

Sustainable theatres – a wider view

Resilient Theatres: Resilient Communities



Pilgrim
Trust

SWIRE
CHARITABLE
TRUST

Host and chair

Claire Appleby

Architecture Advisor, Theatres Trust

Sustainable theatres

Andrew Wylie

Partner and Consultant, Buro Happold

THE THEATRE GREEN BOOK

Version 2

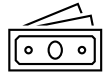
Act Green 2024 Survey:



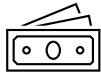
74% say it would make them view the organisation more positively



45% say it would make them more likely to attend



36% say it would make them more likely to donate



19% say they would be willing to pay more for tickets

To be sustainable, we need to...



Sustainable Productions

... make theatre **Productions** as sustainably as possible



Sustainable Operations

... run theatre **Operations** as sustainably as possible



Sustainable Buildings

... make theatre **Buildings** as sustainable as possible

These are the priorities, in order:

Insulation

*Roofs, walls and windows ... so your building **needs** less energy*

Efficiency

*Efficient plant and good controls ... so your building **uses** less energy*

Renewables

*So you generate **renewable** energy*

Biodiversity (and use less water)

45

Theatre Green Book • Building Survey Tool

Theatre Green Book
we're making theatre sustainable

Read the question in the Question column.

If the answer is NO, delete or hide the whole row (right-click on the row and 'Hide').

If the answer is YES (or MAYBE), name the location in the Location column.

If you have several locations, make extra rows (right-click on the row and 'Insert').

BURO HAPPOLD

Green Project	Question	Location	Action	Next Step	Notes
---------------	----------	----------	--------	-----------	-------

1 EASY WINS

INSULATION

Simple roof insulation	Do you have an attic where you could easily install rolls of insulation?	If NO, delete the line. If YES (or MAYBE), name the location in this cell (e.g. 'Auditorium Roof' or 'Whole Building'). For several locations, make extra rows.	Install roof insulation	Find a builder to inspect and quote	Don't cover fixings or equipment which you need to inspect from above. For example, historic plaster ceilings often need to be inspected from the attic above, and insulation can make this harder.
Cavity wall insulation	Do you have a mid-20th century building with 'cavity walls' (i.e. walls constructed with two thicknesses of brick and a gap behind them)?	ditto	Inject cavity wall insulation	Find a specialist builder to inspect and quote	If you're not sure, get professional advice. Seek professional advice if your walls are exposed to heavy rainfall or flooding, as cavity wall insulation can make them less waterproof.
Draught-proofing to doors	Do you have external doors with no draught-proofing?	ditto	Install draught-proofing	Find a builder to inspect and quote	
Draught-proofing to windows	Do you have external windows with no draught-proofing?	ditto	Install draught-proofing	Find a builder to inspect and quote	
'Air curtains' to entrance doors	Do you have external doors which are often open, and where you can't build a draft lobby or fit revolving doors?	ditto	Install an "air curtain" to prevent heat loss	Find a builder to inspect and quote	An air curtain creates a barrier of hot air over an entrance. Pipework and cabling in historic spaces will need careful design and planning.

EFFICIENCY

Voltage optimisation	Do you have an electricity supply with no voltage optimisation?	If NO, delete the line. If YES (or MAYBE), name the location in this cell (e.g. 'Auditorium Roof' or 'Whole Building'). For several locations, make extra rows.	Install voltage optimisation	Find an electrical contractor to inspect, advise and quote	Voltage optimisation reduces energy consumption by managing the voltage drawn from mains supplies.
'Smart' heating controls	Could you fit thermostats and timers to make sure you're only heating rooms that are in use (and not over-heating them)?	ditto	Install thermostats and timers	Find a builder to inspect, advise and quote	
Building Management Systems	Do you have a Building Management System (BMS) (computer control of your building services)?	ditto	Use BMS to analyse energy use and identify changes to use less energy. Upgrade it if necessary. Make sure staff know how it works	Find a professional to analyse data and propose changes	Requires professional consultant. More appropriate to complex systems.
Thermostatic radiator valves (standard or 'smart')	Do you have radiators which have no control on how hot they get?	ditto	Install Thermostatic Radiator Valves	Find a builder to inspect, advise and quote	Helps control individual spaces more effectively and remotely.
Lighting controls	Do you have lights which are on even they're not needed, for example in corridors or open-plan offices?	ditto	Install daylight sensors to turn on lights if they're not needed, or occupancy sensors to turn them on only if there's movement in the room.	Find a builder to inspect, advise and quote	
Hot water operating hours	Does your water heat up even if it's not needed?	ditto	Adjust heating times to match patterns of use. If your controls won't let you do that, upgrade the controls	Find a builder to inspect, advise and quote	

