# Energy in the North West

## Bringing about a low-carbon, affordable energy future

*A briefing for the North West Green Party by Dr. Anne Chapman*

Green Party
for the common good

Promoted by David Jones on behalf of the North West Green Party, c/o 12 Kenneth Square, Salford M7 4UP.

# Summary

Oil, coal, natural gas and uranium will not last forever – and our addiction to these non-renewable sources of energy is damaging our health and our climate. We must urgently make the transition to a sustainable, low-carbon and low-energy economy.

About 18 GW of coal, oil and nuclear power stations are due to close by 2020, about one fifth of the UK's current generation capacity[1]. Investment in new generation and in the grid system is therefore needed, and so we are at a crossroads for energy in the UK.

There is consistent public support for renewables in the UK, with recent data showing that 77% of the population supports renewable energy, in contrast with 37% for nuclear energy and 27% for shale gas.

The North West currently generates 17% of the renewable electricity generated in England as a whole, while its land area (at 14,100 sq km) is 11% of the total area of England and current energy consumption is just 11% of the UK total. We are already one of the leaders in renewable energy but our windy coasts and upland areas offer many more opportunities and the potential to produce much more renewable energy.

Already the £1.2 billion renewables industry in the North West employs over 9400 people across 611 companies. In the UK as a whole the renewables industry could provide 400,000 jobs by 2020[2].

However the amount of renewable energy we can produce is ultimately limited by the area of land or sea we have and are willing to use for this purpose. Reducing demand plays a crucial role in the transition towards an energy supply that is 100% renewable. Large-scale action is needed at the national level to insulate homes, make smarter use of energy efficient technology, and to facilitate a change in travel habits away from oil-based transportation.

The Green Party has long argued the case for making the energy transition as fast as possible. The benefits will include more jobs, less pollution, better health, cosier homes and fewer flood disasters. But despite these compelling environmental and economic advantages, other parties have lacked the political will to make it happen.

The Green Party is calling for urgent action to move us to a low-carbon affordable energy future:

- Carbon tax revenues used to invest a major programme to make *all* homes super-energy efficient
- Greater support for existing energy efficiency schemes, which could be funded from the estimated £150 million in additional VAT revenue that the Treasury will receive as direct result of higher energy prices this winter, and from a windfall levy on energy company profits
- Reinstatement of the Government's duty to eliminate fuel poverty (which a Government amendment to the Energy Bill is seeking to remove)
- To meet this duty, robust minimum energy efficiency standards for households on low incomes, comparable to those for new-build homes
- An end to tax breaks for fracking and a moratorium on all activities

- A programme to phase out fossil fuel subsidies, which cost the UK £4.3 billion in 2011
- Measures to make the energy market fair for community-owned renewable companies, including giving them priority access to the Grid
- Measures for a regulatory framework which allows communities to buy the electricity they generate at wholesale costs
- Stronger incentives for larger scale renewable companies, set at adequate levels to remove the current policy uncertainty which is deterring investment
- A commitment to a binding EU-wide target on renewables, which should be 45% of our energy sourced from renewables by 2030.

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## Contents

# 1 Scope

This briefing considers electricity generation, energy used for heating, cooking and transport, and industrial uses of fossil fuels. These account for around 85% of UK emissions of greenhouse gases[3].

It is important to consider them together because reducing emissions of greenhouse gases is likely to require use of electricity for things that we currently use gas and oil for, such as heating and transport. Switching to electricity can in some instances increase efficiency. We can also generate the electricity from renewables, rather than fossil fuels.

The embedded energy or carbon emissions in imported goods is beyond the scope of this briefing. It can be argued that much of the apparent reduction in UK emissions over the last few decades has been achieved by moving our manufacturing to China and other places[4] where the carbon-intensity of the economy is greater than it is in the UK. We have not reduced the carbon emissions caused by our consumption - just moved them elsewhere.

We need to reduce our consumption and move quickly towards a low-carbon economy globally.

This briefing mainly deals with the scope for action in North West England.

# 2 Current energy consumption and sources

Table 1 shows the energy consumed in the North West of England (181 TWh per year) and in the UK as a whole (1607 TWh/year).

Table 2 provides information about electricity supply and generation for the UK in 2012. The difference between the amount of electricity supplied and electricity consumed (in Table 1) is a result of losses in transmission.

Around 11% of electricity generated in 2012 came from renewable sources. But because electricity makes up only 20% of our total energy consumption, renewables contributed less than 3% to the total energy consumed.

The high price of gas relative to coal meant that generation of electricity from gas fell from 40% in 2011 to 28% in 2012, and coal increased from 30% to 39%[5]. Generating electricity from coal produces more than twice as much carbon dioxide compared to generating the same amount from gas, so the switch from gas to coal resulted in a 3.5% increase in the UK's greenhouse gas emissions[6]. Coal in the UK also causes an estimated 1,600 premature deaths a year as well as more than a million incidents of lower respiratory symptoms[7].

Data on energy production in the North West is not readily available. The major power stations are Fiddlers Ferry (pictured below) near Warrington, which burns coal and some biomass, and the two nuclear power stations at Heysham, near Lancaster.

Fiddlers Ferry produces around 6 TWh per year[8,], and the Heysham power stations together produce 17 TWh per year.

The Heysham power stations are currently due to close by 2023[9]. In addition there is at least one major gas fired power station, Rocksavage, near Runcorn, which has a capacity of 800 MW, and three large scale combined heat and power plants, each with a capacity of 30 MW or more[10]. A gas power station at Roosecote in Cumbria was closed by its owners, Centrica, in 2012.

There are seven gas fields in the Irish Sea off the North West coast. Gas from four fields comes onshore at Connah's Quay on the Dee Estuary, while gas from the northern three fields comes on shore at Barrow.[11] There are also many offshore wind farms in the Irish Sea.

## 3 From fossil fuels to renewables

The Green Party wants to see a rapid energy shift from nuclear and fossil fuels (oil, coal and natural gas) to renewables.

The burning of fossil fuels releases carbon dioxide taken out of the atmosphere millions of years ago by growing plants. Along with deforestation, the burning of fossil fuels has caused atmospheric carbon dioxide levels to increase from around 270 to 400 parts per million over the last two hundred years, increasing the heat retained by the earth, and changing our climate.

