

A new energy strategy for Gloucestershire

Stakeholder workshop stimulus paper

For Stakeholder Workshop, SGS Berkeley Green, 9th October 2018

This short paper is designed for reading in advance of the workshop to provide participating stakeholders with (a) an understanding of the approach being taken to the development of a new energy strategy for Gloucestershire and (b) a stimulus to thinking in advance of the event.

It includes a short description of the approach we are taking to the development of the strategy, an Energy Datasheet with facts and figures about energy supply and use in Gloucestershire, and a brief exploration of what national targets for the energy system (particularly for reducing carbon emissions) would look like when applied to Gloucestershire.

There are some questions at the end of this paper which it would be very useful for you to have considered in advance of the workshop so that you can contribute as fully as possible to the event and thereby to the development of the strategy.

Background

The Centre for Sustainable Energy (CSE) (supported by Severn Wye Energy Agency) has been commissioned by GFirst (the Local Enterprise Partnership for Gloucestershire) and Gloucestershire County Council to develop a new energy strategy for Gloucestershire. The development of the strategy are sponsored by the Department for Business, Energy and Industrial Strategy (BEIS).

The strategy will be based on a review of evidence which describes what the county needs to do to play its role successfully in securing the low carbon, affordable and resilient energy future to which the UK is committed. It will enable GFirst to establish, on behalf of the county as a whole, a clearly prioritised strategy and action plan setting out the key steps to realise the required changes locally and maximise the economic, social and environmental advantages to the county's people and businesses of doing so.

The scope does not include new analysis of the technical or economic potential for. For these, we rely on nationally available data and on the many previous regional and local studies and analyses. Instead, the strategy will have a particular focus on defining a near term programme of action to take place in the county. This will detail the actions required, who might be involved, how this might best be orchestrated, resourced and implemented, and the nature of the economic and wider benefits which could result from success.

Our approach

There are three elements to our approach to developing the strategy which shape how participants will be encouraged to consider the issues and make their contributions at the stakeholder event. These are:

- To consider county-wide action in the context of a nationally established trajectory for energy system change.
- To ‘walk right round’ the issues so that the full range of factors which will influence success (or otherwise) are taken into account.
- To develop road maps for action with a particular focus on identifying ‘the first next steps’.

These elements are each outlined in more detail below with the intention of helping stakeholders to structure their thoughts in advance of the event.

County action in a national context of energy system transformation

The backdrop to the strategy is the fact that, like every other part of the UK, Gloucestershire’s energy system will need to change rapidly. This is needed to ensure the county makes an appropriate contribution to legally binding national carbon emission reduction targets (80% by 2050) while sustaining reliable energy supplies and ensuring energy costs remain (or, for some, become) affordable for households, businesses and other organisations.

The changes required in the county’s energy system over the next 20 years are already well understood. They are, by and large, the changes required of the energy system nationally and every other part of the UK, as documented in various official national strategies and plans¹. They include:

- i. a complete shift to very low or zero carbon electricity generation, mostly renewable and much of it decentralised;
- ii. smarter and more flexible management of demand, including storage, to enable higher penetration of variable renewable generation and to optimise electricity system operation;
- iii. huge reductions in energy demand by improving significantly the energy performance of our buildings (across all sectors and all tenures) and the equipment and processes within them;
- iv. decarbonisation of heat (i.e. stop relying on fossil fuel gas and oil) for buildings, hot water and industrial processes;
- v. a dramatic rise in use of electric vehicles and other steps to cut the carbon emissions of road transport (as electricity is decarbonised);
- vi. ensuring new build developments achieve their full low carbon potential and contribute effectively to a smarter energy system.

The strategy will not assess whether these are the transformations required in Gloucestershire. These changes represent the nationally stated direction of change and will be broadly the same anywhere in the UK, driven by the same current and emerging policies, regulatory frameworks, market developments and funding and innovation regimes and markets.

