

Managing summer temperatures in school buildings and grounds



Many schools experience hot, stuffy and uncomfortable classrooms and grounds with high temperatures and little shade, with some spaces becoming unusable on the hottest days. This impacts on the learning, health, wellbeing and behaviour of students and staff.

Ensuring that schools are sustainable and resilient to risks from climate change is a core principle of the DfE [Education Estates Strategy](#), and taking steps to cool your building and grounds and manage ventilation and humidity will support your estate management plan to meet [Education Estate Management Standards](#).

Creating achievable changes

Whilst there is a limit to what can be achieved within the constraints of existing buildings and budgets, improving the management of heat in buildings and grounds can be achieved by:

- Understanding what creates problems with heat, humidity and air flow
- Changing how you use the building and grounds that you already have
 - ✓ often free or low cost
 - ✓ requires knowledge, motivation, willingness to try new things and effective communication with building users
- Making physical changes to buildings and grounds
 - ✓ usually require financial investment
 - ✓ some investments have a relatively short return on investment period, after which they will reduce annual outgoings (for example, approximately 18 months on average for LED lighting)
 - ✓ other investments, such as solar window film or tree planting, have less easily quantifiable financial returns, but funding may be available
 - ✓ where physical solutions (particularly basic and lower cost solutions such as insulation, opening windows or window blinds) are not already installed they should be considered for any future capital spend or asset management plans.

Understanding heat in buildings

High temperatures are experienced in schools when the heat entering or generated in buildings exceeds the heat that escapes through walls and ventilation. High temperatures are often accompanied by poor air circulation and high humidity levels which contribute to poor levels of thermal comfort and affect student wellbeing and ability to learn.

	Effects on building temperature	Low cost/cost effective solutions
Building fabric	<ul style="list-style-type: none"> • building materials (e.g. stone, brick, breeze block) absorb and retain varying levels of heat • levels of shading / solar heat protection • the amount and type of glass (single glazed vs double or triple glazed or tinted) • the colour of the walls and roof affect heat absorption 	<ul style="list-style-type: none"> • painting building fabric in a pale colour or insulating it can reduce heat absorption (although the year-round energy performance of such measures should be considered)
Building orientation and external environment	<ul style="list-style-type: none"> • south facing buildings with many windows on this orientation will absorb more heat • hard, particularly dark, surfaces, surrounding a building will absorb and reflect heat into the building 	<ul style="list-style-type: none"> • painting hard surfaces a pale colour can reduce the heat absorbed and reflected into the building • plants and long grass close to the building will reduce the ambient temperature around the building
Barriers to heat	<ul style="list-style-type: none"> • opening windows when air is hotter outside allows hot air into a building, windows being open when air outside is cooler (early mornings and nights) lets warm air leave • external blinds, shutters or brise soleil can prevent heat entering through glass (<i>if they are used</i>) • internal blinds or curtains are generally less effective than external, but will reduce heat entering (<i>if they are used</i>) 	<ul style="list-style-type: none"> • practice night purging to let out hot air at night (see section below) • open windows wide if it is hotter inside than outside (if practical and concerns with air pollution or noise do not outweigh) • open windows slightly to allow air circulation and ventilation if warmer outside • use blinds/curtains – close while it is still cool to prevent heat gain
Heating and ventilation systems	<ul style="list-style-type: none"> • poor control of the heating systems, including automated systems not functioning, often contributes to overheating • the temperature of air drawn in to a ventilation system should be considered – if hot air is drawn in from the south side of a building temperature will increase • air conditioning units can cool a space, but are energy and cost intensive to run, with energy use (and cost) increasing in hot weather 	<ul style="list-style-type: none"> • opening internal doors and windows can improve air circulation through the building (<i>automatic closing systems should be used for fire safety</i>) • fans can help with air circulation • understand and optimise heating and ventilation systems (modern HVAC systems can be automated to purge heat and bring in fresh air)
Body warmth	<ul style="list-style-type: none"> • more people in a space will increase the room temperature • active people generate more heat than sedentary 	<ul style="list-style-type: none"> • use outdoor and larger spaces in hot weather if safe and comfortable • reduce levels of physical activity indoors on hot days
Technology	<ul style="list-style-type: none"> • electrical (or other) devices such as computers, ovens and lighting generate heat and cost energy 	<ul style="list-style-type: none"> • minimise the amount of time that electrical, heating and lighting devices are turned on

Building type opportunities and limitations

Victorian and Edwardian buildings	Mid to late 20 th century buildings	Modern (post 2000) buildings
Key characteristics	Key characteristics	Key characteristics
<ul style="list-style-type: none"> • brick or stone built, solid walls • high thermal mass (ability to store heat in structure) • high ceilings • often single glazed windows • often aging heating systems • most likely building type to be listed 	<ul style="list-style-type: none"> • typically have a high risk of overheating • low thermal mass, poor insulation • often single glazed with high glass coverage • buildings often oriented to the south, increasing solar gain 	<ul style="list-style-type: none"> • moderate thermal mass • often high insulation standards • large areas of glass • often incorporate automated heating and ventilation systems
Limitations and opportunities	Limitations and opportunities	Limitations and opportunities
<ul style="list-style-type: none"> • likely to be limited technological solutions without additional investment • policy and actions will help mitigate impacts of heat • have a protocol for building managers to carry out night-time and morning purging in hot weather • use manual actions to cool any hot spots within buildings (e.g. using blinds, opening windows appropriately during the day) • reduce energy generated in the building by heating, lighting, cooking & computers and by pupil activity 	<ul style="list-style-type: none"> • likely to be limited technological solutions without additional investment • prioritise actions to reduce heat gain via windows, especially on south side (e.g. using blinds, opening windows appropriately) • prioritise reducing energy generated in the building by e.g. heating, lighting, cooking & computers and pupil activity • prioritise school policy and actions to mitigate the impact of heat • use manual or other technology to allow night-time and morning purging in hot weather 	<ul style="list-style-type: none"> • prioritise understanding and utilising automated systems to reduce temperatures, especially by night-time and early morning purging • prioritise actions to reduce heat gain via windows (e.g. using blinds, opening windows appropriately) • policy and actions will help mitigate impacts of heat • reduce energy generated in the building by e.g. heating, lighting, cooking & computers and pupil activity

