Tyndall Centre for Climate Change Research 21 years

Super-Low Carbon Live Music:

a roadmap for the UK live music sector to play its part in tackling the climate crisis

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NB: All views contained with this report are attributable solely to the authors and do not necessarily reflect those of researchers within the wider Tyndall Centre.

About the Tyndall Centre for Climate Change Research

The Tyndall Centre is a partnership of universities bringing together researchers from the social and natural sciences and engineering to develop sustainable responses to climate change. We work with leaders from the public and private sectors to promote informed decisions on mitigating and adapting to climate change. The Tyndall Centre was founded in 2000 to conduct cutting edge, interdisciplinary research, and provide a conduit between scientists and policymakers. With approximately 200 members across career stages, the Tyndall Centre represents a substantial body of the UK's climate change research expertise. Since 2000, the Tyndall Centre has significantly advanced various areas of climate change research and policymaking including: the development of emission reductions pathways for major energy consuming sectors, the understanding of climate impacts, risks, and adaptation options, the public perceptions of climate change, and the governance of climate negotiations and policymaking.

The partnership institutions are: University of East Anglia, University of Manchester, Cardiff University and Newcastle University. This report was produced by researchers from the University of Manchester.

For further information please see www.tyndall.ac.uk

Executive Summary

In this roadmap we outline a set of clearly defined and measurable targets that the live music sector could adopt to play a leading role in meeting the Paris Agreement on climate change. In our discussions and interviews with people from across the sector, we found widespread commitment to reassembling practices post Covid-19 so that they are fundamentally more sustainable. There are many excellent examples of super-low carbon practices already happening, however, progress must be rapidly accelerated and substantial shifts in industry practice are needed.

We outline targets for energy use in buildings and outdoor events, surface travel and air travel (for people and equipment) and audience travel. High level targets include: reducing emissions from buildings to zero by 2035; at least matching UK grid electricity emissions at outdoor shows from 2025 onwards; reducing surface travel emissions to zero by 2035 and limiting total sector aviation emissions to a maximum of 80% of 2019 levels. We also provide interim targets to demonstrate that immediate reductions must be made. We do not propose a 'net zero' date, rather we outline the progress needed to reduce emissions across different areas of activity. In those areas where low carbon options are currently not available (e.g. aviation) we propose a focus on reducing demand. If offsets are used to claim 'net zero' status then we recommend that these should be carbon removals with long term geological storage and that these should only be used where further reductions in emissions are not possible. In order to retain focus on the sustained need to reduce emissions beyond the date that any 'net zero' goal is reached, targets for emissions reduction should remain specifically articulated until emissions are fully eliminated (i.e. targets should go beyond a 'net zero' framing to drive action to fully eliminate emissions from the sector – aiming for zero rather than 'net zero').

We suggest actions and approaches across the various sources of emissions, however there are some overarching principles that we believe are needed to really drive change. Firstly, super-low carbon practices can only be delivered if they are central from the inception of a tour. Super-low carbon needs to be baked into every decision – routing, venues, transport modes, set, audio and visual design, staffing, promotion etc. Secondly, this requires the various actors in the sector to use their direct power as well as their wider influence to overcome barriers and champion new practices. Thirdly, progress must be monitored and reviewed. Whilst we should of course celebrate and share examples of best practice, reporting and review of all activity is required to drive systemic change in the sector. Such review will allow identification of issues that need additional action such as policy or regulatory change, greater investment, collaboration etc. and this process can also help ensure that smaller venues and festivals are appropriately supported in the transition.

Whilst we have set out a broad direction in this roadmap, we believe it is those working within the sector who have the expertise, creativity and power to really determine how this transition happens. We hope that our work is useful in demonstrating the scale of the challenge, the potential for change and the need for an urgent and significant reassembly of practices in the sector.

Background to the work

In 2019 Massive Attack commissioned researchers at the Tyndall Centre for Climate Change Research to explore opportunities for significantly reducing emissions associated with live music touring. The first phase focused on reviewing Massive Attack's own touring practices. The second phase focused on developing a roadmap for the wider live music sector to support delivery of emissions reductions in line with the UN Paris Agreement.

The Covid-19 pandemic resulted in some delay to the work and a refocussing on the potential for the sector to 'reassemble' in a much more sustainable way as it emerged from the extreme challenges that the pandemic has created for those in the sector. In addition to literature review, the research team have conducted a number of interviews with actors in various roles in the live music sector and presented a draft version of the roadmap for feedback with a broad range of senior stakeholders kindly convened by the industry group LIVE. Researchers have also attended, and contributed to, various conferences, round tables and meetings with a range of organisations supporting sustainability in the sector. We would like to thank all of those who have given time to support the development of this roadmap and stress that their participation in our work does not imply that they endorse it. As requested by Massive Attack, and in line with our own approach to supporting climate action, we offer the work openly to all to support the commitment clearly held by many in the sector to transform practice in terms of sustainability.

