2010

Exmoor National Park Carbon Neutral Programme Consultation

forum21

Towards a Sustainable West Somerset

Executive Summary

Global climate change presents a significant and imminent threat to Exmoor's landscape, biodiversity and way of life. In response to this challenge a commitment has been made in the Exmoor National Park Management Plan (2007-2012) to develop a "carbon neutral" programme to deliver a target of zero net carbon emissions by 2025 for the National Park area.

This document, 'Carbon Neutral Programme Consultation', summarises the findings from several assessments and sets out a programme for discussion and consultation with the wider community. It is the intention that it is presented and owned as an Exmoor wide community programme and not by any single organisation.

Can Exmoor become carbon neutral by 2025?

In order to achieve a carbon neutral national park by 2025 the gap between the baseline emissions and removals (ie net emissions 305,870 t CO_2e) must be bridged by that date.

Even after an ambitious programme our net emissions will be 197,851 tonnes per annum in 2025 if we do not account for renewable energy export in our target, or 116,144 tonnes per annum if we do.

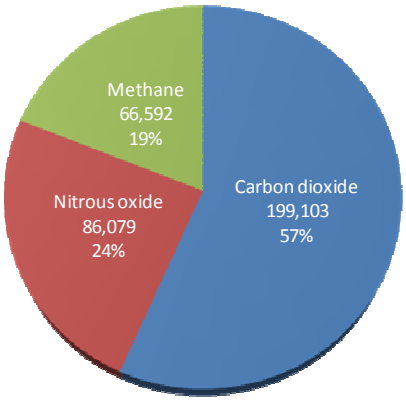
According to the assessments and subject to today's technology and knowledge, then Exmoor can only become carbon neutral if it offsets or enables greenhouse gas emission reductions elsewhere.

The consultation sets out an ambitious programme in an attempt to deliver against this target. But as will be shown, it is not possible to become carbon neutral if it offsets or enables greenhouse gas emission reductions elsewhere. The consultation therefore gives rise to the questions; how practical is this for a community and is it even possible for a geographical area to become carbon neutral? Is there a more appropriate target or is this a challenge that given the threat of climate change, we must collectively take up?

Exmoor's greenhouse gas profile

351,772 tonnes of carbon dioxide equivalent (CO_2e) per year are emitted due to Exmoor's energy consumption, land use and agricultural activities[1].

Figure 1 Exmoor's emissions by greenhouse gas (tonnes) per annum



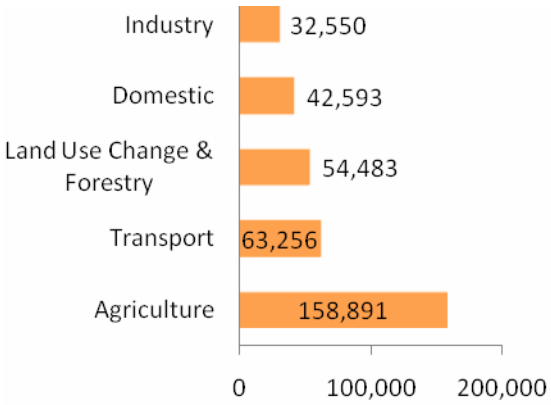
	tCO_2e p.a.	%
Carbon dioxide	199,103	57
Nitrous oxide	86,079	24
Methane	66,592	19
Total	**351,774**	

[1] Figures provided are from 2006 – the most recent available data at the time of writing

The per capita emissions for Exmoor residents are **14.1 tonnes per capita**. This figure is significantly higher than the national average of 9.5 tonnes, the average for the SW England of 8.9 tonnes, the average for the West Somerset District of 11.4 tonnes (Forum 21, 2008) and for North Devon of 9.4 tonnes.

Agricultural emissions are the dominant source of greenhouse gases from Exmoor making up 45% of the total. This is followed by transport then land use, land use change and forestry (LULUCF). Emissions by sector, presented in figure 2, illustrate the significance of agriculture in the National Park.

Figure 2: Emissions by sector (tonnes of CO_2e pa)



Exmoor's energy profile and potential to reduce CO_2

Heat and electricity

Annual CO_2 emissions attributable to our use of energy are estimated to be 63,578 tonnes per annum. This represents 18% of total emissions across the National Park.

The community of Exmoor spends an estimated £11.6 million on energy (excluding fuel for transport) every year. £7.4 million is spent by the domestic sector and £4.1million by the industrial, business and commercial sectors.

It is estimated that CO_2 emissions can be reduced by 14,000t (4%) per annum by 2025 if we implement an ambitious energy efficiency programme. This equates to 4% of the total greenhouse gas emissions for the National Park and represents a 22% reduction of associated emissions from energy use.

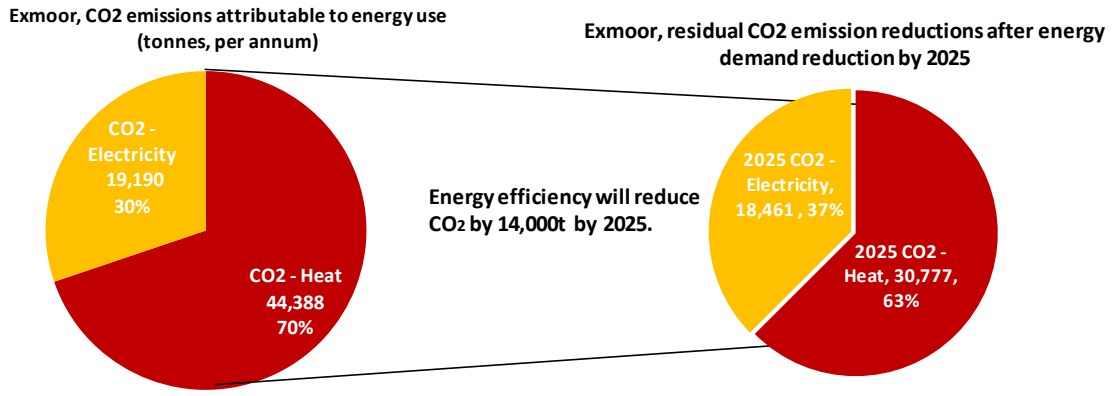


Figure:3 Potential savings from energy efficiency

Renewable energy (not including biomass export) can potentially reduce these emissions further by 48,000tCO_2 by 2025 (14%) of the total greenhouse gas emissions). If the energy efficiency programme is implemented alongside the renewable heat programme then the forecast suggests that by 2022 heat demand will be met by supply from renewable sources. This is considered the maximum that can be achieved and includes solid wall insulation of more than 1200 properties and all properties fully insulated in terms of draught proofing, cavity wall and loft insulation. This also made provision for 50% of all properties having floor insulation by 2025.

The supply of electricity for use in relation to non-heat purposes meets demand by 2021 if the intervention measures proposed here are implemented up to 2025. This would include the deployment of wind power. Without wind power the electricity demand of the National Park area is unlikely to be met unless further research shows that reservoir hydro is a greater resource than estimated here.

Transport

Annual emissions from transport are estimated to be 63,256 tCO_{2e}. This represents 17% of total emissions across the National Park, making the sector the second largest contributor.

Assessments have forecast that promotion of a variety of initiatives across the National Park could potentially reduce transport emissions by around 20% (13,600tCO_2) by 2025.

The UK government forecasts a significant increase in traffic volumes, accompanied by a range of policy measures that increase fuel efficiency. The net effect will be that emissions from transport in 2025, under business as usual conditions, are expected to be similar to those of today.

A transition to electric vehicles has been included in the modelling for this consultation and an assumption has been made that 10% of Exmoor vehicle kilometres will be replaced by electric vehicles by 2025 saving 5% of the transport related carbon emissions.

Ultimately emissions reduction targets for transport can only be met if people drive their cars less. There are a number of well known policy measures that can encourage this, such as improved facilities for home working (better broadband connections, for example), encouragement of car share schemes for commuting, and home delivery of goods to reduce individual shopping journeys.

Residents of deep rural areas in the Exmoor National Park, many living well away from any regular scheduled bus routes, should have transport options as alternatives to the private car. The operation of private car clubs, in which a local membership shares access to a small number of cars, can be a cost effective and efficient use of limited resources. There is also some potential for the current Demand Responsive Transport service in West Somerset to be extended to anyone who wishes to use it in deep rural areas, providing extra choice to people, perhaps alongside car club membership.

Land use management

Farming, land-use and land management give rise to over half of all greenhouse gas emissions in the Exmoor National Park. This is an unusually high proportion, but easily explained by the importance of these activities to the area and its relatively low population.

Although this sector is responsible for over half of the GHG emissions from the National Park, it is also the sector that will provide us with many solutions in the face of a challenging future. From acting as a sink for sequestration of CO_2 to supplying us with an alternative to fossil fuel, land use management is crucial to climate change adaptation.

Assessments have estimated that greenhouse gas emissions can be reduced by 50,000 tCO_2 per annum (31%) of the total of agricultural emissions by 2025 through land use management (excluding baseline removals (lulucf)).

Changing the use of land has an impact on carbon emissions as illustrated in the figure below and reflects the subsequent change in carbon storage in the vegetation and/or soil organic matter. Most of these changes involve a long period of adjustment in the carbon balance.

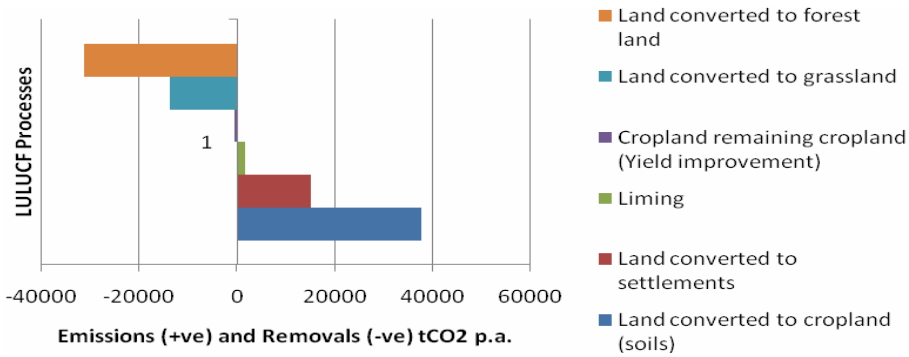


Figure 4: Emissions and removals from land use and management

Technically, there is considerable potential for establishing new woodland in the National Park. The draft programme proposes a significantly increased planting rate of around 180 hectares per year, with a mixture of short rotation coppice, short rotation forestry and long rotation broadleaved woodland.

Another land-use change that can have significant carbon benefits is the increased planting of Miscanthus, provided that the end use is restricted to local heat generation or combined heat and power (CHP). The draft programme allows for around 1500 hectares of Miscanthus to be established by 2014.

Over twenty measures have been identified that can help to reduce greenhouse gas emissions arising from agricultural activity. Most apply to grassland management, and are designed to build up carbon storage in the soil organic matter.

An important quantity of carbon is stored in peat in Exmoor's blanket mires and valley fens. This store is at risk from drying out and erosion but can be increased by mire restoration. The programme supports an extended "Mires on the Moors" project that will have biodiversity, water quality, flood alleviation and climate change benefits.

Contents

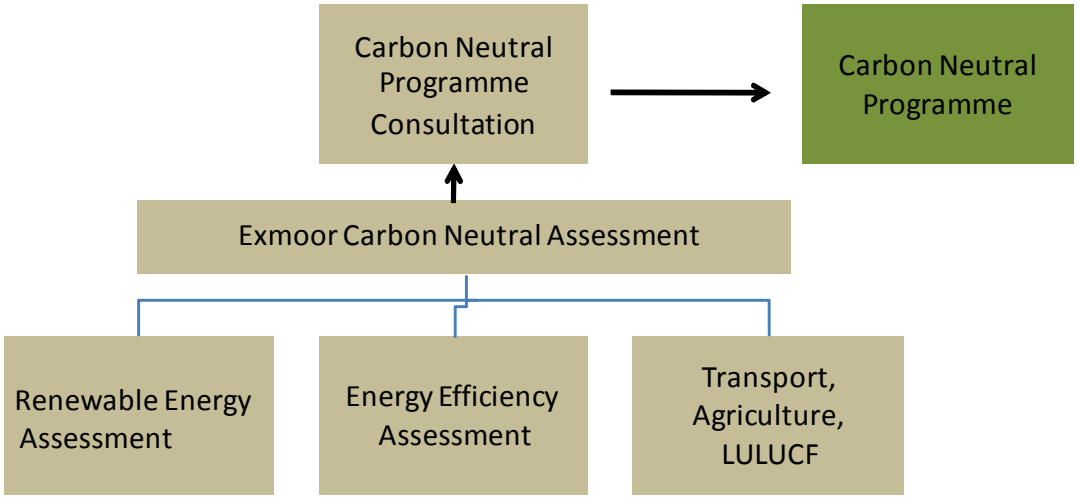
About this document

Global climate change presents a significant and imminent threat to Exmoor's landscape, biodiversity and way of life. In response to this challenge a commitment has been made in the Exmoor National Park Management Plan (2007-2012) to develop a "carbon neutral" programme to deliver a target of zero net carbon emissions by 2025 for the National Park area.

This programme aims to:

- Identify the current baseline emissions attributable to the National Park area and its activities
- Identify and model the potential to reduce those emissions over a given period of time
- Propose activities that will reduce those emissions

Over the last year the baseline assessments have been undertaken and documented in a report 'Exmoor Carbon Neutral Assessment'. The report and supporting documents are available to you at www.exmoor-nationalpark.gov.uk/carbonneutralprogramme and provide a lot more detail showing how the results and programme presented here were reached.



