Saving energy means saving on greenhouse gas (GHG) emissions. It is that simple--for Livery halls as for other buildings and businesses. Many of these savings can be made without great capital outlay, simply through more careful maintenance. Reducing energy consumption reduces GHG emissions. Some may need alterations to equipment, control systems or habits. But the best time to start thinking about possible energy savings is now, and advice is available and there are tools to help.

Lightening the load

Heating, ventilating and lighting together use a lot of energy. Those Companies that own halls or other properties need to be raising questions about planned maintenance schedules and thinking about rolling replacement programmes for out-of-date technology. Boilers, air-handling units (AHUs), lighting, lighting controls and building management software (BMS) systems should all be checked and serviced annually. A budget needs to be put together for the replacement of systems fired by natural gas and for lighting upgrades that use LED lights. Taking advice on the use of smart control systems can help too.

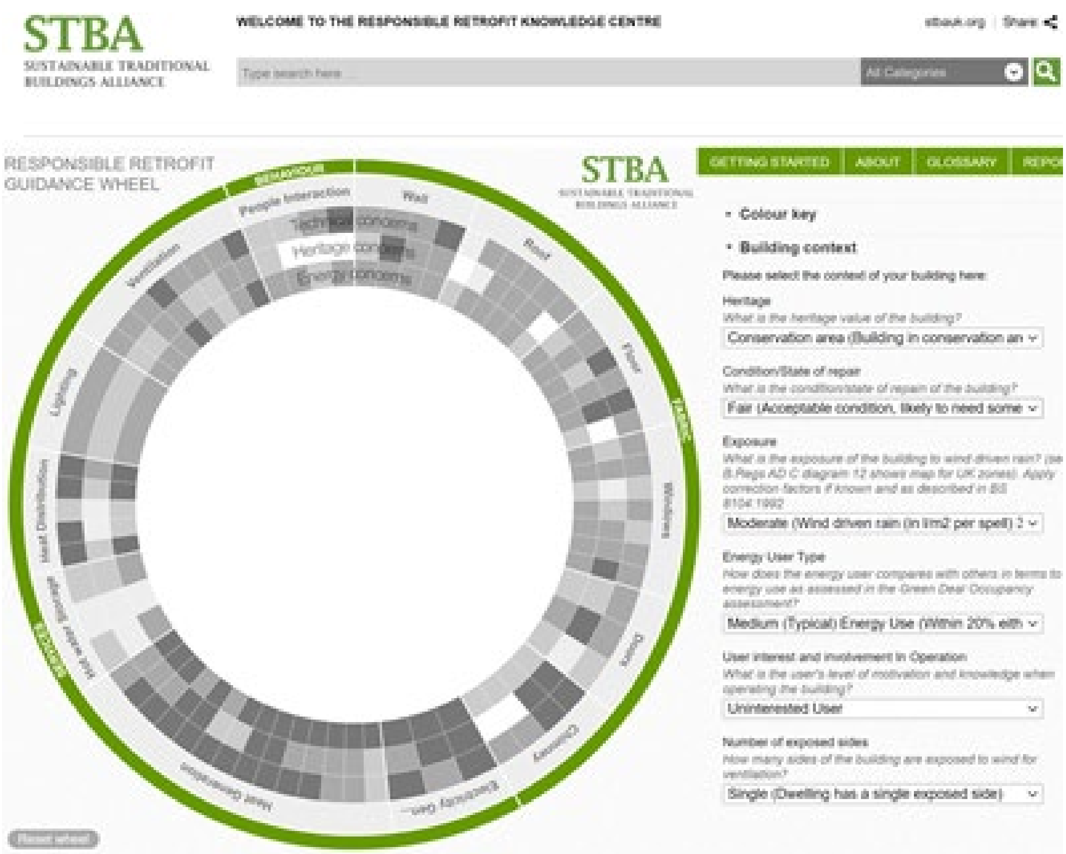
Currently most buildings use natural gas for heating. This is a significant source of GHG emissions, and government policy on the use of natural gas is already changing. Cutting back such emissions will require better insulation, a switch to non-fossil fuels and more efficient ventilation. Buildings therefore need to be assessed to see how demand for energy can be reduced, how energy-efficiency can be improved, whether more sustainable sources of energy can be used, and what further measures can be taken to adapt to climate change.

One of the first approaches to reducing the amount of energy required to heat and cool existing buildings is to improve the insulation, termed 'fabric first'. Similarly, more efficient ventilation can improve air quality and help meet health requirements, by avoiding overheating and under ventilating in winter and providing sufficient ventilation in summer.

It is a widely held view that older buildings are simply not energy-efficient and must be radically upgraded to improve their performance. Yet with professional advice the energy and carbon performance of most historic buildings can be improved, helping them remain viable and useful, now and in the future. That said, striking the right balance between benefit and harm is not easy. The unintended consequences of getting energy efficiency measures wrong (or doing them badly) include harm to building fabric; harm to heritage values and significance; harm to human health (termed 'sick building syndrome'); and failure to achieve the predicted savings or reductions in environmental impact.