Live Music Roadmap

Only a material and fundamental shift in practices and technology globally can prevent catastrophic climate change [1].[i] How live music stakeholders and the industry as a whole embrace climate action is a part of this global response.

This document has three sections. Firstly, a discussion of the global and national climate change landscape that must be considered in setting a science based and equity guided roadmap for the UK live music industry. Secondly, a suite of targets are recommended across different areas of emissions in the sector and guidance on the recommended shifts in practices and technology that could be adopted to meet these. Thirdly, suggested actions for different groups across the sector.

1. Climate change context

To keep global warming to well below 2°C with a chance of limiting to 1.5°C, global emissions of carbon dioxide need to be about 45% lower than they were in 2010 by the year 2030 and net zero in 2050 [1]. The 2030 midpoint highlights the importance of progress over time (and therefore how quickly the global carbon budget is used up) and the need for near term as well as longer term goals.

In 2019 global CO_2 emissions were up by 7% compared with 2010 [2]. Without a fundamental change in approach to human activities, emissions in 2022 will likely bounce back from their 2020 dip and continue the trend of steady growth seen in the

2010s [3]. We are off the pace required to meet the commitments made in the Paris Agreement - a massive step change and sustained increase in effort to reduce emissions is needed [4].

While the 1.5˚C global temperature target (Paris Agreement) implies almost halving annual carbon dioxide emissions in the next 9 years for the world as a whole, and to reach net zero by around 2050, it is also acknowledged that the burden of change sits more on developed economies such as the UK. The world is really counting on faster and more ambitious action from capable countries, organisations and sectors.

We propose that given the commitment to tackling climate change evident in the music sector, at a minimum its goals should exceed the UK's statutory climate change goal and the national emissions pathway in order to demonstrate leadership on climate action.

Interpreting climate change targets for the live music sector

As we move beyond the ~1.2˚C of global warming above the pre-industrial average seen so far, there is no 'safe' level of further climate change. Organisations can however look to align themselves with goals of the Paris Agreement on Climate Change to hold global temperature rise to well below 2°C.

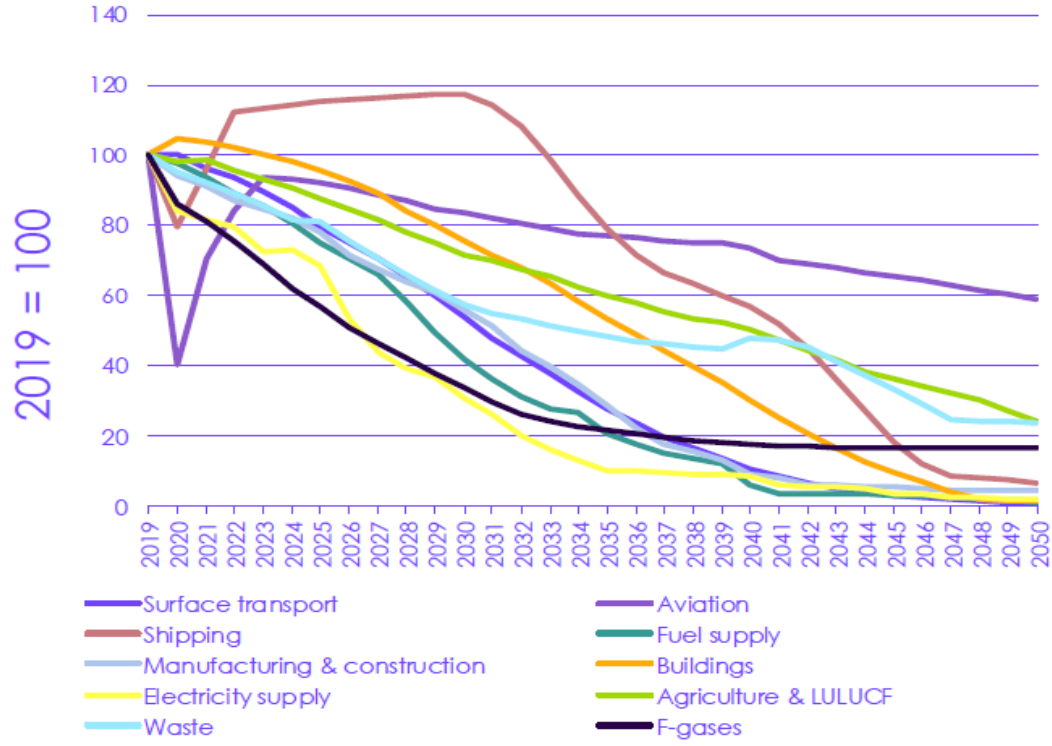
To make a contribution to achieving this goal, organisations can set quantified targets for activities that they have direct control over (e.g. building energy use, corporate travel, waste and procurement) as well as a timeline to adopt best practice on activities that are more difficult to quantify and where the organisation is a key partner – such as audience travel. The Commons Select Committee on Digital, Culture, Media and Sport, recommend that the sector should now adopt independent oversight on progress against its environmental pledges, and work with local authorities to develop and implement standardised environmental objectives for event licencing [5]. The targets in this roadmap have been developed with this in mind (measurable goals with interim milestones) and are suitable for a review of performance indicators and aligning with local authority climate change goals. This section considers what the Paris Agreement goals would mean for UK live music if the sector took a leading role.