This document, 'Carbon Neutral Programme Consultation', summarises the findings from the assessments and sets out a programme for discussion and consultation with the wider community. It is the intention that it is presented and owned as an Exmoor wide community programme and not by any single organisation.

This programme should be seen as the beginning of a journey toward a lower carbon Exmoor National Park and the basis upon which we can stimulate dialogue, collaboration, and action.

This document is presented as a community response to climate change. Becoming carbon neutral will require collective focus from every individual and organisation within Exmoor.

The development of this programme has been led by Forum 21 with funding from the Exmoor National Park Sustainable Development Fund provided by Defra. It has been developed by Climate Action West (CAW) on behalf of Forum 21 in consultation with Exmoor National Park Authority and the Exmoor Trust.

It is now presented to you for your input, views and adoption.

Introduction and background

Climate change the global context

It is now widely accepted that climate change is happening and due largely to the burning of fossil fuels (such as oil, coal and gas). This emits carbon dioxide emissions (CO_2) - sometimes referred to as carbon emissions. Other greenhouse gases such as methane (CH_4) and nitrous oxide (N_2O) also contribute to climate change and these can arise from the way in which we use our land to grow crops, farm animals and deposit waste.

The challenge facing the world is to meet rising energy demand, whilst supporting economic growth and reducing emissions. Global primary energy demand is forecast to grow 53% by 2030 with a 55% increase in CO_2 emissions[2].

The UK Government[3] has identified 3 main issues:

- security of energy supply
- affordable prices
- climate change

It is estimated that through inaction the overall costs and risks of climate change will be equivalent to losing between 5 and 20% of global GDP each year, now and forever. In contrast, the cost to reduce greenhouse gas emissions to avoid the worst impacts of climate change can be limited to around 2% of global GDP each year[3].

The investments that take place in the next 10-20 years will have a profound effect on the climate in the second half of this century and in the next. Inaction now and over the coming decades will increase the risk of major disruption to economic and social activity on a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century[4].

Climate change the local context

The Exmoor National Park Management Plan (NPMP) (2007-2012) states that *"climate change probably represents the greatest environmental threat facing Exmoor today and it is anticipated that it will lead to a rise in rainfall, storminess, sea level and flooding as well as having a huge impact on biodiversity. At the level of the National Park the contribution to global warming is very small, however action to reduce emissions has to take place at local, regional, national and international levels"*.

Farming, land-use and land management are significant factors in the overall emissions profile of Exmoor giving rise to over half of all greenhouse gas emissions attributable to the area. The way that we use the land can sequester greenhouse gases as well as emit them.

[2] International Energy Agency, 2006

[3] Energy White Paper, May 2007

[4] The Stern review, UK Treasury, 2006

For example *'it is estimated that there are some 10 million tonnes of peat on Exmoor storing 1 million tonnes of carbon. If this peat is allowed to dry out, it will over time, emit some 3 million tonnes of carbon dioxide into the atmosphere. This is roughly equivalent to the total domestic carbon dioxide emissions for the whole of Devon for a full year'*[5].

As one of its objectives the Exmoor NPMP (2007-2012) has committed to

'minimising the net emissions of carbon dioxide and other greenhouse gases into the atmosphere in order to achieve a carbon neutral National Park and minimise Exmoor's contribution to global climate change'.

This programme is intended to set out how this objective might be achieved.

It will incorporate other work already underway that contributes to the reduction or avoidance of emissions. For example, the mire restoration project, the settlement sustainable energy plans, the ongoing work of the West Somerset Community Climate Change Strategy and the West Somerset and Exmoor Carbon Reduction Implementation Board (CRIB), as well as many other initiatives.

Seeking to be carbon neutral is a courageous move and presents significant challenges. In embarking upon this journey the community of the Exmoor National Park will be helping prepare itself to be more sustainable and self sufficient in the face of a challenging future. In its efforts to learn by doing it will provide much needed knowledge and experience to others seeking to accelerate the reduction of greenhouse gas emissions.

Exmoor National Park

Exmoor is designated a National Park for the following statutory purposes:

- To conserve and enhance the natural beauty, wildlife and cultural heritage of the National Parks
- To promote opportunities for the understanding and enjoyment of the special qualities of the Parks by the public.

Whilst doing so, it also has a duty to foster social and economic well-being of the National Park's communities

The National Park is located in the South West of England and covers an area of 691 sq km and has a population of 10,863. The northern boundary includes 44 km of Bristol Channel coastline and the park covers a large part of West Somerset District and the north eastern portion of the North Devon District.

Exmoor was designated as a National Park in 1954. This status affords it special protection nationally in recognition of its landscape richness and recreational value. Exmoor is designated within an Environmentally Sensitive Area and contains 17 sites of Special Scientific Interest and a National Nature Reserve managed by the National Trust.

[5] Exmoor national park management plan (2007-2012)

Part 1 Assessment – The baseline and the potential to reduce emissions

Before we can identify how we can reduce our greenhouse gas (GHG) emissions we must first understand the source and quantity of GHG emissions attributable to our activities. This is referred to in this document as our carbon dioxide equivalent (CO_2e) profile. National data sets have been used to assess the CO_2e profile of Exmoor by quantity (tonnes), type (of GHG – CO_2, CH_4, N_2O) and source (energy by sector, land use and agriculture).

Given the profile an assessment has been undertaken to identify how the greenhouse gas emissions from Exmoor's activities can be reduced.

Separate assessments were undertaken for the following four main areas of:

- Energy efficiency
- Renewable energy
- Transport
- Land use and management

Each of the assessments considered various intervention measures (activities) and evaluated by how much each of these measures would reduce or avoid emissions and be the most effective in achieving the target of a carbon neutral Exmoor by 2025.

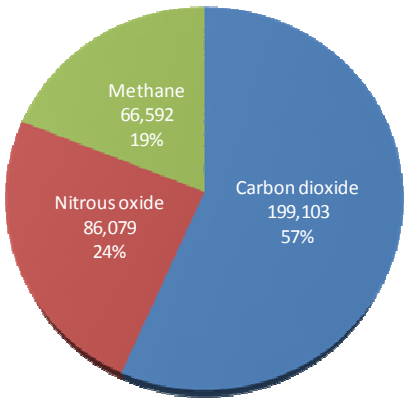
CO_2e Emissions Profile of the Exmoor National Park Area

The data available at the time of writing shows that 351,772 tonnes of carbon dioxide equivalent (CO_2e) per year are emitted due to Exmoor's energy consumption, land use and agricultural activities[6].

Emissions by gas

The relative contributions of the three principal greenhouse gases are shown in the figure below. Collectively methane and nitrous oxide are responsible for 43% of Exmoor's emissions and carbon dioxide 57%. The importance of nitrous oxide and methane is higher than the UK average as a consequence of the relatively low population and the balance between agriculture and industry.

[6] Figures provided are from 2006 – the most recent available data at the time of writing



	tCO_2e p.a.	%
Carbon dioxide	199,103	57
Nitrous oxide	86,079	24
Methane	66,592	19
Total	**351,774**	

Figure 5 Exmoor's emissions by greenhouse gas (tonnes) per annum

The way in which land is used (including forestry) can also remove CO_2 from the atmosphere through a process known as sequestration. This is referred to as biosphere removals. The data shows that for the same period biosphere removals were 45,904 tCO_2e per annum.

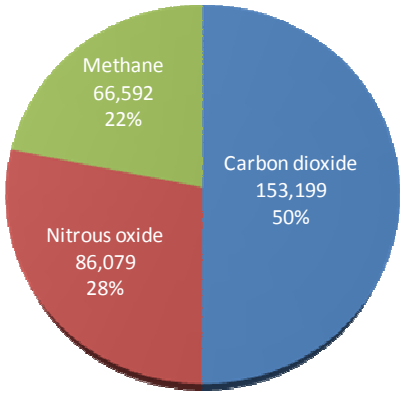
Therefore net emissions are 305,870 tCO_2e (351,774 – 45,904 tCO_2e).

Figure 6 Balance of carbon emissions and removals, Exmoor National Park, 2006

	t CO_2e p.a.
Emissions residents, businesses, visitors & biosphere (EMI)	351,774
Biosphere removals (REM)	45,904
Renewable energy export (REE)	0
External carbon offsetting (ECO)	0
Therefore **net emissions**	**305,870**

The balance of emissions taking into account the removals shows that methane and nitrous oxide collectively emit 50% and carbon dioxide 50% of net emissions.

Figure 7 Exmoor's emissions (pa) by greenhouse gas (tonnes) taking account of removals



	tCO_2e p.a.	%
Carbon dioxide	153,199	50
Nitrous oxide	86,079	28
Methane	66,592	22
Total	**351,774**	

Emissions per person (capita)

Emissions per capita are normally quoted for carbon dioxide only, using a net figure for land use land use change and forestry (LULUCF). This data is calculated and provided annually to the Government

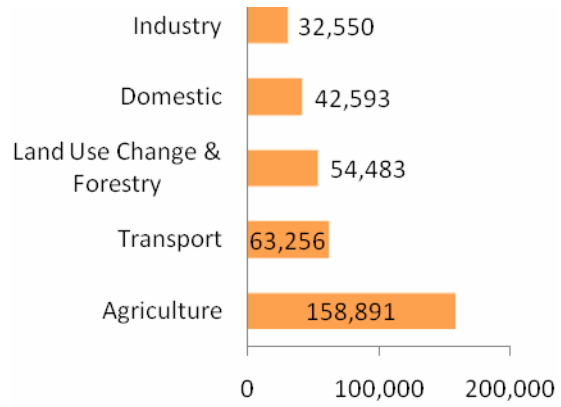
by The National Atmospheric Emissions Inventory (NAEI). The per capita emissions for Exmoor residents are therefore (199,103 – 45,904) divided by the population of the National Park, 10,863 = **14.1 tonnes per capita**. This figure is significantly higher than the national average of 9.5 tonnes, the average for the SW England of 8.9 tonnes, the average for the West Somerset District of 11.4 tonnes (Forum 21, 2008) and for North Devon of 9.4 tonnes. The reason for this higher per capita figure is likely to be the degree to which oil and electricity are used for heating and cooking.

Emissions by sector

The total emissions for the three greenhouse gases are shown by economic sector in figure 8 below. Agricultural emissions are the dominant source of greenhouse gases from Exmoor making up 45% of the total. This is followed by transport then land use, land use change and forestry (LULUCF).

The domestic and industrial sectors combined make up just 21% of the total emissions. This is an interesting discovery because efforts to reduce emissions in most communities have tended to focus on the domestic and industrial (including business and commercial) sectors. This profile highlights the significance of the agricultural and LULUCF sectors and the need to develop a programme that will begin to tackle these emissions.

Emissions by sector, presented in figure 8 below illustrate the significance of agriculture in the National Park and this can be understood further with reference to the emissions by process presented in Figure 9.



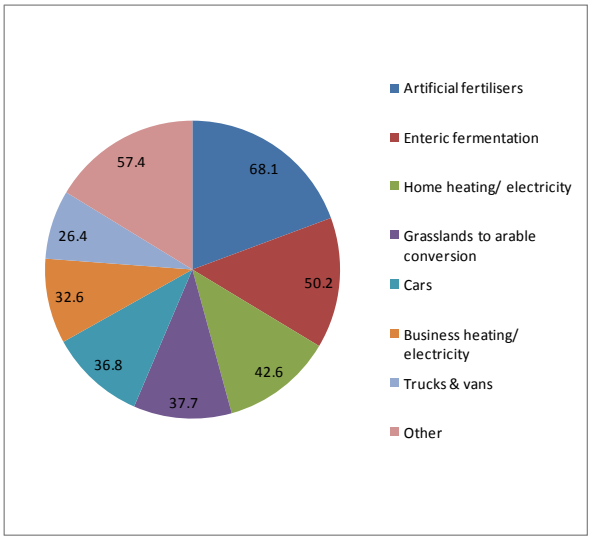


Figure 8: Emissions by sector (tonnes of CO_2e pa) & Figure 9: Emissions by process (ktCO_2e pa)

The emissions attributable to each sector are shown for each greenhouse gas in figure 9. It can be seen that carbon dioxide is the most significant greenhouse gas for all sectors except agriculture, where methane and nitrous oxide form the largest contributions.

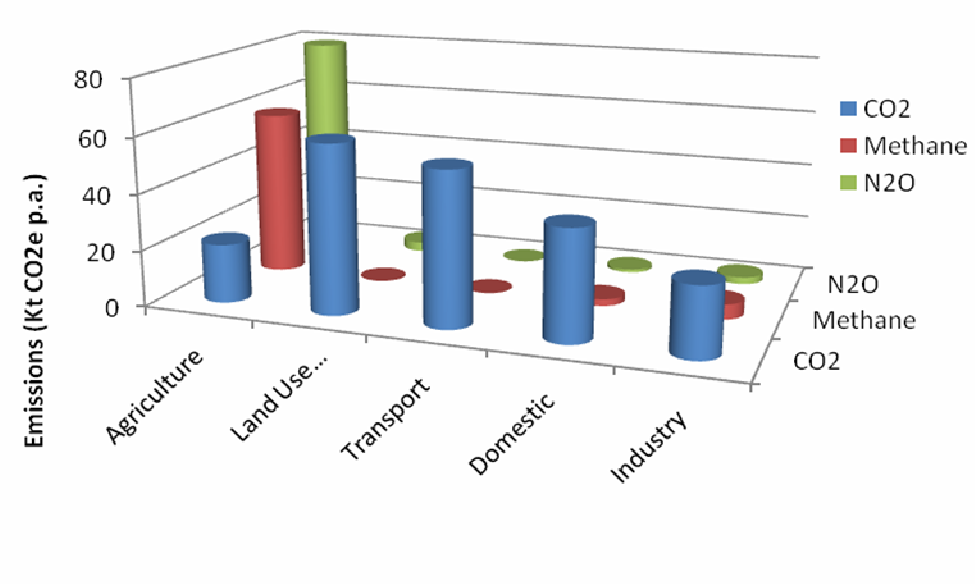


Figure 10: *Emissions by greenhouse gas and sector*

The spatial distribution of carbon dioxide emissions, excluding LULUCF, across the National Park, is shown below. Concentrations of greenhouse gases can be seen around the settlements of Dulverton, Lynton/ Lynmouth, Porlock and Dunster.

