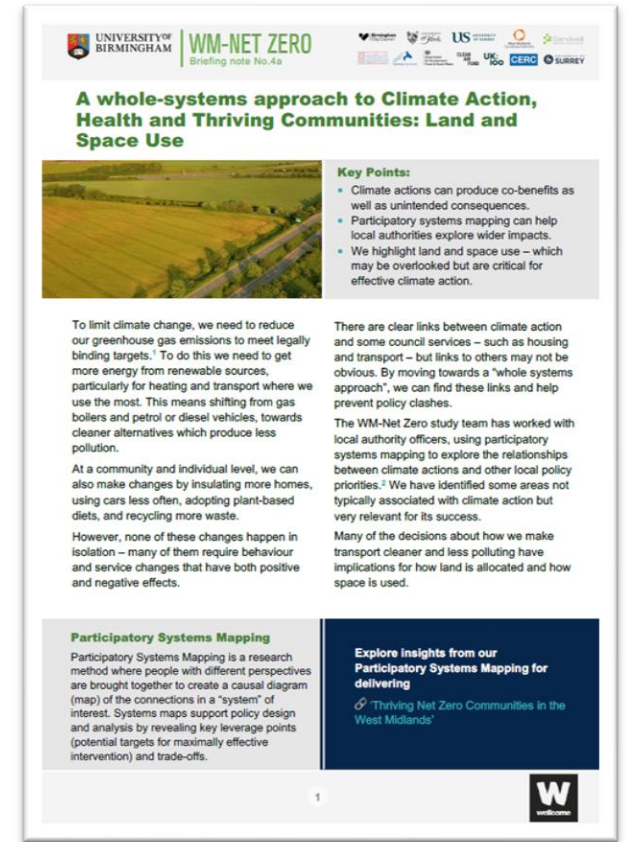
- **Replacing fossil fuel powered transport** with cleaner alternatives
- **Reducing car use and** encouraging more walking, cycling, and use of public transport.
- **Replacing gas boilers** in homes and businesses with cleaner alternatives
- Helping **people to understand air pollution** and local solutions
- Helping **people to change behaviour** and improve air quality in their homes.
- **Working jointly across portfolios** to protect vulnerable people and reduce inequalities.
- **Working jointly with the WMCA** to support regional action



Briefing Note 4a: A whole-systems approach to Climate Action, Health and Thriving Communities: Land and Space Use

WM-NET ZERO

- Climate action shapes how we use our streets, neighbourhoods and public spaces
 - Transport decisions affect land use, community safety and access to nature, which then in turn impacts health
 - Walking, cycling and wheeling can reduce emissions while improving health and wellbeing
 - Well-designed public spaces connected by active and public transport can help create thriving communities
- Relevant statutory areas: Community safety, Highways, Parks



Briefing Note 4b: A whole-systems approach to Climate Action, Health and Thriving Communities: Jobs, Education and Skills

WM-NET ZERO

- A successful net zero transition depends on people having the skills and opportunities to participate
 - Climate investment can create new employment opportunities across multiple sectors
 - Access to training, education and transport is critical for ensuring that communities benefit
 - A "just transition" can support workers and communities affected by industrial change
- Relevant statutory areas: Economic Growth, Education, Adult Skills

Briefing Note 4c: A whole-systems approach to Climate Action, Health and Thriving Communities: Outdoor Air Quality

WM-NET ZERO

- Many climate actions improve air quality, but wider system impacts need to be considered
 - Electric vehicles reduce tailpipe emissions but do not eliminate all sources of air pollution
 - Reducing car dependency through active travel can improve both environmental and health outcomes
 - Air quality should be considered alongside transport, environmental health and waste policies
- Relevant statutory areas: Highways, Environment Health/Health Protection, Public Health, Waste Management

Participatory Systems Mapping Guide for Local Authorities

WM-NET ZERO





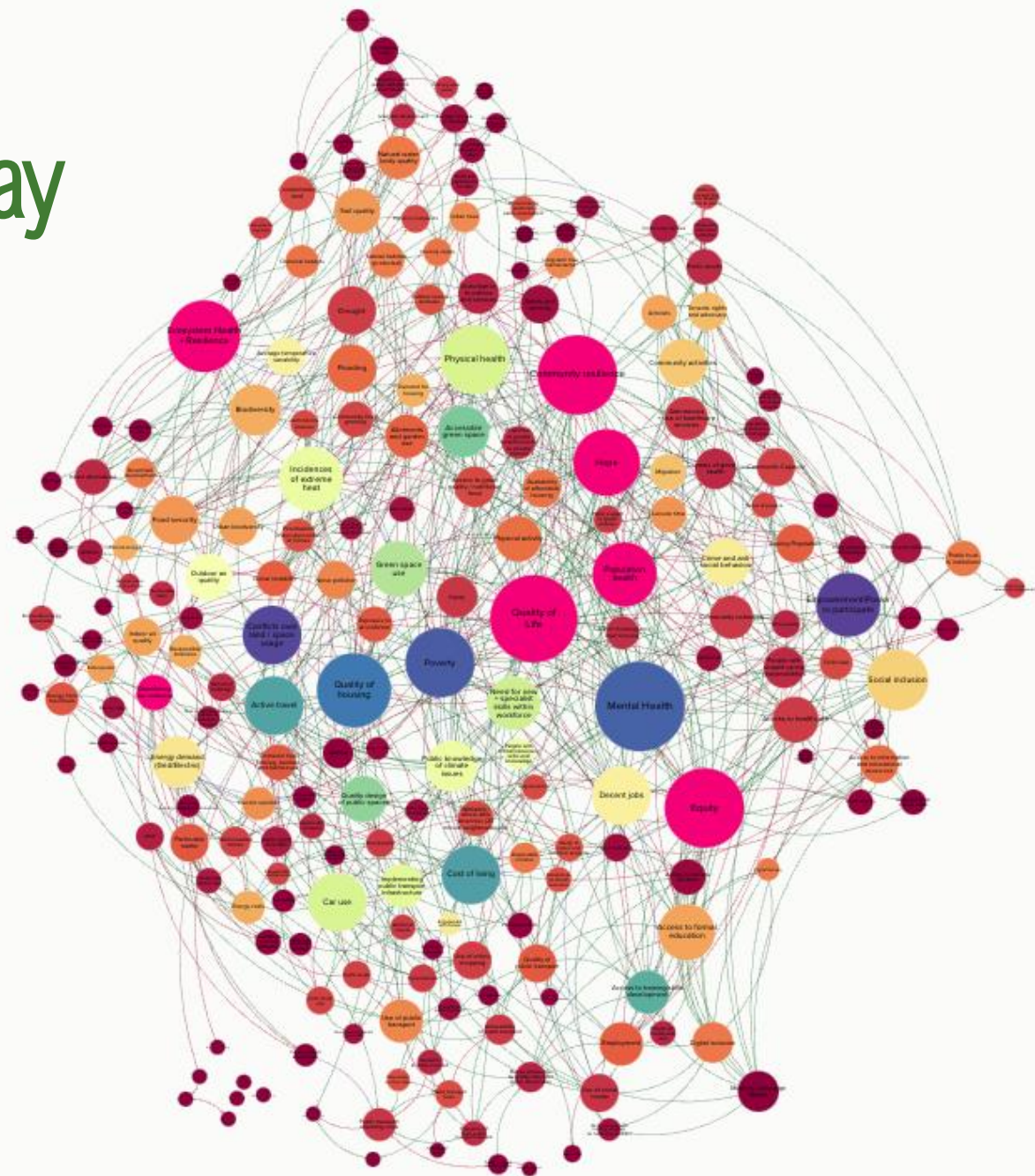
Local Authorities deal with complex challenges everyday