The strategy will be about how to deliver these changes in Gloucestershire. This needs to be viewed through two lenses: (i) what is required of this county within a national delivery context to contribute

1 Such as the [Clean Growth Strategy](#) (October 2017), which sets out the government’s plans to meet the fifth carbon budget and capture the associated economic benefits, and [Upgrading our energy system: smart systems and flexibility plan](#) (July 2017), which sets out the plans of the government and Ofgem to enable a smart, flexible energy system.

as fully as we can to national success, and; (ii) what are the specific local circumstances which influence the detail of what we should do in the county to ensure it gains as fully as possible in the process. To meet these needs, we are establishing as the backdrop of the strategy an understanding of three different aspects of the required energy system changes as they relate to Gloucestershire:

- a. **The nature of these changes in Gloucestershire:** in the context of the changes which need to happen ‘everywhere’ (as outlined above), what are the specific circumstances and anticipated future developments in the county (in terms of, for example, its built forms, renewable resources, energy and transport infrastructure, energy supply and demand, socio-demographics, patterns of economic activity etc.) which shape the precise nature of these changes in the county (and thus how they resemble or differ from changes occurring elsewhere)? And are there other relevant county and/or local priorities (such as tackling fuel poverty) which need to be factored in to how the county approaches these changes?
- b. **How well Gloucestershire is set up to deliver these changes:** The current capabilities, skills, supply chains, organisational capacity, institutional arrangements and commitments across the county – their strengths and weaknesses – upon which a county-wide programme to secure these changes would be built. This will determine the nature and scale of the key interventions required to ensure Gloucestershire delivers these changes successfully.
- c. **Where there are economic growth opportunities for Gloucestershire from the changes:** Those aspects of the changes which Gloucestershire is, or can become, particularly good at delivering – both in terms of demonstrating how the changes happen but also in developing and perfecting skills, capabilities, technologies, services, business models, or public engagement techniques in the design and delivery of these changes, both for the county but also in wider markets (in UK and overseas).

Walking right round the issues to build a more complete picture of what’s needed for success

In exploring these aspects, it is important that the study takes more than a technological or economic perspective of our strengths and weaknesses and the challenges and opportunities involved.

The transformation of the energy system described here represents huge changes not just in how we produce, distribute and use energy, but also what we invest in and how we do business and live our lives. It requires a different pattern of capabilities and supply chains, many of which are relatively rare, still emerging, or focused on serving other interests (which may currently be more rewarding). And it requires a level of public involvement in, and consent for, change which, to date, has often not featured strongly in nationally driven programmes.

To avoid missing these sorts of issues, we are looking to ‘walk right round’ the issues and consider the technical, commercial, policy and regulatory, and socio-cultural dimensions involved. This should help to ensure that the strategy reflects a more complete understanding of what is involved in delivering change and the conditions required for success. This, in turn, should enable a more thorough consideration of the possible range of actions required to create those conditions.

To give an example, to drive energy demand reduction and more flexible energy use patterns in buildings within a smarter energy system, the following conditions need to apply:

- **The energy system needs and has the potential the action:** there needs to be potential for energy demand reduction and demand flexibility and a system need which it meets.
- **We need to have – or be able to develop – the capabilities to deliver:** Unless people can develop the capabilities, the techniques and the tools to capture and analyse data, and someone

has the initiative-taking clout to organise these and secure funding to get started, they are unlikely to be in a position to establish a value-creating enterprise.

- **The commercials need to be right:** In spite of the significant potential for demand reduction and demand flexibility, nothing can happen if the commercial arrangements don't stack up enough to fund interventions to secure change. Unless there is sufficient financial value in stimulating households and building occupiers to reduce consumption and/or change their energy use patterns, it is unlikely such activity will emerge in the market as organised services.
- **The policies and market rules need to reward action:** the commercials being right will depend, at least in part, on how the market and trading rules are set and whether they enable those providing demand reduction or peak shifting services to capture a decent share of the value they are creating for the energy system (e.g. by providing balancing services, reducing investment in new generating capacity, avoiding network reinforcement etc).
- **The public need to be willing and engaged to participate:** unless the public and building owners and occupiers can be engaged constructively with their smart energy data – and with offers of assistance to use it well or with interventions to put it into action – the market won't really exist and hardly any of the technical potential or economic value will be realised.

