

JULIE'S BICYCLE 

Moving arts

Managing the carbon impacts of our touring

REPORT

Volume 3: **THEATRE**

Foreword

Tony Wadsworth

Chairman Julie's Bicycle

Since our founding three years ago Julie's Bicycle has published four major research contributions to environmental sustainability for the performing arts; we have developed new industry-specific tools to measure our greenhouse gas impacts; and we have produced resources and guides to help creative businesses to cut their emissions.

This latest work on international touring is our most ambitious to date. Touring is a fragmented, complex and elusive sector unused to collecting and accounting for emissions data. We want this research to trigger a major global shift in the touring industry which puts environmental concerns at the heart of the business. Nothing less. Legislation, carbon pricing and markets are inexorably shifting the ground anyway.

Now is the time for a shared international ambition with the vision and processes that can embed sustainability deeply into our work. We are at a pivotal junction in which the decisions taken today will determine the future of generations to come.

Great leadership is always driven by integrity and by being an example of what you intend to inspire. But instead of relying on one individual we can all do it: and therein lies the heart of our vision.

Special thanks to Niall Black, Philip Brown, Sally Cowling, Paul Handley, Andrew Jones, Bryan Raven, Fern Smith, Rachel Tackley and John Young for their work on the steering group, our funder British Council and to Catherine Bottrill, Christina Tsiarta and the superb team at Julie's Bicycle for this pioneering and extremely challenging contribution to our industry. I hope we will meet it.

Moving arts – Managing the carbon impacts of our touring

Volume 3: THEATRE

Contents

Foreword – Tony Wadsworth	
Foreword – Theatre Touring Steering Group	2
Preface – Alison Tickell	2
Overall summary findings for Bands, Orchestras and Theatre	4
1.0 Introduction	5
2.0 Conclusions	6
3.0 Recommendations	7
3.1 Headline recommendations	7
3.2 Tools and resources needed	8
3.3 Further research needed	8
3.4 Detailed recommendations for each key participant	9
4.0 Barriers to environmental action	13
5.0 Research findings	17
5.1 Summary findings	17
5.2 Sector trends	17
5.3 Environmental initiatives	17
5.4 Theatre companies' status	18
5.4.1 Total number of performances	
5.4.2 Total audience size	
5.5 Total GHG emissions from touring theatre companies	19
5.5.1 Initial values and ranges per theatre performance	
5.6 Examples of tour GHG emissions	20
5.6.1 A UK small-scale subsidised theatre tour	
5.6.2 A small-scale subsidised theatre tour in Asia	
5.6.3 A middle-scale subsidised theatre tour in Europe	
5.6.4 A middle-scale subsidised theatre tour in North America	
5.6.5 A large-scale subsidised theatre tour in the UK	
5.6.6 A large-scale commercial theatre tour in the UK	
6.0 Research approach	22
6.1 Research boundaries	22
6.1.1 Key definitions	
6.1.2 Emissions boundary	
6.1.3 GHG Emissions	
6.1.4 Sector boundary	
6.1.5 Timeframe boundary	
6.1.6 Beyond the scope of the study	
6.2 Data collection	24
6.2.1 Tour samples	
6.2.2 Interviews with key informants	
6.2.3 Focus groups with key informants	
6.2.4 Surveys	
6.2.5 Secondary sources	
6.2.6 Data quality	
7.0 Emerging technologies and practice	26
7.1 Lighting	26
7.1.1 Market trends	
7.1.2 Lighting in the performing arts sector	
7.1.3 Emerging technologies available from lighting suppliers	
7.1.4 Cyps Go LED by Bryan Raven, White Light	
7.2 Trussing and rigging	27
7.3 Trucking and tour buses	27
7.4 Set construction and disposal	28
8.0 Hot topics	29
Hot topic 1: Governance: for the record, we must change the system By John Elkington	30
Hot topic 2: Putting a price on what we can't always see By Helen Heathfield and Christina Tsiarta , Julie's Bicycle	31
Hot topic 3: Carbon offsets: cop out or climate winner? By Dr Adam Bumpus , University of British Columbia, Canada	33
Hot topic 4: Up in the air or out to sea? By Tristan Smith , University College London Energy Institute	35
Hot topic 5: Biofuels: solving our climate and oil woes? By Alexandra Morel , University of Oxford	37
Hot topic 6: Leisure travel: the untapped savings By Dr Jillian Anable , University of Aberdeen	40
Hot topic 7: Snacking on emissions By Dr Rebecca White , University of Oxford	42
Appendix 1 Guidance, tools, awards and regulation	44
Appendix 2 Background to the theatre sector and its touring practices	46
Glossary	50
Abbreviations	52
Contributing authors	53
Contributors	54
Bibliography	55

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Foreword

Theatre Touring Steering Group

Theatre in this country is one of the things we do best. Our theatre traditions are centuries old and touring – whether it be as traveling players or big shows – has always been at the heart of our relationship with our performers, producers and audiences.

Our first priority then is to nurture the capabilities in theatre itself so that it will continue to thrive. Almost a year ago we embarked on this study into the carbon impacts of our touring work. During that time we have discovered a huge appetite to better understand what we are doing now and what we must change.

For most of us taking part, this has been the first attempt to quantify the carbon impact of our touring work. Knowledge is power and this report is a major step forward in our understanding. The real challenge starts here: making our touring as low carbon as we can. And that's not just about greening what we do, it's also about doing what we do differently. We need new approaches, new skills and a shared commitment to taking this issue forward. Though the economic climate is challenging, the cost of not acting is too great.

Quick to understand the vision, the industry is now seeking practical support and advice which will focus our collective efforts on the most useful actions. This report takes the first steps in recommending practical things we can do to get started. It is our collective responsibility to act now to ensure that theatre can continue to be made, shared and enjoyed for centuries to come.

Preface

Alison Tickell

When we began researching the environmental impacts of British based touring bands, theatres and orchestras last September we had no idea that the scientific and political framework within which we were working would change so dramatically. The month between mid- November and mid-December seeded sudden doubt in the integrity of science and witnessed political disarray in Copenhagen. Now we have become hesitant and it is clear that for the vast majority the resumption of economic growth ranks far higher than action on human- induced climate change.

However, trajectories for greenhouse gas emissions combined with our knowledge of related environmental concerns such as species extinction and ocean acidification remain the stuff of high tragedy. After hopes were so dramatically dashed in the last moments of 2009 we are now experiencing the onset of uncertainty which makes it harder to gauge appropriate responses and, crucially, take decisive action. Already I see this in the cultural sector – it shimmies between stances that could easily tip over to schisms: either to deal with carbon dioxide, or to promote overall sustainability. This is a false opposition; it polarises identity and paralyses action; above all it unveils how deeply uncomfortable we are with uncertainty. If ever the arts could intervene and bridge the 'eithers' and the 'ors' it is now.

Before embarking on the report it is worth anticipating and heading off likely apprehensions. We do not suggest that we stop touring or that international touring is worse than domestic, that

large-scale touring is excessive, or that bands are worse than orchestras. There are no goodies and baddies; in reality comparisons of this kind are rarely useful and tend instead to splinter arts communities and reinforce stereotypes. What is much more interesting is that this broad collection of people have come together and given freely of their time and painstakingly gathered data because everyone has committed to understanding their part in this crisis.

Every day we use – and waste – huge quantities of energy. The degradation of the planet – including human-induced climate change – boils down to inequitable over-consumption largely perpetrated in developed countries. Sadly it is not within our direct capacity to prevent wholesale species from extinction but it is possible to reduce our energy consumption by planning routing, or flying less. Reducing consumption and decarbonising our touring will return a direct positive net profit to the environment, including species preservation – not to mention ethical, reputational and financial benefits.

The research has highlighted environmental costs and existing fiscal mechanisms intended to account for them. To date our market system has not begun to reflect the true costs of environmental impacts; so if we are anxious about financial stability we must surely factor in cost considerations that give us the long view. A resilient international performing arts industry that flourishes for generations will be one that anticipates its financing to operate

within ecological limits. This is simple good sense.

We set out to probe the business of touring, harvesting the abundant creative raw materials from which to craft a touring industry that puts environmental concerns at its heart. Our goal? To thrust the issue of environmental impacts, starting with decarbonisation, into the heart of the touring industry so that it becomes important enough to provoke an industrial shift.

We have produced a three-volume research study, each volume with a voice of its own but there is much common content. Each sector – bands, theatres and orchestras – considers itself unique, quite distinct from all others. Whether this is the case or not, what matters is accounting for this common perception. What is certainly true is that the cultures and behaviours of the people in these industries, the professional relationships and dynamic interplays, are very different. Within the industries decisions are prescribed by subtle dynamics which operate alongside the obvious financial and logistic transactions. If we are to stimulate change it is important to understand how we can best deploy the human element: it uniquely informs each touring realm and our ambition to alter a complex supply chain means pulling the right levers of influence; to maximise power relationships we need to be aware of where they are. For example, in commercial band touring successful artists are the definitive force, in theatre it is shared between the work itself and the creative interpreters; with orchestras it is the forces of repertoire and management.

Our research legacy will be contingent on whether we manage to draw out common ambitions, issues, and activities, while maintaining the capacity for each industry to tailor and champion environmental priorities internally.

Failure to understand how these ultimately powerful dynamics flow is perhaps why responses from government, science and media are often ineffective and enervating. The assumption that if we focus hard enough on celebrity, regulation or science we will effect a behavioural revolution has proved distinctly shaky. By understanding the science and deploying our creativity in the manner in which we consider best we are much more likely to shape regulation as it will affect us.

A word on expectations: this piece is only a start. It looks at core touring activities: the movement of people and product and how that translates into the generation of greenhouse gases. Touring doesn't have the advantage of fixed or stable data gathering points, such as gas or electricity meters, repetitive work patterns, a predictable or permanent work force, or easy access to information about audience travel. There were things we had to remove from our initial scope: notably show power demand and some festival tours and all three industries share a common deficit: available data. Too much of our time was spent doing basic detective work.

We want to track environmental performance and use it in policy, planning and industry intelligence, so where there is relevant data that is in our mutual best interests it makes sense to share it.

We have avoided comparisons across sectors because the scale of activity and audience generally corresponds to the emissions profiles: international touring generates the most emissions

because distances are vast and people tend to fly. Similarly, the emissions produced by bands far exceed orchestras and theatres, but so do their audiences.

While there are some pioneering examples of leadership we are, as a community, short on vision and long on doubt. We need to take a few priorities and commit to them. Only large-scale will do, action at the margins is simply not enough. We are suggesting that we begin with the actions that can command the broadest assent and achieve the quickest results. So we propose beginning with four core, principled, priorities:

1. Get to know the issue, engage with energy and environmental issues.
2. Measure your impacts: understanding what the carbon profile of touring is the first step towards managing it.
3. Identify what you can do to reduce your impacts, support 'green' products and activities to help shift markets.
4. Talk about it, disclose your impacts, invigorate the issue, talk to your artists and audiences, be accountable. We all want to avoid suspicions of greenwash.

Finally we would be missing a trick if we failed to bring into the narrative the art itself: the song, the play, the piece. Whatever other factors are at work – including taste – the art is what brings us together and what shapes the industries. We cannot ask artists to 'do' climate change but we can help those artists who choose to make climate change and the environment a part of their work.

Good outcomes ultimately require trust, transparency, accountability and cooperation on a grand scale – in other words, good governance. We have to stop being parochial as it relates to the comfort of art forms and national boundaries, and scale up our ambition.

This research is a heartfelt appeal to the touring industries to be sure-footed and assertive in your environmental responses. With good will and determination our recommendations will become standard practice and the research itself can be archived. Until then I hope that it is, above all, useful, and helps free that palpable but paralysed energy that has characterised our research encounters over the last nine months. Over 300 people have contributed to this research: we all need to look back and know that it has been worth it.

Alison Tickell
Director, Julie's Bicycle

Overall Summary Findings for Bands, Orchestras and Theatre

Touring greenhouse gas (GHG) emissions of performing arts:

- Bands = c 85,000 t CO₂e
- Orchestras = c 8,600 t CO₂e
- Theatre = c 13,400 t CO₂e

Figure 1 Initial values of the GHG emissions *per band performance* by each size by region, in tonnes CO₂e

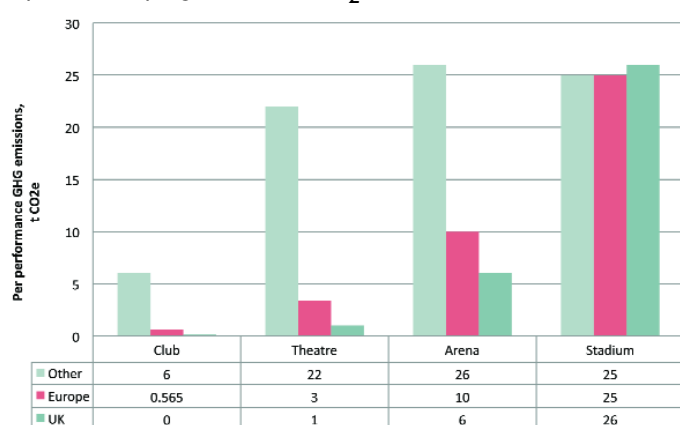


Figure 2 Initial values of the GHG emissions *per orchestra performance* by each size by region, in tonnes CO₂e

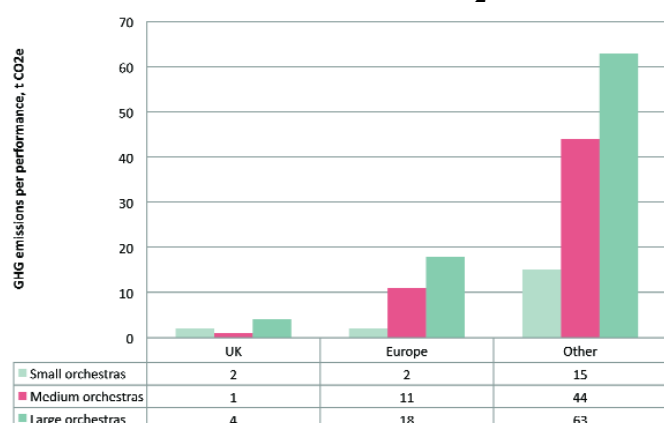
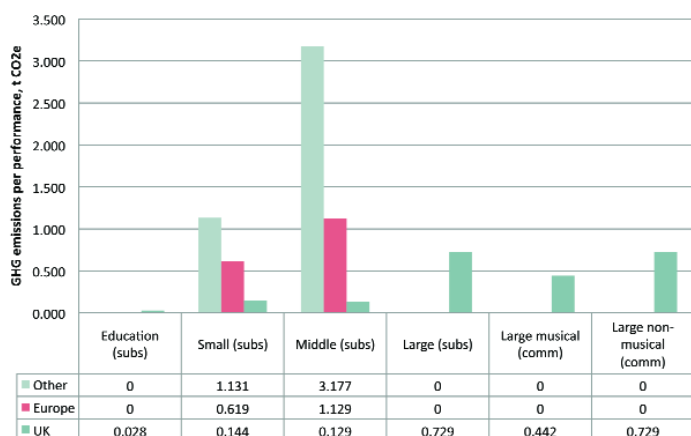


Figure 3 Initial values of the GHG emissions produced *per theatre performance* by production scale by region, in tonnes CO₂e



Concluding observations

This study has found that touring bands, orchestras and theatres have not systematically embedded environmental considerations into touring practices. They are at the start of the process of engaging, measuring, reducing and communicating their efforts to improve the environmental performance of touring. We found professionals across the sector are willing and committed to take action, but need guidance on the priorities and support in taking actions.

General recommendations

Touring productions

- Embed environmental sustainability into tour planning.
- Create demand for goods with strong environmental credentials.
- Scope the GHG emissions when planning a tour.
- Measure the GHG emissions after the tour.
- Report the GHG emissions produced from touring.
- Calculate the environmental damage of a tour by pricing these impacts.

The business supply chain

- Venues embed environmental sustainability into operations and investment plans.
- Suppliers invest in and offer customers goods with strong environmental credentials.
- Funders require as condition of funding measurement of GHG emissions.
- Membership organisations disseminate information on environmental action to members and communicate the concerns of members to relevant stakeholders.

Collective action

- Collection and analysis of environmental statistics on live performance sector.
- Provision of environmental training to develop knowledge, expertise and skills.
- Commit to a small number of joint priority actions across the sector.
- Fast-track environmental innovation for the performing arts sector.

1.0 Introduction

Sustainability is the art of living well, within the ecological limits of a finite planet. Art is more than an instrument in this process. It's the nature of it.

Professor Tim Jackson, 2010¹

If any experience captures the art of living well it must be the experience of live performance. Theatre connects us to one another, creating a vital bond between the performers and the audience. When it's good, the imprint stays with us forever. Touring is one of the most creative and flexible ways that audiences can get access to live performance, and many theatre makers embrace the discipline of touring as a fundamental part of their creative challenge.

Innovative touring experiments, often embarked upon by financial necessity, can generate wholly new ways of working: perhaps introducing audiences to the experience of seeing work in unusual and non-traditional theatre spaces or to being part of an audience made up of very different people than they would normally encounter. Touring is, of itself, adventurous and usually attracts theatre makers with a zeal to take their work to wider and more diverse audiences than those reached from a single venue and for whom the variety of response is of enormous creative value.

But Professor Jackson is mainly referring to sustainability in terms of how we in the developed world manage – or mismanage – the environmental consequences of our current lifestyles.

And while the experience of theatre is sustaining is this also true of the business? This research was undertaken to address that question as it relates to touring, and to identify how to reduce the environmental impacts.

It is understandable that theatre makers are fearful that environmental concerns might act as a barrier to continuing to share their work so widely but, by virtue of the imaginative and flexible approach common to touring theatre makers, they are in fact uniquely well-equipped to help design a new model of touring that continues to offer access and participation to large numbers of people worldwide but that creates a far smaller environmental impact whilst doing so. The research that Julie's Bicycle has undertaken provides fascinating insights, but crucially it provides the evidence base that theatre makers can use for practical action: recommendations, tools and resources. It is directed at all those who are engaged in the business of theatre touring: the companies themselves, funders, as well as the promoters and venues who present the work.

This study is the first systematic attempt to link the evidence of environmental impacts with practical solutions for cutting carbon emissions. It presents an in-depth understanding of GHG emissions

generated across all scales of touring activity. We have focused on the movement of people and of the production – in other words the primary business of touring – because these decisions have ramifications for all associated greenhouse gas emissions. The findings are the result of extensive data gathered from a wide variety of tours undertaken in 2009 and from conversations with a broad cross-section of touring professionals.

With this information we have been able to:

- 1) Quantify the total annual and per performance greenhouse gas emissions from all scales of touring activity undertaken in the UK and by UK-based theatre companies touring overseas.
- 2) Identify practical actions through the business supply chains which, if taken now, pave the way for a touring sector with a minimal environmental impact.

This is the first time most of the participants have been asked to provide data for the purposes of calculating the GHG emissions and many found this challenging. We need more touring companies to measure GHG emissions in their planning. By doing so, and by giving the resulting information to Julie's Bicycle, they will be supporting the development of more robust environmental performance benchmarks including an ability to track the sector's progress overall. Julie's Bicycle has developed a free online Industry Green "IG" tool to facilitate this process.

The urgency of climate change is not the only motivation for touring theatre companies to reassess their way of working. Increasing volatility of the price of oil will, in the coming years, inevitably affect a sector dependent on transport. Actions taken to reduce GHG emissions now will have the benefit of buffering the sector from any oil price spikes in the future as well as having a net impact on our stifled biosphere.

These issues are driving both mandatory government regulation and voluntary action. In the UK, the Climate Change Act, which requires an 80% reduction in greenhouse gas emissions by 2050, is directly affecting larger venues, freight companies, and lighting and sound manufacturers and suppliers. Whilst direct regulation of a theatre tour itself is not likely in the short term, regulation will be experienced via increases in the cost of oil, and carbon costs passed on by venues, transport or equipment suppliers.

The market aided by regulation is already beginning to put a true price on the environmental impacts of business and consumer choices. This price will become clearer in coming years as regulation develops and oil becomes a scarcer commodity.

Whether we like it or not, paying the real cost of goods and services, including the environmental costs, will profoundly influence businesses, organisations and consumer choices. The theatre sector can only benefit from pre-empting and championing

¹ Julie's Bicycle and British Council (2010). *Long Horizons: An exploration of art and climate change*. British Council, London

a shift towards practices that minimise environmental impacts, and adapting to changing circumstances. This most adaptable of theatre practices is in a position once again to demonstrate its ability for creative re-design.

Our recommendations outline immediate actions which will, we hope, open the way for further changes to practice. To support the development of thinking and practice, this study includes a number of specialist pieces focused on “hot topic” issues (such as aviation, biofuels, carbon offsets and leisure travel) that are of immediate relevance to the theatre sector. We also champion the emerging community of organisations and practitioners at hand to help theatres navigate safely through these issues.

Environmental leadership will take commitment, time and resources but there is a clear opportunity for the theatre sector to

embrace this issue with confidence. Wisely done, the cultural influence of theatre can inspire wider systemic shifts towards a society that embeds environmental sustainability as a guiding principle.

So it is timely to be taking stock of theatre touring practices. Dealing with these issues now will give the theatre sector a greater ability to respond to future challenges posed by environmental issues, and help to determine its own future.

This study of theatre touring is part of series conducted by Julie’s Bicycle into the GHG emissions produced by a number of performance forms. The other two areas under analysis are band and orchestra touring, with the scope for additional performing arts sectors to undertake similar scrutiny.