Systems mapping can help

- Visualise the complexity
- Build a shared understanding
- Find ‘leverage points’
- Reveal unexpected connections/understand context
- Inform theory of change / intervention design & Monitoring and Evaluation

Systems mapping can help

- Visualise the complexity
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How to do PSM in a Local Authority context

WM-NET ZERO

- We've created a guide with people from across different LAs in the West Midlands/the WMCA – undergoing final changes now
- The guide walks you through setting up and running a PSM process, (including miro space for designing and practicing your process)
- We'd love for you to try it out so we can improve it!

Participatory Systems Mapping in Local Government

Tips for designing and facilitating a participatory systems mapping process

Please contact us if you'd like to be involved –we'd love to hear from you



Sophie_morris@sandwell.gov.uk
Alexandra.penn@sussex.ac.uk

DISCUSSION



WM-NET ZERO

PHOTO+LUNCH

The WM-NetZero project is supported by Wellcome Trust (227150_Z_23_Z) under the
Advancing climate mitigation policy solutions with health co-benefits in G7 countries
scheme.



SESSION 3: PROJECT PARTNER INSIGHTS



WMCA 5-year plan

Laurie Duncan, West Midlands Combined Authority

Second Five Year Plan



ENERGY
CAPITAL

- In-house team recruited
- No longer a political consensus on climate action – much stronger focus on co-benefits
- Makes the case for place-based, locally led delivery
- Identifies where the WMCA can have the greatest impact by working collectively across the region

Mayoral Foreword

People in the West Midlands are already feeling the benefits of climate action – they just might not know it.

These are real benefits for real people. Healthier streets, lower bills, cleaner journeys, and better jobs – this is what net zero looks like in the West Midlands.

The message of this Five Year Plan is clear: a fair, thriving energy transition will only happen through local delivery.

It's our roadmap to unlocking investment, pioneering innovative technologies, and growing local supply chains to deliver lower bills, healthier communities, create green jobs, and strengthen our resilience to a changing climate.

Accelerating towards this future through local action, backed by government, is the best way to make the transition work for everyone. Climate action is not just about targets – it's about improving people's lives.



Richard Parker
Mayor of the West Midlands



Dr. Laurie Duncan (He/Him)



Director of Public Health report

Aiden Hall, Birmingham City Council

WM-Net Zero Showcase: Birmingham Director of Public Health Annual Report 2026

Aidan Hall
Public Health Service Lead
Birmingham City Council

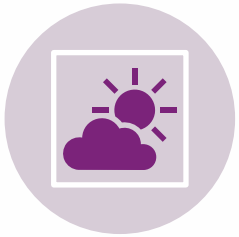


DPH Annual Report

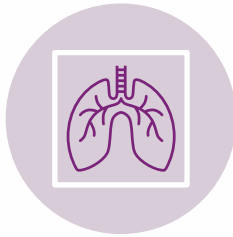
- Directors of Public Health in England have a statutory duty to produce an annual report on the health of their local population
- This report is intended to be a powerful tool for advocacy, helping to influence policy, communicate key health challenges and priorities, and support professionals across the system
- The 2026 DPH Report will explore how climate change is affecting health locally and describe the steps we can take to build a more resilient and healthier city



How we are exploring climate, health and adaptation in Birmingham



Extreme weather



Air quality



Vector-borne diseases



Food supply



Social factors (e.g.
Climate-related
displacement)

Health impacts

- What is the local impact in Birmingham?
- How does it affect health?
- Who is most vulnerable and why?



Adaptation

- What are we currently doing?
- What else do we need to do to prepare?



Co-benefits

- What are the actions that can improve both health and climate outcomes?

Contributions from WM Net Zero



Article

Delivering ‘Thriving Net Zero Communities in the West Midlands’—Insights from a Participatory Systems Mapping Process for Local Authorities

Naomi Bennett-Steele ^{1,*}, Sophie Morris ², Sarah J. Moller ³, James Hall ⁴, Jenny Stocker ⁵, Xinfang Wang ⁶, Suzanne Bartington ⁴, Zongbo Shi ⁷ and Alexandra Penn ^{1,*}

Climate Health Explorer

Evidence, insight, and action for a healthier and more resilient West Midlands.