A brief analysis of the current state of activity in this field would suggest that none of these conditions is being met fully at the moment. It would also suggest that Gloucestershire has some promising capabilities and that national policies and programmes are seeking to address some (but not all) of these conditions. So what actions could be taken locally to take full advantage of the emerging national initiatives and to help to create all of these conditions more rapidly within Gloucestershire?

The event on 9 October will give stakeholders an opportunity to share their perspectives of the county's strengths and weaknesses and the key opportunities they see. This will help ensure the strategy reflects a clear picture of the current state of play in relation to each change, which is where any strategy must start if it is to prove successful.

Roadmaps and 'first next steps'

The stakeholder event will also contribute to the development of road maps which will help to define a coherent sequence of actions for each area of change. These need to start from the 'current state of play' and acknowledge the limitations of current practice, the identified constraints on progress, the conditions required for success and the range of uncertainties in play, having 'walked right round' the issues.

In developing the road maps, we are keen to define in most detail the 'first next steps'.

These 'first next steps' are the key actions which kick start progress by specifically focusing on initiatives which address the current state of play and start immediately to change these for the better. That way, they create the conditions in the county which enable the 'steps after next' to be taken more easily and more quickly across the county.

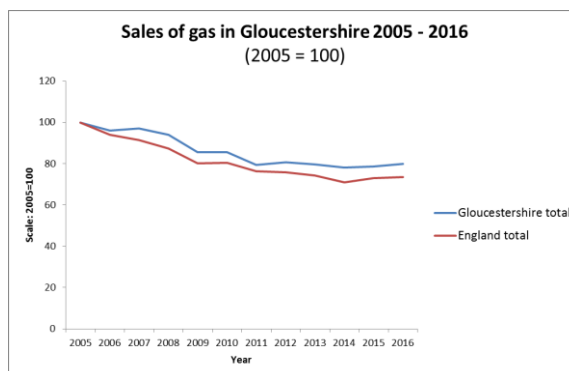
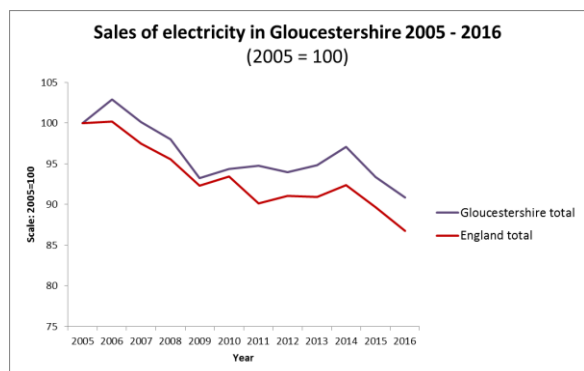
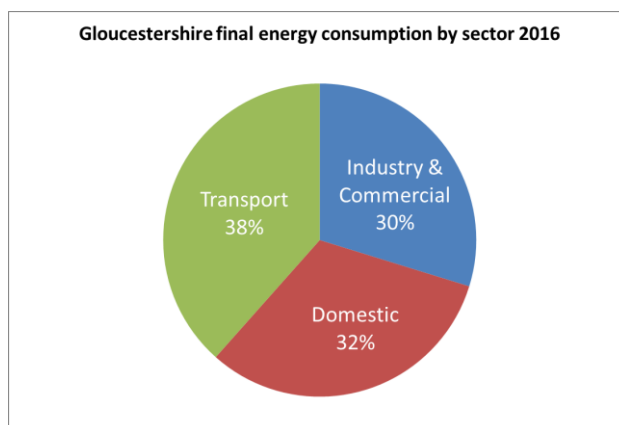
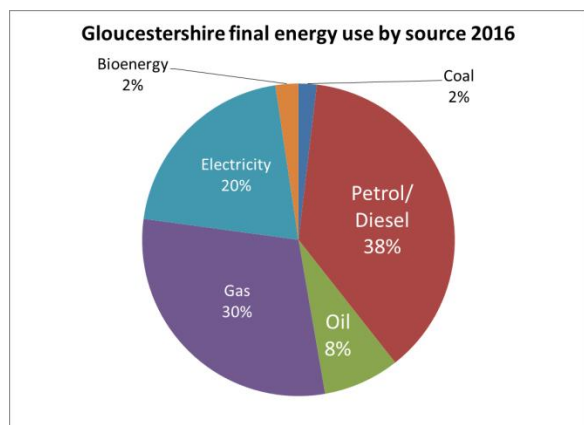
Considering the full range of conditions required for success and taking this road-mapping and 'first next steps' approach will enable the county and its stakeholders to set clear priorities and move quickly from strategy to action.