Night purging

Opening windows will be beneficial if the air outside is cooler than the air inside, and if air is hotter outside then windows should be opened only enough to increase air flow.

As heat builds during the day, and buildings are generally cooler in the morning after a cooler night, letting hot air out overnight has significant benefits and can be achieved by:

- manual overnight or early morning purges (through opening windows and doors).
- optimising automated ventilation systems to remove heat overnight.
- many schools have concerns about leaving windows open at night and the risk of intruders or impact on insurance. Some schools have contacted their insurer and been given confirmation that their insurance will not be affected if they leave inaccessible windows open.
- if night-time purging is not feasible, windows and doors should be opened as much as possible early in the morning in hot weather.

If you are interested in exploring options for physical changes to your school building or grounds, the [London Climate Resilient Schools programme materials](#) focus on physical adaptations and may be helpful.

Outdoor spaces

High outdoor temperatures are worsened by:

- lack of shading
- surfaces and structures that trap heat such as tarmac and dark roofing materials
- Metal slides and climbing frames, which absorb heat and can become dangerously hot

Natural cooling solutions – trees, grass and plants

Replacing hard surfaces with plants, grasses, water features and natural materials that absorb less heat can help reduce outdoor temperatures in schools (as well as reducing waterlogging and flooding issues). Compared with asphalt, grass can reduce temperatures in the immediate vicinity by up to 24°C while trees can reduce temperatures by up to 19°C. Artificial grass surface temperatures can be as much as 30°C higher than natural grassⁱ.

Adding planters and managing existing green space differently can also have a significant impact.

Grass

Longer grass cools an area significantly more than very short grass. Adopting low or no mow regimes to areas of grass which are not used for sports can help to cool spaces through evapotranspiration and increased ground shading. Low mow regimes can also:

- increase water retention, reducing flood risk
- increase the biodiversity of your site
- reduce costs of landscaping management
- protect the grass during hot weather
- provide opportunities for outdoor learning in the form of habitat and species surveying

If your school is under PFI or other grounds maintenance contract, you may still be able to change the landscape or to alter activities carried out at landscape maintenance visits e.g. reduce frequency of visits, specify higher mower setting heights or replace lawn mowing with other activities.

Hedging and trees

Increasing hedging and trees on a school's grounds has many of the benefits listed above and also provides screening around site boundaries. This increases privacy for students and can help to limit the amount of air pollution reaching school grounds, particularly in urban areas.

There are often free tree giveaways from a number of national charities for which schools can apply, and experts such as the council [Community Forestry team](#) may be able to support with planting and aftercare.

Ponds and water

Adding a water feature to your site can have multiple benefits for cooling, learning and nature. It can also support flood prevention where this is an issue for your site.

Water features can take a variety of forms, from permanent ponds to scrapes which only fill with water during heavy rain.

The [London Climate Resilient Schools programme materials](#) contain examples of various sustainable drainage and flood resilience measures.

Creating or improving a water feature on your site is likely to require financial input and has safety risks which should be carefully considered and mitigated: many schools have done this successfully and enjoyed the benefits.

The wellbeing and learning benefits of improving the school grounds with more trees, plants, (longer) grasses and ponds are huge, particularly for schools in urban areas and/or in areas of deprivation. Improving the nature and biodiversity of your schools will also support you to meet government climate action plan expectations.

There are many funding streams available to support nature improvements and the government funded [Climate Ambassador](#) and [National Education Nature Park](#) programmes can offer support.

Other physical solutions outdoors

Whilst requiring investment and maintenance, installing shade structures and reflective surfaces can be an effective way to reduce temperatures on your site.

Shade structures

Any shade structures should be robust enough to withstand heavy rain, snow and high winds and consideration should be given to drainage to avoid any flooding implications.

Playground and sports facility materials

Where tarmac or asphalt is required, light coloured surfacing can reduce the amount of heat absorbed and lower the ambient temperature in the immediate area. For newly built areas, technology is continually improving and other cool surface options could be considered. If considering replacement or new surfaces, permeability should also be considered for drainage.

Access and adaptations

Timetabling and adaptations to activities will often be the most affordable solution to adapt to hot weather outdoors (see 'Ready to learn in warm and hot weather' information sheet). Some schools make good use of local parks for learning activities during the summer and as a venue for sports day.

ⁱ [The impact of local microclimates and Urban Greening Factor on schools' thermal conditions during summer: A study in Coventry, UK - ScienceDirect](#)