Environmental Risk Factors

Environmental Outcomes

Health Outcomes

Equity Indicators

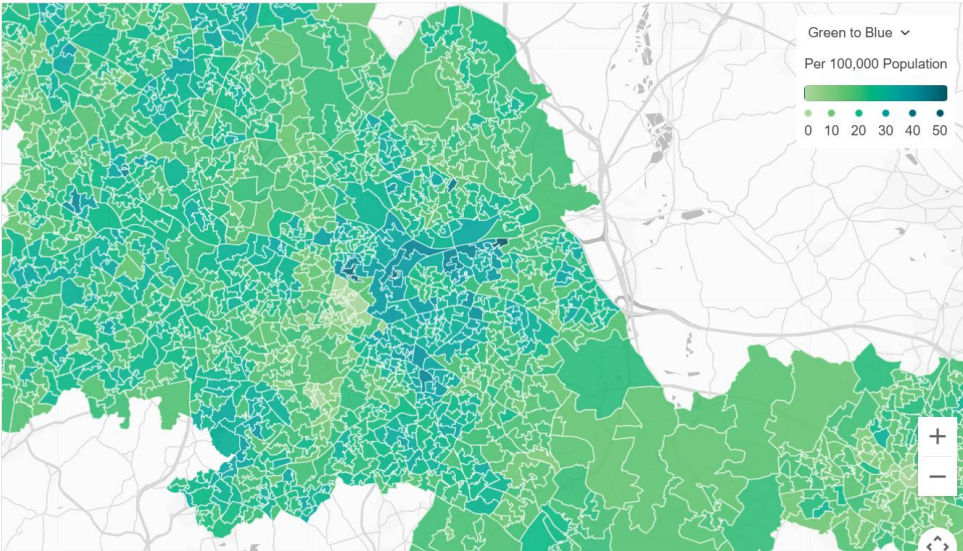
West Midlands Combined Authority Area

Lower Super Output Area

Climate Action Scenarios

2024 Baseline

Environmental Risk Factors



Directly contributing to our work and demonstrating what is possible

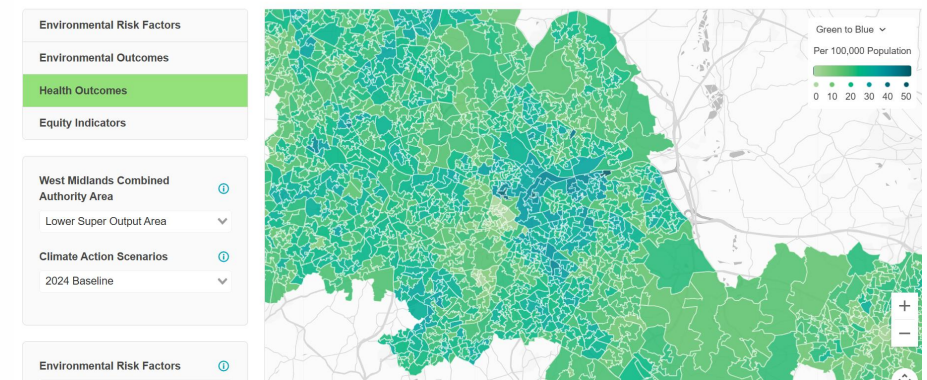
- Helping us understand underlying vulnerability and inequalities
- Directly contributing to our work and the report through data tools, evidence and review
- Demonstrating capacity and capability to develop tools that can be used to:
 - appraise co-benefits of climate policies
 - target policy and interventions to benefit communities that need it the most
 - Inform business cases and decision making at a local level



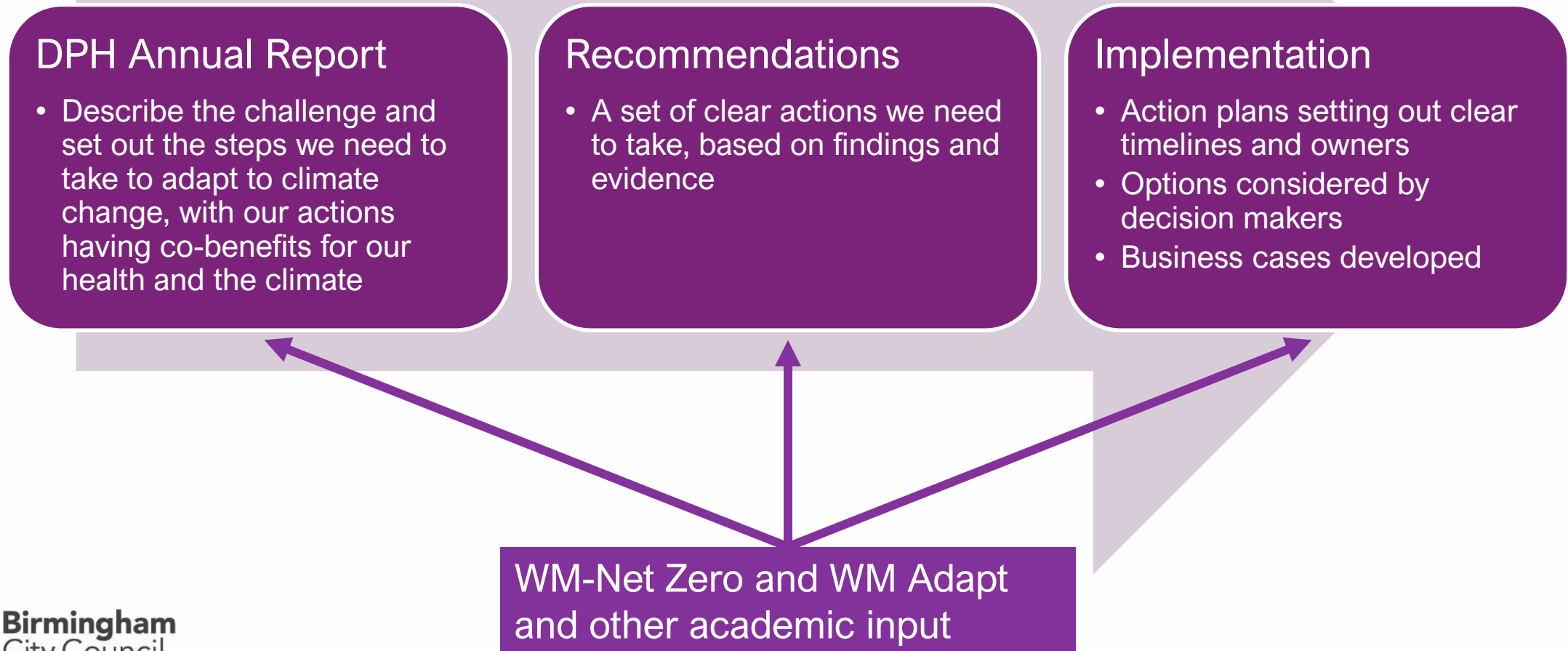
Design by Kayna Taylor (Birmingham City University)

Climate Health Explorer

Evidence, insight, and action for a healthier and more resilient West Midlands.



Looking ahead



The benefits of collaboration

Academic partners

Capability and capacity to develop new tools and approaches

Expertise in research and modelling

Access to and production of local evidence

Independent challenge

Local authority

Key policy questions and challenges

Local data and insight from communities

Operational understanding

Clear route from evidence to decision making



Air Quality Health Needs Assessment

Jasmine Peak, Birmingham City Council

Air Quality, Health and Inequalities: Learning from Birmingham's Air Quality Needs Assessment

Using WM-Net Zero tools and evidence to inform local action

Dr Jasmine Peak – Senior Public Health Officer
Built and Natural Environment Team



Our Remit

The core aim of the BNE team is to improve and protect the health of Birmingham's residents.