Beyond Net Zero 2050

The UK Government has a statutory target to have net zero greenhouse gas emissions by 2050 at the latest and to stay within 5-yearly carbon budgets – including reducing to 78% of 1990 levels by 2035 (about 60% below today's levels).

The figure below is taken from the UK Government's Climate Change Committee's (CCC) Sixth Carbon Budget Report that sets out their Balanced Pathway for reaching net zero in 2050 [6]. It shows how emissions of greenhouse gas emissions would need to change from 2019 levels to follow the path to net zero. Activities such as building energy use and surface transport emissions reach zero before 2050.

The use of carbon removals for 'net' balance of emissions applies to sectors such as aviation, shipping, waste and agriculture which are not expected to reach zero by 2050.



Source: CCC analysis.
Notes: Aviation and shipping pathways are lower in 2020 due to COVID-19. LULUCF = Land-use, land-use change and forestry.

Figure 1: Change in Sectoral Emissions Relative to 2019 for the UK as a whole in Climate Change Committee Balanced Pathway to Net Zero [5]

While the UK net zero target follows the expectation for global emissions as a whole to keep temperatures well below 2˚C, there is a compelling case that the UK as a large historic carbon emitter and industrially advanced country should do more.

The UK net zero 2050 goal has been criticised for not taking sufficient account of the development needs of less developed countries when determining the UK's share of the global remaining carbon budget, and for relying on future removals of carbon not yet proven to work at large scale. Work by researchers at the Tyndall Centre finds that if equity principles are more fully applied, efforts undertaken in the UK energy system should be even more ambitious – reaching zero emissions for the energy system between 2035 and 2040 [7].

If the live music sector is not ahead of the curve on these targets, it will still be affected by measures to tackle this issue nationally and globally (for example changes to diesel fuel subsidy and regulation). Being reactive as opposed to proactive across the sector may particularly impact smaller venues and festivals if policy, consumer demand or industry standards were to change rapidly. **We recommend that the sector act collaboratively to support smaller venues and festivals that may struggle to meet improved regulation and standards to be well positioned for the net zero transition.**

The following section presents a set of targets for the sector guided by making a reasonable contribution to meeting the goals of the Paris Agreement and adopting a leadership position on delivering significant and immediate reductions in emissions.

2. Targets for UK live music

Tackling climate change involves a material change in the practices and technologies adopted by the sector.

Different sources of carbon emissions lend themselves to different types of goal setting depending on data availability and whether the sector has direct control over emissions or instead must influence others. The recommendations presented here are a combination of specific targets tailored to different activities within the sector aligned with an overall commitment to ambitious climate action. The recommendations reflect input from workshop participants and interviewees as well as existing literature and best practice in the sector.

These recommendations also follow best practice in setting net zero emissions targets by applying the following principles (based on [8]):

- reducing the sources of carbon emissions from organisational activities to very low levels
- minimal contribution of carbon removal offsets to reaching net zero
- near-term and long-term goals to limit overall emissions for the time period

Summary of recommended targets:

Source of emissions	Target recommendation
Energy use in buildings	Set target for zero CO_2 emissions from buildings by 2035 [50% lower than 2015 level by 2025]
Energy use outdoors (festivals)	Set target to match UK electricity grid emissions intensity at all shows from 2025 onwards
Surface travel (artist, production and business)	Set target for zero emissions from organisational travel[ii] by 2035 [20% lower than 2015 level by 2025]
Air travel (artist, production and business)	Set target to limit total sector air miles to a maximum of 80% of 2019 levels as the sector re-opens [review this target from 2030 with a view to further reductions]. Reduce air freighting of equipment
Audience travel	Adopt measures that promote significant uptake of low carbon travel options by 2025
Non-energy consumables (inc. sets, food and drink)	Adopt procurement practices that evaluate whole life costs on financial, environmental and social grounds

We recommend these targets are reviewed at least every five years in light of of developments of best practice in the sector and beyond, technological improvements and national and international climate commitments.

In addition to these energy and transport related targets, emissions related to waste, shipping and refrigerants should be reviewed. Waste minimisation and elimination strategies on food, single use plastics, set design and equipment will reduce whole life emissions from production through to disposal.

As with road and air freight, shipping equipment worldwide makes a contribution to global warming and the live music sector needs to address this. Reducing the tonnage shipped annually is the most direct way to address this (provided air freight isn't used as an alternative). 'Plug and play' models for venues, standardisation of equipment worldwide, light weighting and increasing artist and fan awareness of the environmental consequences of shipping large volumes of material could contribute to a significant reduction in impacts.