2.0 Conclusions

- Touring is fundamental to the theatre sector: it extends audience reach and is an important funding source.
- Commercial theatre touring is the most significant contributor to the theatre sector's touring related GHG emissions, due to the large number of performances and scale of production.
- Subsidised theatre, especially at the small and middle scale, contributes a substantial proportion of emissions resulting from the presentation of work overseas. There are only a small number of large-scale subsidised productions each year.
- Most touring theatre companies have not considered the environmental impact of their touring activities. To date this has not been a business priority, nor a requirement for public funding.
- The relationship between a touring theatre company and venue is very important in determining what and when work is presented. The venue typically has more power in determining when a small-scale production can be presented in the venue.
- Funders for the theatre sector have a pivotal role in setting environmental criteria for grant recipients to adhere to, and in signposting the theatre sector to guidance and resources to reduce their environment impact.
- Reducing the environmental impacts from theatre touring will require the development of new touring models, which might involve, for example, increasing performances per tour (at a single or multiple venues) and assessment of logistics (performer travel and freightage). This will require tools, guidance and training. Furthermore, investment is needed to pilot and demonstrate new touring models that reduce environmental impacts as well as extend audience reach, maintain economically viable theatre organisations and ensure artistic quality is retained.

3.0 Recommendations

Environmental action is an ongoing process requiring a commitment to four principles: company or personal engagement with the issues; measurement of impacts; development of a strategy to reduce damages; and communication of what you are doing.² To fulfil these principles Julie's Bicycle recommends that the steering group and the theatre sector adopt the following actions.

The recommendations are addressed to those responsible for organising the tour; suppliers of products and services; funders and trade associations/membership bodies. The list below identifies 12 priorities for action. In addition, we have prepared detailed tables of immediate action for each participant in the touring business. The tables which can be found in Section 3.4, also outline the scale of ambition for environmental improvement.

3.1 Headline recommendations

Planning:

1. Embed environmental sustainability into tour planning alongside artistic and financial considerations. The main areas for touring theatre companies to consider during the planning stages are; set design; show power demand; routing and venue selection; travel logistics; and goods and service procurement. This requires senior management and board engagement at the strategic and operational levels so the business risks and benefits of taking environmental improvements can be understood and action taken.

2. Scope the greenhouse gas emissions when planning a tour. This is vital for identifying opportunities to reduce GHG emissions early on in the planning process. Use the free Industry Green tour tool to predict GHG emissions from the tour.

Measure:

3. Measure the greenhouse gas emissions after the tour. Measurement should take place upon completion of the tour to evaluate environmental performance against comparable sector benchmarks. Use the free Industry Green tour to calculate the actual GHG emissions from the tour.

Action:

4. Share the GHG emissions produced from touring and any steps taken to reduce environmental impacts. Sharing this information with staff, suppliers and Julie's Bicycle would enable the development of robust sector environmental performance benchmarks and disseminate emerging and best practice on improving environmental performance.

5. Theatre venues embed environmental sustainability into day-to-day operational practices and in future building investments. Venues should seek a standard accreditation for their environmental performance and communicate this to all incoming companies. Touring theatre companies should request information about venues' environmental performance, for example, by using a green rider. In the mid-term Julie's Bicycle is launching a database of venues with strong environmental credentials so touring theatre companies can consider this information when making venue selection.

6. Suppliers invest in, offer and signpost touring theatre companies to the products and services with strong environmental credentials. This is relevant for a whole number of suppliers such as trucking, hotels and consumables. Touring theatre companies should request information about suppliers' environmental performance and policy.

7. Membership organisations should increase member awareness of the importance of embedding environmental sustainability in operational practice, and communicate the concerns of members to relevant stakeholders. Membership organisations should work with Julie's Bicycle to collect, collate and report sector intelligence on touring that is relevant for monitoring environmental impacts.

8. Environmental training is provided to develop expertise and skills for taking actions. Training should be incorporated as part of the curriculum in sector relevant degree courses and certification programmes and also professional development training offered by employers and membership organisations.

9. Fast-track environmental innovation that is grounded in the business realities of the performing arts sector. Identify the most appropriate sources and vehicles for investment to support innovation pilots. The purpose would be to identify low carbon future technologies, formats and business models specific to the performing arts sector, and to take the best innovations to scale.

10. Collect statistics on performance arts sector. Important statistical information about the sector is fragmented, opaque, un-collated or simply not collected at all. This creates a significant barrier to taking environmental action forward. Certain organisations are well-placed to collect data for monitoring the sector's environmental performance. The sector would benefit from this information being shared regularly (e.g. through annual intelligence reports) to inform strategic thinking and enable actions that can reduce the sector's environmental impact.

² These principles form the foundations of the Industry Green framework developed by Julie's Bicycle specifically to support the creative industries in reducing its environmental impact.

Finance:

11. Calculate the environmental damage of a tour by pricing these impacts. This is an increasingly mainstream practice and is done by measuring environmental damage (i.e. GHG emissions of the tour) and then multiplying this by a price per unit of environmental damage. Knowing the environmental damage of a tour will help inform decision-making to ensure environmental considerations are taken into account and reduced to the greatest extent possible. Furthermore, if wanting to invest in sector specific climate mitigation and adaptation the calculated environmental damage cost can be applied to determine the appropriate amount to invest.

12. Funders require touring theatre companies to measure their GHG emissions as condition of funding.

Funding bodies are in a pivotal position to encourage touring theatre companies to embed environmental considerations into touring practices, at the same time recognising the potential business plan implications of change and working with the sector to find ways to mitigate the impact. Furthermore, funding bodies should signpost touring theatre companies to tools and guidance for improving environmental performance and financially support organisations providing resources and training.

3.2 Tools and resources needed

A series of web-based information and tools is needed to support the touring sector. Some of these tools are already in prototype development and others need to be created. The benefits of these tools will grow as organisations and companies contribute information and the sector uses them:

- Industry Green (IG) tool for touring emission measurement and tracking (prototype)
- A database of venues with environmental accreditation(s) (prototype)
- A database of suppliers offering goods and services with environmental credentials
- A database of venue equipment in-house and local suppliers
- A database of set materials for rental, sale and recycling
- Sharing of emerging practice to improve environmental performance
- Standard template green rider for venues
- Standard template for venues to report environmental performance

3.3 Further research needed

The performing arts sector will benefit from further environmental research in the following areas in order to be able to strategically address its environmental impacts:

- A study of audience travel to venue-based performances and public transport provision
- Assessment of the GHG emissions of performing arts festivals and their relationship to other touring practices

3.4 Detailed recommendation for each key participant

For: Touring Theatre Companies (Artistic Director, Director and Producer)

Your actions	Where we want to be	How you do it
Tour Planning		
Ensure environmental issues are taken into account when planning a tour.	Environmental considerations are embedded into all tour planning decision-making.	Include responsibility for environmental actions in the job requirements of all those planning a tour.
Ensure creative staff on short-term contracts are made aware of the company's environmental stance from the start.	Sector made more aware of environmental opportunities.	Ensure contractual discussions encompass environmental concerns.
Maximise the usefulness of all international travel and minimise tour gaps.	Touring companies visit regions for longer periods.	Discuss opportunities for residencies, workshops, seminars etc., alongside performances. Network with academic and community organisations in the same cities as your key presenting partners.
Emissions Measurement		
Commit to pre- and post GHG emissions measurement of each tour.	All tours are measured for GHG emissions at the planning stage and upon completion stage of each leg.	Use the free web-based Industry Green (IG) touring tool to measure and track the emissions of tours by leg.
Tour Routing		
Assess the environmental impacts of your routing options.	All tours use a routing schedule that will minimise the GHG emissions produced from travel.	Calculate travel distances between performance dates and use the free web-based IG touring tool to work out the GHG emissions of route options.
Weigh the environmental considerations of long-haul travel against the ease of touring to familiar partners.	UK theatre touring becomes more geographically coherent.	Actively develop relationships with promoters based in mainland Europe and those close to your existing partners.
Encourage the development of a consortia approach amongst the promoters with whom you regularly network.	Promoters and presenters work with each other in geographically-bounded consortia to share incoming work.	Take responsibility for developing new relationships and for introducing your contacts to each other.
Venue Engagement		
Use a green rider to ask venues for information about their environmental performance.	Venues with strong environmental credentials become market leaders.	Use Julie's Bicycle venue environmental reporting template (or equivalent) in your green rider.
Travel Logistics		
Use low emission transport options where commercially competitive and convenient.	All tours make travel choices specifically to minimise the GHG emissions from moving production equipment and personnel on tour.	Use rail rather than flying where possible. Use logistics companies with fuel efficient vehicles and drivers with eco-driving training. If using biofuels use sustainably sourced. For overseas touring sea freight when possible rather than air freight.
Emission Reporting		
Report tour GHG emission results to staff, suppliers and audiences as well as for industry tracking.	All tours report their GHG emissions to assist with benchmarking and tracking of the live performance sector.	Use the free web-based IG touring tool to report emissions for confidential anonymised sector analysis.

Continued - For: Touring Theatre Companies (Artistic Director, Director and Producer)

Your actions	Where we want to be	How you do it
Costing the Environment		
Make the environment a budgetary consideration.	All tours make the environment a budgetary consideration.	Allocate time and resources for staff and contractors to assess environmental options.
Apply a price of carbon to tour emission results to help inform decision-making.	A total price of carbon is applied to all tour emission results. This amount is invested into schemes supporting climate mitigation and adaptation.	Use the free web-based IG touring tool to calculate the carbon costs. Costs could be compensated for by contributing funds to reduce environmental impacts and support adaptation of the performing arts sector or by funding carbon offset projects.

For: Production Managers, Lighting Designers & Technicians

Your actions	Where we want to be	How you do it
Show Power Demand		
Learn about the environmental pros and cons of different lighting design and set materials.	Sector specific information about environmentally responsible lighting and set materials widely available.	Talk to your suppliers about what environmentally responsible products and services they offer and are available on the market. Read the <i>White Light Green Lighting Guide</i> .
Minimise the show power demand.	All tours have minimised the show power demand.	When designing the show calculate the total show power demand and identify design and technologies that will reduce the power demand.
Communicate to suppliers and technicians that you want show power demand to be minimised and equipment used efficiently in set-up and rehearsals.	There is strong communication and cooperation between tour production and suppliers about opportunities for minimising environmental impacts cost effectively.	Talk to your suppliers about what environmentally responsible products and services they offer and are available on the market.
Production		
Freight only essential production elements.	Sector-wide freighting of lighting and set materials is minimised.	Contact venues upfront to ensure that you have information on all equipment and materials available in host venues.
Adopt an environmental sustainability procurement policy to use environmentally responsible suppliers where possible.	All tours use sustainably sourced materials, equipment is sourced locally (where possible) and lighting has a low energy demand.	Learn about the environmental impacts of goods and services - gather intelligence on best suppliers. Ask suppliers to provide you information about their environmental credentials. Use suppliers with recognised environmental accreditation(s).
Re-use and recycle production equipment, staging and properties where possible.	National and regional stage storage hubs with searchable web-based database are created for the sharing of set materials.	Use agencies such as Scenery Salvage to rent and recycle set materials.
Try to locally source set and properties where possible.	An available database of recommended suppliers, craftspeople and technicians.	Ask host venue for detailed lists of local suppliers and craftspeople and their environmental credentials. Share good experiences with other companies.

Continued - For: Production Managers, Lighting Designers & Technicians

Your actions	Where we want to be	How you do it
Accommodation and Consumable Suppliers		
Adopt an environmental sustainability procurement policy to use environmentally responsible suppliers where possible.	The mainstream use of goods and services with strong environmental credentials.	Learn about the environmental impacts of goods and services - gather intelligence on best suppliers. Ask suppliers to provide you with information about their environmental credentials. Use suppliers with recognised environmental accreditation(s).

For: Theatre Venues

Your actions	Where we want to be	How you do it
Tour Company Engagement		
Communicate what steps you are taking to incoming productions.	There is strong communication between venues and incoming productions on environmental considerations.	Use Julie's Bicycle environmental reporting template for venues (or equivalent). The same template should be used to respond to the green rider requirements of artists.
Provide incoming productions with information about equipment available on-site or locally available.	The amount of equipment needing to be moved venue to venue is reduced.	Make available information about in-house production and local suppliers on venue website.
Ask incoming productions what steps they are taking to reduce their environmental impact.	There is strong communication between venues and incoming productions on environmental considerations.	Ask for this information via the promoter rep or ask the production team directly.
Emissions Measurement		
Measure the GHG emissions of your venue(s).	All venues measure their GHG emissions.	Use venue auditing and management tools such as Industry Green (IG) venue tool, SMEasure, and Best Foot Forward Footprinter.
Emissions Reporting		
Report venue GHG emission results to staff, suppliers and audiences as well as for industry tracking.	All venues report their GHG emissions to assist with benchmarking and tracking of the live performance sector.	Use the free web-based IG venues tool to report emissions for confidential and anonymised sector analysis.
Seek a standard environmental performance accreditation for venues.	All venues have standard environmental performance accreditation(s).	Apply for Industry Green status for Venues, Carbon Trust Standard, British Standard 8901 and/or ISO 14001. Submit information on venue accreditation(s) to Julie's Bicycle database of venues with environmental credentials.
Costing the Environment		
Invest in building staff capacity to address environmental issues, energy efficiency and renewable energy.	All venues are investing in reducing building energy use and support renewable energy development.	Ring-fence money from energy saving efforts to further improve your venue's environmental performance.
Apply a price of carbon to venue emission results to help inform decision-making.	A total price of carbon is applied to all tour emission results. This amount is invested into schemes supporting climate mitigation and adaptation.	Use the free web-based IG touring tool to calculate the carbon costs. Costs could be compensated for by contributing funds to reduce environmental impacts and support adaptation of the performing arts or by funding carbon offset projects.

For: Product and Service Suppliers, e.g. Lighting, Sound System, Stage Set, Travel Logistics, Hotels, and Consumables etc.

Immediate	Where we want to be	How you do it
Learn about the environmental sustainability of the goods and services you provide to theatre companies.	Suppliers understand and communicate the environmental performance of what they sell to clients.	Contact manufacturers for information about the environmental credentials of their products and services.
Promote the products and services you provide with strong environmental credentials.	Environmentally responsible products and services supplied to the sector are widely available and cost competitive.	Signpost your customers to the products and services you offer with strong environmental credentials, e.g. on your company website.

For: Membership Organisations

Immediate actions

- Make environmental sustainability a standing agenda item.
- Keep abreast of legislation, financial/economic implications and audience concern.
- Signpost tours to resources for how to reduce the environmental impacts of touring.
- Develop a charter for members, which set out environmental principles, and includes a commitment to monitor and reduce emissions.
- Recognise and award members that are environmental leaders, and publicise models of good practise.
- Use lobbying power to push for the further development of environmentally sustainable technologies.
- Collect, collate and report statistics on live performance activities relevant for monitoring environmental impacts of sector.

For: Funders

Immediate actions

- Ensure environmental sustainability is a core issue on the agenda for strategy development.
- Signpost to information on emerging practice for greening touring within the performing arts sector.
- Support organisations providing resources and training to help organisations embed environmental decision-making within all activity areas.
- Support organisations working to co-ordinate efforts to reduce the environmental impacts of presenting work.
- Set GHG emission guidelines and reporting requirements for grant recipients to measure and report GHG emissions.
- Assess the funding support given to organisations on environmental criteria in addition to the artistic and financial criteria.
- Make environmental sustainability a budget provision for RFO and project funding applications.
- Publicise models of good practice, including outstanding creative achievements using green technology.
- Work with analogues to promote the development of cross-border touring and to encourage consortium working amongst venues.
- Advocate for the abolition of exclusion zones.
- Work with touring companies to support and develop residency models alongside performance.

These barriers have been identified to help each participant understand where they could focus to make their actions more effective.

4.0 Barriers to taking environmental action within the touring theatre sector

Participant	Creative	Financial	Operational
Artistic Directors/ Directors	<ul style="list-style-type: none"> • Primacy of artistic vision will supersede environmental considerations. • Directors planning collaborative projects often feel the need to conduct those creative conversations in person even if that involves repeated international travel. • Concern that new technologies and materials will not deliver desired results. • Desire to replicate high standards of original production when touring. • Desire to present work in artistically stimulating environments not always compatible with low impacts. • Ensuring tour schedule is sensitive to well-being of performers to maintain performance quality supersedes efficiencies. 	<ul style="list-style-type: none"> • Budget constraints will determine production design much more than environmental considerations. • A hired director may be inheriting a production budget and performance schedule that has already been set and is unlikely to feel able to push for environmental action at such a late stage. • Not likely to choose environmental solutions if notably more expensive or if they will alter the artistic vision. 	<ul style="list-style-type: none"> • Concern about maintaining quality control causes resistance to using locally sourced production.
Producers/ General Managers	<ul style="list-style-type: none"> • When working with the Director and assembling the creative team artistic and creative concerns will supersede environmental considerations. • The shape of a tour – its order, length and stop-off points – will assess the relative status of inviting venues, exclusion zones and the requirements of funding and co-producing partners but not its environmental impacts. 	<ul style="list-style-type: none"> • Priority to ensure financial stability and, in many instances, maximise income from touring. • Slim profit margins on touring mean the producer will not take environmental actions that increase cost. • More cost efficient in many cases to take production on the road rather than source locally, especially for large scale tours. 	<ul style="list-style-type: none"> • Limited availability of personnel trained with the skills for addressing environmental considerations in creating productions. • Need to balance schedules as often managing more than one production at any one time so this is priority. • Limited control over day to day running of the production once on the road. • Time constraints and the difficulties of cold selling lead to repeatedly working with supportive presenters rather than developing new relationships that might lead to more environmentally efficient touring. • Time constraints limit exploration of new suppliers and technologies. • Limited interest and lack of accessible information on the relatively few venues with strong environmental credentials. • No power to require significant alterations to be made to venues unless hiring for extended runs or part of a company managing venues.

Participant	Creative	Financial	Operational
Performers	<ul style="list-style-type: none"> • Desire to perform work in artistically stimulating environments not always compatible with low impacts. 	<ul style="list-style-type: none"> • Cost and convenience supersede environmental considerations when deciding travel arrangements. • Limited work of desirable standard and status make performers unlikely to refuse work on environmental grounds. 	<ul style="list-style-type: none"> • Need to balance schedules as might be working on more than one production at any one time. • Trade body regulations only allow for performers to be away from home-base for a certain amount of time, requiring the tour schedule to adapt accordingly. • Necessity to travel with the production and crew may preclude environmental considerations.

Participant	Creative	Financial	Operational
Designers	<ul style="list-style-type: none"> • Concern that new technologies and materials will not deliver desired results. • Copyright and design integrity can mean it is difficult for theatre companies to re-use sets from previous productions. 	<ul style="list-style-type: none"> • Constrained by budget provided by manager. 	<ul style="list-style-type: none"> • Limited interest and lack of accessible information on design measures to reduce the environmental impact of tours. • Set design limit by load in and out requirements.

Participant	Creative	Financial	Operational
Production/ Touring Managers	<ul style="list-style-type: none"> • Not applicable. 	<ul style="list-style-type: none"> • Have to follow the briefing given to them by the producer and artistic director. • Production decisions will be based on budgetary constraints. 	<ul style="list-style-type: none"> • Responsible for realising the artistic vision of the production, and may have limited or no input on show design. • Very time constrained when on tour to follow through on actions to minimise and track environmental impacts. • Likely to have a tour project immediately before and after. • Transport modes dictated by tour schedule as might be limited time between show dates. • Large scale tours with bespoke staging are too complex to be sourced reliably on the road and will need to travel complete. • Restricted by the dimensions of the buildings and ability to move and/or to source equipment. • Limited interest and lack of accessible information on measures to reduce the environmental impact of touring. • Suspicion that environmentally sustainable materials will be less durable and therefore not hold up to the rigours of touring. • Not typically easy to store or recycle staging materials, sets and properties, so go to landfill.

Participant	Creative	Financial	Operational
Technicians	<ul style="list-style-type: none"> • Have limited or no input on show design, rather responding to the equipment and logistical requirements set by the artistic and production design. • Dependent on plan of action set down by the producer and director. 	<ul style="list-style-type: none"> • Budget constraints will determine equipment and lights used much more than environmental considerations. • Not likely to choose environmental solutions if notably more expensive or if they will require a compromise in the artistic vision of the artistic director. 	<ul style="list-style-type: none"> • Restricted by the dimensions of the buildings and ability to move and/or to source equipment. • Limited interest and lack of accessible information on technical measures to reduce the environmental impact of tours. • Testing of lighting design can waste energy. • Need production to get in and out efficiently to be able to schedule other events.
Participant	Creative	Financial	Operational
Technical Suppliers	<ul style="list-style-type: none"> • Equipment manufacturers and suppliers are primarily concerned with the effects that can be created with their equipment, rather than environmental considerations. 	<ul style="list-style-type: none"> • Can only offer equipment that is available in market place and in-stock. • Directors and designers are not yet creating the demand for environmentally sustainable technology and equipment. 	<ul style="list-style-type: none"> • Not applicable.
Participant	Creative	Financial	Operational
Logistic Suppliers	<ul style="list-style-type: none"> • Not applicable. 	<ul style="list-style-type: none"> • Touring companies are not yet creating sufficient demand for environmentally sustainable vehicles. • The purchase of efficient vehicles for freight company fleet constrained by purchase price and running costs. 	<ul style="list-style-type: none"> • Number of vehicles depends on amount of equipment, properties and sets being used, and driver regulations (i.e. Health and Safety). • Freight companies rarely use public transport because of unreliability or inaccessibility of services. • Environmentally sustainable fuels are not readily available on the road, making use of vehicles running on these fuels difficult.

Participant	Creative	Financial	Operational
Venues Managers/ Programmers	<ul style="list-style-type: none"> • Priority is to deliver on creative requirements of visiting companies before those of environmental sustainability. • Impossible for venue to have equipment to answer every incoming production's creative and environmental needs. • The need for a balanced programme and competing requests can make it difficult to respond to a company's environmentally-driven date requirements. 	<ul style="list-style-type: none"> • A perception of competition for audiences from other tour venues leads to the imposition of exclusion zones. • Budget constraints preclude additional costs of 'green rider' or 'green' audience concessions. • Cannot undertake major changes in building operations for single productions. • Often old buildings requiring major refurbishment, with onus of responsibility dependent on landlord-tenant terms. • Investment in energy saving improvements depends on incentives and regulations. • Venues often are locked into energy contracts and can only ask for a renewable energy tariff at the re-negotiation stage. Unlikely to purchase a renewable energy tariff unless it is cost competitive. 	<ul style="list-style-type: none"> • Many venues do not currently share or coordinate programming information, which could enable touring theatre companies to maximise their time in a particular locale. • Venues can be multipurpose spaces so need to be able to easily adapt the space for other events. • Venue staff may be too busy or unwilling to adopt environmental measures that increase their workload. • Venues may not have the capacity or inclination to oversee local sourcing or building of set and properties. • Venues may not have information on local suppliers of environmentally sustainable equipment. • Concessions in venues typically have long-term contracts so the venue can only negotiate for environmental sustainability procurement when these are up for renewal.

