TRANSITION Clean Air Network Launch

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TRANSITION
NETWORK

Optimising air quality and health benefits associated with a low-emission transport and mobility revolution in the UK

The UK Government's Transport Decarbonisation Plan* outlines a second UK transport revolution, characterised by rapid decarbonisation, increased automation and enhanced connectivity. This radical transformation presents both opportunities and challenges for improving air quality, occurring in the context of disruptive changes in transport technology, environmental awareness and evolving transport behaviours.

The TRANSITION Clean Air Network, funded by £0.5m investment from the UKRI Clean Air Programme, seeks to address these clean air challenges, by connecting researchers across nine UK higher education institutions (led by the University of Birmingham), Public Health England and more than 20 stakeholder partners spanning the private, public and civil sectors.

Over a three-year programme from September 2020 the network will undertake co-definition of key areas with potential to improve, and reduce risk of deterioration in transport related ambient and indoor air quality. It also seeks to catalyse the delivery of innovative, evidence-based clean air solutions at the intersect of technological innovation, behaviour change and public policy.

Planned network activities include TRANSITION summits, problem-solving workshops, discovery studies, mobilisation and exchange placements, policy engagement initiatives and creative outreach activities. TRANSITION's partners thereby seek to shape future air quality, climate and transport policy in the UK to achieve cleaner air and to protect public health.

*DfT 2020. Decarbonising Transport: Setting the Challenge. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/932122/decarbonising-transport-setting-the-challenge.pdf

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Citing this Report

This report was prepared by Dr James Levine and Dr Suzanne Bartington (Innovation Network Manager and Lead of the TRANSITION Network respectively), University of Birmingham, with contributions from the invited speakers named herein and valuable feedback from TRANSITION Co-Investigators. Please cite this report as follows:

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Introduction

The TRANSITION Clean Air Network Launch Summit was held online on 24th November 2020. The objective of the workshop was to identify new emerging indoor and outdoor air quality challenges and risks associated with transport decarbonisation over the next decade. This report provides recommendations for priority research areas linked to these challenges and risks.

Over 60 invitees attended the launch on behalf of more than 45 organisations, comprising: 5 local authorities; 3 national Government agencies or public bodies; 2 public companies; 18 private companies; 4 not-for-profit and charitable organisations; and 13 UK universities (including nine represented by TRANSITION Investigators). The event was structured in three sections: (1) *Policy Context;* (2) *Stakeholder Perspectives* and (3) *Cross-Cutting Synthesis.* Summaries of the presentations given can be found in respective Annexes of this report and presentation slides are available on our website: **www.transition-network.org.uk**. We highlight below the key recommendations informed by our invited speakers and subsequent breakout group discussions (focussing upon three questions; see box below). We are most grateful to all who participated in the launch, to the speakers for their personal contributions, and to the group facilitators and rapporteurs.

This was the first TRANSITION Network summit and, as such, sought blue-sky thinking in relation to the air quality challenges and risks linked to the UK low-emission mobility revolution. Stakeholder perspectives and breakout group discussions were structured by transport environment to encourage focussed and detailed insights to emerge among those with relevant and related expertise. In future network activities, however, we will 'constructively disrupt' these silos, bringing people together with complementary but contrasting insights, as we seek holistic solutions recognising the complexity and interplay of transport choices, technology and policy, reflected in the cross-cutting network themes (see Annex 3).

Breakout group discussion questions

1. What are the emerging indoor/outdoor air quality challenges/risks over the next decade?
2. Which priority indoor/outdoor air quality research questions need to be addressed?
3. Which additional stakeholders need to be involved to address these challenges/risks?

Recommendations

General

- Responding to the challenges and risks for air quality across the indoor and outdoor transport interface requires complementary and contrasting expertise, experience and perspectives from academics and commercial/public/not-for-profit stakeholders.
- No single approach will be sufficient to address the air quality challenges and risks: we need a combination of coordinated technological innovation, behaviour change and policy making, alert to the impacts that each component has on the others.
- We need a joined-up approach which delivers sustainable, context-relevant connectivity (i.e., urban, suburban and rural) since provisions for each transport mode affect citizen access to, and the suitability of, transport choices and equity.
- Ensure UK's air quality legislative framework reflects the highest health standards, e.g., adoption of the World Health Organisation's (WHO) fine Particulate Matter ($PM_{2.5}$) exposure limits, and binding targets for emerging air pollutants recognised to be harmful for human health.
- We will leverage research capacity provided by the UKRI Clean Air Programme activities, including the Wave 2 Clean Air Networks: BioAirNet, CleanAir4V, Breathing City, TAPAS and HEICCAM.