BASIC

INTERMEDIATE

ADVANCED

Building Survey Tool

ARTS GREEN BOOK

Sustainable Buildings
(version 1)



Supported using public funding by
**ARTS COUNCIL
ENGLAND**

SUPPORTED BY
MAYOR OF LONDON



What is a DEC?

- Designed to show and publicly display the energy performance of buildings.
- They use a scale that runs from 'A' (best) to 'G' (worst)
- Mandatory when:
 - At least partially occupied by a public authority
 - Total floor area over 250m²
 - Frequently visited by the public
- Private organisations:
 - DEC optional
 - Might be needed if the building is sold or rented
- Validity:
 - 1 year for buildings over 1,000m²
 - 10 years for buildings between 250 and 1,000m²

Display energy certificate (DEC)

Cabinet Office
Prime Minister & First Lord of the Treasury
10 - 12 Downing Street
LONDON
SW1A 2AA

Operational rating
C

Certificate number: 2881-1666-5278-9406-4901
Valid until: 31 May 2024
Total useful floor area: 6,792.02 square metres

Energy performance operational rating

The building's energy performance operational rating is based on its carbon dioxide (CO₂) emissions for the last year.

It is given a score and an operational rating on a scale from A (lowest emissions) to G (highest emissions).

The typical score for a public building is 100. This typical score gives an operational rating of D.

Score	Operational rating	This building	Typical
0-25	A		
26-50	B		
51-75	C	75 C	
76-100	D		
101-125	E		100 ..
126-150	F		
150+	G		

This building's energy use		
Energy use	Electricity	Other fuels
Annual energy use (kWh/m ² /year)	144.49	102.73
Typical energy use (kWh/m ² /year)	180.57	180.08
Energy from renewables	0%	0%

Previous operational ratings

Date	Operational rating
June 2023	75 C
June 2022	150 F
June 2021	106 E

Total carbon dioxide (CO₂) emissions

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO₂.

Date	Electricity	Heating	Renewables
June 2023	540	143	0
June 2022	542	226	0
June 2021	550	174	0

Assessment details

Assessor's name	Steve Jones
Employer/Trading name	Mitie
Employer/Trading address	The Shard, Level 12, 32 London Bridge Street, London, SE1 9SG
Assessor's declaration	Contractor to the occupier for non-EPBD services.
Accreditation scheme	Sterling Accreditation Ltd
Issue date	4 June 2023
Nominated date	1 June 2023

