KENT AND MEDWAY
ENERGY AND LOW EMISSIONS STRATEGY



EVIDENCE BASE

A SUMMARY OF NATIONAL, REGIONAL AND LOCAL ENERGY, EMISSIONS AND AIR QUALITY DATA AND EVIDENCE

CONTENTS

1 INTRODUCTION

This evidence document supports the ***Kent and Medway Energy and Low Emissions Strategy*** *(ELES)*.

It summarises evidence and data related to energy, transport, greenhouse gas emissions, fuel poverty and air quality in Kent and Medway; drawing on national, regional and local sources of data. It also includes appendices which provide the national, regional and local policy context.

This evidence base has been used to inform the Strategy and supporting implementation plan, and is a snapshot in time, based on the data available up to November 2019. Key datasets within this document will be used as performance indicators that will enable the Strategy's implementation to be monitored and to support future decision making.

The collation of this evidence base was completed with the assistance of consultants working in partnership: Tim Williamson, Aether and Rachael Mills, SE2 Ltd.

2 THE GROWTH CHALLENGE IN KENT AND MEDWAY

Kent is growing. The ***Kent and Medway Growth and Infrastructure Framework*** (GIF)[1], updated in 2018, provides a clear picture of the development and infrastructure requirements to support growth across the area up to 2031. The aspiration is for 178,600 additional homes between 2011 and 2031 (24% growth), 396,300 additional people (23% growth) and 170,300 additional jobs (21% growth). It is estimated this will require a £16.4bn investment across transport, utilities, health and social care, education, community and culture and the natural environment.

Figure 1 gives an indication of where the key housing growth areas are expected to be; the larger the grey dot, the more anticipated growth. Much of the planned growth is expected to be in the north and east of the county, with strong clusters around Dartford and Gravesend, Chatham, Ashford, Sittingbourne, Canterbury, Herne Bay, Margate and Dover.

Accommodating significant levels of housing and economic growth without increasing energy demand and air pollution will be a major challenge. Achieving "Clean Growth", ie. delivering increased economic growth and decreased emissions, is therefore an imperative. To do this, new homes and buildings need to be built to sustainable design standards. A sustainable approach to development will bring benefits including healthier living and working environments; improved efficiency and productivity in use; and the reduction of fuel costs and the costs of vehicle ownership . Local plans have a key role in defining how this will work at a local level.

The GIF explores four future scenarios to 2050 to examine how the area can ensure it is adaptable, resilient and connected in planning for a sustainable future. The most favourable scenario is the high economic growth, moderate climate change impacts scenario, named 'Fertile Ground' (Figure 2). Amongst other things, within this scenario the GIF envisions:

- new housing via high-quality new green towns and urban extensions, redevelopment and infill
- shared autonomous vehicles / autonomous shuttles
- focus on walkability with new paved routes and spaces
- increased rail capacity in London.

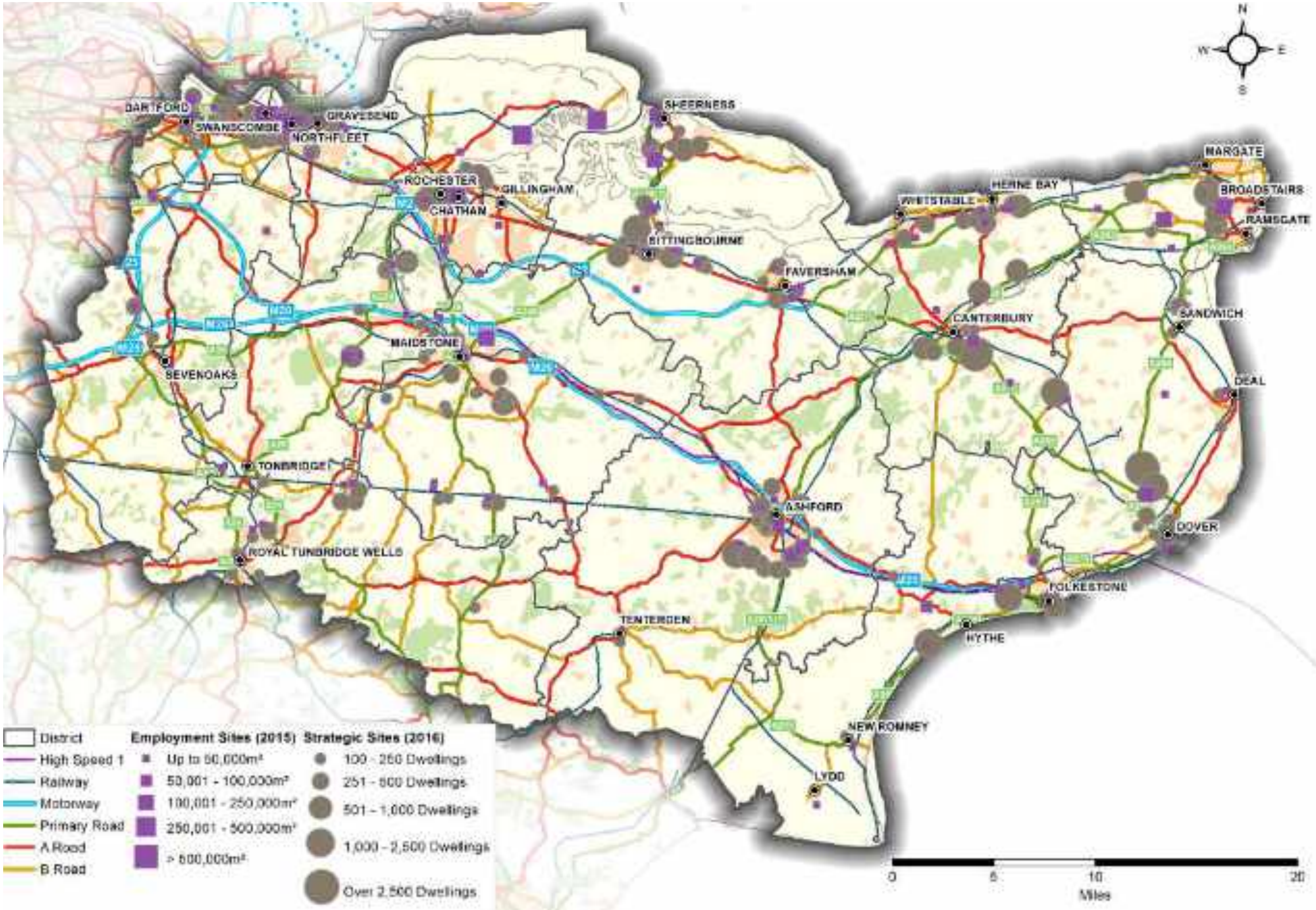


Figure 1: Kent and Medway growth context (GIF, 2018)[1]

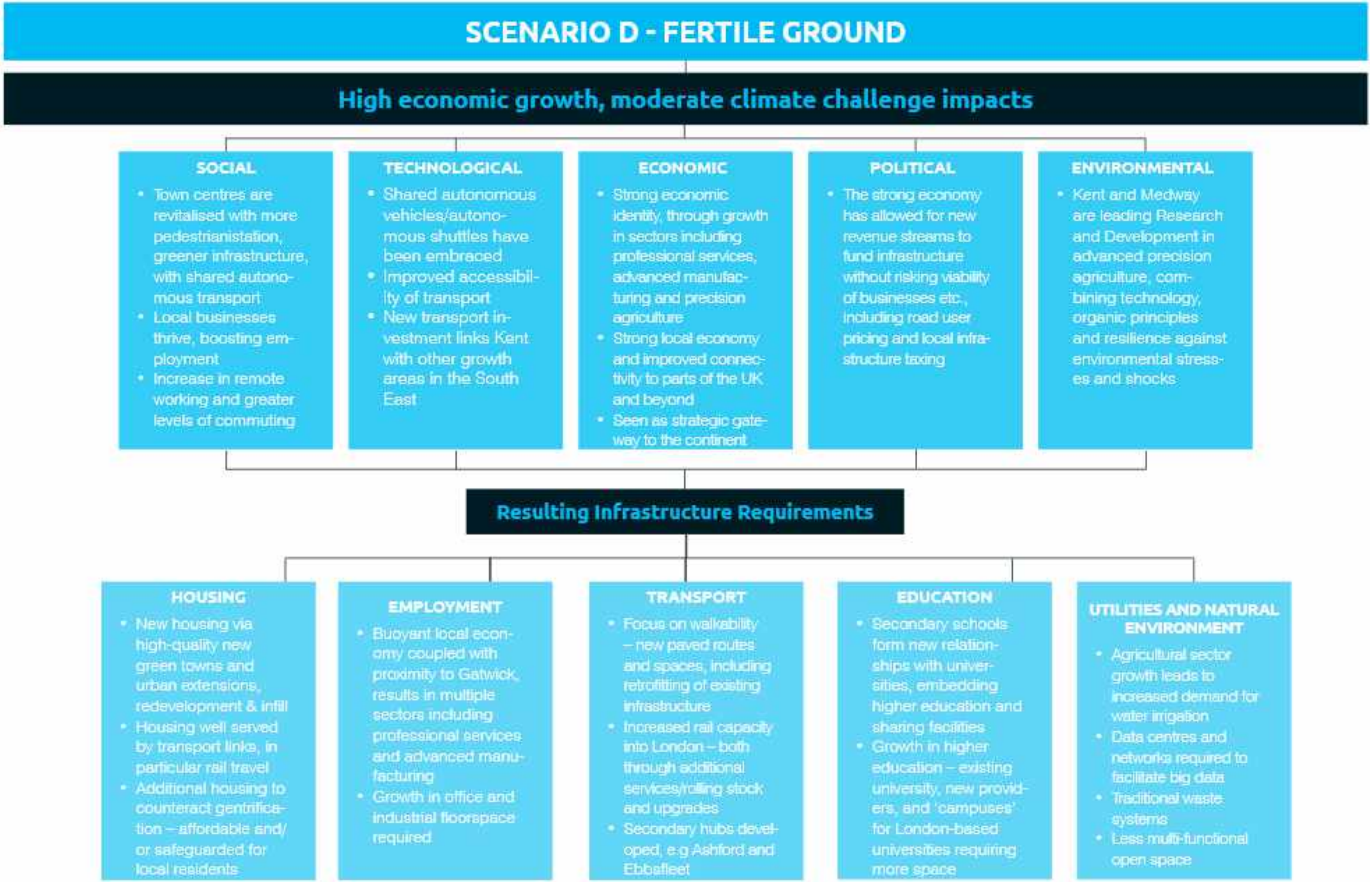


Figure 2: The 'Fertile Ground Scenario' (GIF, 2018)[1]

Regardless of the scenario, the GIF recognises the critical necessity for more sustainable energy production and delivery: 'With an imminent influx in the adoption of electric vehicles, there will be significant implications for the way in which energy is delivered to support this new infrastructure. In addition, growth pressures, whether in a high- or low-growth scenario, will mean that pressures on the grid are exacerbated further. There will be a need to strategically plan the way in which electricity is generated and delivered.'

The GIF also highlights the challenges that an aging population will have on infrastructure demand in Kent and Medway. Like the rest of the UK, the population of Kent and Medway is ageing. The percentage of residents aged 65 or over, is predicted to rise from 17% to 23% of the population between 2011 and 2031, an increase of 6%. In contrast, those of approximately working age (20-64), will decline by 5% in their total share of the population over the same period **(Figure 3).** This has implications for both health and the economy.

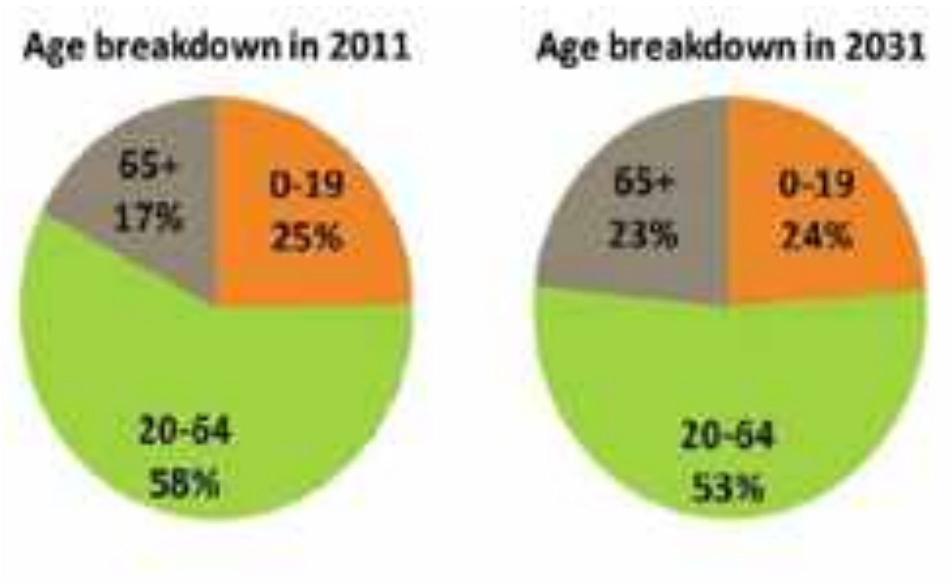


Figure 3: Forecast differences in population by age group between 2011 and 2031 (GIF, 2018)[1]

Although Kent and Medway have a relatively high standard of living compared to England as a whole, there are still pockets of deprivation in urban areas such as Chatham, Gillingham, Ashford, Folkestone and Dover, as well as peripheral coastal and estuarial areas (Figure 4). This is caused by a variety of reasons including local demographics and a lack of access to healthcare, skills training and potential job markets.

Kent and Medway is the strategic gateway from the UK to continental Europe. The county is therefore a vital part of the UK's transport network, facilitating the movement of goods, services and people across international markets. In 2018, Kent and Medway's motorway network facilitated the movement of 4.8 million vehicles through the Port of Dover and another 4.4 million vehicles through the Channel Tunnel . The GIF states that £120 billion of traded goods comes through Dover each year, 17% of Britain's total. The county also has well connected and increasingly busy train lines, strategically important trunk roads and an essential local highway network.

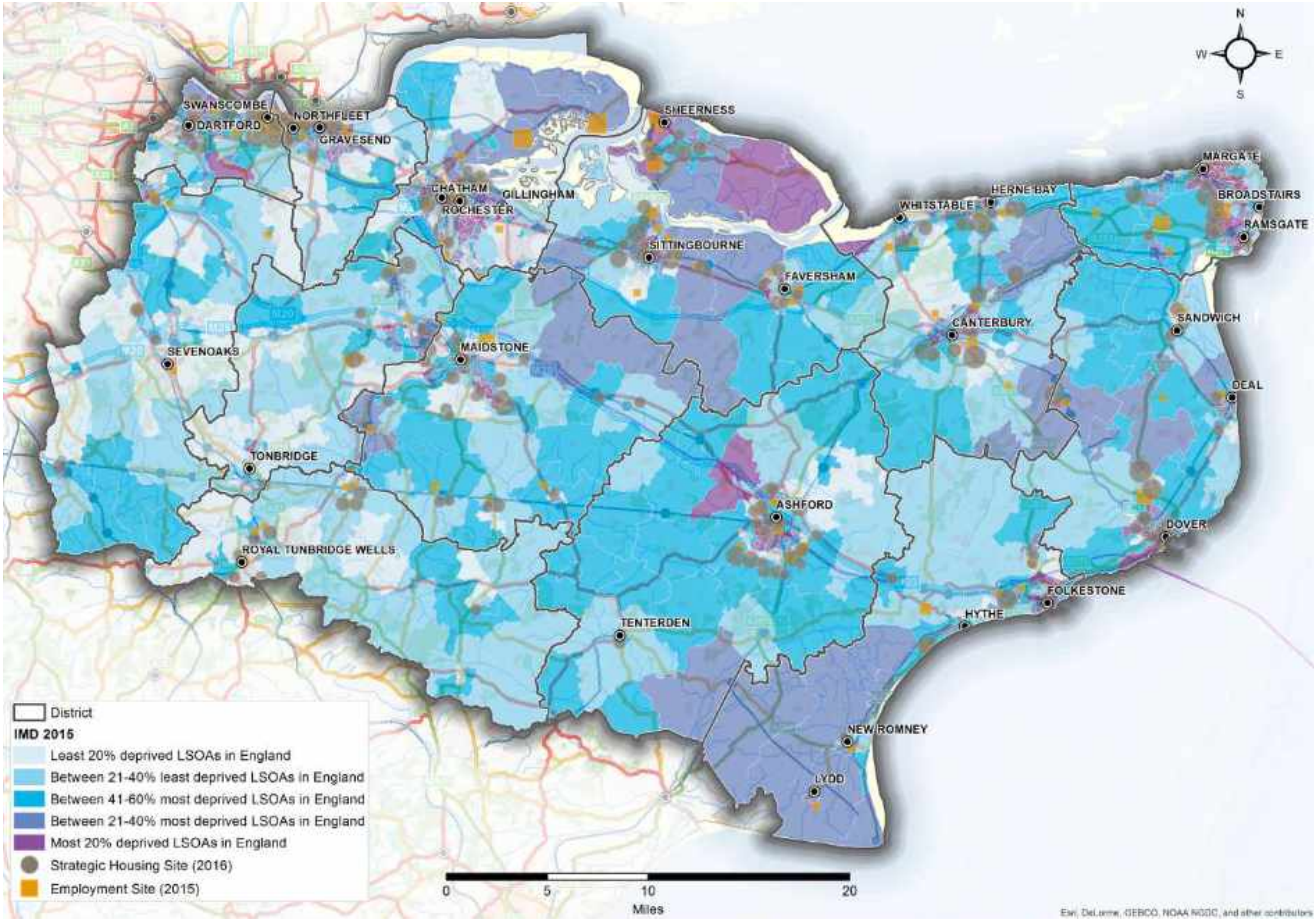


Figure 4: Map showing Indices of Multiple Deprivation 2015 (GIF, 2018)[1]

Kent and Medway are facing increased congestion on both road and rail networks and increased capacity will be needed if the county's growth potential is to be unlocked. Roads are already congested, particularly in major town centres. Average delays on locally managed A-roads in Kent and Medway increased 6.3% and 7.2% respectively between 2015 and 2018 and average speeds have dropped 1% over the same period. Although average delays in Kent are lower than the South East average, delays in Medway are considerably higher (Figure 5).

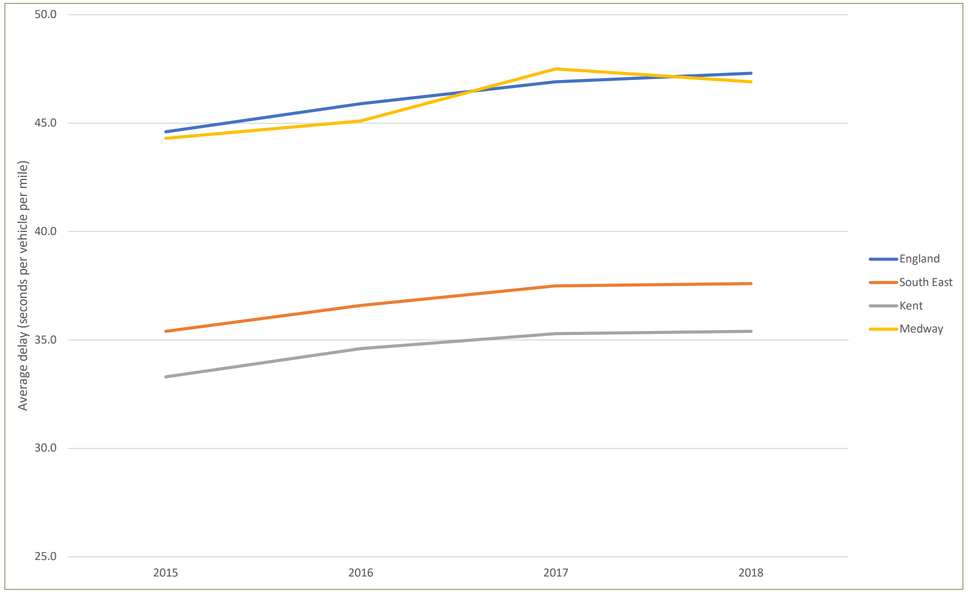


Figure 5: Average delay on locally managed 'A' roads in 2018 (Department for Transport, 2019)[5]

The local road network in Kent and Medway can also be heavily impacted by Operation Brock and Operation Stack, which are brought into force in the event of disruption to services across the English Channel, such as bad weather or industrial action. Operation Stack is a procedure that uses part of the M20 to queue lorries travelling towards the continent, to prevent queuing on local roads in and around the Port of Dover. Operation Brock, an alternative to the older Operation Stack, is a set of measures designed to keep the M20 open in both directions by using different lorry holding areas across Kent. The use of these interventions can cause significant congestion and delays on local communities in south east Kent, particularly when used for consecutive days, confounding existing congestion and air quality issues.

Road transport is one of the key sources of poor air quality. Further growth in housing, commercial space and cross-Channel traffic is likely to increase vehicle numbers and congestion; offsetting and potentially reversing any air quality improvements from the uptake of cleaner vehicles.

The development of a county-wide traffic model will help to identify problem areas and develop solutions. However, without investment and innovation, the county could be severely gridlocked in the medium-long term. Kent County Council's ***Local Transport Plan 4: Growth Without Gridlock 2016-2031*** (LTP4) sets out the county's transport priorities[8]. It aims to deliver "safe and effective transport, ensuring that all of Kent's communities and businesses benefit, the environment is enhanced, and economic growth supported".

To achieve Clean Growth and the LTP4's ambition, there must be a multi-pronged approach to investment and innovation that focuses on:

- clean road transport, such as electric and alternatively fuelled vehicles
- smarter driving and traffic management
- integration of alternative forms of transport such as walking and cycling
- ensuring smooth connections to clean public transport
- supporting new transport models such as car clubs, car sharing and automated vehicles using smart technology.

At the same time, we need to support smarter working practices. The GIF forecasts an additional 70,300 jobs by 2031, a 21% increase from 2011 levels. Better broadband services and enhanced access to digital services and technology will help transform working practices; enabling more people to work or access services flexibly from home, or any location, reducing the need to travel at all.

3 ENERGY IN KENT AND MEDWAY

3.1 ENERGY CONSUMPTION

In 2017, 35,693 GWh of energy was consumed Kent and Medway: 39% in the transport sector, 35% in the domestic sector and 26% in the industry and commercial sector, which also includes the public sector (Figure 6). [9]

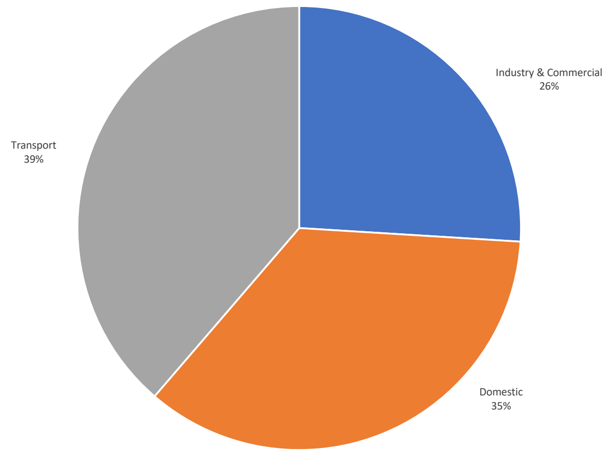


Figure 6: Kent and Medway energy consumption by sector in 2017 (BEIS, 2019)[9]

The carbon emissions of these sectors are slightly different due to the carbon intensity of the energy sources used: transport is responsible for 42% of emissions, industry and commercial for 30% and the domestic sector for 28%. See section 3.5 for further details.

As a country we spend £32 billion a year on heat[10] and almost three-quarters of industrial energy use is to produce heat, often at very high temperatures[11]. The *Energy South2East Local Energy Strategy* [12] states that much of the heat produced in the South East is wasted through discharges into the atmosphere, despite the fact it could be reused in a number of ways.

Uses for waste heat include:

- reuse within the same facility for heating or cooling
- reuse by another end-user via a heat network
- converting waste heat to power.

This presents a huge opportunity to utilise more efficient technologies and achieve cost savings for the county's businesses and residents alike. In the domestic sector, high heat consumption is due to the poor energy efficiency of our housing stock; which also contributes to poor housing conditions and fuel poverty (see section 3.6).

3.1.1 ENERGY CONSUMPTION IN THE NON-DOMESTIC SECTOR

Energy use in the non-domestic sector includes all the energy used in commercial, industrial and public sector buildings and processes.

Total energy consumption in the non-domestic sector in Kent and Medway was 9.044 GWh in 2017; 26% of all energy consumption.[13] Within the non-domestic sector, 44% of the energy used was electricity, 42% gas, 12% petroleum products, 2% coal and less than 1% manufactured fuels (Figure 7).

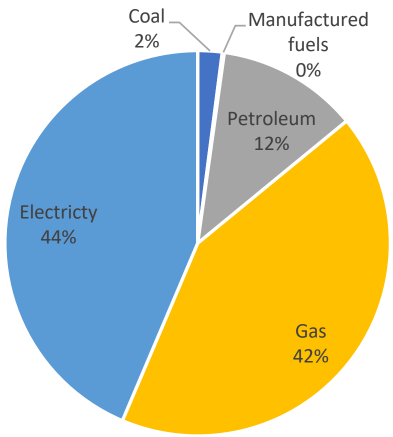


Figure 7: Non-domestic fuel consumption in Kent and Medway by fuel type in 2017 (BEIS, 2019)[13]

Non-domestic gas consumption in Kent and Medway fell 56% between 2005 and 2017, from 8,800 GWh in 2005 to 3,828 GWh in 2017 (Figure 8). Non-domestic electricity consumption saw a 17% fall over the same period, from 4,735 GWh in 2005 to 3,944 GWh in 2017 (Figure 9).

