Building Energy Efficiency

Operational Improvements Towards Zero Carbon Shropshire

Version	Draft 2.5
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Zero Carbon Shropshire 2030

1 Introduction

Reducing utility bills is fundamental to reducing buildings operating costs. Costs include; staffing, management fees, maintenance. Rising utilities costs are partly due to inflation and unstable fossil fuel markets are a significant factor.

There is a shift in Government policy towards 100% electrification for building energy including heating. By 2030 most heating systems in both rural and urban settings will be electric. This shift reflects the "**greening of the grid**" and that the carbon factor for electricity from the National Grid is reducing year on year. Electrical power is already a convenient and low-carbon to source of energy for lighting, ICT. Designed correctly, electric is also an efficient means of heating and cooling too. Choosing a "green tariff", is a quick-win to achieve zero-carbon in terms of energy supply. Additionally, shifting usage to off-peak hours can also secure further financial savings.

Whole-life-cycle costs should be considered when designing procuring any new powered equipment. The government's electricity price forecast for the National Grid estimates a 12-25% rise in real prices over the next 10 years for residential, service and industrial users.

Energy costs depend on both the consumption of energy units (kWh) and the tariff price (pence per kWh) of primary heating fuel (typically 4-5p/kWh) and electricity (typically 10-15p/kWh). Building use, occupancy and fundamentally user behaviour should also be considered. In short, improved building efficiency in terms of "hard interventions" ***and*** "soft interventions" i.e. operational improvements all help to reduce overall running costs. Water consumption should also be considered from a resource perspective, associated financial cost and carbon factor (kgCO2e).

Renewable sources of onsite generation of power and heat are now becoming mainstream and "normalised". These include solar PV (photo-voltaic) and an occasionally wind power are effective solutions in rural areas. Solar thermal for hot water, air or ground sourced heat pumps or biomass for how water and space-heating demand are good alternative solutions in rural locations instead of oil. Drivers to improve efficiency:

- Reduce carbon emissions and fuel bills.
- Meet our climate change objectives (**climate emergency states zero carbon by 2030**)
- Take a managed approach to avoid a "fuel poverty" vicious cycle
- Improve comfort levels for staff and public occupants.
- Improved health and wellbeing benefits linked to above and productivity for staff.
- Comply with statutory requirements such as **Part L of the Building Regulations**.
- Comply with new statutory Government legislation **MEES (Minimum Energy Efficiency Standards)** for the Private and Public Rented Sector Regulations.

Further guidance and references are given at the end of this document.

2 Internationally Recognised Standards for Sustainability

There are several internationally recognised standards from the International Organization for Standardization, that can assist Operational Improvements Towards Zero Carbon. Additionally, there are many British standards that bridge directly into specific areas of legislation such as Part L of building regulations, building control, electrical, mechanical and civil engineering. Some of the newer standards cross into multi-discipline technologies including renewable energy, such as the Micro-generation scheme (MCS) for small scale generation for solar, wind, hydro and heat pumps. A full list of these standards is given in the references section from page 16.

2.1 ISO 50001:2018 – ENERGY MANAGEMENT SYSTEM

ISO 50001 is based on the management system model of continual improvement also used for other well-known standards such as ISO 9001 or ISO 14001. This makes it easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management.

ISO 50001:2018 provides a framework of requirements for organizations to:

- Develop a policy for more efficient use of energy
- Fix targets and objectives to meet the policy
- Use data to better understand and make decisions about energy use
- Measure the results
- Review how well the policy works, and
- Continually improve energy management.

https://www.iso.org/iso-50001-energy-management.html

2.2 ISO 14000 FAMILY – ENVIRONMENTAL MANAGEMENT

The ISO 14000 family of standards provides practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities.

ISO 14001:2015 and its supporting standards such as ISO 14006:2011 focus on environmental systems to achieve this. The other standards in the family focus on specific approaches such as audits, communications, labelling and life cycle analysis, as well as environmental challenges such as climate change.

The ISO 14000 family of standards are developed by ISO Technical Committee ISO/TC 207 and its various subcommittees. For a full list of published standards in the series see their standards catalogue.

https://www.iso.org/iso-14001-environmental-management.html

2.3 Further British Standards and References –on page 16

3 Standards for New Builds

3.1 BREEAM Standard

BREEAM (Building Research Establishment Environmental Assessment Method) applies to new buildings, any significant extension (over 100m^2) and refurbishment of existing buildings. It is based on BREEAM's underlying approach to sustainability, which is divided into key areas:

Management • Commissioning • Construction site impacts • Security.