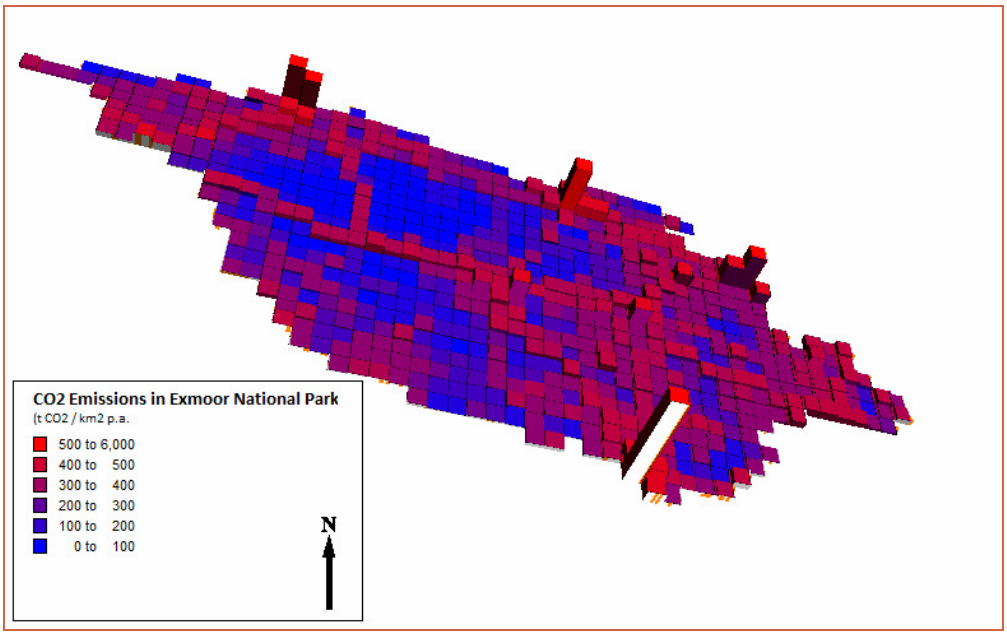


Figure 11: Spatial distribution of CO2 excluding LULUF

Understanding the amount of CO_2e we emit and the source of our emissions will help us focus effort where it will be most effective.

Exmoor's Energy Profile

Annual CO_2 emissions attributable to our use of energy are estimated to be 63,578 tonnes per annum. This represents 18% of total emissions across the National Park. The table and charts below show the overall balance of energy and CO_2 emissions associated with the use of energy for heat and electricity for power.

The total energy delivered (including gas, electricity oil and 'other') is around 156,293 MWh. 77% of the total energy delivered is estimated to be used as heat and an estimated 23% of the energy delivered is electricity used for power.

	Industrial	Domestic	Total
Energy delvered (MWh)	**48,316**	**107,977**	**156,293**
Heat (MWh)	21,204	98,674	**119,878**
Electricity (MWh)	27,112	9,302	**36,415**
CO2 attributable to energy	**24,512**	**39,066**	**63,578**
Heat - attributable CO2	10,224	34,164	**44,388**
Electricity -attributable CO2	14,288	4,902	**19,190**

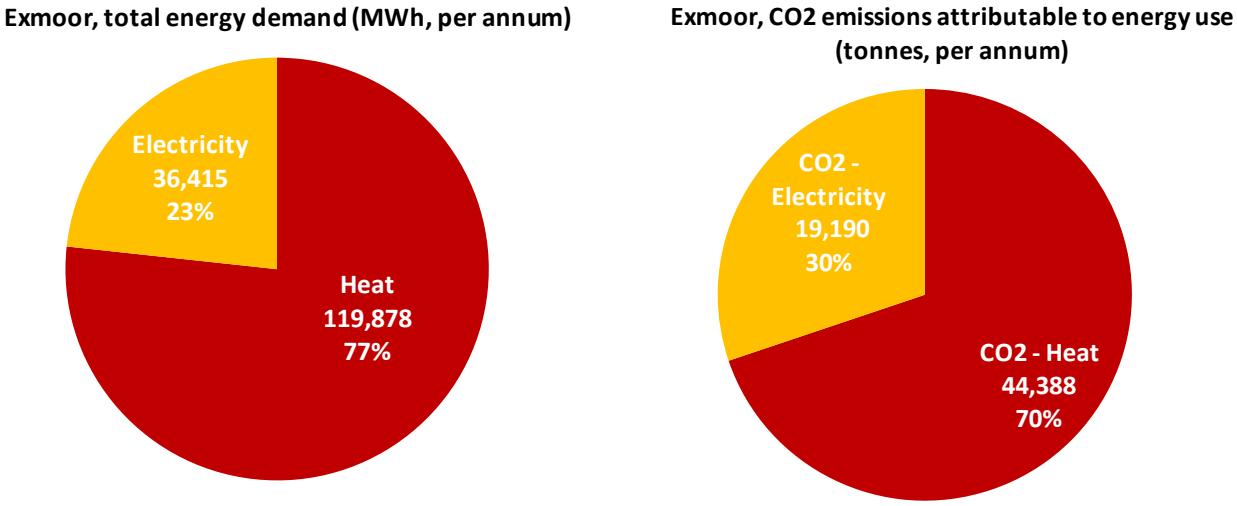


Figure 12: Energy demand and associated CO_2 emissions

The community of Exmoor spends an estimated £11.6 million on energy (excluding fuel for transport) every year. £7.4 million is spent by the domestic sector and £4.1 million by the industrial, business and commercial sectors.

Understanding how we use energy across Exmoor is critical to identifying the appropriate action to reduce the associated emissions and to identifying and utilising more sustainable sources of energy. Energy efficiency can reduce the overall demand and the residual demand can be supplied from renewable and more sustainable sources of energy. This will both reduce CO_2 emissions within the National Park and the amount of revenue leaving the local economy.

Methodology for assessing potential reductions of greenhouse gases

The energy efficiency and renewable energy resource assessments are available as sub reports to this strategy; only the key findings are summarised here. The assessments are based on 2006 CO_2 emissions data.

Each of the assessments has considered the potential activities (intervention measures) that will reduce emissions and by how much each of these measures will reduce or avoid emissions. All of the potential measures and the CO_2 reduction potential were modelled to determine which ones would be the most effective in achieving the target of carbon neutral by 2025.

For each renewable energy and energy efficiency measure, the cost of investment and return on investment to the local economy has also been modelled. This provides the information to understand the £/tonne of CO_2 reduced, the overall net benefit to the local economy through the displacement of imported energy and export of locally generated energy.

Understanding the most effective measures that will reduce CO_2 is vital so that policy and programmes can make well informed decisions about where best to focus resource. Of course priorities will shift and different groups and organisations will have different priorities. This strategy has focussed purely on its remit that is to assess how the target of becoming carbon neutral can be achieved by 2025.

However, the measures that have been proposed are subject to a range of factors including, cost, planning, public acceptance and take up to name but a few. In assessing the options, this strategy has first considered the most cost effective and least challenging and then added the more costly and more challenging in later years. The options are many and the interest from different parties to promote different options will inevitably vary. The options assessment undertaken for this strategy is reported as a sub report.

Energy efficiency to reduce CO_2 emissions -HEAT

The community of Exmoor spends an estimated £8 million on heat energy and £6.3 million of this is a cost borne by the domestic sector.

64,000tCO_2 are emitted from our use of energy (excluding transport) and assessments have estimated that these emissions can be reduced to 49,239tCO_2 by 2025 (a 23% reduction) if we implement an ambitious energy efficiency programme.

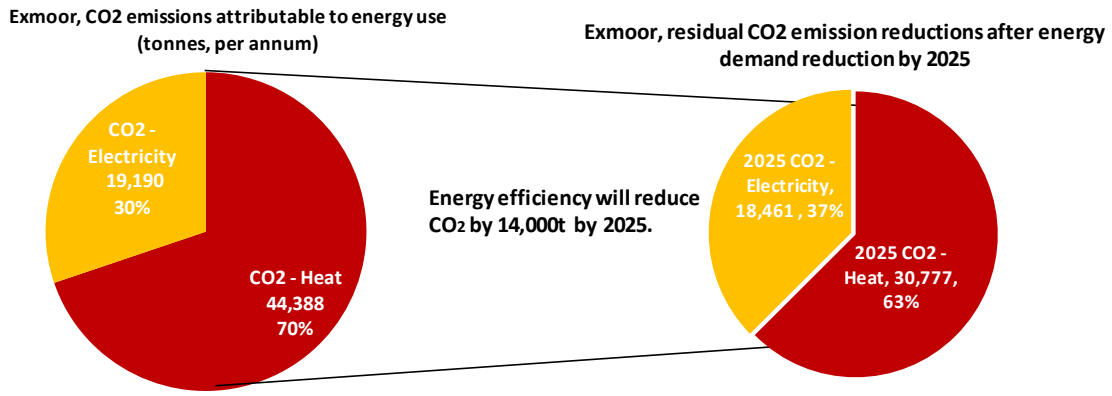


Figure 13: Potential CO_2 reductions from energy efficiency programme

Heat Energy

Just over 44,000 tCO_2 emissions are attributable to the energy we use for heat – this is 70% of the total emissions associated with our use of energy (excluding transport).

A range of energy efficiency measures for the domestic and industrial, business & commercial sectors will collectively achieve reductions of around 14,000 tCO_2 by 2025 (32% of the CO_2 emissions from heat energy) leaving a balance of 31ktCO_2 per annum.

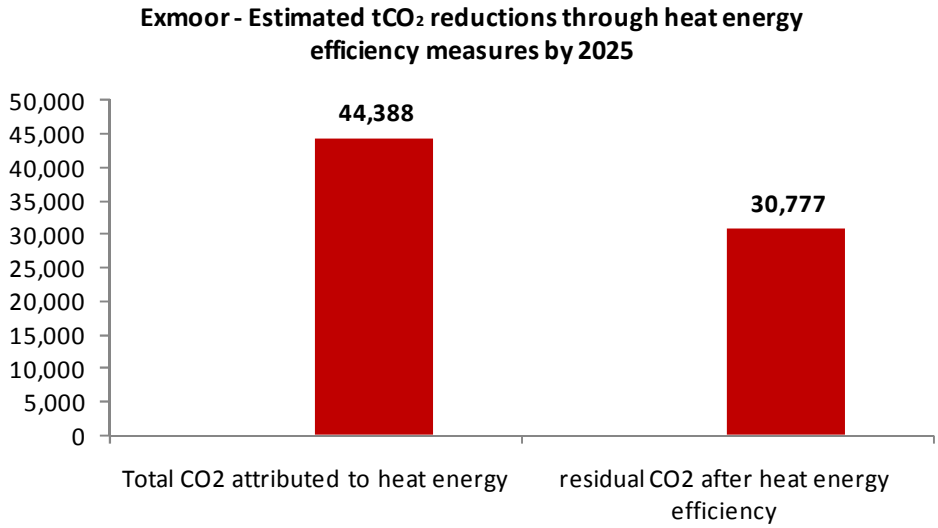


Figure 14: Estimated CO_2(t) reductions through heat energy efficiency measure by 2025

Domestic sector demand reduction -Heat

In the domestic sector the energy efficiency measures include insulation for cavity walls, solid walls (internal & external), lofts and floors as well as draught proofing.

An ambitious programme throughout the domestic sector would enable us to reduce the domestic CO_2 emissions by around 40% (of domestic heat emissions) by 2025. This is considered the maximum that can be achieved and includes solid wall insulation of more than 1,200 properties and all properties fully insulated in terms of draught proofing, cavity wall and loft insulation. This also made provision for 50% of all properties having floor insulation by 2025. Without solid wall insulation the reductions are estimated to be around 31% of total domestic emissions.