Figure 8: Non-domestic gas consumption in Kent and Medway, 2005-2017 (BEIS, 2019)[13]

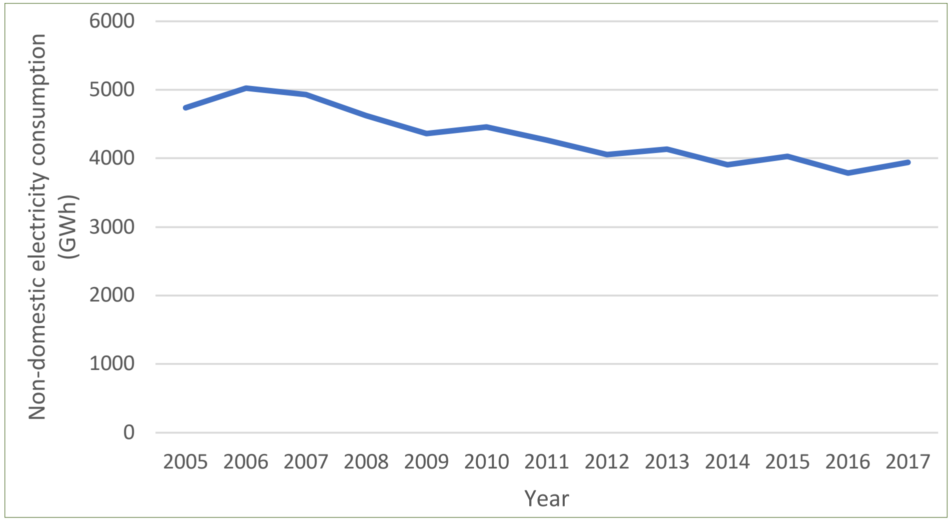


Figure 9: Non-domestic electricity consumption in Kent and Medway 2005-2017 (BEIS, 2019)[13]

3.1.1.1 THE INDUSTRIAL AND COMMERCIAL SECTOR

The industrial and commercial sector is significant in Kent and Medway. In 2015/16 there were 38,660 properties paying business rates in Kent and Medway: 31% of these were in retail, 30% industrial, 23% offices and 15% 'other' (Figure 10). However, the industrial sector accounts for 52% of floor area, retail accounts for 22%, offices 11% and 'other' 14% (Figure 11). The need for increasing levels of quality commercial space with good transport connections is identified as a growth need in the GIF.

EVIDENCE GAP: The number of businesses exempt from paying business rates is unknown, as exemptions are agreed on a case-by-case basis with the local councils who collect business rates. Future data collection to be considered.

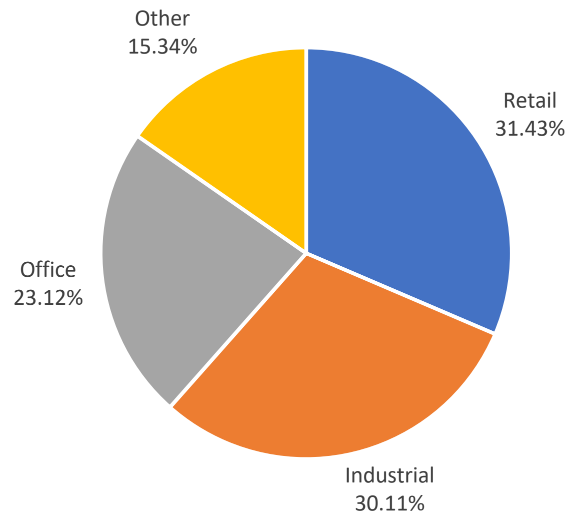


Figure 10: Number of Kent and Medway properties paying business rates in 2015/16 (KCC, 2016)[14]

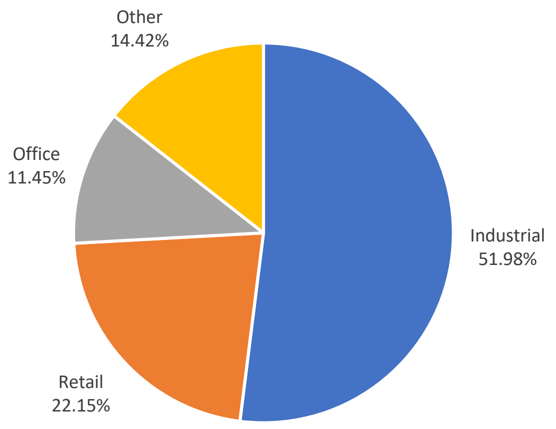


Figure 11: Floor area of Kent and Medway properties paying business rates in 2015/16 (KCC, 2016)[14]

EVIDENCE GAP: Data about energy use and carbon emissions in the industrial and commercial sector in Kent and Medway is limited. Further analysis is needed to segment and better understand the market, for example:

- Which commercial sectors are prevalent in Kent and Medway and which are most energy/carbon intensive? (e.g. professional, scientific & technical, administrative, retail, information & communication, accommodation & food, finance & insurance).
- Which industrial sectors are prevalent in Kent and Medway and which are most energy/carbon intensive? (e.g. food & drink, pulp & paper, cement, chemicals, glass & ceramics; agriculture could also be considered here). What are the opportunities for heat recovery or energy from waste?
- Geographically mapping the sector at a local authority level to understand where clusters exist. An understanding of economic output, employment, etc can help to identify where there may be opportunities to augment existing support services or create new offerings.
- Understanding commonalities related to buildings and to organisational behaviour, including age and EPC rating of buildings; functional use of space; occupancy and work patterns; tenure; fleet, freight and commuting.

One support mechanism for the commercial sector in Kent has been identified in the Energy South2East Local Energy Strategy as an exemplar project for replication across the South East region. Supported by European funding, the Low Carbon Across the South East (LoCASE) project provides free support to help businesses become more competitive and profitable, by reducing environmental impacts through resource efficiencies and encouraging low carbon solutions. It does this through the three-pronged approach of stimulating demand, supporting supply and transferring knowledge.

This project has seen nearly £3.5M of EU grant funding approved for 425 Kent Small and Medium sized Enterprises (SMEs) towards a huge range of purposes. This investment is set to deliver over 4,000 tonnes CO_2 equivalent of savings, through 250 energy and resource efficiency projects; from simple lighting, heating and insulation retrofit works, to investing in more effective and sustainable business practices. This support has helped create 160 jobs, launch 45 new products or services and support 31 business start-ups in Kent and Medway's burgeoning Low Carbon and Environmental Goods and Services (LCEGS) sector.

3.1.1.2 THE PUBLIC SECTOR

Within the ***Kent Environment Strategy,*** [15] there is a commitment to ***'reduce negative impacts and maximise the resource efficiency of public sector services, setting out our public commitments for energy, waste and water use reduction'.***

Total energy consumption across local authority estates in Kent and Medway fell by 6% between 2013 and 2018 but rose 2% between 2017 and 2018. [16]

Public buildings are required to have a Display Energy Certificate (DEC) which provides an energy rating from A-G (A being the most energy efficient and G being the lowest). DECs can also be provided for private sector buildings, but this is optional. DECs were produced for 11,616 buildings in Kent and Medway between 2008 and 2018.[17] Figure 12 shows the distribution of ratings: 64 buildings have a DEC rating of A (0.55% of all buildings with a DEC); 452 are G-rated (3.89%). The most common rating is a D, with 4,704 buildings (40.50%).

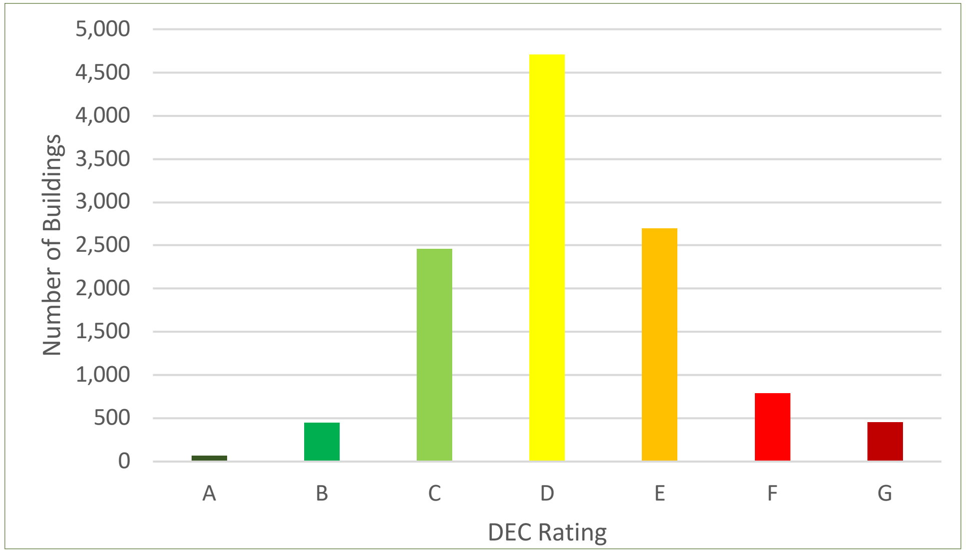


Figure 12: Number of buildings with a DEC in Kent and Medway and their energy ratings, 2008-2018 (MHCLG, 2019)[17]

Medway has 13 A-rated public sector buildings, the most in Kent and Medway. Gravesham and Sevenoaks have the fewest with zero. Medway also has the highest number of F- and G- rated public sector buildings (189 buildings).

EVIDENCE GAP: Further analysis of this data is required to better understand why there is such a range of energy performance in these buildings across the county, for example is there a much older stock profile in some areas? Is planning guidance stronger in certain Districts influencing sustainable design and resultant energy use?

Through its ISO14001:2015 certified environmental management system, Kent County Council has a strong track record in reducing energy use across its estate and is on track to deliver a 32% reduction in greenhouse gas emissions over the five-year period 2016-2021. Most significantly all traffic signals maintained by KCC use low energy light emitting diode (LED) lamp technology and a further 120,000 streetlights are being upgraded to LED in a three-year programme due to complete in 2019. This is expected to deliver over 60% reduction in electricity use from streetlighting and several million pounds of savings in energy bills and maintenance. As well as lamp upgrades a central management system will allow control of every lamp column, enabling remote switching and dimming of lighting as well as quickly identifying faults.

LED lighting also provides an excellent opportunity to significantly reduce electricity use in buildings and many public sector premises and schools have already upgraded to this technology. There are still significant opportunities for this technology to further reduce energy use across the public sector. Interest-free government funding is available through Salix Finance[18] on an invest-to-save loan basis, where the reduction in the energy bills repay the capital investment over several years.

Energy used by heating systems is another significant way to reduce energy use, emissions and costs, however the investment required across the public sector estate runs to millions of pounds and these projects have a much longer payback, usually more than 10 years. Salix Finance can be used to provide a top-up to existing capital investment budgets for heating systems replacement. For example, when converting oil fired boilers to gas systems, where an upgrade to an existing or a new gas pipeline is required at additional cost.

Other public sector organisations such as Kent Police have also made good use of this finance mechanism to implement energy efficiency measures. There is a significant opportunity to make better use of Salix Finance funding across the Kent Public Sector and this is already being considered by the NHS acute trusts as part of the Kent and Medway Sustainability and Transformation Programme.

3.1.2 ENERGY CONSUMPTION IN THE DOMESTIC SECTOR

Total energy use in the domestic sector in Kent and Medway was 12,611 GWh in 2016.[19] Of this, gas accounted for 69% of consumption; electricity 24%; and petroleum products, manufactured fuels and coal making up the remaining 7% (Figure 13).

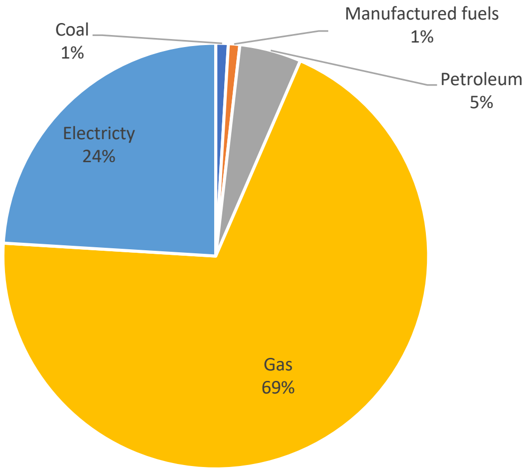


Figure 13: Domestic fuel consumption by fuel type in 2017 (BEIS, 2019)[19]

Domestic gas consumption in Kent and Medway fell 21% between 2005 and 2017; from 11,085 GWh in 2005 to 8,760 GWh in 2017 (Figure 14). Domestic electricity consumption saw a 6% fall over the same period, from 3,237 GWh in 2005, to 3,030 GWh in 2017 (Figure 15).

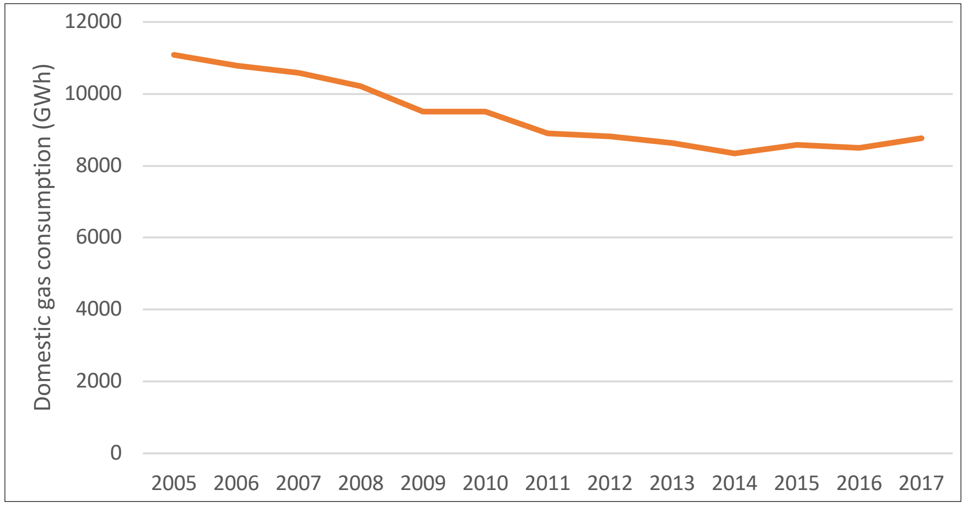


Figure 14: Domestic gas consumption in Kent and Medway, 2005-2017 (BEIS, 2019)[19]

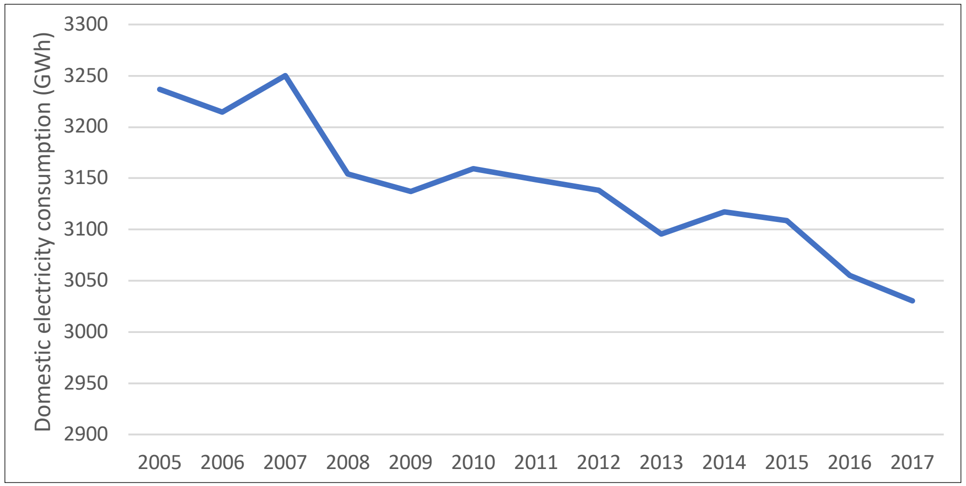


Figure 15: Domestic electricity consumption in Kent and Medway, 2005-2017 (BEIS, 2019)[19]

The scale of growth forecast in the Kent and Medway Growth and Infrastructure Framework will lead to greater energy demand. As a result of this growth, Kent and Medway domestic gas and electricity sales are predicted to rise by 23% and 19% respectively between 2014/15 and 2030/31 (Figure 16). Without mitigation, this will cause emissions from the domestic sector to rise (Figure 17). To offset this increase in demand there needs to be a significant increase in the use of low or zero emission technologies such as heat pumps and LED lighting and a switch to non-fossil fuelled energy sources, such as solar power and hydrogen instead of gas.

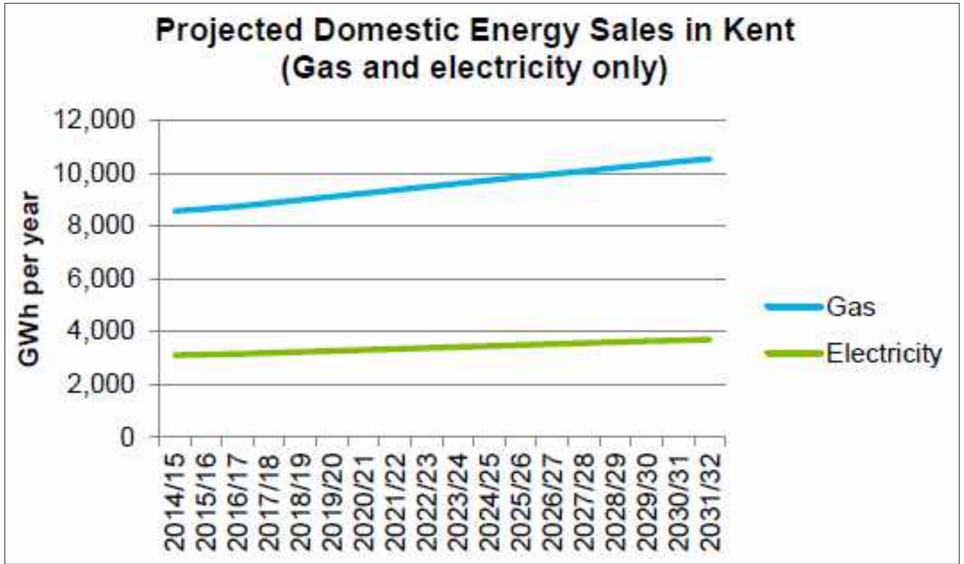


Figure 16: Projected domestic gas and electricity sales in Kent between 2014/15 and 2031/32 (KCC, 2017)[20]

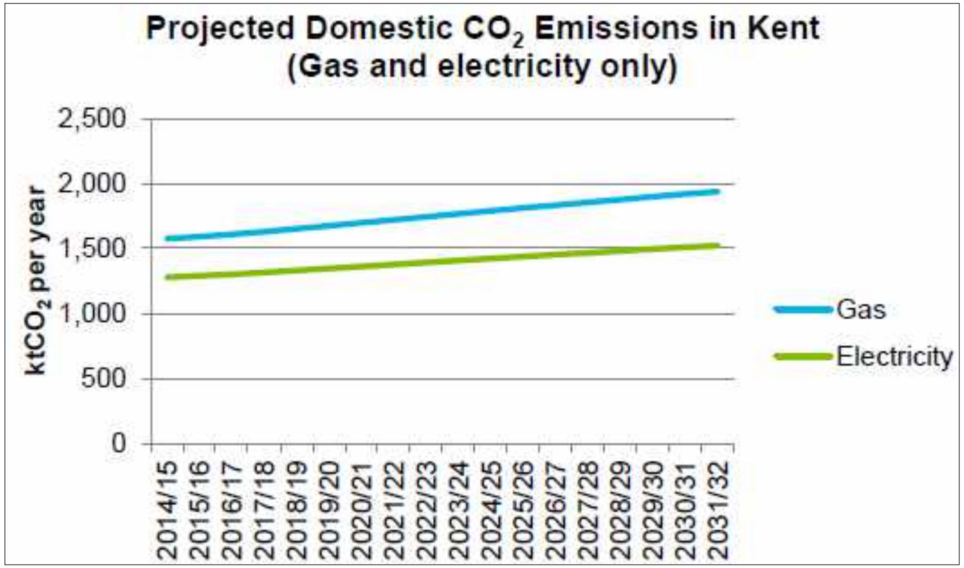


Figure 17: Projected domestic gas and electricity carbon emissions in Kent between 2014/15 and 2031/32 (KCC, 2017)[20]

However, it's important to remember that not all homes in Kent and Medway are on the gas network. In 2016, 571 GWh of energy in the domestic sector came from petroleum products (5%), 116 GWh from coal (1%) and 88 GWh from manufactured fuels (0.75%).

The latest data from Department for Business, Energy and Industrial Strategy (BEIS), shows that an estimated 94,464 households in Kent and Medway are not connected to the gas network; ranging from 7% in Medway to 20% in Ashford (Figure 18). This compares to average of 13% in the South East.

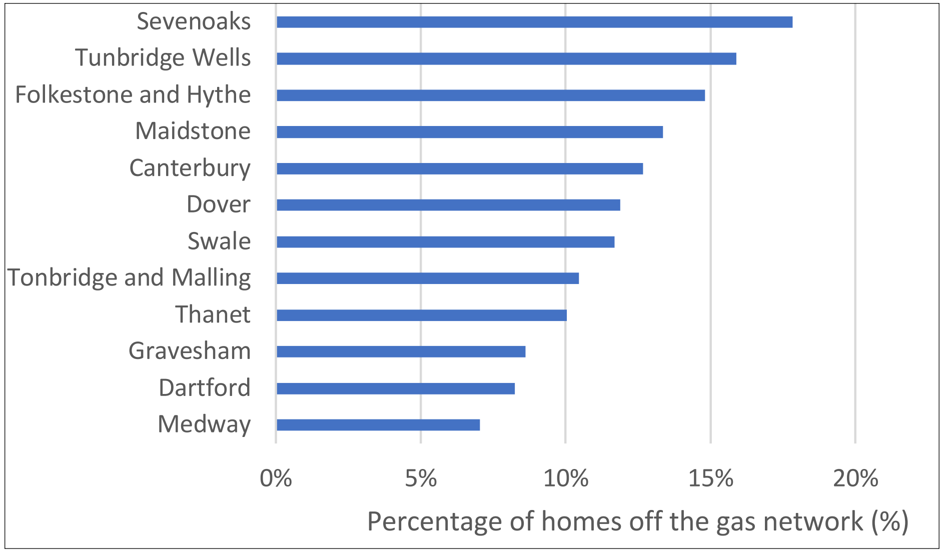


Figure 18: Percentage of homes off the gas grid in Kent and Medway in 2018 (BEIS)[22]

Comparing the low super output (LSOA) areas with 85-95% off-gas properties (Figure 19, dark blue on map) to levels of fuel poverty; Canterbury, Folkestone and Hythe and Tunbridge Wells all have off-gas grid properties with higher levels of fuel poverty at between 12 and 13% These tend to be 3 bedroom homes, privately owned or mortgaged with oil fired heating on average 500 metres or more away from the mains gas grid.

Heating oil produces approximately 25% higher carbon emissions than natural gas , which means that emissions from these off-gas homes are also very high. In addition, these homes tend to have poor energy efficiency, because for example, they are of solid wall construction or have low levels of insulation, and so use more energy to heat compared to a more energy efficient home. Connecting these homes to the gas grid is one of the priorities in Energy South2East Local Energy Strategy under the low carbon heating theme, and work is already underway by Southern Gas Networks to target these premises to get them onto the gas grid.

Energy Performance Certificates for homes (EPCs) are used to show the energy efficiency of domestic buildings. They give a rating of A to G, with A being the most energy efficient and G being the least energy efficient.

71% of homes in Kent and Medway had an Energy Performance Certificate issued between 2008 and 2018. As shown in Figure 20, 583 homes are A-rated (0.1% of all homes with an EPC) and 7,929 homes are G-rated (1.44%). The most common EPC rating is D, at 212,022 homes (38.60%).

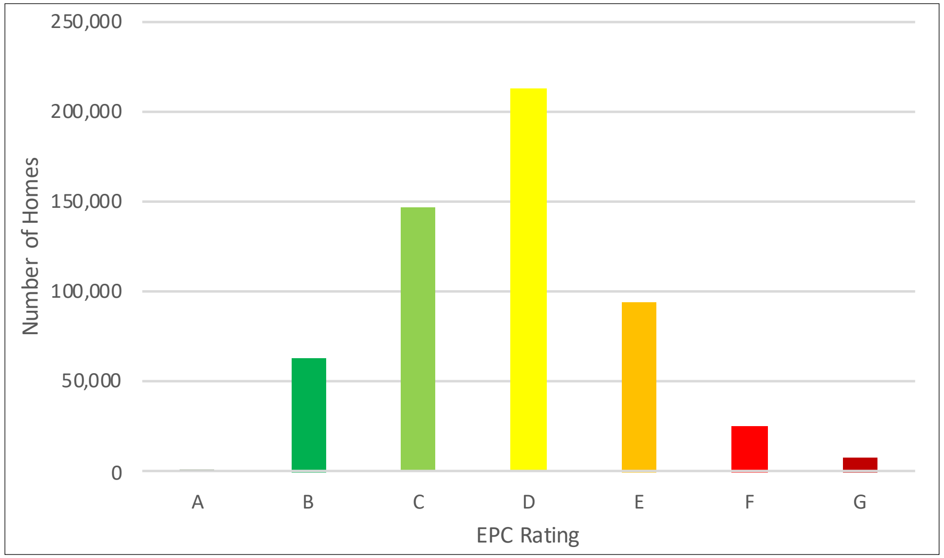


Figure 20: Distribution of domestic EPC ratings in Kent and Medway (MHCLG, 2018)[24]

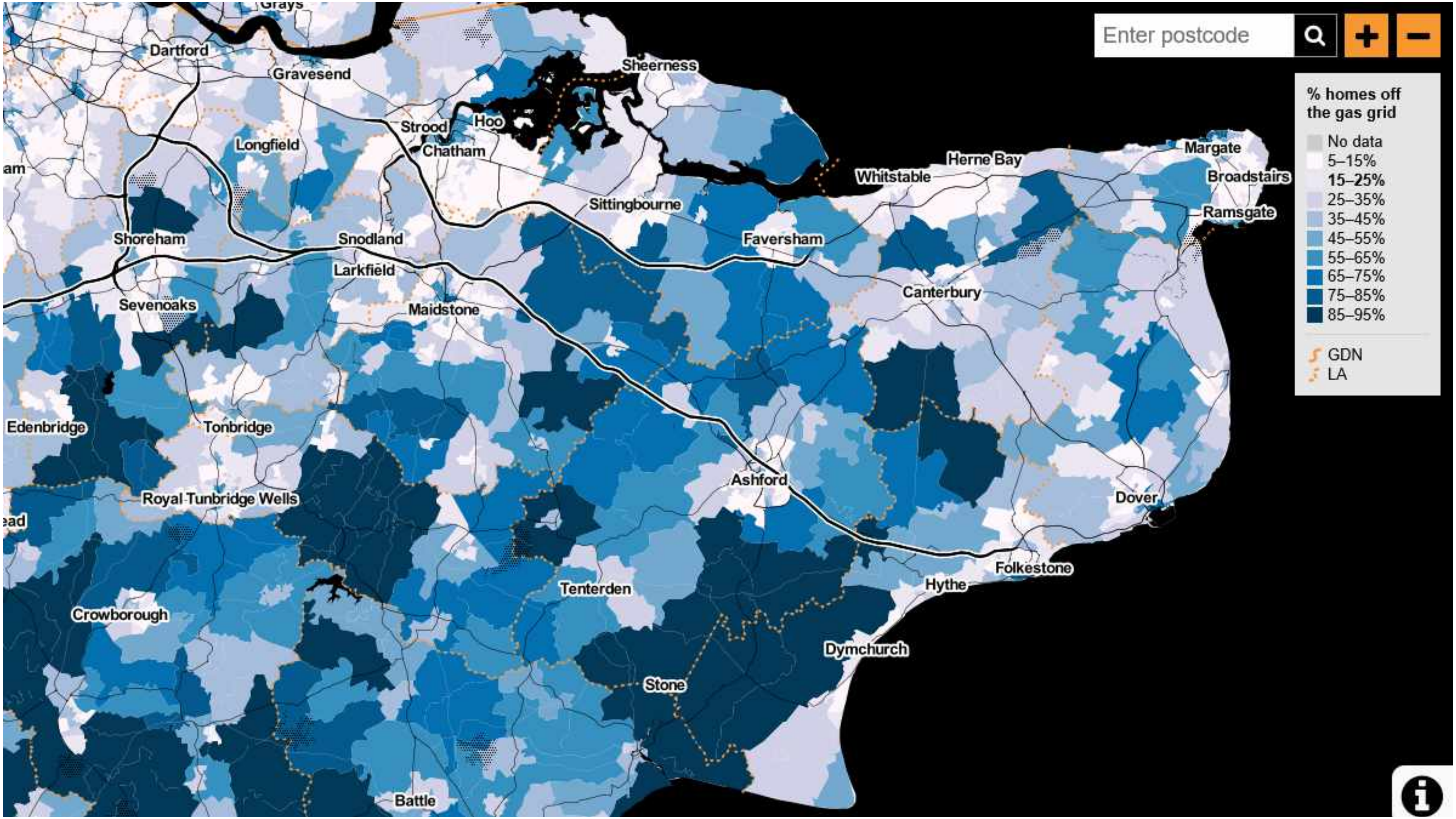


Figure 19: Off gas grid map by lower super output area (LSOA) (nongasmap.org.uk)

Comparing districts, Ashford and Canterbury have the highest number of homes with an EPC rating of A, with 69 homes each (0.18% and 0.14% respectively of all EPCs). Sevenoaks has the least, with just 17 homes (0.06% of all EPCs). The district with the lowest rated homes is Thanet: 3,829 homes have an F or G-rating (7.14% of all EPCs).