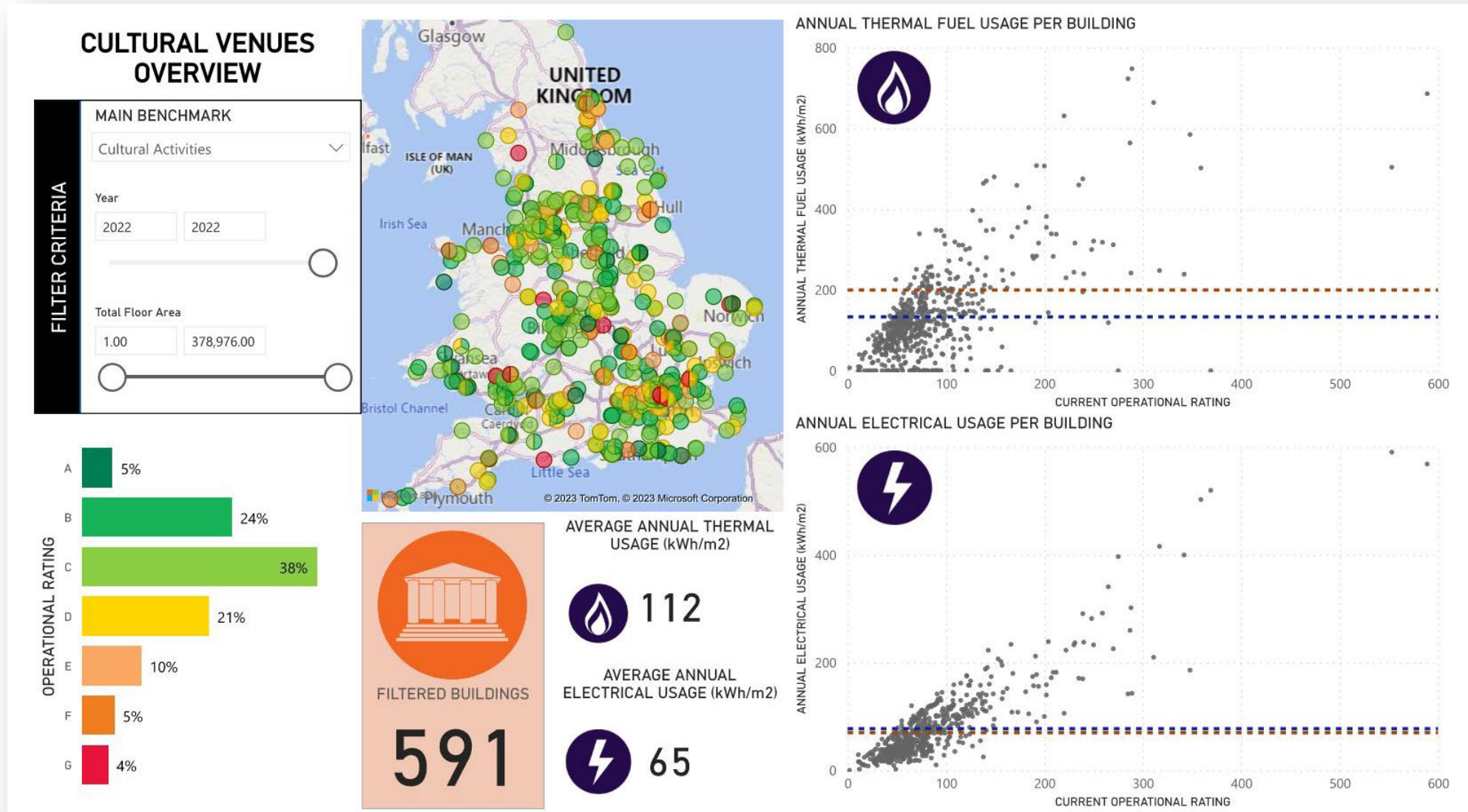
11

How are they useful?



- All DEC's are produced from **measured metered** energy use information.
- All buildings that fall within the same category are compared to a **regulated energy benchmark**.
- Energy usage data and other DEC information is **publicly available** on the government database.
- Data has been collected since **2008** and being updated yearly.
- Having a history of DEC's in a building allows for **measurable records** of the energy impacts of building improvement measures.
- They provide valuable metrics for sector studies.

2022 Scenario – Raw Data



Operational Rating and CO₂ Emissions

There are a large number of museum buildings in the UK. Many are listed and often struggle with funding. With energy costs rising and a drive to reduce our carbon footprint, it can often be difficult to know where to spend time and money. All museums are different; opening hours, visitor numbers, exhibition format and needs. However, we all have a responsibility to contribute to carbon reduction.