On refrigerant gases, following best practice around UK F-gas regulations is essential.

2.1 Energy use in buildings

The reference pathway aligned with UK national legislation (Climate Change Committee's Balanced Pathway) is for buildings to have zero CO_2 emissions by between 2045 and 2050, with significant progress made by 2030 (Fig 1).

The live music sector can set a more ambitious target for energy emissions in venues, offices and other premises it uses of zero emissions by 2035. An interim goal of a 50% cut from 2015 levels by 2025 would also help track required progress. Current outlooks on electricity supply emissions and available heating, cooling, ventilation and catering technologies and energy efficient AV equipment suggests that this target is technically feasible for the live music sector.

Electricity: The UK National Grid is the process of decarbonising electricity supply – having halved these emissions in the last decade. Organisations will therefore see their carbon emissions from electricity use fall significantly over the coming decade, with the potential for zero emissions by 2035 [9]. Decarbonisation of electricity is challenging in that the grid must add more renewables while overall and peak electricity use increases, due to more transport and heating moving to electric[iii]. Organisations can support this by setting goals to:

- **Minimise peak and overall electricity use by appliances (such as lighting, sound equipment and refrigeration) through a strategy of promoting/requiring the use of the most energy efficient options.**
- **Generating renewable electricity onsite with technologies such as solar PV.**
- **Increase data sharing and awareness of electricity used in productions to all stakeholders and promote greener productions that provide spectacle with less power demand.**
- **Switching to energy tariffs that directly support renewable energy projects. This does not affect the physical carbon emissions of operating a building, but it directs revenue to support the overall decarbonisation of the electricity grid. It should be ensured that these meet the highest levels of green accreditation (i.e. purchasing and investing in renewables directly) and decision-makers should consider whether they wish to work with a supplier than *only* offers green tariffs.[iv]**

Fuel use: The other key sources of emissions in buildings is natural gas and/or oil for heating and catering. Switching from fossil fuels to a low carbon alternative – such as electrified options - is required over the coming decades. The sector can meet its decarbonisation goals on fuel use by:

- **Improving building fabric and building management systems to require less energy to heat, cool and ventilate.**
- **Move to a low carbon option (likely a heat pump solution) for heating in the coming decade.**
- **Onsite catering should plan for and implement a move away from natural gas and oil fuelled appliances.**

2.2 Energy use - outdoor

Diesel electricity generators are a high carbon source of power. Direct CO_2 emissions are around 1,220 gCO_2/kWh to 1,940 $kgCO_2$/kWh depending upon efficiency and loading [10], [11]. UK electricity grid emissions have fallen from ~540 gCO_2/kWh in 2008 to 250 gCO_2/kWh in 2020 [12]. As a consequence, the gap in the environmental impact of 'off-grid' events reliant on fossil fuel diesel and 'grid-connected' events is widening.

Furthermore, discussions with stakeholders suggest considerable amounts of diesel is wasted as a result of over sizing and running generators for peak load throughout the event. Scheduling and managing generator use would result in cost saving that could be redirected into low carbon investment as an interim step.

Although individual festivals may only include a few weeks of intensive activity at a site in a year, in aggregate, across all festivals a significant amount of diesel fuel is currently used. Lower carbon options are being developed – including various biofuel alternatives[v] and forms of battery and microgrid configuration – but are not widespread. Seeking to make festivals grid connected is advised, but due to festival locations this may be challenging and other electricity supply solutions might be needed. Managing peak electricity demands and involving production stakeholders to facilitate less wasteful power supply options is advised. **Outdoor events such as festivals should set a deadline to phase out the use of diesel generators by 2025 and seek to at least match the contemporary carbon intensity of the UK electricity grid going forward.**

2.3 Business travel and equipment transportation (surface and aviation)

Transport is a sector where emissions have increased in the UK – both in terms of surface transport (vehicles and trains) and flights – up until the pandemic. Unlike most other sectors (Fig 1) aviation emissions are only expected to have a slow decline over coming decades in the CCC Balanced Pathway.[vi] Prior to the pandemic aviation emissions had grown significantly over the previous decade, despite only around 25% of the UK population taking more than one fight a year and around 50% not flying at all in any given year [13]. The targets and actions suggested here relate to the day to day business travel for meetings etc. by organisations in the sector as well as artist and crew travel for touring and equipment transportation. The current model in the sector is based on transporting lots of equipment, and making frequent and long distance trips by plane and diesel vehicles.

Surface travel:

For surface travel for personnel, reductions in emissions will likely entail a focus on switching to active or public transport and electric vehicles where possible as well as eliminating the need for some travel through video conferencing etc. However, as technical solutions to reduce emissions from HGVs (e.g. alternative fuels) may take

longer to phase in, it is particularly important that the amount of equipment being transported is minimised.