ENERGY DATA SHEET for Gloucestershire – Stakeholder Workshop 9 October

Gloucestershire energy consumption, meters, and expenditure (2016 not including transport)

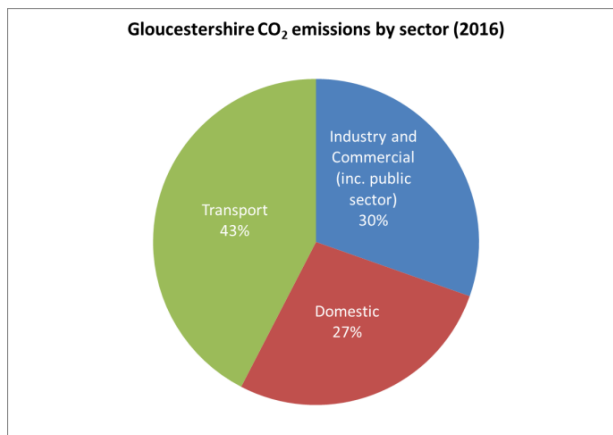
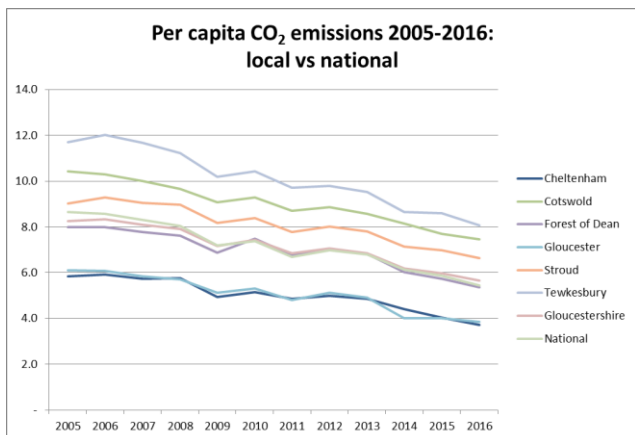
Sector	Fuel	Annual Consumption (GWh)	Meters	Total Spend (£ million)
Domestic	Standard Electricity	911	239,000	146
	Economy 7 Electricity	277	45,000	33
	Gas	2,739	220,000	105
	Oil	30		10
Non-Domestic (Industrial, commercial public sector, farming)	Electricity	1,728	26,000	181
	Gas	1,415	3,000	34
	Oil	66		20
Total		7,100	533,000	529

1. Gloucestershire’s households, businesses and organisations spend more than £1 billion a year on electricity, gas, coal, oil, petrol and diesel, including more than £0.5 billion on energy use in buildings and equipment and for process heat for industry.
2. At least 85% of the energy used is fossil-fuelled (either directly or at a power station to generate electricity).