Participant	Creative	Financial	Operational
Funders	<ul style="list-style-type: none"> • The importance of artistic freedom and the quality of work seen by audiences currently outweigh environmental considerations. 	<ul style="list-style-type: none"> • Limited funding available to facilitate touring theatre companies in making touring more environmentally sustainable. • Requirements of public funding bodies mean that audience numbers and diversity currently outweigh environmental considerations. 	<ul style="list-style-type: none"> • Established funding priorities and processes have not yet created the infrastructure and support for improving environmental sustainability of tours. • Lack of tools, guidance or signposting for touring theatre companies on such issues. • No environmental criteria in funding stipulations for touring theatre companies as yet. • Lack of national regulatory framework which will mandate funders to act.

Participant	Creative	Financial	Operational
Trade and Membership Organisations	<ul style="list-style-type: none"> • Priority for trade organisations to demonstrate their value to their members means they are protective of their position in relation to a given issue. 	<ul style="list-style-type: none"> • Priority to deliver financial benefits to membership supersedes considerations of environmental sustainability. 	<ul style="list-style-type: none"> • Representing the best interests of the membership is not always compatible with the best interests of the environment. • Membership organisations can be slower and less flexible in responding to emerging issues. • Membership organisations are always interpreting what is best for their membership, which can act as a brake on issues of emerging concern.

5.0 Research findings

This section presents our findings on the greenhouse gas (GHG) emissions resulting per annum from theatre tours undertaken by UK-based touring theatre companies within the UK and globally.

5.1 Summary findings

- The total GHG emissions impact by UK theatre touring companies within the UK and globally in 2009, based on available data, is estimated to be approximately 13,400 t CO₂e (see Figure 6).

- UK-based commercial theatre accounts for over a third of all touring performances in the UK, three-quarters of the total audience of the sector and two-thirds of the total touring GHG emissions of the sector.
- UK-based small-scale subsidised theatre accounts for two-fifths of all touring performances in the UK, a sixth of the total audience of the sector and a sixth of the total touring GHG emissions of the sector.
- Overseas touring by small and middle-scale subsidised theatre accounts for 5% of all touring performances in the UK, 3% of the total audience of the sector and a fifth of the total touring GHG emissions of the sector.
- Large subsidised theatre accounts for less than one percent of all touring performances in the UK, 1% of the total audience of the sector and 1% of the total touring GHG emissions of the sector.
- Education related-performances account for 17% of all touring performances in the UK, 3% of the total audience of the sector and 1% of the total touring GHG emissions of the sector.
- In the UK, hotel accommodation is a significant source of emissions, closely followed by freighting.
- For overseas touring, air travel is typically the most significant source of GHG emissions.

5.2 Sector trends

Key informants interviewed identified a number of sector trends. These will have a bearing on the GHG emission profile of the sector in the future.

- There is increasing variety in the types of theatre being toured.
- There is a growing interest on the part of touring theatre companies in offering site-specific or site-responsive work, which can bring different creative challenges and potentially attract different audiences.
- There is a growing perception of competition between different art forms operating on the large scale, such as musicals, opera and ballet.
- Fewer producers are creating work at the middle and large

scales because of the high costs per production. This is in part down to the difficulties that emerging producers have in gaining experience at this level.

- It is becoming more common for theatre companies and venues to embark upon co-productions, thereby sharing financial costs and risks.
- British Council-supported touring to areas such as India, the Middle East and China has increased in recent years as part of an ongoing programme to encourage greater cultural diplomacy and cross-cultural dialogue between the UK and these regions.
- Most particularly through the proceeds of the National Lottery, a great deal of public funding has been invested in the refurbishment of theatre buildings.
- The commercial sector has undergone recent consolidation with The Ambassadors Theatre Group now owning more than 40 regional venues across the UK.
- Theatre companies are increasingly exploring and/or have used digital media platforms to present their work. Digital performances are very different audience experiences and so are currently seen as complementing, rather than replacing live performance.

5.3 Environmental initiatives

A number of environmental initiatives are already underway in the theatre sector:

- A newly formed UK-wide green theatre initiative using the same approach as has been adopted by the music industry. This approach focuses on understanding climate change and environmental issues as they pertain to the sector and developing joint and co-ordinated reduction actions. This project follows on from the London Greening Theatres initiative instigated by the Greater London Authority and is being facilitated by Julie's Bicycle.
- The Theatre's Trust ECOVENUES initiative is focusing on environmental management in smaller London theatre venues.
- In 2009 Slowboat, organised by Artsadmin and the British Council, was the first performing arts conference to discuss the disjunct between current touring practice and environmental sustainability. This work on touring is intended to continue as part of Artsadmin's membership of the 2020 network (a consortium of European venues looking at issues of sustainability), funded by the European Commission Culture Programme.
- Shift Happens is an arts festival interested in sustainability, technology and arts. The festival is exploring the development of new business models for the creative sector and examining environmental sustainability issues within this context.
- Arts Council England and the British Council have signed a Memorandum of Understanding and are both in the process of

formulating strategies that, at the time of writing look likely to bring issues of environmental sustainability into their support for touring work.

Furthermore, a number of theatre companies have already started to take actions, for example:

i) Company related

- Some companies are developing environmental sustainability policies, for example limiting their use of flying within the UK.
- One company interviewed assesses the artistic importance of touring a large production overseas against the environmental costs as part of its strategic planning process.
- A number of companies have joined the 10:10 campaign, which is a voluntary campaign whereby organisations and individuals are committing to a 10% reduction in GHG emissions in 2010.

ii) Production related

- Some companies are keeping old set materials to recycle for future productions.
- Stage sets are increasingly built locally to avoid the need for freighting, particularly for overseas productions where the costs are prohibitive.
- Technical equipment is increasingly sourced locally to avoid the need for freighting.
- Venues are charging incoming theatre companies for their energy use.

5.4 Theatre companies' status

A touring theatre company's success and therefore its touring ambition is measured in terms of the number of performances, its audience size, its production scale and the location of touring.

5.4.1 Total number of performances

Based on best available data and reasonable assumptions it is estimated there are approximately 36,000 performances per annum by UK-based touring theatre companies within the UK, and also by UK-based theatre companies performing overseas (see Figure 4).

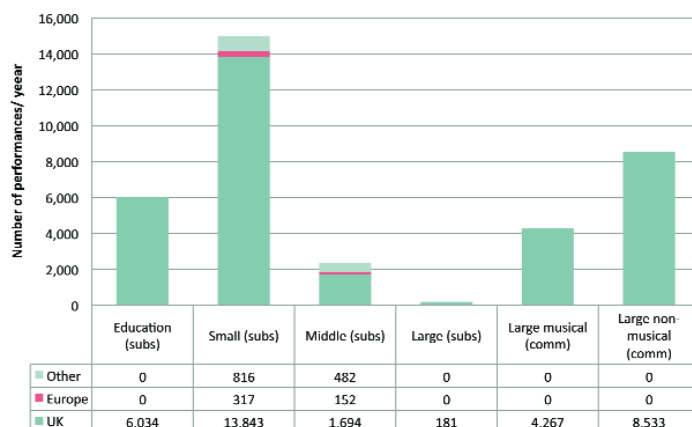
Of these performances:

- by production scale: a significant proportion (41%) are small-scale, subsidised theatre productions; a third (35%) are large-scale (musical and non-musical), commercial theatre productions; almost a fifth (17%) are educational-scale, subsidised and non-subsidised theatre productions; and a small percentage (7%) are middle and large-scale, subsidised theatre productions.

- by region: the vast majority are in the UK (95%, ~35,000 performances); and just 1% are in Europe and 4% in 'other' geographic regions. This is in part based on a commercial theatre business model where international presentation is licensed and entirely re-staged by the international licensee. Therefore

international presentation by UK theatre companies that retains control over the supply chain is mainly the province of non-commercial companies and will more often than not require public subsidy.

Figure 4 Estimated number of performances per geographic region by production scale. Total = 36,319 performances were estimated for 2009



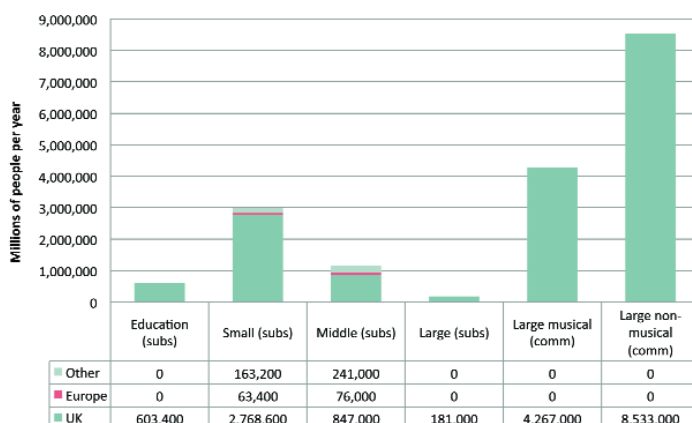
Note: subs = subsidised and comm = commercial scale

5.4.2 Total audience size

Total audience numbers for venue-based performances by UK touring theatre companies are estimated to be 18 million of which the vast majority are UK audiences (97%). In the UK almost three quarters of the audience (72%, ~13 million) comes from attendance at commercial theatre performances; almost a fifth (17%, ~3 million) is for small-scale subsidised theatre performances; and less than a tenth (8%, 1 million) for middle and large-scale subsidised theatre performances. The remaining 3% of the audience is drawn from attendance at education-related performances presented in schools and community hall type of facilities (i.e. not dedicated theatre venues).

Internationally, it is estimated that each year at least 500,000 people attend small and middle-scale theatre productions delivered by UK theatre touring companies (see Figure 5).

Figure 5 Total estimated audience numbers in 2009 by production scale in each geographic region. Total = 18 million people



5.5 Total GHG emissions from touring theatre companies

The total GHG emissions impact by UK theatre touring companies within the UK and globally in 2009, based on available data, is estimated to be approximately 13,400 t CO₂e (see Figure 6).

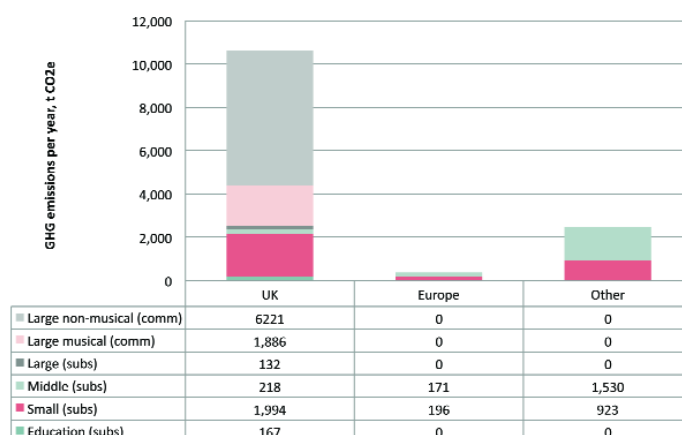
By production scale:

- close to two-thirds (60%, ~8,100 t CO₂e) are attributable to commercial theatre touring within the UK; of this 14% are from commercial musicals productions and 46% from commercial non-musical productions
- close to a quarter (23%, ~3,110 t CO₂e) are from small-scale subsidised theatre touring
- a sixth (14%, ~2,000 t CO₂e) come from middle-scale subsidised theatre touring
- one percent (~132 t CO₂e) come from large-scale subsidised theatre touring
- one percent (~167 t CO₂e) is from education-related theatre touring
- Furthermore, of overseas emissions, middle-scale subsidised theatre accounts for 60% and small-scale subsidised theatre accounts for 40%. Commercial theatre does not typically tour internationally; instead productions will be licensed to overseas business partners

By region:

- four-fifths (79%, ~10,600 t CO₂e) of theatre touring emissions are from touring activities within the UK; of which
 - commercial theatre produces close to four-fifths (~8,100 t CO₂e)
 - small-scale subsidised theatre produces almost a fifth (~2,000 t CO₂e)
 - and large-scale subsidised theatre accounts for only a very small proportion of total touring emissions, as there are only a small number of productions at this scale each year
- close to a fifth (18%, ~2,500 t CO₂e) comes from touring internationally to 'other' geographic regions
- and just 3% (~400 t CO₂e) is due to touring within Europe (see Figure 6)

Figure 6 GHG emissions of the UK touring theatre sector for 2009 for each geographic region by production scale

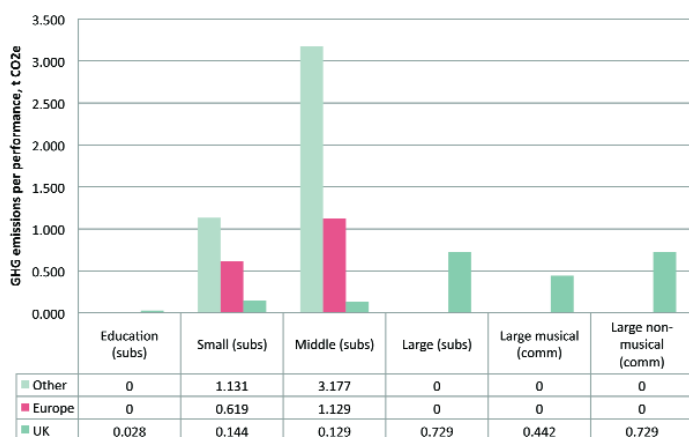


5.5.1 Initial values and ranges per theatre performance

Identifying what constitutes a typical tour in each range and region will, over time, become straightforward. This study is the first attempt to systematically analyse and classify touring according to the circuit (i.e. venue type) and leg (i.e. territory). Based on our 31 tour leg samples from 13 touring theatre companies we have calculated initial values of the GHG emissions produced per performance at each production scale touring in different geographic regions (see Figure 7). The initial values are the average per performance results for each tour circuit and leg. The data we collected constitutes a rich set of tour samples but it is still too small to determine robust average GHG emissions per performance. However, these initial values serve as a useful starting point from which we can build up an idea of the average GHG emissions for each category. Table 1 provides the per performance ranges (i.e. minimum and maximum) in the tour data we received.

As more theatre companies measure and report the GHG emissions produced from their touring activities these initial values will become increasingly robust. When the sample size is sufficiently large it will then be possible to benchmark tours (freighting, air travel, accommodation etc) so that touring theatre companies can usefully interrogate and compare their touring activities with other similar tours. This will enable them to manage their tours 'down' in terms of GHG emissions, as well as prepare the industry for compliancy and support artists and audiences in their 'green' ambitions.

Figure 7 Initial values of the GHG emissions produced per performance at each venue type touring in different geographic regions, in tonnes CO₂e



Note: 0.028 tonnes = 28 kg. We did not have any samples of large scale commercial non-musical touring productions, so we assumed the initial value we derived for large scale subsidised touring productions, for which we had 4 samples.

On a performance basis our initial values indicate a large-scale subsidised production results in five times as many GHG emissions per performance compared to a middle-scale subsidised production.

The GHG emissions for a small-scale subsidised production touring internationally outside Europe, compared to the same production touring in Europe are almost double per performance.

The GHG emissions for a middle-scale subsidised production touring internationally outside Europe, compared to the same production touring in Europe are almost three times higher per performance.

5.6 Examples of tour GHG emissions

The study focused on collecting information about the movement of people and production requirements of each show. The examples below illustrate GHG emission results for different touring circuits (small, middle and large-scale plus education/community touring) in different geographic regions. For each tour example we present the proportion of emissions by activity source, as well as the per performance result compared to the initial value we have calculated for that tour circuit and leg. (see Figure 7)

5.6.1 A UK small-scale subsidised theatre tour

This 12-performance date tour with a touring party of 3 people resulted in 1.4 t CO₂e (117 kg CO₂e per performance, which is close to our initial value result of 144 kg CO₂e). The emissions were relatively evenly split between hotels, personnel ground transport and production freighting (see Figure 8).

Figure 8 Percentage of GHG emissions by source for a UK small-scale subsidised theatre tour

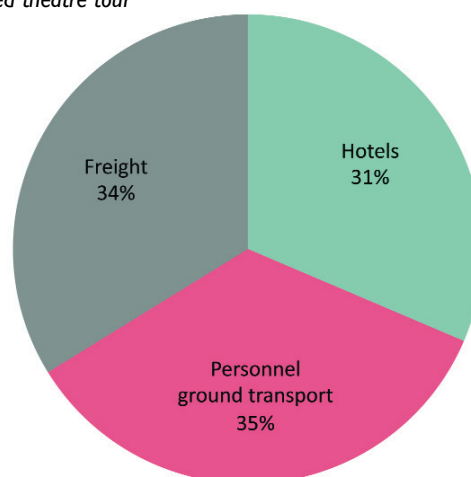


Table 1 Ranges of GHG emissions per performance (in tonnes CO₂e)

	UK		Europe		Other	
	Min	Max	Min	Max	Min	Max
Small	0.037	0.23	0.22	1.19	0.52	2.22
Medium	0.029	0.31	0.21	1.91	0.92	6.54
Large	0.16	1.53	14.07*		N/A	

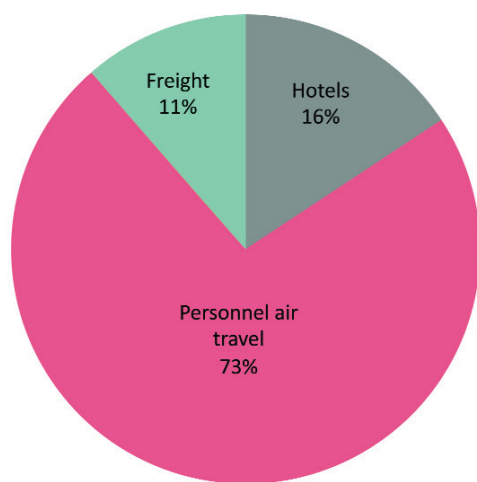
Note: 0.037 tonnes = 37 kg

* No range is available as only one tour leg sample was submitted.

5.6.2 A small-scale subsidised theatre tour in Asia

This 50-performance tour with a touring party of 3 people resulted in 13 t CO₂e (0.26 t CO₂e per performance is significantly lower than the initial value of 1.313t CO₂e). This is because of the large number of performances over which the emissions are distributed. Three-quarters of the emissions were produced from air travel (73%). The remaining emissions were produced from hotel accommodation (16%) and freight (11%) (see Figure 9).

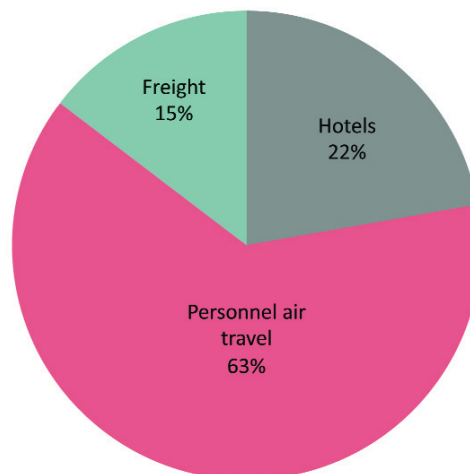
Figure 9 Percentage of GHG emissions by source for a small-scale subsidised theatre tour in Asia



5.6.4 A middle-scale subsidised theatre tour in North America

This 5-performance tour with a touring party of 9 people resulted in 13 t CO₂e (2.6 t CO₂e per performance, which is a fifth less than the initial value result of 3.18 t CO₂e). Over half of the emissions were produced from personnel air travel (63%). The remaining emissions were produced from hotel accommodation (22%) and freight (15%) (see Figure 11).

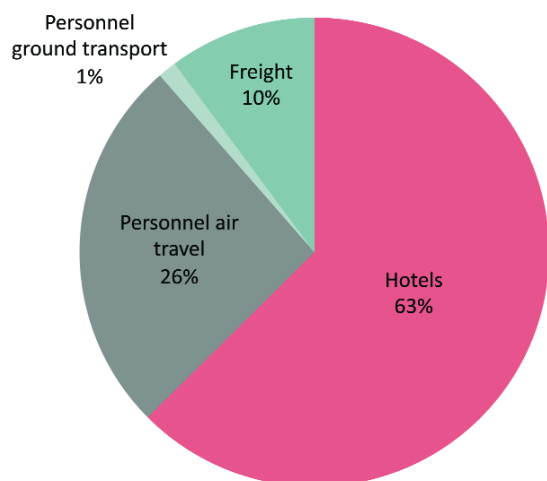
Figure 11 Percentage of GHG emissions by source for middle-scale subsidised theatre tour in North America



5.6.3 A middle-scale subsidised theatre tour in Europe

This 74-performance tour with a touring party of 24 people resulted in 99 t CO₂e (1.34 t CO₂e per performance, which is close to the initial value result of 1.13 t CO₂e). Over half of the emissions were generated as a result of accommodation and a quarter of the emissions were from air travel (see Figure 10).

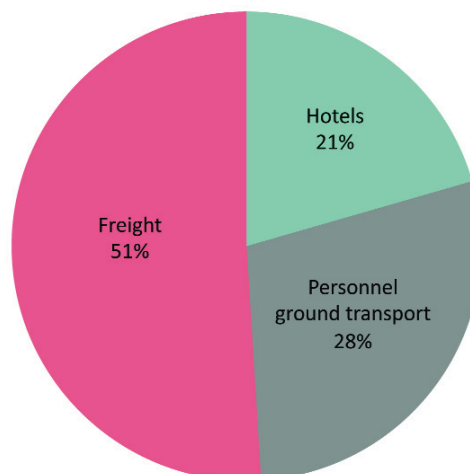
Figure 10 Percentage of GHG emissions by source for middle-scale subsidised theatre tour in Europe



5.6.5 A large-scale subsidised theatre tour in the UK

This 35-performance tour with a touring party of 25 people resulted in 6 t CO₂e (0.171 t CO₂e per performance, which is almost three times lower than the initial value result of 0.729 t CO₂e). A large proportion of the emissions were due to freight (51%), with ground transportation for personnel producing 28% of emissions, and hotel accommodation producing 21% of emissions (see Figure 12).