- Our remit is to support **creating healthy places, reduce inequalities**, and improve health through increased access to good-quality housing, green, blue and grey infrastructures, a healthy food environment, and active travel.
- We advocate a **health-in-all-policies approach**, shaping policies in planning, licensing, housing, green infrastructure, clean air, and transport that enhance the health and well-being of Birmingham's residents, improve the living and working environment, and promote equity.

What We Do



Local Economy

Good quality Employment & Education

Natural Environment

Convenient access to Blue & Green open spaces for play and social connections

Healthy Food Environment

Healthy, Available, and Affordable food and drink options

Climate Change

Adaptive and responsive to climate change – Air Quality.

Housing

Safe, Affordability and Good Quality Homes

Transportation

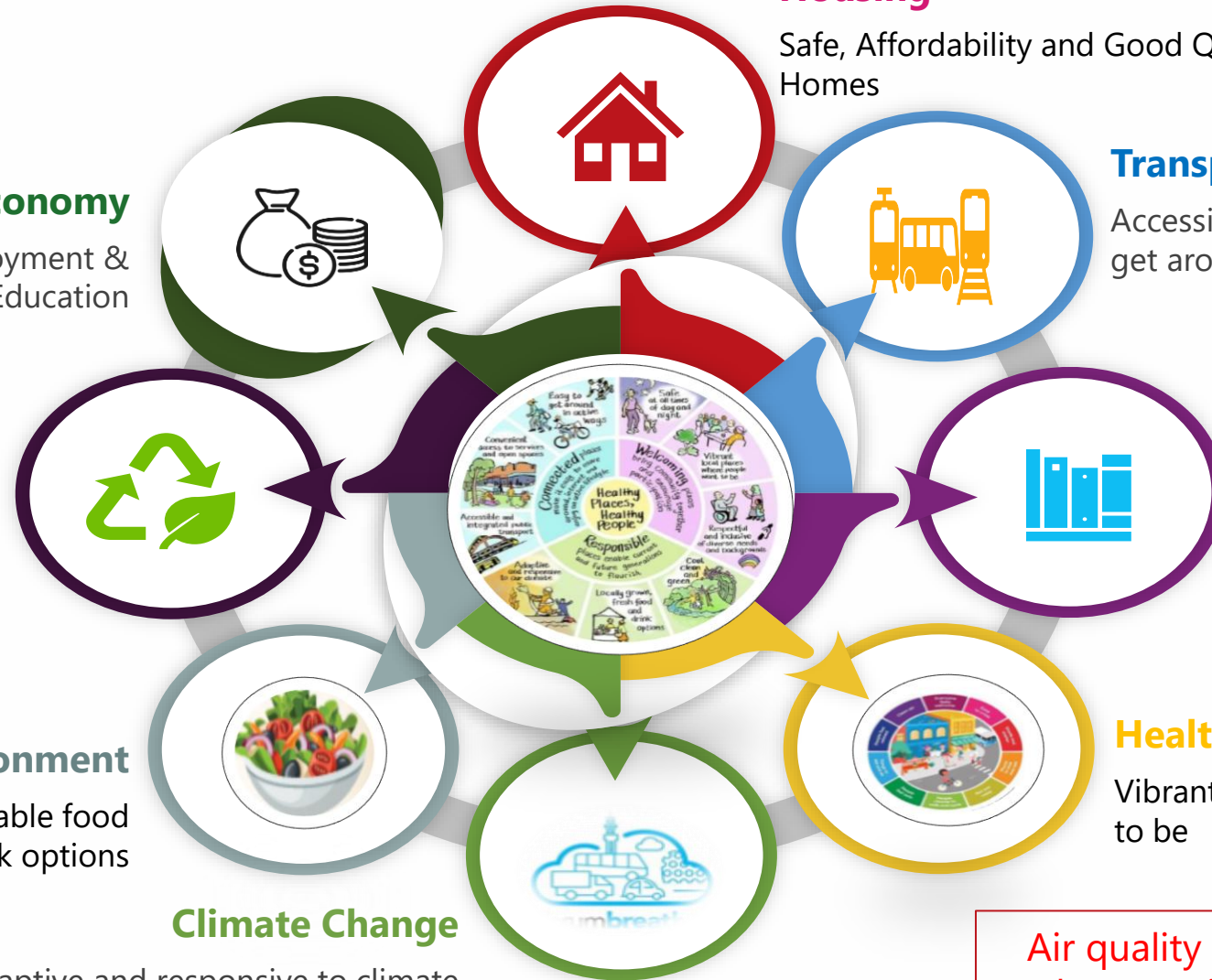
Accessible, integrated and easy to get around –active travel

Neighbourhood Design

Complete, Compact & Connected Communities

Healthy High Street

Vibrant local places where people want to be



Air quality was identified as a priority area because it influences health outcomes, health inequalities and wider determinants of health across Birmingham.

Birmingham Air Quality Context

- All automatic monitoring sites now record annual mean NO₂ concentrations below the statutory objective.
- No monitoring sites exceeded PM₁₀ air quality objectives in 2025.
- Clean Air Zone NO₂ levels have reduced by almost 40% since 2016.
- Air pollution is not distributed evenly across the city, with higher concentrations generally found in central and inner urban wards.
- **Despite these improvements, air pollution remains Birmingham's largest environmental health risk and continues to contribute to preventable ill health and health inequalities.**

Why Did We Need an AQNA?

Air Quality data tell us:

✓Where pollution is

But Not:

How residents experience air pollution in their daily lives?

Who is most affected by poor air quality?

Which health outcomes are associated with air pollution?

Where interventions should be prioritised?

The Air Quality Needs Assessment was developed to answer these questions

Components of the AQNA



How WM-Net Zero Supported the AQNA

Climate Health Explorer

- Estimated attributable mortality and disease burden from PM_{2.5} and NO₂ exposure.
- Quantified impacts on childhood asthma, dementia, stroke and cardiovascular disease.
- Identified inequalities in burden by deprivation.

AQ-LAT

- Modelled future health and economic benefits of cleaner air.
- Tested Net Zero and WHO Air Quality Guideline scenarios.
- Identified communities where air quality improvements could deliver the greatest health gains.
- Helped us to develop a business case for the Clean Air Hospital Project.

AQNA Steering Group

- University of Birmingham expertise in the group.
- Interpretation of the modelling outputs.
- Support with findings and recommendations.

Climate Health Explorer: What Did We Learn?

The modelling demonstrated that air pollution contributes to much more than respiratory disease.