Nuclear power has other problems, such as very long-lived and highly radioactive waste products, the potential for catastrophic accidents, nuclear weapons proliferation issues, and high (and often hidden) economic costs.

Fossil fuels are a very concentrated form of energy that can easily be transported and burned when needed to produce heat and thence electricity. Nuclear energy is even more concentrated – you need a very small amount of uranium fuel to produce a great deal of energy.

In contrast, renewable forms of energy – wind, sunshine, moving water – tend to be dispersed. We would need 3,500 of the large, 2MW wind turbines, such as the one at Lancaster University (visible from the M6) to produce the 17 TWh per year that the two nuclear power stations at Heysham produced in 2011[12].

The amount of renewable energy we can produce is ultimately limited by the area of land or sea we have and are willing to use for it. On the basis of theoretical considerations David Mackay has estimated that the UK could perhaps produce just under 3900 TWh/year from renewable sources, but suggests that around 400 TWh/year is a more realistic figure[13]. This is one-quarter of the UK's current energy consumption (Table 1).

In their recent Zero Carbon Britain (ZCB) report, the Centre for Alternative Technology (CAT) estimated that we could supply just over 1,000 TWh per year from renewable sources.[14] This is broadly comparable with estimates made by British Pugwash[15] and WWF[16].

In the ZCB scenario (Figure 1) just under 64% of energy is provided as electricity, with UK-grown biomass providing most of the remainder. The biomass is used as fuel for heating and to produce biogas via anaerobic digestion. Wind is the primary means of generating electricity, with offshore wind providing 530 TWh per year (70% of the electricity) and onshore wind 51 TWh per year. This requires 14,000 10MW turbines offshore and 10,000 2MW turbines on shore. 58 TWh of solar PV are also needed (75GW maximum power, covering 10-15% of the UK roof area), plus wave, tidal, geothermal and hydro power.

The demand for electricity fluctuates from minute to minute, hour to hour, and over the seasons.

Fossil fuel power stations, particularly those burning gas, can easily be turned on and off to supply electricity just when it is needed; nuclear power stations tend to be on all the time, producing a constant 'baseload', but must be shut down for at least two weeks a year for maintenance.

In contrast, renewable energy is only available when the wind blows, the sun shines or the water moves (in a river, or the sea). This means there is a potential problem of matching supply and demand.

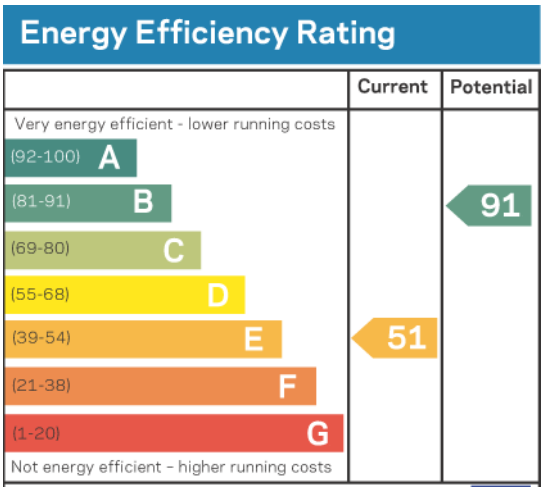
Having a significant percentage of renewables in the electricity supply will require development of more storage capacity (such as the pumped storage facility at Dinorwig in Snowdonia), and devices that switch demand to times when excess electricity is available.

The ZCB scenario includes additional pumped storage facilities, the use of batteries in electric vehicles, shifting demand by use of smart devices on appliances such as heaters, and fridges, and the use of excess electricity to make hydrogen by electrolysis of water.

The latter is combined with biogas to produce a carbon-neutral synthetic liquid fuel for heavy vehicles and planes and a synthetic gas which can be burned in gas power stations to produce electricity during cold, calm and overcast periods in winter when wind, solar, hydro and other renewables cannot meet demand. This requires the retention of the gas power station capacity that we have today.

## 4 Saving energy

Providing for all of our energy needs from renewables therefore requires a significant reduction in energy use. At the current levels of demand it is simply not possible achieve 100% renewables.




The ZCB scenario involves reducing energy demand by 60%. This requires:

- reducing energy used for heating in buildings by around 50% through

improved insulation, better heating controls, more efficient heating systems and reduced average internal temperatures;

- reducing energy used for cooking, lighting and electrical appliances by 40% through improvements in efficiency;
- reducing industrial energy intensity by 25% on average (while output increases by 16% on 2007 levels);
- reducing energy used in transport by 78% by reducing the distance travelled per person by 15%, shifting from cars to public transport, walking and cycling, completing electrification of the railways, switching to electric cars, cutting out domestic air travel and reducing international air travel by two thirds.

Whilst consuming and travelling less will be important, changes to more efficient technologies that use electricity rather than oil or gas are critical.[17] Even with the current carbon-intensity of grid electricity, it is better to use an electric car than a petrol or diesel one because in the latter 75% of the energy goes to heating up the engine rather than in moving the car forward[18]. This principle also applies to buses and trains. Electric trains also save on the weight and cost of the engine, as electricity is supplied by an overhead line or third rail rather than a battery.

For heating, getting to 100% renewables requires a shift away from natural gas to heat pumps. These use electricity to extract heat out of the air or ground (just as your fridge extracts heat out of the fridge and puts it in your kitchen). With efficient heat pumps it is possible to get out as useful heat three or four times the amount of energy that you have put in as electricity.[19]

## 5 Are we getting there?

Some facts about current renewable generation.

- The amount of electricity generated from renewable sources has grown over 8-fold since 1990 (see Figure 2) and increased by one fifth in 2012.
- The UK renewables mix is currently dominated by the burning of biomass with or instead of coal in coal fired power stations (Figure 3). Just over one quarter of the increase in 2012 was a result of the conversion of Tilbury power station from coal to biomass. It uses wood pellets imported mainly from south east USA and Canada[20], so the sustainability of this fuel source is questionable.
- There are now around 1300 offshore wind turbines (just under one tenth of the number required for the ZCB scenario).[21]
- The market for small and medium sized wind turbines almost doubled in size over 2012 and is now worth over £100 million a year. There are around 24,000 small and medium wind turbines installed in the UK with as many exported by UK manufacturers.[22] The number of jobs grew fourfold between 2010 and 2011.
- The costs of solar PV have fallen by at least two thirds in the last four years and large scale solar PV is now cheaper than

offshore wind, but more expensive than onshore wind. There is currently around 2.5GW of solar PV installed, which generated 1.4 TWh of electricity in the year to June 2013. The government estimates that between 7 and 20 GW (which would produce to 6-18TWh) could be installed in the UK by 2020.[23]

The growth in renewable generation within each English region is shown in Figure 4. Tables 3 and 4 give the available data on large and small scale renewables in the North West.