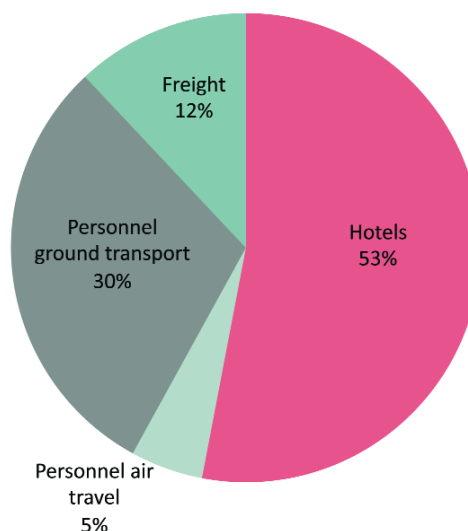
Figure 12 Percentage of GHG emissions by source for a large-scale subsidised theatre tour in the UK



5.6.6 A large-scale commercial theatre tour in the UK

This 128-performance tour with a touring party of 68 people resulted in 57 t CO₂e (442 kg CO₂e per performance). Over half of the emissions were generated by accommodation (53%). Ground transportation produced one-third of the emissions (30%), with freight producing 12% and air travel contributing a further 5% of emissions (see Figure 13).

Figure 13 Percentage of GHG emissions by source for a large-scale commercial theatre tour in the UK



6.0 Research approach

This study has focused on the core activities of touring: movement of people and the production to create the live performance.

The study was in two parts:

- 1) Quantify the total annual and per performance greenhouse gas emissions from all scales of touring activity undertaken in the UK and by UK-based theatre companies touring overseas.
- 2) Identify practical actions through the business supply chains which, if taken now, pave the way for a touring sector with a minimal environmental impact.

A steering group of experienced individuals from core professions in the theatre sector was established at the outset to inform and guide the work. On this group were theatre directors, producers, production managers, suppliers and funding body / cultural agency representatives. Critically this group brokered access into the sector and enabled us to get a good cross-section of tour samples essential for analysis.

This section provides a synopsis of our approach as a detailed technical note is available on our website (www.juliesbicycle.com) with an explanation of how the information was collected and used to calculate the GHG emissions from theatre touring.

6.1 Research boundaries

Setting the study scope is critical to understanding the findings, and to ensure that the analysis can be interrogated both on its own terms but also in comparison to other reputable research and data.

6.1.1 Key definitions

I) Environmental sustainability

Environmental sustainability refers to the ability of natural ecosystems to remain diverse and productive, thus being able to support life over a period of time. All human activity is based on these ecological goods and services. Some human activities, such as the excessive production of GHG emissions (including carbon dioxide), has led to the decline in natural ecosystems and to changes in the balance of natural cycles, thus undermining and degrading the capacity of ecosystems to continue supporting life. Living sustainably, for example, by reducing carbon dioxide and other GHG emissions, will ensure the long-term viability and productivity of these ecosystems, providing both humans and other living systems with the capacity to endure. It is in this context that we create a direct link between GHG emission reductions and environmental impacts.

II) Commercial theatre

Commercial (for profit) theatre organisations. These are not in receipt of significant public funding particularly for their core operations, though are occasionally able to access project grants from public funders for additional activities serving non-commercial ends, for example diversifying their audience. Often presenting large-scale work.

iii) Subsidised theatre

Theatre companies in receipt of public funding, commonly set up as charities or social enterprises. Often described as not-for-profit.

IV) Regularly/Revenue Funded Organisations

Organisations in receipt of public subsidy, often from a national Arts Council, on an ongoing annual basis. Such funding is mainly for core costs and programme rather than for specific projects. Funding agreements can vary in length: three years is common but in practice funding often continues for many years.

V) Presenting theatres

Venues whose programme is predominantly comprised of work produced and toured by others for periods ranging from one night to several weeks or months. Managers of such theatres have responsibility for the programming and the promotion of any performances taking place at their venue. Sometimes known as receiving houses.

VI) Producing theatres

Producing theatres are venues whose programme is mainly comprised of work created in-house by the theatre itself, sometimes in partnership (co-production) with other producing venues or companies. Programmes may also include in-coming tours. Sometimes known as repertory theatres, they rarely have a resident acting company but do have in-house artistic, production and technical staff and facilities. Producing theatres will sometimes tour their own productions to other venues.

VII) Site-specific theatre

Site-specific theatre is created to exist in unique and usually untraditional settings. Typically, the particular nature of the site itself will be a strong influence on the content of the work. More broadly, the term is used to describe any work that is (more or less) permanently attached to a non-theatrical location.

VIII) Theatre touring party size

Touring party size can vary from one tour to the next, so a theatre company can operate in more than one category depending on the needs of the individual productions. For the purposes of this study:

- Small-scale: less than 7 in touring party
- Middle-scale: 7-24 in touring party
- Large-scale: 25 or more in touring party
- Education-scale: less than 7 in touring party

IX) Average audience size

Venues are classified into small, middle and large-scale based on the number of seats in the auditorium. We used the following assumptions about average audience size per performance in order to estimate total audience figures.

- Education-scale subsidised and non-subsidised: 100 people
- Small-scale subsidised: 200 people
- Middle-scale subsidised: 500 people
- Large-scale subsidised, commercial musical, commercial non-musical: 1,000 people

X) Tour

A tour is defined to be one or more performances away from the theatre company's home base (i.e. not in the town or city in which it is located). The tour samples received have been classified by size - i.e. small, middle and large-scale subsidised; large-scale commercial; education-scale; and by tour leg.

6.1.2 Emissions boundary

Table 2 outlines all the main areas of GHG emissions associated with live performance, which are produced directly (in the control of the organisation), indirectly (not in the control of the organisation) or embodied (cumulative emissions through the supply chain) in the goods and services on the tour. The areas of tour activity from which we calculated the GHG emissions were:

- transportation of all performers and accompanying crew
- hotel accommodation
- freighting of all production equipment

It was not possible to examine the show power demand because the data was not available. However, this activity is within the performance emissions of the theatre company because show power demand is determined by decisions made by the artistic director and the production team. We recommend that theatre companies collect this information for inclusion in their GHG tour measurements as it will make it much easier for them to plan productions bearing emissions reductions in mind.

6.1.3 GHG emissions

The most relevant greenhouse gas (GHG) emissions resulting from touring are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), as opposed to others associated with energy production and manufacturing. These gases are emitted as the result of combusting fossil fuels for heating, electricity and travel. Carbon dioxide will be the most dominant gas with CH₄ and N₂O at much lower levels. Almost all the GHG emissions conversion factors used to translate energy use to GHG emissions were those provided by the Department of Environment, Food and Rural Affairs and Department of Energy and Climate Change in their 2009 guidelines to companies for GHG emissions reporting.

6.1.4 Sector boundary



The study has quantified an indicative estimate of the total emissions from theatre companies touring within the UK and UK-based theatre companies performing overseas. Total UK touring emission estimates do not include the travel of international theatre companies and their productions into the UK. This is because it was beyond the scope of our study to collect tour data internationally and is also a recognition of the lack of readily available data on the percentage of theatre performances in the UK that are delivered by theatre companies based overseas. All of our UK tour samples are from tours that originated in the UK.

6.1.5 Timeframe boundary

The study has calculated the GHG emissions of touring for 2009. Therefore, the majority of the tour data received is from tours undertaken in 2009 by UK-based theatre companies. The 2009 carbon footprint will therefore form the baseline for future reductions by the industry. Some variation from these boundaries was necessary and a few of the samples collected were from 2008 or 2010 due to tour data gaps from 2009.

Table 2 The main areas of GHG emissions in the theatre sector

Electricity & Gas	Transport	Goods/Services
Offices	Personnel	Stage Set Materials
Rehearsals	Stage Set Materials	Catering
Venues	Production Equipment	Tickets/ Programmes
Show Power Demand	Instruments	Merchandise
Accommodation	Audience	Food & Drink Concessions

 GHG emissions quantified in the study as they are activities integral to putting on the performance
 GHG emissions not quantified in study

6.1.6 Beyond the scope of the study

- Touring to performing arts festivals, because although a key activity of the sector it was decided at this first stage of touring research to study it separately. The environmental impacts created by festivals are best examined through a focused examination of festival promoter decision-making. This was beyond the time constraints of the study to undertake. However, festival organisers were interviewed to understand how theatre companies presenting at a festival interacts with taking the production on tour.
- Overseas theatre companies travelling into the UK for a tour.

6.2 Data collection

The study collected several forms of data from which to base the analysis. The results of the study can be found in Section 5.0.

6.2.1 Tour samples

We collected data from 31 tour samples (including site-specific work) by 13 theatre companies, which were broken down by scale of work and by tour legs. These samples were used to calculate emissions from touring activities and extrapolated to produce a GHG emissions footprint for the entire UK theatre sector for 2009. Table 3 breaks down the number of samples collected by size and by tour leg.

6.2.2 Interviews with key informants

We talked to a range of people closely involved in touring activities. They included creative leaders of producing theatres, theatre directors, general managers, production managers, representatives of funding bodies, suppliers, venue directors and programming managers. The interviews provided us with a 'real-life' context in which to analyse the emissions calculations from the tour samples, and enabled us to determine the relationship dynamics in the supply-chain of the industry.

6.2.3 Focus groups with key informants

Focus groups were used to determine the dynamics involved in the relationships between business players. The first group consisted of venue managers and programmers, the second of producers and artistic directors, and the third of representatives from trade associations.

6.2.4 Surveys

Three online surveys were circulated to the theatre sector. These surveys were used to help estimate the GHG emissions of the sector as well as develop appropriate recommendations. The surveys were as follows:

- a) A survey of theatre touring patterns over three seasons (2008, 2009 and 2010). The survey circulated to touring theatre companies funded by the British Council had 62 respondents (out of approximately 150 touring theatre companies) with a good spread of touring scales as well as UK and international touring activity.
- b) A short email survey to touring theatre companies that perform productions predominantly in schools, community halls and rural venues across the UK. The survey had six respondents and the information was used to calculate estimates of GHG emissions per performance.

6.2.5 Secondary sources

Additional data sources informed the assumptions underpinning our calculations for number of tours and number of performances delivered by the subsidised and commercial theatre sectors in England, Scotland, Wales and Northern Ireland, as well as in Europe and “other” world regions. Informed assumptions were also made regarding the number of tours and performances to schools, community halls and rural venues across the UK. The sources for the secondary data used in the study are: Arts Council England, Arts Council of Wales, Scottish Arts Council and British Council. In addition we used the 2009/10 programmes of eight theatres receiving touring productions.

6.2.6 Data quality

This is the first time the majority of the participants involved have been asked to provide data on the touring activities of the live performance industry for the purposes of calculating the GHG emissions of touring. Many organisations had difficulty providing accurate data (such as the amount of fuel used in trucks) because currently this information is not being systematically saved or filed. To the greatest extent possible, results have been based on real data received from our participants. On the occasions when this was not possible, reasonable assumptions were made in consultation with the steering group and other professionals supplying the data. Our research team assisted tour sample contributors as much as possible to help improve the quality of data submitted to the study and made suggestions for continued self-monitoring.

Table 3 Number of theatre tour samples received by size and by tour leg

	UK	Europe	Other	Total (size)
Small	4	4	5	13
Middle	3	4	5	12
Large	5	1	N/A	6
Total (region)	12	9	10	31

7.0 Emerging technologies and practice

The following section discusses emerging technologies with environmental benefits in the performing arts sector in the key areas of: lighting; trussing and rigging; trucking and tour buses; and set design. Julie's Bicycle is not endorsing any of the companies and technologies but includes them as illustrations of positive recent developments for reducing environmental impacts.

7.1 Lighting

7.1.1 Market trends

Lighting technologies offer substantial potential to reduce energy use and carbon emissions. Globally, lighting is responsible for 19% of electricity consumption and therefore a significant proportion of greenhouse gas emissions. Within this, the entertainment/stage lighting sector is tiny but trends in the general lighting market will affect venues and stage lighting. Investing in efficiency measures in electricity consumption is a cheaper way to reduce greenhouse gas emissions than investment in power generation such as photovoltaic panels and wind power. Regulation of lighting efficiency standards is clearly shaping the market, with domestic phase out of inefficient light sources such as incandescent lamps and some fluorescent lamps required by 2013/2014 in most developed economies.

The transition away from traditional light sources is currently dominated by Compact Fluorescent Lights, but Light Emitting Diode (LED) lighting is anticipated to overtake CFLs in about five years time. LEDs now offer greater efficiency than CFLs and can last up to five times longer (and twenty times longer than incandescent lighting). The LED thus offers reduced electricity costs and reduced product and labour costs for replacement. Also, the reduced heat generated by LEDs means less materials are needed to act as a heat sink, resulting in smaller units and more design flexibility, including for luminaries (where the light source sits within a designed fitting). LED costs remain prohibitive to many (despite already offering pay back in the long term), but are dropping at a rate of about 20% per year.

The transition to LED has significant implications for the current global lighting market, as the long life span of the products kills off the replacement market that has been a key revenue stream for the big players. Therefore, LEDs are a “disruptive” technology that will open up a previously consolidated market – indeed it may take new players to promote LED solutions, as the dominant companies promote the LED alternatives more slowly because they transit away from what was a previous revenue stream. Regulation will however ensure the shift takes place.

7.1.2 Lighting in the performing arts sector

Developments in the lighting market will directly affect venues and offices in live performance. Low emission lighting solutions will be installed throughout front of house and back stage in venues as

in stage lighting, but given its particular needs to illuminate spaces intensively for short periods of time these solutions are likely to be somewhat bespoke compared to mainstream lighting requirements.

Lighting has a central role in shaping the aesthetics of a show. With the increasingly demanding expectations from the audience for spectacular events there is great pressure to put on shows with extraordinary lighting features – which, by definition, rarely consider environmental impacts or energy costs. However, striking a balance between the aesthetic and the environmental demands of a product is possible with smart lighting design and technologies. Those in the industry responsible for designing for performances need to be aware of the benefits and constraints of emerging technology.

To date, environmental considerations are often not the lead driver in the development of new lighting solutions, but some manufacturers, such as Philips, see the market and branding opportunities of creating innovative technologies with strong environmental credentials. These manufacturers in turn require the support of sector suppliers to take up and actively promote the new technologies to their clients, thereby catalysing further research and development from manufacturers.

In recent years there have been a number of technological innovations that enable artistic directors and lighting designers to create a visual feast whilst reducing power demand; and simply by reducing show power demand usually reduces the amount of lighting equipment taken on the road, which in turn reduces transport impacts as well.

7.1.3 Emerging technologies available from lighting suppliers include:

- **GLP (German Light Products GmbH)** has created the Impression, a light fixture that offers a 400w reduction in power demand, weighs 7.5kg and has a lifespan of 50,000 hours for the LEDs (in comparison with a 575w lighting fixture weighing 27kg with a lifespan of 750 – 1000 hours for the light fixture).
- **PRG (Production Resource Group)** also supply ‘greener’ options including Vari-lite VLX, now manufactured under Philips. This is the next generation of Solid-State Lighting. VLX provides low-energy consumption and reduced maintenance costs with seven replaceable 120w RGB LED chip-sets, 14,000 lumens of output and a 10,000 hours source life. In addition, it draws approximately 30% less electrical current than a tungsten equivalent.
- **White Light** has consciously invested in procuring low carbon technologies as a priority. They invest half of their £1.5 million annual new equipment budget into new LED technology. They have prepared a green guide to lighting to help collate information for lighting designers and riggers to be more aware of environmental issues and to know what low energy lighting solutions might work in specific circumstances.

7.1.4 Cycs Go LED by Bryan Raven, White Light

Sometimes new products are not chosen for their eco-credentials per se, but because they achieve something that no older product can. Energy saving and other advantages are 'free' bonuses!

An example: the dramatic shift to using LED lighting for cyclorama skycloths that has taken place over the last two years. For the 2008 UK tour of Mary Poppins, associate lighting designer Rob Halliday was left with just 30cm of space to light an enormous sky. Previous productions had allowed almost two metres of space, so this presented quite a challenge. After an exhaustive period of trying every kind of lighting fixture, he started experimenting with the LED grids intended as video screens. These didn't quite work, but did lead to the discovery of EvenLED, a then-little-known product designed specifically for this purpose.

EvenLED proved a triumph on the show: a 13x8 grid of the 1m² tiles rigged just 25cm behind the cyclorama let the show's design team achieve everything they needed and more; far more than would have been possible with traditional cyc lighting techniques. As a bonus, the cyc used relatively little power compared to conventional equipment, ran cool, and did not require the regular replacement of blown lamps or burnt out colour – the bugbears of traditional cyc lighting.

Though expensive as all new technologies are, EvenLED has since been eagerly embraced by lighting designers on a wide range of other shows – by Peter Mumford for the opera Prima Donna at the Manchester Festival, by Keith Johnson for Eddie Izzard's touring show, by Rob Halliday again for Famous Last on Sky TV, and by Paule Constable firstly for Oliver! and then for Love Never Dies, Andrew Lloyd Webber's sequel to The Phantom of the Opera. Another measure of EvenLED's success: there are now at least three other companies making similar products.

7.3 Trucking and tour buses

Fuel efficient vehicles can significantly reduce the GHG emissions produced from transporting equipment. Specialised tour trucking companies are investing substantial amounts of money to improve the fuel efficiency of their vehicle fleet, for example:

- **EST** upgraded their fleet to include a further 14 Euro 5 trucks, which produce particle emissions 25% below the enhanced low emission vehicles (LEV). ES Group has set-up an environmental management system to run in line with their 2010 ISO14001 assessment.
- **KB Event** remains the only BS8555 accredited trucking company in the UK, certification which demonstrates they have integrated an environmental management system into their business operations. They have invested over £1 million updating their fleet including converting a number of their existing vehicles to meet the requirements of the London Low Emissions Zone (LEZ). They have replaced their larger trucks with the efficient Euro 4 vehicles featuring exhaust gas recycling.
- **McGuinness Forwarding Ltd** worked on Radiohead's most recent tour for which they purchased Euro 5 vehicles that used Ad-Blu additive. This additive reduces and minimises harmful emissions in the fuel. Each vehicle has its own independent air conditioning unit that runs off battery, which means the engine does not have to be left idle to maintain comfort levels inside the vehicle.
- **Tigertours Ltd** have recently invested £200k in new Euro 5s to update and expand their fleet, replacing all Euro 4 vehicles. They service their vehicles before and after hire and regularly check tyre pressures to optimise fuel efficiency.

7.2 Trussing and rigging

The Tyler GT, designed by Tyler Truss Systems, provides environmentally responsible trussing for the live industry by reducing the requirements for trucking: the units can be loaded up with the required lighting equipment and then stored without the need for bulky cases. The truss is made out of aluminium, of which 70% is recycled from scrap. By eliminating excess raw materials, reducing the amount of labour required to move and install the units, and reducing the space required for transportation the Tyler GT achieves a number of environmental benefits.

7.4 Set construction and disposal

By Christina Tsiarta and Emily Kay, Julie's Bicycle

Set construction, storage and disposal was identified by a number of our participants as a significant barrier to making the touring process they face more sustainable. The first reason cited was financial. Finance determines the sourcing and type of materials to be used in set construction, and with many environmentally sustainable materials costing more, the overall environmental sustainability of the set will be affected.

There are various types of material available for set construction, with varied environmental credentials and associated costs. For example, whereas wood is considered to be biologically carbon neutral, aluminium and steel are associated with a carbon-intensive manufacturing process that requires energy, which is translated into the burning of fossil fuels and the generation of GHG emissions. Wood varieties can even have differing environmental credentials; for example, plywood, depending on the method of harvesting, transportation and processing, can be very environmentally destructive, but if it is used in whole sheets and is Forest Stewardship Council (FSC) certified, then it can be both sustainably sourced and recyclable. Engaging with artistic directors and designers early on is thus crucial in being able to construct and deliver an environmentally sustainable set. Currently however, the lack of awareness amongst artistic directors and designers often leads to resistance to change, and construction materials selected regardless of their environmental credentials.

Another consideration tied to the budget is storage. For the numerous small- and middle-scale theatre companies, tight budgets cannot include storage facility fees, particularly when the possibility of re-using the set in the future is uncertain. Whereas large theatre companies – both subsidised (e.g. the National Theatre, the National Theatre of Scotland) and

commercial (e.g. Ambassadors Theatre Group) – have the luxury of space and the ability to store sets and props for future use, small or middle-scale companies often do not. One option for smaller companies may be to invest in a shared storage facility that can be used for storing sets and props for future use.

A theatre company must also consider practicalities when planning a tour, such as the need to transport the set with the performers as opposed to sourcing the materials and constructing it locally. When a production is on the road for a short amount of time, it is often unfeasible and impractical to construct the set locally, due to cost and time constraints. The end result is the generation of GHG emissions produced by the various modes of transportation (e.g. planes, ships, trains, trucks) carrying the set around the world. Furthermore, once transported to another region, the set cannot be disposed of locally at the end of the tour. A series of export and import requirements mean that theatre companies have to bring the set back to the originating country. This translates into greater transport costs and even more emissions.

Scenery Salvage, based in London, is creating a pioneering model of set storage, re-use and recycling. The company buys props from companies that no longer need them, and re-sell them at reduced prices from a centralised online catalogue. They are also able to pick-up, store and recycle sets, which customers pay for per tonne of weight. Scenery Salvage are looking to expand capacity and reach, by relocating both office and reclamation centre to one site that will be more centralised, with potentially a biomass boiler and biodiesel generator on site and possibly creating regional satellite hubs around the country.

8.0 Hot Topics

The following set of expert pieces cover a wide range of high-profile issues or hot topics on sustainability that are relevant to the theatre sector.