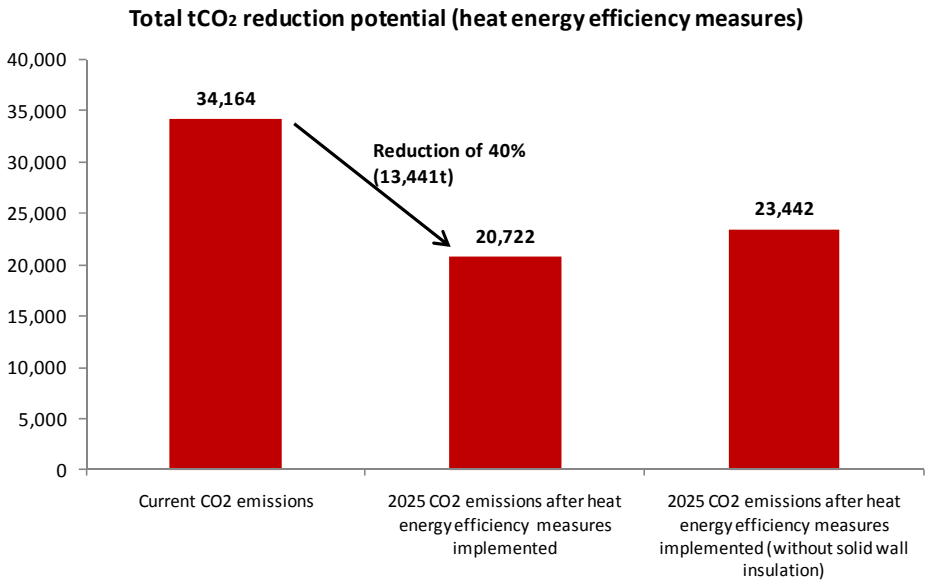


Figure 15: Potential CO_2(t) reductions by 2025 from heat energy efficiency in the domestic sector

Industrial, business & commercial sector demand reduction - Heat

Energy efficiency desk top modelling is normally less accurate for industrial, business and commercial sectors. Unlike the domestic sector which can be treated as fairly homogenous, the industrial, business and commercial sector has a variety of uses for energy to deliver its services. Further analysis is required to understand the potential to reduce CO_2 from this sector and in the meantime it has been assumed that less than 2%[7] (168t) of CO_2 reductions can be achieved through heat energy efficiency.

Energy efficiency to reduce CO_2 emissions -ELECTRICITY

Just over 19,000 tCO_2 emissions are attributable to the energy we use for power – this is 30% of the total emissions associated with our use of energy (excluding transport).

Demand reduction measures for electricity are more difficult to quantify than those for heat.

[7] Please note that this should be read as less than 2% of this sectors heat CO_2 (10,224 tonnes) or 0.4% of total heat emissions (44,388 tonnes).

Compact fluorescent (low energy) lighting is probably the simplest and cheapest way to save electricity. Smart meters can cut bills if the energy user is conscientious.

Over the last 25 years, there have been significant gains in energy efficiency. However, increased demand for electrical goods has more than negated this rise in efficiency. Over this time period, domestic electricity demand for lighting and appliances has increased by a factor of 2.5[8]. In the past few years, this growth in demand has flattened off and even become negative. Notably the switch over to digital is likely to increase energy demand for power and associated CO_2 emissions. Based on these assumptions we have assumed no overall CO_2 emissions reductions through electricity energy efficiency in the domestic sector.

For the industrial, business and commercial sector we have estimated that 5% reduction of CO_2 emissions by 2025 will be achieved against current emissions associated with electricity used for power.

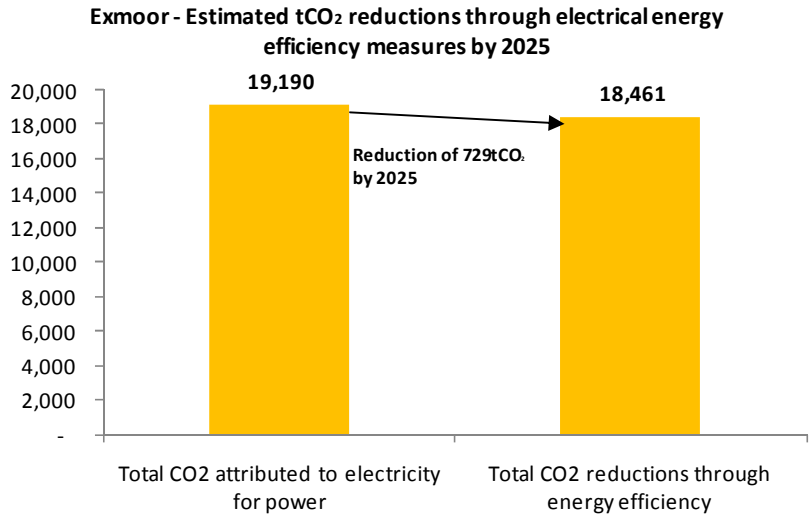


Figure 16: Estimated CO_2(t) reductions through electrical energy efficiency measures by 2025

Cost benefits

The total cost of energy efficiency measures to the domestic sector is estimated to be in the region of £7 million but the benefit to the local economy is estimated to be in the region of £3.5 million over the period of the programme. because of the cost of energy saved. This is a saving to the local economy year on year once the measures have been implemented. Some of this saved income may be spent on locally produced goods and services thereby benefitting the local economy. If solid wall insulation (which will be very difficult to implement on the scale suggested) is removed from calculations then the cost is £4.5 million and the savings around £2.5 million.

Cavity wall and loft insulation and draught-proofing are all eligible for grant funding so the cost should not be seen as one that must be entirely borne locally. However, it should be noted that

8 BRE domestic energy fact file 2008

grant funding is dependent on the income and status of the householder so that in some cases, costs will need to be found by the householder. There are programmes that are being piloted to tackle 'whole house' energy measures including solid wall and floor insulation as well as microgeneration technologies such as solar thermal and heat pumps. These are proposed to be on a low cost loan basis.

Renewable Energy Assessment and Potential - HEAT

For the National Park to be carbon neutral by 2025, the renewable energy (RE) resource potential of the region must be utilised by installing technology that can capture and use that energy.

The key finding of the renewable energy assessment is that a reduction of 28,239 tCO_2 per annum can be achieved through the deployment of RE heat technologies. This is 44% of total energy attributed CO_2 and 74% of the CO_2 emissions attributable to heat energy on its own.

Biomass, (wood, log, pellet and chip), heat pumps (air and ground source) and solar thermal technologies would be suitable for use across Exmoor. To achieve the reductions of CO_2 seen here would require the installation of:

- 2,973 biomass boilers
- Nearly 2000 heat pumps (40% of the theoretical limit)
- And 979 solar thermal units (20% of the theoretical limit)

Indicative costs per unit have been included in brackets in the list of technologies though these will vary in reality.

There is room for growth in some areas like business and commercial (including industrial) but equally the number of technologies that will actually be deployed is ambitious yet necessary to achieve the target. The figure below shows the relative contribution of each technology against heat demand emissions and total energy demand emissions.

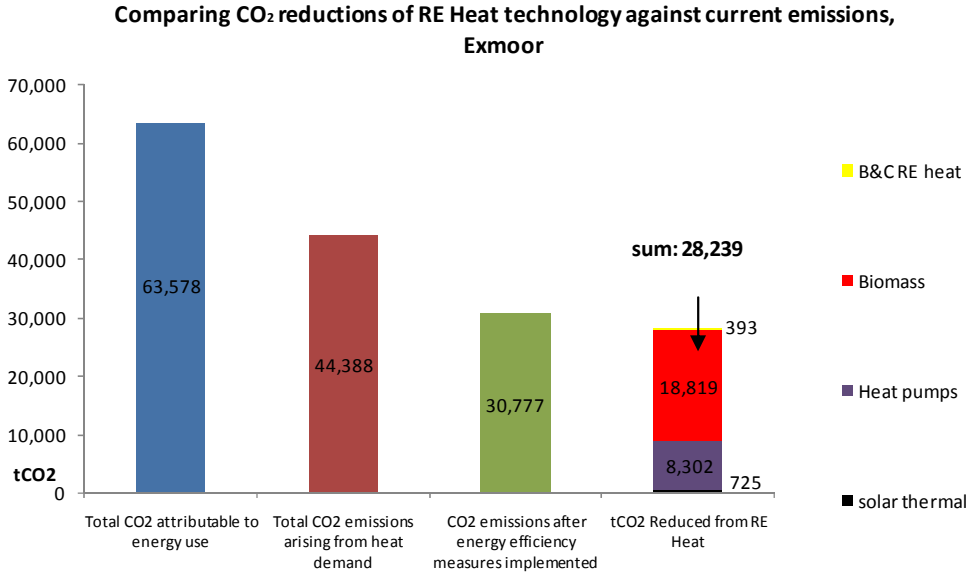


Figure 17: Comparing CO2 reductions of RE heat technology against current emissions

Note: B&C in the above figures refers to business and commercial and in some data sets is reported as industrial and commercial. These are interchangeable in this document. Because this sector cannot be treated as homogenous as the domestic sector a percentage reduction has been applied rather than specific measures for a range of specific processes and activities. In reality there will be many differences and this percentage could increase or even decrease. This provides a baseline for the purposes of this assessment and recommends a programme to address emissions from business including the agricultural sector and other related activities to land use and management, transport and energy use.

Resources exist in the National Park to supply 102,984 MWh (86%) toward the total current heat energy demand of 119,878 MWh. This is just 16,894MWh (14%) short of the estimated demand as shown in figure below.

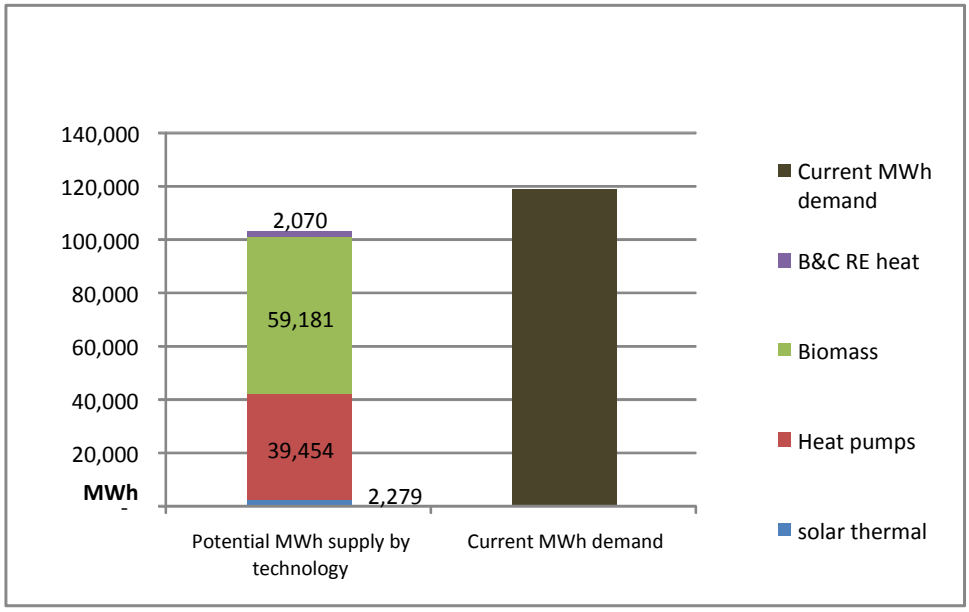


Figure 18: Potential MWh RE heat supply for each technology against current demand

Considering the renewable energy contribution to reducing emissions in isolation does not take account of the reduction in emissions from the energy efficiency programme. If the energy efficiency programme is implemented over the next 15 years it will reduce the energy demand for heat. In turn this will reduce the renewable energy requirements to supply heat across Exmoor. For example if the energy efficiency programme is implemented alongside a renewable heat programme then the forecast suggests that by 2022, heat demand will almost be met by supply.

The total cost of implementing the renewable heat technologies is estimated to be £52 million and the most cost effective of these appears to be wood and other biomass boilers and heat pumps with a Coefficient of Performance (CoP) of 4.

Renewable Energy Assessment and Potential - ELECTRICITY

The CO_2 emissions associated with the use of electricity for power is 19,190 tonnes per annum. A reduction of 19,561 tCO_2 per annum can be achieved through the deployment of RE electricity technologies if implemented by 2025. This is a 45% reduction against total delivered electricity

attributed CO_2 of 43,423 tonnes (including that used as heat) and 102% of the CO_2 emissions attributable to the use of electricity for electrical (power) purposes.

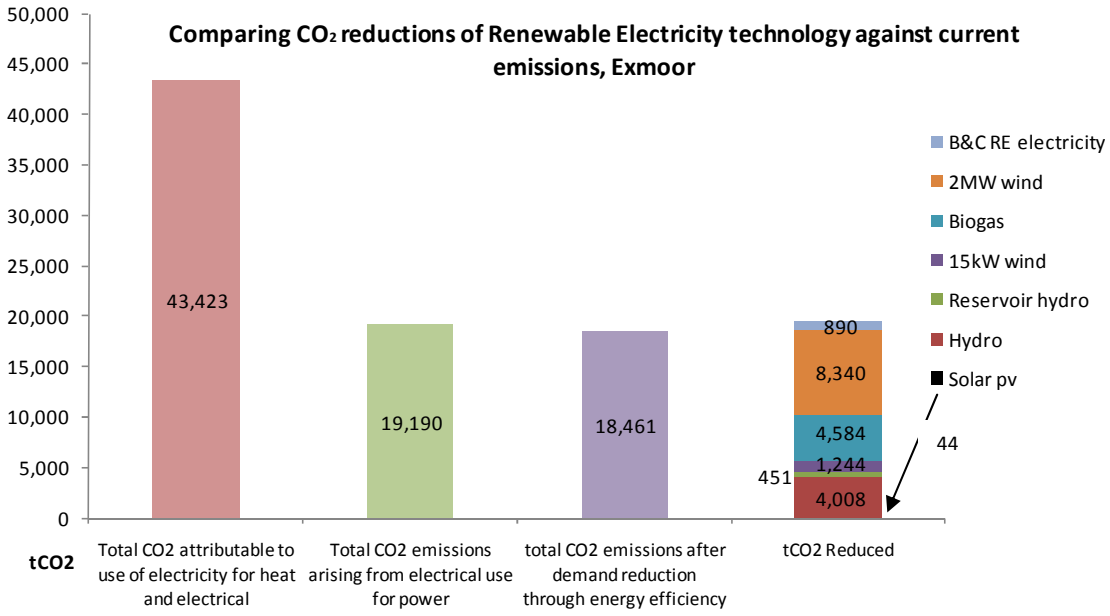


Figure 19 Comparing CO2 reductions of RE electricity technology against current and future emissions

The theoretical renewable electricity resource of Exmoor is estimated to be 64,580 MWh. Given that the electricity demand is estimated to be 36,415MWh the renewable electricity potential will exceed current demand by 28,165MWh and could save/avoid CO_2 emissions of 33,582 tonnes per annum.