A free and easy tool to use, for anyone who wishes to improve energy efficiency in an historic building, is the responsible retrofit wheel. As a first step towards reducing energy consumption, the wheel provides an excellent tool to review and discuss options to pursue. The wheel has been developed by the Sustainable Traditional Buildings Alliance (STBA). It is linked to the STBA Knowledge Centre where further information, case studies and retrofit advice is available.

The wheel depicts more than 50 measures that can be used for the retrofitting or refurbishing of traditional buildings. It encourages exploration of the measures' advantages, concerns about their performance and possible interactions between them.



Current practice tends to focus on replacing old equipment with new. But this approach is often premature—and wasteful. The better solution might be to evaluate what already exists, improve its efficiency and use the savings generated to invest in capital improvements.

Limited retrofits can pay off quickly in terms of energy savings and building performance when combined with a building management system. This also helps produce more accurate budget forecasting and repair and procurement plans which will be valuable to inform business cases for any future capital projects.

Consider ranking capital projects by their energy-impact potential. Invest strategically only in certain, carefully selected equipment upgrades, such as heating, ventilation and air-conditioning (HVAC). Heritage properties were generally built before air-conditioning was in use and may have intrinsic passive heating and cooling capabilities.

The current government policy is that from 2025 any new builds will not be allowed to install fossil-fuelled gas boilers. Heating must be changed from natural gas to some combination of direct electrical heating, ground-sourced heat pumps, air-sourced heat pumps and possibly some district heating if routes can be found for the pipework and there is a reliable source of heat. Hydrogen could also be considered, if it is available through upgraded gas mains. See NZIIC (Net Zero Industry Innovation Centre). Trials are in progress in the north of England and Scotland to see if hydrogen can replace natural gas in gas mains and in modified boilers. Manufacturers are starting to produce “hydrogen ready” boilers that can burn natural gas now and be modified later to burn hydrogen. Meanwhile, the City of London is upgrading existing gas pipework to make it ready for the twenty-second century.

ENERGY EFFICIENCY

There are several tools that can be employed to help improve the energy efficiency of any building you manage, such as:

Energy Audits

Livery Companies with halls or other properties need to carry out energy audits and review all aspects of energy consumption as a first step towards a comprehensive energy management strategy. An energy audit will not only focus on the amount of energy used by different appliances, but also on losses due to wiring, poor insulation, faulty sensors, or leaks. The data from such an audit can help with:

Continuous improvement in energy efficiency

Identifying resulting cost-saving opportunities

Thermal Imaging

Heat loss is a measure of negative heat transfer through a building's fabric from the inside to the outside. This can be due to convection, conduction, radiation, mass transfer, or a combination of all these processes. Typically, the older a building is, the more it is likely to be susceptible to heat loss.

Thermal imaging, or thermography, measures surface temperatures by using infrared video and still cameras. These tools see light that is in the heat spectrum. Images on the video or film record the temperature variations of the building's skin, ranging from white for warm regions to black for cooler areas. The resulting images help determine whether insulation is needed, and where in the building it is needed. They also serve as a quality-control tool, to ensure that insulation has been installed correctly and to monitor ongoing performance.

A thermal imaging inspection is either an interior or exterior survey. Interior scans are more common, and usually more accurate, because warm air escaping from a building does not always move through the walls in a straight line. What is more, it is harder to detect temperature differences on the outside surface of a building during windy weather.

Thermography uses specially designed infrared video or still cameras to make images (called thermograms) that show surface heat variations. This technology has a number of applications. Thermograms of electrical systems can detect abnormally hot electrical connections or components. Thermograms of mechanical systems can detect the heat created by excessive friction.

Energy Performance Certificates (EPCs)

EPCs provide an approximation of the energy efficiency 'banding or grade' of a property and recommend specific ways in which this can be improved.

Listed buildings are likely to be exempt, but the exemption is qualified. It states: "Insofar as compliance with certain minimum energy performance requirements would unacceptably alter their character or appearance".

You can obtain a copy of an EPC online from the Landmark register or Gov.UK, if one already exists. Details are provided on the type of information included in an EPC, how it is calculated, and its limitations as an assessment method when applied to older buildings. The guidance also covers the issues to be considered when commissioning an EPC and weighing its recommendations.

You may also need to obtain consent under Building Regulations. These set standards for how to construct buildings to achieve a minimum level of acceptable performance. They typically cover health and safety, energy performance and accessibility requirements.

Building Regulations only apply to new building work and major refurbishments. There is no general requirement for all existing buildings to be upgraded to meet these standards.

However, certain changes can trigger the need to comply - for example, if parts of a building are to be substantially replaced, extended or renovated, or if there is a change of use. The requirements do not apply to normal maintenance and repair work.

Historic England has produced guidance, on Energy Efficiency and Historic Buildings. Part L is the section of the Building Regulations that deals with energy-efficiency requirements to help prevent conflicts between the energy-efficiency requirements in the regulations and the conservation of historic and traditionally constructed buildings.

Quick wins to achieve an energy-efficient building

The context of the building matters here. There is no one optimal solution for all existing buildings.