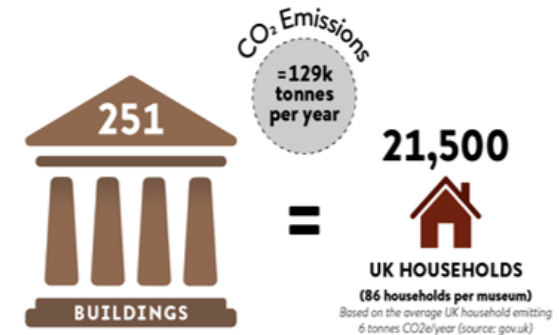
To help gain a better understanding of the of the energy usage and carbon impact of the museum sector, a number of case studies were carried out. Buro Happold's Environmental & Sustainability Engineers visited site and utilising the approach outlined in the Arts Green Book reviewed the building envelope, its major mechanical and electrical plant and environmental systems along with the energy usage figures and profiles. This enabled a better understand of where and when energy is being used and highlighted a number of areas where that would help to reduce energy use and carbon footprint.

The information in the following pages summarises a research exercise from the publicly available data from DEC certificates. Display Energy Certificates (DECs) are designed to show the energy performance of publicly occupied buildings. They use a scale that runs from 'A' to 'G' - 'A' being the most efficient and 'G' being the least.

The aim of this research was to gather information about the current state of the UK museum buildings', in terms of energy usage and related carbon emissions (*), to set the scene on key sector metrics and potential savings for the group.

The data extracted from the DEC database has been filtered by benchmark (cultural activities) and then segregated to ensure the sample was representative of the museums sector only. The final list of venues analysed was 251, 70 of which are members of the NMDC.

() The carbon emissions associated to this research are the ones used by the DEC engine instead of the more current values used in the rest of the study.*



The infographics on this page represent data involving operational rating and related CO₂ emissions.

40% of buildings analysed were scored D to G, which means that their performance was average or below average compared to the benchmark.

In terms of CO₂ emissions, the totality of the 251 venues analysed emit a total of 129k tonnes of CO₂ per year. This equates to the emissions generated by 21,500 UK households every year.

It should be noted that operational rating does not account for thermal comfort in buildings, and it's mainly based on energy usage (a building using less heating / electricity will score higher even if that affects the final user comfort).

For More Information on the Arts Green Book:

[Buro Happold celebrates the launch of the Arts Green Book - Buro Happold](#)

[Home - Arts Green Book](#)

Profile / Fitzwilliam Museum, Cambridge

Arts Green Book | Case Study

- The Fitzwilliam is the largest and oldest museum of the University of Cambridge estate, housing over half a million objects and works of art, spanning over 10,000 years. It is a leading cultural provider in the region, welcoming 350,000-400,000 visitors a year.
- The original Founder's Building was built in the 1830s. Since then, there have been multiple extensions and refurbishments including flat roof insulation upgrades.
- The site includes permanent gallery spaces, exhibition spaces, a café, gift shop, libraries, archive rooms, conservation studios, offices and meetings rooms.
- Spaces are regularly used for public events and corporate hires.
- The Fitzwilliam Museum is in an important phase of transformation. The Museum's ten-year Masterplan will be a key mechanism through which it plans to develop and reinvigorate its spaces, connect with audiences onsite and digitally as never before, and revolutionise the ways its collections and research are experienced. A significant aspect of the Masterplan is a commitment to improve sustainability and protecting the environment, aligning with the University's target to achieve absolute zero carbon emissions by 2048.



Operational Rating

Score	Operational rating	This building	Typical
0-25	A		
26-50	B		
51-75	C		
76-100	D		
101-125	E	114 E	100
126-150	F		
150+	G		



The key constraints to development on this site include:

- The listed status of the building, original fabric and glazing.
- Very tight space constraints, particularly with back of house spaces.
- Specific environmental requirements for installations & artwork.
- Consistent foot traffic, would make building works difficult to carry out.