567

PM_{2.5} attributable
deaths

259

Dementia cases linked
to PM_{2.5}

348

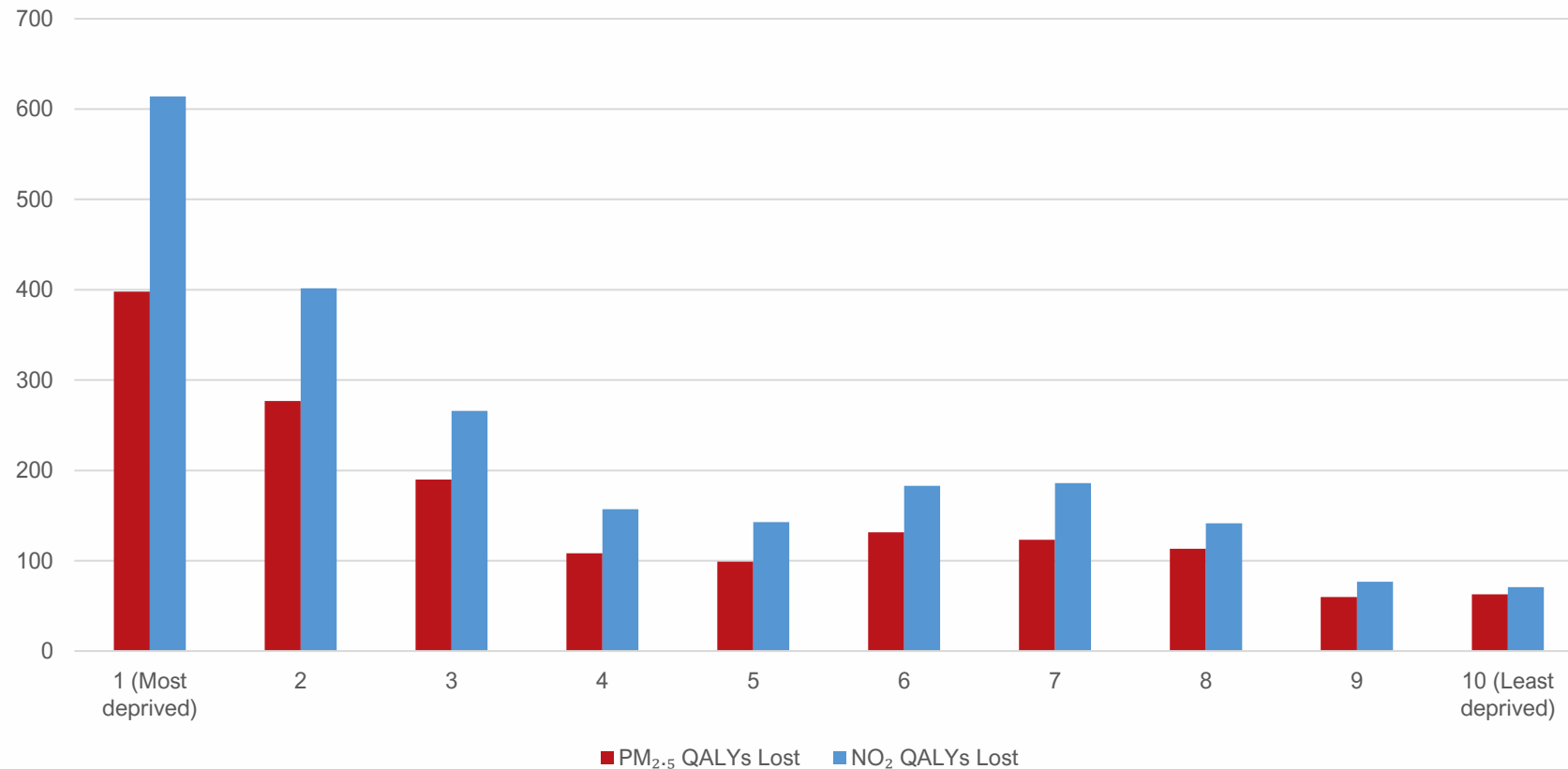
NO₂ attributable deaths

130

Stroke cases linked to
PM_{2.5}

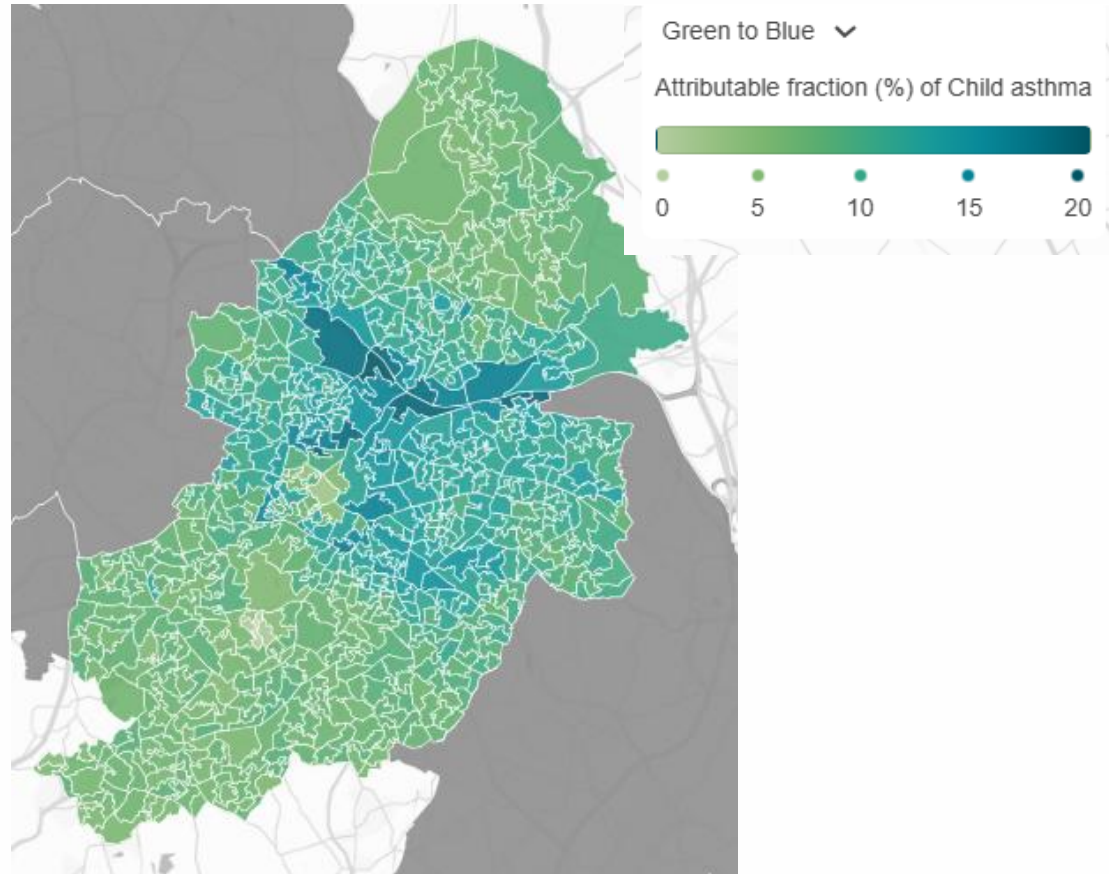
Air Pollution Is an Inequalities Issue

Key Finding: Children in Birmingham's most deprived communities experience a substantially greater health burden from air pollution-related childhood asthma than those in the least deprived communities.