- Reduce heat loss: in most buildings, draughts are within walls, windows and doors.
- Review energy supplier for a better deal.
- Fill gaps between floorboards.
- Change to LED lighting.
- Review current heating system.

- Review all aspects of water heating.
- Insulate the roof.
- Add smart heating controls.
- Fit triple-glazing.
- Install an energy-efficient stove in a fireplace, and/or block the chimney.
- Insulate the walls.
- Insulate the floors.
- Reflect heat from radiators.
- Add a curtain lining.
- Use free-standing heater for smaller rooms (if only a few rooms are used at a time).
- Circulate Heat more effectively. See turning to green.
- Improve insulation to sloping ceilings.
- Identify electrical systems and appliances to ensure that they perform efficiently

When adding insulation linings or closing chimneys, ensure this does not have a negative impact on the building, for example by interfering with the intrinsic 'breathing' properties of the building fabric or space. If too much ambient moisture is retained within a building, this can lead to a deterioration in the historic building fabric.

Options for heating systems and net-zero targets

- **Radiant heating**: Underfloor heating systems can be installed in a wide range of renovation projects. Most systems can be retrofitted with existing sub-floors without the need for excavation, allowing fast and efficient installation. An important feature to look out for in a floor heater when retrofitting is system depth. When refurbishing, minimise floor build-up heights as the ceiling height is fixed.

- **PhotoVoltaic (PV) cells:** This will likely involve solar PV modelling and advice on which technologies to use and how much energy they are likely to be able to supply. During operation, electricity is generated instantaneously, and must either be used immediately, stored in batteries or exported to the National Grid. Reduction in use of mains electricity may be possible if heritage requirements allow photovoltaic panels on south-facing roofs.

- **Solar water-heating:** Solar water-heating, or 'solar thermal' systems, convert the sun's energy to heat water. A heat transfer fluid is pumped through a solar heat collector, which absorbs thermal energy to generate hot water. Solar electricity is a renewable energy source and does not release any harmful carbon dioxide or other pollutants – thus reducing your carbon footprint. It also means lower electricity bills each month. There are no grants as such from the UK Government to pay for solar-panel installation. Instead, there is a feed-in-tariff which pays you money for 20 years after your solar panels have been installed. Further information on government regulations can be found here.

- **Heat pumps:** These are a low-carbon technology that uses electricity to generate hot water highly efficiently. Heat pumps are not themselves an energy-generation source. Their overall carbon footprint depends upon the carbon-intensity of the electrical supply. Heat pumps can thus only be net-zero in operation if the electricity supply they use comes from zero-carbon sources. The most common heat pumps for buildings at present are air-source heat pumps (ASHPs) although as they require external mountings these may not always be permitted for listed or historic buildings. A few Livery halls may have space in courtyards or gardens for ground-source heat pumps (GSHP) but most will not. With ground-sourced heat pumps the temperature of water in radiators is understood to be about 55°C, which is less than with a gas boiler, so larger radiators are needed. There is useful information on the website of the Ground Source Heat Pumps Association (GSHPA), including standards and lists of consultants, drillers, suppliers and installers.

- **Wind turbines:** Wind turbines operate by extracting kinetic energy from the wind. The transfer of energy rotates the turbine, which drives an electric generator. Smooth and efficient wind-turbine operation is highly sensitive to the direction, consistency and uniformity of the prevailing wind. Turbines can be mounted near buildings but may be visually intrusive. They could also cause noise and shadow-flicker problems.

- **Combined Heat and Power (CHP):** Such systems provide both electricity and heating on site. They capture heat produced during electricity generation from combustion processes that would otherwise be wasted and use this as a heat supply. CHP systems can offer significant efficiency savings in comparison to combustion-based electricity production alone and are often used in district heating schemes where there is a predictable electricity demand. CHP systems perform best where there is constant demand, and are often installed where there is a predictable and steady large aggregate demand. Where there is such demand for both heat and electricity in the same location, CHP can reduce energy costs whilst reducing carbon emissions and air pollution. Traditional CHP systems use fossil-fuel generated electricity, so they are not a net-zero carbon technology. Natural gas CHP is recognised as a 'bridging fuel' which could bring efficiency benefits during the transition to lower-carbon fuels. The future for CHP would be to use zero-carbon fuels, such as hydrogen, for the combustion process. However, the Corporation of London does not encourage this form of heating.

- **Biomass boilers:** These tend to be larger in size than conventional boilers and use wood chips or pellets as fuel to generate heat. They are carbon-neutral, in that emissions from the combustion process are balanced by the planting and regrowth of trees, which sequester carbon dioxide during their lifetime. Biomass installations require more frequent and complex servicing than conventional oil or gas boilers.

- **An Active Building:** This is "a building that supports the wider grid network by intelligently integrating renewable-energy technologies for heat, power and transport.” Active Buildings can be self-sufficient, but they are not designed to operate in isolation. They use their ability to generate and store energy to exchange or trade with other buildings, the national grid or electric vehicles. Such communities of energy can be more resilient to sudden changes in supply or demand.

Fact checked by:

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