This excludes tidal technology which could generate up to 1 TWh. Tidal turbines are a potential source of renewable energy off the north coast of Devon where the tidal conditions for this type of technology are some of the best in the country. Recent tests of the technology off the Lynmouth coast are reported to show positive results. However, the technology is not yet commercially proven so the potential has been excluded here. [Please refer to the Renewable Energy Assessment sub report for more information].

However, it should be noted that the resource and the application of technology to utilise that resource are very different. The options assessment considered the implementation of that technology and presents a very ambitious programme which will achieve **48,406 MWh** by 2025 and not the theoretical limit of 64,580 MWh.

The supply of electricity for use in non-heat purposes meets demand by 2021 if the intervention measures proposed here are implemented up to 2025.

To achieve this would require installing the following technologies.

- Three 2MW wind turbines;
- 20 small scale biogas plants
- Fifty one 15kw (11 metre) wind turbines

- Developing 100 hydro schemes
- Developing one reservoir hydro scheme
- Installing around 30 solar photo voltaic units

Since the announcement of the Feed in-Tariff from April 2010, the value /MWh is likely to be greater and more cost effective since time of writing the assessment

However, without wind power the electricity demand of the National Park area is unlikely to be met unless further research shows that reservoir hydro is a greater resource than estimated here. For example without wind power only 26,217 MWh is likely to be supplied leaving a shortfall of just over 10,000 MWh's. Because the efficiency of wind turbines improves greatly with the height and size of the turbines, deploying larger turbines would mean that the electricity demand could be met with far fewer turbines. For example 32,185 MWh/year (current demand) represents four to six, 2MW wind turbines. However, the deployment of larger turbines is considered to be unlikely to be a realistic goal given landscape considerations within a National Park.

What should be noted is that a significant proportion of electricity generated is likely to be exported to the grid and not used locally. This is especially the case with wind and hydro (larger scale) unless private wire is installed and utilised for local distribution. This has implications for achieving the carbon neutral target which is outlined in section 3 of this document.

The total cost of implementing the renewable electricity technologies is estimated to be £23 million.

This assessment has estimated the value to the local economy through the displacement of grid imported energy (savings) and used this to calculate the payback in years. The value to the economy just in terms of energy saved from the deployment of RE technology is estimated to be just over £5M by 2025. This gives an average payback of 4.6 years. This does not include reservoir hydro because of the uncertainty of resource.

Case study: Torrs community-owned hydro-power scheme

This Exmoor carbon neutral programme recommends that opportunities for community owned renewable energy schemes are identified and supported. The Torrs community owned hydro-power scheme in New Mills, in the Peak district is an example of how this can be achieved.

The Torrs Hydro New Mills Ltd (THNM) www.torrshydro.co.uk is a community owned company which was set up to raise funds for and manage a 63kW Archimedes Screw hydropower system. With the assistance and support of Water Power Enterprises, the scheme was deployed less than two years after the idea had originally been raised.

The scheme had the strong support of the local community which helped considerably in raising funding for the project. Funding was provided by the East Midlands Development Agency (£75k), the Co-operative Fund (£75k) and the Peak District Sustainable Development Fund (£15k). However, the biggest fund-raising initiative turned out to be a share issue which raised £98k in just over two months. The total cost of the scheme was in the region of £250k.

Indicative costs to implement energy programme

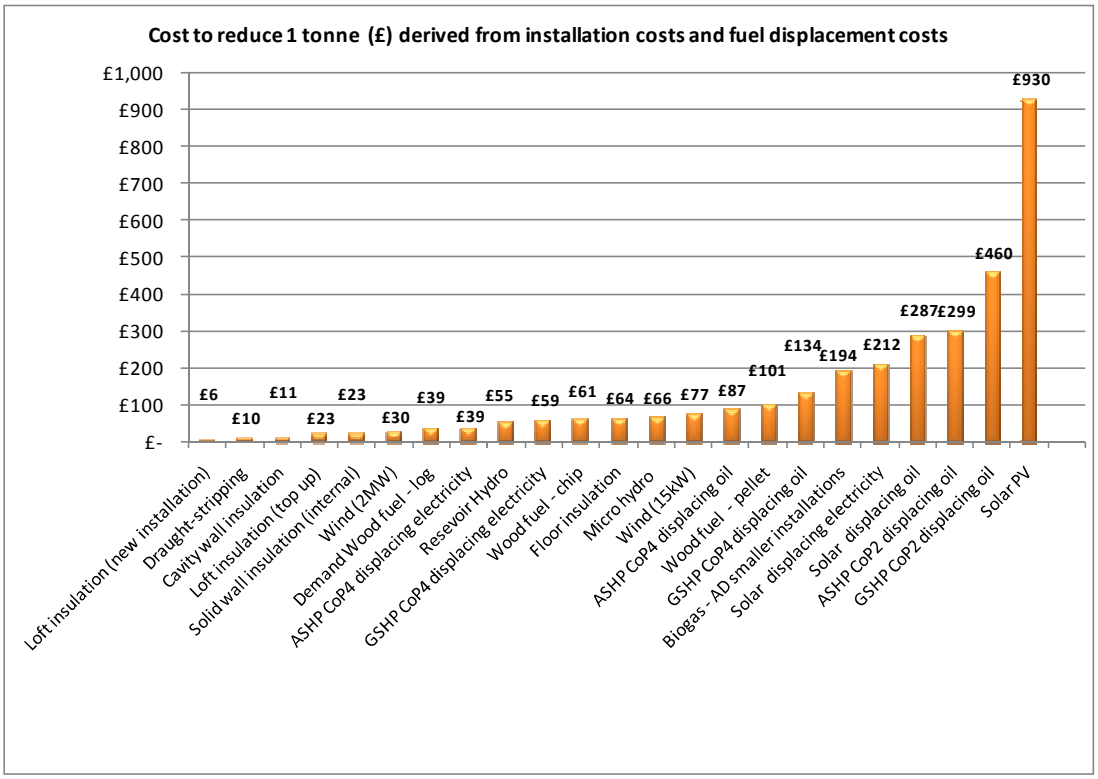
The level and rate of practical action over the timescale can and probably will change and the example programme has been presented for demonstration purposes only. It provides a snapshot of the level of intervention that would be required so that there is an appreciation of what this would mean in practice including the indicative costs.

The following tables provide information about the level of costs to install the energy measures identified to help meet the carbon neutral target. However, there is a cost benefit associated with implementing these measures and the details of the cost displacement and value coming back to the economy can be found in the sub reports to this document.

Understanding the cost benefit of different technologies is one measure but perhaps a more important measure to understand is how much it costs to reduce 1 tonne of CO_2 for different measures implemented. In developing this carbon neutral strategy the assessment proposes that the key criteria to consider is the cost effectiveness of the measures in £/tCO_2 reduced and absolute tonnes of CO_2 that can be achieved by implementing the measure.

Because of the lack of available information the costs of agricultural, lulucf and transport measures have not been modelled using this methodology. Only renewable energy and energy efficiency measures have been modelled in this way. It is recommended that when data does become available to model the other measures in this way then this should be undertaken and compared to provide a more complete assessment to help support future decisions.

The cost effectiveness takes into account the installation cost, the revenue generated if it can be exported (for example electricity from wind to the grid) and the cost savings where more expensive fuel is displaced. The following figure shows the results of this modelling.



The following tables present the Heat and Electricity measures separately with an estimation of the required capital costs by year and by technology.

Year	Solar PV	Hydro	resevoir hydro	15kW Wind	Biogas	2MW Wind	Capital funding requirements (£)
2010	2						54,000
2011	2						54,000
2012	2	6			2		1,373,320
2013	2	5			2		1,320,100
2014	2	4			2		1,266,880
2015	2	7	1	5	2		2,014,040
2016	2	7		4	2		1,576,540
2017	2	7		4	2		1,576,540
2018	2	7		4	2		1,576,540
2019	2	7		5	2		1,614,040
2020	2	10		5	2		1,773,700
2021	2	7		5	2	3	6,614,040
2022	2	9		5			720,480
2023	2	7		5			614,040
2024	2	10		5			773,700
2025		7		4			522,540
Total	30	100	1	51	20	3	23,444,500
capital for each technology across the period	810,000	5,322,000	400,000	1,912,500	10,000,000	5,000,000	23,444,500

HEAT											
Year	Solar thermal	Biomass	Cavity wall insulation	Solid wall insulation (external)	Solid wall insulation (internal)	Loft insulation (new installation)	Loft insulation (top up)	Floor insulation	Heat Pump	Draught-stripping	Capital funding requirements (£)
2010	61	184	353			304	558			306	2,338,509
2011	61	184	353			304	558			306	2,338,509
2012	61	184	353			304	558		4	306	2,378,509
2013	61	184	353	48	48	304	558		2	306	2,560,975
2014	61	184	353	48	48	304	558	245	-	306	2,785,775
2015	61	184		48	48			245	-	306	2,458,963
2016	61	184		48	48			245	-	306	2,458,963
2017	61	184		48	48			245	212	306	4,574,519
2018	61	184		48	48			245	218	306	4,634,519
2019	61	184		48	48			245	218	306	4,634,519
2020	61	184		48	48			245	218	306	4,634,519
2021	61	184		48	48			245	218	306	4,634,519
2022	61	184		48	48			245	218	306	4,634,519
2023	61	184		48	48			245	218	306	4,634,519
2024	61	184		48	48				218	306	4,389,719
2025	61	184		48	48				218	306	4,389,719
Total	979	2,937	1,763	627	627	1,518	2,791	2,448	1,958	4,896	58,481,275
capital for each technology across the period	4,160,750	27,659,209	528,900	1,441,364	1,190,692	379,500	725,660	2,448,000	19,580,000	367,200	58,481,275

Transport emissions and alternatives

Annual emissions from transport are estimated to be 63,256 tCO_2e. 95% of this is in the form of carbon dioxide, the balance in nitrous oxide and they arise exclusively from road transport. This represents 17% of total emissions across the National Park, making the sector the second largest contributor.

Transport emissions in the National Park arise exclusively from road transport, as there are no railways.

Per head of population, transport emissions represents 5.1 tonnes, well above the UK average. This is a consequence of these factors:

1. The rural nature of the National Park, with long distances to services.
2. Weak public transport infrastructure.
3. A significant contribution from visitors.

Additionally, average vehicle size is likely to be above the regional average, and vehicles will tend to be older and less carbon efficient.

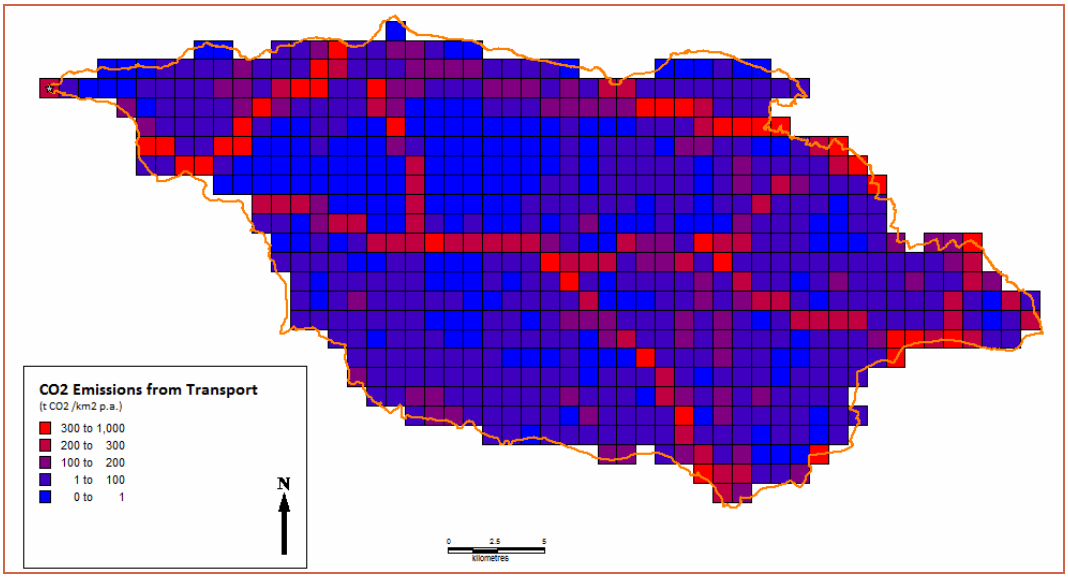


Figure 20: Spatial distribution of transport emissions

The spatial distribution of transport emissions (Figure18) follows road vehicle volumes, with the highest emissions focused along the A39 Minehead- Taunton road on the north east-fringes of the National Park, and lower volumes around Dulverton, between Minehead and Porlock, Raleigh's Cross and Simonsbath, and Lynton/Lynmouth to Barnstaple.

The UK government forecasts a significant increase in traffic volumes, accompanied by a range of policy measures that increase fuel efficiency. The net effect will be that emissions from transport in 2025, under business as usual conditions, are expected to be similar to those of today.

Measures to reduce emissions from the transport sector can be divided into efficiency measures and demand reduction measures. The former measures include both vehicle technology improvements and fuel substitution, both of which are already included in the forecast for 2025.