Health and Wellbeing • Daylight • Occupant thermal comfort • Acoustics • Indoor. air and water quality • Lighting.

Energy • CO_2 emissions • Low or zero-carbon technologies • Energy sub-metering • Energy efficient building systems.

Transport • Public transport network connectivity • Pedestrian and Cyclist facilities • Access to amenities • Travel plans and information.

Water • Water consumption • Leak detection • Water re-use and recycling.

Waste • Construction waste • Recycled aggregates • Recycling facilities.

Pollution • Refrigerant use and leakage • Flood risk • NOx emissions • Watercourse pollution • External light and noise pollution.

Land Use and Ecology • Site selection • Protection of ecological features • Mitigation/enhancement of ecological value.

Materials • Embodied life cycle impact of materials • Materials re-use • Responsible sourcing • Robustness.

Innovation • Exemplary performance levels • Use of BREEAM Accredited Professionals • New technologies and building processes.

3.2 Shropshire Council Energy Efficiency Standards

Reducing utilities costs is clearly an imperative for reducing service delivery costs as well as our carbon footprint. So, the focus for new and existing buildings is to reduce utilities costs (electricity, primary heating and water). The key points to follow both for designing new buildings and upgrading existing buildings:

- **A methodical approach should be taken and whole lifecycle costs considered for new equipment.**
- **A fabric first policy should be followed for new and retrofitting existing buildings for both. (This implies that insulation and glazing is addressed as a priority to reduce heat losses).**
- **BREEAM Standard Very Good or Excellent is expected for every new build with a value of > £500k.**
- **A BREEAM aspirational target is expected for new builds of value of less than £500k.**
- **This standard may be referred to by Property Services Group as Building Control ++.**
  (This means that generally the same method is followed, however full compliance is not necessary).
- **New Builds valued <£500k should achieve an EPC rating of at least a B following the SBEM methodology.**
- **Retrofitting existing buildings should be uplifted using the SBEM Methodology e.g. D→B or C→A.**
- **The use of SBEM methodology and any existing EPC's and DEC's for retrofitting existing buildings.**
  (please see over page for details of this method and free downloadable software toolset).

4 Retrofitting

4.1 SBEM (Simplified Building Energy Model)

SBEM is a software tool developed by BRE that provides an analysis of a building's energy consumption for new and existing builds. SBEM is used for non-domestic buildings in support of the National Calculation Methodology (NCM), the Energy Performance of Buildings Directive (EPBD) the Green Deal.

The tool is currently used to determine CO2 emission rates for new buildings in compliance with Part L of the Building Regulations (England and Wales) and equivalent Regulations in Scotland, Northern Ireland, the Republic of Ireland and Jersey. It is also used to generate Energy Performance Certificates for non-domestic buildings on construction and at the point of sale or rent.

SBEM was developed by BRE for the Department for Communities and Local Government. The latest version of the SBEM tool and its accompanying user interface, iSBEM, can be downloaded free of charge from the dedicated National Calculation Methodology website at http://www.ncm.bre.co.uk/
A special version – cSBEM – was created to accompany the recent consultation on the 2013 revision of Part L of the Building Regulations in England and can be accessed at http://www.2013ncm.bre.co.uk

4.2 EPC's and DEC's (applicable to new and existing builds)

It is a legal requirement to display publicly an EPC (Energy Performance Certificate) for new builds and any property which is leased or to be sold. It is a legal requirement to display ongoing a DEC (Display Energy Certificate) for any public building with a floor area >1000m^2.

The **EPC (Energy Performance Certificate): reflects building energy performance** and **2) DEC: reflects total energy consumption (electric plus primary heating fuel if any)**. Both certificates rate the building between A and G (A being the best performance). Both EPCs and DEC's for non-domestic buildings are freely available online https://www.ndepcregister.com/ and are undertaken by a qualified assessor. The advantage of these documents is they are evidence-based prioritizing recommended improvement measures, cost and payback period. EPC's and DEC's are a reliable way to quickly rate a building and determine achievable savings. To determine the payback period, seek independent quotes to determine the capital costs, calculate the savings made based on the kWh efficiency savings and cost-effective tariff from the utility's company.