The Department for Business, Energy and Industrial Strategy (BEIS) publishes assumptions about the cost of upgrading the energy efficiency of homes. This is provided by measure and by dwelling type only. The average cost to raise a house from a G-rating to a C-rating, for example, is not provided. Low, medium and high price bands are provided. Table 3.1 uses the median price for a small semi-detached or large end-terrace home (<80m^2).

Energy efficiency measure	Cost
Cavity wall insulation	£570 (materials + labour)
External solid wall insulation	£8000 (materials + labour)
Internal solid wall insulation	£7,700 (materials + labour)
Loft insulation (joists)	£395 (materials + labour)
Loft insulation (rafters)	£2,200 (materials + labour)
Double glazing	£5,550 (materials + labour)
Secondary glazing	£110/m2 of glazing (materials + labour)
Gas central heating installation	£3,800
Gas boiler replacement	£2,800
LEDs	£3.50 to £10.00 (cost per bulb DIY)

Table 3.1: Average cost of energy efficiency measures (BEIS, 2017)[25]

3.2 FUTURE ENERGY SCENARIOS

Each year, National Grid publishes their Future Energy Scenarios (FES)[26] to identify a range of energy scenarios for the next 30 years and beyond. They look at how much energy we might need, where it could come from and what future changes might mean for the energy industry and their customers.

The 2018 FES provides a new scenarios framework linked to the speed and level of decarbonisation (Figure 21). The framework estimates speed by looking at government policy, economics and consumer attitudes, and estimates the level of decarbonisation by looking at how close the production and management of energy is to the end consumer.

Of these scenarios, only the Community Renewables and Two Degrees options will deliver the UK's 2050 carbon reduction target. The key messages in the 2018 FES are:

- Energy capacity could double by 2050, with up to 65% of that being locally generated. This changing generation mix will mean new ways to maintain system balance will have to be found.
- Electricity demand is expected to grow significantly by 2050, driven by increased electrification of heating and transport. There could be 36 million electric vehicles by 2040; these could support the rollout of renewables by storing excess low carbon electricity generation.
- Decarbonisation of heat needs to gather pace in the 2020s to meet carbon reduction targets. Up to 60% of homes could be using heat pumps by 2050 and one third of homes could be heated by hydrogen.

In response to this, the UK government announced in its spring 2019 budget statement that a 'future homes standard' would ensure that new UK homes will be built without fossil fuel heating from 2025. The government also announced new proposals to increase the proportion of 'green' gas in the gas grid, which would help to reduce emissions from the mains gas supply. This signals the start of a phasing out of natural gas for cooking and heating. This will create significant future challenges for house developers and the future of home retrofit, which will need to consider the adoption of new technologies such as heat pumps and heat networks.

2050 carbon reduction target is not met

CONSUMER EVOLUTION	
Electricity demand	Moderate-high demand: high for electric vehicles (EVs) and moderate efficiency gains
Transport	Most cars are EVs by 2040; some gas used in commercial vehicles
Heat	Gas boilers dominate; moderate levels of thermal efficiency
Electricity supply	Small scale renewables and gas; small modular reactors from 2030s
Gas supply	Highest shale gas, developing strongly from 2020s

STEADY PROGRESSION	
Electricity demand	Moderate-high demand: high for EVs and moderate efficiency gains
Transport	Most cars are EVs by 2040; some gas used in commercial vehicles
Heat	Gas boilers dominate; moderate levels of thermal efficiency
Electricity supply	Offshore wind, nuclear and gas; carbon capture utilisation and storage (CCUS) gas generation from late 2030s
Gas supply	UK Continental Shelf still producing in 2050; some shale gas

2050 carbon reduction target is met

COMMUNITY RENEWABLES	
Electricity demand	Highest demand: high for EVs, high for heating and good efficiency gains
Transport	Most cars are EVs by 2033; greatest use of gas in commercial vehicles but superseded from mid 2040s by hydrogen (from electrolysis)
Heat	Heat pumps dominate; high levels of thermal efficiency
Electricity supply	Highest solar and onshore wind
Gas supply	Highest green gas development from 2030s

TWO DEGREES	
Electricity demand	Lowest demand: high for EVs, low for heating and good efficiency gains
Transport	Most cars are EVs by 2033; high level of gas used for commercial vehicles but superseded from mid 2040s by hydrogen
Heat	Hydrogen from steam methane reforming from 2030s, and some district heating; high levels of thermal efficiency
Electricity supply	Offshore wind, nuclear, large scale storage and interconnections; CCUS gas generation from 2030
Gas supply	Some green gas, including biomethane and BioSNG; highest import dependency

LEVEL OF DECENTRALISATION ➤

SPEED OF DECARBONISATION ➤

Figure 21: Future Energy Scenario (Source: National Grid, 2018)[26]

Security of energy supply is also an issue for the future. The UK's electricity and gas supplies come from a diverse range of sources and geographical locations; it is a reliable system, but no system can be entirely risk free. Demand is generally higher in the winter than in the summer: 70% of household gas demand happens between October and March, and on a cold day, peak demand can be three times as much as average consumption. Around half of Britain's gas supplies come from our own North Sea gas fields, the remainder is imported from a variety of sources including pipelines linking us with Europe and liquified natural gas shipped in from around the world.

In the electricity system, the Capacity Market has been introduced by the government to ensure security of electricity supply. This is delivered by running annual auctions for capacity contracts, which provide a payment for reliable sources of capacity. However, in November 2018 the EU ruled that the Capacity Market could be in breach of State Aid rules and the mechanism was suspended. In February 2019, following a consultation on proposed technical amendments, the government announced a number of changes that would allow the Capacity Market to be restarted.[28]

There are significant electricity grid constraints within Kent and Medway making new connections increasingly difficult, particularly for energy generation projects. Innovation is required to overcome this at an infrastructure level, otherwise Kent's growth plans will be severely hampered. Some work has already begun, with UK Power Networks (UKPN) and National Grid launching a new Active Network Management scheme to boost grid capacity and simplify the connections process for energy generators. However, much more innovation is needed to ensure housing developments can go ahead without significant grid connection charges.

3.3 GREENHOUSE GAS EMISSIONS FROM ENERGY DEMAND

3.3.1 NATIONAL POLICY CONTEXT: TACKLING THE CLIMATE EMERGENCY

According to the International Panel on Climate Change (IPCC) , human activities are estimated to have already caused approximately 1^{0}c of global warming above pre-industrial levels. Global warming is likely to reach 1.5^{0}c between 2030 and 2052, if it continues at the current rate.

The 2015 Paris Agreement commits all nations to undertake ambitious efforts to keep global temperature rise this century to well below 2^{0}c and to pursue efforts to limit warming to 1.5^{0}c. However, the IPCC estimates that the actions currently pledged are not enough; with current ambition likely to result in warming of 3^{0}c by 2100. Warming of 2^{0}c and above will lead to significant impacts around the world and in the UK, such as sea level rise, flooding, heatwaves, water shortages and falling crop yields.

In its 2018 Special Report[30], the IPCC advised that global emissions must decline by 45% by 2030 (from 2010 levels), and reach net-zero by around 2050 to limit warming to 1.5^{0}c. To achieve this, there must be rapid and far-reaching transitions in energy, land, buildings and infrastructure. The IPCC acknowledge that this will be very difficult without immediate action, but also noted that "the energy transition required to limit global warming to 1.5^{0}c is already underway in many sectors around the world".

Following the publication of the IPCC's Special Report, the UK Government wrote to the Committee on Climate Change (CCC), asking them to reassess the UK's long-term emissions targets, and advice on how further reductions might be achieved. They published their response on 2 May 2019: Net Zero – the UK's contribution to stopping global warming. [31]

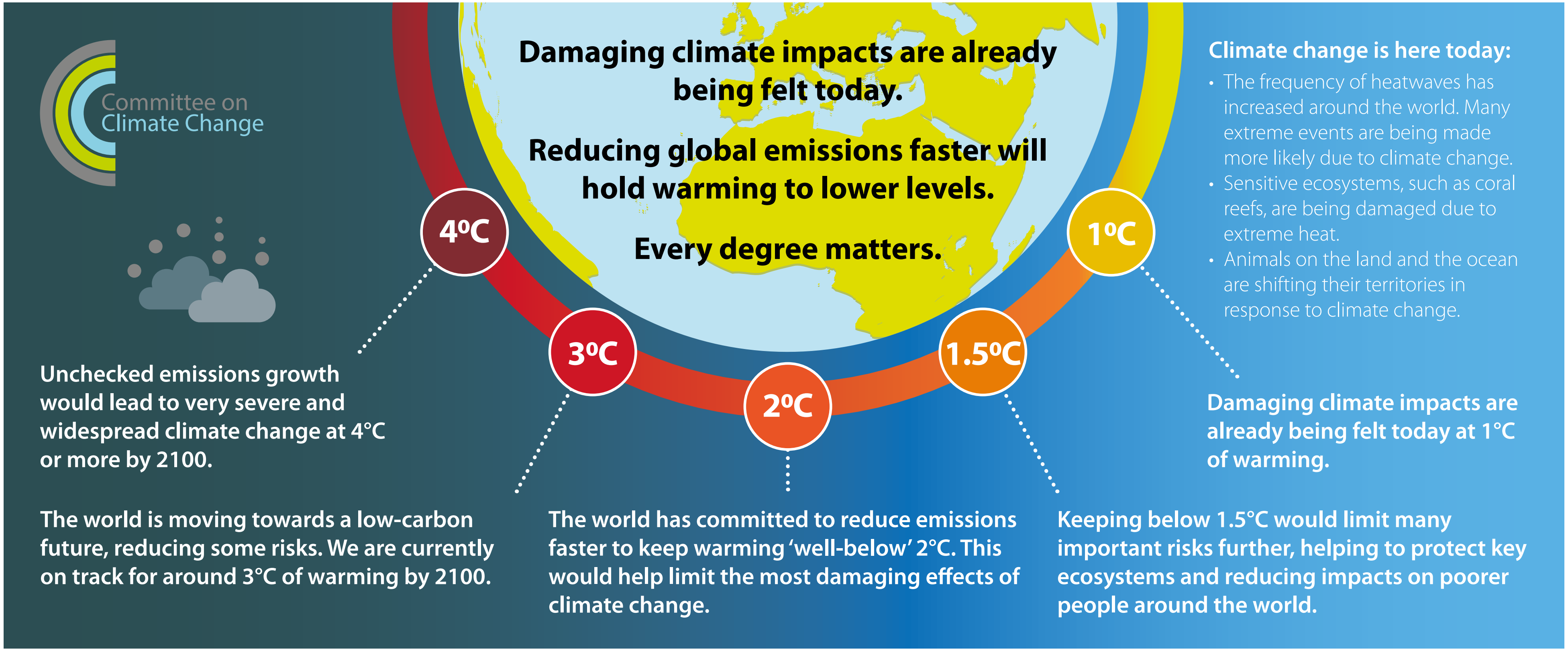


Figure 22: Impact of global temperature rise (Committee on Climate Change, 2019)

The report advised that the UK should set a new emissions target of net-zero greenhouse gas emission by 2050. The CCC believe that a net-zero target for 2050 will deliver on the UK's commitment made through the Paris Agreement in 2015 and that it is achievable using known technologies, and that the annual costs of achieving net-zero emissions are comparable to the costs accepted when the original 2050 target was legislated. One of the reasons for this, is that innovation has driven down the cost of key technologies, such as offshore wind and battery storage. In addition, any increased costs to consumers, such as increased heating bills, can be offset by cheaper transport costs and cheaper electricity bills.

However, the CCC also warned that achieving net-zero would only be possible if clear, stable and well-designed policies to reduce emission further were introduced immediately. They highlighted that government policy at the time was insufficient for even existing targets, and that a major ramp-up was required:

- low carbon electricity must quadruple its supply by 2050
- all building stock to be energy efficient with low carbon heating (not just new build)
- 2040 is too late to phase-out petrol and diesel cars and vans
- urgent large-scale trials for heat pumps and hydrogen to decarbonise heating systems
- actual delivery of carbon capture and storage
- change of approach to ensure afforestation targets are met.

The CCC also advised that new policies were needed to address challenges that have yet to be addressed:

- industry must be largely decarbonised
- heavy goods vehicles must switch to low carbon fuel sources
- emissions from international aviation and shipping can't be ignored
- a fifth of agricultural land must shift to alternative uses that support emissions reduction (eg. afforestation, biomass production and peatland restoration).

The report goes on to state that clear leadership is needed across all levels of government in the UK and that zero-carbon policies and actions must be delivered in partnership with businesses and communities. It also acknowledged that the polices must be funded and implemented coherently across all sectors, in order to drive the necessary innovation, market development and consumer up-take of low carbon technologies and influence behaviour change.

Following the publication of the Committee on Climate Change's report to government in May, the government amended the Climate Change Act 2008[32], to set the UK greenhouse gas emissions reduction target to at least 100% compared to 1990 levels, otherwise known as 'net-zero'. Progress against the 2050 target is measured by legally binding carbon budgets, which cap the amount of greenhouse gases that can be emitted by the UK over a five-year period: these are measured by the Committee on Climate Change (CCC).

In 2017, the UK's greenhouse gas emissions were 43% below 1990 levels, while the economy grew by two-thirds over the same period. This means that the UK has met the first two carbon budgets (2008-12 and 2013-17) and is on track to meet the third (2018-22). However, it is not on track to meet the fourth, which covers the period 2023-27.

The *South2East Local Energy Strategy* highlights that the reduction in energy demand needed to meet the 2032 carbon budget is very unlikely to be met by a reduction in energy demand by society in general, ie. we will want more energy than greenhouse gas emission allowances will allow (Figure 23). Instead, the difference between demand and traditional energy supply will have to be made up by clean (low and zero emission) energy generation at both a national and local scale. This will include existing known technologies such as solar, wind and energy from waste; but will also need to incorporate more innovative solutions, such as the wider adoption of heat pumps, the wide-scale development of low carbon heat networks and hydrogen as an energy source. An example project is Western Power Distribution's Freedom Project, which is trialling hybrid heating systems that use both a gas boiler and an electric heat pump, alongside an aggregated demand side response control system.

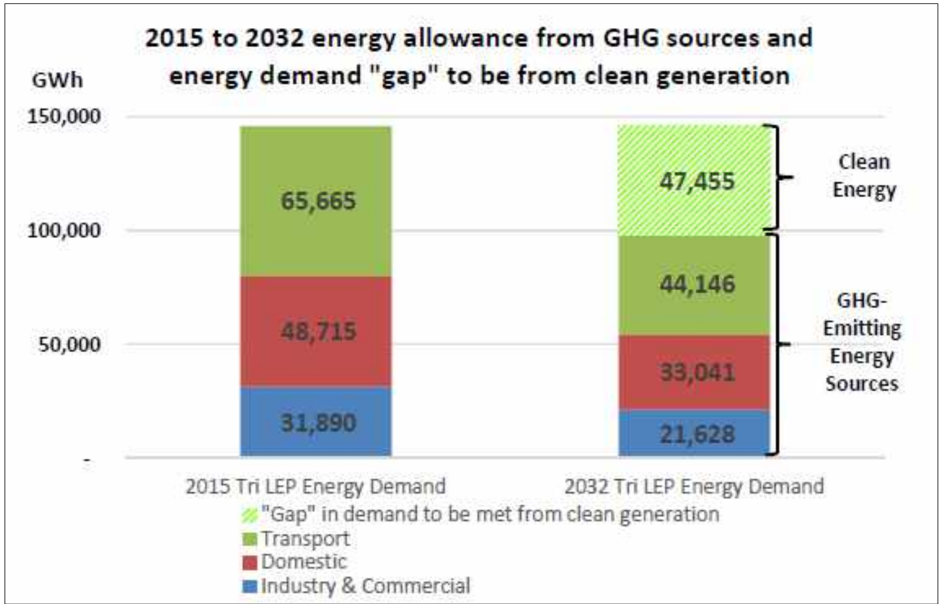


Figure 23: Comparison of 2015 to 2032 energy demand by Sector, highlighting energy "gap" to be met by clean energy (Energy South2East, 2019)

Over the last 45 years, climate change in Kent has largely been in line with UK trends. South East average temperatures have generally increased more than in the north of the country; our sea level has risen about 1 mm per year since the mid-20th century; we've seen more heavy winter downpours; and a decrease in summer rainfall. Other gradual changes have been recorded in Kent, which also indicate the impact of climate change:

- sea level rise at Sheerness
- earlier emergence dates for butterflies
- earlier arrival and breeding of bird species that require warmer climates.

For further information on the impacts of climate change in Kent can be found in the Kent Climate Change Risk And Impact Assessment. [34]

3.3.2 KENT AND MEDWAY EMISSIONS FROM ENERGY DEMAND

Since 2005, the government has produced annual estimates of carbon dioxide emissions at a local authority level. These are intended as a resource to help the monitoring of efforts to reduce carbon dioxide emissions. The dataset includes all the emissions in the national inventory, excluding aviation, shipping and military transport; for which there is no obvious basis for allocating to local areas.

Overall, emissions fell 37% in Kent and Medway between 2005 and 2017.[35] However, whilst emissions from the industrial and commercial sector and domestic sector have fallen significantly over this period (falling 57% and 35% respectively), the transport sector has not followed this trend (Figure 24). The transport sector now accounts for 42% of Kent and Medway emissions. Although transport emissions fell 0.19% between 2016 and 2017, these remain the two higher years for transport emissions since 2007.

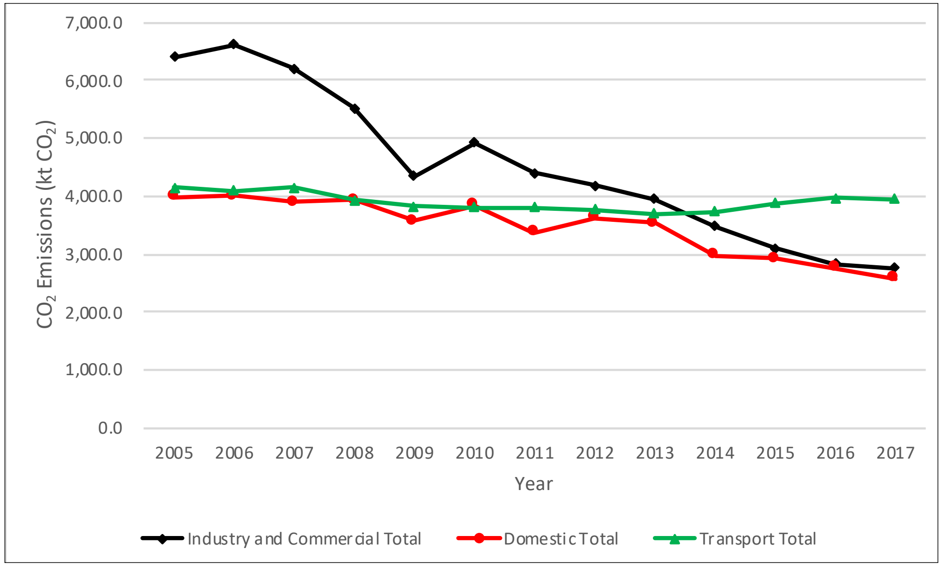


Figure 24: Kent and Medway carbon dioxide emissions by sector between 2005 and 2017 (BEIS, 2019)[35]

Much of the reduction in emissions during this period comes from the industrial and commercial sector. Between 2006 and 2009 some local authority areas saw old industrial sites/machinery removed or redeveloped, which had a big impact on emissions. For instance, Gravesham saw an 86% reduction in industrial and commercial sector emissions when a cement works closed in 2008. Nationally, this sector has also experienced a decrease in emissions, which reflects the decrease in the use of coal for electricity generation. Figure 25 shows the latest sectoral split of carbon emissions for Kent and Medway.

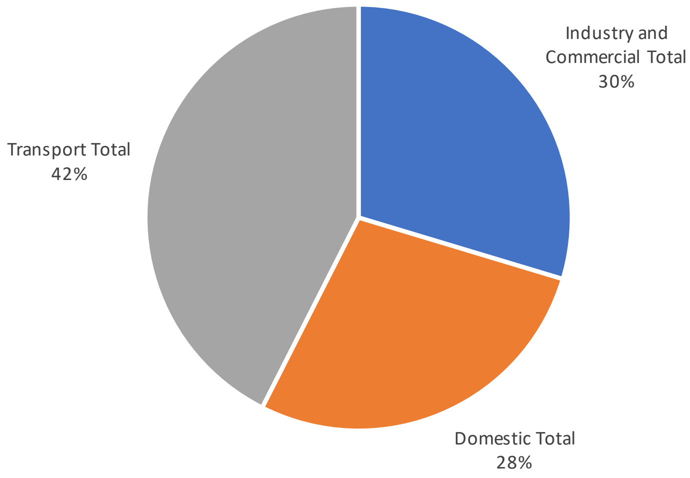


Figure 25: Kent and Medway carbon dioxide emissions by sector in 2017 (BEIS, 2019)[35]

Further analysis of carbon dioxide emissions at a sub-sector level shows that domestic gas (18%), A-roads (18%), Motorways (16%) and industrial and commercial electricity (11%) are the largest contributors to Kent and Medway's total emissions (Figure 26).

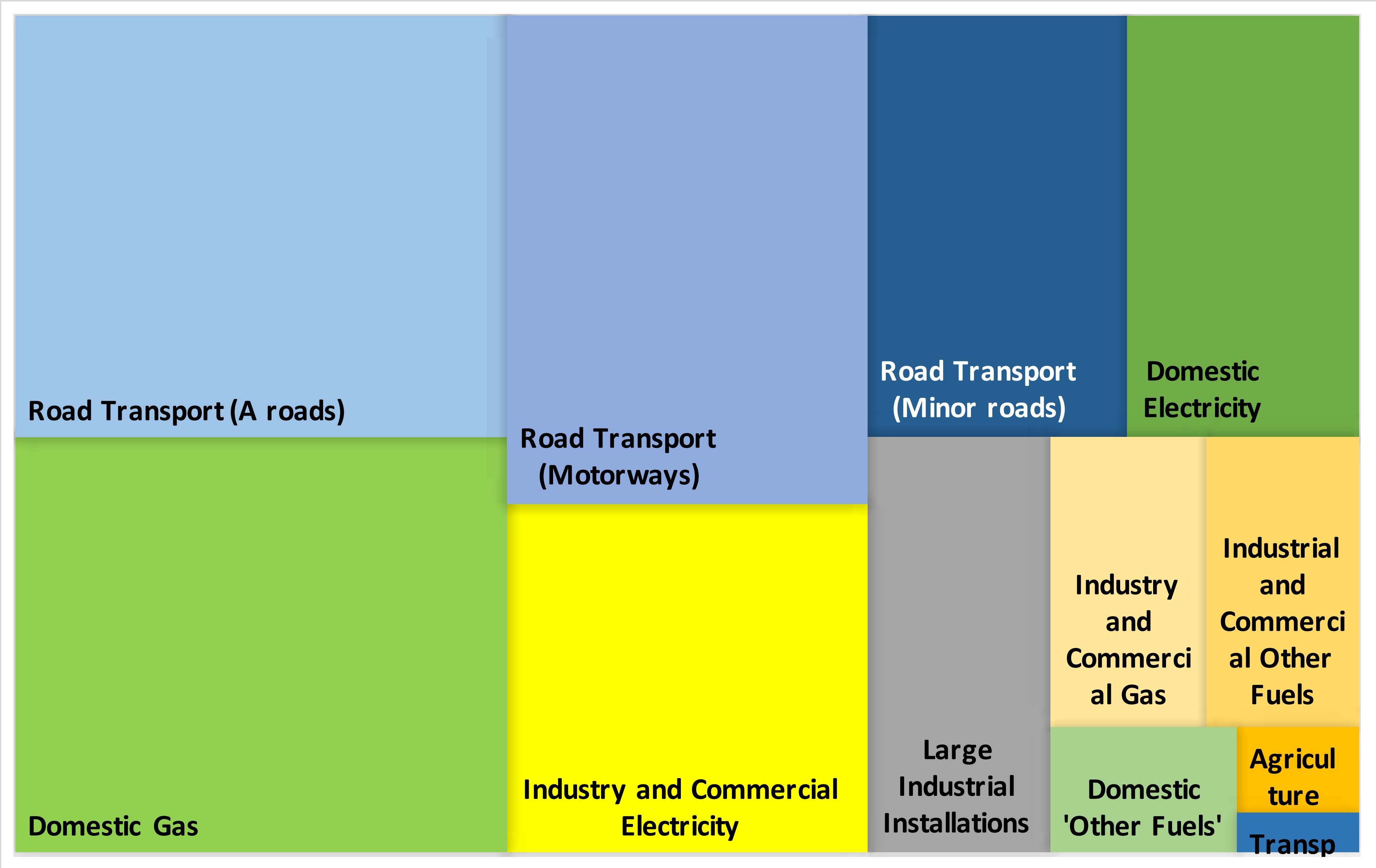


Figure 26: Percentage of Kent and Medway carbon dioxide emissions by sub-sector (BEIS 2019)[36]

Per capita carbon dioxide emissions vary across Kent and Medway; from 3.3 tonnes per capita in Medway, to 8.0 tonnes in Swale (Figure 27). The average for the South East is 4.8 tonnes and the average for England is 5.1 tonnes.[37] The variation within Kent and Medway is mostly due to the amount of energy intensive industry in the local authority area and the extent of the motorway network. Population density also influences the per capita emissions calculation.