Hot Topic 1:

Governance: for the record, we must change the system

By John Elkington

Hot Topic 2:

Putting a price on what we can't always see

By Helen Heathfield and Christina Tsiarta,
Julie's Bicycle

Hot Topic 3:

Carbon offsets: cop out or climate winner?

By Dr Adam Bumpus, University of British
Columbia, Canada

Hot Topic 4:

Up in the air or out to sea?

By Tristan Smith, University College London
Energy Institute

Hot Topic 5:

Biofuels: solving our climate and oil woes?

By Alexandra Morel, University of Oxford

Hot Topic 6:

Leisure travel: the untapped savings

By Dr Jillian Anable, University of Aberdeen

Hot Topic 7:

Snacking on emissions

By Dr Rebecca White, University of Oxford

Hot Topic I

Governance: for the record, we must change the system

By John Elkington

The news that Michael Jackson was working on a song about climate change not long before his death highlights at least two things. First, it underscores the fact that, in fits and starts, the global warming issue is pushing into the popular mainstream. And we should welcome that. But, second, it also spotlights the uncomfortable fact that we are still addressing what looks set to be the defining challenge of the twenty-first century with sporadic, voluntary and often self-serving initiatives.

Clearly, if a best-selling pop star wrote a song and if it became a best-seller and if it then persuaded people to change their thinking and if that, in turn, persuaded large numbers of us to change our behaviour, then we would have some degree of cultural lift-off. But that would be a rare event indeed.

So, let's celebrate individual initiative – and let's encourage people to make a difference, however small. But let's also remember that our economic, social and political systems rarely change because we think it would be a good idea. Here's the rub: if we want to move beyond changing individual hearts, minds and behaviours to the necessary transformation of cultures, paradigms and even civilizations, then we had better get good at governance.

Simply put, this is the activity of governing. No, I know, but hold on in there. Those who govern define expectations, they grant power and, crucially, they verify and incentivise performance. So far, so boring, but here's the thing: unless we get the governance dimension of our climate change responses, we are – to put it indelicately – screwed.

Look elsewhere in *Long Horizons*, *First Step* or the Julie's Bicycle website³ for guidance on why climate change is happening, why it is important, who is going to be impacted, how the performing arts are currently responding – and what it might usefully do in future. My theme is the art and science of governance, global governance, national governance and – crucial here – industry, corporate and organisational governance.

In headlines, this is about what priorities get set, how they are tackled and who gets rewarded – or punished – as a result.

Let's start with the big picture and global governance. No question, international institutions like the United Nations, the OECD, the World Trade Organisation, the World Bank and the World Economic Forum pay much more attention to sustainability issues – including climate challenge – than they once did. But the unravelling of the UN COP15 climate conference in Copenhagen late in 2009 underscored just how weak global governance currently is when it comes to such issues. Effective global governance will come, but probably only – as in the case of CFCs – when we have discovered climate's equivalent of the Antarctic Ozone Hole.

Focus down to the national level – or regional level in such cases as the EU, NAFTA or ASEAN – and the situation improves a little, but questions of growth, employment and investment still largely drown out those who argue for a shift to cleaner, greener forms of development and growth. But there are bright exceptions, among them South Korea, whose President has declared the ambition that the country will become a hub for low carbon, green growth over the next 60 years.

Still, the oil spill disaster caused by the sinking of the Deepwater Horizon rig off the Louisiana coast has dramatized the fact that even President Obama has so far failed to put in place the governance, regulatory, compliance and other systems needed to switch the United States onto a low carbon, green growth path.

Recently, we looked at the whole process of disruptive innovation – and the scaling of new solutions to challenges like climate change – and developed a simple, 5-stage 'Pathways to Scale' model of change.

In the model, Stage 1 is Eureka! – the creative moment where new opportunities for innovative solutions become apparent. Stage 2, the Experiment, is where entrepreneurs test, prototype, fail, learn, and adapt new solutions. It is the early stage venture. Stage 3, the Enterprise, is where experiments become organisations and initiatives with more developed business models, invested in by a broad range of investors. Stage 3 is about growing a business.

Yet if anything close to system change can begin to happen, there is a need to shift the spotlight from individual enterprises to an organisation's or sector's wider influence in society and markets. Stage 4, focusing on the creation of an Ecosystem of change agents, is about creating new markets, incentives, and frameworks for solutions to diffuse and mainstream. Accelerating change is critical to embed the new cultural codes and forms of governance into the mainstream functioning of the Economy, represented by Stage 5.

While stages 1-3 are extremely important, the main focus of our attention currently is on the transition from Stage 3 to Stage 4. Moving from individual business models to broader ecosystems requires collaborative forms of leadership. This is where Julie's Bicycle and its partners are operating.

Ultimately, if anything like a truly sustainable and equitable future is to be achieved as the world pushes toward a human population of 9 (or even 10) billion, campaigns and entrepreneurial initiatives must scale up further to Stage 5 system change – typified by broad-based market and societal adoption of new mindsets, models and technologies. Success in moving from Stages 4 to 5 will involve the transformation of political priorities, governance process, market rules and cultures. Here is where the music industry can play a pivotal and transformative role. Touring – the international communications tool par excellence – can be one crucial, living vehicle for propagating the relevant messages and information, and for modelling the appropriate new behaviours.

Finally, in addition to the UK music industry's accelerating efforts to tackle climate change, it would be wonderful to see sector leaders doing two things. First, ensuring that the related priorities, targets and initiatives are hard-wired into their own governance mechanisms – and into the agendas of their Boards. And second, supporting the artists and creators, industry innovators, entrepreneurs and venture investors who are driving the transition towards a cooler, fairer economy.

³ www.juliesbicycle.com

Hot Topic 2

Putting a price on what we can't always see

By Helen Heathfield
and Christina Tsiarta

Julie's Bicycle

Our economy is totally dependent upon goods and services from the ecosystems that surround us, such as water purification, soil creation, pollution dilution and waste treatment. One such ecosystem crucial for our carbon cycle is the capacity of our oceans, vegetation and soil to absorb carbon emissions. Despite being completely reliant on these ecosystems, our economy does not recognise, and therefore value these goods and services in financial terms, anything like sufficiently. A United Nations programme is currently seeking to address this problem. The Economics of Ecosystems and Biodiversity (TEEB) study is finding that the costs of conserving biodiversity compared to the benefits of doing so are in a ratio of 1:10 – 1:100. TEEB is expected to report this summer on how policymakers can make sure that business reflects the true costs and benefits.

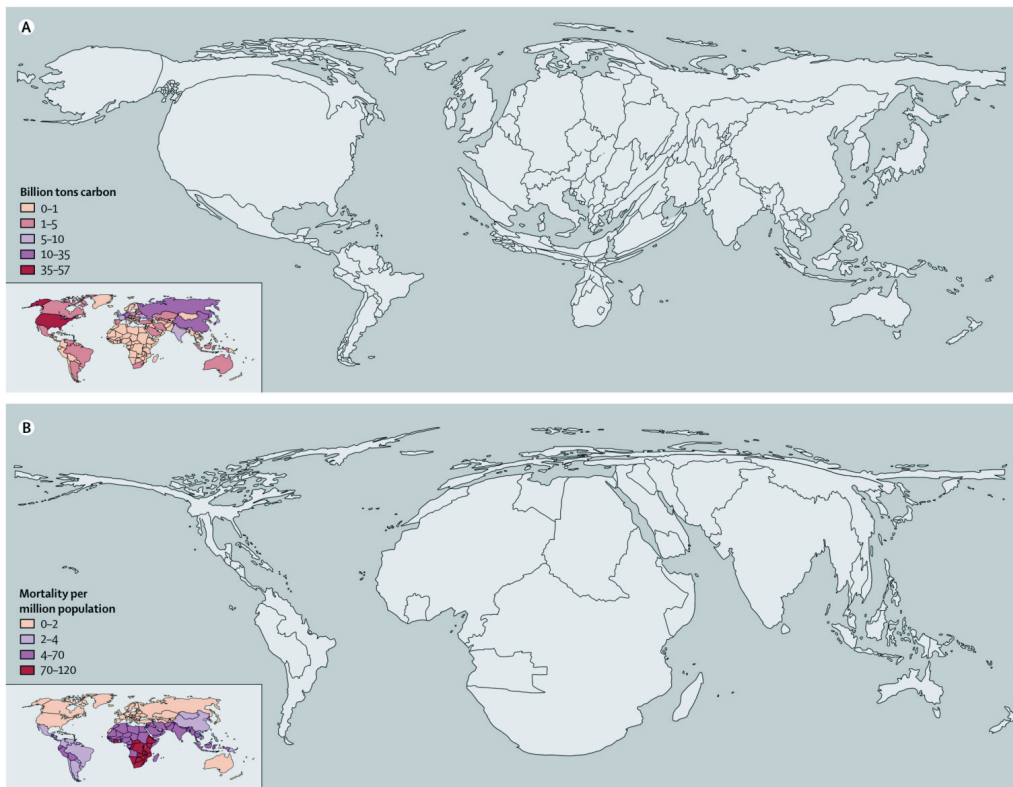
Take for example felling a tree to make a musical instrument or a theatre script. Some of the costs included in the financial modelling of this product might be running the chainsaw, paying the lumberjack and transporting the log. Costs excluded might be the loss of rainfall management, a home for an orang-utan, a livelihood for an indigenous person, the soil the tree roots were holding and the future capacity of that tree and soil to absorb carbon from the air. These implicit costs are rarely factored in to the economics of a musical instrument or paper manufacturing.

Economists have termed this an externality: simply put, when a price does not reflect the full costs. Positive externalities are commonplace and unnoticed: for example a beekeeping business generating revenues from honey while the surrounding farmers receive a free pollination service.

The classic negative externality is the example of a factory polluting a river and, as a consequence, fishermen downstream catching fewer fish. The factory pollutes for free while the fishermen pay the costs of that pollution.

Climate change is perhaps the most dramatic example of global negative externalities. The illustration below (Figure 14) depicts country size according to responsibility for climate change 1950-2000 and highlights the distribution of four climate-sensitive health impacts during the same period. This shows that those generating the emissions are not those suffering the consequences.

Figure 14 Comparison of undepleted cumulative CO₂ emissions by country for 1950 (A) - 2000 (B) and the distribution of climate-sensitive health consequences (deaths from malaria, malnutrition, diarrhoea and inland flood) Source: Lancet 2009



If the negative externality of the factory versus fisherman is compared with the externalities associated with climate change it becomes clear what the scale of climate change externalities might be:

Factory v fishermen

Only the factory is polluting, the factory will understand this, know it can stop and how much it will cost.

Only the fishermen are affected and they know how much the pollution is costing as a result of loss of fish.

The fishermen have a legal and financial system that can help identify the factory, the harm and demand damages.

The pollution has a short term impact and then the fish stocks bounce back.

Climate change

Everyone is responsible for emissions, we rarely have much information about how much of emissions we are responsible for, we are uncertain how we can emit less and there is huge uncertainty of what it costs in externalities.

Everyone is affected – people are dying now as a result of climate change and it will affect all of us in the future though we are not sure exactly how or when. It is difficult to put a value on human life and whole ecosystems such as coral reefs.

Those affected now often have less economic and political power than the large emitters. Our economic and political systems are poor at accounting for future costs to ourselves.

We are now feeling the impact of emissions from 30-40 years ago. Our current emissions will have impacts for centuries. Some impacts are irreversible, such as species extinction and loss of land to sea level rise.

To solve an externality a value needs to be calculated for the damage so that it can be 'internalised' – i.e. accounted for within our economic system. This is relatively straightforward for the factory v fishermen example: the fishermen sue the factory. However the complexities of climate change expose the legal system as totally inadequate and present many barriers to businesses including externality costs in their prices. Individuals seeking to include environmental and ethical issues in their purchasing decisions are often confused. The size and complexity of the externalities requires centralised government intervention to make prices more accurate.

The previous and current UK governments have recognised their role in internalising the externality of climate change. In 2006 the UK government commissioned a study to consider the external costs of climate change. The resulting Stern Review (after Lord Stern, review lead) was the first attempt by any Government to understand the scale of the global economic impact of climate change. In 2007 Stern reported that if warming of 5°C occurred, the costs of adaption to developed countries would be 5-10% of GDP as compared to a 'no climate change' world, and that developing countries would suffer costs above 10% of GDP. The Stern Review estimated that the costs of avoiding this scale of climate change through mitigation of emissions represented 1% of GDP, ergo climate change avoidance is cost effective. Since publication of the Stern Review, Stern has acknowledged that his projections were adaptation cost-conservative, underestimated the sensitivity of the climate and too cautious about the benefits of avoiding climate change through emission mitigation.

So how best to internalise the costs of climate change: in other words to put a price on carbon? Economists argue for two approaches:

- **Fix the price:** estimating the costs of climate change and levying a tax that equals those external costs. For example in the UK, electricity users pay a Climate Change Levy on their bills. Despite best efforts, a tax may still not equal all external costs or reflect everyone's approach to the risks resulting from climate change;
- **Fix a limit on the amount of pollution:** setting a limit on emissions and then allowing emitters to trade in emissions. This sets a price for emissions through the creation of a market where carbon is traded like any other commodity, such as the EU Emissions Trading System. Industrial lobbying and uncertainty about the extent emissions convert into climate change impacts can result in the limit being too high.

New tools and frameworks to protect the environment we all fundamentally rely upon are urgently needed. Our current economic model, based on the traditional capitalist principles of a free market, competition, and private ownership of the means of production, is unfit for purpose in this new context. It needs to be redesigned to reflect environmental costs and benefits. The UK Government is developing its work on carbon valuation to help design policies effectively: see the accompanying box "How much does carbon cost?"

Tours need to recognise that there are costs excluded from the current budgets, and that government action will internalise those costs, penalising activities with high emissions. Cutting emissions now will save costs both to future tours and to the climate.

How much does carbon cost?

The financial valuation of carbon enables both government and market instruments to account for the costs associated with climate change. The value of a tonne of CO₂ is contingent on an emerging appraisal of the damage that CO₂ does. The UK government's approach to valuing carbon is based on estimating the likely costs of meeting specific emissions reduction targets.

Carbon valuation will ensure that policies the UK Government develops are consistent with the emissions reductions targets that the UK has adopted nationally, as well as with the European Union and United Nations. Giving a value to carbon helps the Government fully account for climate change impacts in appraising and evaluating public policies.

This is a new approach to carbon valuation, which until recently was implemented as a 'shadow price', and follows the EU's Climate and Energy Package (2008) rationale. It splits emissions into:

- traded sector - those emissions covered directly or indirectly by the EU Emissions Trading System (ETS);
- non-traded sector - those emissions not covered by the EU ETS such as transport fuels.

The distinction, which leads to two sets of carbon price estimates, will enable more accurate policy appraisal which will take into consideration the costs and benefits to the UK. These prices will be regularly reviewed and revised.

For the purpose of appraising policies that affect emissions in sectors covered by the EU ETS, the traded price of carbon is recommended. The short term traded price of carbon is currently set at £22 per tonne CO₂e, with a range of £12-£27.

For policies that affect emissions that are not traded, the short term non-traded price of carbon is currently set at £52 per tonne CO₂e, with a range of £26-£78.

Furthermore, the Government is reasonably assuming that from 2030 a global carbon market will be in place, and therefore a consistent price of carbon will apply to all emissions. The long term traded price of carbon is estimated to be £70 per tonne CO₂e in 2030, with a range of £35-£105. This price will be added to the price of goods and services, rather than being used to appraise policy choices.

It is possible to use the government's current estimate to give an illustration of future cost increases, assuming the external costs of climate change are internalised.

For example, the emissions from a tour relate to the transport emissions, which are not traded. Using a tour with emissions of 99 tonnes CO₂e, and multiplying that by the current price of non-traded carbon of £52 per tonne of CO₂e, will result in £5,150.

This is the amount of money the tour can expect to pay, for example through future tax changes if emissions stay constant. It is therefore a useful figure to consider when investigating emission saving actions, as anything below that amount will be a cost-efficient investment.

Hot Topic 3

Carbon Offsets: cop out or climate winner?

By Dr Adam Bumpus

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Carbon offsetting is a mechanism that has been used by governments, companies and individuals in order to attempt to reduce the environmental damage of their activities. The performing arts sector, especially music, is using carbon offsetting as a route to address some of the environmental impacts of their activities. Carbon offsetting should not be used as an alternative to direct actions which reduce emissions. Carbon offsetting projects have differentiated environmental and social benefits which need to be understood. This note provides an explanation of what carbon offsetting is, how it works, and guidance on how to choose a carbon offset investment.

What exactly is carbon offsetting?

A carbon offset is a mechanism that allows a company, organisation or individual to reduce its environmental impact on the atmosphere in one area by investing in projects that reduce greenhouse gas (GHG) emissions in another.

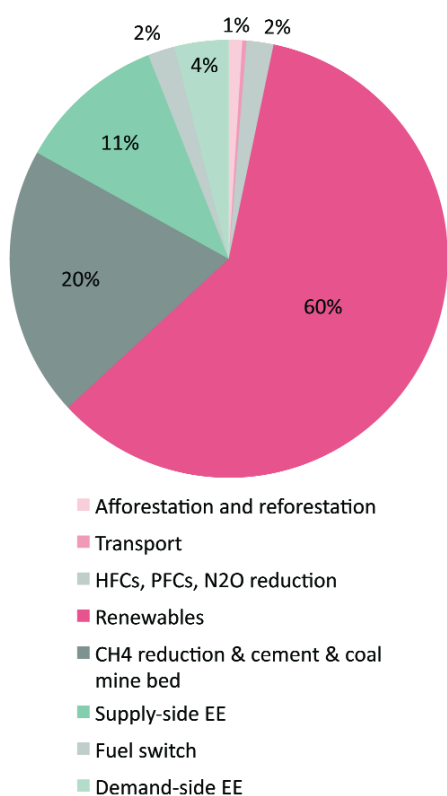
Offsets are controversial. Some offset projects have questionable emissions reductions, create unwanted local effects and open the possibility for fraud and profiteering by 'carbon cowboys'. On the other hand, carbon offsets are popular because they are often cheaper, faster and easier than domestic emissions reductions. Often carbon offsets are carried out in developing countries and in some circumstances projects have led to significant local benefits, assisting communities with direct financial benefits or project co-benefits such as access to electricity. Carbon offsets are neither the solution to climate change, nor the antithesis of carbon mitigation action. If carried out correctly and as part of a wider climate change strategy offsets can create both atmospheric and social benefits.

How does carbon offsetting work?

Project types

Carbon reductions can come in the form of removing carbon directly from the atmosphere, such as planting trees to increase carbon sequestration, or by investing in energy efficiency or new clean technology to replace fossil fuel burning. The difference in emissions that would have been emitted and the current, lower emissions (i.e. because of the new project investment) create reductions that are traded as metric tonnes of CO₂ equivalent (i.e. carbon credits). Many types of projects are used in carbon offsets. These range from industrial gas destruction to community-based agro forestry (see Figure 15).

Figure 15 Number (%) of CDM projects in each category
(source: UNEP Riscoe, Feb 2010)



Markets for creating reductions

The reductions and transference of credits take place in two broad market categories. These markets differ in governance, size, project types and prices (see Table 4 below). Firstly, the compliance market includes the Kyoto Protocol's Clean Development Mechanism (CDM) and Joint Implementation (JI). Secondly, the voluntary carbon offset (VCO) market is not regulated and is used by organisations not bound by Kyoto to offset their emissions primarily for public relations and for reasons of corporate social responsibility (Hamilton et al., 2009). Although traditionally the voluntary and compliance markets differed in project types, credit sourcing in the CDM is increasingly influencing the voluntary markets as project developers sell Verified Emission Reductions (VERs) while awaiting CDM registration (e.g. 32% of project types are Hydroelectricity in both CDM and VCO markets).

Evolution of offset markets

Since the mid-2000s the carbon offset markets have evolved significantly in terms of knowledge, practice and their effective use. More recently, the Clean Development Mechanism (CDM) is being reformed away from the 'project-based approach' to programmes of activities (i.e. reducing emissions of a whole city) or reductions of emissions by industrial sector (i.e. setting standards for emissions reductions in a specific industry). These aim to provide cheaper emissions reductions at scale. In addition the voluntary market is increasingly self-regulating in the context of consumer awareness around carbon offsets. This is important to emerging markets, like the USA, that are looking to use credible carbon reductions in future climate change policy. Increasingly the compliance and voluntary markets are merging, as self-regulation increases.

Offsetting should not be seen as the immediate go-to option for carbon management. Instead it should come after all reasonable action can be made to reduce operational emissions. The UK Carbon Trust has suggested a useful way of engaging offsets through a three stage process:

1. Focus on direct emissions reductions through efficiency;
2. Look at reducing indirect emissions up and down the supply chain;
3. Develop an offset strategy.

Table 4 Characteristics of the compliance and voluntary carbon markets (source: Capoor and Ambrosi 2009; Hamilton et al. 2009).

Market	Rationale	Governance / Standards	Market Size & Value (2008)	Average credit price (2008)
Compliance	Cheap compliance under Kyoto regulations	Governed by UN processes: Clean Development Mechanism (CDM) Gold Standard CDM Joint Implementation	1481 million metric tonnes US\$33 billion	US\$16.78/ tCO ₂ e
Voluntary	Public relations and Corporate Social Responsibility	Outside of formal regulation: Voluntary Carbon Standard Gold Standard VER Climate Action Reserve	123.4 million metric tonnes US\$705 million	US\$7.34/tCO ₂ e

Guidance on what to look for when purchasing a carbon offset for your tour

Rather than project type or size, the best way to ensure credible carbon offsets is to use a credible standard. The Clean Development Mechanism (CDM) is the most regulated standard, but the Voluntary Carbon Standard is increasingly seen as an alternative for project types and geographic regions not allowed under the CDM. For organisations that want to promote the local community development stories associated with carbon offsets, then the Gold Standard (GS) or the Climate Community and Biodiversity Standards (CCBS) will help source credits that have explicitly channelled finance into development projects. Any credible standard should produce offsets that are additional to business as usual practices, measureable, reportable and verifiable. Standards should also encourage the use of a carbon registry to track offset credits in order to prove that they have been retired (taken out of circulation) when they are bought.