4.3 EPC (Energy Performance Certificate)

Mandatory for new, leased or sold properties

The EPC (Energy Performance certificate) reflects the thermal performance and heat-loss as determined by roof, exterior walls, and ground floor materials otherwise known as the "thermal envelope" or building fabric. An EPC is also defined by the floor-area, room volume, building type and occupancy. It is a legal requirement for any new build or building which is to be leased or sold. EPC's are necessary for any non-dwellings >50m^2 or commercial buildings >500m^2 (valid for 10 years). EPC reports make recommendations to improve building fabric and implement renewables where appropriate. The A to G scale is a linear scale is based on the actual building dimensions but with standard assumptions for fabric, glazing and building services and is based on two key points defined as follows:

a) The zero point on the scale is defined as the performance of the building that has zero net annual CO2 emissions associated with the use of the fixed building services as defined in the Building Regulations. This is equivalent to a Building Emissions Rate (BER) of zero.

b) The border between grade B and grade C is set at the Standard Emissions rate (SER) and given an Asset Rating of 50. Since a linear scale, the boundary between grades D and E corresponds to a rating of 100.

4.4 DEC (Display Energy Certificate)

Display energy certificates (DECs) show the actual energy consumption of a building, the 'operational rating'. This is composed of electricity and primary heat energy (normally oil or gas). All buildings over 1000m^2 and open to the public require a DEC and should always be displayed clearly visible to the public. A DEC is always accompanied by an advisory report that lists cost-effective measures to improve the energy rating of the building. The DEC must be renewed annually, but the advisory report lasts for seven years. For buildings 250m^2 to 999m^2, the DEC needs to be renewed every 10 years. The A-G scale rating shows the energy performance of the building as it is being used by the occupants. A building with performance equal to one typical of its type would therefore have an Operational Rating of 100. A building that resulted in zero CO2 emissions would have an Operational Rating of zero, and a building that resulted in twice the typical CO2 emissions would have an Operational Rating of 200.

4.5 Minimum Energy Efficiency Standards (MEES)

The Minimum Energy Efficiency Standards (MEES) was introduced by the government to help improve the carbon footprint of some of the UK's more inefficient properties. Any office or any occupied building requiring heating is required to meet the Minimum Energy Efficiency Standards (MEES). Around 75,000 commercial premises are likely to be affected. There is an obligation to landlords to continually evaluate and reduce energy usage on properties to be sold. This is done via pre-existing Energy Performance Certificates (EPC) based on the thermal performance for non-domestic buildings. Combined with existing building regulations, they require a proactive approach to incrementally improve building fabric and implement efficiency measures. The aim is to bring poor performing properties up to the required EPC rating and reduce bills.

4.6 MEES Deadlines

Legislated from April 2018 landlords with properties based in England and Wales must ensure they achieve an EPC rating of at least an **E** before they can grant or renew a lease.

From April 2023 properties with existing tenancies must have an EPC rating of E or above, or the lease wont legally be allowed to continue.

4.6.1 Who does MEES apply to?

MEES applies to all privately rented commercial properties that are legally required to have an Energy Performance Certificate (EPC).

4.6.2 What are the penalties for non-compliance?

The consequence of failing to comply with MEES is a financial penalty. Dependent on the type of infringement and the length of non-compliance, this could reach from £5,000 up to £150,000 per commercial unit.

4.6.3 MEES Plan

A strategy to evaluate properties at risk under MEES legislation should include the following:

- Site Audit
- Full Recommendations
- Funding Options
- Implementation and Maintenance Plan

The cost for improvements should be evaluated across the asset portfolio and individual works assessed on a site by site basis. Payback periods for works are typically <5years and can be captured back in rents and savings (if the landlord pay's the utilities costs). The valuation procedure of properties should reflect reduced running costs and uplifted EPC's and be updated accordingly. Whether residential or business tenants; reduced running costs make the properties more attractive.

4.7 Building Age and Use

Shropshire's buildings vary in age from: from Tudor, Victorian to newly commissioned buildings. Efficiency interventions for commercial buildings should be targeted based on locality, type, age and use (e.g. office, leisure, catering) and may be specific for rural or urban settings. These measures are based on correct industry guidance such as CIBSE, BRE, Historic England and Carbon Trust. At present the heating is typically mains gas in urban areas and oil in more rural contexts. Sometimes due to building constraints electric is used for heating and hot water.

4.8 Historic Buildings (achieve medium efficiency)

Typically, older buildings cost a lot more to heat than new builds. Heritage buildings shouldn't however "abandon all hope" since there is very good guidance (Historic England) to make buildings efficient whilst being sympathetic to the aesthetic and building fabric. Using correct re-fit techniques, older builds can achieve an EPC C+. Although technically listed properties may be exempt from EPC regulations, building improvements reduce running costs.