Air Pollution Is a Place-Based Issue

Key Finding: Higher asthma burden is concentrated in inner-city neighbourhoods and major transport corridors.



Modelled attributable fraction (%) of childhood asthma associated with NO_2 exposure across Birmingham

Beyond the Data: What Residents Told Us

Findings from ethnographic research with people living in Birmingham highlighted how air pollution is experienced in everyday life.

Everyday Environments

Air pollution is experienced as part of everyday life

- Closely linked to housing, transport, health and local environments.
- Indoor and outdoor air quality were often experienced as interconnected.

Living with Exposure

Residents adapt where they can

- Residents often knew where and when air quality was worst through lived experience rather than formal information.
- Many changed their behaviour to reduce exposure, although practical and financial barriers limited available options.

Inequalities & Influence

The people most exposed often have the fewest choices

- Green spaces were valued for wellbeing and respite from urban environments.
- Residents identified multiple pollution sources but often felt they had limited influence over local air quality.
- Those experiencing the greatest exposure frequently reported the fewest opportunities to avoid it.

Air pollution was rarely experienced as a standalone environmental issue and was closely linked to housing, transport, health, deprivation and quality of life.

3 Strategic Priorities for Birmingham

Drawing on environmental data, health evidence, modelling, stakeholder engagement and resident lived experience, the AQNA identified three strategic priorities for action.

Priority 1: Reduce Air Quality Inequalities

- Target action where pollution, vulnerability and deprivation overlap.

Priority 2: Reduce Exposure Across Daily Life

- Reduce exposure across homes, schools, healthcare settings, transport environments and neighbourhoods.

Priority 3: Embed Air Quality in Decision Making

- Integrate air quality and health considerations into planning, housing, transport, regeneration, healthcare and climate policy.

Using AQ-LAT to Inform Strategic Priority 2

AQ-LAT helped Birmingham quantify the local health and economic benefits of cleaner air around healthcare settings, strengthening the case for a Clean Air Hospital Programme.

Potential Benefits of a 10% Reduction in PM_{2.5} and NO₂

Birmingham Children's Hospital	Birmingham Women's Hospital
1 death prevented	1 death prevented
4 childhood asthma cases prevented	2 childhood asthma cases prevented
3 QALYs gained	3 QALYs gained
£86,594 total economic benefit	£69,783 total economic benefit

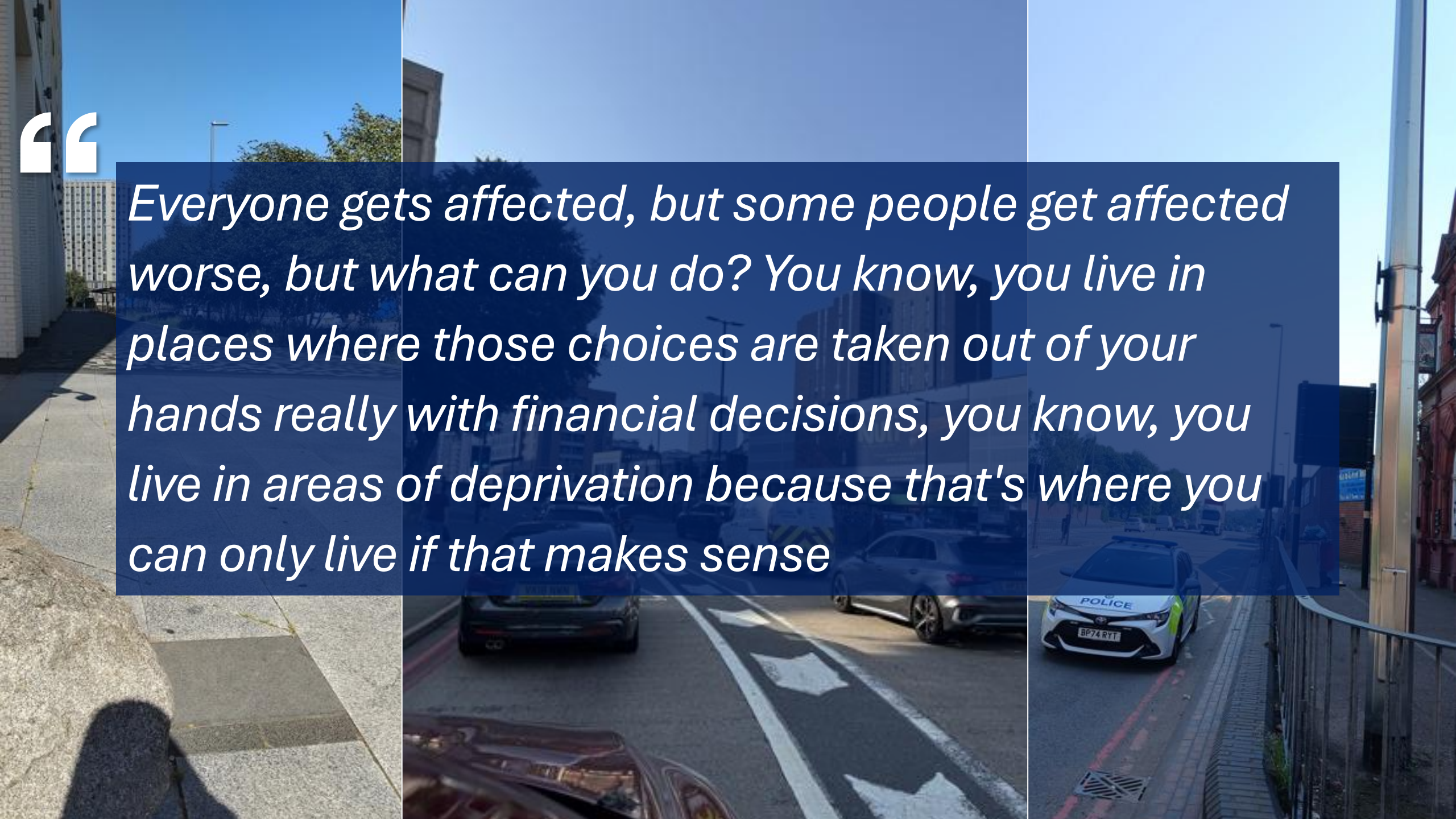
How this informed the AQNA

- Identified healthcare settings as important locations for reducing exposure.
- Demonstrated measurable health and economic benefits.
- Contributed to the recommendation to implement a Clean Air Hospital Programme.