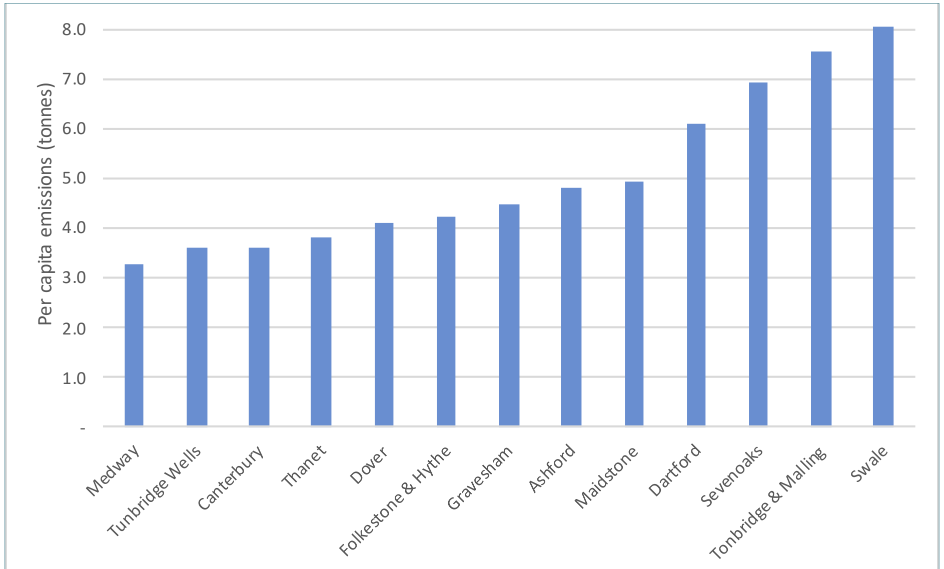


Figure 27: 2017 per capita carbon dioxide emissions for Kent and Medway by local authority area (BEIS 2019)[36]

Carbon dioxide emissions associated with gas and electricity consumption in Kent decreased by approximately 34% between 2012 - 2017, from 6,274 ktCO_2 per year to 4,111 ktCO_2 per year. This change can be attributed to:

- Differences in energy consumption: gas consumption decreased by approximately 10% while electricity consumption increased by approximately 1%.
- Differences in the fuel emissions factors: the carbon intensity of gas has remained relatively stable, while that of electricity has dropped by nearly 30%, from 0.521 kgCO_2 /kWh to 0.345 kgCO_2 /kWh, due to the near elimination of the use of coal to produce electricity and an increasing proportion of electricity generated by wind and solar.

3.4 FUEL POVERTY

Fuel poverty in England is measured using the 'Low-Income High-Costs' (LIHC) indicator. Under this indicator, a household is considered to be in fuel poverty if:

- they have required fuel costs that are above average (the national median level)
- were they to spend that amount, they would be left with a residual income below the official poverty line.

In 2017, over 73,010 households in Kent and Medway were in fuel poverty (9.6% of households). This compares to a fuel poverty rate of 8.7% across the South East and 10.9% in England (Figure 28).

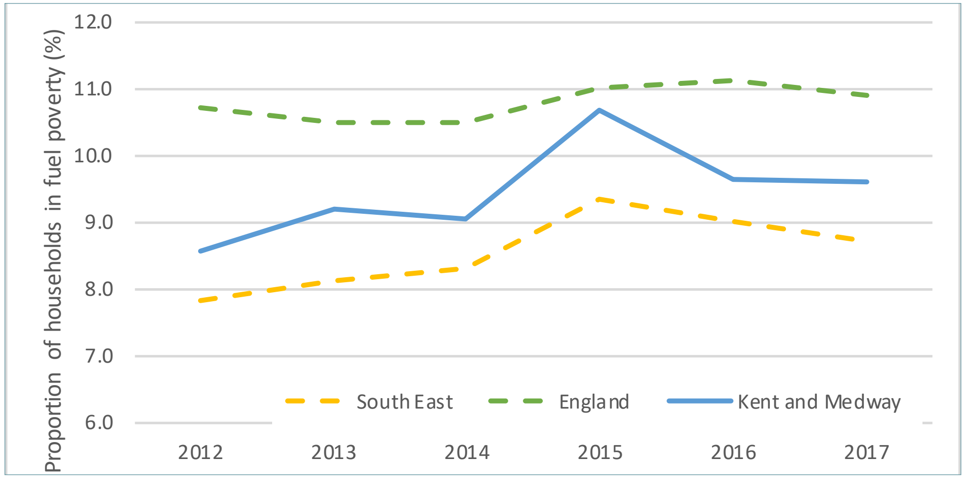


Figure 28: Percentage of households in fuel poverty in Kent and Medway 2012 - 2017 (BEIS 2019)[88]

In 2017, fuel poverty fell nationally by 0.2% to 10.9% compared to the previous year. In contrast, fuel poverty in Kent and Medway remained the same at 9.6% during the same period. Although the number of households in fuel poverty is lower than its peak of 10.7% in 2015, it still higher than its low of 8.5% in 2012. Fuel poverty is higher in some areas of the county compared to others (Figure 29). The local authority with the highest proportion of fuel poor households in 2017 is Thanet (12.3%). Canterbury, Dover, Gravesham, Folkestone and Hythe and Medway all have more than 10% of households in fuel poverty and some specific LSOA's in Kent and Medway experience fuel poverty of up to 25.4%. The lowest incidences of fuel poverty are in Dartford (7.7%) and Tonbridge and Malling (7.9%).

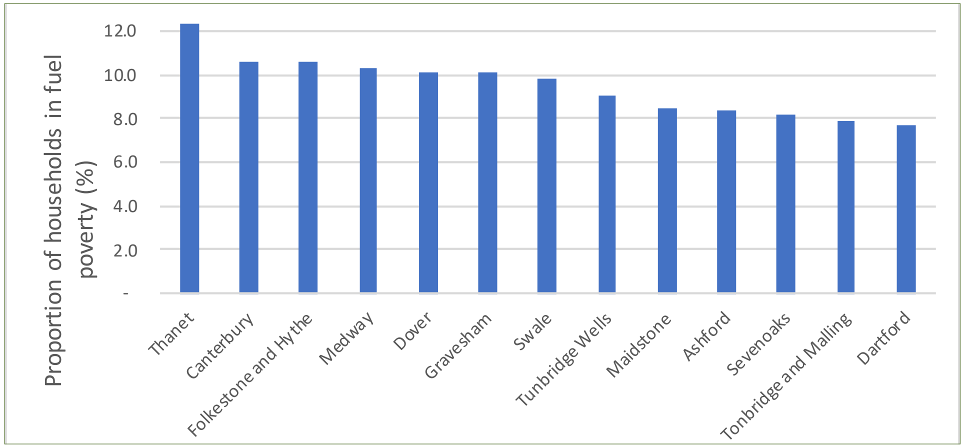


Figure 29: Fuel poverty in Kent and Medway in 2017, by local authority area (BEIS, 2019)[38]

Resident environmental perception surveys are carried out every two years as part of the monitoring of the Kent Environment Strategy. Data from 600 interviews undertaken in July 2018 has been published. The survey results show that 11% of people struggle to pay their energy bills to some extent, which is slightly higher than the Government figures of 9.6% of fuel poverty for Kent and Medway. The proportion who noted they struggle, is highest amongst those aged 25-44 (15%) and those living in rented accommodation (41%). Government data shows that household expenditure on energy is rising (Figure 30). The UK average standard annual gas and electricity bill has risen £320 over the last ten years, with the average domestic combined bill in 2018 costing £1,314.[40] Average bills in the South East are slightly higher than the UK average; in 2018 the South East average gas and electricity bills were £661[41] and £670 ; giving a combined cost of £1,331 (1.29% higher than the UK average). Average costs are lower for those on direct debit (~70% of southeast customers), higher for those on prepayment meters (~10% of southeast customers) and highest for those on credit meters (~20% of southeast customers).

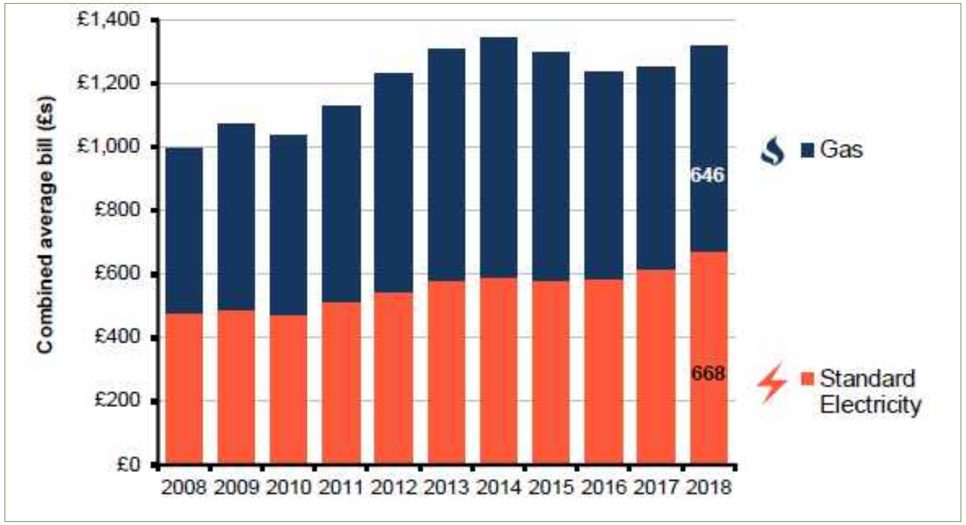


Figure 30: Average standard UK domestic electricity and gas bills 2008 – 2018 (BEIS, 2019)[40]

Delivering Affordable Warmth: a fuel poverty strategy for Kent[43], was published by the Kent Energy Efficiency Partnership in 2016. It outlines the actions required to address Fuel Poverty in the county and is delivered in part, through the Kent and Medway Warm Homes Scheme[44]. Since the scheme began in 2014, Kent and Medway partners have installed nearly 2,700 energy efficiency measures in over 2,500 homes; helping to save residents £9.5 million over the measures' lifetime. Despite this positive activity, which also includes helping residents switch to cheaper energy tariffs and claim the benefits they are eligible for, the significant rise in annual costs of energy is making it more difficult to lift households out of fuel poverty.

Fuel poverty often leads to people living in cold, damp homes. This can contribute to increasing the risk of poor health outcomes, as well as increased morbidity and mortality. Public Health England monitors the levels of fuel poverty and Excess Winter Deaths (EWDs) at a national and council level. The number of EWDs depends on the temperature and the level of disease in the population, including the levels of seasonal influenza, and other factors, such as how well-equipped people are to cope with a fall in temperature. Mortality during winter increases more in England and Wales compared to other European countries with colder climates, suggesting that many more deaths could be preventable in England and Wales.

Excess Winter Mortality (EWM) is calculated so that comparisons can be made between sexes, age groups and regions and is calculated as excess winter deaths divided by the average non-winter deaths, expressed as a percentage. The EWM Index for England is 21.2% and for the south-east is 21.9% (Figure 31). The index varies considerably in Kent and Medway: by far the highest EWM Index is in Dover (35.6%), then Maidstone (30.7%). The lowest is in Tunbridge Wells where it's just 9.8. Thanet, Sevenoaks, Medway and Tonbridge and Malling are also all below the English average. [45]

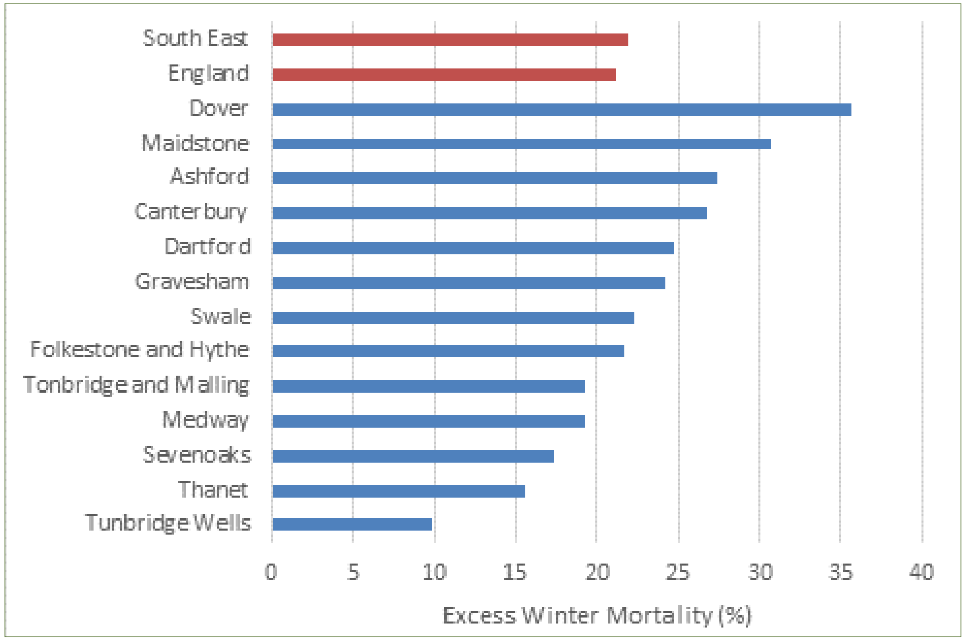


Figure 31: Excess winter mortality index, 2016-2017 (ONS, 2019)[45]

Older people are particularly vulnerable to higher mortality risk, and physical and mental health problems are likely to be exacerbated by living in a cold home. Provisional data for 2017/2018 indicates that around 23% of EWDs are attributable to cardio-vascular diseases and 35% are attributable to respiratory diseases.[46] 21.5% of all EWDs are attributable to the coldest quarter of housing.

In 2014, Age UK estimated that the adverse health effects of living in a cold home carry an estimated cost to the NHS of £1.36 billion a year. [48] This cost to the NHS does not include additional spending by social services or economic loss through missed work.

3.5 RENEWABLE AND LOW CARBON ENERGY IN KENT AND MEDWAY

3.5.1 CURRENT RENEWABLE ENERGY AND LOW CARBON CAPACITY

In 2017, Kent County Council commissioned an update to the *Renewable Energy Action Plan for Kent* report which assesses renewable energy capacity and trajectories across the county.[49] Renewable and combined heat and power (CHP) capacity across Kent has increased significantly in the last five years (Figure 32). The capacity of solar, wind, waste and CHP combined that was active, agreed or under construction was reported as over 1,900 MW (including offshore wind farms), compared with approximately 230 MW in 2012. Most of this increase has been delivered through off shore wind and solar installations, with wind contributing over 1,100 MW and solar over 550 MW.

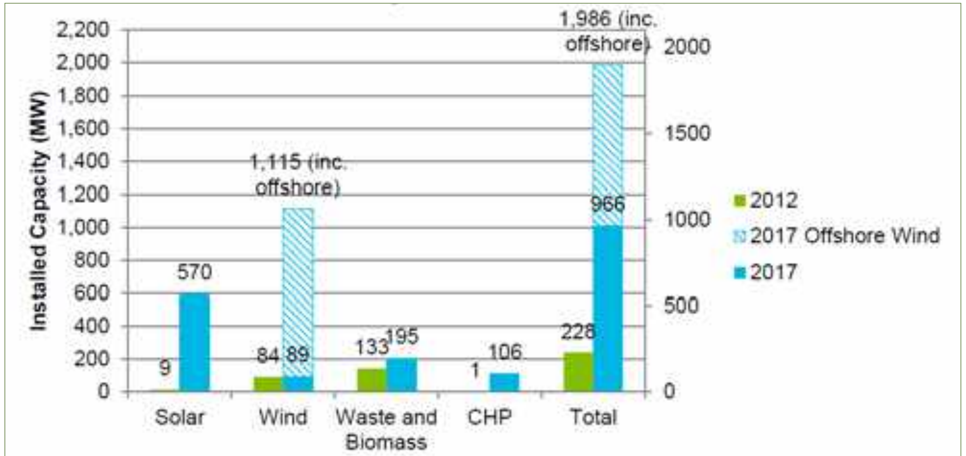


Figure 32: Renewable and CHP capacity in Kent and Medway, 2012 vs 2017: Active, agreed and under construction (KCC, 2017)

3.5.2 SOLAR AND WIND GENERATION

The Energy South2East Local Energy Strategy states that solar PV schemes can produce up to 36% more electricity in the South East than elsewhere in the UK. Approximately 80% of the solar generation capacity in Kent and Medway (457MW) comes from large installations of over 0.5 MW. The rest (113 MW) is made up from many smaller scale installations. 91% (1020 MW) of wind energy capacity comes from large offshore installations (>2MW). Large onshore wind installations make up 8% (84 MW) with the rest coming from small scale installations.

The geographical spread of existing small-scale renewable generation (defined as those <0.5MW, mainly solar and wind) can be seen in Figure 33. Blue indicates high levels of installations, whilst red indicates low levels. The map shows that there are fewer installations in West Kent. The highest levels are in Medway, Swale (Isle of Sheppey) and Thanet.

Given that so much of the renewable generation in Kent and Medway is large scale, most of the energy generated is fed into the national grid and used across the UK. It is not therefore possible to say what percentage of Kent and Medway's energy needs are directly met by local generation.

3.5.3 HEAT NETWORKS

Heat networks (also known as district heating) supply heat from a central source to consumers via a network of underground pipes carrying hot water. Heat networks vary in size, from one building to an entire city, and can be supplied by a diverse range of sources including:

- power stations
- energy from waste (EfW) facilities
- industrial processes
- biomass and biogas fuelled boilers and combined heat and power (CHP) plants
- gas-fired CHP units
- fuel cells
- heat pumps
- geothermal sources
- electric boilers and even solar thermal arrays.

Heat networks currently supply around 1% of building's heat demand in the UK.

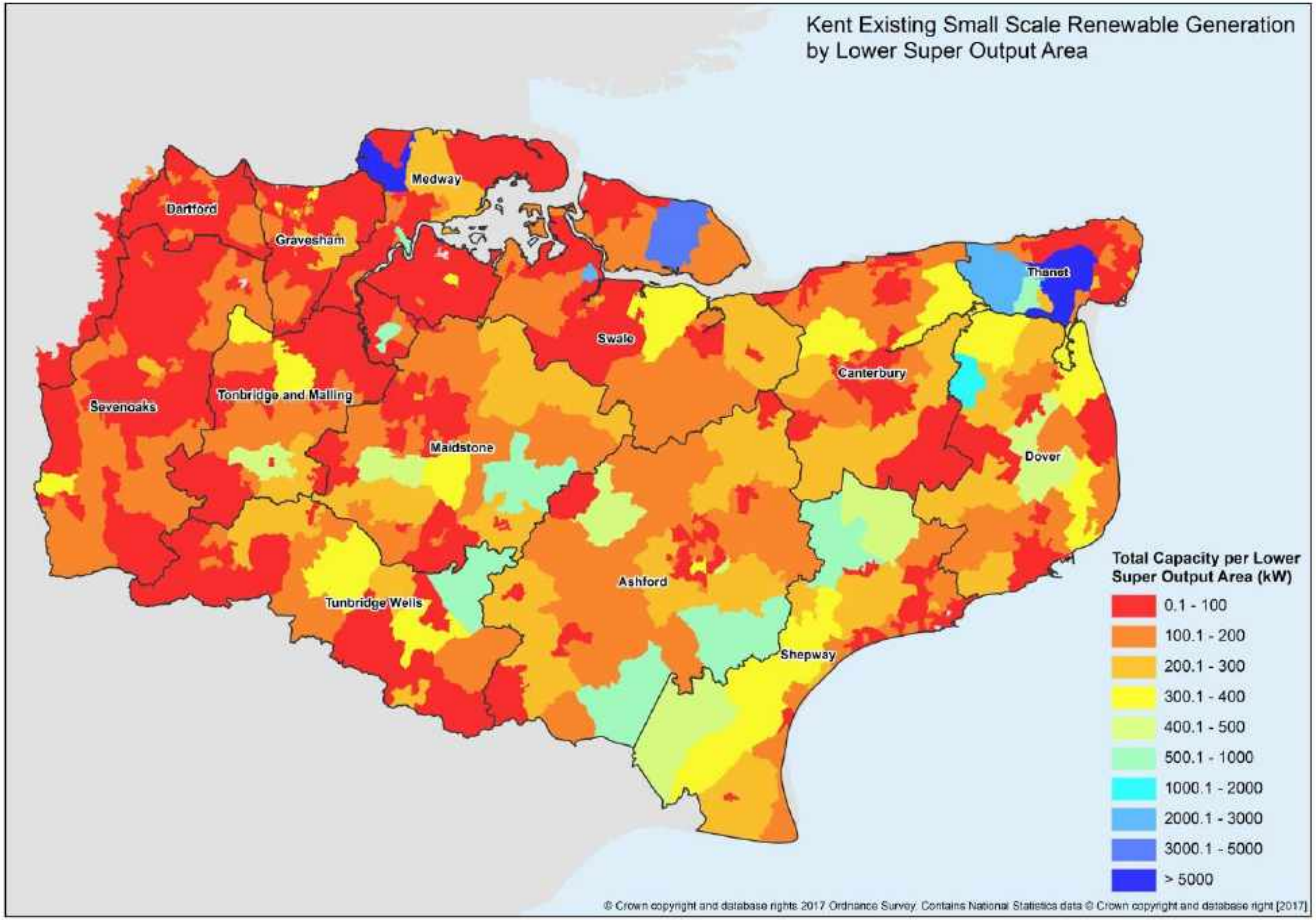


Figure 33: Kent's existing small-scale renewable generation (KCC, 2017)

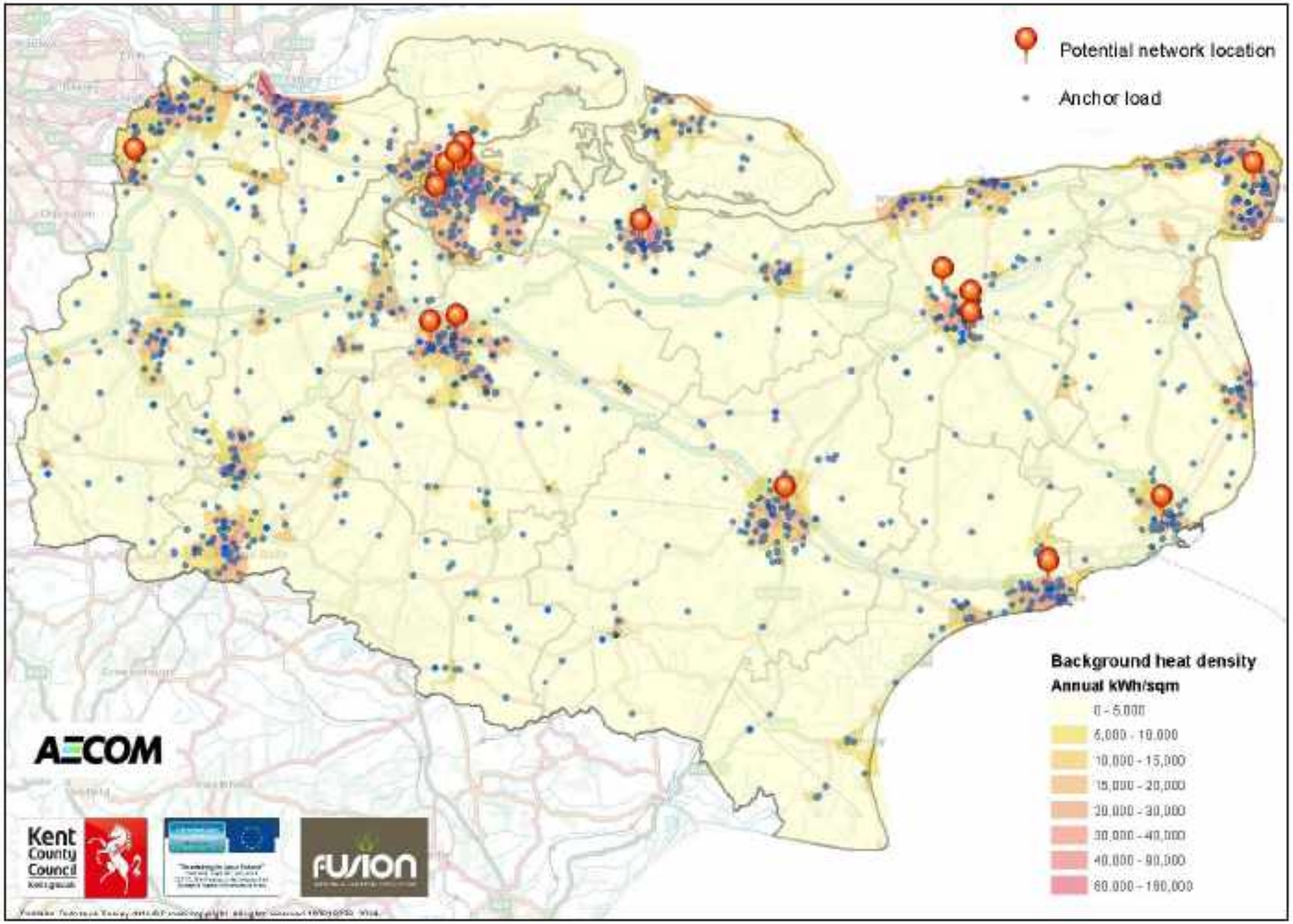


Figure 34: Heat density, anchor loads and potential heat network locations in Kent (KCC, 2014)