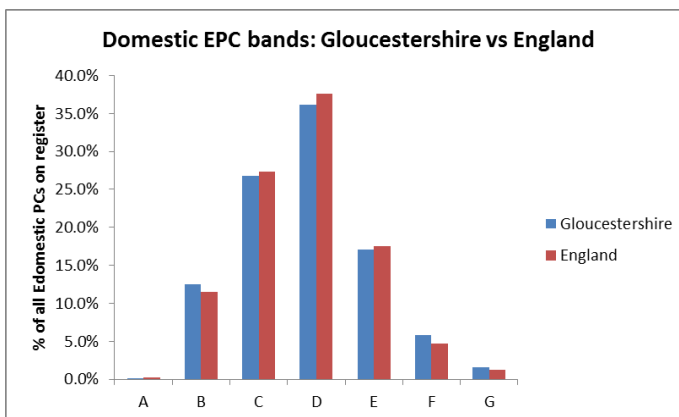
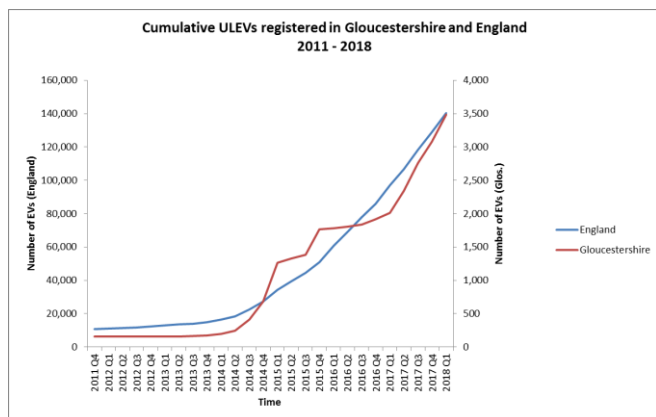


3. 60% of the electricity is used in industrial and commercial settings, 66% of the gas is used in homes.
4. Sales of electricity in Gloucestershire have dropped 9% since 2005, slightly less than the national reduction (13%). The reduction is mainly due to improved energy efficiency standards in equipment and lighting.
5. Sales of gas in Gloucestershire have dropped by 20% over the same period, less than national reductions (26%). Reductions in gas use have been largely due to improvements in building energy performance and boiler efficiency.
6. 30% of the UK’s electricity production is now from renewable sources. At the end of 2017 the 246MW of installed renewable energy capacity *sited in* Gloucestershire generated enough power to meet 11% of the county’s electricity consumption. The renewable electricity generated within Gloucestershire comes 60% from solar PV, 38% from anaerobic digestion, biomass or landfill gas, and 2% from onshore wind.

- 1 in 25 homes across Gloucestershire now has a solar PV system (average size 3.6 kWp), though Stroud (1 in 19 homes) and Forest of Dean (1 in 18 homes) have higher penetration than other districts.
- Carbon emissions per capita across Gloucestershire reduced by 30% between 2005 and 2016, broadly in line with national reductions. Total carbon emissions have dropped by 25% in this period. These reductions have been largely delivered by the significant UK growth of renewables (cutting the carbon emissions of electricity) and by gains from energy efficiency improvements in buildings and equipment (boilers, appliances and lighting).



- 60,000 new homes are expected to be built in Gloucestershire by 2031. If these new homes are built to the energy performance standards in current building regulations, these additional homes will increase housing-related carbon emissions in the county by roughly 12% (and total emissions by 3.4%).
- Gloucestershire has 3,500 registered Ultra Low Emission Vehicles (ULEVs) – mainly electric vehicles. The number of EVs is growing rapidly, doubling roughly every 18 months. A standard EV charging point (7kW) has twice the peak demand of a typical home. For the electricity network to integrate significant numbers of EVs without huge additional costs, it matters where the charging points are on the network and what time of day they are used.