AQ-LAT enabled Birmingham to build a business case for action, linking cleaner air with improved health outcomes and reduced healthcare costs.

“

Everyone gets affected, but some people get affected worse, but what can you do? You know, you live in places where those choices are taken out of your hands really with financial decisions, you know, you live in areas of deprivation because that's where you can only live if that makes sense





Thank You!



Q&A

GARDEN TOUR (Limited Numbers) POSTER SESSION / TEA & COFFEE



UNIVERSITY OF
BIRMINGHAM

WM-NET ZERO

A Health-centred Systems Approach Towards Net-Zero:
Transforming Regional Climate Mitigation Policies

WM-NetZero Pathways to Impact Workshop



Suzanne Bartington



Nick Smith, Clean Air Fund



The WM-NetZero project is supported by Wellcome Trust (227150_Z_23_Z) under the Advancing climate mitigation policy solutions with health co-benefits in G7 countries scheme.



Session Objectives

- Define pathways to impact for specific outputs and key messages

“The pathway to net zero and climate resilience in the West Midlands optimises health and equity outcomes”

Pathways to Impact

WM-NET ZERO

Impact: *an effect on, change or benefit to the economy, society or culture, public policy or services, health, the environment or quality of life, beyond academia.*

Examples:

- The Health Act 2006 **banned smoking in enclosed public spaces and workplaces, saving lives and preventing disease.** The legislative change was underpinned by research showing the health dangers of second-hand smoke in enclosed spaces.
- Ozone research directly led to environmental policy changes, most notably the Montreal Protocol which **phased out 99% of ozone depleting substances and prevented millions of skin cancer cases.**

Impactful Communication

WM-NET ZERO

- Identify the audience
- Lead with the main message
- Tailor the message to the audience
- Use simple language and avoid jargon
- Simplify complex information without sacrificing accuracy
- Tell a clear story!
- **Example formats:** policy briefs, roundtables, public talks, infographics, websites, blogs, press releases, creative approaches (artwork, poetry, film, theatre)....

Pathways to Impact: Group Activity

WM-NET ZERO

**Please check the table plan and join your allocated table.
Each table has a WM-Net Zero facilitator**

Table	Topic	Facilitator
A	Climate Health Explorer	Suzanne Bartington
B	Whole Systems Approach to Net Zero	Sophie Morris
C	Transport and Health	Jenny Stocker
D	Housing and Health	Joe Day
E	Indoor Air Quality and Health	Zongbo Shi
F	Climate Health Explorer	James Hall
G	Whole Systems Approach to Net Zero	Xinfang Wang
H	Transport and Health	Nana Wei
I	Housing and Health	Carlo Luiu
J	Public and community engagement	Nick Smith

Pathways to Impact: Group Activity

- ***What is the key message?***
- ***Who is the target audience?*** - consider diverse groups in the West Midlands, UK and globally
- ***How should the message be communicated?***
- ***Why communicate this message - potential impact?***

Pathways to Impact: Group Activity (~45 mins) WM-NET ZERO

**Please work through the table considering each output/key message in turn.
Complete the “Who”, “How” and “Why sections” on the flip chart pages provided
Your facilitator will guide the discussion and answer any questions
At the session end, each group will be asked to share one pathway to impact**

What? (output or key message)	Who? (target audience)	How? (format)	Why? (potential impact)

Pathways to Impact: Group Activity (~45 mins) WM-NET ZERO

Worked Example

Table A: Climate Health Explorer

What? (output or key message)	Who? (target audience)	How? (format)	Why? (potential impact)
Environmental datasets - Air quality (modelled) - Noise quality - Physical activity			
Health and economic outcome datasets			
Modelling methods			

Pathways to Impact: Group Activity (~45 mins) WM-NET ZERO

Worked Example

Table A: Climate Health Explorer

What? (output or key message)	Who? (target audience)	How? (format)	Why? (potential impact)
Environmental datasets - Air quality (modelled) - Noise quality - Physical activity	Birmingham City Council		
Health and economic outcome datasets			
Modelling methods			

Pathways to Impact: Group Activity (~45 mins) WM-NET ZERO

Worked Example

Table A: Climate Health Explorer

What? (output or key message)	Who? (target audience)	How? (format)	Why? (potential impact)
Environmental datasets - Air quality (modelled) - Noise quality - Physical activity	Birmingham City Council	Air pollution maps – in a briefing note	
Health and economic outcome datasets			
Modelling methods			

Pathways to Impact: Group Activity (~45 mins) WM-NET ZERO

Worked Example

Table A: Climate Health Explorer

What? (output or key message)	Who? (target audience)	How? (format)	Why? (potential impact)
Environmental datasets - Air quality (modelled) - Noise quality - Physical activity	Birmingham City Council	Air pollution maps	To inform Air Quality Needs Assessment, leading to policy change.
Health and economic outcome datasets			
Modelling methods			

Tables A/F: Climate Health Explorer

WM-NET ZERO

Outputs

1. Environmental datasets

- Air quality modelling
- Noise quality
- Physical inactivity

2. Health and economic datasets

- Morbidity and mortality
- Health and social care costs
- Distributional impacts (equity)

3. New modelling method for assessing health co-benefits of climate action



www.climatehealth-explorer.org.uk

Tables B/G: Whole systems approach

WM-NET ZERO

Key Messages (Output)

1. Climate actions can produce co-benefits as well as unintended consequences. (**Journal Article, Systems Map**)
2. Participatory systems mapping can help local authorities explore wider impacts (**Systems Mapping Guide**)
3. Key policy areas may be overlooked but are critical for effective climate action
 - Land and Space Use (**Briefing note 4a**)
 - Jobs, Education and Skills (**Briefing note 4b**)



Article

Delivering 'Thriving Net Zero Communities in the West Midlands'—Insights from a Participatory Systems Mapping Process for Local Authorities

Naomi Bennett-Steele ^{1,*}, Sophie Morris ², Sarah J. Moller ³, James Hall ⁴, Jenny Stocker ⁵, Xinfang Wang ⁶, Suzanne Bartington ⁴, Zongbo Shi ⁷ and Alexandra Penn ^{1,*}

Systems 4202453 Thriving Net zero...: PRSM map



A whole-systems approach to Climate Action, Health and Thriving Communities: Land and Space Use



Key Points:

- Climate actions can produce co-benefits as well as unintended consequences.
- Participatory systems mapping can help local authorities explore wider impacts.
- We highlight land and space use – which may be overlooked but are critical for effective climate action.

