Climate Change and Energy

Throughout this document 'Devon' refers to the administrative area of Devon County Council and 'Torbay' refers to the administrative area of Torbay Council.

Projects like South Brent Community Energy Society's wind turbine are growing in popularity as a local response to climate change and energy prices (Credit: South Brent Community Energy Society)

Economic Prosperity, Health and Wellbeing

The scientific evidence is now overwhelming: climate change is a serious global threat and it demands an urgent global response. 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, through the effects of changes to severe weather on infrastructure, resource availability, supply chains and health. The costs of reducing greenhouse gas emissions to avoid the worst impacts of climate change amount to 1% of global GDP each year[i]. Conversely, assuming strong adaptation occurs in vulnerable parts of the economy, Devon and Torbay are well placed to move towards a low carbon economy and seize the opportunities that a warmer climate will bring; they have good natural resources, centres of international research (including the South West Marine Energy Park), strong organic food and tourism sectors and a vibrant, local grassroots community movement.

In 2009/10 the low carbon and environmental technologies sector contributed £185m and £23m to Devon and Torbay's economy respectively and provided 10,500 and 1,300 full time equivalent jobs[ii]. The low carbon economy is likely to require a diverse array of skills across many sectors, ranging from engineering and design, to waste management, to transport technology, to finance, as well as renewable energy. By 2022 the retrofitting of energy efficiency measures to domestic properties in Devon is anticipated to generate a further 800 jobs and add £500m to the economy[iii].

A changing climate is anticipated to have significant negative impacts on health and wellbeing. Heat-related mortality, currently 2,000 premature deaths per year in the UK, is projected to increase by 70% to 3,400 in the 2020s and by 540% to 10,800 in the 2080s. The elderly are more vulnerable to extreme heat, so future health burdens are likely to be amplified by an ageing population. High temperatures increase levels of ozone and other air pollutants, which aggravate cardiac and respiratory problems and will increase human exposure to pollen and fungal spores, which will cause more acute symptoms for allergy sufferers and will increase exposure to UV radiation which could contribute to more incidences of skin cancer. By the 2080s mosquitos and ticks are anticipated to be spread across much of the UK providing an opportunity for increased activity of vector borne diseases and the introduction of exotic pathogens. Additionally, flooding, and the actual and perceived risk of flooding, can undermine the mental health of communities[iv]. Changes in climate and increases in extreme weather events could disrupt stability in the supply of

food[v]. This will affect the price and availability of food and reduce the ability of people on lower incomes to eat a fresh, well-balanced diet.

Evidence for Climate Change in the UK[vi]

The evidence for climate change is indisputable. The Intergovernmental Panel on Climate Change has concluded it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century[vii]. Average temperatures in England have risen by approximately one degree Celsius since 1980, with 2014 being the warmest year on record. Exmouth has recorded an increase of 1.05°C since 1900 and Ilfracombe 0.64°C. The warmest day recorded in Devon was 32.4°C at Ilfracombe in August 1990, while the highest figure for Exmouth (31.2°C) occurred in June 1976. Annually, South West England has almost 21 fewer days of air frost than it did in 1961. Annual mean precipitation over England and Wales has not changed significantly since records began in 1766. However, based on a linear trend, South West England is experiencing almost 10% more precipitation now that it did in 1961. Seasonal rainfall is highly variable but has decreased in summer and increased in autumn and winter; based on a linear trend the South West experiences 28% more precipitation in autumn, almost 16% more in winter, and approaching 9% less in summer than it did in 1961.