Historic buildings (1950's and older) typically still feature single glazing and solid stone. Any signs of damp imply poor thermal efficiency and high heat loss should be addressed. Improved building fabric, windows and eradi cating damp will reduce heat-loss though the thermal envelope: windows, roof and external walls:

1. Bespoke sympathetic secondary glazing.
2. Ground floor, walls including internal cladding and roof insulation.
3. Address any causes, sources of damp in external walls.

Historic England guidance should be followed for any building fabric improvements undertaken on any heritage buildings, especially listed properties.

4.9 1960's and Newer (achieve good efficiency)

These buildings should be relatively efficient already and able to achieve an EPC B+. if not, they usually are easily uplifted to a higher EPC rating with plenty of opportunity to improve the building fabric with standard retrofits such as cavity wall insulation, secondary glazing, improved heating, efficient electrical equipment and control systems.

4.10 New Builds (achieve high efficiency)

When considering a new build, it is very important to get the design right first time and not only think about the initial capital outlay but avoid expensive future improvements and ensure long-term utility running costs are kept to a minimum. Using good design principles, an **EPC of A** is achievable, by following up to date industry guidance such as CIBSE, SBEM and BREEAM.

4.11 Exemplar New Builds (achieve Zero Carbon)

New zero carbon design criteria are largely achievable via the Passivhaus (Passive-House) standard to reduce heat demand, together with onsite renewable energy to provide additional power. It is possible to heat a building primarily just by the occupants themselves using a range of building fabric improvements, insulation and increasing air-tightness to reduce air change rates. Heat recovery and passive ventilation and air-cooling systems may also be employed. The cost of achieving these types of buildings are no longer prohibitive, and with good design principles solutions catering for building requirements and locality may be achieved to suit a range of budgets. The savings made soon pay for themselves given the investment.

5 Benchmarking (Existing Asset Portfolio)

The first step is to rank the buildings (Table 1) and first prioritised by EPC, DEC. Some historic Buildings underwent energy assessments carried out in 2010. Independent energy audits help benchmark an asset portfolio. The sites should then be prioritized in Table 1 in terms of largest energy spend / floor area (£/m2). This gives a true indicator of performance and efficiency.

Table 1 Benchmark Template (combining annual electric and gas costs)

					TOTAL ENERGY	TOTAL COST	COST/m2
Premises (building/asset)	postcode	Floor area	DEC*** rating	EPC*** rating	kWh	£	£/m2
Worst performer							~£30-£50
Best performer							~£5-£10

5.1 Fit in with an Overarching Goal (e.g. 2025 or 2030)

The next step is to rate the sites showing indicative savings (based on low to high capital spend interventions). Although these savings may be very much ball-park, % savings as provided by **Carbon Trust** and reputable manufacturers data are a reliable source of information to estimate this.

Table 2 Target Costs and Efficiency Improvements Template

		TARGET ELEC	TARGET HEAT	TARGET ENERGY (low capex)	TARGET ENERGY (deep re-fit)	POTENTIAL (Individual) SAVINGS
Premises (building/asset)	postcode	£	£	£	£	£
			Total Savings	**£XX,XXX**	**£XX,XXX**	

5.2 Summarize Savings and Payback Period

Calculate total annual savings based on 1. Low-cost and short-term interventions and 2. Higher spend and longer-term interventions and state assumptions (% savings and unit price of energy for heating and electricity). State the payback period and return on investment for each intervention. It is also prudent to state the total energy saving (kWh) and carbon saving (CO_2e) for each measure.

Table 3 Intervention Savings Summary Table

Interventions	Annual Savings	Assumptions	Payback Period & ROI
1. low capital outlay	£XX,XXX	For example, 40% electric, 20% heat efficiency.	XX yrs. XX%
2. higher capital (deep re-fit)	£XX,XXX	For example, an ideal building performance of **£10/m²**.	XX yrs. XX%

6 Recommended Interventions – All Buildings (short and longer term)

Please refer to latest Carbon Trust or previous (Government) Green Deal guidance and individual energy reports (DEC's, EPC's) for further information on appropriate measures which are wholly dependent on the individual site circumstances. Possible interventions range from standard to innovative (including renewable energy and storage).

6.1 Soft Efficiency (Short Term) Interventions

Typically include a zero spend approach which can be carried out by the responsible parties whether: Facilities Management, frontline service staff, site and branch managers, Building User Groups and staff themselves. Key measures involve optimising heating controls, lighting and electric systems. A lot of these "easy wins" are associated with staff behaviour. The **Climate Crisis** and high public agenda is an enabler to a culture of change and there should be very few now who dispute the drivers and incentives for change. The messages however need to be kept simple and backed up with evidence referencing leading industry guidance such as Carbon Trust. A holistic operational management approach should ensure equipment and lighting switched off after use and heating interventions such as boiler controls and thermostats are set correctly. This method relies on behaviour change and correct use by staff, site managers with accurate guidance. These measures are listed in more detail below "Low Hanging Fruit", also involving initiatives such as "Green Champions" to help make this happen.