The North West generates 17% of the renewable electricity generated in England as a whole, while its land area (at 14,100 sq km) is 11% of the total area of England and current energy consumption is 11% of the UK total. A study carried out for the North West Development Agency in 2010 considered that 40,000 MW of capacity could be installed on shore by 2020 (Table 5).

There is obviously a long way to go on getting to 100% renewables. The UK has a target, derived from EU legislation, of sourcing 15% of its energy from renewable sources by 2020. To achieve this it is generally considered that at least 30% of electricity generation will need to be from renewables by 2020, compared with 11% in 2012.

With the exception of biomass, the 'fuel' for renewable energy – the sun, wind or water – is free. Nearly all the costs have to be paid up-front, in installing the wind turbines or solar panels. That means that investors need long term certainty with regard to the price that will be paid for the electricity generated, to a greater extent than is the case for fossil-fuel generation.

Mechanisms like the feed-in-tariff, introduced in the UK by the last Labour government have been very successful at encouraging small scale renewable generation. Generators registered for the feed-in-tariff are paid at a rate set when they start generating (which then increases with inflation every year) for every unit of electricity they generate.

This need for long term certainty is not helped by continual changes to government policy. For example, in October 2011 the government cut the feed in tariff rate for solar PV by around 50%, with what in effect was six weeks notice. A mechanism for reducing the tariff rate as prices for solar PV come down has now been introduced, but the way the government handled the issue has led to a loss of confidence in government incentives for renewable energy.

Similarly, there is concern about the government's commitment to offshore wind; its forecasts for how much will be installed by 2020 has gone down from 40 GW (in 2010) to just 8-10 GW (in 2013), to the concern of the offshore wind industry.[24]

Added to that the opposition of many Tory MPs to wind power, including ministers at the Department for Energy and Climate, it is clear that the government is not putting out the consistent, supportive message on renewables that is needed to encourage investment.

Meanwhile, the prime minister has said that the government is "going all out" for shale gas: it has introduced tax breaks for shale gas

production which reduce the effective tax rate from 62% to 30%,[25] and has offered financial incentives to local authorities and communities which host shale gas extraction.[26]

While conventional oil and gas wells extract from a permeable 'reservoir' rock strata overlying the rock producing the gas, in unconventional extraction gas is obtained directly from the shale rock that produces it at depths of 3-4km.

Wells are drilled vertically down into the rock, then horizontally through the shale layer. To release the gas the rock must be fracked: fractures are induced in the rock by high pressure water containing sand and synthetic chemicals.

This requires energy; so fracked gas has a higher carbon footprint than conventional gas. Fracking is also associated with leakage of methane - a potent greenhouse gas – into the atmosphere.

Suitable shales are present in North West England west of the Pennines, and exploration is currently being carried out. If extraction proves viable there could be 100 to 200 drill pads in the North West, each with 5-6 boreholes.[27]


There are many concerns about the environmental impact of these operations, including the amount of water they would consume, the risk of water and air pollution, the numbers of lorry movements there would be and the triggering of earthquakes by fracking. Fracking could put at risk the North West farming and tourism industry, particularly in Lancashire.

There is general consensus that fracking in the UK would not bring down UK gas prices.[28]

A more fundamental issue is that if we are going to avoid runaway climate change we need to leave between 60-80% of current known coal, oil and gas reserves in the ground.[29]

Researchers at the Tyndall Centre for Climate Change Research at Manchester University consider that fracking is not consistent with meeting our climate change targets. For example, if just 20% of the reserves identified under Lancashire were to be extracted and burnt, this would emit over 2,000 million tonnes of carbon dioxide, representing around 15% of the UK's greenhouse gas emissions budget through to 2050.[30] Instead of wasting resources looking for new reserves of fossil fuels we should be investing in renewable energy and energy efficiency.

On demand reduction, the government has also shown a deplorable lack of commitment. Its 'Green Deal' introduced in 2013 has had a very low take up, primarily because it is a funding mechanism that requires people to borrow money at interest (of 7%) to increase the energy efficiency of their homes.

In their desire to reduce the 'green levies' on energy companies the Government has reduced by a third the carbon emission savings the companies have to achieve through funding of energy efficiency measures, and have removed the requirement for energy companies to fund solid wall insulation. This has devastated the nascent solid wall insulation industry, and led to the cancellation of planned solid-wall insulation programmes[31].

## 6 Setting the right course

About 18 GW of coal, oil and nuclear power stations are due to close by 2020, about one fifth of the UK's current generation capacity.[32] Investment in new generation and in the grid system will therefore be needed whether or not we are seeking to reduce carbon emissions.

Modelling by the Energy Technologies Institute estimates that we need to invest around £5 bn/year now, rising to £15 bn/year by 2030. They consider that by 2050 we may be spending £300 bn/year on energy, compared with the £120 bn/year that we spend now. In their modelling, the cost of achieving the Climate Change Act target of an 80% reduction in carbon emissions does not add significantly to these costs. Additional costs are estimated at around 0.6% of GDP, less than is currently spend on child benefit payments.[33]

However, this relies on the right decisions being made now. Investment has long lead times, and the right decisions need to be made now to direct investment towards low-carbon generation. Delay will increase the costs of meeting our carbon emission targets.