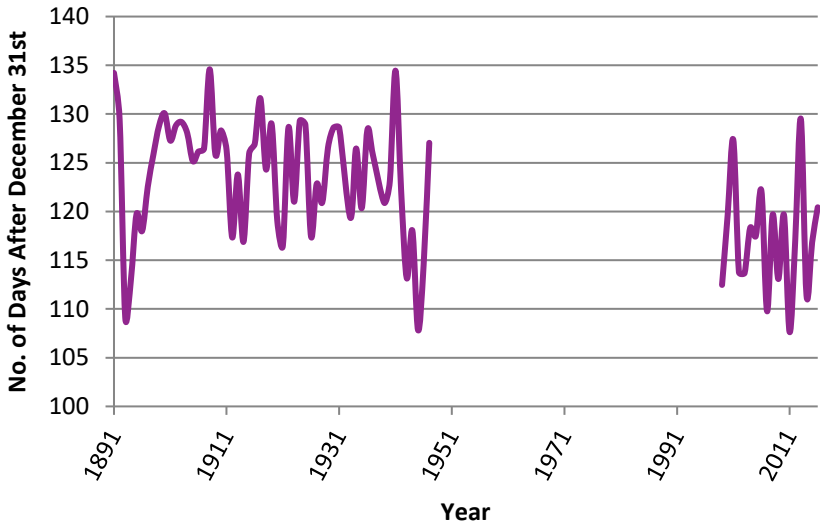


Figure 1 - Timing of Spring Events in the UK. 1891 - 1947, and 1999 to 2016

All regions of the UK have experienced an increase in the contribution to winter rainfall from heavy precipitation events between 1961 and 2006. In summer, all regions except NE England and N Scotland show decreases.

Severe windstorms around the UK have become more frequent in the past few decades, although not above that seen in the 1920s. The 1990s saw 14 strong wind events, compared to 4, 5 and 8 in the 1960s, 1970s and 1980s respectively. These observations are correlated with the strength of the North Atlantic Oscillation for which no trend is identifiable.

Relative sea level (sea level considering changes in land height) in the South West has risen by approximately 250mm since 1916.

Phenology

Phenology is the study of the timing of seasonal natural events. Figure 1[viii] shows the timing of spring events. This is compiled by monitoring the first flowering of hawthorn, first flowering of horse chestnut, first recorded flight of an orange-tip butterfly and first sighting of a swallow.

Since 1999 the annual mean observation dates have occurred 7.5 days in advance of the average dates in the first part of the 20th century, which is strongly linked to warmer temperatures in March and April. The mean observation dates in 2011 were the earliest for which there are records, being 0.2 days earlier than the previously most advanced

dates in 1945. The warmest April in the Central England Temperature series (1659 onwards) occurred in 2011 and was likely to be a factor.

This indicator illustrates the how one aspect of climate change (spring warming) can affect biological systems. Different responses among species may cause problems for natural cycles (e.g. pollinating insects emerging out of synchrony with flowers opening in spring) and make them more vulnerable to extreme events such as late frosts and upset the balance of competition between species.

Climate Change Projections

Table 1 – Projected Changes in Climate for the South West Compared to the 1961 - 1990 Climate Average Under the High Emissions Scenario

Year	Likelihood	Winter mean temp.	Summer mean temp.	Summer mean max temp.	Annual mean precip.	Winter mean precip.	Summer mean precip.	Relative sea level
2020s	Very likely to be > than	0.5°C	0.5°C	0.6°C	-5%	-2%	-24%	6cm
	Very likely to be < than	2°C	2.6°C	3.8°C	6%	18%	18%	18cm
2050s	Very likely to be > than	1.3°C	1.4°C	1.5°C	-6%	3%	-45%	13cm
	Very likely to be < than	3.5°C	5.1°C	5.5°C	6%	41%	8%	41cm
2080s	Very likely to be > than	2.1°C	2.7°C	3.0°C	-7%	8%	-58%	20cm
	Very likely to be < than	5.1°C	7.9°C	11.9°C	10%	73%	4%	69cm

NB1: Either end of the range of projected change is equally likely to occur. The mid-point of the range does not indicate an average projected change. NB2: – 'Vey Likely' in this context refers to 90% statistical certainty, except for Relative Sea Level where it refers to 95% certainty

Climate change projections for the South West region are shown in Table 1[ix]. The projections suggest warmer, wetter winters and drier, hotter summers. The likelihood of extreme changes in climate becomes greater towards the end of the 21st century. Devon and Torbay are already committed to the level of climate change projected for the 2020s as a result of historic and present global emissions. Any action we take today to reduce emissions will not have an impact on climate until the mid-21st century

Energy Consumption[x]

Total energy consumption in Devon, Torbay and Plymouth in 2015 was 22,779GWh. This is a 15% reduction from 26,913GWh in 2005 and has been climbing since 2011 (Figure 2) due to increasing population and economic activity. Figure 3 shows the breakdown by fuel type and sector

.