Annual Energy & Carbon Performance

Gross Internal Area:
11,415 m²

Total Annual Gas usage:
1,287 MWh/yr

Total Annual Electricity Usage:
1,367 MWh/yr

Total Carbon emissions per annum:
~535 t.CO_{2e}

Total Carbon emissions per m²:
~46.9 kg.CO_{2e}/m²

BURO HAPPOLD

 **Home Survey Tool >**

COPYRIGHT © 1976-2024 BURO HAPPOLD. ALL RIGHTS RESERVED

Recommendations / Fitzwilliam Museum, Cambridge

Arts Green Book | Case Study

This section outlines the [key opportunity areas to reduce the operational carbon footprint](#) and move towards net zero carbon. A combination of the Home Survey Tool and a site survey were used.

Quick Wins

1. Apply AHU switch-off times to minimise unnecessary conditioning.
2. Timers on kitchen hot water to prevent constant heating.
3. Maintenance regime: Clean filters, especially to the humidification plant.
4. Give "Visitor Experience" hosts a warmer uniform for winter and leave heating setpoints at 19degC.

Maintenance Projects

1. Run-around coils for AHU heat recovery where thermal wheels do not exist or cannot fit. As well as upgrade to ASHP AHU as part of the planned AHU upgrade.
2. Lighting switch from Halogen to LED.
3. Daylight and presence detection on lighting control to back-of-house spaces.
4. Heating circuit control valves to allow better control of heating. Consider during planned boiler upgrade.
5. Electrical Sub-meter to show where the big consumers are.

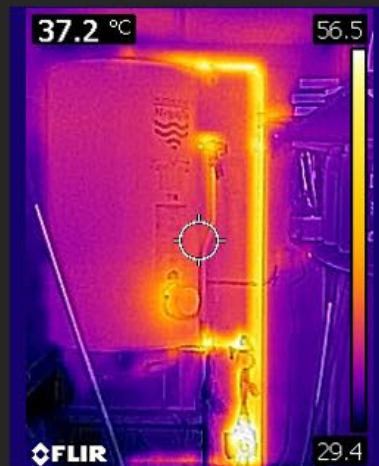
Capital Projects

1. Roofing works: passively minimise heat gain to the Italian gallery, thereby reducing the humidification demand: install external south-light shading; and install a ventilation system to purge the summer heat and use night-time cooling.
2. Photovoltaic Panels: A possible solution to reduce the solar gain in the Italian gallery is to install PV panels over the skylight spaces, thus also producing green electricity on site.
3. Continue to work with the University Estates team to embed the Masterplan into strategic university planning.



Existing Halogen lighting

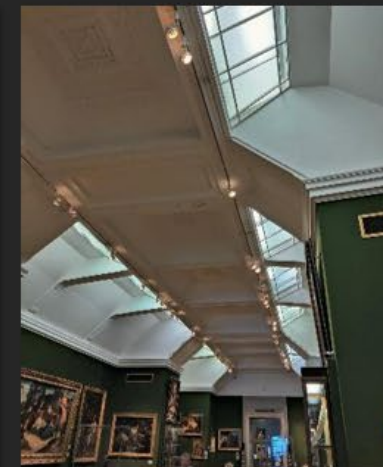
BURO HAPPOLD



Thermal image of uninsulated pipework



Limited heating control in galleries



No daylight sensing



Opportunity for PV panels



Home Survey Tool >

COPYRIGHT © 1976-2024 BURO HAPPOLD. ALL RIGHTS RESERVED

Quick Wins



Improve timing schedules and avoid plant operating outside of required periods

0.2-0.4%



Improve draught proofing

0.2-2.3%



Review temp/humidity records and investigate areas outside of target range

0.7%

Maintenance



Air Handling Units heat recovery

0.4-3%



Switching halogen lights to LED

0.3-5%



Installing lighting sensors/controls

0.1-2.8%



Installing heating controls

0.1-2.0%



Installing electric sub metering

0.2-0.8%



Improve airtightness

4.5%



Improving and repairing insulation

2-4%

Capital project



Additional insulation

1.3-5.0%



Window repairs/secondary glazing

2.7-6.8%



Move to Air Source Heat Pumps

25.9-56%



Introduce Photo Voltaic (PV) to available roofs

0.2-0.9%

Thank you for listening

Andrew Wylie

Partner and Consultant, Buro Happold

How to lead (without really trying)

Colin Johnston

Deputy CEO

The Grand Theatre, Blackpool

From Sceptic to Convert



Gathering the Evidence

”How do I get the information I need to make decisions from someone who isn’t trying to sell me something?”