'Plug and play' options where venues host backline and other resources so that bands can travel with a reduced volume and weight of gear are an example of how the sector can use service innovation to cut costs as well as emissions. In addition, these 'plug and play' systems should adopt the most energy efficient technologies to reduce building electricity demand.

A goal of zero carbon in surface travel by 2035 could be addressed through:

- **Cutting annual distances and frequency of travel for business meetings though virtual meetings.**
- **Switching default transport modes to walking, cycling and public transport for business, artist and crew travel where possible.**
- **Phasing out fossil fuel vehicles in lease/owned/hired vehicles, starting immediately with vehicles where electric options are already available.**
- **Build in low emissions travel from the conception of tours – considering minimisation of transport wherever possible, staffing plans to reduce travel, show design to reduce the volume and weight of transported equipment.**

Aviation:
For a net zero pathway that is in keeping with global climate change targets, aviation emissions in the UK must reduce. It will likely be post-2030 that technical solutions can make a significant contribution to emissions cuts, so demand reduction is the primary action for tackling these emissions in the coming decade [14]. Climate Change Committee guidance in the Balanced Pathway (Fig 1) suggests around a 20% reduction in aviation emissions by the early 2030s compared to 2019 levels.

To widen access to aviation in the UK, frequent flyers would need to moderate their demand until technology solutions are available. This has implications both for the overall aviation emissions of the sector and the emissions for each organisation or act – if the sector is to grow then each actor within it will need to reduce emissions further to make space.

The live music sector can apply measurable targets to aviation for all of its own activities, move to reduce distance travelled and switch to lower carbon modes starting immediately. These targets should cover day to day business travel as well as travel associated with personnel and equipment for touring.

Touring artists can materially and symbolically contribute to this through adopting low carbon travel and planning schedules that make these options viable more often. Reversing past trends and reducing air miles travelled by the live music sector would contribute to tackling aviation emissions until technological solutions are introduced.

Taking the CCC Balanced Pathway 2030 level of a 20% reduction in emissions, the sector could look to limit aviation emissions to 80% of 2019 levels as events and gigs start to open up as Covid-19 restrictions are lifted. This would take the opportunity that 'reassembly' post-Covid offers and avoid simply reinstating previous practice.

As noted above, such a target would mean that if the sector is growing, individual acts and organisations would need to look to better this target. Historical contributions

to emissions through aviation and taking a leadership role on climate action, would warrant consideration of a more ambitious target for the sector overall, as well as for specific organisations and acts. Starting from the point of planning tours to maximise low carbon travel and minimise flights would give tour managers and artists a clearer sense of what levels of emissions reduction could be achieved.

Private jets are currently considered central to facilitating some intensive touring schedules. Whilst they are viewed as offering benefits in terms of convenience and security to artists and other industry professionals, their emissions are significantly higher than commercial air travel. If there is a genuine commitment to climate action, new approaches to planning tours should seek to eliminate their use.

2.4 Audience travel

Audience travel makes up the largest proportion of live music related emissions when all sources associated with events are aggregated. While this provides a holistic view of live music emissions, audience travel is something that the sector might be considered as having influence over but not necessarily full control.

Often the context of live music events in the UK promotes travel by car, such as occurring in areas with limited public transport or at times when transport stops running, while car parking is readily available. While the sector may not be directly 'responsible' for these emissions, opportunities exist to work with audiences, local authorities and transport providers to reshape travel to venues [5].

Surface (land) transport emissions for the UK as a whole face a massive challenge having not reduced in the past 10 years. Electric vehicles are a potential solution to decarbonising surface transport, but research shows that changes to travel mode and practices will also be needed to meet the net zero pathway [15]. **While quantifying and measuring targets on audience travel is challenging for the sector, it can adopt the following measures as standard practice to align with net zero:**

- **For town and city venues - collaborate with local authority and transport providers to increase provision of public transport when shows finish.**
- **Improve secure bicycle storage at venues.**
- **Offer incentives, information and/or integration with public transport travel options through ticketing.**
- **For festivals - provide and promote lower carbon transport options for attendees - particularly in areas not served by existing public transport. e.g. provide secure bicycle storage, frequent bus/coach connection to transport hubs, arrange additional train services and incentivise car sharing.**
- **When good low carbon options are in place, disincentivise private car use and set year on year reduction targets for space dedicated to car parking at sites.**
- **Do not actively promote flying for live music events and develop train/coach package options for overseas visitors where possible.**

2.4 Shipping

As with road and air freight, shipping equipment worldwide makes a contribution to global warming and the live music sector needs to address this. Reducing the tonnage shipped annually is the most direct way to address this (provided air freight isn't used as an alternative). 'Plug and play' models for venues, standardisation of equipment worldwide, light weighting and increasing artist and audience

awareness of the environmental consequences of shipping large volumes of material could contribute to a significant reduction in impacts.