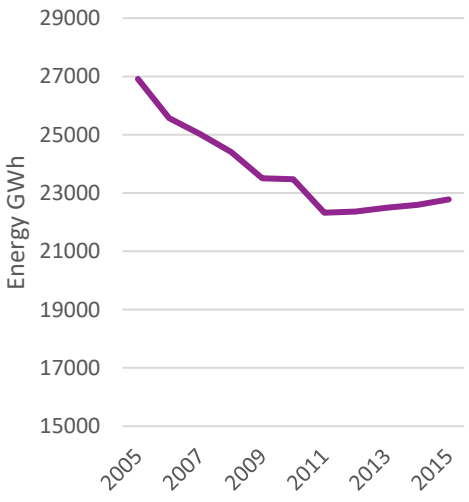


Figure 2 – Energy Consumption in Devon, Torbay and Plymouth

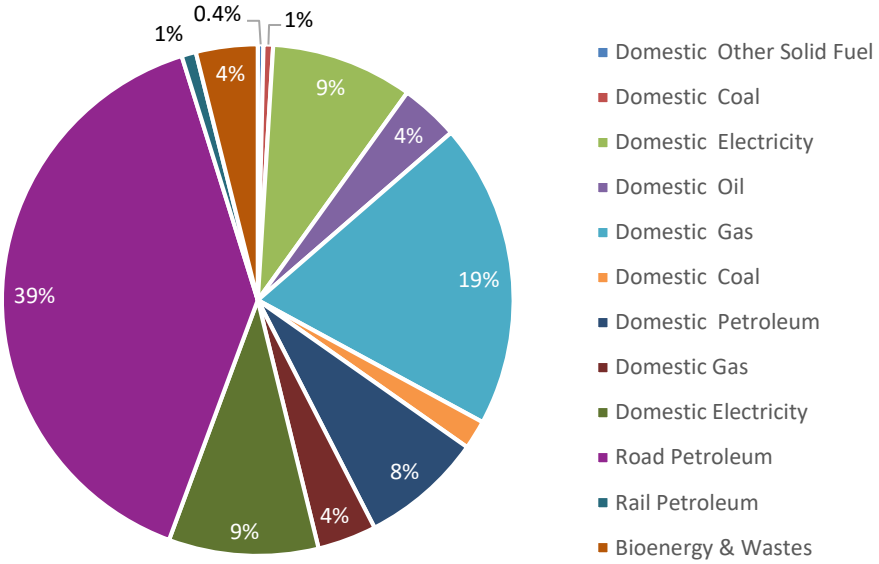


Figure 3 – 2015 Energy Consumption by Fuel Type and Sector in Devon, Torbay and Plymouth

Renewable Energy[xi]

Table 2 –Renewable Energy Capacity and Generation in Devon (2017)

Number of Projects	Electricity MWe	Heat MWth	Percentage of installed capacity (%)
27, 757	728.7	145.1	100

Devon, Torbay and Plymouth are rich in renewable energy resources. Table 2 shows the total installed renewable energy capacity and the amount of energy those projects generate in Devon. Installed capacity has increased substantially since 2011 following the introduction of the Feed in Tariff and Renewable Heat Incentive (Figure 4[xii]). Renewable energy capacity in Devon as of 2017 stands at 874 MW. As of March 2016 Torbay's renweable energy capacity was 6.9MW and in Plymouth it was 21MW.