HotTopic 4

Up in air or out to sea?

By Tristan Smith

University College London Energy Institute

International touring is, by definition, contingent on travel – often by air and sea. However, aviation and shipping rely on fossil fuels and, in the short to medium term there are no viable alternatives. Both these sectors are growth sectors and therefore it is inevitable that the greenhouse gas emissions they generate will also increase. This note gives an overview of the environmental issues associated with air and sea travel, where government policy is heading and some guidance to reduce environmental damage.

Why the environmental concern about aviation and shipping?

Our best guess at the moment is that anthropogenic greenhouse gas (GHG) emissions created by aviation and shipping are of a similar magnitude – each accounting for approximately 3% of global emissions. Analyses to break down that figure for the EU and UK return similar estimates of more localised proportions. Given such a diminutive share of the carbon problem, and considering the complexities of regulating international businesses, it is tempting to focus on the bigger carbon criminals; agriculture, industry, power generation and the like.

But aviation and shipping are the workhorses of globalisation. Together they move an overwhelming majority (80% of global trade travels by ship) of the raw materials, fuels, manufactured products and labour force around the world that has been fundamental to high consumption lifestyles typical of the West, as well as the inexorable industrialisation of China and the Far East.

As a result, both sectors have experienced feverish growth rates over the last few decades. Growth projections assuming business

Conclusions

Carbon offsets have matured since they first became mainstream climate mitigation tools in the late 1990s and early 2000s. The markets have evolved significantly, and there are choices in both the compliance and voluntary markets for organisations wishing to purchase offsets. A robust offset strategy involves achieving internal reductions as far as possible, and then sourcing carbon offsets that are registered to credible standards and tracked through carbon registries. Carbon offsets can be forces for good, but they should be considered as a tool in the box of climate solutions, not as an end in themselves.

as usual suggest that, if we fail to control emissions from aviation and shipping, they could contribute as much as 30% of anthropogenic emissions by 2050. If that happens we will be left wondering why we ignored such a large and fundamental part of the problem.

Beyond the headline figures on emissions proportions, both shipping and aviation have separate and additional climate challenges. Aircraft emissions are complicated by the physical and chemical impacts of their emissions on the upper atmosphere. Some analyses apply a metric or multiplier to the quantity of GHG's emitted by a flight in order to produce a more accurate representation of its climate impact.

Shipping's dirty secret is that it burns some of the lowest grade fuel that we extract from the ground. When crude is distilled to produce petrol and diesel for road transport, the high sulphur content 'heavy fuel oil' is a comparatively cheap by-product and consequently the fuel of choice for the cost conscious shipping industry. Acid rain, smog and health issues associated with burning high sulphur fuels such as heavy fuel oil and coal have led to legislation that has all but banned it from most of its previous applications.

The regulatory complexity and the 'out of sight, out of mind' nature of the shipping industry has meant that burning high sulphur fuels in ships has gone unchecked. Through the International Maritime Organisation (IMO), there is now a framework in place to bring shipping's sulphur emissions down from current levels (about 4.5% of exhausted emissions) closer to that of a modern car. This will be achieved either by switching to low sulphur fuels, or fitting technology to ships that will 'scrub' the sulphur from the engine's exhaust. Similar regulatory attention is being paid to nitrous-oxides and particulate emissions.

One way to solve the land-based anthropogenic GHG problem is to decarbonise energy supply. This might involve increased provision of renewable energy to the grid or the revival of the nuclear power industry. However, it is not easy to plug a plane or

a ship into a wind turbine. For these reasons neither the aviation nor the shipping sector currently foresees an imminent switch away from liquid fossil fuels. The physics of flight constrain planes to energy dense fuels and compact high-power-to-weight ratio engines, which currently limit their options for large long distance aircraft to gas turbines burning aviation fuel (which is currently distilled from oil).

Ships are less restricted from a technological perspective, and have more space and carrying capacity to explore the application of emerging (or recurring) technologies. The motive force for global trade was originally derived from the wind. Tea, wool, spices and many staples of our ancestors' lives were distributed by sail power and some now see the combined challenges of high fuel prices and GHG emissions stimulating resurgence in wind powered shipping. Many modern ships are too large to be powered wholly by sail, and nor would modern expectations of punctuality tolerate such a whimsical service. However, giant kites, flettner rotors (a rotating column which generates lift from the wind) and folding deployable wings have all been studied, and in some cases trialled on large ocean-going ships, to investigate their technical and economic viability. Similarly, solar panels can be used to augment the power generated through internal combustion and their integration into ship design could become commonplace in the future.

Renewable power sources are not reliable and so future ships and planes still need to carry either fuel or energy storage that can be tapped into when the sun stops shining or the wind is not blowing. Biofuels are the most obvious technological answer because they require minimum disruption to our existing liquid fossil fuel infrastructure (See biofuels hot topic). Indeed, blends of biofuels (where biofuel is mixed with fossil fuel to reduce the modifications required to existing engines but incorporate a proportion of the benefits of a low carbon fuel) are already in use. However, the true sustainability of this miracle cure to mankind's oil addiction is now being questioned. As demand for biofuels in all sectors increases, constraints on supply due to the large surface areas and resources (e.g. water) required for their production are likely to constrain their viability. This leaves synthetic fuel, such as hydrogen, ammonia and methanol. Low carbon generation of these fuels is technologically feasible, but the high costs associated with this will prevent their widespread uptake until sufficient regulation is in place.

Government aviation and shipping policies

Aviation and shipping are both included in the UK government's commitment to reduce GHG emissions by 80%. However, it is hard for the UK to act without international collaboration because both are 'mobile' industries that could easily re-route to hubs in neighbouring countries, with negative consequences for the UK's economic growth. This dilemma is epitomised by the current debate regarding the expansion of Heathrow. The turgid progress of global negotiations witnessed at Copenhagen in December 2009 suggests that international consensus on emissions reductions and a framework to enforce it is a long way off. Progress on this international framework is crucial before effective global regulations on aviation and shipping can be used to drive and incentivise emission reduction in these sectors.

Fortunately, as we await those global commitments, the EU has been busy pioneering a GHG Emissions Trading Scheme (ETS)

which places caps on the GHG emissions in certain sectors and provides a market so that the higher emitters can buy 'permission' to emit GHG from lower emitters: this effectively redistributes the burden of GHG emission reduction to the emitters for whom the cost implications are lowest whilst ensuring the cap provides a simple high level control that obviates the need for micromanagement of many industries and sectors. This ETS is now in its second phase and in 2012 will start a third phase that will include aviation within its scope. The terms for including aviation mean that any flight landing or taking off from the EU will be covered (i.e. even those to and from non-EU destinations) and so depending on the market price of carbon this could start to drive up flying costs and encourage adoption of lower carbon technologies and operating practices. Like fuel price forecasts, carbon prices will fluctuate and so it is hard to assess the scale and timing of the impact of this regulation. Current expectations are that even by 2020 price effects created by the EU ETS are unlikely to exceed 50% and could be a substantially lower portion of ticket cost.

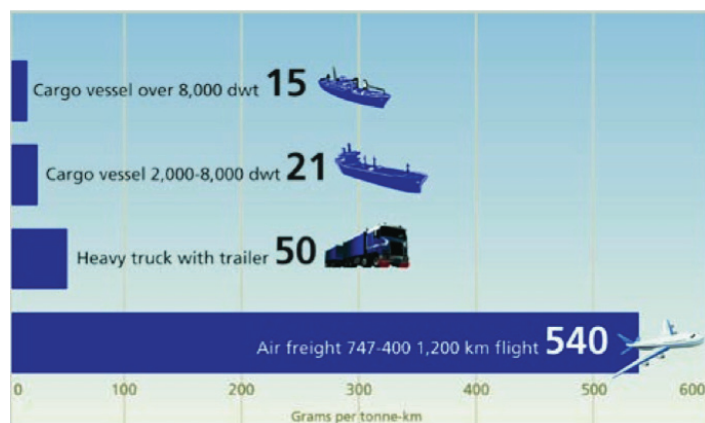
Shipping is further behind aviation from a GHG emissions regulation perspective. The United Nations Framework Convention on Climate Change (UNFCCC) has delegated the responsibility of developing emissions regulation for shipping to the IMO, a UN agency. A variety of tools that could form the basis of emissions reduction implementation is under discussion, including a global ETS for the shipping industry, but all currently face significant technical and political challenges. As a result, only voluntary energy efficiency standards have been introduced so far, and it is expected that it will take some time before legally binding global regulations are introduced. The EU is concerned about the rate of progress at IMO, although it recognises that only global regulation can produce the fundamental changes in the sector that are required for it to achieve a substantial reduction in emissions. To bring the subject into close focus the EU is threatening that should the IMO make insufficient progress towards introducing regulation over the next two years it may incorporate shipping into the EU ETS, perhaps following the model applied to the aviation sector.

So, without substantial regulatory impacts on the horizon, unless we see a dramatic increase in fuel price due to scarcity of supply it is unlikely that in the next ten years we will see significant changes to the aviation and shipping sectors, or to the planes and ships on which freight and passengers travel. This means that emissions reductions are only likely in the shorter time scale if individuals and businesses make careful decisions about how much demand for these sectors they create. Only travelling when absolutely necessary and ensuring that preference is given to sourcing raw materials and products locally is the most effective and immediate response that individuals and companies can take.

Guidance for reducing aviation and shipping emissions when touring

Air freight is easily the worst emitter, and whenever possible preference should be given to transport by ship, even over rail and road transport, although clearly any decision must be based on the details of the specific route (See Figure 16). Unfortunately, the timescales associated with global freight movements by ship may not be consistent with a hectic touring schedule. Perhaps ports will become the preferred concert venues of the future - you could do worse than Sydney, New York and London.

Figure 16 Grams of CO₂e per tonne-km associated with each type of freight



Source: NTM (Swedish network for transport and the environment) – cited in British Chamber of Shipping (2009)

When it comes to passenger transport, it is harder to generalise about the relative GHG impacts of different types of transport. Whilst long distance sea passages are still possible, either on a modern liner like the Queen Mary II or by hitching a lift on a container ship, factoring in weeks of travelling time, romantic though the voyage could be, is a luxury few busy people can afford. Because we demand short passage times, ferries have been getting

faster. Even the Queen Mary II travels at approximately 35 mph, in order to keep the voyage length to a week. Combining such higher speeds with the space and levels of comfort that passengers demand mean that in practice a switch from flying to travelling by sea in our current passenger ships would rarely result in significant emissions savings.

If aviation is the selected mode of passenger transport then you can make some contribution by choosing the most efficient type of flight. The equation is simple: it's all about getting the most people into the largest possible plane flying your route. Unfortunately this means that the responsible thing to do is to shun being pampered in first class, as first class seats reduce the number of more spatially efficient economy class seats you can fit on a plane and therefore increase the GHG. Airlines would stop fitting out large areas of their aircraft to higher class travel if there was no longer the customer demand for this service.

So to sum up, the choice when it comes to travelling or moving equipment long distance is between a bad option (a combination of land and sea transport) and a worse option (flying). As is so often said about GHG emissions, there is no silver bullet which can be applied to revolutionise either of these sectors. However, there are steps being taken to bring in regulation which will provide a framework for implementing change in the future. In the meantime, the best advice if you want to create the minimum GHG impact is to take your time and to enjoy your journey. Take a slower ferry and enjoy the views from a train – its better than the cloudscape you see from the window of an aeroplane.

Hot Topic 5

Biofuels: solving our climate and oil woes?

By Alexandra Morel
University of Oxford

The Issue

The live performance sector has shown a particular interest in biofuels as offering a partial solution for reducing the environmental impacts of tour travel, and a significant number of iconic artists, especially in the US, have used biodiesel in their trucks and buses. However, concerns about the environmental benefits of biofuels remain. This is a short overview of the science and policy and some guidance.

What are biofuels?

In the quest to reduce burning fossil fuels alternative fuels are being developed. One such group of fuels is biofuels, which refers to a wide range of plant material used to create the fuel. There are three “generations” of biofuels, a term which refers to the type of plant material used to create the fuel.

The best-known “first generation” fuels are ethanol and biodiesel.

Ethanol is produced from fermented sugar, which can be derived from corn, wheat, sugar cane and sugar beet. It can be blended with petrol and gas or be used on its own in a flex-fuel vehicle (a vehicle adapted for its use). Biodiesel has similar properties to petroleum diesel. It is produced by processing vegetable oil, such as soybean oil, palm oil, rapeseed/canola oil, wild flaxseed oil and waste cooking oil.

“Second generation” biofuels are meant to overcome the dilemma of using a plant material that is also a food source, explored below. Ethanol can be derived from cellulosic material (e.g. pulp and paper byproducts, switchgrass, corn stover, etc.) or for biodiesel inedible oil such as from the jatropha plant. There are several methods for converting cellulose to a usable biofuel.

Finally, algae are considered a “third generation” plant material for biodiesel. Unfortunately few of the second and third generation technologies are economically viable at present.

Controversy surrounding biofuels is manifold. First generation fuels compete with food production, causing spikes in food prices and/or displacement of food cultivation to currently un-cleared lands. This latter issue can take many forms and has been given the name indirect land use change (ILUC). Often these new areas are in tropical countries that are not limited by temperate seasons, have plentiful solar radiation and (ideally) ample rainfall.

In many parts of the world this is linked to the clearance of logged

rainforest, loss of biodiversity and displacement of local communities. Expansion of agricultural commodities (not specific to biofuels) has already been the cause of considerable rainforest loss in Southeast Asia; however, in the potential race to produce enough “green fuel” greater attention is being paid to Sub-Saharan Africa and South America by multi-national biofuel companies. Tanzania is an example where several American and European companies interested in producing biofuels for export have been accused of displacing local farmers. In addition, sections of the vast tropical forest of the Congo Basin have been sited for extensive oil palm plantations to meet some of China’s demand for biofuels.

Aside from the obvious **human rights issues** associated with the land-grab are the environmental consequences of this expansion. The question of carbon savings is key if biofuels are intended to be a carbon-mitigating measure.

Carbon emissions can result from the clearing of carbon-rich forest; loss of carbon through soil erosion; addition of fertilizers to grow biofuels (including the embedded emissions from fertilizer production and Nitrogen Oxides (NO_x) emissions after application) and transport of feedstock before its conversion.

In order to have a greenhouse gas saving, production of a biofuel should not release more carbon than would have been emitted by combusting the same volume of fossil fuel. Currently, the carbon emissions from combusting the actual biofuel is not included in a carbon lifecycle analysis of the fuel, due to the assumption that the carbon released through burning can be reabsorbed through the re-growth of the biofuel feedstock.

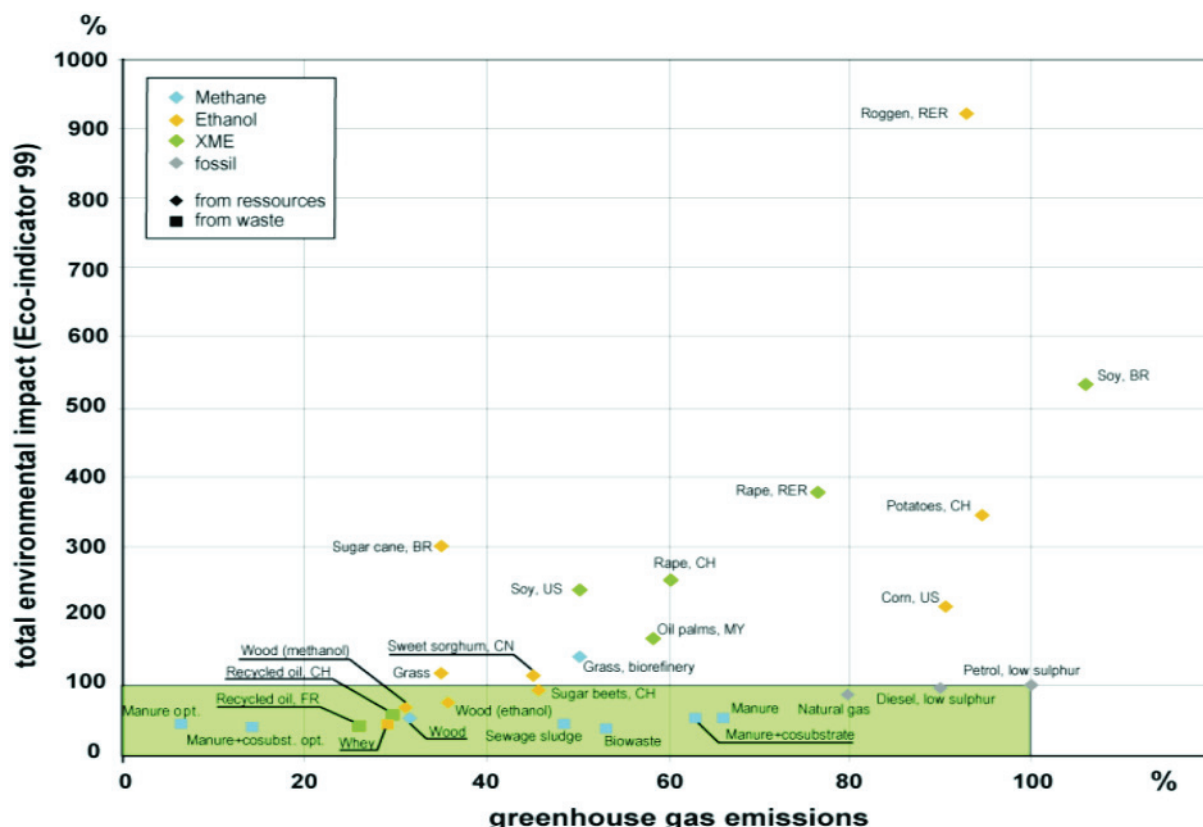
The energy balance of a biofuel refers to the amount of

fossil energy used to produce a biofuel compared to how much energy the biofuel has available for combustion. The carbon saving and energy balance among biofuels is significantly different across plant materials. For example, US corn-ethanol barely breaks even both in terms of carbon savings and energy balance; while, Brazil’s sugarcane ethanol has roughly eight times the energy benefit. Swiss researchers have provided a helpful graph comparing biofuels from their net energy saving benefit (see Figure 17). This graphic shows the estimated carbon savings of the fuel and also their “total environmental impact” described by a single eco-indicator value.

Government biofuels policies

Currently biofuels are having a difficult time competing with the relatively low price for crude oil, and therefore its respective industries are buoyed by government subsidies and mandates. The EU has one of the largest biofuel mandates as part of its **Renewable Energy Directive (RE-D)** which stipulates that 10% of the EU’s transport fuel must come from renewable fuels by 2020 (EU 2009). This policy has been blamed for much of the international hysteria to produce biofuels. As a means of ameliorating the impacts of this mandate, the recently published RE-D provides detailed sustainability criteria, including the requirement that the biofuel used must have a 35% greenhouse gas saving compared to the relevant fossil fuel it is replacing. However, it appears increasingly likely the EU will be reducing its mandate due to a recent study capping the “sustainable” volume of biofuel at 5.6%, after which negative impacts such as ILUC will overwhelm any carbon savings of the policy. At the same time, not all biofuels sold in the EU necessarily meet the sustainability requirements

Figure 17 Greenhouse gas emissions versus environmental impacts for several biofuel feedstocks, including wastes (Source: Zah, R. et al. 2007).



because only biofuel counted toward the RE-D's mandate must meet these criteria. Unfortunately, even the sustainability of these volumes is unclear, as many of the leading fuel retailers in the UK have not properly reported the source of their fuels to the Renewable Fuels Agency (RFA).

The US has both a mandate - the Renewable Fuel Standard (RFS) - that requires fuel blenders to use 36 billion gallons of renewable fuel by 2022 and significant subsidies for biodiesel blending of \$1.00 per gallon of blended biodiesel. This policy has affected the viability of the EU biodiesel industry due to the phenomenon known as "splash and dash", whereby biodiesel produced in other parts of the world are brought to a US port and blended with 1% petroleum diesel in order to receive the tax credit. It is then taken to Rotterdam where it is "dumped" on the EU market. The German government responded by establishing a ban on 20% biodiesel blends from the US, but this does not stop cheap 19% biodiesel blends being traded. Nevertheless, the US biofuel industry (particularly the ethanol industry) is suffering from narrow margins and uncertain markets.

The US biofuel industry recently benefited from an Environmental Protection Agency (EPA) ruling, which increased the ethanol blending volume to increase from 10% to 15% in gas/petrol based on findings this blend could be used in conventional engines after 2001. This effectively increased ethanol demand by 50%, thereby allowing for further investment in the industry. It is possible to purchase an 85% blend of ethanol, which can only be used in a flex fuel vehicle (FFV). This new ruling also includes greenhouse gas saving requirements of 20% for any new biofuel producing facility (e.g. corn starch-based ethanol powered by natural gas, biogas or biomass), 50% for biomass-based diesel or advanced biofuel and 60% to be classified as cellulosic biofuel (EPA 2009). The EPA is continuing to develop environmental rules regarding the treatment of indirect land use change (ILUC) for their greenhouse gas savings estimates and carbon savings for biofuel plant materials, asking for support from the National Academy of Sciences.

Parallel to these efforts, the Roundtable on Sustainable Biofuels (RSB)⁴ is developing sustainability criteria. It is following developments in other certification schemes such as: the Roundtable on Sustainable Palm Oil (RSPO), the Roundtable on Responsible Soy (RTRS) and the Better Sugarcane Initiative (BSI).

Guidance on what you should look if wanting to source biofuels

If sourcing biofuels in the EU, it is important to be sure it meets the RE-D requirements (especially if it has been imported). Alternative certification is not an adequate assurance of the fuel's carbon benefits. For example, the RSPO does not have greenhouse gas emission requirements yet, therefore there is no guarantee that the biodiesel is reducing or preventing carbon emissions. Hence, meeting the EU RE-D requirements is the most important for the carbon savings of the biofuel you purchase. However, by buying a biodiesel produced from edible oil there is always a concern the same volume of oil may be consumed as food from a cheaper less environmentally responsible source. Nevertheless, you can always refer to Figure 17 to see the impact of the plant material in question.