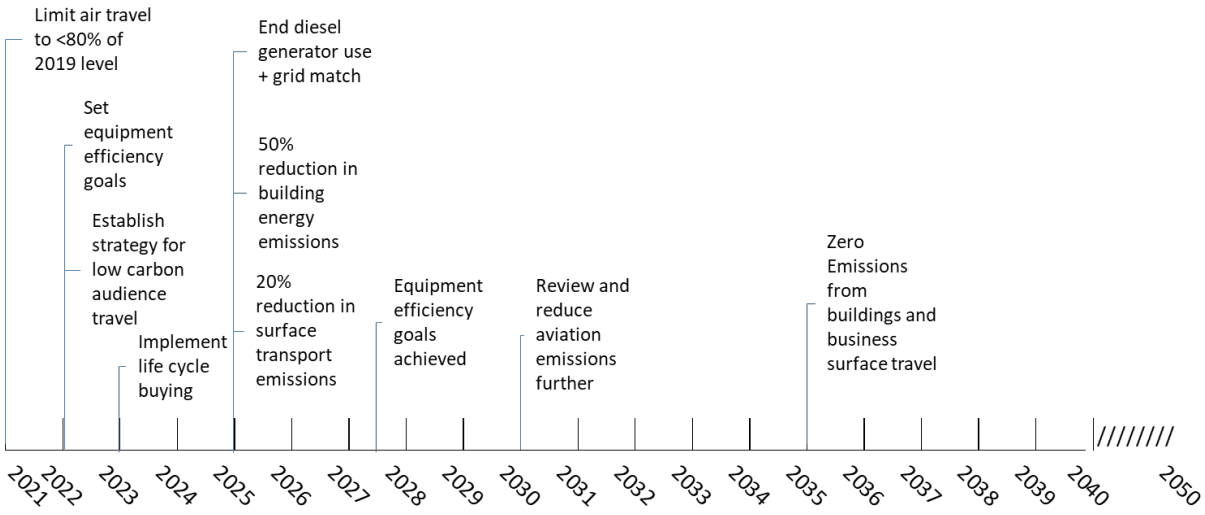
2.5 Balancing Remaining Emissions – Carbon Offsetting

Net zero framings of climate change targets consider not just the reduction in sources of carbon emissions but how remaining emissions might be balanced out through carbon removal elsewhere. Best practice in net zero target setting is to prioritise reducing emissions and use offsets only for residual 'hard to treat' activities [8].

A number of carbon offset approaches exist, but at present the most robust approach, from a 'carbon balancing' perspective appears to be the use of carbon removal technologies that store carbon over long timescales (e.g. geological storage).[vii] This does not preclude investments in schemes that intend to reduce carbon emissions outside of the music sector or improve natural carbon sinks (which may also bring with them a range of other co-benefits). However, we recommend that such investments are not used to 'balance' emissions to net zero. In addition, none of the offsetting options should be considered as a substitute for reducing fossil fuel emissions from the sector itself.

We recommend that the live music sector only use carbon removals with long term geological storage for balancing out emissions and that this is only done where further reductions in emissions are not possible.[viii] In order to retain focus on the sustained need to reduce emissions beyond the date that any 'net zero' goal is reached, targets for emissions reduction should remain specifically articulated until they are fully eliminated (i.e. aiming for zero rather than 'net zero').

2.6 Summary of Key Milestones:



3. Actions across the Sector

Meeting the above targets will require actors across the live music sector to directly change and influence practice in their respective areas. Actors across the sector will need to work together and with outside organisations to develop step by step plans to achieve super-low carbon live music and to deliver those plans. The existing networks that share learning and resources should be further strengthened to support this.

Artists, managers, agents, promoters, tour and production managers, labels and venue operators, all have roles to play. This will include urgently reducing their own direct emissions, choosing the lowest carbon option where they use services provided by others and influencing others to make these options available where they currently are not.

Many UK local authorities have declared Climate Emergencies, and through their local climate action strategies they can support their local music scenes to reduce their emissions. We concur with the recommendation of the Commons Select Committee on Digital, Culture, Media and Sport, that "Government and local authorities do more to hold the sector to account on its environmental impacts through licensing" [5].

Audiences can choose low-carbon travel options, support local venues and those taking climate action, and collectively call upon the industry to take action whilst celebrating those that do.

There is already a great deal of good practice and examples to learn from and upscale as well as organisations and networks within the sector that seek to support sharing and learning. From our discussions with a range of stakeholders, it is clear that the creativity that can be unleashed to reduce emissions is one of the sector's most significant assets. It is now essential that the incentives and processes that are re-assembled as we recover from the pandemic ensure that this can be harnessed. **We recommend that a central independent body monitors progress of the sector against clearly defined, measurable targets to assess delivery and opportunities for accelerating action.**

Actions for artists, managers, tour managers, promoters, designers, labels and agents	
Energy use in buildings	• Understand the energy consumption of a show • Design shows to reduce excessive power consumption • Perform at, and promote, venues that are taking action to reduce their building energy use
Energy use outdoors (festivals)	• Understand the energy consumption of a show • Design shows to reduce excessive power consumption • Support, promote and perform at festivals whose power supply at least matches UK grid carbon emissions
Surface travel	• Programme tours to ensure low carbon travel opportunities are maximised • Design shows to reduce set and equipment transport demand