A Green Party position paper on the Energy Price Debate (Dec 2013)[34] set out ten things that the Green Party believes should happen now to move us to a low-carbon affordable energy future:

- Carbon tax revenues used to invest a major programme to make *all* homes super-energy efficient
- Greater support for existing energy efficiency schemes, which could be funded from the estimated £150 million in additional VAT revenue that the Treasury will receive as direct result of higher energy prices this winter, and from a windfall levy on energy company profits
- Reinstatement of the Government's duty to eliminate fuel poverty (which a Government amendment to the Energy Bill is seeking to remove)
- To meet this duty, robust minimum energy efficiency standards for households on low incomes, comparable to those for new-build homes
- An end to tax breaks for fracking and moratorium on all activities
- A programme to phase out fossil fuel subsidies, which cost the UK £4.3 billion in 2011
- Measures to make the energy market fair for community-owned renewable companies, including giving them priority access to the Grid
- Measures for a regulatory framework which allows communities to buy the electricity they generate at wholesale costs
- Stronger incentives for larger scale renewable companies, set at adequate

levels to remove the current policy uncertainty which is deterring investment

- A commitment to a binding EU-wide target on renewables, aiming for 45% of our energy sourced from renewables by 2030.

## 7 Reaping the benefits

Reducing our energy use and shifting from fossil fuels to renewable energy is essential to tackle climate change.

But it will also have other benefits. Internal wall insulation not only cuts down on the amount of energy needed to heat the home, it also means the wall is no longer cold and therefore damp with condensation with mould growing on it – as so many walls in are in the North West of England.

Mould causes asthma, so an insulated home is healthier as well as warmer. Burning fossil fuels, produces other pollutants as well as carbon dioxide.

The Health and Environment Alliance (HEAL) consider that the burning of coal in UK power stations causes 1,600 premature deaths, 68,000 additional days of medication, 363,266 working days to be lost and more than a million incidents of lower respiratory symptoms.

Together these cost the UK economy which is costing £1.1 to 3.1 billion each year.[35]


Similarly, reducing the number of internal combustion engines driving around our towns and cities spewing out nitrous oxides and particulate matter, will make our urban air cleaner, improving the health of their inhabitants.

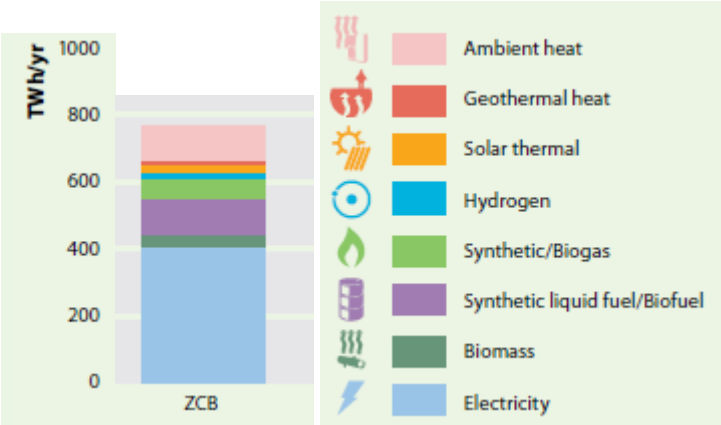
Finally, insulating our homes and workplaces and installing renewable energy systems will create jobs. Unlike the jobs from nuclear power these will be dispersed throughout the country, with jobs in every town and city.

Studies have found that wind energy provides twice as many jobs as gas.[36] If we could manufacture more of the renewable energy systems within the UK rather than importing them from Germany or China we would create even more jobs. Already the £1.2 billion renewables industry in the North West employs over 9400 people across 611 companies. In the UK as a whole the renewables industry could provide 400,000 jobs by 2020.[37]

## 8 FIGURES AND TABLES

**Figure 1: Zero-carbon Britain scenario**[xxxviii]

Fuel mix:




Energy Supply

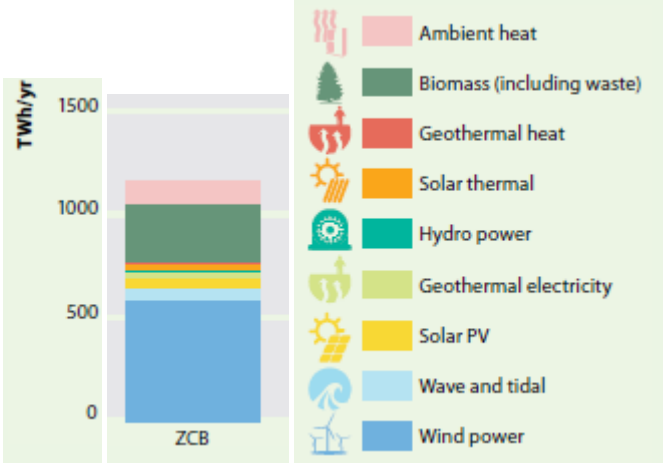



**Figure 2: Electricity generation by main renewable sources since 1990**[xxxix]

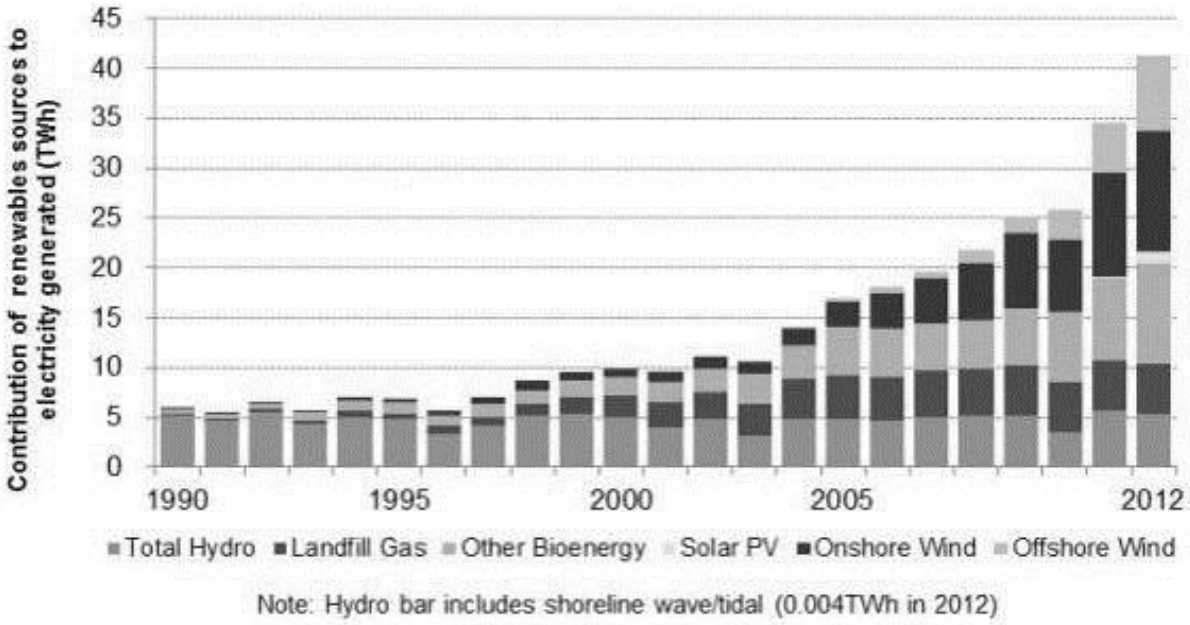
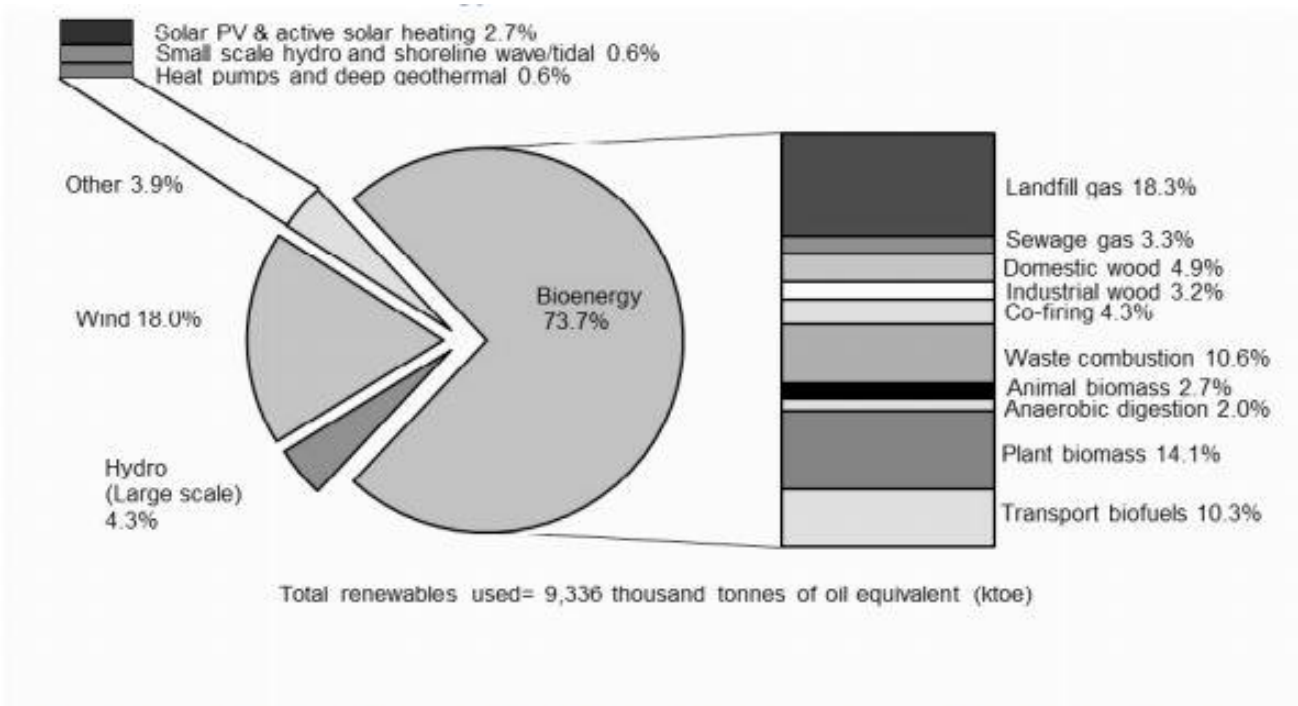
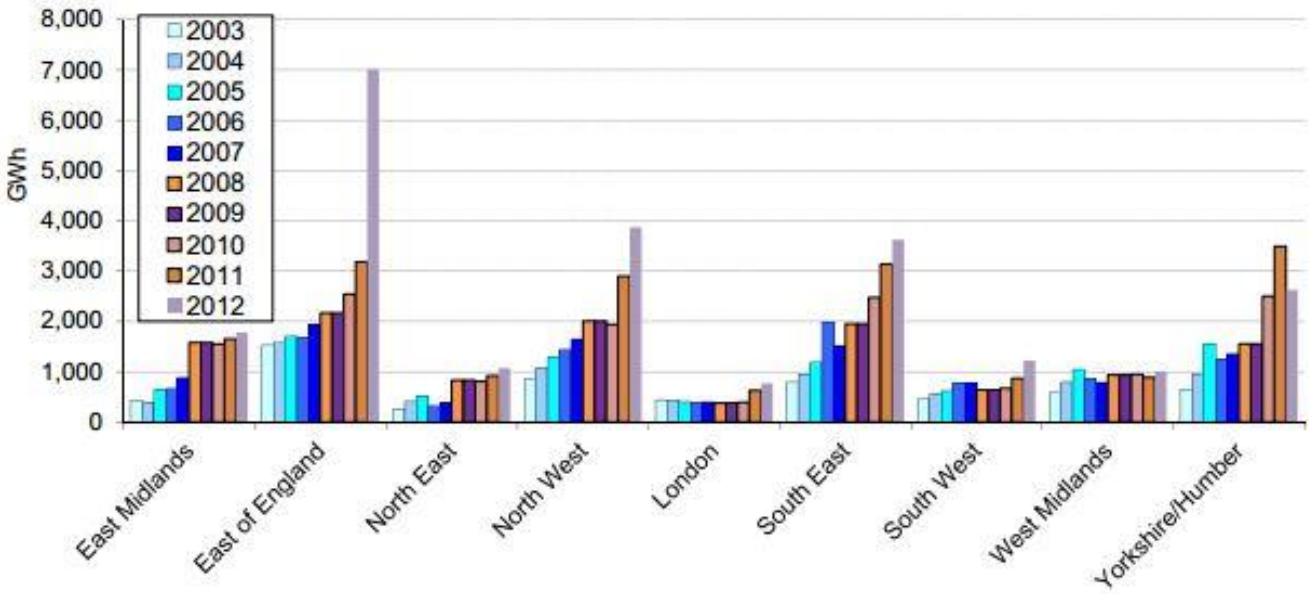


**Figure 3: Renewable energy fuel use 2012**[xl]




*(1) Excludes all passive use of solar energy and all non-biodegradable wastes (696 ktoe). In this chart renewables are measured in primary input terms.*
*(2) Biomass co-fired with fossil fuels in power stations.*
*(3) 'Animal biomass' includes farm waste, poultry litter, and meat and bone combustion.*
*(4) 'Plant biomass' includes straw and energy crops.*

**Figure 4: Trends in Renewable Generation by English Region**




From https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244732/1_regional_renewables_2012.pdf Includes large scale renewables only (excludes small scale systems which receive support under the Feed in Tariff Regime.