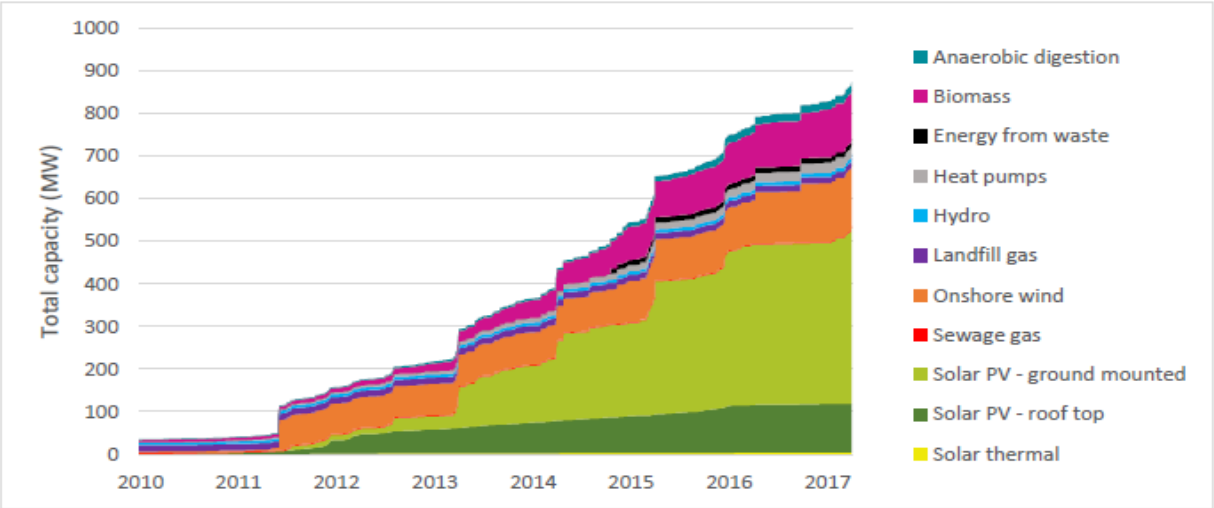


Figure 4 – Increase in renewable energy capacity in Devon since 2010

Annual generation from renewable sources stands at 1,205GWh in Devon. This means that 9.7% of energy consumption in Devon is provided for by renewable sources within the area.

Figure 5 shows that solar photovoltaic (PV) panels are the most significant source of renewable energy in Devon, by installed capacity, followed by onshore wind turbines.

Current and future trends indicate further growth in deployment of renewable energy. With excellent natural resources and a strong local supply chain and expertise, the area is well positioned to take a prominent role in delivering the 2020 national target of 15% of energy from renewable energy sources[xiii].

36% of the electricity consumption in Devon was met by renewable generation in 2017, with the largest amount being met in Torridge. (Table 3)

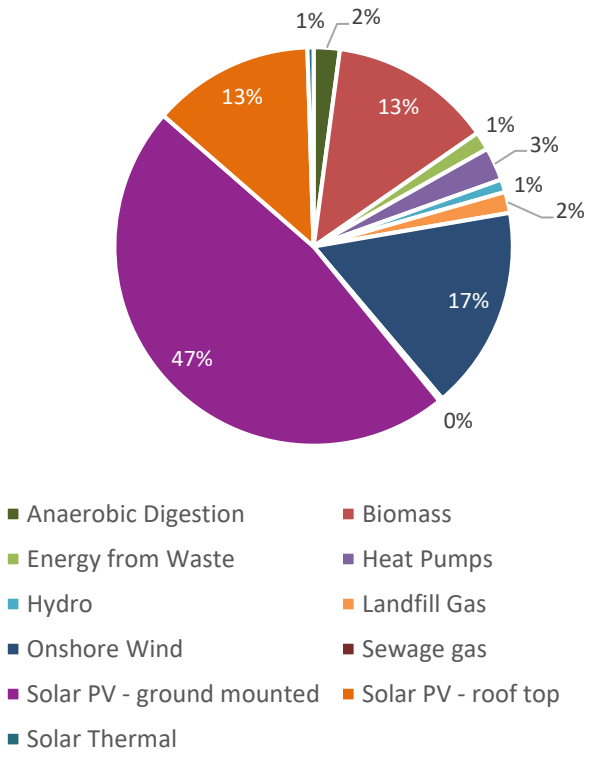


Figure 5 – Renewable Energy Capacity by Technology in Devon

Table 3[xiii] - Electricity demand met by renewable electricity generation by local authority in Devon