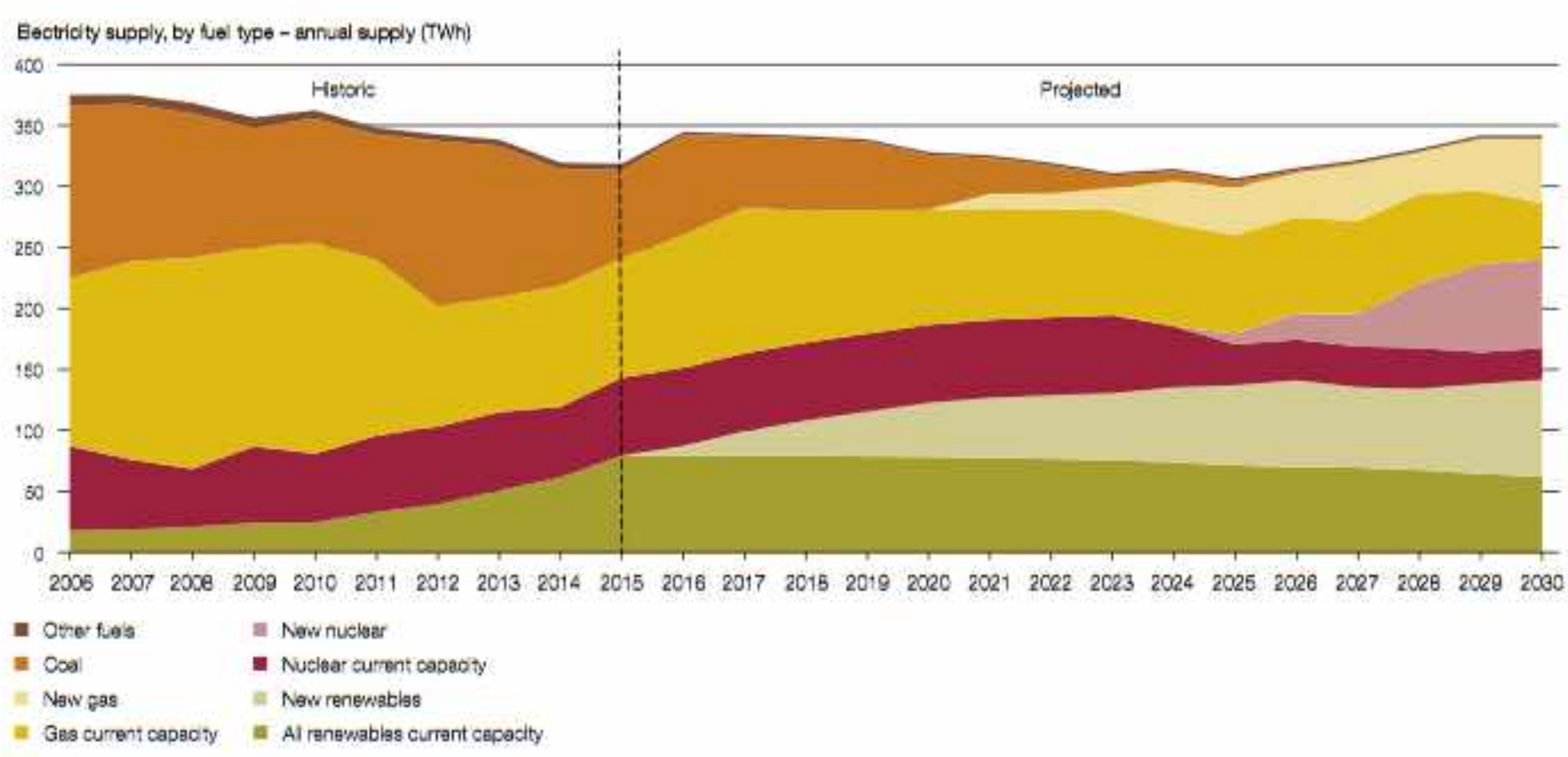


Figure 35: Electricity generation by fuel type - historic and projected as at November 2015 (NAO, 2016)

The government's *Clean Growth Strategy*[50] estimates that heat networks will meet 17% of heat demand in homes and up to 24% of heat demand in industrial and public-sector buildings by 2050.[51]

The South2East Local Energy Strategy proposes that the building and extension of heat networks be encouraged, particularly in new build developments: *'Taking these schemes from concept to commissioning should be a priority for the region since they deliver substantial reductions in emissions and provide good rates of return for investors'.*[52] The strategy sees a key role for the Greater South East Local Energy Hub in ensuring public and private sectors work together to identify opportunities and overcome any technical or commercial obstacles for the development of heat networks.

In 2014, a mapping exercise identified 15 areas in Kent and Medway that are likely to be particularly suitable for heat networks (Figure 34).[53] Each area was assessed against technical, social, environmental, economic and practical factors. The clusters prioritised following this process were Chatham University, Chatham Hospital, Canterbury Longport, Ashford and Maidstone County Hall.

More detailed feasibility and planning work is taking place for a heat network in north Maidstone, incorporating Kent County Council offices, Maidstone Prison and a new commercial development.[54]

3.5.4 NUCLEAR POWER

Nuclear power generates around a quarter of the UK's electricity and that is expected to rise to 35% by 2035 (Figure 35). The government wants nuclear power to *'form an important part of a "balanced mix" of generating technologies, so it provides reliable, low-carbon and cost-competitive electricity'.*[55]

There is a nuclear power station at Dungerness, on the south coast of Kent: Dungeness B consists of two operational 615 MW reactors, and Dungeness A ceased power generation in 2006 and is expected to enter the 'care and maintenance' stage of decommissioning in 2027. The power stations provide over 850 full time jobs in Kent as well as over 200 full time contract partners. At the time of writing, the government are not currently proposing any new nuclear power station sites in the county.

Whilst nuclear energy is zero emission, nuclear power plants require greater levels of capital investment and longer timescales to build than other forms of power generation. They also produce significant quantities of hazardous radioactive waste that requires specialist treatment, containment and secure disposal, long after a plant has been decommissioned: this makes nuclear power a less attractive option environmentally.

4 TRANSPORT AND TRAVEL

Transport makes up 42% of Kent and Medway carbon emissions and transport emissions are on the rise; now at their second highest since 2007 (see section 3.3.2 and Figure 25). This increase in emissions reflects the growth in the overall number of vehicles on the road, particularly vans. In Kent, freight transport volumes are disproportionally greater than other parts of the UK strategic road network, with 2.5 million HGV freight movements through Dover and 1.7 million lorry movements through Eurotunnel[58] in 2018.

This intercontinental traffic creates air pollution and increased traffic volumes along the M2/A2 and M20/A20 corridors, which contributes to background air pollution levels and peak traffic congestion. The main air pollutants are nitrogen dioxide (NO_2) and to a lesser extent particulate matter (PM), which mainly impacts on residents living in urban town centres and along busy A roads or close to the motorways.

Economic growth predicts an increase in traffic volumes. Without positive interventions, this could see increased congestion, increased journey times and increases in the concentration of air pollutants along specific routes or in specific locations. The transport measures that can have an impact in reducing these air pollutants can be summarised as:

- strategic road network improvements and specific junction improvements to increase capacity and improve traffic flow e.g. funded through Local Growth Fund
- targeted use of low or ultra-low emission zones (also known as clean air zones)
- update vehicle fleets to accelerate the uptake of EURO 6/Real Driving Emission test (RDE) compliant vehicles
- targeted measures, including retrofitting, for fleets operating in urban areas; such as buses and taxis
- increasing the availability of electric vehicle charge points and non-fossil fuel refuelling facilities eg hydrogen
- licensing policies for taxis
- improved walking and cycling infrastructure, including connectivity to public transport, schools and business parks
- schemes that enable car sharing, or provide access to ultra-low emission pool cars and bicycles
- organisation-wide travel plans supported by smarter working, travel and parking policies that promote alternatives to car travel
- raising awareness of personal actions to reduce emissions and protect health.

All these measures can be found in the individual air quality action plans for Kent and Medway. For the first time, countywide data and information is being reviewed to identify which of these measures need to be prioritised for increased partnership action to target reductions in air pollution.

4.1 TRANSITION TO ULTRA LOW EMISSION VEHICLES (ULEV)

Ultra Low Emission Vehicles (ULEVs) are currently defined as having less than 75 grams of CO_2 per kilometre (g/km) from the tail pipe. Due to advancements in technology, from 2021 the Vehicle Certification Agency expects to define ULEVs as a car or van that emits less than 50 g/km CO_2. [59]

In 2018, the government published its *Road to Zero Strategy*[60] setting out its ambition for at least 50%, and as many as 70%, of new car sales to be ULEVs by 2030, alongside up to 40% of new vans. By 2040, the ambition is for all new road vehicles to be "effectively zero emission". This marks a significant step change in UK policy to deliver on the ambitions set out in the UK's Clean Growth Strategy and supports delivery of the *Clean Air Strategy 2019*.[61]

The transition to zero emission vehicles, paves the way for the investment and development of alternative fuels and technologies, for example; electric, hydrogen and compressed natural gas. With the government incentivising the switch to electric cars and vans by providing a grant towards the cost of a new vehicle, the take up of electric vehicles is significantly increasing.

In Kent and Medway during 2018-19, the Low Carbon Across the South East (LoCASE) business support programme has also been able to offer additional grants to further incentivise the adoption of electric vehicles by local small and medium sized businesses. By March 2019, this has helped 16 businesses invest in a range of ultra-low emission fleet vehicles, from pool cars to all-electric work vans to reduce their running costs and air quality impacts. There was also significant interest and take up from taxi operators. Up to March 2019, 27 grants had been awarded to taxi businesses with 18 of these for the TX black taxi with demand for grants outstripping availability for these owner-operators.

There were 4,424 ULEVs registered in Kent and Medway as of the end of June 2019 and this growth is largely in line with the UK trend (Figure 36). [62]

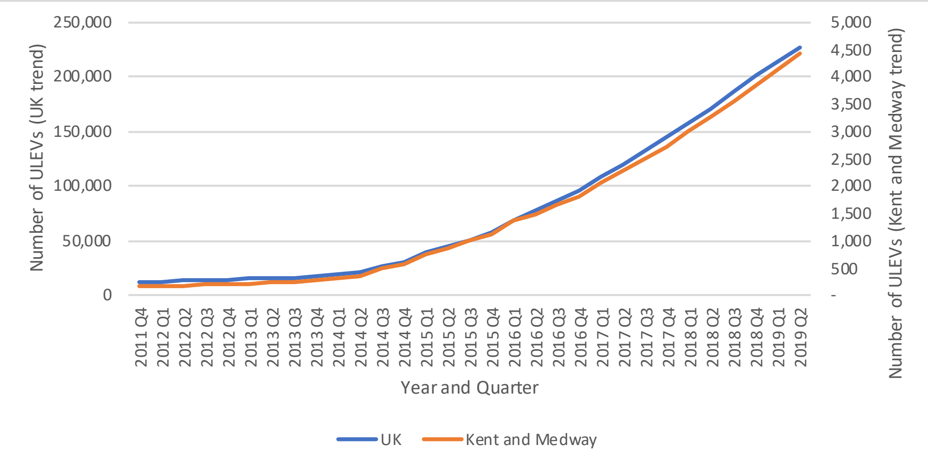


Figure 36: Number of ULEVs registered in Kent and Medway and UK per quarter 2011-2019 (DfT, 2019)[62]

Public transport is also being transformed, with several national and regional bus providers introducing electric-hybrid and other low emission buses, particularly those used in busy town centres and along major commuter routes. Fully electric buses were demonstrated in Kent during a trial along the Dartford Fast-track route in 2018.[63] Following this successful trial, Fastrack vehicles are being considered for electrification from the start of the 2022 contract, dependent upon the complimentary infrastructure being installed.

KCC have supported operators to upgrade current diesel engines to the cleanest possible current modes and are actively encouraging the transfer to alternatively powered vehicles. Large bus operators in the county are making significant progress towards EURO V and VI standards. More work is needed to support providers of public transport; especially smaller companies who operate older vehicle fleets.

KCC commits around £5.7 million to support rural bus routes and off-peak services not provided by commercial operators. In light of challenging budgets, the council is also exploring innovative and sustainable ways of providing transport to rural communities in Kent. Based on feedback from a public consultation called 'The Big Conversation' in July 2018, five pilot schemes in Dover, Maidstone, Sevenoaks, Tenterden and West Malling were launched in 2019.. The success of the pilot schemes will be determined by several measures, including customer feedback and passenger numbers.

Hydrogen and compressed natural gas are also being adopted as alternative low emission fuels, albeit on a smaller scale, which at the time of writing are predominantly in use by larger commercial vehicle operators. The lack of refuelling stations along the strategic road network is a significant barrier, with Kent's closest hydrogen refuelling station being on the M25 at Cobham services. However, as has been the case for the growth in electric vehicles, as the refuelling network grows, the uptake of vehicles is expected to increase; and this is likely to be achieved within the decade.

4.1.1 ELECTRIC VEHICLE STRATEGY

There is increasing demand for charging infrastructure by members of the public who are switching to plug-in electric vehicles. Consequently, KCC are considering their role in supporting a shift to electric and hybrid plug-in vehicles, and in addressing the county's electric vehicle infrastructure requirements.

There is a need for additional planning guidance to help ensure new developments adequately support their residents to adopt plug-in vehicles, and this will be included in future updates to the Kent Design Guide. Creating public charging hubs in partnerships with local authorities and the private sector is considered important to help allay 'range anxiety' fears, for those wishing to make longer journeys in plug-in vehicles. Additionally, KCC will consider the testing of new charging technologies on the public highway and will look for ways to enhance the use of plug-in vehicles in KCC's own fleet, as well as those of its partners.

4.2 ACTIVE TRAVEL

Active travel is defined as walking or cycling as a means of transport, in order to get to a destination such as work, school, the shops or to visit friends. It does not cover walking and cycling done purely for pleasure, for health reasons, or simply walking the dog.

In 2015, the Department of Transport published a report called Investing in Walking and Cycling: The Economic Case for Action[65] which concluded that *'sustainable and more specifically, active travel interventions, have the potential to deliver strong benefits and deserve a place in the modern toolkit of transport policy'.* Importantly from a return on investment perspective, the report also concluded that *'sustainable travel, as well as cycling and walking, can deliver very high benefits when compared to their costs'.*

The report draws on evidence from several UK active travel intervention studies and the benefit cost ratios calculated, ranging from 2.6:1 to 10:1. The report further confirms that *'one can confidently conclude that sustainable travel and cycling and walking in particular, regularly offer high and very high value for money.'*

4.2.1 CURRENT ACTIVE TRAVEL IN KENT AND MEDWAY

Data from the 2011 Census revealed that 54.4% of Kent's residents aged 16 to 74 who were in employment travelled to work by driving a car or van, 10.1% travelled by foot and 1.7% cycled (Figure 37). The amount walking to work is higher than both the national and regional average of 9.8%. However, the amount cycling to work in Kent is lower than the English (1.9%) and South East (2.0%) averages. Between 2001 and 2011, the number of people who walked or cycled to work in Kent decreased by 0.8% (Figure 38). This is in line with the decreases recorded nationally and regionally. In the UK, the decreases have coincided with increases in the distance travelled tow work.

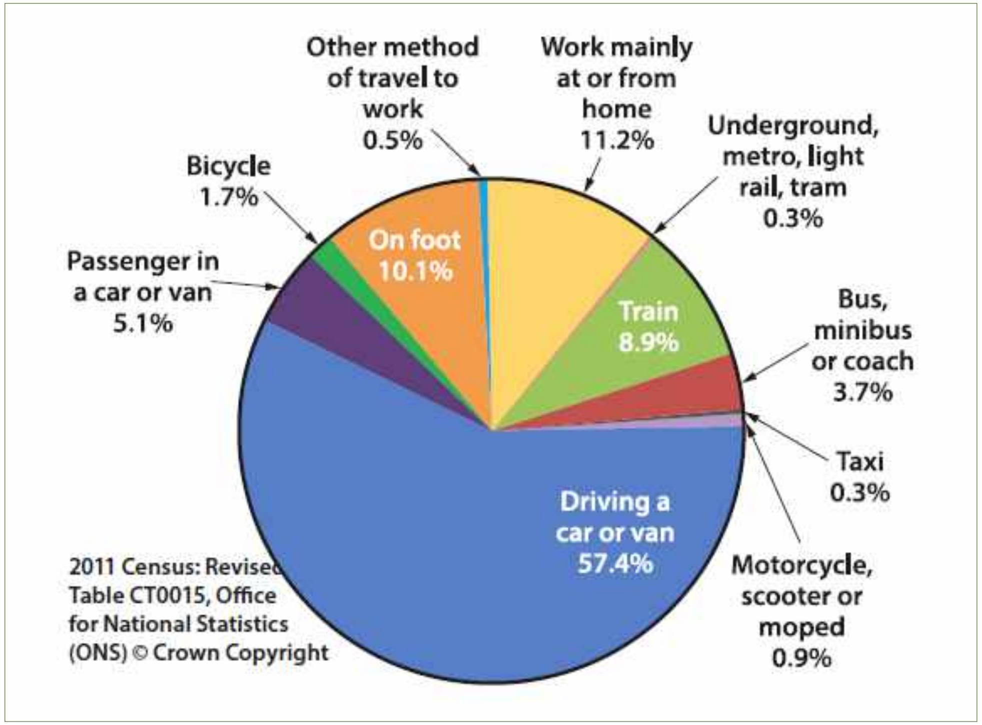


Figure 37: Method of travel to work in Kent - 2011 Census (ONS, 2011)

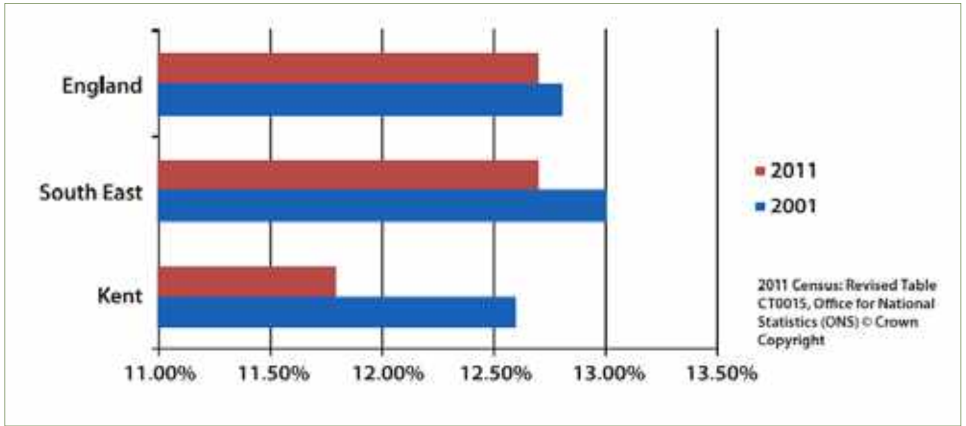


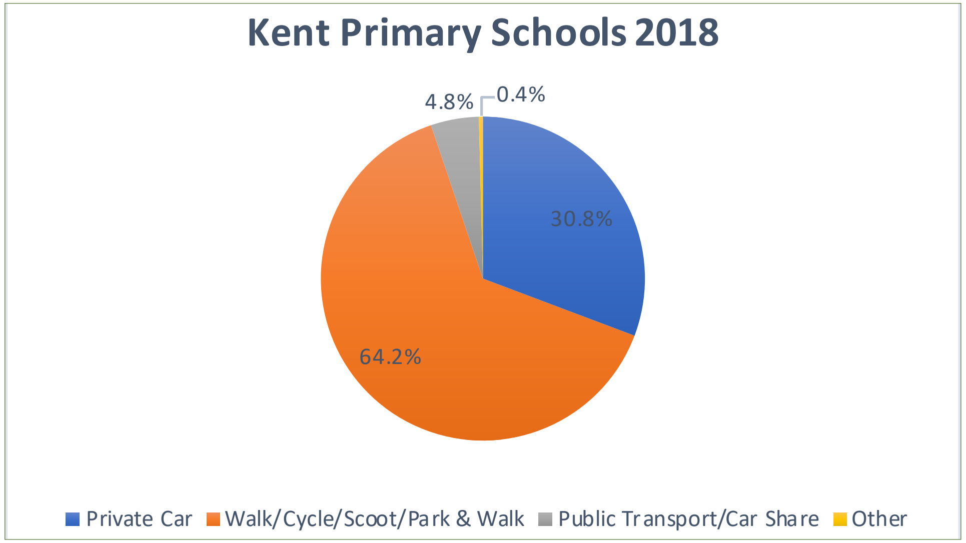
Figure 38: Proportion of Kent residents travelling to work on foot or bicycle in 2001 and 2011 (ONS, 2001/2011)

According to the Department of Transport's National Travel Survey figures for 2018, 49% of English primary school children and 39% of English secondary school children walk to school. [66] This largely reflects the longer distances secondary children travel to school. The proportion of primary and secondary school children walking to school has remained broadly similar since 2002.

In Medway, 56.7% of pupils aged 5-10 and 51.6% of pupils aged 11-15 walked to school in 2017/18 [67] , which is significantly higher than the national averages.

In Kent, 64.2% of primary school pupils and 36.6% of secondary school pupils walked, cycled, scooted or parked and walked to school in 2018.

Figures 39 and 40 show the distribution of transport modes used by Kent primary and secondary school children in 2018, based on the data provided through school travel plans. [68] The sample size for the 2018 schools' data was 23,089 respondents for primary schools and 11,864 respondents for secondary schools. Although this demonstrates a positive picture, this data only covers schools participating in the travel plan initiative (18.1 % of primary school children and 11.6% of secondary school children).



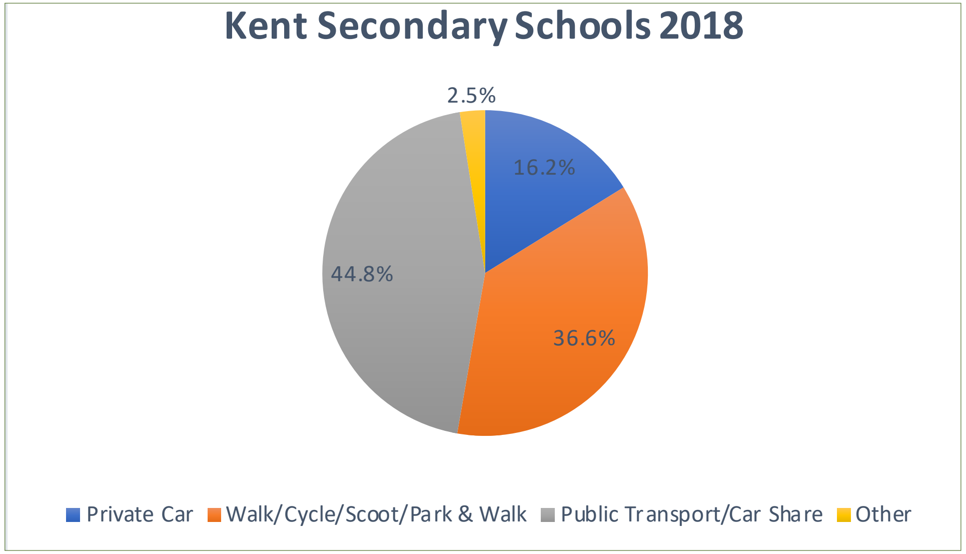


Figure 40: Mode of travel to Kent secondary schools in 2018 (KCC, 2019)[68]

4.2.2 KCC ACTIVE TRAVEL STRATEGY

KCC published its *Active Travel Strategy*[69] in March 2017 and aims to make active travel an attractive and realistic choice for short journeys in Kent. By developing and promoting accessible, safer and well-planned active travel opportunities, this strategy will help to establish Kent as a pioneering county for active travel. The strategy has three main action areas:

1. integrate active travel into planning
2. provide and maintain appropriate routes for active travel
3. support active travel in the community.

The strategy sets targets for active travel in Kent[a], including by 2021:

- 2 in 3 primary children and 1 in 3 secondary children will travel actively to school
- the proportion of people that work within 5km of their home and actively travel to work in Kent to increase to 40%
- the number of people cycling along key routes monitored by the Department of Transport in Kent to increase by 10%.

A key action is to target regular short journeys, such as to work and school, in areas where there is peak traffic congestion and local air pollution hotspots.

4.2.3 PUBLIC RIGHTS OF WAY

The Public Rights of Way network provides 'off the highway' walking and cycling routes. The network is increasingly being improved and promoted as a healthier route to work, school and stations; avoiding the pollution generated by road traffic. Recent schemes funded by Local Growth Funds include:

- **West Kent Local Sustainable Transport (cutting congestion) -** A package of schemes and initiatives to allow people to transfer between different types of transport; making sustainable transport a real alternative to the private car in Sevenoaks, Maidstone, Tunbridge Wells and Tonbridge and Malling.
- **Kent Thameside Local Sustainable Transport (integrated door-to-door journeys)** - to improve walking and cycling facilities in and around bus and train stations in Dartford and Gravesham, as well as improving the Fastrack service to reduce the reliance on cars.
- **Sholden village housing development, near Deal -** KCC is providing upgrades to existing public footpaths to facilitate cycling. These improvements are being completed at the request of the parish council and in response to planning application conditions to provide traffic free cycle access to local schools, Fowlmead Country Park and Deal town centre.

[a] These targets do not currently include Medway

4.3 PUBLIC TRANSPORT

4.3.1 BUS SERVICES

The use of public bus services across Kent and Medway is in decline. In 2017/18, there were 63.2 million passenger journeys on local bus services, a reduction of 3.8 million journeys since 2009/10 and a fall of 8 million journeys from their peak of 71.2 million in 2013/14 (Figure 41).

On a per head basis, the Kent local authority area is slightly better than average at 35.4 journeys per head, compared to other authority areas in the South East, although fall far below areas such as Brighton & Hove and Reading, which generate 170 and 132 journeys per head respectively.