Please also see the recycling and repurposing interventions References 8.8

6.1.1 Green Champions

Perhaps there already are "eco-warriors" within the organisation who wish to champion the future. Green Champions raise awareness and engage staff to encourage good environmental practice amongst colleagues, setting an example in their workplace. They should receive "carbon-literacy training" to answer questions such as climate change, energy efficiency, recycling and plastics. Green Champions help implement carbon-reduction activities by monitoring energy usage and identifying opportunities for reduction. Their scope covers energy, water, recycling, travel, and office consumables. It helps if they meet regularly and collaborate, sharing resources to create a roadmap towards achieving a big overarching aim or commitment such as **Zero Carbon 2030**.

6.1.2 "Low Hanging Fruit" (Easy Low-Cost Solutions)

Responsible Parties: Facilities Management, Site Maintenance, Frontline Service Staff, Building-User-Groups, Accommodation Officer, Site/Branch Managers, Administrators and Responsible Officers.

Typically include a zero spend approach and involve optimising heating controls, lighting and electric systems. It means a management approach to ensuring equipment and lighting switched off after use and boiler controls and thermostats are set correctly. This method relies on behaviour change and correct use by staff, site manager intervention and correct guidance. Measures are listed in more detail below, they involve initiatives such as "Green Champions" to help make this happen.

Heating systems and correct use has a high impact running costs. Common issues with little cost to implement include correctly setting the heating schedule (based on occupancy), equally thermostats, room temperatures and switching off equipment after use. These types of interventions are very simple and low-cost. Managers and staff alike and should take control of their energy consumption by using smart meters to spot anomalies and become pro-active as opposed to reactive in keeping their utility costs down and is very low or zero cost to implement:

The responsible party as listed above should ensure the following steps are taken:

1. Register the building/service on Systems Link (with the Energy and Water Officer).
2. The manager should familiarise themselves with WME and the Systems Link Energy Portal.
3. An AMR (automated meter reader) may need installing for electric, gas and water.
   (Individual electrical energy monitors are also available on request).
4. Please submit monthly utilities bills to: utilities@shropshire.gov.uk
5. Keep a regular check on Systems Link or the WME portal to spot anomalies and reduce costs:
   https://shropshire.energymanagerlive.com/
   https://staff.shropshire.gov.uk/media/708715/new-web-portal-user-guide-ver-10.pdf
6. Check the building EPC, DEC's (and advisory reports): https://www.ndepcregister.com/
7. Heating System (manual or automated) Interventions
   a) Keep boilers and heating system checked serviced and maintained annually (via maintenance or PSG).
   b) Set the heating schedule (timers) hourly, weekly and monthly to exactly reflect building occupancy and usage patterns. Ensure managers know how to adjust to reflect changes.
   c) Ensure summer/winter setting correct. (Newer systems have weather compensation).
   d) Set correct room set-point temperature (18°C) and guidance to staff for winter clothing.
   e) Ensure all windows and external doors are closed if the heating is on on.
   f) Avoid supplementary heaters – make sure main heating system works.
   g) If night storage heaters fitted: Check and ensure controls are set properly and correct tariff.
   h) If hot water tanks or small water-boilers for hot-drinks fitted – ensure timers set correctly.

8. Electrical System (manual or automated) Interventions
   a) Ensure all non-critical equipment: ICT or lights **are turned off outside operational hours**.
   b) Critical equipment: fridges, servers or security equipment should be left on according to requirements.
9. When the buildings are temporarily closed or vacated please ensure all heating and non-critical electrical systems are deactivated (heating systems may need a 5°C frost protection in the winter).

6.2 Hard Efficiency Interventions:

Involves capital investment and typically a retrofit (light or deep) of the building to make it more efficient. Interventions possible range from standard to more innovative engineering solutions across building heating, lighting and other electrical systems. As outlined earlier there is a shift to electric for all energy provision.

6.2.1 "Medium Hanging Fruit" (Standard Efficiency Solutions)

Responsible Parties: Asset Manager / Corporate Landlord / Maintenance (Property Services Group) Sustainability Officer – to raise business case, design and implement interventions appropriate to site.