**Table 1: UK and NW England energy consumption (average over the period 2010-2012)[xli]**
**The NW has more domestic (probably caused by poor housing stock), industrial and commercial, road freight and aviation emissions than the UK average.**

| Form of energy | UK final consumption | ...of which | | UK kWh/ person/ day* | NW England final consumption | NW kWh/ person/ day* | GHG emissions due to NW England consumption |
|---|---|---|---|---|---|---|---|
| | TWh | | TWh | | TWh | | Mtonne $CO_2$e |
| Electricity | 325 | Domestic | 111 | 4.8 | 13 | 5.1 | 7 |
| | | Industry & commerce | 214 | 9.3 | 24 | 9.4 | 12 |
| Natural gas | 640 | Domestic | 340 | 14.8 | 38 | 14.9 | 7 |
| | | Industry & commerce | 300 | 13.0 | 34 | 13.3 | 6 |
| Oil | 642 | Road passenger transport | 306 | 13.3 | 34 | 13.3 | 9 |
| | | Road freight | 157 | 6.8 | 18 | 7.0 | 5 |
| | | Rail, water transport | 30 | 1.3 | 3 | 1.2 | 1 |
| | | Aviation | 149 | 6.5 | 17 | 6.7 | 9+ |
| Totals | 1607 | | 1607 | 70 | 181 | 71 | 56 |

*UK population 63 million, NW England population 7 million.

+ the emissions figure for aviation has been doubled to take account of radiative forcing. This is the effect whereby emissions from aircraft at high altitude have a greater impact than does burning the same amount of fossil fuel at ground level. The Department for Transport estimate this is between 1.3 and 2 times, but some experts believe it could be up to 4 times.

**Table 2: UK Electricity supply, 2012[xlii]**

| | TWh | % of generation | Tonnes $CO_2$ per GWh of electricity[xliii] |
|---|---|---|---|
| Total supply | 376 | | |
| Pumped storage | 3 | | |
| Net imports | 12 | | |
| Generation: | 364 | | |
| Coal | 143 | 39 | 886 |
| Natural Gas | 100 | 28 | 355 |
| Oil | 3 | 1 | 650 |
| Nuclear | 70 | 20 | |
| Renewables | 41 | 11 | |
| Other | 3 | 1 | |

**Table 3: Large Scale Renewables in North West England by end of 2012**

| Technology | Number of sites | | Capacity | | Generation | |
|---|---|---|---|---|---|---|
| | NW | % of England total | NW MW | % of England total | NW GWh | % of England total |
| Hydro | 41 | 20% | 7.1 | 22% | 16.5 | 20% |
| Wind and wave [1] | 332 | 12% | 919.6 | 24% | 2728.9 | 31% |
| Landfill gas | 53 | 15% | 147.4 | 17% | 690.5 | 16% |
| Sewage gas | 25 | 15% | 23.7 | 13% | 93.5 | 14% |
| Other bioenergy [2] | 37 | 18% | 111.4 | 6% | 266.3 | 3% |
| Solar PV | 31,940 | 10% | 111.4 | 8% | 75.9 | 8% |
| Total | 32428 | 10% | 1320.4 | 16% | 3871.5 | 17% |

[1] Wind Offshore is allocated to regions/countries according to where the cabling comes ashore. Non-FiTs micro-wind has been included in the tables as part of the Wind and Wave data, apportioned according to the regional breakdown of FIT schemes

[2] Includes bioenergy sources co-fired with fossil fuels

From Tables 1-3 of

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244732/1_regional_renewables_2012.pdf