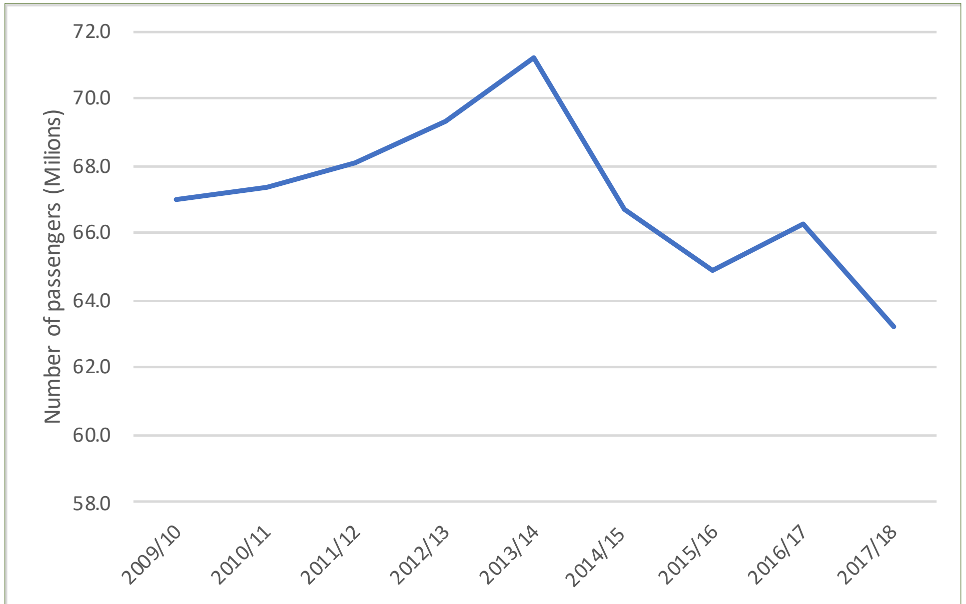


Figure 41: Passenger journeys on local bus services in Kent and Medway, 2009/10 – 2017/18 (DfT, 2019) [72]

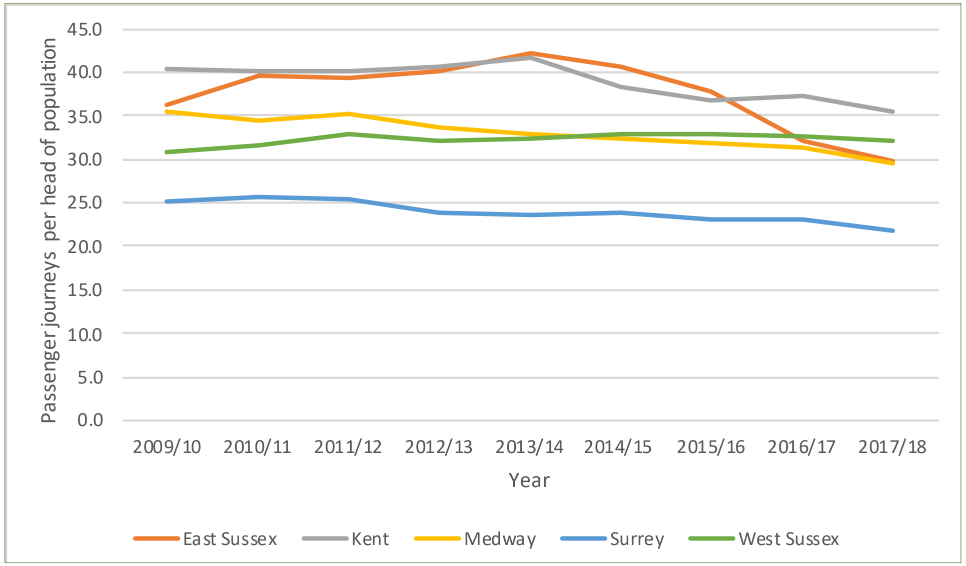


Figure 42: Passenger journeys in the South East per head of population, 2009/10 – 2017/18 (DfT, 2019)

The Urban Transport Group's national report into the cross-sector benefits of supporting bus services confirmed that for every £1 of public money spent on socially necessary bus services, in excess of £3 of benefits can be generated[74]. Benefits include boosting employment, tackling physical inactivity, enabling access to education and cutting greenhouse gas emissions and congestion. It also highlights that 91% of people living in Great Britain are within 13 minutes' walk of a bus stop. This figure may be lower for a rural county such as Kent, however county level data is not available. The socially necessary bus services funded by Kent County Council and Medway Council aim to ensure all rural communities are serviced by a bus service. The survey also confirms that bus journeys are mainly used for shopping, leisure and access to education.

Data is still being gathered to confirm the range of EURO Standard buses in operation across the county. Private operators are making improvements to their stock and some larger bus operators have invested in recent years to achieve at least EURO V Standards for most of their fleet.

Making bus transport more attractive and promoting journeys by bus, is a key action to reduce the number of cars on the road and reduce congestion in order to have a beneficial impact on air quality and greenhouse gas emissions.

4.3.2 RAIL SERVICES

Rail transport usage is growing significantly across Kent, both for commuting and leisure. The Highspeed service linking London to the European continent marked its 10th anniversary in 2019. The data in Table 4.1 shows that over 54 million passengers had used Highspeed services between London and Kent by July 2017, with Ebbsfleet, Ashford and Canterbury taking 23 million passengers alone.

Annual passengers (1000s)	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Totals
Ashford	10	584	952	1,058	1,118	1,228	1,377	1,472	1,529	9,328
Canterbury	0	259	561	666	714	792	942	970	984	5,888
Chatham	0	120	239	257	265	284	311	341	352	2,169
Dover	0	94	170	175	182	209	226	132	155	1,343
Ebbsfleet	9	356	602	756	935	1,029	1,226	1,339	1,397	7,649
Folkestone	0	179	369	445	462	535	669	702	732	4,093
Maidstone	0	25	72	152	186	224	252	253	267	1,431
Ramsgate	0	69	135	152	160	177	227	257	275	1,452
Other stations	0	764	1,807	2,165	2,428	2,611	3,166	3,665	4,095	20,701
Totals	**19**	**2,450**	**4,907**	**5,826**	**6,450**	**7,089**	**8,396**	**9,131**	**9,786**	**54,054**

Table 4.1: Annual journeys between Kent Highspeed stations and London, July to July since 2010 (London and Southeastern Railways Ltd)

These Highspeed services have enabled growth across the county, with journey times to London being reduced by at least 40 mins for passengers travelling from stations in the east of the county, such as Ashford, Canterbury and Dover.

There are continued plans to further upgrade and modernise stations and services across the county, including a new Thanet Parkway station.

4.4 EMISSIONS FROM MARITIME TRAFFIC AND AVIATION

4.4.1 EMISSIONS FROM MARITIME TRAFFIC

In January 2019, the Government published *Maritime 2050: Navigating the Future,*[75] which was supported by a 'Clean Maritime Plan', published in summer 2019.

The ambition is for the UK to be a global exemplar in green maritime issues. The Maritime Strategy includes the aims that by 2050: the impact of the UK maritime sector on the environment is close to zero, as well as a leading supplier of zero and low emission shipping technology and green maritime finance.

The Government requires major ports to publish Port Air Quality Strategies in summer 2019 and will work with ports to review their understanding and implementation of climate change adaptation measures and encourage periodic reporting via the Adaptation reporting power.

The Dover Strait is one of the busiest straits in the world, with almost 20% of worldwide maritime traffic passing through in 2006.[76] Data collected through a study for the EU Interreg PASSAGE project (and shown in Table 4.2), estimated that cross-border activities in the Dover Strait emitted over 2.5 million tonnes of carbon dioxide equivalent (CO_2e) in 2016, with an additional 1.2 million tonnes emitted from port operations and road and rail traffic related to the Port of Dover and Channel Tunnel.[77]

The study also revealed that more than 70,000 ships passed through the strait in 2016 without calling at any of the strait's ports, and these vessels carried about 702 million tonnes of cargo. The study concluded that maritime activity in the Dover Strait was responsible for 104 million tonnes of CO_2e, from which just 14%

was emitted within the boundary of the strait. The study highlights the difficulties Kent and Medway, and indeed the UK government, have in influencing and tackling the impacts of maritime traffic in the Dover Strait.

Emission source (within the strait's boundary) in tCO_2e		France	Cross-border	UK
Port operations	Energy consumption	6 543		9 662
	Ships in port areas	146 732		60 136
Maritime transport	Local maritime cruise		725 457	
	Maritime cruise with calls to the strait's ports		21 834	
	Transit maritime cruise		1 702 548	
In-land traffic	Road transport	1 185 908		426 075
	Railway transport	16 796		16 154
	Waterways transport	36 345		0
	Tunnel		64 899	
Induced economical activities	Industries	8 346 854		0 [b]
	Cities & Towns	980 425 [c]		686 589 [d]
	Tourism	8 074		29 822
	TOTAL	**10 727 677**	**2 514 739**	**1 228 439**

Table 4.2: Source of emissions within the Strait of Dover in 2016 (PASSAGE, 2018)[77]

[a]In Kent, no industry included in the strait's perimeter is part of the EU emissions trading system. For a better understanding of these figures, please refer to the methodology of the study.
[b]Equivalent of 1.252 tCO2e/inhabitant
[c]Equivalent of 1.32 tCO2e/inhabitant

4.4.2 EMISSIONS FROM AVIATION

The Government consulted on Aviation 2050: the future of UK aviation, in summer 2019.The executive summary states *"The UK has the largest aviation network in Europe and the third largest in the world. Aviation directly contributes at least £22 billion to the economy and supports around half a million jobs. The government supports the growth of aviation and the benefits this would deliver, provided that growth takes place in a sustainable way, with actions to mitigate the environmental impacts."* [78]

The objectives of the strategy are to:

- help the aviation industry work for its customers
- ensure a safe and secure way to travel
- build a global and connected Britain
- encourage competitive markets
- support growth while tackling environmental impacts
- develop innovation, technology and skills.

This includes asking for views on reducing the environmental and air quality impacts of aviation, including improving connectivity to other forms of transport.

A white paper is expected to be published following the consultation.

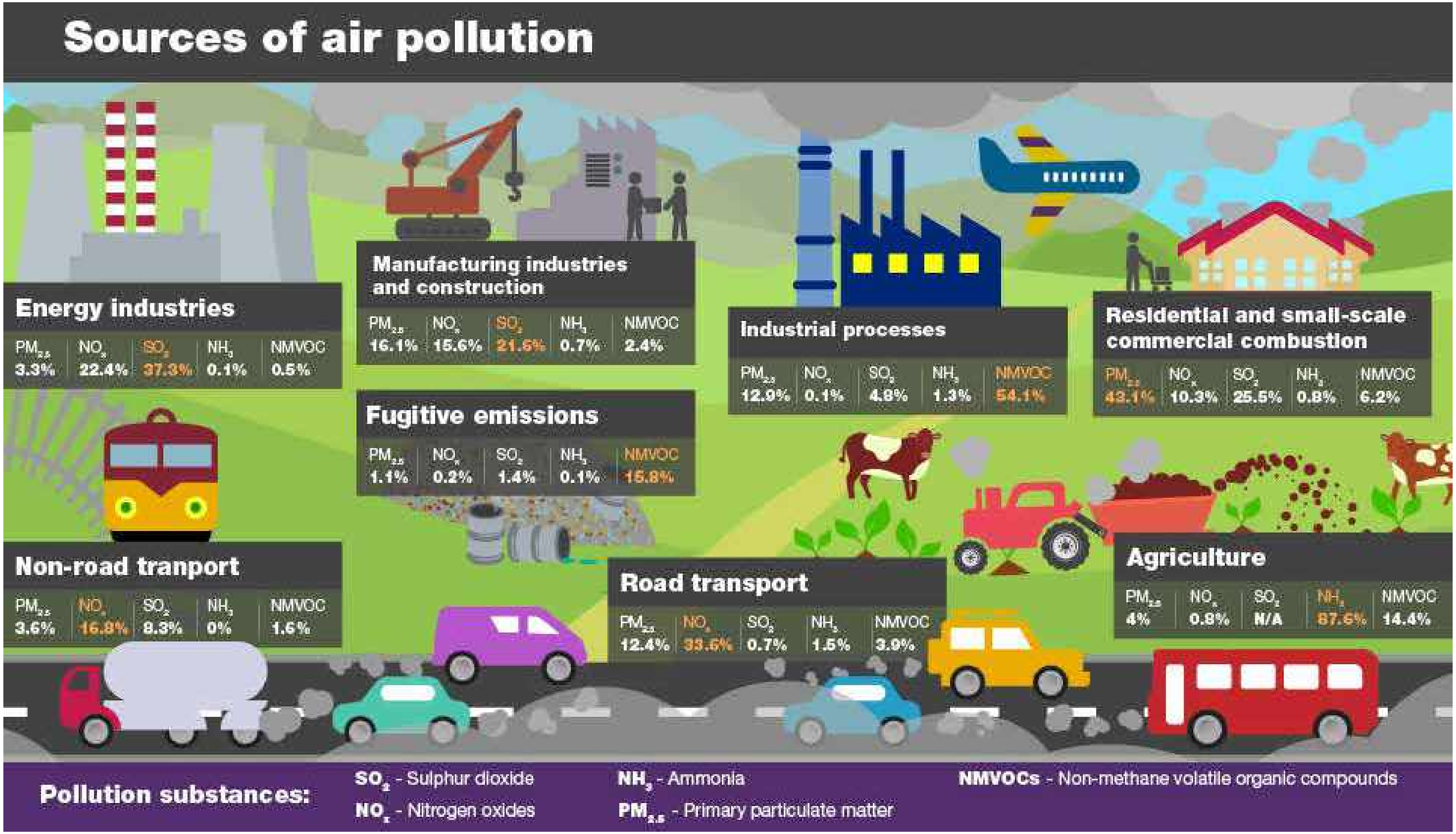


Figure 41: The sources of air pollutants (PHE, 2018)

5 AIR QUALITY

The term "air quality" describes a wide range of substances and processes which create a state of air to which people or ecosystems are exposed and which may cause harm to human or environmental health. Poor air quality usually refers to air where pollutant levels are higher than levels set by government or health organisations. These pollutants can have profound impacts on the natural environment; however, poor air quality is more commonly associated with negative impacts on human health, as outlined in section 5.2. Further information on air quality, including its health effects, can be found on the Kent Air website.[79]

Figure 41 provides an illustration of the main sources and effects of air pollution.[80] People and ecosystems are both impacted by air quality and are described as receptors. Not all receptors will be impacted by poor air quality in the same way.

Air pollution emitters, or sources, include almost anything that involves fuel combustion such as:

- car and lorry engines
- domestic or commercial heating boilers
- gas or coal fired electricity generation
- open fires
- anything else where a fuel is burned.

Sources also include industrial processes, some agricultural practices and even natural vegetation and livestock. Factors affecting the impact on receptors are:

- the types of substance being emitted
- the concentration
- the distance between source and receptor
- the behaviour of the substances transported in the air.

Understanding the source-transport-receptor process is key to understanding air quality and to taking action to improve it.

Research into the health effects of poor air quality has identified the key pollutants which drive those effects. They include:

- Fine particulate matter (PM_{10} or $PM_{2.5}$)
- Nitrogen dioxide (NO_2)
- Ozone (O_3).

Other pollutants, such as sulphur dioxide (SO2), carbon monoxide (CO) and lead were a problem in the past, with many cities and towns experiencing smogs. Following the introduction of the Clean Air Act 1956, emissions have significantly reduced, albeit current levels are still known to be harmful to health.

5.2 HEALTH IMPACTS OF POOR AIR QUALITY

Poor air quality is the largest environmental risk to the public's health, contributing to cardiovascular disease, lung cancer and respiratory disease. [81] Indeed, between 28,000 and 36,000 deaths each year in the UK are associated with air pollution.[82]

Poor air quality increases the chances of hospital admissions, visits to A&E Departments and respiratory and cardiovascular symptoms which interfere with everyday life. There is also ongoing research into the effects of air pollution on the brain; including studies of air pollution and Alzheimer's and Parkinson's diseases. There is also emerging evidence that inflammation associated with poor air quality could influence diabetes, developmental outcomes in children and reproductive health outcomes such as low birth weight.

While air pollution affects everyone, it doesn't affect everyone equally. People living with lung diseases, such as chronic obstructive pulmonary disease (COPD) and asthma, as well as heart disease, may find that their symptoms become worse on days with higher air pollution. Those not sensitive to any immediate effects of air pollution are still at risk through the long-term health effects of air pollution. These effects happen at lower pollution levels than the short-term effects and are often not noticed by people at the time the damage is being done.

Gestation[e], infancy and early childhood are vulnerable times because the young body is growing and developing rapidly. We know that the heart, brain, hormone systems and immunity can all be harmed by air pollution. Research is beginning to point towards effects on growth, intelligence, and development of the brain and coordination. The elderly are also vulnerable, due to the decline in organ function with age and an increased prevalence of age-related disease, which could be exacerbated by exposure to pollutants. Those who spend more time in highly polluted areas could also be affected more and this would contribute to a widening of health inequalities. With almost 250 Kent schools within 500 metres of an Air Quality Management Area, this provides a focus for Public Health to raise awareness and influence actions to reduce the sources of localised pollution.

Public Health England (PHE) monitors the impact of poor air quality on premature mortality at a national and council level. The indicator used in the Public Health Outcomes Framework (PHOF) is the fraction of mortality attributable to particulate air pollution. Table 5.1 indicates how Kent and Medway councils compare to England and the South East.

England	5.1
South East	5.6
Kent	5.6
Medway	6.3

Table 5.1: Fraction of all-cause adult mortality attributable to particulate air pollution 2017 (PHE, 2017)

Analysis by Kent Public Health Observatory used the PHOF 3.01 indicator to calculate the premature (under 75), mortality rate per 100,000 that was attributable to $PM_{2.5}$. It concluded that poor air quality is linked with an approximately similar rate of death as respiratory disease and liver disease. It is associated with more deaths in Kent and Medway than suicide and communicable diseases.[86]

Table 5.2 presents the overall premature mortality rate per 100,000 and the mortality rate attributable to $PM_{2.5}$ for each council (note that Medway is excluded from this table as it is a unitary authority). It also includes the district councils' rating on Indices of Multiple Deprivation (IMD2015) which is the official measure of relative deprivation for small areas in England. [87] Broadly speaking, the areas with the highest overall premature mortality rate also tend to have the highest premature mortality rate attributable to $PM_{2.5}$ (key exception is Tonbridge and Malling) and the highest deprivation ranking (key exception is Dartford).

District Council Mortality rate (per 100,000) attributable to $PM_{2.5}$ Overall Premature Mortality Rate All Causes (per 100,000) Kent Ranking on IMD2015

District Council	Mortality rate (per 100,000) attributable to $PM_{2.5}$	Overall Premature Mortality Rate All Causes (per 100,000)	Kent Ranking on IMD2015
Thanet	20.1	395.6	1
Dartford	19.4	353.3	6
Swale	18.7	350.0	2
Folkstone and Hythe	17.3	355.4	3
Dover	17.0	340.9	5
Gravesham	16.6	322.1	4
Maidstone	15.9	288.8	9
Canterbury	15.7	321.0	8
Ashford	14.7	289.4	7
Tonbridge & Malling	14.6	367.5	11
Tunbridge Wells	14.1	267.9	12
Sevenoaks	12.5	248.7	10

Table 5.2: Premature mortality rates per 100,000 and attributable to $PM_{2.5}$

[e]Whilst a baby is growing in the womb.

It is estimated that there were 922 deaths in 2017 that could be associated with particulate matter ($PM_{2.5}$) exposure across Kent and Medway.

The UK Health Forum and Imperial College London, in collaboration with, and funded by Public Health England, carried out a modelling study. It quantified the potential costs to the NHS and social care system due to the health impacts of $PM_{2.5}$ and NO_2 and developed a tool for use by local authorities to quantify the number of expected disease cases and costs in their local area. [88]

The total NHS and social care cost due to $PM_{2.5}$ and NO_2 in 2017 was estimated to be £42.88 million (based on data where there is more robust evidence for an association), increasing to £157 million when diseases are included where there is currently less robust or emerging evidence for an association. Between 2017 and 2025, the total cost to the NHS and social care of air pollution where there is robust evidence for an association, is estimated to be £1.60 billion for $PM_{2.5}$ and NO_2 combined increasing to £5.56 billion if we include other diseases for which there is currently less robust evidence for an association.

5.3 ASSESSING AIR QUALITY

Air quality can be assessed in two different ways, by monitoring or modelling.

5.3.1 AIR QUALITY MONITORING

Monitoring involves taking physical measurements of the composition of the air and is thus often seen as being more reliable. Monitoring methods can be further divided into passive sampling and continuous monitoring.

- **Passive sampling,** for example using diffusion tubes are often used to measure concentrations of nitrogen dioxide (NO_2). They can only provide data on the average concentration over a specific period, usually several days or weeks. This sampling is not suitable for measuring the concentration of particulate matter which requires more complex techniques.
- **Continuous monitoring** utilises more complex equipment, which samples the air continuously and provides data over very short time period (seconds to minutes). High quality data such as that produced by well-maintained continuous analysers is generally required to show compliance with air quality legislation.

There were 15 sites with continuous analysers operating in Kent and Medway in 2017, measuring NO_2, PM_{10}, $PM_{2.5}$, Ozone and Sulphur Dioxide (SO_2), as shown in Table 5.3.

Site Name	Pollutants measured	Site type
Canterbury	NO_2 O3 PM_{10}	URBAN BACKGROUND
Canterbury Military Road	NO_2	ROADSIDE
Chatham Roadside	NO_2 PM_{10} $PM_{2.5}$	ROADSIDE
Dover Centre Roadside	PM_{10}	ROADSIDE
Gravesham A2 Roadside	NO_2 PM_{10}	ROADSIDE
Gravesham Industrial Background	NO_2 PM_{10}	URBAN BACKGROUND
Maidstone Rural	NO_2 PM_{10}	RURAL
Rochester Stoke	NO_2 PM_{10} $PM_{2.5}$ O3 SO2	RURAL
Swale Newington	NO_2 PM_{10}	ROADSIDE
Swale Ospringe Roadside	NO_2 PM_{10}	ROADSIDE
Swale St Pauls Street	NO_2	ROADSIDE
Thanet Birchington Roadside	NO_2 PM_{10}	ROADSIDE
Thanet Ramsgate Roadside	NO_2 PM_{10}	ROADSIDE
Tonbridge Roadside	NO_2	ROADSIDE
Tunbridge Wells A26 Roadside	NO_2 PM_{10}	ROADSIDE

Table 5.3: Continuous air quality monitoring sites operating in Kent and Medway

Local authorities in Kent and Medway also routinely use networks of diffusion tubes to assess levels of NO_2 at key locations, and the results can be found on the Kent Air website. [89]

5.3.2 AIR QUALITY MODELLING

One of the downsides of monitoring air quality is that it only provides information on air quality at that specific location. To estimate the levels of air pollution at other locations, and to assess the likely effect of actions to address air quality in the future, air quality modelling is required.

In order to replicate the variability of emissions, the weather, chemical processes in the atmosphere and geographical features, air quality models are generally very sophisticated and require specialist expertise to operate. Nevertheless, their usefulness means that they are considered essential to obtaining a detailed picture of air quality in an area.

The UK uses a model to supplement air quality monitoring data to assess compliance with European air quality standards. Local authorities routinely use modelling to characterise area of high air pollution in their areas, an example of which is shown in **Figure 42.**

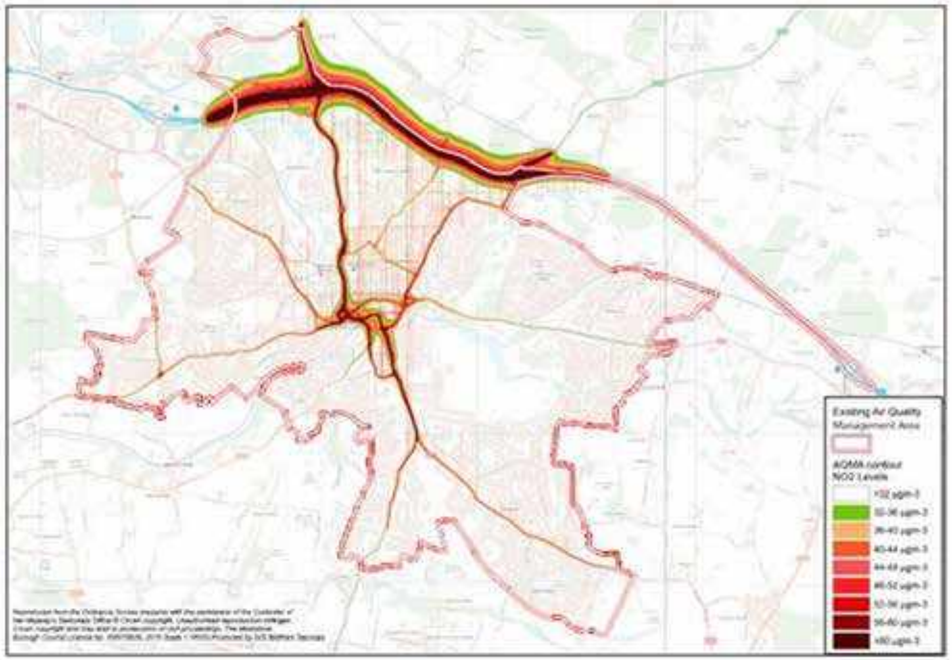


Figure 42: Modelling for Maidstone Borough Council in 2017 (Maidstone Borough Council ASR, 2017)

While local modelling has been undertaken in Kent and Medway, there is no current model covering the whole county. It is hoped this will be developed in future as a useful tool to support District planning and development of air quality actions plans. Maps of 'background' concentrations of air pollutants are available now from Defra, as outputs from the national modelling processes.

5.3.3 SOURCES OF AIR POLLUTION EMISSIONS

A key tool in understanding and modelling air quality is an **emissions inventory.** This is a model which reconstructs emissions of different pollutants from different sources, potentially placing them geographically. This is done at its most basic level by multiplying activity data (eg. number of cars using a stretch of road), by an emission factor (eg. the amount of a pollutant emitted by an individual car per kilometre travelled). All emissions calculations are based on assumptions (for example, assuming all cars emit the same amount of the pollutant as each other all the time).

A well-designed emissions inventory allows policies to be tested for their impact on air quality. For example, a scheme providing incentives for people to buy electric or low emission vehicles will change the composition of traffic. The impact of this change can be estimated by adjusting the emissions inventory; the outputs from which can be fed into air quality models and so the effectiveness of the policy can be assessed before it is implemented. In this way, a high-quality emissions inventory can result in better, more informed decision making and more cost-effective actions.

The UK Government maintains a national emissions inventory (the National Atmospheric Emissions Inventory,[90] or NAEI), both to help develop policy and to fulfil its legal requirements to report on the UK emissions of air pollutants and greenhouse gasses. There is no separate emissions inventory for Kent and Medway, nor do local authorities run and maintain emissions inventories for their areas.

Using the NAEI, it is possible to extract emissions data for Kent. Figures 43 and 44 provide a breakdown of emissions in Kent and Medway for NO_X and $PM_{2.5}$

EVIDENCE GAP: Breaking the figures down further, for example breaking down road transport emissions into fuel, vehicle or road type, would be beneficial for policy development and tracking, but is not possible with the dataset as it currently stands.