Standard Carbon Trust measures have very quick payback periods. "Behind the scenes" plant room: thermal-lagging, heating controls. These typically achieve 20% saving for each intervention. If the building uses electric for heating: storage heaters, controls should set correctly, and timers for economy tariff. It should be noted that typically the operating costs for heating by electric can be up to 3 times more expensive than gas (~15p/kWh electric as opposed to 4p/kWh for gas). If a heat pump system is prohibitive then install high efficiency condensing boilers.

Interventions to improve building heating efficiency can either be individual retrofit solutions:

1. Change a wet system from primary heating fuel (gas or oil) to a low carbon source: electric or biomass.
   a. Shift to electrical heating systems (such as heat pumps or storage heaters).
   b. A wet system may be connected to a heat pump system or wood-pellet biomass for example.
   c. Utilise Thermostatic radiator valves (TRV's) for wall mounter emitters.
   d. Utilize individual thermostat zones with set-point temperatures (normally set at 18C).
   e. Larger properties consider a building management system (BMS) such as Trend.
2. An alternative to heat pumps is biomass boilers or electric night-storage heaters
   a. Night storage heaters (for example Dimplex Quantum or Econorad).
   b. Ensure they are optimized to use the cheap overnight economy tariff or store renewable energy.
   c. Set timer controls set to reflect operational hours.
   d. Fit a time clock to stop charging heaters when no operations.
3. Warm air can be lost in high ceiling voids –de-stratification fans appropriate:
   Set fans to circulate warm air down in winter.

In conjunction to heating efficiency, improvements for electrical equipment such as ICT equipment and efficient LED lighting. Motion, daylight sensors and controls for sporadically used zones such as toilets may be appropriate. LED lighting is typically 60% more efficient than older technologies. Adding controls to LEDs such as motion sensors can make them 80% more efficient than fluorescents. Electrical efficiency improvements include:

1. Efficient electrical equipment (A or B rating) for offices including ICT.
2. LED lighting and motion and/or lux sensor controls (for areas of sporadic use and natural daylight).
3. AMR (automated meter reader) for commercial sub-tenanted areas (gas, electric or water).
4. **Further Electrical System Optimisations**: Voltage Optimization (regulates down voltage in high voltage areas), power factor correction and correction of load imbalances for three phase systems.

6.2.2 "High Hanging Fruit" (More Innovative Solutions)

A deep-retrofit / whole building solution whereby multiple measures are recommended using a combination of standard and innovative efficiency measures not an exhaustive list:

- BEMS (Building Energy Management Systems) with weather compensation included.
- Heat Ventilation Air Conditioning (HVAC) systems with heat exchangers and heat recovery.
- Variable Speed Drives (VSD) for any large motors (e.g. pumps or fans in air handling units).
- Night Storage heaters with smart flexible controls and PV optimisation; e.g. Dimplex Quantum.
- Thermal accumulator (hot water store) combined with a load diverter to optimize solar energy.
- Heat or Thermal Batteries (phase change materials), used in conjunction with renewable energy.
- Battery Storage (lithium-ion) sized for building demand to optimize tariff and renewable energy.

6.2.3 Low Carbon Generation (Including Renewable Heat or Electric)

Responsible party: Commission specialist contractor(s) renewable installer(s) via the Property Services Group.

Balancing a mixed renewable generation portfolio against energy demand will be crucial to our future resilience.

In urban areas mains gas is often used for primary heating, in rural areas oil may still be used. For both scenarios solar PV (photovoltaics) or solar thermal or a combination are effective to offset heating costs. For urban settings mains gas CHP (combined heat and power) is a good solution due to the low cost of natural gas to cover both electric and heat demand. CHP has been adopted by some leisure centres due to the low cost of gas (~4p/kWh as opposed to 15p/kWh for electric). For rural locations heat pumps (air source or ground source) are candidates to consider, especially for new builds. Low-carbon generation (offset energy costs only if standard efficiency is done):

- Solar PV, Solar Thermal (suitable urban or rural locations if there is suitable roof/aspect).
- Wind turbine in suitable flat or elevated rural locations with appropriate wind speeds.
- CHP (combined heat and power) – **urban locations only** utilizing mains natural gas.
- Heat Pumps (Air Source or Ground Source) suitable for **rural locations**.
- Biomass - for **rural locations** – if access for fuel deliveries (wood pellets/chip).
- **District heat networks –** these may be linked to low carbon sources of heat generation or a pre-existing source of heat such as CHP or incinerator plant linked to a recycling (waste to energy) plant.
- Industrial processing high heat and low heat and how these blends with renewables
- Lower temperature blended solutions (<300°C) include solar thermal and deep geothermal, heat pumps.
- Higher temperatures (>300°C) include blended solutions can include combustion of biomethane, biogas, biomass and hydrogen.
- Hydrogen is manufactured using electricity (by electrolysis) from renewables or synthetically from anaerobic digestion (AD) or Pyrolysis (using bio or industry waste) as part of the future energy mix.
- Hydrogen will likely be key to supporting future transport (trains, air, freight) in fuel cells whist electricity used direct to run motors in personal vehicles.