Road Transport

- We should act to mitigate the health impacts of non-exhaust emissions, especially PM from tyre wear (see, e.g., Air Quality Expert Group – AQEG, 2019), for instance through new guidance and regulation.
- We should clarify which metric(s) for each established pollutant (e.g., mass, number or surface-area concentration) best capture(s) (i) its emissions and (ii) its health impacts, and robustly measure them.
- It is essential we monitor, and research the health impacts of, emissions of currently unregulated and/or novel, emerging pollutants (e.g. volatile organic compounds in exhaust) to determine what further pollutants we need to regulate, at what levels.

Public Transport

- Modal shift towards public transport and active travel is essential to clean, sustainable mobility. Local authorities need national Government support to stimulate modal shift.

- We need to incentivise both the use of public transport (e.g. by reducing congestion, and thereby journey times) and provisions of clean public transport (e.g. by removing the cost burden of substation improvements from electric public transport operators).
- New research is needed to inform people of the consequences of their travel choices for: their personal exposure to air pollution (indoors, outdoors and in vehicles of different types); and their personal contribution to air pollution and its impact upon others.

Active Travel

- Modal shift and achievement of carbon-zero targets requires increased active travel, as well as increased use of public transport: think of 'first and last miles' and the opportunities to reduce the 70% of journeys of between 1 and 5 miles that are made by car or van (Department for Transport – DfT, 2019a).
- Increasing active travel, in part, means reducing use of privately owned vehicles, relieving congestion: reduced vehicles and vehicle movements yields more space, and more attractive spaces, in which to walk and cycle more safely.
- The vocal public minority must not drown out the silent majority: 86% of people agreed that the Government should take action in local neighbourhoods to improve air quality, with 78% of people supporting local reductions in road traffic (Report to DfT by Kantar, 2020).

Built and Indoor Environments

- Highways authorities need to update their design standards, e.g. by adopting the standards set out in the DfT's (2007) Manual for Streets (and recent LTN 1/20 guidance on 'Cycle Infrastructure Design'; DfT, 2020a) and, perhaps more importantly, incoming 2021 updates from DfT and the Chartered Institution of Highways and Transportation.
- An overhaul of the current Transport Analysis Guidance (TAG) appraisal approach is needed to: incorporate new metrics of the qualities/outcomes we seek in order to change travel patterns, such as the proximity, accessibility and connectivity of public transport hubs via designated active travel provisions; and integrate their evaluation with the current appraisal of transport safety, efficiency and reliability.
- We need to: intensify new/re-developments, providing for businesses, recreation and education within a 20 min walk of people's homes (in urban contexts); and ensure connectivity within, and between, these 20 min neighbourhoods via active travel and public transport.

Annex 1. Policy Context

1.1 Transport Policy Context and Challenges

Jason Torrance, Policy Director, UK100

Jason identified three major challenges going forward, in relation to: transport infrastructure; focus, or lack of focus, on clean air; and support of ambitious local action. Firstly, within the Government's spending review, there is currently a commitment to £27 billion investment in roads (Highways England, 2020), and a previous commitment of £88 billion to High-Speed rail (HS2; Shapps, 2019), but only £3.8 billion investment in improving air quality via cleaner transport (Rebecca Pow's contribution to HC Deb 20 October 2020). Jason called for greater investment in creating vibrant places where we live than connectivity to drive between them.

Secondly, Jason noted that the most recent Clean Air Strategy from the UK Government was released in January 2019, and there has been little further development of this in the last two years. He believes there has been insufficient investment in air quality monitoring and the gain of critical understanding regarding the health impacts of air pollution, coupled with a slowing of parliamentary business and policy (e.g., the Environment Bill; https://services.parliament.uk/bills/2019-21/environment.html) due to COVID-19.

Finally, regarding local action, Jason called for greater support of local leaders, as they seek to introduce Clean Air Zones, through evidence, garnering of public support and increased funding; he understood that 8 out of 10 English councils are currently at risk of bankruptcy if required to continue to deliver their statutory duties at current funding levels (Centre for Progressive Policy – CPP, 2020). Meanwhile, the legislative framework governing those duties must move to adopting the WHO targets for PM concentrations, which are much lower than our current national air quality objectives in line with EU legislation.