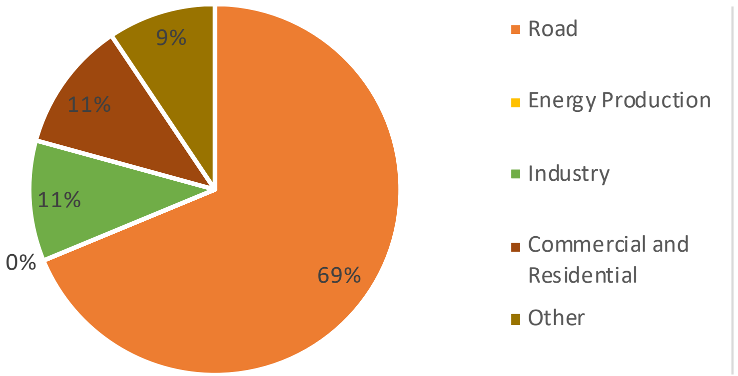


Figure 43: NO_X emissions from Kent and Medway, 2015 (NAIE)

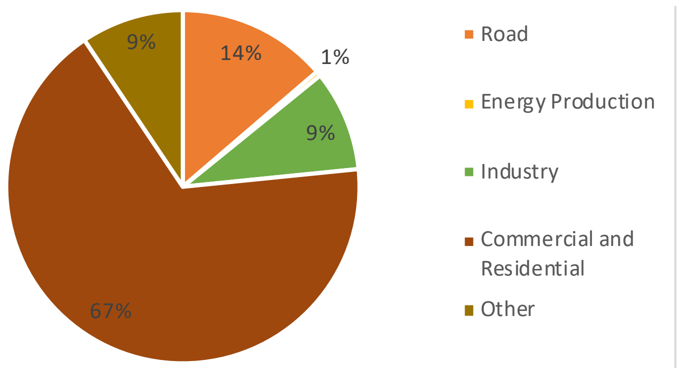


Figure 44: $PM_{2.5}$ emissions from Kent and Medway, 2015 (NAIE)

It is also possible to map this data, to provide a view on the distribution of emissions across the area. Figures 45 and 46 shows emissions maps of Kent and Medway for NOX (as NO_2) and Figures 47 to 49 provides the same maps but for $PM_{2.5}$. Table 5.4 provides the total emission for NOX and $PM_{2.5}$ for Kent and Medway local authorities.

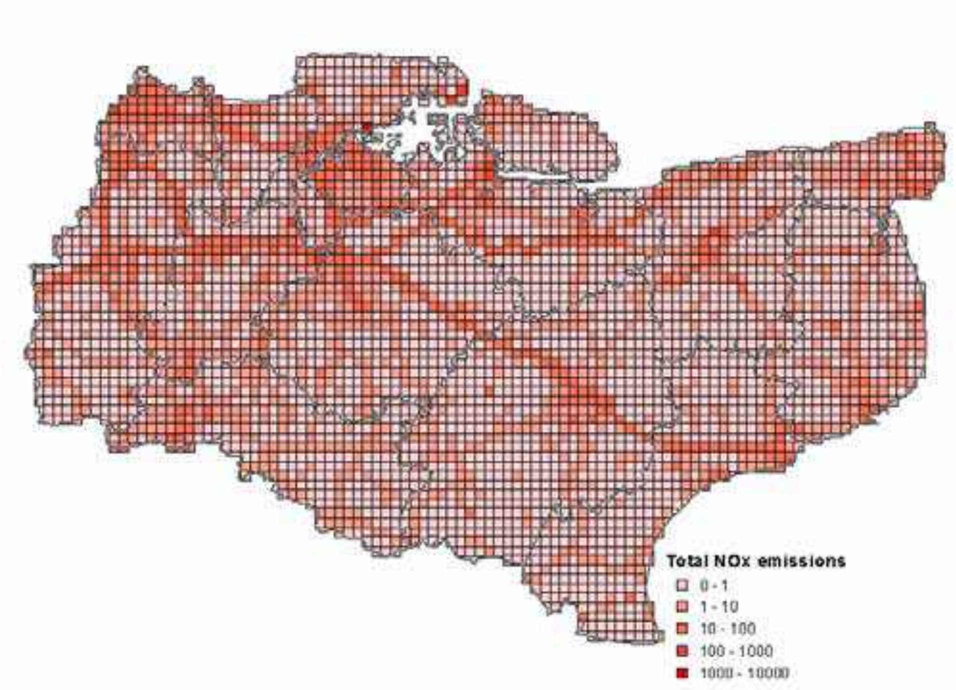


Figure 45: Total NOX (as NO_2) emissions for Kent and Medway, 2015 (NAIE)

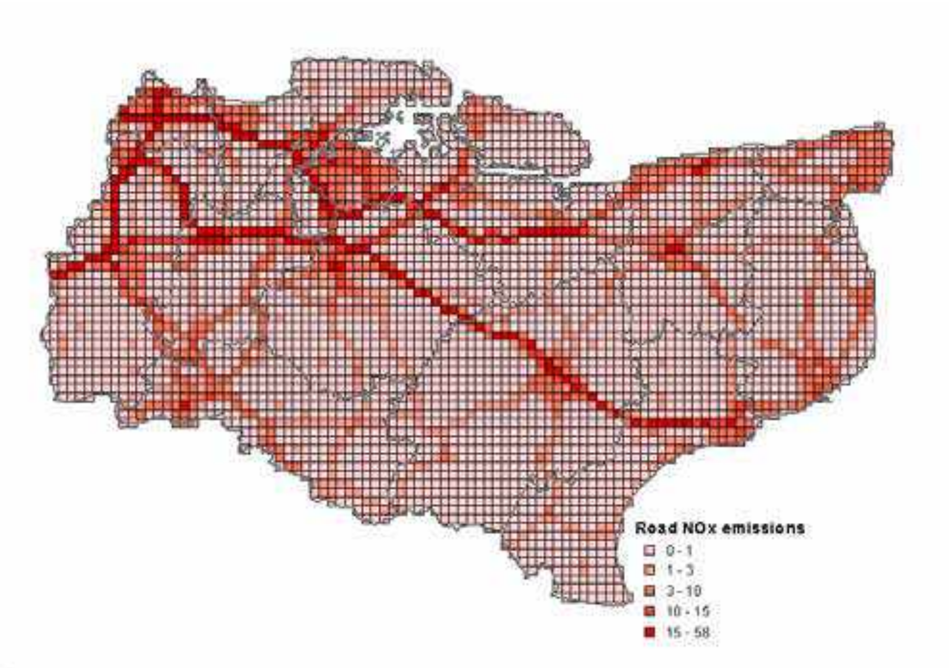


Figure 46: Road NOX (as NO_2) emissions for Kent and Medway, 2015 (NAIE)

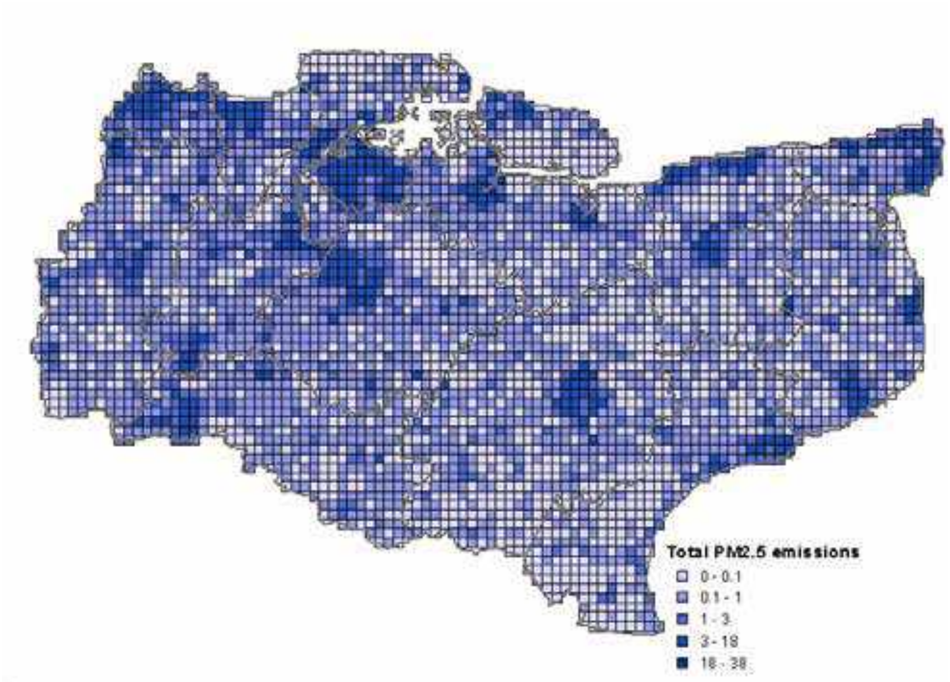


Figure 47: Total $PM_{2.5}$ emissions for Kent and Medway, 2015 (NAIE)

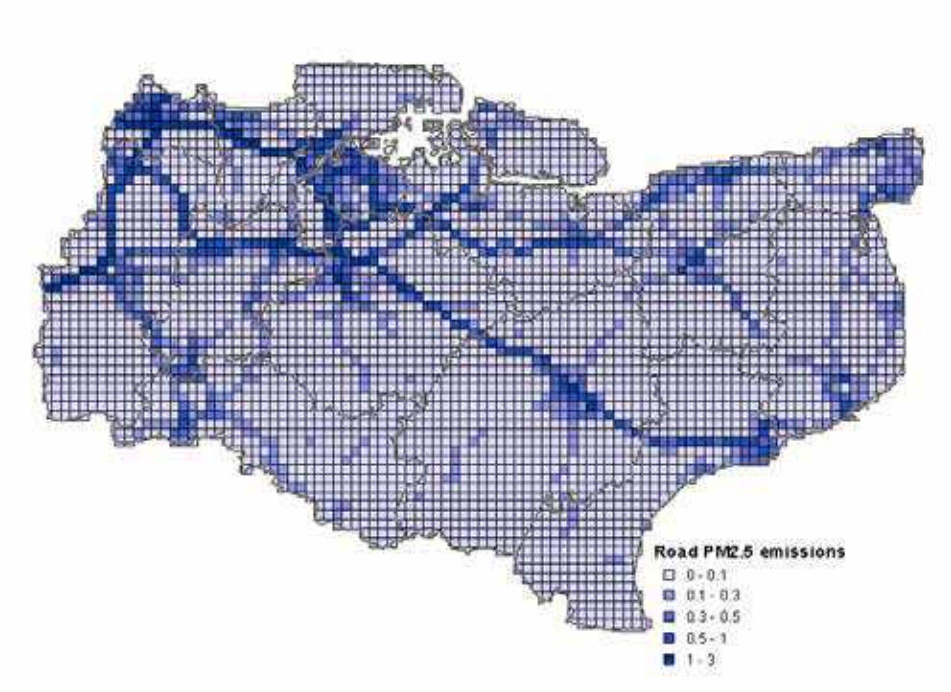


Figure 48: Road transport $PM_{2.5}$ emissions for Kent and Medway, 2015 (NAIE)

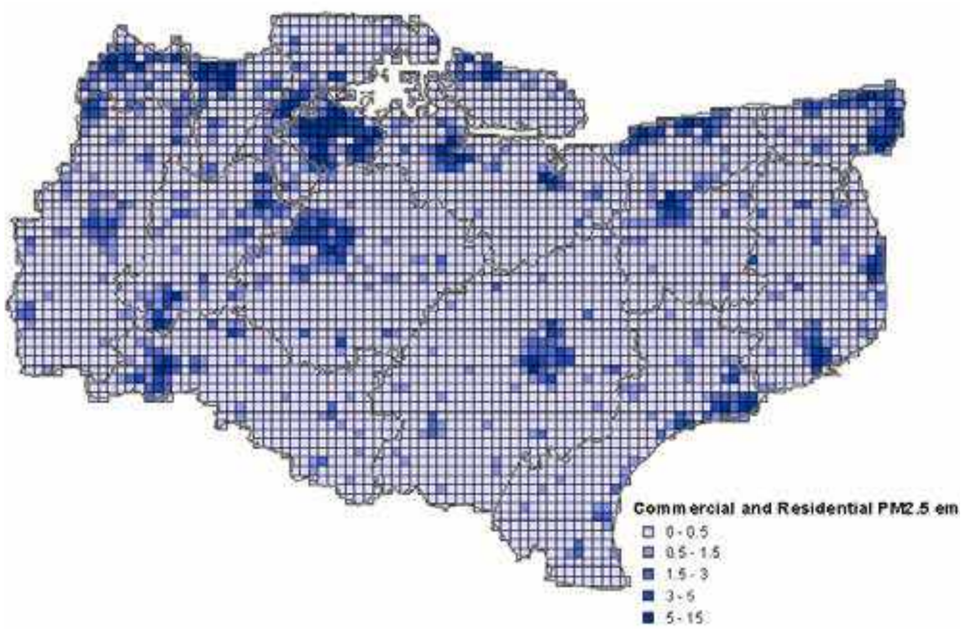


Figure 49: Commercial and residential $PM_{2.5}$ emissions for Kent and Medway, 2015 (NAIE)

District	Total NOX emitted (t)	Total PM2.5 emitted (t)
Ashford	1,227	251
Canterbury	1,054	232
Dartford	1,207	158
Dover	670	207
Gravesham	658	152
Maidstone	1,520	290
Medway	3,278	383
Sevenoaks	1,608	230
Folkstone and Hythe	742	172

Swale	1,864	329
Thanet	609	180
Tonbridge and Malling	2,295	246
Tunbridge Wells	686	187
Kent and Medway Total	17,418	3,017

Table 5.4: Total NOX and $PM_{2.5}$ emissions for Kent and Medway Districts, 2015

Figure 50 shows the trends in annual emissions of six air pollutants in UK since 1970 (1980 for ammonia)[91]. It shows the general trend is downwards and improving, apart from ammonia, which is increasing. The main sources of ammonia emissions are from agriculture, in particular livestock farms. While agriculture in Kent is a significant sector, it is largely arable, orchard and soft fruit crops, with ammonia emissions arising from organic wastes spread on the land to enrich the soil. Currently Defra and the Environment Agency work with agricultural sector to address this trend.

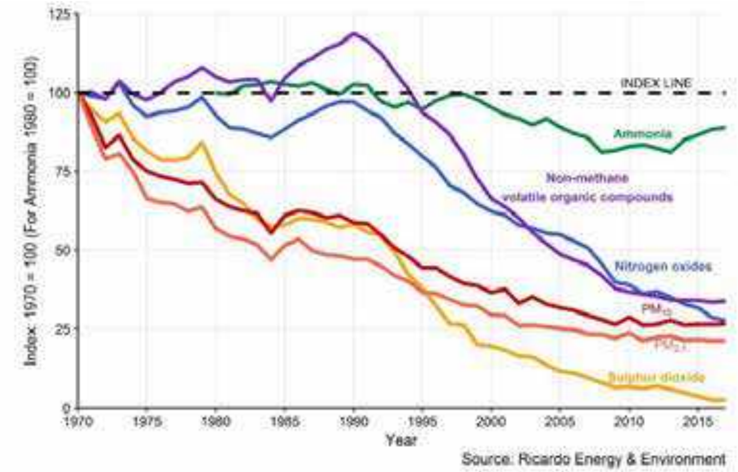


Figure 50: Trends in annual emissions of six air pollutants in the UK, 1970 – 2017 (Defra, 2019)

Figure 51 shows the emissions trend by source sector for NOX, identifying the key components for road transport.[92] The prime focus for local authorities across Kent and Medway is influencing the reduction in emissions from road transport on roads maintained by Kent County Council and Medway Council. Whilst the traffic using the motorways and trunk roads in the county (maintained by Highways England) is significant and impacts background emission levels, there is less direct impact on residential properties or areas where the public are exposed whilst walking and cycling.

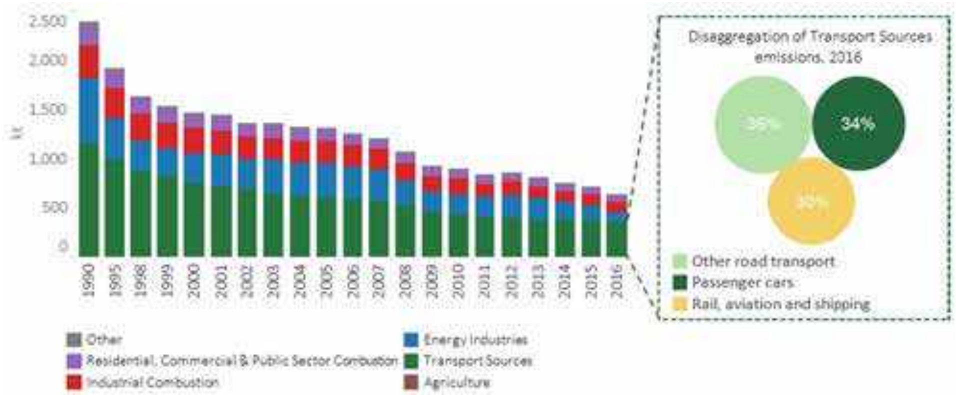


Figure 51: Emission trend for nitrogen oxides by source sector, England, 1990-2016 (NAEI, 2018)

While the NAEI provides very useful information on emissions at a national scale and offers a starting point for understanding emissions from Kent, it does not use information specific to Kent to construct emissions for the area. Sub-national scale inventories have been constructed for London (the LAEI), Wales and Scotland, and increasingly for larger urban areas in the UK, in response to a requirement for such areas to investigate Clean Air Zones. Defra is showing an increasing interest in embedding more local scale inventories into the national policy development framework.

In the absence of a local scale emissions inventory, source apportionment can be used to estimate the key sources contributing to air quality as assessed at monitoring stations.

Table 5.5 shows the source apportionment calculated for six locations within one of Medway Council's Air Quality Management Areas, as part of its Air Quality Action Plan[93] adopted in 2015. This has been constructed by subtracting the 'background' concentration from the measured concentrations at that location. The remainder is then split between different road transport sources using local traffic counts. This is a very useful way of estimating the key sources at a specific location, it cannot be used to provide information at locations without any monitoring, nor can it be used to test ex ante policy effectiveness.

Location	Total NO2	Road NO2	Back ground	Cars	HGV	LGV	Buses	Motor cycles
Luton Arches Junction	44.2	24.5	19.7	11.4	2.5	3.3	7.2	0.05
18 Star Hill	45.6	25.9	19.7	11.5	4.5	3.2	6.7	0.05
High Street, Strood (Tanning Shop)	45	25.3	19.7	11.8	5.6	4.2	3.7	0.04
High Street, Strood (Southern Heating)	52.4	32.7	19.7	16.9	4.5	5.8	5.5	0.06
London Road, Strood	41.6	21.9	19.7	10	4.2	5.1	2.5	0.03
33 London Road, Strood	42.9	23.2	19.7	11.2	3.8	6	2.2	0.03

Table 5.5: Central Medway AQMA NO_2 source apportionment diffusion tube sites where 2013 annual mean concentration greater than 40 µg.m-3 (Medway Council, 2015)

5.4 AIR QUALITY IN KENT AND MEDWAY

5.4.1 AIR QUALITY OBJECTIVES

Based on available data, air quality in Kent and Medway is generally improving, with the number of days of moderate or high air pollution falling between 2012 and 2016, although 2017 data showed an increase to 49 days compared to 32 days in 2016 (where at least one pollutant recorded levels of moderate or higher air pollution).

Areas where concentrations of nitrogen dioxide (NO2) or particulate matter are above or close to the national Air Quality Standards, have been declared as Air Quality Management Areas, with 43 currently declared across the county.

Defra provides the complete set of EU Limit Values and National Air Quality Objectives.[94] The limits for nitrogen dioxide and particulate matter are:

- Nitrogen Dioxide (NO_2) - annual average concentration of 40µg/m^3
- PM_{10} -
  - o Annual average concentration of 40µg.m^{-3}
  - o 24hr average PM_{10} concentration of 50 µg m^{-3} with 35 exceedances allowed per year
  - $PM_{2.5}$ - annual average $PM_{2.5}$ concentration of 25µg.m^{-3}

5.4.2 NITROGEN DIOXIDE (NO_2)

Figure 52 shows the background concentrations on NO_2 for Kent and Medway, for 2015. The map is taken from data provided by Defra to assist local authorities in assessing air quality in their area. It gives the annual average concentrations averaged in each 1x1km grid square. This means that the higher concentrations found closer to sources such as major roads are smoothed out. However, it provides a good indication of the distribution of NO_2 across the area and clearly shows the importance of both urban areas and major roads, including the motorway network in contribution to poor air quality. It also shows the proximity of London with higher levels of air pollution also contributes to overall pollution levels in the north east of the county.

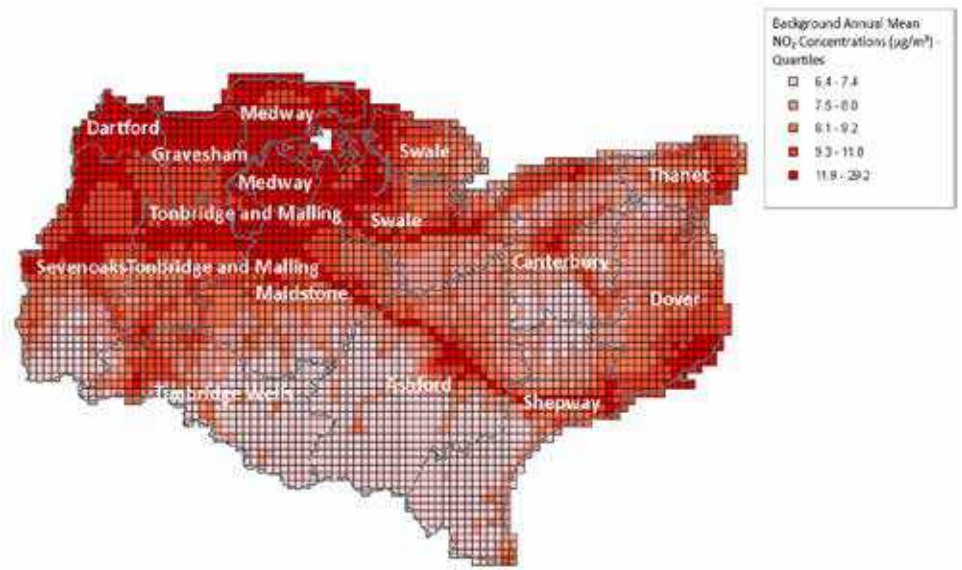


Figure 52: Modelled background concentrations of NO_2 (annual average) in Kent and Medway, 2015 (Defra)

Monitoring data from roadside locations generally shows higher concentrations than indicated by the map above. Figure 53 shows the trend in roadside NO_2 concentrations in Kent and Medway, based on the continuous analysers currently in operation. The dotted line shows the average concentrations over the period while the shaded area shows the range of annual averages measured. While the overall trend is downward, progress is slow.

The monitoring results for the period for currently operating sites are shown in Table 5.6. [95] In 2017, three sites out of 18, shown in **bold underlined type,** measured annual average NO_2 concentrations at or above the UK air quality objective (AQO) of 40μg/m^3.

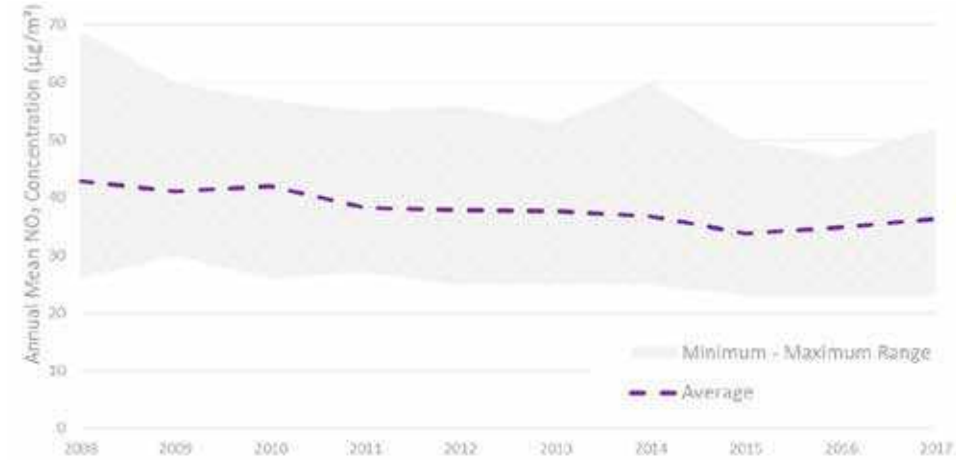


Figure 53: Trend in annual average NO_2 concentrations in Kent and Medway at all continuous analyser sites, 2008-2017

Sites	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Canterbury AURN	17	16	18	15	15	15	12	11	14	15
Canterbury Military Road	**40**	37	34	34	33	34	28	28	33	37
Chatham Roadside AURN			38	30	32	26	25	23	26	26
Dartford Bean Interchange	**58**	**58**	**54**	**53**	**54**	**43**	**51**	**61**	**57**	**55**
Dartford Town Centre	**43**	**45**	**51**	**40**	**42**	**49**	**44**	37	38	34
Dartford St Clements	**69**	**60**	**57**	**54**	**57**	**53**	**61**	**50**	**47**	**43**
Gravesham A2 Roadside	**40**	38	37	34	35	31	31	30	30	32
Gravesham Industrial Background	28	30	28	26	27	31	24	23	24	24
Maidstone A229 kerbside (revoked 2016)		**46**	**56**	**53.5**	**43.2**	**48.1**	**48.6**	**40.1**	**38**	
Maidstone Rural	18	16	17	13	14	14	12	13	12	13
Rochester Stoke AURN	18	17	24	19	18	14	15	13	14	15
Sevenoaks Bat & Ball	33	31	31	30	29	31	29	32	31	28

Sites	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sevenoaks Greatness Park	21	21	21	19	19	20	17	17	17	16
Swale Newington 3 (new 2011)				29	30	35	33	30	28	30
Swale Ospringe Roadside 2 (revoked 2016)				39	35	37	34	33		
Swale St Pauls Street (new 2013)						34	34	35	38	35
Thanet Birchington Roadside	39	40	35	36	41	35	31	25	32	32
Thanet Ramsgate Roadside	26	30	26	27	25	25	26	23	23	23
Tunbridge Wells A26 Roadside	49	52	57	43	48	47	48	44	44	40

Table 5.6: Annual average NO2 concentrations measured by currently operating continuous analysers in Kent and Medway, 2008-2017

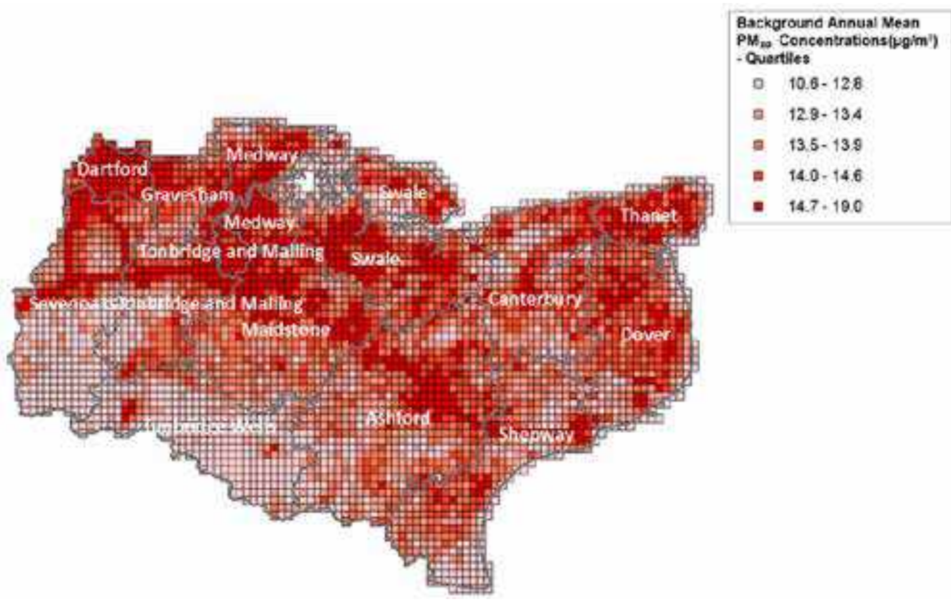


Figure 54: Modelled background concentrations of PM10 (annual average) in Kent and Medway, 2015 (Defra)

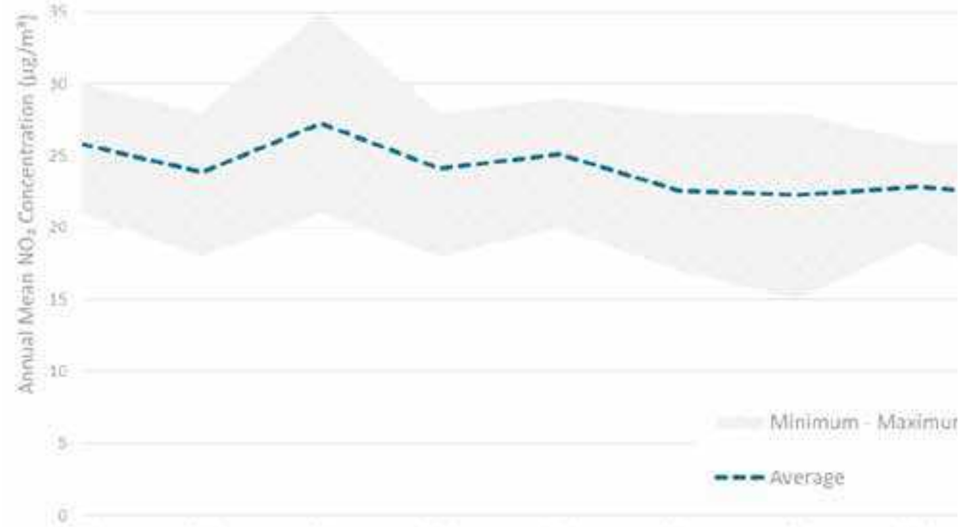


Figure 55: Trend in annual average PM10 concentrations in Kent and Medway at continuous analysers sites, 2008-2017

PM10 is currently measured at 18 sites across Kent and Medway, none of which measured an exceedance of the national air quality objectives in 2017, as shown in Tables 5.7 and 5.8. However, evidence indicates that PM10 does not have a "safe" level, and that health benefits are accrued from any reduction in population exposure. Further action is therefore needed on PM10.