7 Summary of Next Steps

These next steps listed are generally for Retrofitting in terms of the procedure for design and costing out and procuring works to be carried out.

1. Obtain past 4-5 years billed data for electric, gas, oil, water as applicable.
2. Obtain DEC's where available and prioritize worst performers (£/m2).
3. Find out repairs and maintenance cost and any other utilities costs or management fees.
4. Carry out technical assessments: benchmark whole building energy costs as above (data as available).
5. Model and carry out an **options appraisal** across the different short term and longer-term energy efficiency and renewable energy interventions as outlined earlier in this document.
6. Estimate the annual savings, capital spend, and payback period based on each intervention.
7. Select the most effective options in terms of lifetime running costs, annual £ savings and carbon savings.
8. Prepare an Outline Business Case or Expression of Interest based on above and funding source.
9. Use industry guidance on pricing to help cost out works (Government DBEIS for example).
10. Raise a tender or quotations to obtain offers with necessary quality assurance for the public sector.
11. Commission (efficiency or renewable energy specialists) local installers where possible through a competitive process.
12. As a reference point you may find the following helpful to assist with procurement:
    Carbon Trust: https://www.carbontrust.com/home/
    Energy Saving Trust: https://energysavingtrust.org.uk/
    Re-fit Scheme: http://localpartnerships.org.uk/our-expertise/refit/
    Save Money Cut Carbon: https://www.savemoneycutcarbon.com/

8 Sources of Funding

Government grants, 0% SALIX or capital on an invest to save basis may be used towards efficiency measures. Additionally, local communities are often keen for environmental to invest in improvements.

- Own capital contributions – on an invest to save basis.
- SALIX (zero interest loan towards efficiency measures): https://www.salixfinance.co.uk/
- Refit Programme for energy efficiency measures and local energy generation projects: https://localpartnerships.org.uk/our-expertise/re-fit/
- Shareholders or Trust Scheme such as Sharenergy: https://www.sharenergy.coop/
- Business grants as advised by Carbon Trust, or Government grants may be applicable.
- Central Government Grants may apply if these buildings come under public sector.
- Please see the **RE EE Funding Opportunities** website for the latest list of funding opportunities.
- Or separate document **RE EE Funding Opprotunitesv3.pdf**

9 For Further Information

Resources for the Public and External Stakeholders: Climate Change and Sustainability

Resources for Shropshire Council Staff: Climate Change and Sustainability

https://shropshirecouncil.sharepoint.com/sites/Sustainability

Please see additional web resources over the page and contact the Sustainability Commissioning Support Officer in relation to **Buildings Efficiency and Renewable Energy: sam.kirby-bray@shropshire.gov.uk**

10 References - Web Resources

10.1 Building Efficiency

BRE, Building Regulations Part L

Building regulations in England setting standards for the energy performance of buildings.

BREEAM (Building Research Establishment Environmental Assessment Method)

BREEAM recognizes and reflects the value in higher performing assets across the built environment lifecycle, from new construction to in-use and refurbishment.

Carbon Trust - Expert Independent Industry Guidance

An independent expert in carbon reduction and commercializing low carbon technologies.

CIBSE: The Chartered Institution of Building Services Engineers.

DEC (Display Energy Certificate)

Guidance about the regulations for Display Energy Certificates of public buildings.

EPC (Energy Performance Certificate)

An Energy Performance Certificate is required for properties when constructed, sold or let. It provides details on the energy performance of the property and what can be done to improve it.

Domestic: https://www.epcregister.com/

Energy Saving Trust

“We are a leading and trusted organization helping people save energy every day”

OFGEM: Consumer protection and government regulation household and business energy.

Marches Energy Agency: We deliver practical solutions to reduce fuel poverty and cold homes, promote energy reduction and encourage the uptake of renewable energy.

Non-Domestic: https://www.ndepcregister.com

BEEP (Business Energy Efficiency Programme)

SBEM (Simplified Building Energy Model)

SBEM is a software tool developed by BRE that provides an analysis of a building's energy consumption. It is used for non-domestic buildings in support of the National Calculation Methodology (NCM), the Energy Performance of Buildings Directive (EPBD) and the Green Deal:

http://www.uk-ncm.org.uk/

MEES (Minimum Level of Energy Efficiency’ standards)

Guidance to landlords of privately rented domestic and non-domestic properties.