1.2 Transport Planning for the Future

Susan Claris, Associate Director, Arup

Susan outlined the role of transport as both a cause of problems and a potential cure, with future transport planning playing a central role in creating safe places for people to be healthy and happy. Currently, around 20% of journeys under 1 mile, and 70% of 1-5 mile journeys, are made by car or van (DfT, 2019a). Here, Susan identified the potential for active travel, particularly in relation to leisure and shopping: whilst annual mileage per vehicle has decreased by about a fifth over the last 20 years, the number of vehicles on our roads has increased by about a third (DfT, 2019a), and there has been a surge in large vehicles that

are more dangerous, more polluting and take up more space. She advocates modal shift towards active travel and public transport to, not only reduce our climate impact and improve air quality, but also create safer, more attractive places of greater amenity.

Susan argued that we should: be wary of the 'technical fix'; prioritise walking and cycling first; and address 'transport gluttony'. Firstly, regarding technical innovation, she believed electrification could only be part of the solution: uptake of electric vehicles (EVs) has been much slower than forecast, with currently only around 164,000 pure EVs, and 374,000 plugin models including hybrids (Next Greencar, 2020) compared with predictions ranging from 270,000 to over 3 million (Transport Research Laboratory – TRL, 2011); Sports Utility Vehicles (SUVs) have been outselling EVs by a ratio of 37:1 (Auto Express, 2019), negating [some] benefits from electrification; and EVs continue to emit PM from non-exhaust sources (brake, tyre and road wear), do not ease congestion or public health concerns regarding physical inactivity, and continue to take up precious space in the public realm. Likewise, autonomous vehicles do not address these problems but could, through greater 'control' of vehicular transport, potentially aid reduction of speed limits for increased safety and support adaptive Clean Air Zones that respond to real-time measurements of local air quality.

Secondly, Susan encouraged us to support a modal hierarchy: walking coming first and foremost, whether it be for whole or part-journeys; cycling second; public transport third; taxis, freight and service-related vehicles fourth; and, last of all, the use of privately owned vehicles. Correlated with provision for active travel, are healthy streets (e.g. as advocated by the Greater London Authority – GLA, 2017) with direct benefits for human health and economic prosperity (Transport for London – TfL, date unknown): physically active employees take 27% fewer sick days; and people who walk and cycle more frequently visit their High Street, and spend 40% more there than those who have driven. Susan cautioned, however, that there is need for much greater inclusivity in consultation, planning and provisioning for cycling, as explored in Arup's (2020) report, 'Cycling for Everyone'.

Finally, we should address 'transport gluttony', the excessive desire for transport and its negative impacts on people in the vicinity, including: short car trips, use of large vehicles (e.g. SUVs), excessive speed and other dangerous behaviour, the blocking of crossings and footways, and idling engines unnecessarily polluting. As well as incentivising walking and cycling, Susan called for disincentives to driving, such as: lower speed limits, reduced provisions for parking and increased costs of parking. The good news is that, despite the disagreement reported in the news, there is support for low traffic neighbourhoods (Report to DfT by Kantar, 2020): 86% of people surveyed agree, or strongly agree, that the Government should take action in local neighbourhoods to improve air quality; and 78% support local reductions in road traffic.

Annex 2. Stakeholder Perspectives

2.1 Road Transport

Nick Molden, Founder & CEO, Emissions Analytics

Emissions Analytics is an independent testing house specialising in quantifying real-world emissions; it has the largest commercially available database of independent, real-world emissions data and leads EU standardisation groups on exhaust emissions and cabin air quality. Nick presented a series of key take-home messages. Firstly, regarding the emissions of nitrogen oxides (NO_x = NO + NO_2) from diesel vehicles: Euro 3, 4, 5 and pre-Real Driving Emissions (RDE) Euro 6 vehicles show very similar (high) levels of emissions; only post-RDE Euro 6 vehicles exhibit a significant reduction; and NO_x emissions will only be brought under control at the fleet level by addressing the legacy of diesel vehicles sold up to 2018/19. The story regarding NO_2 (alone) is similar. Moving to PM, Nick emphasised the emissions of particles were no longer *principally* in the exhaust of new cars (with the exception of cold-start conditions), but rather from brake, tyre and road wear. Just as for carcinogenic emissions of volatile organic compounds in exhaust, these non-exhaust emissions are currently unregulated. They are also undiminished by the move to EVs and/or hydrogen-fuelled vehicles. He highlighted tyre wear in particular, citing an average of 75 mg particle emissions per km (cf. the 5 mg/km legal limit for particle mass in exhaust emissions).

2.2 Public Transport

John Birtwistle, Head of Policy, First Group Plc (Bus Division); President, EPTOA

John spoke of road-based public transport in a UK context, and broader European one, with some relevance to rail too. Currently, public transport is in crisis due to COVID-19: the use of public transport dropped by as much as 90% in some periods of the pandemic and, prior to the November 2020 UK lockdown, recovered only to ~55-60% of pre-COVID-19 levels.