	• Adopt public transport, cycling and walking where possible • Use electric vehicles for private transport • Prioritise 'plug and play' venues where possible to reduce the use of transport when touring
Air travel	• Programme tours to ensure low carbon travel options are maximised • Design shows to reduce set and equipment transport demand • Revisit existing revenue sharing models for recorded music to reduce the financial pressure on acts to tour • Reduce flying to levels below the total sector targets • Aim to eliminate the use of private jets • Offer, ask for and choose virtual meetings as the default option • When touring internationally, rent staging and other equipment locally where possible
Audience travel	• Demonstrate credibility and leadership by celebrating artist use of low carbon travel to encourage low carbon audience travel • Develop public transport options for fans which incentivise public transport and explore opportunities for the journey to be part of the performance experience
Shipping	• Reduce amount of equipment shipped year on year • When touring internationally, rent staging and other equipment locally where possible

Actions for venues	
Energy use in buildings	• Monitor and provide information on the energy consumption of shows to all artists and their teams • Choose the most energy efficient options when buying new equipment • Develop highly efficient plug and play infrastructure • Work with local partners to install on-site renewables where possible, and for local retrofit initiatives • Purchase energy on a renewable tariff with the most stringent 'green' credentials
Energy use outdoors (festivals)	• Monitor and provide information on the energy consumption of the festival and design shows to reduce excessive power consumption • Manage power requirements to reduce peak load • Match UK grid emissions for on-site electricity supply
Surface travel	• Adopt a 'plug and play' service model
Air travel	• Reduce flying to levels below the total sector targets • Offer, ask for and choose virtual meetings as the default option
Audience travel	• Work with local authorities and other local stakeholders to improve safety, accessibility and affordability of public and shared transport • Provide secure cycle parking

Actions for equipment manufacturers and suppliers	
Energy use in buildings	• Actively provide information about the energy consumption of equipment and promote the most efficient options • Provide and promote service packages for highly efficient plug and play models
Energy use outdoors (festivals)	• Provide information about the energy consumption of equipment and promote the most efficient options
Surface travel	• Adopt public transport, cycling and walking where possible • Use electric vehicles for private transport • Develop plug and play business models to reduce the use of transport when touring • Design equipment to reduce transport demand
Air travel	• Reduce flying to levels below the total sector targets • Offer, ask for and choose virtual meetings as the default option
Shipping	• Reduce amount of equipment shipped year on year • When touring internationally, rent staging and other equipment where possible

Actions for Local and National Government	
Energy use in buildings	• Provide funding and support for venues looking to reduce their energy consumption, including for building fabric-retrofit
Energy use outdoors (festivals)	• Include requirements on on-site energy use and a plan for year on year improvements as part of licensing conditions
Surface travel	• Liaise with venues and event sites to support public transport provision and communications • Provide charging points for electric vehicles close to venues • Include requirements on shared audience travel (e.g. car-share, coach) and a plan for year on year improvements as part of licensing conditions
Air travel	• Include requirements on reporting aviation emissions as part of licencing conditions and a plan for year on year improvements
Audience travel	• Provide secure cycle parking close to venues • Provide a safe environment for walking, cycling and public transport by working with the late-night licensed sector to make areas around venues safer particularly for groups most likely to be vulnerable • Work with local public transport providers to improve safety, accessibility and affordability of public transport

References:

[1] V. Masson-Delmotte *et al.*, "Summary for Policymakers," 2018.

[2] P. Friedlingstein *et al.*, "Global Carbon Budget 2020," *Earth Syst. Sci. Data*, vol. 12, no. 4, pp. 3269–3340, Dec. 2020, doi: 10.5194/essd-12-3269-2020.

[3] P. M. Forster *et al.*, "Current and future global climate impacts resulting from COVID-19," *Nat. Clim. Chang.*, vol. 10, no. 10, pp. 913–919, 2020, doi: 10.1038/s41558-020-0883-0.

[4] C. Le Quéré *et al.*, "Fossil CO2 emissions in the post-COVID-19 era," *Nat. Clim. Chang.*, vol. 11, no. 3, pp. 197–199, 2021, doi: 10.1038/s41558-021-01001-0.

[5] House of Commons Digital Culture Media and Sport Committee, "The future of UK music festivals," 2020. [Online]. Available: https://committees.parliament.uk/committee/378/digital-culture-media-and-sport-committee/.

[6] Climate Change Committee, "Sixth Carbon Budget," 2020. [Online]. Available: https://www.theccc.org.uk/publication/sixth-carbon-budget/.