- More than 60% of Gloucestershire's existing housing has an energy performance rating below 'C' (the Government's target for all housing by 2035), a broadly similar picture as across England as a whole.
- 9.4% of the county's households – more than 25,000 homes – are defined as in fuel poverty (meaning nearly 1 in 10 of Gloucestershire's households struggle to afford to keep adequately warm in winter).
- More than 80% of homes have access to gas (which currently provides the cheapest type of heating) but there are high proportions of homes off the gas network in the Forest of Dean (39%) and Cotswold (33%) districts.
- Western Power Distribution (WPD) – the local electricity distribution network operator for a large part of Gloucestershire – is expecting to invest c.£175 million over the next 5 years across its four license areas on developing its smart energy capabilities and associated innovations. Scottish & Southern Energy Network (SSEN) (which covers some of the east of the county) is developing similar plans.
- More than 75% of all the heat for buildings in the county is produced from gas (mostly distributed by Wales and West Utilities, although Cadent also serve some areas to the north of the county), of which less than 1% is currently from 'green gas'. Typical peak gas demand on the coldest day of winter is some 5 times higher than the peak demand which the electricity system is currently designed to meet.

What do the national energy-related targets look like if applied to Gloucestershire?

The Government has set out a range of national targets and ambitions for the energy system. Many of these derive from the changes required in the way we generate and use energy in order to meet the legally binding target of an 80% reduction in carbon emissions (from 1990 levels) set under the Climate Change Act 2008. These targets and ambitions are outlined in the Government's [Clean Growth Strategy](#) (October 2017), its [Smart Systems and Flexibility Plan](#) (July 2017) and other policy documents such as the [Fuel Poverty Strategy for England](#) (March 2015). The [Annual Progress Report to Parliament](#) of the Committee on Climate Change also provides a clear picture of the timetable for how different aspects of the energy system (such as the provision of heat) need to decarbonise in order to contribute appropriately to the overall long-term carbon emissions reduction target.

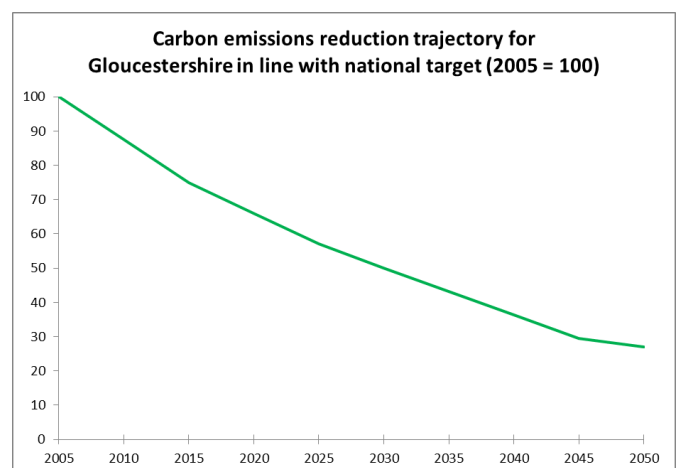
So what would these targets look like if they were applied to Gloucestershire? And what rate of change would that imply (and how does that compare with recent experience)?

The initial answers to these questions, derived from the evidence reviewed to date for the strategy development, are set out below. They are provided to give an indication of what sort of targets might need to be adopted if Gloucestershire was aiming to make an appropriate contribution to the national objectives. Of course, as the Committee on Climate Change has pointed out, these targets do not, in themselves, result in any change. That only happens (and the targets will only be met) if specific policies and actions are put in place at national, regional and local level to ensure current practices and behaviours shift to become more strongly dedicated to their achievement.

- **Carbon emissions**

1. Gloucestershire's carbon emissions reduced by 50% by 2030 (on 2005 levels) and by 73% by 2050 (on 2005 levels) (= 80% on 1990 levels, in line with Climate Change Act target)

As a starting point, it should be expected that the trajectory for carbon emission reductions for the county will mirror that of the UK as a whole to meet the Climate Change Act target. This trajectory (shown in the graph to the right) broadly represents a continuation of the current rate of progress since 2005, with an expectation that, as additional carbon reductions become more difficult (because the 'easy stuff' has been done), the rate of reduction will reduce. As outlined under 'Decarbonising electricity' below, some of the carbon emission reductions achieved will be as a result of changes taking place elsewhere on the electricity system so that the power consumed in the county is very low or zero carbon.