Smorgasbord



Convincing the Decision Makers

Fit for purpose



Financial viability



Future proof



Influencing / educating



Share the Lurve



And finally.....



Thank you for listening

Colin Johnston

Deputy CEO

The Grand Theatre, Blackpool

www.blackpoolgrand.co.uk

Facebook, X and Instagram: @Grand_Theatre

Building a sustainability culture

Angela Wachner

General Manager
Bush Theatre, London

Organisational learning journey and culture change

1. Talk to people: surveys and focus groups
2. Create a community: green group
3. Build knowledge: carbon literacy training
4. Commitment from the top: board champion
5. What's in the future?

What our staff say

70% of staff feel the Bush have a strong commitment to environmental sustainability

56% said they would choose not to work for an organisation whose environmental policies they did not agree with

85% of staff say that our approach to environmental sustainability is important to how good they feel at work

What our audience say

86% of our audience are concerned about environmental sustainability

38% of our audience said organisations sustainability approach would impact their choice to attend

49% think we are doing a good job with our environmental sustainability efforts.

Green group initiatives

We built a bug hotel for our little friends and visitors to enjoy

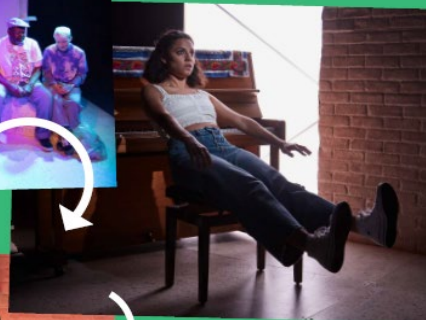




Follow the journey of materials through a year at the Bush...

First, some of the same wood ordered for *House of Ife* featured in every show for our Studio season.

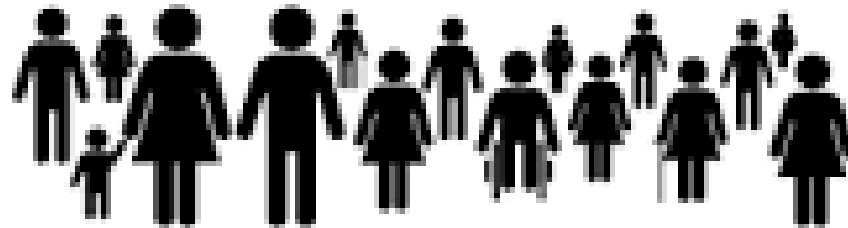
Featuring four completely different productions, this season was a revolutionary new approach in sustainable design for us as every show happened on the same set designed by Georgia Wilmot.



The shifting worlds of Nikhil Parmar's *Invisible*, Will Jackson's *Clutch*, Anoushka Lucas' *Elephant* and Tania Nwachukwu's *The Kola Nut Does Not Speak English* took the wood on a journey of identity, music and a whole lot of driving throughout the year in the studio.

Carbon Literacy

**Carbon Literacy
Project**



Board Champion

- To put in place effective Board Environmental Champions
- To support best practice in governance and leadership

What's in the future?

- Deeper community connections
- Building a social justice model

Thank you for listening

Angela Wachner
General Manager
Bush Theatre, London

www.bushtheatre.co.uk
Facebook, X and Instagram: @bushtheatre

Audience Q&A



Host and Chair

Claire Appleby Architecture Advisor, Theatres Trust

Speakers

Andrew Wylie Partner and Consultant, Buro Happold

Colin Johnston Deputy CEO, The Grand Theatre, Blackpool

Angela Wachner General Manager, Bush Theatre, London