A transition to electric vehicles has been included in the modelling for this consultation and an assumption has been made that 10% of Exmoor vehicle kilometres will be replaced by electric vehicles by 2025 saving 5% of the transport related carbon emissions.

Ultimately emissions reduction targets for transport can only be met if people drive their cars less. There are a number of well known policy measures that can encourage this, such as improved facilities for home working (better broadband connections, for example), encouragement of car share schemes for commuting, and home delivery of goods to reduce individual shopping journeys.

Residents of deep rural areas in the Exmoor National Park, many living well away from any regular scheduled bus routes, should have transport options as alternatives to the private car. The operation of private car clubs, in which a local membership shares access to a small number of cars, can be a cost effective and efficient use of limited resources. There is also some potential for the current Demand Responsive Transport service in West Somerset to be extended to anyone who wishes to use it in deep rural areas, providing extra choice to people, perhaps alongside car club membership.

Promotion of these sorts of initiatives across the National Park could potentially reduce transport emissions by around 21.5% (13,600tCO_2) by 2025.

Land use and management

Farming, land-use and land management give rise to over half of all greenhouse gas emissions in the Exmoor National Park. This is an unusually high proportion, but easily explained by the importance of these activities to the area and its relatively low population. There is also a significant, but much lower, rate of carbon removals by processes such as woodland planting and restoration of peat mires.

Carbon dioxide, methane and nitrous oxide each contribute about a third of the greenhouse gas emissions in this sector. Methane is produced by enteric fermentation in cattle and sheep, while nitrous oxide comes mainly from breakdown of artificial nitrate fertilisers. Carbon dioxide arises from land-use changes that alter the carbon storage capacity of soils; arable land, for example, holds very little carbon in the soil compared with permanent grassland or heathland, although it can take many decades for the soil carbon to reach a new balance after a land use change has been made. Woodlands have the highest carbon storage, so woodland planting involves removal of carbon from the atmosphere over a period of time.

Changing the use of land has an impact on carbon emissions as illustrated in the figure below and reflects the subsequent change in carbon storage in the vegetation and/or soil organic matter. Woodlands have the highest carbon storage per hectare and grasslands have higher soil carbon storage capacity than crops, so ploughing of grass and heath land results in loss of carbon storage and in CO_2 emissions. Conversion of land to settlements (development) also causes loss of stored carbon. Most of these changes involve a long period of adjustment in the carbon balance. Policies to

support land use changes that increase removals, such as afforestation, will also take many years to have full effect.

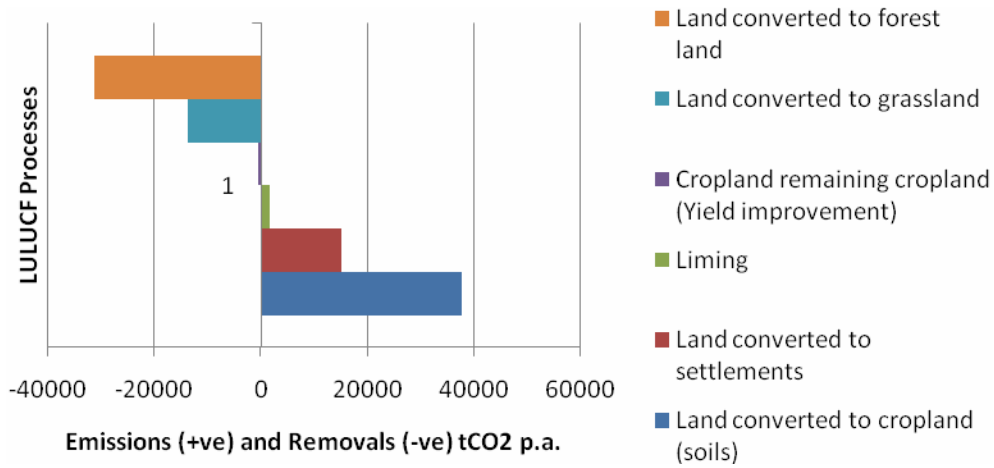


Figure 21: Emissions and removals from land use and management

Afforestation has several climate change benefits Trees lock carbon up in their biomass and the soil around them as they grow; the wood when harvested can substitute for other products of higher carbon intensity, such as fossil fuels in power or heat generation. Newly planted woodland can be managed as short rotation coppice, cut on a cycle of around four years, short rotation forestry, on a cycle of 20 years, or left to a full economic rotation of around 80-100 years for broadleaves. In addition to carbon sequestration and fossil fuel substitution, afforestation can potentially benefit us in terms of climate change adaptation. Appropriately planted woodland can slow down the rate at which rainfall enters streams and rivers and prevent erosion thereby mitigating flooding.

Technically, there is considerable potential for establishing new woodland in the National Park. Areas of Grade 4 agricultural land with low biodiversity value and shallow to moderate slopes are likely to be most suitable. The draft programme proposes a significantly increased planting rate of around 160 hectares per year, with a mixture of short rotation coppice, short rotation forestry and long rotation broadleaved woodland.

Another land-use change that can have significant carbon benefits is the increased planting of Miscanthus, provided that the end use is restricted to local heat generation or combined heat and power (CHP). Grade 3 agricultural land with relatively low wind exposure is technically suitable, conditions locally concentrated around the northern slopes of the Brendon Hills. The draft programme allows for around 1500 hectares of Miscanthus to be established by 2014.

An important quantity of carbon is stored in peat in Exmoor's blanket mires and valley fens. This store is at risk from drying out and erosion but can be increased by mire restoration. The programme supports an extended "Mires on the Moors" project that will have biodiversity, water quality, flood alleviation and climate change benefits.

Case Study: Exmoor mire restoration project

Rewetting the top layer of peat prevents it from drying out, oxidising and releasing carbon into the atmosphere. In addition to this the peat that will accumulate as a consequence of this work will store an estimated 135 tonnes of carbon in the new layer. The annual restoration rate is likely to be at least 270 hectares per annum.

We have estimated savings of 4,500tCO_2e from mire restoration by 2025.

Over twenty measures have been identified that can help to reduce greenhouse gas emissions arising from agricultural activity. The Climate Change Committee, in preparation for its report to government in December 2008, commissioned a major review of the measures available to mitigate greenhouse gas emissions in various sectors. Section 5 of the Carbon Neutral Assessment sub report summarises the main conclusions on agriculture, land use and forestry relevant to the Exmoor National Park. Most apply to grassland management, and are designed to build up carbon storage in the soil organic matter.

Crops and soils

Examples include using manure nitrogen as far as possible, and reduced or zero tillage. With 2349 hectares under crops in the National Park, these measures can potentially reduce emissions individually by between 200 and 2400 tonnes CO2e/yr. The benefits are not necessarily additive though, as there are interactions between them. Some of these measures are applicable to permanent grassland. With 35000 hectares of permanent grassland such measures clearly have greater potential for total emissions reduction or increased removals.

Many of these are cost negative i.e. introducing them will generally save farmers money.

Livestock measures

The main abatement options from the livestock sector, independent of grazing/pasture management, are through the efficiencies with which ruminant animals utilise their diet and manure management. The livestock measures assessed in the Scottish Agricultural College report refer to cattle, and, in a few cases, to pigs and poultry. None refer to sheep, as the authors assume that traditional extensive methods of sheep husbandry will continue. The relative impact of these measures in the National Park is therefore likely to be limited.

Part 2 - Can Exmoor become carbon neutral by 2025?

In order to achieve a carbon neutral national park by 2025 the gap between the baseline emissions and removals (i.e net emissions 305,870 t CO_2e) must be bridged by that date.

Even after an ambitious programme our net emissions will be 197,851 tonnes per annum in 2025 if we do not account for renewable energy export in our target, or 116,144 tonnes per annum if we do.

According to the assessments and subject to today's technology and knowledge, then Exmoor can only become carbon neutral if it offsets or enables greenhouse gas emission reductions elsewhere. However, offsetting would entail investment by the community as a whole as opposed to an individual organisation. Consequently it is difficult to envisage how this may be achieved.

Carbon offsetting '*is a way of compensating [for our emissions] by making an equivalent carbon dioxide saving elsewhere. Carbon offsetting involves calculating emissions and then purchasing 'credits' from emission reduction projects*'[9].

The proposed carbon neutral programme will implement a range of activities and these have been categorised as:

- **Demand reduction**: Includes energy efficiency, behaviour change and fuel switching in areas of energy consumption, (heat and electricity) and fuel for transport.

- **Renewable energy**: Includes micro-generation technology such as solar thermal, biomass (wood) boilers and heat pumps as well as larger scale renewable technology. This has been further subdivided to account for **renewable energy use locally** and **renewable energy exported** to the national grid.

- **Biosphere removals:** which includes projects like mire restoration and changes in land use for example more woodland planting to sequest CO_2 from the atmosphere.

- **Carbon offsetting:** A compensatory mechanism where emissions are reduced outside of the National Park but are equal to the residual emissions from activities within the National Park Area

Exmoor's baseline greenhouse gas emissions stand at 351,774 tonnes pa. If the range of **demand reduction** activities and **local renewable energy technologies consumed locally** are implemented in accordance with the programme then by 2025 a reduction of 57,943 tonnes of CO_2 will be achieved.

This is reflected in the figure below where greenhouse gas emissions are projected to be at 293,831 at 2025, down from 351,774 today. These measures alone cannot deliver a carbon neutral Exmoor.

[9] The definition of carbon offsetting according to DEFRA

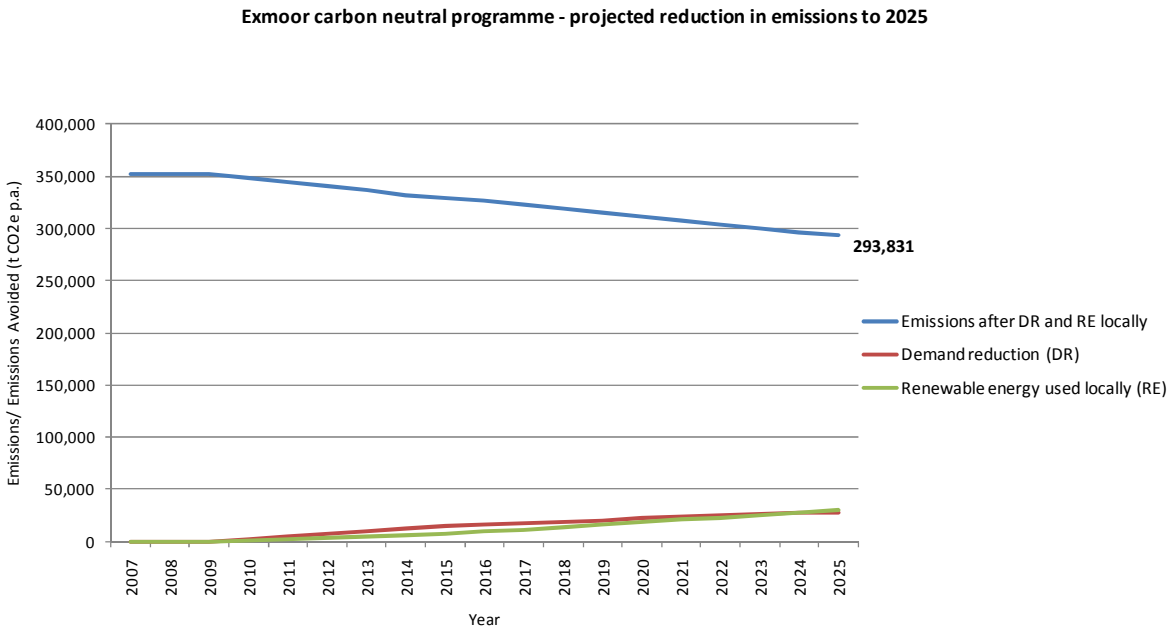
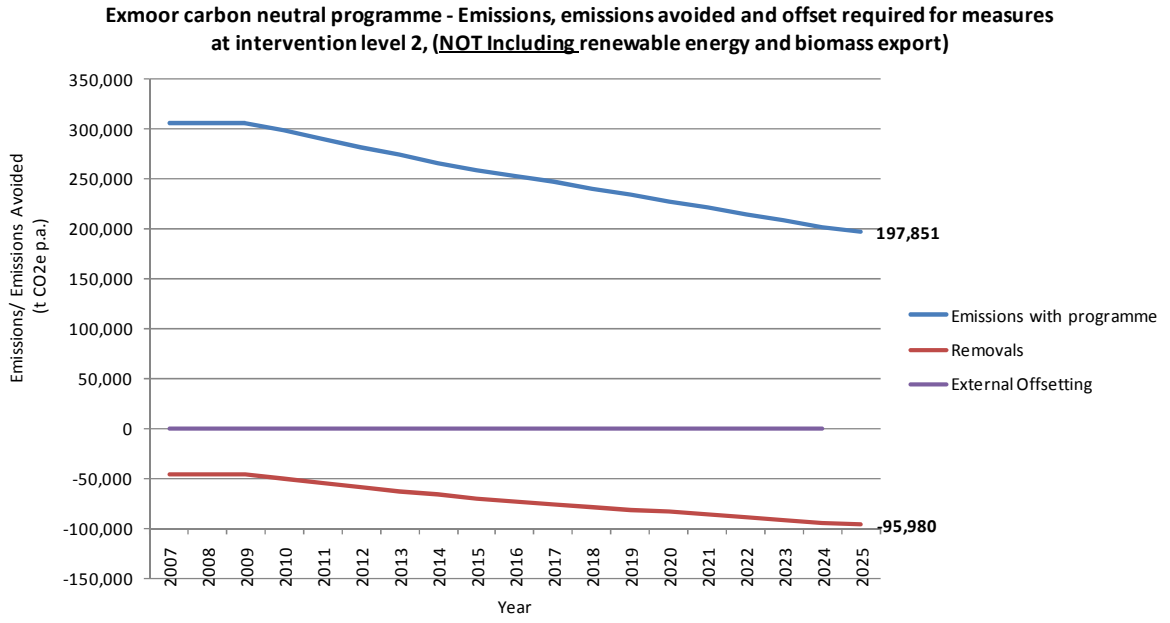


Figure 22: Exmoor carbon neutral programme – projected emissions to 2025.