**Table 4: Small scale renewable energy installations in the North West by local authority area at end of Sept 2013**

| Local Authority Name | Photovoltaics No. | Photovoltaics Capacity kW | Wind No. | Wind Capacity kW | Hydro No. | Hydro Capacity kW | Anaerobic Digestion No. | Anaerobic Digestion Capacity kW | Domestic PV Installations per 10,000 households |
|---|---|---|---|---|---|---|---|---|---|
| Allerdale | 867 | 3,678 | 29 | 453 | 5 | 23 | 2 | 1,800 | 180 |
| Barrow-in-Furness | 178 | 625 | 8 | 46 | - | - | - | - | 50 |
| Blackburn with Darwen | 1,518 | 4,822 | 9 | 102 | - | - | - | - | 251 |
| Blackpool | 414 | 1,431 | - | - | - | - | - | - | 59 |
| Bolton | 1,028 | 3,927 | 1 | 6 | - | - | - | - | 84 |
| Burnley | 346 | 1,473 | 9 | 70 | - | - | - | - | 81 |
| Bury | 550 | 2,002 | 4 | 297 | 1 | 100 | - | - | 67 |
| Carlisle | 890 | 3,175 | 21 | 219 | - | - | 1 | 500 | 176 |
| Cheshire East | 2,367 | 9,308 | 15 | 274 | 3 | 27 | - | - | 140 |
| Cheshire West and Chester | 1,839 | 7,320 | 4 | 28 | - | - | - | - | 123 |
| Chorley | 644 | 2,308 | 6 | 2,294 | - | - | - | - | 138 |
| Copeland | 516 | 1,952 | 16 | 292 | 6 | 610 | - | - | 154 |
| Eden | 817 | 3,417 | 21 | 166 | 2 | 6 | - | - | 308 |
| Fylde | 557 | 1,988 | 1 | 22 | - | - | 1 | 800 | 149 |
| Halton | 352 | 1,545 | 2 | 11 | - | - | - | - | 62 |
| Hyndburn | 304 | 1,162 | 4 | 44 | - | - | - | - | 80 |
| Knowsley | 1,126 | 3,793 | 1 | 6 | - | - | - | - | 174 |
| Lancaster | 697 | 3,319 | 11 | 93 | - | - | - | - | 111 |
| Liverpool | 1,212 | 4,119 | 2 | 18 | - | - | - | - | 58 |
| Manchester | 2,622 | 7,701 | - | - | - | - | - | - | 122 |
| Oldham | 569 | 2,869 | 3 | 25 | - | - | - | - | 59 |
| Pendle | 529 | 1,791 | 10 | 136 | - | - | - | - | 128 |
| Preston | 676 | 2,549 | 3 | 27 | - | - | - | - | 109 |
| Ribble Valley | 563 | 2,209 | 12 | 132 | - | - | - | - | 225 |
| Rochdale | 1,190 | 3,935 | 3 | 39 | - | - | - | - | 130 |
| Rossendale | 584 | 1,800 | 21 | 161 | - | - | - | - | 189 |
| Salford | 707 | 2,128 | - | - | - | - | - | - | 64 |
| Sefton | 920 | 3,088 | 5 | 42 | - | - | - | - | 74 |
| South Lakeland | 975 | 3,355 | 20 | 179 | 8 | 732 | - | - | 182 |
| South Ribble | 682 | 2,918 | 2 | 17 | 1 | 200 | - | - | 138 |
| St. Helens | 743 | 2,421 | 1 | 22 | - | - | - | - | 93 |
| Stockport | 2,981 | 8,057 | 1 | 5 | 1 | 74 | - | - | 235 |
| Tameside | 598 | 2,359 | - | - | - | - | - | - | 59 |
| Trafford | 648 | 2,338 | - | - | 1 | 4 | - | - | 66 |
| Warrington | 1,477 | 4,200 | 1 | 15 | - | - | - | - | 165 |
| West Lancashire | 616 | 3,018 | 12 | 87 | - | - | - | - | 123 |
| Wigan | 2,488 | 7,445 | 1 | 11 | - | - | - | - | 177 |
| Wirral | 1,203 | 3,976 | 3 | 36 | - | - | - | - | 82 |
| Wyre | 837 | 3,122 | 18 | 166 | - | - | - | - | 165 |
| Total | 37,830 | 132,644 | 280 | 5,543 | 28 | 1,774 | 4 | 3,100 | 129 |

This table excludes micro-CHP, which has a total capacity of 54 kW in 54 installations, with between 1 and 3 installations per area.

From Sub-regional Feed-in Tariffs confirmed on the CFR statistics available at https://www.gov.uk/government/statistical-data-sets/sub-regional-feed-in-tariffs-confirmed-on-the-cfr-statistics

**Table 5: Accessible renewable energy resource in the North West, by technology, sub-categories and subregion (at 2020)**

| Technology group | Total energy (MW) | Sub-categories | Electricity (MW) | Heat (MW) | TOTAL (MW) | Cheshire | Cumbria | Greater Manchester | Lancashire | Merseyside |
|---|---|---|---|---|---|---|---|---|---|---|
| Wind | 24,468 | Wind – commercial | 23,587 | | 23,587 | 4,806 | 10,399 | 1,265 | 6,497 | 619 |
| | | Wind – small scale | 669 | | 669 | 235 | 220 | 0 | 201 | 13 |
| Biomass | 1,118 | Plant Biomass – Managed woodland | 20 | | 20 | 2 | 13 | 1 | 3 | 1 |
| | | Managed woodland (HEAT) | | 122 | 122 | 12 | 81 | 6 | 9 | 4 |
| | | Energy crops | 11 | | 11 | 3 | 3 | 1 | 3 | 2 |
| | | Energy crops (HEAT) | | 60 | 60 | 16 | 15 | 4 | 15 | 10 |
| | | Waste wood | 39 | | 39 | 7 | 12 | 7 | 10 | 4 |
| | | Agricultural arisings (straw) | 11 | | 11 | 4 | 2 | 1 | 3 | 1 |
| | | Animal Biomass (Wet Organic Waste) | 206 | | 206 | 49 | 99 | 7 | 49 | 2 |
| | | Animal Biomass (Poultry Litter) | 9 | | 9 | 3 | 3 | 1 | 2 | 0 |
| | | Municipal Solid Waste (MSW) | 211 | | 211 | 33 | 17 | 77 | 43 | 41 |
| | | Commercial & Industrial Waste (C&IW) | 135 | | 135 | 22 | 9 | 56 | 26 | 22 |
| | | Landfill gas | 68 | | 68 | 32 | 3 | 8 | 14 | 11 |
| | | Sewage gas | 28 | | 28 | 6 | 0 | 16 | 4 | 3 |
| | | Co-firing of biomass | 198 | | 198 | 198 | 0 | 0 | 0 | 0 |
| Hydro | 77 | Small scale hydropower | 77 | | 77 | 4 | 47 | 13 | 10 | 3 |
| Microgen. | 14,871 | Solar Photovoltaics (PV) | 1,158 | | 1,158 | 153 | 90 | 440 | 238 | 237 |
| | | Solar Water Heating (SWH) | | 1,158 | 1,158 | 153 | 90 | 440 | 238 | 237 |
| | | Ground Source Heat Pump | | 2,471 | 2,471 | 344 | 207 | 906 | 511 | 503 |
| | | Air Source Heat Pump | | 9,884 | 9,884 | 1,376 | 829 | 3,623 | 2,043 | 2,013 |
| TOTALS | | | 26,426 | 13,695 | 40,122 | 7,459 | 12,139 | 6,871 | 9,929 | 3,725 |
| Percentage (%) | | | | | | 18.6% | 30.3% | 17.1% | 24.7% | 9.3% |

From *Northwest renewable and low carbon energy capacity and deployment, Project Report* August 2010 by SQW for the North West Development Agen

## 9 About the author

Dr Anne Chapman has worked as an environmental consultant and as a Green Party City Councillor in Lancaster. She is a director of MORE (Morecambe Bay Community Renewables) and a member of the Greenhouse think tank. Her book 'Democratising Technology' was published by Earthscan in
2007.

## 10 Notes and References

[1] https://www.gov.uk/government/publications/public-attitudes-tracking-survey-wave-8

[2] Friends of the Earth, *Fracking, Fuel and Jobs*, Briefing, April 2013.