- **Decarbonising electricity**

2a. Carbon emissions per unit of electricity below 100g by 2030 with at least 30% of electricity consumed in the county generated from renewable energy sited within the county

The electricity generation carbon intensity target of less than 100gCO₂/kWh is as set out nationally in the fifth carbon budget (as described in the Clean Growth Strategy). Much of the reduction in carbon intensity will be due to an end to coal generation and the growth in offshore wind and increased renewable energy generation in Scotland; Gloucestershire can, in part, rely on those developments elsewhere to help decarbonise electricity supplies. But more will need to be done within the county, both to reflect the potential here and to make a reasonable contribution to achieving the national target. A county target of generating, by 2030, 30% of electricity consumed in the county from 'within county' renewable generation would represent roughly a tripling of current within-county generation (in 2016 it stood at 11% of current county electricity consumption). Assuming electricity demand increases by 25% from current levels (because of increased use for EVs and electric heating, partly offset by greater efficiency), this 30% target would set a goal of generating:

2b. 1 TWh a year of renewable electricity from projects sited within the county by 2030 from 2017 levels (requiring an extra 0.75 TWh)

To provide a sense of the challenge of what might at first appear to be a relatively modest goal (30% by 2030), meeting this target from in-county renewable energy projects requires at least a quadrupling of the county's 2017 solar PV capacity (to reach at least 1 in 10 homes and an extra 630 MW in larger installations on buildings and low grade land) and of on-shore wind capacity (20-30 additional medium-sized turbines) plus a tripling of electricity generation from anaerobic digestion.

- **Reducing energy demand in buildings**

3. Every existing building to at least an (accurate) EPC rating of C by 2035

This target (indicated by the Government in the Clean Growth Strategy) will require retrofit activities in the 60% of Gloucestershire's housing stock and 66% of non-domestic buildings which are currently below a C rating. This should be subject to appropriate consideration of the character and construction fabric of buildings of recognised heritage value and also reflect the need to avoid overheating as the risk of summer heatwaves increases. At current energy prices and household income levels, there are very few households in England in C rated homes which are officially fuel poor (under the 'Low Income High Costs' definition). Achieving this target would therefore also help to ensure that fuel poverty in the county was effectively addressed.

Given the timescales and the current state of the housing stock (as from the county EPC data), this target requires c. 1 in 20 homes being improved to a C each year.

This rate of activity is higher than the current rate of retrofit/refurbishment which requires a planning application (estimated from available data at between c. 3 and 4 homes per hundred across the county), though not all current refurbishment activity requires a planning application. The rate of refurbishment is therefore probably not the issue; it is the fact that the refurbishment currently being undertaken is not focused on improvements which lower carbon emissions and improve the energy performance of the building.

The required rate of energy performance improvement in non-domestic buildings would be 1 in 18 buildings each year.

- **Decarbonising heat (or ‘finding an alternative to fossil fuel gas’)**

4. Heat demand in the county – for heating buildings and for industrial processes – needs to be decarbonised (i.e. not relying on fossil-fuel gas or oil) by 2040

The Committee on Climate Change has indicated that, by about 2040, the UK will need to more or less stop relying on carbon-based fuels (coal, oil and gas) to generate heat to keep buildings warm or produce hot water or steam) in order to be on target to meet national carbon emission reduction targets for 2050. While the detail of how this will be done remains unclear, there are several different approaches which will need to be considered: (a) reducing demand for heat in existing and new buildings (see above and below); (b) optimising the roll-out of heat networks in urban centres and deliver zero carbon heat supplies through them using waste heat and/or renewable heat; (c) overcoming barriers to increased take up of renewable heat technologies and/or fuels including air-, water- and ground- source heat pumps (because electricity will be very low carbon by then), biomass and bio-wastes in buildings and industrial processes; (d) generating and using green gas locally, either directly or via the gas network; (e) injecting hydrogen into the gas network to displace fossil fuel gas (whilst ensuring the hydrogen production is – or could be – zero carbon).