Biofuel derived from waste products (such as used cooking oil or animal carcasses) has minimal environmental and carbon issues, so is the most straightforward to source.

In the US, the EPA is in the process of developing similar environmental regulations to the EU; however, most of the biofuel available has been produced domestically and therefore the relative impact of the feedstock can be assessed from Figure 17.

Where to source biofuels

If your tour wants to use biofuels in trucks, buses and other vehicles it is easier to source biodiesel separately, as ethanol is usually blended with petrol and can only be used in flex-fuel vehicles in its pure form. Make sure to source biofuels in Europe that meet EU RE-D requirements.

Updated information on EU biodiesel regulations: <http://www.ebb-eu.org/>

To identify stations selling biodiesel globally: <http://findbiodiesel.org/>.

For stations in the US that sell E85: <http://e85vehicles.com/e85-stations.html>

For a guide to buying biodiesel in the US: <http://www.biodiesel.org/buyingbiodiesel/guide/>

Useful Sources

Low-Impact Living Initiative (LILI) (useful links on biofuels): <http://www.lowimpact.org/linksbiofuels.htm>

Scientific Facts on Liquid Biofuels for Transport: Prospects, Risks and Opportunities. (peer reviewed). Green Facts: <http://www.greenfacts.org/en/biofuels/index.htm#2>

⁴ The Roundtable on Sustainable Biofuels (RSB) (2009). RSB Principles & Criteria for Sustainable Biofuel Production. École Polytechnique Fédérale de Lausanne (EPFL), Lausanne

Hot Topic 6

Leisure travel: the untapped savings

By Dr Jillian Anable

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Audience travel is the largest cause of greenhouse gas emissions in the performing arts sector. However, leisure travel has had little attention by government policy-makers, transport operators, and researchers to understand the travel choices and how these choices could be shifted to be more environmentally sustainable. There is incredible scope to reduce leisure travel emissions and have a knock-on effect in other areas of travel. This note provides an overview of why a focus on leisure travel is so important to target and what can be done to reduce its environmental impact.

Why leisure travel is important?

The apparently insatiable demand for the movement of goods and people, particularly by road and air, means that the transport sector is consistently responsible for around a quarter of carbon dioxide emissions in developed countries. About two-thirds of these emissions are accounted for by individual passenger movements, and the rest by freight demand. Most importantly, transport is one of the few sectors of the economy where emissions continue to increase year on year despite improvements in vehicle efficiency and the increasing potential for some journeys to be substituted by information and communication technology.

Policy, media and research attention focuses on the plight of the (urban) commuter, the problems created by the increasingly car oriented journey to school and, more recently, the unprecedented growth in air travel. This is despite the fact that, in the UK, these segments of transport activity currently account for only 24%, 2% and 2% respectively of domestic emissions from personal transport.⁵

By contrast, leisure travel, in all its guises (but not including shopping), is responsible for around 30% of personal travel emissions and represents one of the only journey purposes with essentially universal participation. Importantly, nearly everyone participates in some kind of discretionary activity away from home at some point whereas, at the very most, only around 50% of the population travel to work, have children in school or fly in any one year. More poignantly, in terms of car dependency, leisure comprises one of the fastest growing sectors of car based travel demand. This applies to the UK context but will be typical for many western economies.

Yet, apart from the occasional focus on holiday traffic 'mayhem', leisure travel rarely hits the headlines or is afforded the policy and research attention it deserves. It is also true to say that within the black box of 'leisure' which encompasses a diverse array of activities, we understand little of the contribution of specific demands such as audience travel to cultural events.

Government transport policies

It is true to say that leisure journeys present a particular set of challenges for policy that is attempting to encourage lower carbon choices. In the study of leisure sociology and psychology, most authors agree that leisure participation is an expression of identity, personal values and attitudes. Precisely the same factors closely associated with leisure also conjure up notions of a state of mind connected with the 'love affair with the car' such as freedom of choice, freedom from obligation, liberty and free access, enjoyment, relaxation, a lack of evaluation, voluntary participation, and so on. Consequently, for policy to be successful in this area, interventions need to replicate the necessary conditions for this state of mind to be created whilst using transport modes other than the car.

In very broad terms, the options for policy to reduce carbon emissions fall into four categories: each tackling a main source of energy demand and emissions from transport. These include policies, which incentivise, invest in or regulate for:

- (i) The technical efficiency of engines used to power the vehicles
- (ii) The operational efficiency with which vehicles are used, including their occupancy and how they are driven
- (iii) The mode of transport used to meet a given demand
- (iv) The demand for movement (distance travelled), itself derived from the need or desire to access goods and services and largely determined by land use patterns.

In the UK and elsewhere, the overwhelming balance of effort lies with technical solutions at the expense of attempts to alter mode choices and patterns of movement. The UK's low carbon reduction strategy for example, published in July 2009, expects 94% of the carbon savings from the sector by 2020 to come from technical based solutions, mainly improvements to car efficiency.⁶

On the one hand, the push for further improvements in vehicle and fuel technologies to reduce the environmental impacts of motorised transport without limiting distances travelled is an obvious priority. However, this emphasis leaves the problem that travel demand is growing faster than capacity possibly can. It also ignores the problem that efficiency gains can be offset by the uptake of vehicles with greater power and additional features and neglects the social issue that a significant share of the population cannot drive or does not have access to a car, for reasons of income, age, or ability.

The emphasis on vehicle and fuel technologies ignores the increasingly large body of evidence now pointing to the potential for the right combination of incentives, service improvements and information to alter travel choices over relatively short time periods, for many different types of journey at low cost. This evidence comes from the relatively recent attempts to address problems of ever increasing demands for road space by focussing on a range of activities defined as mobility management. This broad approach is aimed at encouraging the use of alternative modes by changing behaviour on behalf of organisations and individuals and utilises interventions such as travel plans, ticketing and pricing

⁵ Department for Transport (2008). Carbon Pathways Analysis: informing development of a carbon reduction strategy for the transport sector. Department for Transport, London

⁶ Department for Transport (2009). A Carbon Reduction Strategy for Transport: Impact Assessment. Department for Transport, London

alterations, car clubs and car sharing schemes, personalised journey planning and promotional campaigns.

The important point is that the definition of 'behaviour change' in mobility management is not simply restricted to mode choice and 'getting people out of their car'. Solutions are built around making the best use of the available infrastructure and this relies, at least in part, on the cooperative behaviour of transport users, with car sharing being a common example of a means by which considerable efficiency savings can be made. It also involves using the transport mode most appropriate for each journey, flexible use of travel time and route choice. Most of all it involves increasing understanding of travel behaviour and the reasons for individual journeys within specific contexts and organisational settings in order that interventions can be designed and targeted accordingly.

This is where the lack of emphasis on leisure travel, and especially travel to cultural events, has been an incredible missed opportunity. Successful mobility management requires tapping into social influences on individual's decision making and altering the bounds of what is considered 'normal behaviour'. What could be considered more influential than popular culture and the associated social networks as a source of inspiration, creativity and alternative behaviour?

Guidance for how to reduce audience travel emissions

Targeting audience travel to venues hosting festivals, music, sporting and theatrical events has the potential to have an impact much greater than the sum of its parts. By altering aspirations, experiences, information channels and behavioural norms, successful changes achieved in audience travel behaviour could have a trickle down effect and help to embed lower carbon choices into a wider set of travel decisions. For instance,

- The development of sophisticated information communication technology tools to facilitate car sharing could add to its position as a viable alternative to single occupancy car travel for a number of journey purposes

- Exposing people to the benefits of coach travel could have far reaching impacts given that it is the most efficient mode of transport over longer journey distances

- Altering just a small proportion of long distance journeys to cultural events could have a disproportionately larger impact than altering a larger number of short distance commuting and school travel journeys

- Stimulating the market for 'green' car hire and car clubs could even have the potential to reduce car ownership and the development of associated car dependent lifestyles.

The latter is based on the fact that many people are car owners and own large family cars chosen with the relatively infrequent number of annual leisure and holiday journeys in mind. Helping to alter car purchasing patterns and a shift away from owning large cars which are primarily used for single occupancy short urban journeys could have a far reaching impact on emissions from the transport sector.

Efforts to influence audience travel patterns necessitate excellent partnership working between transport operators, promoters, local authorities and venues. As the transport psychologists and sociologists suggest, the key will be to create and market journey experiences which rival the independence, flexibility and perceived lack of stress offered by the private car. The journey experience itself needs to become an integral part of the whole cultural and leisure experience. This includes integrated methods of payment which at least offer the illusion of 'free travel' to rival the often perceived 'free' marginal costs of car travel. Information between all the relevant actors needs to be shared to develop targeted and innovative information and exploit existing social networks. Most importantly, lower carbon alternatives need to be aspirational experiences to alter social norms and expose audiences to alternative ways of doing things which, if mainstreamed into everyday life, could have far reaching consequences on emissions from the transport sector.

Hot Topic 7

Snacking on emissions

By Dr Rebecca White

University of Oxford

Eating and drinking are absolutely central part of live performances – whether that be in keeping artists and crew going through intensive work schedules, or for audiences as part of the live event experience. Large quantities of food and drink are consumed, for which considerable resources are required in the production stages; and when we don't finish our food and drink, these resources effectively go in the bin, so there is also the issue of waste. Both food production and disposal leads to the emission of GHGs, alongside other environmental impacts.

There are plenty of good reasons to engage with reducing food's GHG impact including economic, environmental and marketing drivers. Through awareness and targeted action by those responsible for food provision in the live performance sector, GHG emissions can be reduced. This sheet is aimed at those who procure food, lease catering tenders and cook/ prepare food in the live performance sector. A brief introduction to the GHG emissions of food is provided here, alongside the policy context and some guidance.

Food – a climate change contributor

Food is thought to be responsible for 20-30% of our national GHG emissions⁷ (Audsley, Brander et al. 2009). Similarly, at the EU level food has also been calculated to contribute 30% of total emissions. Climate changing gases arise at all stages of food production,

⁷ This figure includes all the emissions from food that we consume in the UK, whether that food has been made in the UK or abroad. The higher figure of 30% also includes emissions from changes in land-use (e.g. cutting forest to grow animal feed) that can arise in the process of making some foods.

Electricity, transport fuel, gas and other energy sources

preparation and disposal. See Figure 18 for a diagram of two supply chains for foods commonly sold at live performance venues – beer and beef burgers. These also happen to be relatively GHG intensive food stuffs.

Farming in particular, through the production and use of fertilisers, the creation of feed for livestock, the emission of methane (CH₄) burps from ruminant (cows, sheep) digestion and nitrous oxide (N₂O) from soil⁸, emits comparatively more GHGs than other stages of the food chain. That is not to say however that other stages of production – whether that be transporting food, processing, manufacturing, packaging or cooling it – do not also warrant looking into. In fact, in many cases it can be easier to reduce emissions from the non-farming stages as methane and nitrous oxides in particular are harder to measure and manage.

The impact of climate change on food

Climate change will also impact food in the longer run. As the climate changes the conditions for growing food will alter. While it is anticipated that this might be beneficial for northern latitudes in the shorter term to 2050, it is likely to have a negative impact for less developed countries in mid to low latitudes. Assuming we continue to emit greenhouse gases globally at the current rate, towards the end of this century climate change is expected to have an increasingly negative effect on agriculture across all countries (Parry et al 2007). Extreme weather events will also affect distribution and other production infrastructure.

Government policy on food and climate change

The government has signed up to 80% reductions in GHG emissions by 2050 – a large target that will affect each stage of the food chain. To date the food industry has not been specifically targeted by regulations to reduce emissions although a number of policies, such as the climate levy (a tax on energy) and the EU Emissions Trading Scheme do affect some parts of the supply chain.

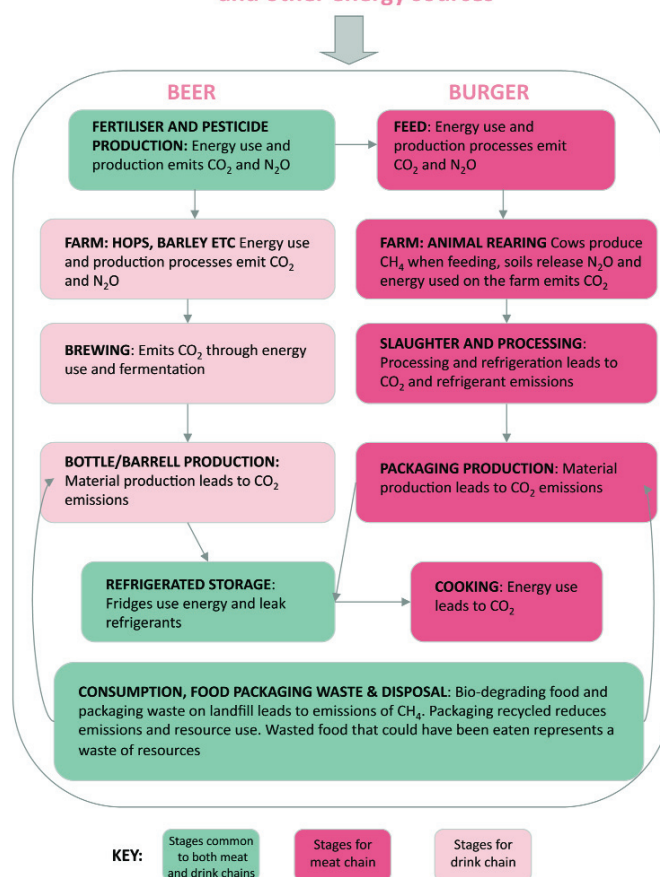


Figure 18 Sources of emissions from food consumed in the UK

The most specific development for encouraging the food and drink industry to assess and improve environmental performance has been the Food Industry Sustainability Strategy, an industry lead initiative, and PAS 2050, a product carbon footprinting and labelling scheme developed by the Carbon Trust.

Table 5 Approaches to reducing food and drink GHG emissions

Approach	Example Action
Increase efficiency of production	Consider the energy use of your premises, appliances and transport modes. When it comes to replacing equipment (if not before) use energy ratings, labels and advice to buy the most efficient.
Reduce waste	Monitor how much food you buy-in and have to dispose of. Minimise packaging. Recycle and assess the viability of installing compost facilities or an anaerobic digester to recover energy from food waste.
Change production and disposal to eliminate GHG intensive stages	Consider having freely available water fountains/drinking water taps. Consider using the Incredible Cup company at your event to reduce plastic waste by using their re-usable cup system, which has successfully been implemented at large venues, arenas and stadium events.
Reduce consumption of GHG intensive foods	As a general rule minimise animal products as these are more energy and resource intensive. Offer customers, artists and crew good quality and imaginative vegetarian options. Procure local and seasonal food.
Change to no/low carbon energy sources	Source your energy from a renewable energy provider or generate your own renewable energy, e.g. using solar PV for electricity, heat pumps or solar thermal to heat space and water, and anaerobic digestion to turn your waste into electricity.

⁸ CH₄ is a greenhouse gas 25 times more powerful than carbon dioxide. N₂O is a greenhouse gas 298 times more powerful than carbon dioxide.

Voluntary initiatives underway

Adnams - A brewery that has developed an environmental and social policy that shapes their business development. They have taken a number of environmental initiatives such as producing a carbon neutral beer and a distribution centre with grass roof, rainwater collection, renewable energy sources, and environmentally benign materials and design. To learn more go to: http://www.youtube.com/watch?v=_YjIAqc8opY

E-CO₂ - The E-CO₂ Project seeks to carbon footprint farmers and growers, and gives advice on renewable energy generation on farms. They have been working with McDonalds.

Large Retailers - Retailers are taking increasing interest in the greenhouse gas emissions in their supply chains, including carbon labelling. For example Tesco is working with dairy farmers to examine emissions in the supply chain and opportunities for improvements.

Guidance to the live performance sector

There are a number of strategies that will reduce the emissions created by food and drink consumption. Table 5 outlines 5 broad approaches and gives examples of the types of actions that can be taken under each approach.

Suggestions for venues

- Develop a sustainable procurement policy for food and drinks.
- Learn about the environmental impacts of food and drink sold at the venue.

- Assess the energy used for food and drink provision and identify opportunities for energy savings.
- Work with contracted food and drink concessions to offer consumerables with low environmental impacts.
- Communicate efforts to reduce the environmental impact of food and drinks to audiences.

Suggestions for incoming productions

- Hire caterers with environmental policy and credentials.
- Ask venues about their food and drinks procurement policy and about the actions they are taking to reduce its environmental impacts. This could be part of a green rider.

Finally, some links for further reading and watching:

The Food Climate Research Network - lots of information, research and reports: <http://fcrn.org.uk/>

Low Carbon High Potential video about SMEs and the environment: http://www.youtube.com/watch?v=_YjIAqc8opY

Sustain - lots of food-environment-society information, especially initiatives.: <http://www.sustainweb.org/>

WRAP - All things resource efficiency, recycling and waste.: <http://www.wrap.org.uk/>

Business in the community: <http://www.bitc.org.uk/>

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Appendix I - Guidance, tools, awards and regulation

Name, category, link	Description
Guidance	
Best Foot Forward bestfootforward.com	Carbon and ecological footprinting experts, conducted analysis for Radiohead.
Eco Action Partnership Ecoactionpartnership.com	Consultancy offering guidance on sustainable event management and ethical PR.
ECOVENUE http://bit.ly/8uoITN	A theatre-specific, environmental business support project for 48 theatre and performing arts venues across London. It aims to achieve quantifiable improvements in the environmental performance of London's theatres. Theatres will be provided with advice to develop Environmental Policies and achieve Display Energy Certificates (DECs).
Julie's Bicycle juliesbicycle.com	Not for profit offering free resources, research and initiatives to support GHG emissions reduction in the creative industries.
Slowboat Report http://bit.ly/dwxlut	Report and accompanying documents following the 2009 conference on sustainable touring hosted by ArtsAdmin and British Council.
Sustainable Events Guide sustainableeventguide.com	A practical guide to reducing the environmental impacts of large events.
Sustainable Touring sustainabletouring.com	Team of specialist music and media sustainability consultants who provide in depth support in all areas of event management.
Online Tools	
Arts Energy Toolkit artsenergy.org.uk	Arts Council England has developed a self-assessment web-based toolkit for arts organisations to help them implement an effective energy management programme including an action plan. Measures building energy use only, in kWh and CO ₂ .
Eventberry eventberry.com	Provides step by step support for achieving BS 8901 (see below), identifying all documentation required, providing check lists, database and project management functions.
IG tools juliesbicycle.com/ig-tools	Free online tool that automatically calculates an "audit snapshot" of the GHG emissions produced by tours (by leg), offices and venues (annually). Results are measured against industry benchmarks where available.
SMEasure smeasure.org.uk	Free online tool that tracks a venue or office's weekly energy use and GHG emissions. Analyses performance against external temperature and identifies over/under-spend. Provides projected EPC ratings.

Name, category, link	Description
Awards, Certifications, Standards	
BS 8555	British Standard (ISO) guidance for any organisation wanting to set up a system to ensure improvement of environmental performance. Particularly suited to small to medium companies (SMEs) wanting a clear phased approach before moving to ISO 14001.
BS 8901	British Standard (BS) guidance for events organisers, venues and suppliers wanting to set up management systems that ensure improvement of sustainability performance. (environmental, economic, social). Events organisers, venues and suppliers can be certified to this British Standard.
ISO 14001	International Standard (ISO) guidance for any organisation wanting to set up a system to ensure improvement of environmental performance.
Carbon Trust Standard carbontruststandard.com	For companies (including venues) who wish to demonstrate reductions in GHG emissions.
Carbon Reduction Label carbon-label.com/	Assesses the GHG emissions of products (eg beer or t- shirts) using the PAS 2050 life cycle methodology.
Green Tourism Business Scheme	In the performing arts, most suited to iconic venue owners who wish to demonstrate their sustainability credentials to the tourism market.
Industry Green juliesbicycle.com/industry-green	For creative industry companies (including venues and festivals) who wish to demonstrate reductions in GHG emissions.

Note: Many Standards and Certification schemes use internationally recognised protocols that are freely available, for example the GHG Protocol provides guidance for organisational footprinting. These are however quite technical and not recommended for complete beginners to carbon accounting.

Regulation	
Carbon Reduction Commitment environmentagency.gov.uk/business/topics/pollution/98263.aspx	Mandatory GHG emissions trading scheme for large businesses whose annual half-hourly metered electricity use is above 6000 megawatt-hours (MWh) (approximately over £500k per year). Affects large music venues and venue groups.
Display Energy Certificate	Mandatory for any building occupied by a public authority or institution and more than 1,000m ² in floor area (including venues) – requires external assessment of building energy use, including A to G ranking.
Energy Performance Certificate	Mandatory for any building being built, sold or rented (including venues) – requires external assessment of building energy use, including A to G ranking.

Appendix 2 - Background to the theatre sector and its touring practices

This is an attempt to offer some brief contextualising detail on the UK theatre economy and infrastructure for those readers working outside of the sector.

British theatre practice is tremendously diverse in form, ranging from classical and contemporary text-based theatre and musicals to physical theatre, circus, street art, live / performance art and increasingly work, which is participative or digital in its content or which blurs the boundaries between disciplines. It takes place in theatres, on street corners and in a wide range of found spaces from shopping malls to abandoned warehouses. There are several hundred professional companies putting on productions across the UK and over a hundred regularly (i.e. at least once every 2 to 3 years) presenting work internationally at all different scales. The sector comprised of commercial and subsidised theatre companies as well as unfunded/voluntary groups - contributes an estimated £2.5 billion a year to the UK economy. By far the largest number of companies is touring companies, meaning organisations with no permanent space of their own in which to present their work but which take their productions to a variety of receiving spaces, both traditional and unconventional, in the UK and abroad.

The primary motivation for touring, and for the public subsidy of many touring theatre companies, is one of access. Touring is the most effective means of ensuring that audiences with little or no regular access can be given the opportunity to see a variety of high quality theatre performances. Many subsidised touring companies will have an obligation to perform within specific regions or sub-regions of Britain as a condition of their funding support. As the global impact and economic value of Britain's creative industries is increasingly recognised by politicians and funders, touring companies with the capacity to do so are also encouraged to present their work abroad and to develop an international profile alongside their domestic presence.