[7] K. Anderson, J. F. Broderick, and I. Stoddard, "A factor of two: how the mitigation plans of 'climate progressive' nations fall far short of Paris-compliant pathways," *Clim. Policy*, vol. 20, no. 10, pp. 1290–1304, Nov. 2020, doi: 10.1080/14693062.2020.1728209.

[8] S. M. Petersen, K., Allen, M., Hilson, C., Jones, C., Reay, D. and Smith, "Destination net zero: setting and delivering ambitious, credible targets," 2021. [Online]. Available: https://www.gla.ac.uk/media/Media_781321_smxx.pdf.

[9] National Grid, "Future Energy Scenarios," 2020. [Online]. Available: https://www.nationalgrideso.com/future-energy/future-energy-scenarios.

[10] C. Jones, P. Gilbert, and L. Stamford, "Assessing the Climate Change Mitigation Potential of Stationary Energy Storage for Electricity Grid Services," *Environ. Sci. Technol.*, 2019, doi: 10.1021/acs.est.9b06231.

[11] A. Q. Jakhrani, A. R. H. Rigit, A. Othman, S. R. Samo, and S. A. Kamboh, "Estimation of carbon footprints from diesel generator emissions," in *2012 International Conference on Green and Ubiquitous Technology*, 2012, pp. 78–81, doi: 10.1109/GUT.2012.6344193.

[12] Department for Business, Energy & Industrial Strategy, "Digest of UK Energy Statistics," 2020. [Online]. Available: https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes.

[13] Department of Transport, "National Travel Survey," 2019. [Online]. Available: https://www.gov.uk/government/collections/national-travel-survey-statistics.

[14] Committee on Climate Change, "Net Zero – The UK's contribution to stopping global warming," 2019. [Online]. Available: https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/.

[15] G. Hill, O. Heidrich, F. Creutzig, and P. Blythe, "The role of electric vehicles in near-term mitigation pathways and achieving the UK's carbon budget," *Appl. Energy*, vol. 251, p. 113111, 2019, doi: https://doi.org/10.1016/j.apenergy.2019.04.107.

[i] The Intergovernmental Panel on Climate Change (IPCC) in its synthesis report on 1.5˚C of global warming concludes that to stay well below 2˚C of global warming sources of carbon dioxide need to be reduced to near zero by the middle of the 21st century - and other greenhouse gas significantly reduced – with significant progress made by 2030. This entails transformational changes in how we travel, heat buildings, source power, eat and our industrial processes in the coming decade as well as the removal for carbon dioxide from the atmosphere to long term geological/chemical storage. Not doing so increases risks of catastrophic impacts on human and natural systems. See https://www.ipcc.ch/sr15/.

[ii] This refers to direct (scope 1) greenhouse gas emissions from surface transport.

[iii] The Sustainability in Production Alliance offer guidance on how to implement more sustainable practices including for power, lighting and winches and automation:
https://www.tourproductiongroup.co.uk/sustainability-resources

[iv] Currently a broad range of electricity tariffs are marketed as 'renewable' – however, some commit to purchasing all supplies from renewable sources and investing in new renewable developments. This variety of 'renewable tariff' should be preferred to maximise the impact of this choice. See guides related to schemes such as the Uswitch Green Accreditation Scheme https://bit.ly/2RvJqwe.

[v] Biofuels such as used cooking Hydrotreated Vegetable Oil (HVO) is one option – but there is a wide range in the environmental impacts of HVO fuel sources. The sector should commit to only using products highly certified to reduce greenhouse gas emissions over their life cycle and avoid wider impacts on land and biodiversity – see https://www.sciencedirect.com/science/article/abs/pii/S0959652617302391.

[vi] Aviation has a privileged status in UK climate change targets. It is not formally included in the UK's Climate Change Act but the Climate Change Committee does include it in its analysis as it is a key sector for keeping to global climate targets.

[vii] Carbon offsetting takes a number of forms but in all cases forms a financial relationship between an activity that releases greenhouse gas emissions and one that is expected to remove or avoid an equivalent amount. For carbon offsetting to work in practice there has to equivalence between the tonne of carbon released and what is avoided or removed the century and beyond. This requires being able to measure the avoidance or removal and verify that this can't be reversed, and knowing that the carbon would not have been avoided anyway (e.g. by a different funding mechanism) and is an additional carbon saving caused by the offset transaction. Across the various forms of carbon offsetting only carbon removal for long term geological storage is measurable, verifiable, equivalent and additional. Carbon is taken form the atmosphere by a biological or chemical process and then mineralised or stored underground. Investments in tree planting and carbon reduction schemes remain positive initiatives for the climate but the extent to which they can replace (balance) emissions reductions is increasingly contested.

[viii] Carbon removal technologies are in the early stages of commercialisation and therefore costs per tonne of CO_2 are high. There is also a limit on the technical feasibility and ecological benefit of removal technologies due to land and energy input needs. Therefore, there is broad agreement that these offsets can only apply to a limited quantity of emissions, and should apply to the hardest to tackle sources of greenhouse gases [8].