To limit climate change, we need to reduce our greenhouse gas emissions to meet legally binding targets. To do this we need to get more energy from renewable sources, particularly for heating and transport where we use the most. This means shifting from gas boilers and petrol or diesel vehicles, towards cleaner alternatives which produce less pollution.

At a community and individual level, we can also make changes by insulating more homes, using cars less often, adopting plant-based diets, and recycling more waste.

However, none of these changes happen in isolation – many of them require behaviour and service changes that have both positive and negative effects.

There are clear links between climate action and some council services – such as housing and transport – but links to others may not be obvious. By moving towards a 'whole systems approach', we can find these links and help prevent policy clashes.

The WM-Net Zero study team has worked with local authority officers, using participatory systems mapping to explore the relationships between climate actions and other local policy priorities. We have identified some areas not typically associated with climate action but very relevant for its success.

Many of the decisions about how we make transport cleaner and less polluting have implications for how land is allocated and how space is used.

Participatory Systems Mapping

Participatory Systems Mapping is a research method where people with different perspectives are brought together to create a causal diagram (map) of the connections in a 'system' of interest. Systems maps support policy design and analysis by revealing key leverage points (potential targets for maximally effective intervention) and trade-offs.

Explore insights from our Participatory Systems Mapping for delivering

Thinking Net Zero Communities in the West Midlands



A whole-systems approach to Climate Action, Health and Thriving Communities: Jobs, Education and Skills



Key points:

- Climate actions can produce co-benefits as well as unintended consequences.
- Participatory systems mapping can help local authorities explore wider impacts.
- We highlight education and skills training – which may be overlooked but are critical for effective climate action.

To limit climate change, we need to reduce our greenhouse gas emissions to meet legally binding targets. To do this we need to get more energy from renewable sources, particularly for heating and transport where we use the most. This means shifting from gas boilers and petrol or diesel vehicles, towards cleaner alternatives which produce less pollution.

At a community and individual level, we can also make changes by insulating more homes, using cars less often, adopting plant-based diets, and recycling more waste.

However, none of these changes happen in isolation – many of them require behaviour and service changes that have both positive and negative effects.

Local and regional authorities can make sure different policies aren't clashing. There are clear links between climate action and some council services, such as housing and transport, but links to others may not be obvious. By moving towards a 'whole systems approach', we can find these links and help prevent policy clashes.

The WM-Net Zero study team has worked with local authority officers, using participatory systems mapping to explore the relationships between climate actions and other local policy priorities. We have identified some areas not typically associated with climate action but very relevant for its success.

Providing the workforce with educational and skills development is key for enabling climate action, particularly for construction. Improved transport links can also increase access to training and employment opportunities.

Participatory Systems Mapping

Participatory Systems Mapping is a research method where people with different perspectives are brought together to create a causal diagram (map) of the connections in a 'system' of interest. Systems maps support policy design and analysis by revealing key leverage points (potential targets for maximally effective intervention) and trade-offs.

Explore insights from our Participatory Systems Mapping for delivering

Thinking Net Zero Communities in the West Midlands

Tables C/H Road Transport and Health

WM-NET ZERO

Key Messages

1. Electrifying vehicles cuts CO₂ emissions but does not help people move more.
2. Shifting car trips to walking and cycling helps people be more active with major health benefits.
3. Accelerated electric vehicle uptake and reducing car use are *both needed* to achieve major health gains.



Tables D/I: Housing and Health

WM-NET ZERO

Key Messages

1. Insulation alone offers limited outdoor air quality benefits but may reduce cold homes and have mixed effects on overheating risks.
2. Heat pumps improve outdoor air quality but do not address pollution from woodburning or prevent cold homes.
3. Insulation, electrified heating, and the elimination of solid fuel burning are *all needed* to deliver major health gains.



Tables E: Indoor Air Quality and Health

WM-NET ZERO

Key Messages

1. Calibrate indoor sensors before fieldwork to ensure accuracy.
2. Overheating is a health risk during heatwaves.
3. Indoor PM_{2.5} is usually lower indoors than outdoors but is very high in some homes.



Table J: Public and Community Engagement

Key Messages

1. Many people do not fully connect climate action with immediate, everyday improvements to their health and the places where they live, work and play.
2. Strong community buy-in is essential for effective place-based climate action.
3. Some climate actions will reduce inequalities, whilst others risk leaving people behind.



Feedback from groups (~15 mins)

- One top pathway to impact from each group

Next Steps

- The ideas will be collected
- We will discuss internally the priorities
- We will follow up on specific points with partners
- We will keep you informed !



THANK
YOU

SUMMARY, NEXT STEPS, AND ONGOING PROJECTS

Summary

WM-NET ZERO

1. Net Zero can improve health — but the benefits depend on how we get there.
2. The best outcomes come from balancing carbon, clean air, less noise and more physical activity.
3. Optimise the system as a whole — think beyond net zero — to maximise health co-benefits.



What is next for WM-Net Zero & beyond? WM-NET ZERO

- Extension towards Sept 2027
- Focus – delivering real word benefits
 - West Midlands
 - National
 - International
- Ongoing sister / follow-on projects:



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WM-NET ZERO



The WM-NetZero project is supported by Wellcome Trust (227150_Z_23_Z) under the *Advancing climate mitigation policy solutions with health co-benefits in G7 countries* scheme.



WM-NetZero Reflections

WM-NET ZERO

- Collaboration
- Growth
- Discovery
- Impact
- Future opportunities



“The pathway to net zero and climate resilience in the West Midlands optimises health and equity outcomes”

Closing Remarks



Ryan Kar-Chun Leung (Wellcome Trust)

Networking and Day 2

- Networking drinks - 5-6:30pm
- Meal 6:30pm
- Tomorrow: Health Homes Workshop (still space if want to attend)

Time	Session/Topics
9:30	Coffee/Tea + Registration
10:00	Welcome and introduction
10:10	Housing Policies and Health Modelling
11:00	Tea/Coffee
11:30	Net Zero Neighbourhood Projects
12:30	Lunch + photo
13:30	Workshop: Retrofit programmes and evaluation plans
	Tea/Coffee (available alongside workshop)
15:00	Closing remarks
15:10	Close



WM-NET ZERO

A Health-centred Systems Approach Towards
Net-Zero: Transforming Regional Climate
Mitigation Policies

Thank you for your attention!

Get involved and stay connected

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