Historic England: Efficiency and Environmental Management of Listed Buildings

A suite of technical advice and guidance on improving the energy efficiency of historic buildings.
https://historicengland.org.uk/images-books/publications/environmental-management-performance-standards/

10.2 Renewable Energy

10.3 MarRE (Marches Renewable Energy Programme)

https://www.herefordshire.gov.uk/MarRE

https://www.shropshire.gov.uk/funding-opportunities/marches-renewable-energy-project/

10.3.1 Electrical Energy

Solar PV (Photo-Voltaic) - MCS

https://www.energysavingtrust.org.uk/renewable-energy/electricity/solar-panels

https://www.gov.uk/government/publications/power-to-the-pupils-solar-pv-for-schools

Wind:

https://www.gov.uk/guidance/onshore-wind-part-of-the-uks-energy-mix

Hydro

http://www.british-hydro.org/

https://www.gov.uk/guidance/harnessing-hydroelectric-power

10.3.2 Renewable Thermal Energy

RHI (Renewable Heat Incentive)

https://www.ofgem.gov.uk/publications-and-updates/domestic-renewable-heat-incentive-product-eligibility-list-pel

https://www.ofgem.gov.uk/environmental-programmes/domestic-rhi/contacts-guidance-and-resources/tariffs-and-payments-domestic-rhi/current-future-tariffs

www.energysavingtrust.org.uk/scotland/grants-loans/renewables/renewable-heat-incentive

https://renewable-heat-calculator.service.gov.uk/

Biomass - MCS

http://www.energysavingtrust.org.uk/renewable-energy/heat/biomass

https://www.gov.uk/find-fuel-supplier

https://www.carbontrust.com/resources/tools/biomass-decision-support-tool/

Heat Pumps - MCS

http://www.energysavingtrust.org.uk/renewable-energy/heat/ground-source-heat-pumps

http://www.energysavingtrust.org.uk/renewable-energy/heat/air-source-heat-pumps

Solar Thermal (Hot Water)

http://www.energysavingtrust.org.uk/renewable-energy/heat/solar-water-heating

CHP (Combined Heat and Power or co-generation)

https://www.gov.uk/guidance/combined-heat-and-power

10.4 National Grid Live Energy Mix

Watch the **"Greening of the Grid"** as we increase our renewable and low carbon energy sources and decarbonize our electricity towards the 2030 target https://gridwatch.templar.co.uk/

10.5 Government Departments - Climate Change

DEFRA Department of Environment, Food and Rural Affairs (DEFRA)

25 Year Environment Plan and related directives in waste, natural resources and agricultural.

DBEIS (Department for Business Energy & Industrial Strategy)

For the Government Latest guidance: including The Clean Growth Strategy, and regional statistics:

UK local authority and regional carbon dioxide emissions national statistics

The aim of these statistics is to provide the most reliable and consistent possible breakdown of CO2 emissions across the country, using nationally available data sets going back to 2005.

Ministry of Housing Communities & Local Government (MHCLG)

Directives and guidance for built environment: commercial and domestic sectors and communities to live and work, and to give more power to local people to shape what happens in their area.

The Waste and Resources Action Programme is at the forefront of the circular economy.

10.6 ISO Standards – Environmental and Energy Management

https://www.iso.org/iso-50001-energy-management.html

https://www.iso.org/iso-14001-environmental-management.html

10.7 UK Energy Statistics

The digest, sometimes known as DUKES, is an essential source of energy information. It contains extensive tables, charts and commentary. Separate sections on coal, petroleum, gas, electricity, renewables and combined heat and power a comprehensive picture of energy production and use over the last 5 years, with datasets back to 1970.

10.8 Resource Management (including zero single-use plastics)

Please refer to Facilities Management (FM) and Procurement for our policy for Single Use Plastics office Waste and resource re-use. The measures which facilitate this are both a municipal and commercial (Dry-Mixed-Recycling) contract with Veolia for office sites and a new contract with Warp-it with respect to office item re-use and repurposing. For more information on both these initiatives please see here:

Recycling: please refer also to "office_recycling_faqs_v15.pdf"

DEFRA Waste Strategy , Veolia Shropshire

WRAP – Waste and Resources Action Programme - At the forefront of the circular economy

Repurposing: Warp-it The Re-use Distribution Network for repurposing stationary, furniture and other office equipment. Please see here for more information: https://www.warp-it.co.uk/company/shropshirecouncil