Moving forwards, he identified two challenges, the first regarding congestion. If we can free public transport, in particular buses, from delays due to congestion, we can make it more attractive to passengers via shorter and less variable journey times. However, current technological roadmaps and policies (e.g. consultation draft of the EC Sustainable and Smart Mobility Strategy) do not address congestion. Neither provisions for electric car charging nor the development of autonomous vehicles reduce the number of vehicles on our roads. Instead, John wanted to see: improvements to the UK national grid to ensure that new developments, requiring electric public transport, are not faced with the full costs of local substation improvements; and implementation of a ‘polluter pays’ principle – a form of

taxation – that advises people of potential journey costs by different modes, and influences their choice.

The second challenge John identified was the range of electric buses. FirstGroup Plc is committed to a [zero exhaust emission] fleet by 2035, buying no diesel buses beyond 2022, but is currently constrained by the range of electric buses: single deckers are capable of 180 miles/day and double deckers only 150 miles/day, which fall short of many current duties, particularly on inter-urban routes. Bus operators face a cost premium for electric buses, and a greater premium for hydrogen-fuelled buses offering greater range. John stressed operators' need for financial assistance to aid investment in suitable buses, particularly whilst capital investment opportunities are so much reduced due to COVID-19.

2.3 Active Travel

Robin Tucker, Trustee, Cycling UK; Managing Director, Red Kite Management Consulting

Making the case for active travel, particularly cycling, Robin started by highlighting the loss of approximately 100,000 UK lives per year (roughly one in six) due to physical inactivity (Public Health England – PHE, 2019), and 1752 due to road accidents (DfT, 2020b), in addition to 28,000 - 36,000 associated with outdoor air pollution (PHE, 2018). Active travel has the potential, not only to improve air quality, but also to increase physical activity and reduce road casualties – all in addition to reducing our carbon emissions and stemming climate change. He noted, however, that active travel works best when integrated with public and shared transport, in a system that requires us to reflect on the consequences of our travel choices.

Robin identified that we know how to make good provisions for cyclists (we can learn from the Dutch) but there is currently a 'chicken and egg' situation that limits progress: people are scared to cycle – only 16% of people in the UK cycle each month (DfT, 2019b) cf. 70% in the Netherlands (Ministerie van Verkeer en Waterstaat – MVW, 2009); relatively low numbers of cyclists limit the political support for new provisions; lack of support leads to lack of investment; and lack of suitable provisions is an impediment to uptake. The primary barriers to change were considered to be political courage and commitment. He hoped that TRANSITION could make a difference by improving the evidence base for policy decisions, e.g. regarding links between physical inactivity and vulnerability to air pollution.

2.4 Built and Indoor Environments

Prof Paul Linden, University of Cambridge; Tackling Air Pollution at Schools (TAPAS) Network Lead

Paul started by putting some numbers to the influences on the composition of air in a room measuring 4 m x 3 m x 3 m. It is recommended that people receive 10 litres of fresh air per second, equating to 1 air change per hour (1 ACH), and ventilation typically delivers 5-10 ACH. If all the air that room moved about at the same speed, this would equate to an imperceptible average flow speed of 4-8 mm/s. Under such conditions, the fall speed of 100 μm droplets (1500 mm/s) is much faster than that average flow speed and the circulation of droplets around that room (i.e., carried by the air) remains limited down to 10 μm droplets (fall speed of 15 mm/s) but increases towards 1μm droplets (fall speed of 0.015 mm/s). This picture of average air flow, however, does not reflect what happens when we have air inlets and outlets. Between these, much higher-than-average flow speeds are observed, typically around 200 mm/s, capable of circulating larger droplets. Added to this, the heat output from a person is sufficient to drive a convective flow of air similar in speed to air flow from a typical vent or window, again in the region of 200 mm/s. The key message was that indoor air flow, which governs the circulation and distribution of air pollutants, is highly non-uniform and sensitive to ventilation mode: e.g. 'mixing' typically associated with air conditioning cf. 'displacement' resulting from the rising of air from low level inlets to high level outlets. Lessons learned in buildings could be relevant to indoor bus, train and tram environments.

Annex 3. Cross-Cutting Synthesis

Dr Suzanne Bartington, TRANSITION Network Lead & Clinical Research Fellow, University of Birmingham

3.1 Overview

The TRANSITION Clean Air Network Launch Summit provided a timely opportunity for exploration of emerging challenges and opportunities afforded by the evolving transition to a low-emission transport economy. The radical scale and pace of disruptive change for connectivity systems over the next decade is becoming increasingly apparent among policymakers, academic stakeholders and increasingly the wider public. Horizon scanning and strategic planning is essential to avoid previous short-term transport policy inefficiencies, such as the legacy of 1960-70s rail restructuring being readdressed through the contemporary '*Restoring Your Railway Fund'* (DfT, 2020c). Achievement of progressive air quality gains will necessitate a cross-sector 'systems approach', optimising the 'clean air' intersect between policy, technologies and human behaviour.