Local Authority	2016 electricity consumption Sales (GWh)[8]	Annual Renewable electricity generation (GWh)	Total electricity consumption met by renewable generation (percent)
East Devon	499	127	25
Exeter	565	49	9
Mid Devon	341	100	29
North Devon	451	366	81
South Hams	453	133	29
Teignbridge	488	72	15
Torridge	264	268	101
West Devon	248	92	37
Devon	3,309	**1,205**	**36**

Emissions[xiv]

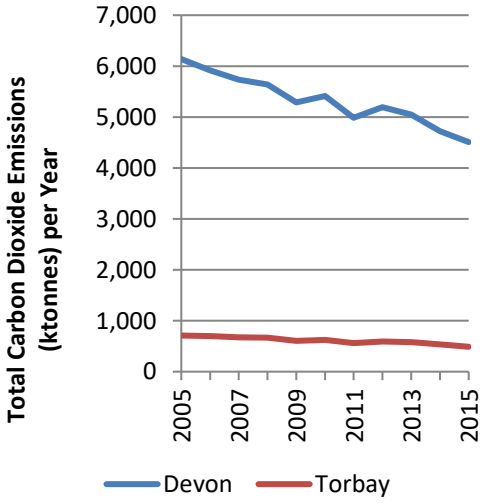
Carbon dioxide (CO_2) emissions in Devon and Torbay have decreased since measurements began in 2005 (Figure 6); 2015 CO_2 emissions in Devon and Torbay were 27% and 31% below 2005 levels respectively. CO_2 emissions per person in Torbay and Devon have followed the same trend as in the South West and nationally in England between 2005 and 2010 (Figure 7). This is due to improving energy efficiency of buildings and vehicles, and the decarbonisation of the electricity grid nationally.

Emission levels per person are markedly lower in Torbay than in Devon and the region due to its urban nature that benefits from the heat island effect, extensive gas network coverage, a lower requirement for private transport, its mild micro-climate and its economic profile that is not reliant on energy intensive sectors such as manufacturing.

CO_2 emissions in Devon are dominated by transport emissions (40%), which have become more dominant in recent years as improvements to domestic and industrial energy efficiency and decarbonisation have been more successful than decarbonising transport. In Torbay, CO_2 emissions are dominated by domestic emissions (41%) (Figure 8).

However, these emissions figures only describe those emissions arising from the UK. Greenhouse gases emitted due to the UK's consumption of resources from abroad (to provide food, construction materials, motor vehicles, chemicals and electronic equipment, for example) are not included. When these emissions are included, the UK's carbon footprint is 10% larger than it was in 1993[xv]; demonstrating that the performance of national measures to reduce emissions has been outstripped by the increase in overseas emissions due to population growth and a demand for more energy intensive food and consumer goods.

Figure 6 - Carbon Dioxide Emissions per Year



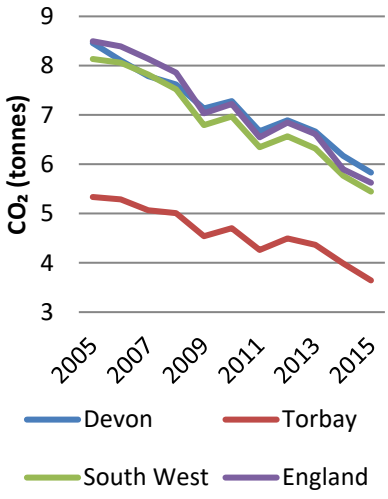


Figure 7 - Carbon Dioxide Emissions per Person, per Year

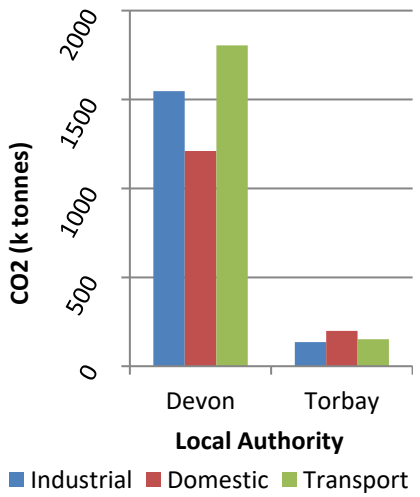


Figure 8 - Carbon Dioxide Emissions by source in 2015

Climate Change Community Networks

There are many climate change community networks in Devon. One example is the global Transition Towns movement of which Totnes was the world's first! They are working to build environmental, social and environmental resilience in response to climate change and peak oil. There are 14 Transition Town initiatives in Devon registered with the Transition Network (Table 4[xvi]) and there are many more unaffiliated groups. Community energy organisations are also prominent and have been developing community-owned renewable energy and energy efficiency schemes. These are represented by the South West Devon Community Energy Partnership - a network bringing together communities and local authority representatives from across Devon (despite its name!).