In order to achieve a carbon neutral national park by 2025 the gap between the baseline emissions and removals (i.e net emissions 305,870 t CO_2e) must be bridged by that date.

Figure 23 below takes account of the removals and show that the overall net emissions will fall further to 197,851 tCO_2e by 2025. External offsetting is set at zero.

Figure 23



Please note offsetting is set at zero, residual emissions are equal to 197,851 tCO_2e.

This is still a long way short of achieving carbon neutral by 2025 and the Exmoor community needs to consider not only how, but if it is possible, to achieve carbon neutral status at all.

Two elements of the above equation have not been accounted for; renewable energy export and carbon offsetting.

Renewable energy export

In defining carbon neutrality questions arise around which CO_2 emissions and reductions should and can be accounted for and claimed against the National Park's target. The decision about what to include will influence the measures implemented and the priority given to each.

CO_2 emissions associated with electricity use are normally accounted for at the point of end use or consumption. The emissions associated with electricity are an average of the fuel mix delivered through the national grid, (a mixture of power from coal, gas and nuclear power stations and renewable energy). So the figure normally used to calculate consumption of electricity has already taken account of the renewable energy that has been exported to the grid. Therefore if we account for it at the point of generation and at the point of end use then it is effectively double counting.

However, if local distribution networks or private wire are used to first utilise the energy locally then the CO_2 reductions can be claimed against target as well as any economic benefits that may arise. Furthermore, if renewable energy is first used locally the CO_2 savings associated with its use are greater than if it was distributed through the national grid and then used. This is because of the losses associated with distributing the power over long distances.

In practice the deployment of renewable energy if exported to the grid does not physically displace CO_2 emissions from the energy used in the National Park. Instead it is absorbed as part of a national average reduction because it is part of the national grid energy mix. By comparison substituting oil or electricity with wood or solar power does displace CO_2 emissions associated with energy in the National Park.

This principle also applies to any biomass that might be exported. If we export 500 tonnes of woodchip to Gloucester for example, the reduction in emissions associated with someone in Gloucester switching from electricity to heat their home to wood chip would be accounted for by them.

If it is decided that the Exmoor National Park will include renewable energy export (including biomass) within its target then the residual emissions are 116,144 tonnes per annum at 2025 as reflected in the figure below.

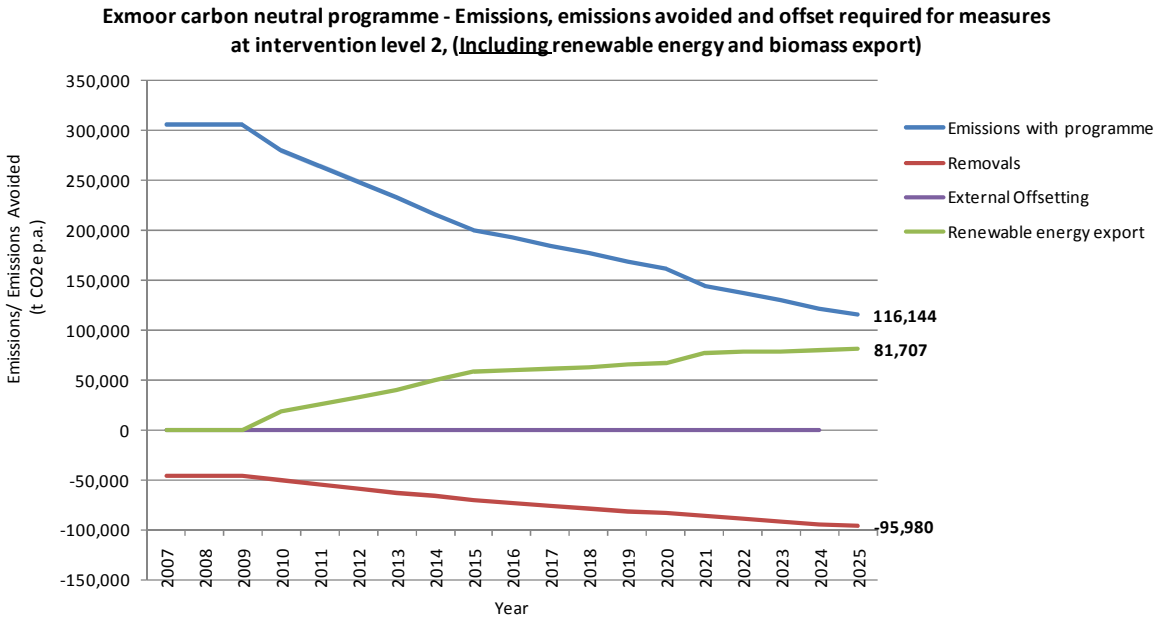


Figure 24 emissions reductions if RE and biomass export are included in the target figure

The figure (25) below tabulates the relevant contribution of each activity toward the carbon neutral target. The first table reflects this by CO_2 equivalent and the second table shows the breakdown by greenhouse gas.

Activity	Assessed Reduction by 2025
Land Use Management	-95,980
Mire restoration	-4,500
Woodland removals	-16,172
Woodland storage	-9,364
Improved fertiliser	-16,740
Livestock measures	-3,300
Lulucf	-45,904
Demand Reduction	-27,960
Energy efficiency - Heat	-13,610
Energy efficiency - Electricity	-729
Transport behaviour change	-10,897
Transport electric car use	-2,724
Renewable energy	-111,690
RE used locally	-29,983
Re export - biomass	-63,889
Re export - Electricity	-17,818
Miscanthus as fuel	-4,978
Total potential reductions	-235,630
Total baseline emissions	351,774
Residual emissions at 2025	**116,144**

Miscanthus not included in total - because would be included in woodland removals

Source	All	Carbon dioxide	Methane	Nitrous Oxide
Domestic	42,593	39,066	2,425	1,102
Business/industry	32,550	24,742	5,315	2,493
Transport				
Cars	36,815	34,851	27	1,937
Trucks & vans	26,441	25,031	19	1,391
Total transport	63,256	59,882	46	3,328
Agriculture				
Fertilisers	68,073	-	-	68,073
Enteric fermentation	50,198	-	50,198	-
Other	40,620	20,956	8,582	11,082
Total Agriculture	158,891	20,956	58,780	79,155
LULUCF				
Emissions				
Liming	1,635	1,635	-	-
Land to settlements	15,092	15,092	-	-
Land converted to cropland	37,730	37,730	-	-
Total LULUCF Emissions	54,457	54,457	-	-
Removals				
Afforestation	- 31,442	- 31,442	-	-
Land conevrted to grassland	- 13,834	- 13,834	-	-
Cropland yield improvemer	- 629	- 629	-	-
Total LULUCF Removals	- 45,905	- 45,905	-	-
Net LULUCF	8,552	8,552	-	-
Overall total (net)	305,842	153,198	66,566	86,078
Overall total emissions	351,747	199,103	66,566	86,078
Overall total removals	- 45,905	- 45,905	-	-

Figure 25 contribution of each activity toward the carbon neutral target

Carbon offsetting

Even after an ambitious programme of activity is delivered, Exmoor will be required to use offsetting as a mechanism to achieve carbon neutrality by 2025. The cost of offsetting will be in the range of £5.9m -10m[10] per annum by 2025 depending on whether renewable energy export is included the local target or not. (Note: in the above figure carbon offsetting is set at zero).

Carbon offsetting *'is a way of compensating [for our emissions] by making an equivalent carbon dioxide saving elsewhere. Carbon offsetting involves calculating emissions and then purchasing 'credits' from emission reduction projects'.*

These emission reduction projects can happen anywhere in the world and in many cases prove more cost effective at reducing the CO_2 than here in the UK. If the National Park area offsets its emissions

[10] This is based on the shadow price of carbon – £51 per tonne at the time of writing

it must be sure that the carbon offset genuinely and effectively avoids or sequesters an equivalent tCO_2 elsewhere.

Without offsetting it is difficult to see how the world will achieve the reductions in CO_2 required to prevent runaway climate change. We have a limited budget and according to the scientists, limited time to prevent runaway climate change.

In the Stern Review (2005) Lord Stern wrote that *'we must reduce emissions, wherever and however it is cheapest to do so'* and overseas carbon reduction is often more cost effective than reducing CO_2 here in the UK.

Until recently, becoming carbon neutral has usually been applied at an organisational or individual level. But in recent years other geographical areas have announced their intention to become carbon neutral, including The Isle of Wight and the Maldives.

To deal with its residual emissions then, the Exmoor community would need to consider how it will achieve carbon neutral status. It can be achieved through offsetting as outlined above or by engaging in projects overseas through a twinning arrangement. These projects could range from implementing renewable energy to reforestation and other land use projects that will sequester carbon.

Twinning with another community will bring many benefits (for example knowledge transfer) and could stimulate reforestation, soil replenishment and similar activities that will sequester carbon dioxide for the benefit of all. If twinning is undertaken with vulnerable communities then the benefit to that community will be climate change adaptation and social and economic development.

Part 3 – Implementing actions to reduce emissions

Proposed programme

The assessment was undertaken in accordance with the following four areas of activity:

- Land use management
- Transport
- Energy efficiency and
- Renewable energy

The proposed measures in each of these areas of activity have been modelled to assess their impact on the overall carbon neutral target and the results have been presented. Variations will exist and over time the activities will be reviewed for their effectiveness.

To initiate the process the proposed programme comprises the following range of activities.

Energy efficiency

An ambitious energy efficiency programme will deliver just under 17,000t of CO_2 reductions per annum at 2025. This includes solid wall insulation on over 1200 properties and cavity and loft insulation on every property across Exmoor that is suitable to take it.

Forum 21 on the West Somerset side of Exmoor already undertakes energy surveys and the sustainable energy plans run surgeries within the communities to increase the uptake of national incentives. Where possible other sustainable energy advice services are brokered in to complement the local work, avoid duplication and make best use of nationally funded support.

Continued support for these activities is necessary and will need extending beyond the current scope to increase the rate of uptake. It will also need to include the facilitation of other energy efficiency measures like solid wall and floor insulation that are not currently covered by existing programmes.

The industrial, business and commercial sector would also benefit from support in this area. National and regional programmes do exist to support this sector but uptake has been historically poor in the wider Exmoor area.

Renewable energy

Promotion and implementation of renewable energy across Exmoor can collectively deliver reductions/avoidance of 111,690t of CO_2 emissions by 2025. This includes a range of micro-generation technologies (less the 50kW) and some larger scale projects.

Experience from the six communities assisted in developing sustainable energy plans during 2009 has revealed the need for and benefits of support in this area. There is a willingness on the part of

the community (individuals and organisations) but there is a lack of local technical support. National programme support can be brokered in but it is limited and often projects flag because of the lack of funding, the amount of paperwork involved for consents and the lack of knowledge about the best technology. The programme proposes a local renewable energy advisory service similar to that of Renewable Energy for Devon (RE4D) which could stimulate uptake and provide concept to implementation support. Unlike the RE4D programme it should target all sectors of the community and facilitate opportunities for community owned schemes.

There is considerable potential for communities and individuals to benefit from income streams from renewable energy generation such as Renewable Obligation Certificates and the Feed-in-Tariff.

The income generated by communities from community-owned renewable energy installations could then be used to fund other sustainable energy projects and community initiatives. This could be as a grant or part subsidised low-cost loan basis. However, a high degree of support is required for communities to identify and exploit such opportunities. It is therefore recommended that this community facilitation service is set up as part of a local renewable energy advisory service.

Land use management

Over twenty farming measures have been identified that can help to reduce greenhouse gas emissions. Many of these are cost negative i.e. introducing them will generally save farmers money. Examples are using manure nitrogen as far as possible, and reduced or zero tillage. Most apply to grassland management, and are designed to build up carbon storage in the soil organic matter. Livestock measures concern increasing the efficiencies with which ruminant animals, such as cattle, utilise their diet. Please refer to section 5.4 of the carbon neutral assessment for more detail.

Policies to support land use changes that increase removals, such as afforestation. The draft programme proposes a significantly increased planting rate of around 180 hectares per year, with a mixture of short rotation coppice, short rotation forestry and long rotation broadleaved woodland.

Another land-use change that can have significant carbon benefits is the increased planting of Miscanthus, provided that the end use is restricted to local heat generation or combined heat and power (CHP). Grade 3 agricultural land with relatively low wind exposure is technically suitable, conditions locally concentrated around the northern slopes of the Brendon Hills. The draft programme allows for around 1500 hectares of Miscanthus to be established by 2014.

An important quantity of carbon is stored in peat in Exmoor's blanket mires and valley fens. This store is at risk from drying out and erosion but can be increased by mire restoration. The programme supports an extended "Mires on the Moors" project that will have biodiversity, water quality, flood alleviation and climate change benefits.