3.2 Situational Awareness

The TRANSITION Clean Air Network community recognises UK transport policy to be a fast-moving policy landscape, notably in the context of: COVID-19 economic recovery; an ageing population; and a shift away from the internal combustion engine. An interdisciplinary network of academic expertise (across sciences, arts and humanities) and cross-sector partnerships, which generates and translates the evidence base, will be critical to deliver benefits for air quality. This community will be required to be flexible, responsive and resilient, prioritising and coordinating activities whilst capturing and sharing existing best practice to maximise efficiency and impact. Binding legal obligations to achieve carbon net-zero ambitions (BEIS and Skidmore, 2019), and the policy spotlight afforded by COP26 in November 2021, will increasingly drive climate policy actions which influence air quality; the community needs to consider and address conflicts, co-benefits and unintended consequences at the earliest opportunity.

It was widely noted that there exists a current disconnect and lack of policy coordination at national, regional and local Government levels. Transport policies have repeatedly failed at implementation stage typically due to political perturbation, embedded structural barriers, or in response to public consultation. For example, temporary traffic restriction measures intended to assist Oxford City's recovery from COVID-19 and allow more road space for cyclists and pedestrians were recently abandoned by Oxfordshire County Council after 7200 people responded to consultation (BBC, 2020) where: 35% said the plan was a good idea;

15% said they thought it was good but were "concerned about the details"; and 46% considered the intervention a bad idea. Applying implementation science and historical analysis to better understand these decision pathways could therefore be a helpful network focus. There exists an underlying structural challenge due to balance of political responsibility for clean air and transport between national and local Government, which will require further appraisal following progression of the Environment Bill (https://services.parliament.uk/bills/2019-21/environment.html). Adoption of legally binding PM limits (including potential for WHO health-based limit values; WHO, 2018) will further shift the clean air policy landscape, necessitating ever more ambitious actions to reduce PM emissions. This occurs at a time of unprecedented financial pressures on local Government, with 8 out of 10 authorities at risk of financial insolvency (CPP, 2020); economic co-benefits will be critical.

3.3 Horizon Scanning and Policy Foresight

Major uncertainty exists regarding the emerging transport landscape – key questions to address include *how will modal shift occur, in which modal direction(s) and at which stage of the clean energy transition?* These changes will also be shaped by preferred 'clean energy' solutions, with an emerging focus upon hydrogen capabilities for commercial, public and private transport. The academic community may support policymakers operate within this uncertain landscape by providing a broad range of scenario predictions and seeking flexible solutions which may be adapted to emerging trends. Presenting novel transport modes as 'potential solutions' raises further research questions, but may divert policy attention and resources away from the core mobility needs of the population.

3.4 Research, Discovery and Innovation

Robust, independent, interdisciplinary academic research will be essential to address these complex challenges, leveraging expertise across science, arts and humanities. Emerging pollutants and gaps in existing regulation (e.g. non-exhaust PM emissions) will present new technical challenges for measurement, exposure assessment and development of legislation. Effective knowledge and information transfer, concerning new technologies and tools to facilitate wider uptake and adoption beyond academic and commercial stakeholder communities, will require an improved understanding of how policymakers assess the evidence base and reach policy decisions. The Clean Air Programme community and six funded Clean Air networks provide multiple opportunities to address these needs (https://www.ukcleanair.org/research/wave-2/).

3.5 Delivering Clean Air Solutions

Policy solutions should seek to achieve air quality and health co-benefits with a focus upon reducing health and social inequalities. Active travel is identified as a priority focus for mitigating impacts of short journeys, whilst delivering recognised public health benefits via physical activity (e.g. Saunders et al., 2013). Indoor air quality will be an increasing focus of research and policy attention, including mechanisms to measure, mitigate and regulate indoor air pollutant exposures across in-vehicle, and in-carriage transport environments. Planning and land use are highlighted as key policy focal areas to achieve long-term change. Improved understanding of clean air intervention funding mechanisms is also necessary to support feasible interventions, including those which redistribute the existing fiscal externalities of transport choices and incentivise further uptake of low-emission modes. Achieving an optimal policy balance between state intervention and personal choice, alongside the need to align multiple policy initiatives, will be increasingly prominent in the pursuit of modal shift. High quality social science research can inform this optimal balance.

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