Table 4 – Devon's Transition Towns

Ashburton	Ottery St Mary
Buckfastleigh	Sampford Peverell
Crediton	Seaton
Exeter	Sidmouth
Exmouth	Tavistock
Honiton	Totnes
Ivybridge	Mortonhampstead

[i] Stern, N. (2007) *The Economics of Climate Change*: *The Stern Review*. Cambridge University Press, Cambridge

[ii] Transform Research Consultancy (2012) *Devon's Green Economy: Report on a Scoping and Baseline Study*. University of Exeter, Exeter. Available at: http://www.devonenvironment.org.uk/wp-content/uploads/2012/07/Final-Report-on-Scoping-Devons-Green-Economy.pdf

[iii] Lash, D. *et al* (2010) *The Low Carbon Economy in the Context of the Devon Economy*. Centre for Energy and the Environment, University of Exeter, Exeter. Available at: http://www.devonomics.info/sites/default/files/documents/Low%20Carbon%20Economy%20final%20report%20v9.pdf

[iv] Health Protection Agency (2012) *Health Effects of Climate Change in the UK 2012*. Health Protection Agency. Available at http://www.hpa.org.uk/hecc2012

[v] Met Office and The World Food Programme (2012) *Food Insecurity and Climate Change* Met Office. Available at: http://www.metoffice.gov.uk/media/pdf/8/7/MO_PUP_insert_FOOD.web.pdf

[vi] UK Climate Impacts Programme (2009) *The Climate of the UK and Recent Trends.* UKCIP. Up to date data available from: http://www.ukcip.org.uk/wordpress/wp-content/PDFs/UKCP09_Trends.pdf

[vii] Intergovernmental Panel on Climate Change (2013) *Climate Change 2013: Headline Statements from the Summary for Policymakers.* Available at: http://www.ipcc.ch/news_and_events/docs/ar5/ar5_wg1_headlines.pdf

[viii] Joint Nature Conservation Committee (2012) *Pressure from Climate Change – Spring Index*. Available at: http://jncc.defra.gov.uk/page-4247. (Accessed 20/08/2015)

[ix] UK Climate Impacts Programme *(*2009) *UKCP09*. UKCIP. Available at: http://ukclimateprojections.metoffice.gov.uk (Accessed: 05/05/2013)

[x] BEIS (2017) *Total Final Energy Consumption 2003 – 2015 at Regional and Local Authority Level.* Available at: https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level

[xi] RegenSW (2016) *South West Renewable Energy Progress Report 2016.* RegenSW. Available at: https://www.regensw.co.uk/Handlers/Download.ashx?IDMF=84ec0a2f-03da-4e7a-9e22-38a30937c50a

[xii] Regen (2018) *Renewable Energy Progress Report for Devon.* Regen. Available at: https://www.regensw.co.uk/renewable-energy-progress-reports

[xiii] University of Exeter Centre for Energy and the Environment (2011) *A review of renewable energy resource assessment and targets for Devon.* University of Exeter. Available at: http://www.devon.gov.uk/reviewofrenewableenergyresourceassessmentandtargetsfordevon.pdf (Accessed: 16/09/2013)

[xiv] DECC (2017) *UK Local and regional CO2 emissions estimates for 2005-2017 Full dataset.* DECC. Available at: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-2015

[xv] Committee on Climate Change (2014) *Reducing the UK's Carbon Footprint and Managing Competitiveness Risks*. Committee on Climate Change. Available at http://www.theccc.org.uk/publication/carbon-footprint-and-competitiveness/

[xvi] Transition Network (2013) *The Big Transition Map.* Transition Network. Available at: http://www.transitionnetwork.org/map (Accessed: 03/09/2013)