Site	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Canterbury AURN	23	19	18	20	18	19	18	17	17	17
Chatham Roadside AURN			21	24	21	23	21	19	19	24
Dartford Town Centre	26	24	24	27	24	28	24	23	33	25
Dartford St Clements	33	31	28	28	22	24	25	20	24	21
Dartford Bean Interchange	29	24	25	24	21	21	27	26	27	28
Dover Centre Roadside	32	29	27	30	26	28	27	25	26	24

Gravesham A2 Roadside	24	24	18	21	18	20	17	15	19	16
Gravesham Industrial Background	31	27	30	24	20	20	19	16	18	22
Maidstone Rural	19	17	14	16	18	19	25	19	20	20
Rochester Stoke AURN	22	20		14	16	18	18	15	16	18
Stanford-le-Hope Roadside AURN	24	21	21	23	23	24	19	17	20	18
Sevenoaks Bat & Ball	23	23	23	25	24	22	21	21	21	20
Sevenoaks Greatness Park	17	20	20	23	20	20	19	21	18	18
Swale Ospringe Roadside 2						29	27	28	25	
Thanet Birchington Roadside	23	23	24	29	25	25	21	23	25	26
Thanet Ramsgate Roadside	31	30	28	35	28	27	25	26	26	24.6
Thurrock AURN	21	21	24	25	18	19	19	17	17	19
Tunbridge Wells A26 Roadside	29	29	28	30	28	28	28	28	26	25

Table 5.7: PM10 annual average concentrations measured by currently operating continuous analysers in Kent and Medway, 2008-2017

Site Name	Exceedance Days*
Canterbury	2
Chatham Roadside	6
Dartford Town Centre	10
Dartford St Clements	4
Dartford Bean Interchange	14
Dover Centre Roadside	18
Gravesham A2 Roadside	5
Gravesham Industrial Background	4
Maidstone Rural	0
Rochester Stoke	4
Sevenoaks Bat & Ball	4
Sevenoaks Greatness	6
Swale Ospringe Roadside 2	-
Thanet Birchington Roadside	9
Thanet Ramsgate Roadside	13
Tunbridge Wells A26 Roadside	13

Table 5.8: PM_{10} "exceedance days" recorded by continuous analysers in Kent and Medway, 2017

5.4.4 PARTICULATE MATTER UP TO 2.5 MICRONS (PM2.5)

$PM_{2.5}$ is measured at only two sites in the area, one of which started measurements relatively recently. The annual average concentrations in 2017 for these two sites are given in Table 5.9. This shows that concentrations at these sites are well below the national air quality objective of 25µg.m^{-3}.

However, this objective, derived from European legislation, is intended as a "backstop" with the main policy instrument being a reduction in population exposure on a national basis, rather than focussing on hotpot areas. The World Health Organisation has suggested a guideline value for the protection of human health of 10µg.m^{-3} while at the same time acknowledging that the evidence does not indicate a "safe" level . Further reduction in $PM_{2.5}$ would therefore derive health benefits for the population of Kent and Medway.

Site Name	Annual Mean (µg m^{-3})*
Chatham Roadside	14
Rochester Stoke	10

Table 5.9: PM2.5 concentrations measured by continuous analysers in Kent and Medway, 2017

5.4.5 OTHER AIR POLLUTANTS

Historically, other air pollutants have had a significant impact on air quality, including sulphur dioxide, carbon monoxide, lead and benzene. However, controls on industrial and transport emissions, changes to the way we generate

[f] Data omitted due to extremely low data capture

electricity and the removal of lead and sulphur from road fuels have reduced concentrations to the point where they no longer cause significant health impacts in the UK. Indeed, concentrations are generally at or below the limits of detection for standard monitoring methods in most areas.

Sulphur Dioxide remains a significant transboundary air pollutant and contributes to the formation of secondary particulate matter, and as such is subject to emission controls at a national level.

Ozone is another significant transboundary pollutant but one which is entirely "secondary" in nature. Reduction in ozone's precursor pollutants – Nitrogen dioxide and some volatile organic compounds – has greatly reduced peak concentrations but both national and international action is required to reduce levels further. Evidence shows that action at the level of Kent and Medway would do little to reduce ozone concentrations in isolation.

Ammonia is a further pollutant of concern and is the only major pollutant whose emissions are not decreasing over time. It differs from most other pollutants in that it is not produced by combustion processes. Ammonia is produced almost wholly from agricultural processes and it is highly reactive. This means that concentrations of ammonia are generally very low, but it is a key component in secondary particulate matter and thus has significant indirect impacts on both human and environmental health. It also has a significant impact on the natural environment, on vulnerable eco-systems and habitats (especially those which are naturally nitrogen poor). Therefore, the control of emissions of ammonia are a priority for national and international emissions control legislation.

5.5 ACTING ON POOR AIR QUALITY

In response to the requirements of Local Air Quality Management (as established through the Environment Act 1995), all District councils in Kent and Medway Council have developed air quality action plans: 43 Air Quality Management Areas (AQMAs) have been declared across the area. These are listed in Table 5.10, which provides a description of each AQMA declared in Kent and the latest monitoring data, where available. All the AQMAs have been declared on an exceedance or risk of exceedance of the NO_2 annual average air quality standard (40µg.m-3) using diffusion tube monitoring. Two district councils, Ashford and Folkstone and Hythe, have not declared AQMAs.

Local Authority	Name of Air Quality Management Area	Description of Air Quality Management Area	Most recent measured NO2 annual average (µg.m^{-3})	Measurement year
Ashford	N/A	N/A	N/A	N/A
Canterbury	Air Quality Management Area – Canterbury 3	Larger City Centre AQMA	47.1	2017
	Air Quality Management Area – Herne 1	Junction of the A291 and School Lane	38.2	2017
Dartford	A282 Tunnel Approach	The approach road to the Dartford Crossing which is flanked at several points by residential properties	56	2016
	London Road	The length of London Road (A226) which runs from Swanscombe in the east to the Princes Road roundabout, Dartford.	47	2016
	Dartford Town Centre and Approach Roads	Several stretches of road converging on Dartford town centre.	38	2016
	Bean Interchange	An area encompassing residential properties near to the Bean Interchange between the A2 and Bluewater Shopping Centre.	57	2016

Local Authority	Name of Air Quality Management Area	Description of Air Quality Management Area	Most recent measured NO2 annual average (µg.m^{-3})	Measurement year
Dover	A20 AQMA	An area following the A20 from just west of the Limekiln Roundabout at the western end to a point c.140m from the Eastern Docks in Dover. No longer includes properties in Marine Parade and East Cliff to the east.	42.8	2017
	High Street/Lady -well AQMA	An area encompassing roads and properties between the junction of Effingham Crescent/High Street, and Priory Hill/High Street.	45.4	2017
Gravesham	A2 Trunk Road AQMA	The A2 Trunk Road AQMA. An area extending either side of the length of the A2 within the borough	31	2016
	Northfleet Industrial Area AQMA	An area encompassing the Northfleet Industrial Area in Gravesham	33.6	2016
	A226 One-way system in Gravesend AQMA	An area incorporating the entirety of the A226 One-way system in Gravesend	40.6	2016
	B262/B261 Pelham Arms Junction AQMA	An area encompassing the junction of the B262 Pelham Road, B262 Pelham Road South and the B261 Old Road West	34.5	2016
Gravesham	A227/B261 Wrotham Road/Old Road West Junction AQMA	An area encompassing the junction of the A227 Wrotham Road and B261 Old Road West extending south to a point just beyond the Woodlands Restaurant	38.2	2016
	The Echo Junction Area AQMA	On B261 Gravesend	34.4	2016
	The Parrock Street Area AQMA	An area encompassing Parrock Street (from the point at which it crosses the railway line, southwards to the junction of Christ Church Road), and Lord Street (from its junction with Parrock Street to its junction with Windmill Street	30.5	2016
Maidstone	Maidstone Town AQMA	An Area encompassing the entire Maidstone conurbation including the location previously designated as the separate M20 AQMA	79.3	2017

Local Authority	Name of Air Quality Management Area	Description of Air Quality Management Area	Most recent measured NO2 annual average (µg.m^{-3})	Measurement year
Medway	Central Medway AQMA	A large central AQMA which includes the previous AQMAs of Frindsbury Road, Cuxton Road, Strood Centre, Rochester Centre and Chatham Centre which have been slightly extended, but also includes the new areas of Luton Road, Chatham, High Street, Chatham and Rainham Road, Chatham.	51	2017
	Rainham AQMA	An area running along the High Street in Rainham.	45.4	2017
	Gillingham AQMA	An area along Pier Road in Gillingham	42.9	2017
	Four Elms Hill AQMA	Part of Four Elms Hill, Chattenden	50.8	2017
Sevenoaks	AQMA 1	Junction 3 of the M25 to the district boundary with Tonbridge and Malling Borough Council including part of the A20 at Farningham.	45.8	2016
	AQMA 2	County border with Surrey to district border with Dartford, including Junctions 3, 4 and 5 and the extension of Junction 5 to connect with the A25 at Bessel's Green	43.1	2016
Sevenoaks	AQMA 3	M26 - from junction 5 of the M25 to the district boundary with Tonbridge and Malling Borough Council.	No current monitoring	N/A
	AQMA 4	Swanley Bypass - from junction 3 of the M25 to the district boundary with the London Borough of Bromley	No current monitoring	N/A
	AQMA 6	Junction 5 to Kent / Surrey border	No current monitoring	N/A
	AQMA 8	Swanley – London Road (East); High Street; Bartholomew Way and parts of Central town area	No current monitoring	N/A
	AQMA 10	Sevenoaks – High Street	54.7	2016
	AQMA 13	The entire length of the A25 from the border with Tonbridge and Malling in the east to the border with Tandridge in the west.	57.9	2016
	AQMA 14	The junction of London Road and Birchwood Road, Swanley.	60.5	2016
Folkstone and Hythe	N/A	N/A	N/A	N/A

Local Authority	Name of Air Quality Management Area	Description of Air Quality Management Area	Most recent measured NO2 annual average ($\mu g.m^{-3}$)	Measurement year
Swale	AQMA 1: Newingto n (A2 / High Street)	An area encompassing those parts of London Road and High Street, Newington where the speed limit is 30mph	48.5	2017
	AQMA 6: Ospringe Street, Faversham (A2 / Ospringe)	Area incorporating all of Ospringe Street, Ospringe which is a section of the A2 London Road, trunk road near Faversham between the grid reference 600106, 160936 and the grid reference 600466, 160839.	61.3	2017
	AQMA 3: East Street, Sittingbourne (A2 / Canterbury Road)	The designated area incorporates the area of East Street, Sittingbourne.	42.5	2017
	AQMA 4: St Paul's Street, Milton, Sittingbourne (B2006)	The designated area incorporates the area of St Pauls Street, Sittingbourne	55.7	2017
	AQMA 5: Teynham (A2 / London Road)	A2 London Teynham.	39.9	2017
Thanet	Thanet Urban AQMA	An area encompassing a number of urban areas within Thanet	40	2016
Tonbridge and Malling	M20 AQMA 1	An area extending 39m from the centreline along the M20 motorway between the points where it passes below New Hythe Lane, Larkfield to the west and where it crosses Hall Road, Aylesford to the east.	36.7	2017
Tonbridge and Malling	Ditton AQMA 2	An area incorporating the Station Road/London Road A20 crossroads in the Parish of Ditton.	31.9	2017
	Tonbridge High Street AQMA 3	An area incorporating the High Street between Botany and the High Street/Vale Road roundabout, Tonbridge.	49.6	2017
	Wateringbury AQMA 4	An area incorporating the Red Hill/Tonbridge Road A26 crossroads in the Parish of Wateringbury.	61.3	2017
	Aylesford AQMA 5	An area encompassing the A20 London Road in Aylesford, including the junction with Hall Road and Mills Road.	44.8	2017
	Larkfield AQMA 6	An area encompassing the A20 London Road in East Malling, Larkfield and Ditton, including the junction with New Hythe Lane.	43.2	2017
	Borough Green AQMA 7	Parts of Sevenoaks Road A25, Western Road and the High Street in Borough Green	43	2017
Tunbridge Wells	A26 AQMA	The A26 between Park Road and Neville Terrace and also including Grosvenor Road at 0- 80m from the road	43.3	2017

Table 5.10: AQMAs declared by Kent and Medway councils baes on diffusion tube data

A number of the air quality action plans are currently being reviewed and updated, so a definitive list of the actions currently underway is not available. However, a preliminary analysis of published reports showed around 250 individual actions; ranging from the very specific, e.g. addressing a particular junction or road section, though to the more general, dealing with broader council policy or approach.

Roughly two thirds of the actions were aimed at transport sources, including:

- promotion of low emission vehicles and infrastructure
- supporting walking and cycling
- low emission buses and taxis
- specific road improvements.

The other third was aimed at development control and council policies, including:

- the adoption of common guidance on handling air quality in planning applications
- a commitment to a joint air quality strategy
- the development of awareness raising campaigns
- reducing the impact of Council fleet vehicles.

5.5.1 THE ROLE OF GREEN INFRASTRUCTURE

Green infrastructure is a term usually used to describe an urban network of greenspace that is often strategically planned and managed. It includes roadside trees, shrubs and hedges; parks, cemeteries and allotments; urban woodland, riverbanks and wetlands; private gardens; and green walls, sustainable urban drainage systems and green roofs.

There has been increasing recognition that green infrastructure can play an important role in influencing urban air quality. Vegetation acts as a natural filter; with the surface of leaves absorbing carbon dioxide, dust particles and other pollutants such as sulphur dioxide. A 2017 study for the Office of National Statistics[97] estimated that existing UK vegetation reduces the average annual surface concentrations of $PM_{2.5}$ by 10%, PM_{10} by 6%, ozone by 13%, ammonia by 24% and sulphur dioxide by 30%, but did not markedly change nitrogen dioxide concentrations. The study concluded that UK vegetation removes 1,354 kilotons of pollutants annually, with an annual value of £1 billion.

Research by Lancashire University showed that trees removed airborne pollutants at three times the rate of grasslands. The research also revealed that there is variation in the effectiveness of different species of trees: Scots pines, common alder, larch, Norway maple, field maple, ash and silver birch were found to remove the most pollutants. However, species of oak and willow were found to be detrimental to air quality, due to the emittance of biogenic volatile organic compounds (bVOCs), which enhance the formation of pollutants such as ozone. Other negative impacts related to trees and hedges include the release of allergenic pollens in some species; the loss of effectiveness in winter due to leaf fall in deciduous species; and a reduction in air-flow if planted too densely, leading to pollutant concentration spikes. However, these impacts can all be avoided if suitable species are selected and correctly planted at the outset.

As well as the air quality benefits, green infrastructure is seen as an essential tool in the creation of healthy and sustainable communities because it provides many other benefits, including:

- enhanced physical and mental wellbeing
- important urban wildlife habitat, supporting many different species
- acts as a sound barrier, reducing the impact of urban noise
- natural drainage, which helps prevent flooding
- urban shading, to reduce the impact of heatwaves and mitigate the 'urban heat island'
- carbon storage, mitigating the impacts of climate change
- increased property values from enhanced aesthetics

A recent report by Fields in Trust concluded that based on estimates of a reduction in GP visits by regular park users in the UK population, the annual NHS cost saving from parks and greenspace is £111 million, or £3.16 per person.[99]

However, whilst green infrastructure is beneficial for air quality and has many multiple benefits, it is unlikely to resolve air quality problems at a city scale. One of the problems is that there is often insufficient space to plant vegetation in the quantity required to have an impact. Research from the Air Quality Expert Group on behalf of Defra concluded that realistic urban planting schemes would reduce PM10 concentrations by only a few percent. [100] For this reason, Public Health England have recently cautioned that appropriately designed urban green infrastructure can improve air quality, improve health inequalities and promote health and wellbeing, but should not be used in isolation to address air pollution.[101]

5.6 PUBLISHED AIR QUALITY INFORMATION

The Kent Air website provides access to published data and reports for Medway and all district councils except for Dartford and Sevenoaks; whose data is hosted on the London Air Quality Network:

http://kentair.org.uk   http://www.londonair.org.uk

These websites provide information and advice for individuals and to be used as educational resources and together show the status of air pollution across the county.

5.6.1 ASHFORD BOROUGH COUNCIL

Air Quality in the borough is considered to be good with pollutant concentrations below the national air quality objectives and monitoring data showing levels are continuing to decrease slightly. The council has therefore not declared any AQMAs.

5.6.2 CANTERBURY CITY COUNCIL

There are two AQMAs declared in the district. Monitoring of the levels of nitrogen dioxide is from a continuous analyser at a roadside site and a network of 44 diffusion tube sites. In addition, nitrogen dioxide, ozone and PM10 monitoring take place at an urban background AURN affiliated site.

The nitrogen dioxide diffusion tube network was further expanded in 2017 to include additional sites in response to a number of planning applications and local concerns.

5.6.3 DARTFORD BOROUGH COUNCIL

There are four AQMAs declared in Dartford for NO_2 and PM10 mainly due to emissions from road traffic sources. Levels of pollution have been improving over recent years but remain high. All four AQMAs still record levels of NO_2 in excess of the annual average objective.

Dartford has two major trunk roads running through it, incidents on these roads can result in vehicles being displaced onto the local road network. This combined with higher background pollution levels due to its geographical proximity to London results in pollution levels higher than many other Kent districts. New air quality action plans are to be produced in 2019.

5.6.4 DOVER DISTRICT COUNCIL

There are two AQMAs declared in the district. The extent of these AQMAs has now been reviewed and modelled by the council's consultants and no changes to area boundaries are necessary. Although additional monitoring at an extra four sites at the High Street /Ladywell AQMA and at residential locations close to the Townwall Street AQMA continue.

Dover faces several challenges to manage traffic to and from the Port and discussions are taking place with central government and Highways England to manage the expected major increase in housing stock in South East England coupled with proposals for the third Thames crossing.

5.6.5 FOLKESTONE AND HYTHE DISTRICT COUNCIL

Folkestone and Hythe District Council has not been required to declare an AQMA and the 2017 annual status report supports this decision.

The 2017 monitoring results indicated that the prescribed objectives were all being met. The highest monitored levels are still at the busy roadside sites in Folkestone town. Therefore, the council continues to monitor at these locations to demonstrate continued compliance with the prescribed objectives. A review of the network will also be considered to ensure the monitoring stays relevant.

5.6.6 GRAVESHAM BOROUGH COUNCIL

There are seven AQMAs declared in the district. The adoption of the action plans and Air Quality Strategy have enabled the council to make excellent progress in improving air quality and three AQMAs are being considered for revocation around the area of Rathmore Road, although monitoring of NO2 will continue. This will help the council to ascertain whether the actions being taken through the planning process, including junction improvements when new developments come along, have a beneficial effect on air quality.

The general trend of pollution levels across the borough is a downward one, with significant improvements being made in the AQMAs above.

5.6.7 MAIDSTONE BOROUGH COUNCIL

Extensive air quality modelling was undertaken in 2016, to enable a review of the boundaries of Maidstone's AQMA. Maidstone previously had one large AQMA covering the whole of the urban area, but the modelling showed that a much smaller AQMA could be considered. Maidstone councillors approved this change at the end of 2017 and a new AQMA has been declared which closely follows the carriageways of the main roads through Maidstone Borough. The actual boundary of the AQMA is based on the 36µgm-3 NO_2 contour predicted by the modelling.

A review of air quality monitoring provision in Maidstone was undertaken, which concluded that automatic monitoring in the town centre was essential, with Upper Stone Street being the preferred location. A suitable monitoring site in Upper Stone Street was identified and a new monitoring station has now been installed, which measures NO_2 and PM10 and also measures $PM_{2.5}$ in Maidstone for the first time.

5.6.8 MEDWAY COUNCIL

Many challenges still lie ahead for Medway Council in terms of making a positive contribution to improving air quality.

A weak trend of decreasing measured concentrations of NO_2 is apparent at most sites from 2011 to 2017. However, monitoring results for 2017 demonstrate that air quality in Medway continues to exceed the annual mean NO_2 objective at some locations adjacent to roads covered by the four AQMAs. Measured pollution concentrations remain below the national objectives outside the declared AQMAs, and at numerous sites within them.

The council is now planning to develop an Air Quality Action Plan for this AQMA, which is expected to run in conjunction with development of the new Medway Local Plan during 2018/19.

5.6.9 SEVENOAKS DISTRICT COUNCIL

There are nine AQMAs declared in Sevenoaks district for NO_2 and PM_{10} mainly due to emissions from road traffic sources.

Sevenoaks district Council maintains a network of air quality monitoring including ozone monitoring. Levels of NO_2 and PM_{10} have generally been improving over recent years however Ozone levels recorded at the Greatness park background have breached objective levels in nine of the last ten years.

A review of the current AQMAs is to be carried out in 2019 as part of the development of a new air quality action plan. It is likely that some of the AQMAs will be able to be revoked as a result of this review.

5.6.10 SWALE BOROUGH COUNCIL

There are five AQMAs declared in the district, due to elevated levels of NO_2

from excessive traffic and congestion on and near the A2. The extension to the Ospringe AQMA has now been consolidated into one AQMA designation.

Monitoring activity has reduced. The Ospringe monitoring site has been closed since February 2017 to accommodate the building of a new property; this has meant that access to the station was not possible. A review of diffusion tubes has left a similar number as before - 72 tubes - but some sites have been moved as different requirements have been accommodated. Results still show extensive individual exceedances of the NO_2 annual means in most of the AQMAs.

There have been a significant number of large planning applications with associated, complex air quality assessments to review. Reference to the significant amount of Swale monitoring data has been critical in this process.

5.6.11 THANET DISTRICT COUNCIL

An urban wide AQMA was declared in 2011 to incorporate several busy junctions that were close to or exceeding the annual objective for nitrogen dioxide. During the last five years there have been good air quality improvements, which have led to only one exceedance at High Street St Lawrence, Ramsgate. However, the large urban AQMA boundary will be retained until all areas fall below health objectives, as it provides the council with more flexibility to secure mitigation measures through the development control process over a wider area and benefiting the whole district.

5.6.12 TONBRIDGE AND MALLING BOROUGH COUNCIL

There are seven AQMAs declared within the district. All are declared due to exceedances of NO_2, and the M20 AQMA also exceeds the objective for particulate matter. Air quality is monitored using 74 diffusion tubes, as well as a continuous NOx analyser currently located on Tonbridge High Street.

With the scheduled refit of the site of the NOx analyser, the continuous analyser will be moved to Wateringbury Village Hall, to better monitor air quality in the AQMA there.

5.6.13 TUNBRIDGE WELLS BOROUGH COUNCIL

There is one AQMA declared in the district. Amendments to the AQMA boundary to create a longer, but narrower, AQMA were approved and the order made on the 1st September 2018. Public consultation on a draft plan was also carried out between September and October 2018, with a new Air Quality Action Plan adopted in March 2019.

The council measures NO_2 and PM^{10} in a continuous monitoring station in St Johns Road, in addition to a network of diffusion tubes. Results at most tube locations were lower in 2017 than in 2016. The annual mean NO_2 level measure at the continuous monitoring station in 2017 was equal to the annual mean objective for NO_2 at $40 \mu g m^{-3}$

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ENERGY AND LOW EMISSIONS STRATEGY

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