The logistics of putting together a touring theatre production are complex, even at the small-scale where much of this work originates. Aside from the central creative processes involved in making a piece of theatre, a tour will need to be constructed by first contacting and then persuading presenters to host performances; marketing the shows to very diverse audiences; arranging the transportation of set and equipment; organising accommodation and transport for members of the cast and crew and finally getting the show in and out of each differently-configured venue, often very swiftly. The pressures and time constraints are significant and the business model well-established so it is imperative that when looking at options for change, these elements are factored into our recommendations.

a. Financial context

For most touring theatre companies, public presentation of their work provides the majority of their income, often accounting for over 70% of turnover. Earned income is derived from a number of sources, such as performance fees, direct ticket sales and merchandise as well as from public funding, corporate sponsorship, grants from trusts and foundations; EU cultural funds and private giving.

Within commercial theatre companies, almost all overall income is derived from direct ticket sales. Typically for commercial companies, any income from international presentation will come in the form of a fee to license the production for re-staging after which the theatre company will no longer be involved in production decisions.

Most non-commercial touring theatre companies depend on receiving an element of public subsidy in order to make their business model work. This element generally comprises between 10% and 50% of a company's annual turnover and is usually received through the UK's domestic funding agencies (i.e. the Arts Councils of England, Wales, Northern Ireland and Scotland) in addition to the British Council, the UK's international cultural relations organisation. Public subsidy can be regular or occasional, for example touring companies in England are funded by both RFO (Regularly Funded Organisations) and Grants for the Arts schemes.

Commercial theatre productions are seen by many as more reliably marketable commodities in times of financial difficulty and as such remain in high demand. However, the scarcity of producing companies means that middle and large-scale venues in particular are finding it difficult to source enough touring product to fill their spaces.

At the time of writing the UK is anticipating significant contraction in all sectors of public expenditure and this will be challenging for those in the sector who are dependent on public funds. The need for strategic planning is of particular concern for the touring theatre sector whose administrative resources are often stretched through lack of personnel and the logistical complexities of touring whilst diminishing levels of disposable income amongst audiences inevitably leads to more conservative programming policies amongst venue managers. This will clearly have an impact on emerging theatre companies and on those producing more experimental work.

In recent years public funders have been less prescriptive and more flexible in what work they fund, where that work is presented and for how long and this has led to a concentration of work in a more limited number of venues. Looking ahead, funders are keen to rebalance the equation, ensuring that distribution and access issues are emphasised again, alongside the need for a breadth and quality of work.

- More public funding will be allocated to support the re-touring

or extended touring of work to maximise audience reach.

- Additional priority is likely to be made for the support of middle and large-scale productions.
- The key goal of Arts Council England's new 10-year Arts Strategy is to deliver 'great art for everyone'. As such touring will be a tool to achieve the following:
 - A more balanced distribution of work across the country
 - A greater number and more diverse range of people experiencing touring theatre
 - A greater breadth of work on tour so that audiences across England can experience work by a wide range of artists and companies
 - A stronger relationship between the works that is funded to tour and the organisations that are funded to programme touring work. These latter include arts centres, festivals, touring consortia and commercial venues

Given the increased emphasis on touring as an important element of provision, clearer Arts Council touring guidance will be developed to enable artists, companies and promoters to more effectively plan their activity.

b. Sector relationships

A number of protagonists collaborate to organise the presentation of theatre work: artistic directors and other creative personnel, producers, technicians, promoters, venues and, of course, performers and audiences. A tour project will typically start with internal discussions within a theatre company concerning the artistic work, the key people who should be involved (e.g. director and producer/s) and where it might be performed. Producers and promoters consequently negotiate directly with one another with the shape and duration of tours finally being determined on the

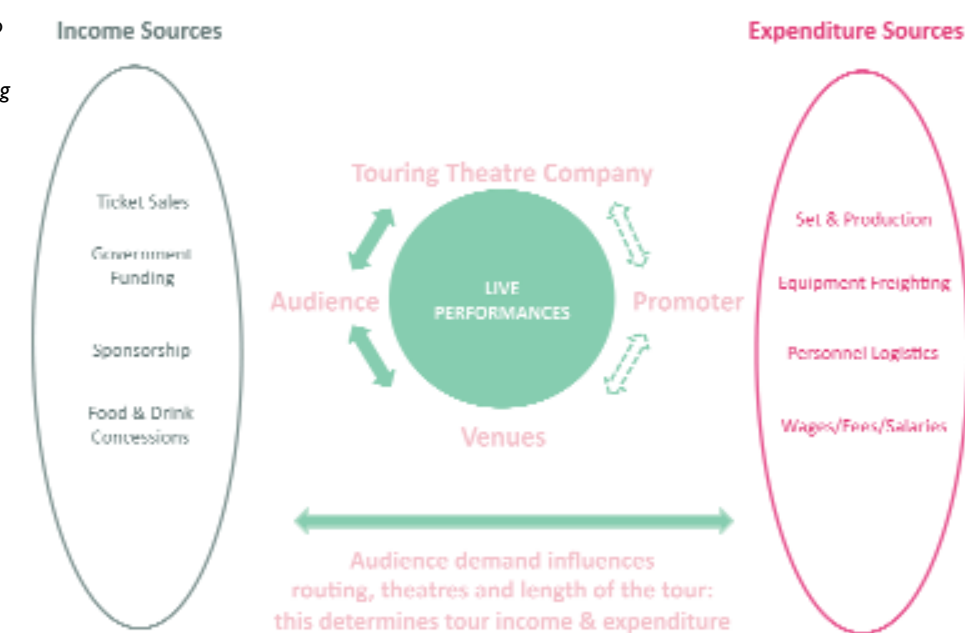
basis of income (fees, ticket sales, public funding, and sponsorship) and expenditure (staging, personnel logistics, wages and venue hosting fees) (see Figure 19).

There are a number of influential membership bodies representing the interests of different constituents in the sector, such as the Theatrical Management Association (TMA), Federation of Scottish Theatres (FST), Society of London Theatres (SOLT), Independent Theatre Council (ITC) and trade unions BECTU (for technicians) and Equity (for performers). These bodies provide regulations and guidance setting out payment structures and codes of conduct for those they represent. Each trade body will represent the interests of their members to funders, policymakers, other membership bodies and other relevant stakeholders.

Venues are typically either producing or receiving houses and some will do a combination of both and can be commercially independent, subsidised or local authority owned and managed. A commercial theatre will be a receiving house for both commercial and subsidised productions and venues in local authority ownership often solely function as presenting houses, dependant on bringing in touring productions.

In England there are several limited networks of venues that work together as touring consortia with varying degrees of formality. They may collaborate to commission new work but more usually to present existing and available work in a co-ordinated manner. Internationally, large-scale and prestigious festivals operate a flexible, mutually-advantageous consortium approach, most usually around the commissioning and distribution of new work by a globally-renowned (and costly) artist or company. Within the UK theatre sector therefore, that opportunity is likely to be limited to less than a dozen British companies. Pragmatic, geographically-determined networks also exist, for example in Australia and New Zealand, where most season and festival dates are deliberately contiguous in order to make regional touring more likely and more affordable. It is clearly both cost-effective and efficient in terms of workload to tour under the auspices of a collaborating group of

Figure 19 Core relationship determining income and expenditure in theatre touring



* Applicable only to theatres.

presenters. However individual personal relationships, the intellectual curiosity of the artists concerned and economic realities remain the strongest determinants of where a touring production will travel, touring to China, for example, having increased exponentially with its economic growth and the ability of its presenters to pay Western-level performance fees.

c. Characteristic theatre touring

There are broadly three scales of touring company: large, middle and small-scale, categories derived from venue capacity, although a significant number of companies work across more than one scale. Whether a touring company typically does small, middle or large-scale productions depends on artistic direction, financial resources, venue size and audience demand. Large and middle scale theatre productions are typically planned two years in advance, small scale usually in less than a year. The decision to tour middle or large scale work will very often come as a result of critical or box office success after a building-based production has been staged. Small scale work is usually designed to tour from its inception.

Those companies touring large productions are usually resident for at least a week in each location and will tour for a couple of months to make presenting the work financially viable. Small-scale touring theatre companies may spend only one or two nights at each venue they visit. The economic requirements of a commercial tour means that they will habitually run for considerably longer than non commercial productions, the need to off-set production costs and create an ultimate profit outweighing any desire to offer more varied theatrical diet to audiences.

d. Tour planning

Key stages in planning a theatre tour

1. The creative development of the production
2. Securing funding to create and present the work, although not necessarily to tour at this stage
3. Securing invitations to tour the production, typically happening in one of two ways:
 - a. Presenting the production at a festival or sponsored showcase in order to attract promoter interest and investment
 - b. Approaching a promoter (usually one already familiar to the touring theatre company's work) to gauge interest in booking the production
4. Securing funding to tour the production
5. Contracting presenting venues
6. Organising travel and technical logistics for set, performers and staff

However, these planning stages can happen in a different order, for example, securing the funding and invitation and then developing the production and organising the logistics based on financial and time-bound constraints.

The decision to tour a production, especially internationally, will usually be made on the basis of reviews or a viewing. Therefore, theatre festivals and sponsored showcases, such as the British Council's biennial Edinburgh Showcase, are important outlets for promoting work. The time taken from the point at which a promoter expresses interest to the performances taking place may be as little as 6 months or as much as 2 years during which period the theatre company is likely to have at least one other production touring and be in development for a third.

A touring theatre company's professional network is profoundly influential in determining where a production will tour. A theatre company's representative will initially approach those promoters and venues with whom they have worked in the past and who have a history of interest in their productions. Therefore, the booking of legs in a tour will often be shaped by the location of regularly supportive presenters rather than more obviously logical or geographically-proximate routes.

The venue - as the main financier of the production through its ticket sales - rather than the theatre company usually has the greater negotiating power in deciding when a performance takes place. Venue managers tend to build their programmes in distinct seasonal blocks and will consider the balance of productions to ensure they can offer a variety of work to different audiences. A venue will want to avoid programming similar types of productions back-to-back (e.g. two comedies, two dramas or two musicals). This will also affect the routing of a tour.

Venues, and especially festivals, usually want to be the sole presenters of a production within a specific territory and so may have an exclusion policy which specifies a time period and the distance in miles within which a company cannot present the same show. Exclusion policies can restrict opportunities to present multiple performances of a production within a single tour. However, although many large and middle-scale venues currently operate such exclusivity policies, those interviewed for this study expressed a willingness to negotiate the terms with companies. Their main requirement was to be consulted, so as to avoid any surprises that could adversely affect ticket sales.

e. Travel logistics

For a touring theatre production it is usually the case that personnel and at least some elements of the set and staging will need to be transported between venues. The quantity of people and staging will depend on the scale of the production and in particular of the set design; the budget and the time constraints under which the tour is operating. Budget constraints are the key determinant. What gets transported and how will also depend on the resources (e.g. lighting) available at the intended venues; the degree of complexity of the production, (the more bespoke the design the more likely it is to be transported in its entirety) and the necessity for haste.

There is considerable time pressure in presenting touring work. Performance runs are usually short - typically one week or less - so venues demand that the limited turnaround time between incoming and outgoing companies is used efficiently. The longer the technical preparations take to mount and dismantle a production,

the greater the costs associated with it (and often to the company) will be. Consequently, with pressure on touring theatre companies to assemble and disassemble their productions quickly, it is often considered most efficient / cost-effective for those companies to transport and use their own sets and lighting systems.

Most touring theatre companies in the UK will move set and lighting equipment by truck or van. Large-scale commercial touring companies and a small number of large-scale subsidised touring companies will own a fleet of trucks and vans dedicated to this purpose but the majority of small and middle-scale companies will own one or two vans only or use rented vehicles. In addition, specialist lighting companies might be sub-contracted - particularly in a medium / large-scale or festival context - to deliver hired lighting equipment to venues.

For European tours of large and middle-scale work, the sets, lights, props, and costumes are invariably transported by truck as this is considerably cheaper than air freight. For tours to other parts of the world theatre companies will carefully assess what staging elements are essential because of the prohibitive costs of this form of transportation. Time permitting, companies will instead send freight by sea to territories such as the US (taking at least 4 weeks) or Australia and New Zealand (taking at least 8 weeks). Many decisions are driven by the imperative to keep costs as low as possible; sourcing sets locally sometimes proving to be just as expensive as transporting them from the UK because of the cost of additional materials and labour.

For tours within the UK personnel are often responsible for organising their own transport and will be given a travel allowance as recompense. Car sharing is common, but sometimes insurance companies will make it a requirement that key performers do not travel together in case of an accident. Some touring companies will organise vehicles for personnel, especially if undertaking small-scale regional tours and in these cases production equipment may be taken in the same vehicle. For international touring, the theatre company will organise travel logistics and the transport mode will be determined by time and cost constraints.

Glossary

Environmental terminology

Adaptation: Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Biofuels: A wide range of fuels derived directly from living matter. The term covers solid biomass, liquid fuels and various biogases. Examples of biofuels are bioethanol, biodiesel and algal fuel (see Hot Topic 5 for more information on biofuels).

Carbon Dioxide (CO₂): A naturally occurring gas, and a by-product of burning fossil fuels and biomass, as well as of land-use changes and of other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential of 1.

Carbon Dioxide equivalent (CO₂e): The universal unit of measurement used to indicate the global warming potential (GWP) of each of the six Kyoto greenhouse gases. It is used to evaluate the impacts of releasing (or avoiding the release of) different greenhouse gases.

Carbon footprint: The total set of greenhouse gases (GHG) emissions caused by an organisation, event or product. For simplicity of reporting, it is often expressed in terms of the amount of carbon dioxide or its equivalent of other GHGs emitted.

Carbon offsets: A carbon offset is a mechanism that allows a company, organisation or individual to reduce its environmental impact on the atmosphere in one area by investing in projects that reduce greenhouse gas (GHG) emissions in another (see Hot Topic 3 for more information on Carbon offsets).

Carbon valuation: In order to be able to incorporate, in monetary terms, the cost of potential damage to the environment caused by GHG emissions, a consistent carbon pricing or carbon valuation should be applied to public policies and project budget appraisals – this will provide a complete costing of a policy or project which includes the often hidden, but nevertheless real cost of the policy or project, even if that cost is not borne directly by the customer (see information box on internalising the price of pollution by adopting carbon valuation).

Climate: Climate in a narrow sense is usually defined as the “average weather,” or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands of years. The classical period is three decades as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind.

Climate change: A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, and which is in addition to natural climate variability over comparable time periods.

Climate change mitigation: Measures or actions to decrease the intensity of radiative forcing in order to reduce global warming. Mitigation is distinguished from adaptation, which involves acting to minimise the effects of global warming. Most often, mitigations involved reductions in the concentrations of greenhouse gases (GHG), either by reducing their sources or by increasing their sinks.

Disclosure: The action of making new or secret information known. In the context of climate change, it refers to the disclosure of direct and indirect emissions produced from buildings, transport, the production and movement of goods and services, etc.

Direct emissions: Emissions that are produced by organisation-owned equipment or emissions from organisation-owned premises, such as carbon dioxide from electricity generators, gas boilers and vehicles, or methane from landfill sites.

Embodied carbon emissions: The term “embodied carbon” refers to carbon dioxide emitted at all stages of a good's manufacturing process, from the mining of raw materials through the distribution process, to the final product provided to the consumer. Depending on the calculation, the term can also be used to include other GHGs.

Emissions: The release of a substance (usually a gas when referring to climate change) into the atmosphere.

Environmental sustainability: Environmental sustainability refers to the ability of natural ecosystems to remain diverse and productive, thus being able to support life over a period of time. All human activity is based on these ecological goods and services. Some human activities, such as the excessive production of GHG emissions (including carbon dioxide), has led to the decline in natural ecosystems and to changes in the balance of natural cycles, thus undermining and degrading the capacity of ecosystems to continue supporting life. Living sustainably, for example, by reducing carbon dioxide and other GHG emissions, will ensure the long-term viability and productivity of these ecosystems, providing both humans and other living systems with the capacity to endure. It is in this context that we create a direct link between GHG emission reductions and environmental impacts.

Global Warming (GW): The continuous gradual rise of the earth's surface temperature thought to be caused by the greenhouse effect and responsible for changes in global climate patterns.

Global Warming Potential (GWP): The GWP is an index that compares the relative potential (to CO₂) of the six greenhouse

gases to contribute to global warming i.e. the additional heat/energy which is retained in the Earth's ecosystem through the release of this gas into the atmosphere. The additional heat/energy impact of all other greenhouse gases are compared with the impacts of carbon dioxide (CO₂) and referred to in terms of a CO₂ equivalent (CO₂e) e.g. Carbon dioxide has been designated a GWP of 1. Methane has a GWP of 21.

Greenhouse effect: Trapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. Some of the heat flowing back towards space from the Earth's surface is absorbed by water vapour, carbon dioxide, ozone, and several other gases in the atmosphere and then reradiated back toward the Earth's surface. If the atmospheric concentrations of these greenhouse gases rise, the average temperature of the lower atmosphere will gradually increase.

Greenhouse Gases (GHG): The current IPCC inventory includes six major greenhouse gases. These are Carbon dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF₆).

Indirect emissions: Emissions that are a consequence of the activities of the reporting company but occur from sources owned or controlled by another organisation or individual. They include all outsourced power generation (e.g. electricity, hot water), outsourced services (e.g. waste disposal, business travel, transport of company-owned goods) and outsourced manufacturing processes. Indirect emissions also cover the activities of franchised companies and the emissions associated with downstream and/or upstream manufacture, transport and disposal of products used by the organisation, referred to as product life-cycle emissions.

Light-emitting diode (LED): A light-emitting diode is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. LEDs present many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved robustness, smaller size, faster switching, and greater durability and reliability.

Sector terminology: Theatre

Artistic Director: Has overall responsibility for the artistic vision and programme of work of a theatre company or venue. In a producing organisation this role involves choosing plays for production, hiring key creative/production personnel and sometimes directing individual productions. In a venue the Artistic Director also plans the theatre's season.

Commercial theatre: Commercial (for profit) theatre organisations. These are not in receipt of significant public funding particularly for their core operations though are occasionally able to access project grants from public funders for additional activities serving non-commercial ends, for example diversifying their audience. Often presenting large-scale work.

Director: Has overall responsibility for an individual production and is the primary visionary, making decisions on the artistic concept and interpretation of the text and its staging. The director collaborates with a team of creative individuals to achieve each

production including actors, designers and often, in the case of new writing, the playwright.

Performances away from home base: Performances that take place in a different location than where the theatre company is based.

Presenting theatres: Venues whose programme is predominantly comprised of work produced and toured in by others for periods ranging from one night to several weeks or months. Managers of such theatres have responsibility for the programming and the promotion of any performances taking place at their venue. Sometimes known as receiving houses.

Producer: The individual or organisation responsible for mounting a theatre production. The producer manages the business of the production in order to realise the artistic vision. This includes raising funds, creating and overseeing the budget, planning where and when the work will be presented, marketing and practical production (e.g. rehearsals, set production). In some cases the producer also commissions or finds the script and chooses the director.

Producing theatres: Producing theatres are venues whose programme is mainly comprised of work created in-house by the theatre itself, sometimes in partnership (co-production) with other producing venues or companies. Programmes may also include incoming tours. Sometimes known as repertory theatres, they rarely have a resident acting company but do have in-house artistic, production and technical staff and facilities. Producing theatres will sometimes tour their own productions to other venues.

Regularly/Revenue Funded Organisations: Organisations in receipt of public subsidy, often from a national Arts Council, on an ongoing annual basis. Such funding is often given towards core costs and programme rather than for specific projects. Funding agreements can vary in length: three years is common but in practice funding often continues for many years.

Site-specific: Site-specific theatre is created to exist in unique and usually untraditional settings. Typically, the particular nature of the site itself will be a strong influence on the content of the work. More broadly, the term is sometimes used to describe any work that is (more or less) permanently attached to a non-theatrical location.

Subsidised theatre: Theatre companies in receipt of public funding, commonly set up as charities or social enterprises. Often described as not-for-profit.

Theatre touring party size: Touring party size can vary from one tour to the next, so a theatre company can operate in more than one category depending on the needs of the individual productions. For the purposes of this study:

- Small-scale: less than 7 in touring party
- Middle-scale: 7-24 in touring party
- Large-scale: 25 or more in touring party
- Education-scale: less than 7 in touring party

Touring: A tour is defined to be one or more performances away from the theatre company's home base (i.e. not in the town or city in which it is located). The tour samples received have been classified by size - i.e. small, middle and large-scale subsidised; large-scale commercial; education-scale and by tour leg).

Touring company/party size: The amount of people travelling from one show location to the next for a given project.

Touring Companies and Producers: Non-venue based theatre organisations who create and tour their own work sometimes in partnership (co-production) with other producing companies or venues. Responsible for raising funds, creating, managing and touring the work such companies and independent producers often maintain a very small infrastructure year round increasing in size during production and touring periods.

Tour leg: A part of the tour confined to a specific geographic territory i.e. just UK dates, or just EU dates, or just US dates etc.

Venue size: Small - under 300 capacity; middle - 300–800 capacity; large - over 800 capacity.

Abbreviations

ACE: Arts Council England

SAC: Scottish Arts Council

ACW: Arts Council of Wales

BC: British Council

CO₂: Carbon Dioxide

CO₂e: Carbon Dioxide Equivalent

Decc: Department of Energy and Climate Change

Defra: Department for Environment, Food and Rural Affairs

EU: European Union

EU ETS: European Union Emissions Trading System

GHG: Greenhouse gases

Kg/kgs: Kilogram/kilograms

Km/kms: Kilometre/kilometres

kWh: Kilowatt-hours

NO_x: Nitric Oxide (NO) and Nitrogen Dioxide (NO₂)

t: Tonnes

UN: United Nations

Units

1000g = 1 kg

1 tonne = 1000 kg

1 mile = 1.61 km

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