- **The shift to electric vehicles**

5. By 2028, half of all new vehicles in Gloucestershire are likely to be EVs (and will need smart charging to minimise network costs and maximise the value of renewable electricity generation)

On current rates of take up of EVs (doubling roughly every 18 months), we could expect every other **new** vehicle registered in Gloucestershire will be an EV by 2028. What this means for the overall vehicle fleet will depend on scrappage rates and how EV market growth sustains (which will itself depend on the availability of a smart charging network). It will also depend on the success of wider efforts to reduce the need to use (and therefore own) a car or to constrain their use to reduce air pollution and improve amenity. At current vehicle numbers, this rate of take-up could mean that nearly half of all vehicles in the county were EVs by 2030. We estimate this would increase local electricity demand by 15 - 20% (cf 2015).

- **New developments**

6. All new developments to be net carbon negative and smart-energy-enabled from 2020 onwards

Meeting the county’s carbon emission reduction targets while maintaining energy affordability requires that the anticipated growth in new homes and other developments across the county do not add to carbon emissions but rather help to reduce them. As mentioned on the Stakeholder Workshop Energy Datasheet (see point 6 on page 7 above), if current new homes were only built to current building regulation standards for energy performance (rather than ‘zero carbon’ standards), they would collectively add 3.4% to the county’s carbon emissions. Hitting emission reduction targets would then require additional reductions from existing buildings, transport uses and industry.

Questions to consider in advance of the Stakeholder Workshop

We would like stakeholders to apply the approaches described here to their understanding of Gloucestershire and different aspects of its energy system. To help with this, outlined below are some questions to consider in advance of the 9 October event.

Stakeholders will be encouraged at the event to choose to explore with other stakeholders one of the following energy system changes.

- i. Increasing renewable energy and securing a smarter, more flexible grid (including storage & demand flexibility)
- ii. Upgrading the energy performance of Gloucestershire's homes
- iii. Upgrading the energy performance of commercial and public buildings
- iv. Reducing carbon emissions from industrial energy use in the county
- v. Accelerating (and managing) the growth of Electric Vehicles (EVs)
- vi. Getting Gloucestershire's new build and new infrastructure to achieve zero carbon standards
- vii. Decarbonising heat (i.e. what replaces fossil-fuel gas and oil?)

We recognise that some stakeholders will have interests in more than one of these, while other stakeholders will have a more specialist interest. We hope that by drilling down into each but including a wide range of consideration of the factors which will shape success, we can enable all stakeholders to make valuable contributions to the event outputs.

In relation to your chosen energy system change, please consider the following questions:

1. What would you consider the strengths in Gloucestershire?

It is worth considering each of the 'walk right round the issue' dimensions to get more of a complete view:

- Scale of the potential for action:
- Capabilities and initiative-taking clout:
- Commercials/access to funding:
- Policy/regulatory support:
- Public engagement and consent:

2. What would you consider the weaknesses in the county?

- Scale of the potential for action:

- Capabilities and initiative-taking clout:
- Commercials/access to funding:
- Policy/regulatory support:
- Public engagement and consent:

In the case of both strengths and weaknesses, this should include any national factors (such as the availability of innovation funding or the lack of a supportive policy environment) which are influencing what can be done in the county.

3. a. Which of these weaknesses do you think we have to address in Gloucestershire *as a priority* to ensure success?

b. How would you go about addressing this weakness?

4. a. What do you think most threatens progress in the county?

b. What do you think we could do about that (and what would be your first next step to doing so)?



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