Transport

Ultimately emissions reduction targets for transport can only be met if people drive their cars less. There are a number of well known policy measures that can encourage this, such as improved

facilities for home working (better broadband connections, for example), encouragement of car share schemes for commuting, and home delivery of goods to reduce individual shopping journeys.

Residents of deep rural areas in the Exmoor National Park, many living well away from any regular scheduled bus routes, should have transport options as alternatives to the private car. The operation of private car clubs, in which a local membership shares access to a small number of cars, can be a cost effective and efficient use of limited resources. There is also some potential for the current Demand Responsive Transport service in West Somerset to be extended to anyone who wishes to use it in deep rural areas, providing extra choice to people, perhaps alongside car club membership.

Promotion of these sorts of initiatives across the National Park could potentially reduce transport emissions by around 20% by 2025.

The diagram in figure below summarises the area of activity and the associated projected CO_2e reductions that might be achieved. It provides a cross reference to the theme in the proposed programme.

Activity	Assessed Reduction by 2025
Land Use Management	**-95,980**
Mire restoration	-4500
Woodland removals	-16,172
Woodland storage	-9,364
Improved fertiliser	-16,740
Livestock measures	-3,300
Lulucf	-45,904
Demand Reduction	**-27,960**
Energy efficiency - Heat	-13,610
Energy efficiency - Electricity	-729
Transport behaviour change	-10,897
Transport technology shift	-2,724
Renewable energy	**-111,690**
RE used locally	-29,983
Re export - biomass	-63,889
Re export - Electricity	-17,818
Miscanthus as fuel	-4,978
Total potential reductions	-235,630
Total baseline emissions	351,774
Residual emissions at 2025	**116,144**

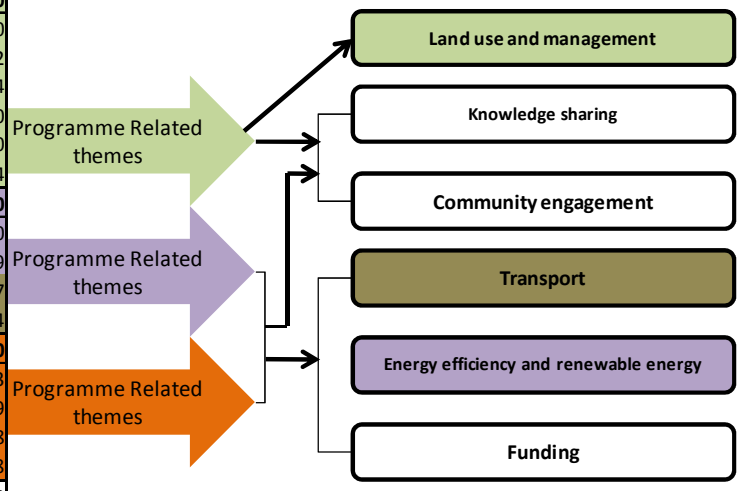


Figure 26: Showing how the assessment relates to the programme themes

Note: Miscanthus not included in renewable energy total because may substitute fuel and therefore would be double counting if both figures were included.

The proposed Exmoor carbon neutral programme comprises the following themes:

- Land use management
- Knowledge sharing
- Community engagement
- Transport
- Energy efficiency and Renewable energy
- Funding

The draft programme is presented below and presents the objectives and actions against each theme.

EXMOOR DRAFT CARBON NEUTRAL PROGRAMME			
Theme	**Objective**	**Actions**	**Potential partners**
Land management	Increase the removal of greenhouse gases from the biosphere and protect carbon stores from degradation	Support land-use change to appropriate woodland and from arable to permanent pasture (how?)	Exmoor National Park Authority, Forestry Commission, National Trust, Crown Estate, landowners
		Maintain and extend the "Mires on the Moors" programme	South West Water, Environment Agency, Exmoor National Park Authority
	Assist farming in Exmoor in making the transition to a low carbon future and in re-establishing its position as the focal point for sustainable rural communities in Exmoor	Undertake research to identify models of farming that will enable the agricultural sector in Exmoor to make the transition to a low carbon future	Exmoor National Park Authority, South West Rural Enterprise Gateway, National Farmers Union, Farming and Wildlife Advisory Group, Exmoor Uplands Livestock Initiative, Country and Landowners Association
		Ensure there is adequate provision of sustainable energy advice for Exmoor's farmers	Farming and Wildlife Advisory Group, Exmoor National Park Authority
		Set up a working group to identify and implement appropriate supports for the agricultural sector to enable it to make the successful transition to a profitable, low carbon future.	Exmoor National Park Authority, Exmoor Uplands Livestock Initiative
		Support the continued promotion of local food	Exmoor National Park Authority
	Increase knowledge of the impacts of LULUCF on the carbon balance of Exmoor and in relation to the development of sustainable communities	Continue to identify and keep under review information gaps relating to land-use and land-use change and commission research as appropriate	South West Uplands Taskforce, Exmoor National Park Authority
Transport	Reduce transport-related greenhouse gas emissions	Introduce measures to support the shift to the use of electric vehicles (including buses, cars, bicycles and quad bikes) such as supporting the development of: • a network of charging points (ideally linked to renewable energy installations) • electric vehicle hire services within and around the National Park	Forum 21, Exmoor National Park Authority, Somerset County Council
		Support the development of car clubs, car sharing and demand responsive transport	Forum 21, Exmoor National Park Authority, Somerset and Devon County Councils
		Improve facilities for home working and for the development of small businesses within Exmoor (e.g. through improved broadband availability)	Somerset and Devon County Councils

Theme	Objective	Actions	Potential partners
Energy efficiency/renewable energy	Substantially reduce carbon dioxide emissions arising from energy use	Develop a sustainable energy advice service (fully integrated with existing advice services) to provide independent, bespoke advice to householders and small businesses in Exmoor	Climate Action West, Exmoor National Park Authority, West Somerset Council, Taunton Deane Borough Council, Sedgemoor District Council, Somerset County Council, North Devon Council, Devon County Council, Forum 21
		Develop a community sustainable energy facilitation service to: • provide continued support to communities that have already embarked on the sustainable energy planning process • extend support to other communities in Exmoor • provide a branded focal point for communities to endorse and participate in projects	Exmoor National Park Authority, Forum 21
		Continue to support the work of the existing West Somerset and Exmoor CRIB energy efficiency working group	Exmoor National Park Authority, North Devon Council, West Somerset Council, Forum 21
		Undertake research in relation to addressing 'hard to heat/treat' homes in Exmoor	Westcountry Energy Action, West Somerset Council, North Devon Council, Exmoor National Park Authority
		Increase the deployment of wood fuel heating	Wood fuel producers, ENPA, Crown Estate, National Trust, Somerset Strategic Partnership, Fuel Poverty Biomass Sub Group
Knowledge sharing	Accelerate the pace of transition towards a low carbon economy	Organise an annual programme of knowledge sharing events	West Somerset and Exmoor CRIB
		Develop and maintain a web-based resource to provide comprehensive local information regarding low carbon working and living e.g. Community Hub	Forum 21
		Work closely with communities in Dartmoor National Park to share knowledge more broadly regarding low carbon working and living	Dartmoor and Exmoor National Park Authorities and community representatives
Community engagement	Build the capacity of communities to play their full part in contributing towards the achievement of a carbon neutral National Park and in	Develop a community sustainable energy facilitation service to: • provide continued support to communities that have already embarked on the sustainable energy planning process	Exmoor National Park Authority, Forum 21

	tackling climate change	• extend support to other communities in Exmoor • provide a branded focal point for communities to endorse and participate in projects	
Funding	Secure funding for the delivery of actions within the Carbon Neutral Programme	Develop a sustainable mechanism for funding community sustainable energy and other projects providing community benefit, possibly through income generated through the sale of renewable energy generated in Exmoor	Exmoor National Park Authority, Forum 21

The following table outlines the rate at which these measures would need to be implemented up to 2025 to achieve the reductions outlined earlier. The table includes some indicative costs to the local economy.

Activity	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	**2024**	2025	Total
Land Use and Management (ha activity)																	
woodland planting 180 ha/annum: split evenly between short rotation coppice willow, short rotation forestry (ash) and long rotation native woodland	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	2560
Removal of permanent grassland from agricultural production (grade 4) (ha)			191	191	191	191	191	191	191	191	191	191	191	191	**191**	191	2675
Mire restoration						4500											4500
Transport																	
Transport initiatives	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Introducing electric vehicles			*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Energy efficiency (number of installations)																	
Cavity wall insulation	353	353	353	353	353												1765
Loft insulation (top up)	558	558	558	558	558												2790
Loft insulation new	304	304	304	304	304												1520
Solid wall insultation (external)				48	48	48	48	48	48	48	48	48	48	48	**48**	48	624
Solid wall insultation (internal)				48	48	48	48	48	48	48	48	48	48	48	**48**	48	624
Floor insulation					245	245	245	245	245	245	245	245	245	245			2450
Draught proofing	306	306	306	306	306	306	306	306	306	306	306	306	306	306	**306**	306	4896
Renewable energy technology number of installations																	
Solar thermal units	61	61	61	61	61	61	61	61	61	61	61	61	61	61	**61**	61	976
Biomass boilers	184	184	184	184	184	184	184	184	184	184	184	184	184	184	**184**	184	2944
Heat pumps			4	2				212	218	218	218	218	218	218	**218**	218	1962
Solar PV	61	61	61	61	61	61	61	61	61	61	61	61	61	61	**61**	61	976
Hydro	184	184	184	184	184	184	184	184	184	184	184	184	184	184	**184**	184	2944
Reservoir Hydro						1											1
15kW wind turbines						5	4	4	4	5	5	5	5	5	**5**	4	51
Biogas			2	2	2	2	2	2	2	2	2	2	2	2	**2**	2	28
2MW wind turbines												1					1
Business and Commercial initiatives																	
	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Estimated investment required/year (Not including land use & management and transport)	2,392,509	2,417,201	3,776,521	4,218,360	4,483,394	4,935,215	4,497,715	6,613,270	6,648,579	6,686,079	6,845,739	8,352,745	5,479,926	5,373,486	5,256,873	4,912,259	82,889,872

Part 3 – Your views

Your input is vital to the development and implementation of any programme that will help deliver reductions in greenhouse gases associated with the activities across Exmoor. Setting a carbon neutral target is ambitious in itself and the achievement of this will require collective effort from everyone.

Although extensive modelling and research has been undertaken other information and data may come forward that might influence the outcome presented here.

How to respond to this consultation?

This programme is presented to you for consultation. It is the beginning of a journey and the basis upon which we can stimulate dialogue, collaboration, and action.

We now seek your views and a list of questions is presented below. You can do this by visiting the website www.exmoor-nationalpark.gov.uk/carbon-neutral-programme.

General questions

1. Do you support the Exmoor National Park Management Plan (2007-2012) objective to become carbon neutral by 2025?
2. If not, what would represent an appropriate alternative target for the community in Exmoor National Park? For example, would you support a shift to reduce our greenhouse gases and if so what would be an appropriate target?

Examples include:

- UK targets of 32% by 2020 and 80% reduction by 2050 (CO_2 only)
- Scientists believe we have less than 10 years to prevent runaway climate change therefore should a target be set at 2016?

3. Do you agree that the target should include all greenhouse gases that have been assessed in this programme – carbon dioxide, methane and nitrous oxide?

4. Do you believe that it is acceptable, appropriate and practicable to offset any residual emissions to achieve a carbon neutral or lower carbon status?

5. What is your view about whether or not we should include renewable energy and biomass export in the overall accounting against target?

Land Use Questions

6. Has the draft covered all significant opportunities in the land use sector for moving towards carbon neutral status?

7. In the management of crops, pasture and livestock, what are the main opportunities and barriers to the proposed measures being delivered?

8. What level of new woodland planting is desirable and achievable?

9. Do you support the proposed balance between short-rotation coppice, short-rotation forestry and native woodland establishment?

10. Do you agree that Miscanthus can be grown in the National Park at the levels proposed without significant adverse effects on other National Park objectives?

11. Are there significant unintended consequences of these proposals that need to be taken into account?

Transport Questions

12. Has the draft covered all significant opportunities in the transport sector for moving towards carbon neutral status?

13. Do you support the proposal for a feasibility study of the use of electric vehicles in the tourism sector by 2012?

14. Do you support the proposal for development of Car Clubs and Demand Responsive Transport in the National Park?

15. Are there related measures in other sectors, such as planning, that could help the transport programme delivery?

Renewable Energy Questions

16. Has the draft covered all significant opportunities in the renewable energy sector for moving towards status?

17. Of the renewable energy options proposed in the programme – which technologies do you support and which do you not – please give your reason.

18. Do you support the proposal for a renewable energy service to be provided locally to support both the domestic and business sectors?

19. Do you foresee any technical (or other) difficulties in deploying the technologies proposed in the programme.

Demand Reduction

20. Has the draft covered all significant opportunities in the energy efficiency sector for moving towards carbon neutral status?

21. Of the energy efficiency measures proposed in the programme – which technologies do you support and which do you not – please give your reason.

22. Do you support the proposal that continued support should be delivered to increase and widen the scope of the current energy efficiency advice available locally?

23. Do you foresee any technical (or other) difficulties in deploying the technologies proposed in the programme?

About the Authors

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Wendy is a co-ordinator for Forum 21 and a Director of Climate Action West. She is the author of the West Somerset Climate Change Strategy, has developed the Community Hub and is developing the settlement sustainable energy plans for 6 settlements across Exmoor. She is a special advisor to the Western Somerset Local Action Group. Outside of Greater Exmoor, Wendy is the CEO of The Converging World, a Bristol based climate change charity.

Bill Butcher