[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/140069/1217-ghg-inventory-summary-factsheet-overview.pdf. The other major sources of emissions are agriculture F(8.6%), landfill sites (3%) and production of cement and smelting of iron (1.8%).

[4] See for example, *Ministers shouldn't boast about Kyoto; the UK's greenhouse gas emissions have risen,* a Green House Gas by Brian Heatley, available at: http://www.greenhousethinktank.org/page.php?pageid=gases.

[5]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65818/DUKES_2013_Chapter_5.pdf

[6]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/193414/280313_ghg_national_statistics_release_2012_provisional.pdf

[7] http://www.env-health.org/IMG/pdf/heal_briefing_what_does_coal_cost_health_in_the_uk_29112013final1_1.pdf

[8]http://www.sse.com/WhatWeDo/AssetsAndProjects/#/?country=All&category=All&primaryEnergy=Thermal&secondaryEnergy=Coal_Fired&location=FiddlersFerryPowerStation

[9] http://www.edfenergy.com/about-us/energy-generation/nuclear-generation/nuclear-power-stations.

[10] See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65831/5969-dukes-2012-electricity-supply-map.pdf.

[11] See p. Map 4.2 in https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65800/DUKES_2013_Chapter_4.pdf

[12] In its first year the university turbine produced just under 4,000 MWh of electricity (communication from Lancaster University). The output of the Heysham power stations is available at: http://www.edfenergy.com/about-us/energy-generation/nuclear-generation/nuclear-power-stations.

[13] Mackay, D.J.C. (2009) *Sustainable Energy - without the hot air.* UIT Cambridge, http://www.withouthotair.com

[14] See http://zerocarbonbritain.com. The latest report, *Zero Carbon Britain, Rethinking the future* was launched in July 2013.

[15] British Pugwash, 2013, Pathways to 2050: Three possible UK energy strategies http://www.britishpugwash.org/documents/British%20Pugwash%20Pathways%20to%202050%20INNERSREVsmall.pdf

[16] WWF, 2011, Positive Energy: how renewable electricity can transform the UK by 2030. http://www.wwf.org.uk/wwf_articles.cfm?unewsid=5356

[17] In the Zero Carbon Britain scenario energy used in transport is reduced by 37% by changes to travel behaviour then a further 41% by changing to electric vehicles and trains.

[18] There is lots of information on the efficiencies of different vehicles in Mackay, D.J.C. (2009) *Sustainable Energy - without the hot air.* UIT Cambridge. See also http://www.withouthotair.com

[19] See Mackay, D.J.C. (2009) *Sustainable Energy - without the hot air.* UIT Cambridge, p.300. http://www.withouthotair.com

[20] *DUKES 2013 Chapter 6: Renewable sources of energy* available at https://www.gov.uk/government/publications/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes. Information on Tilbury power station is available at: http://www.rwe.com/web/cms/en/1295424/rwe-npower/about-us/our-businesses/power-generation/tilbury/tilbury-biomass-conversion/

[21] http://www.theguardian.com/environment/2013/oct/18/offshore-wind-expansion-under-threat?

[22] http://www.renewableuk.com/en/news/press-releases.cfm/2013-10-17-small-and-medium-wind-energy-crucial-for-the-rural-economy

[23] Department of Energy and Climate Change (DECC) *UK Solar PV Strategy Part 1: Roadmap to a Brighter Future* October 2013. Available at: https://www.gov.uk/government/publications/uk-solar-pv-strategy-part-1-roadmap-to-a-brighter-future

[24] http://www.theguardian.com/environment/2013/oct/18/offshore-wind-expansion-under-threat?

[25] See *Budget 2013: Support for Shale Gas Sector,* bu Guy Chazan, Financial Times, 20th March 2013. http://www.ft.com/cms/s/0/ca8ce446-9162-11e2-b839-00144feabdc0.html#axzz2mPX31INA

[26] See *Fracking in the UK: 'We're going all out for shale,' admits Cameron* by Nicholas Watt, the Guardian, 13th Jan 2013. http://www.theguardian.com/environment/2014/jan/13/shale-gas-fracking-cameron-all-out.

[27] Information from a talk given by Prof.Ernest Rutter of Manchester University at Westmoreland General Meeting on 14th December 2013.

[28] See *Fracking, fuel bill and jobs: Why shale gas is a false solution for Lancashire,* Friends of the Earth Briefing April 2013.

[29] See http://www.carbontracker.org/wastedcapital

[30] See http://www.tyndall.ac.uk/communication/news-archive/2011/shale-gas-expansion-would-jeopardise-climate-commitments

[31] From *Energy Price Debate* – Green Party Position Paper, December 2013 and *pers comm.*

[32] See http://www.energy-uk.org.uk/publication/finish/3/451.html and DUKES Table 5.7 at http://www.energy-uk.org.uk/publication/finish/3/451.html

[33] 'Creating an affordable energy system for the UK' by Mike Colechin and p.6 of *Modelling the UK energy system: practical insights for technology development and policy making* by George Day, both available at: http://www.eti.co.uk/technology_strategy/energy_systems_modelling_environment/

[34] http://www.carolinelucas.com/assets/images/carolinelucas/CL.com/Energy%20debate%20briefing%20final%20(2).pdf.

[35] Climate and Energy Briefing Paper, December 2013, http://www.env-health.org/IMG/pdf/heal_briefing_what_does_coal_cost_health_in_the_uk_29112013final1_1.pdf

[36] Friends of the Earth, *Fracking, Fuel and Jobs,* Briefing, April 2013.

[37] Friends of the Earth, *Fracking, Fuel and Jobs,* Briefing, April 2013.

[xxxviii] From p.40 and p.55 of , *Zero Carbon Britain, Rethinking the future,* July 2013.

[xxxix] Chart 6.2 of *DUKES 2013 Chapter 6: Renewable sources of energy* available at https://www.gov.uk/government/publications/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes

[xl] Chart 6.1 of *DUKES 2013 Chapter 6: Renewable sources of energy* available at https://www.gov.uk/government/publications/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes. The Tilbury plant burns wood pellets imported predominantly from South East USA, Canada and Europe (http://www.rwe.com/web/cms/en/1295424/rwe-npower/about-us/our-businesses/power-generation/tilbury/tilbury-biomass-conversion/).

[xli] Much of this table was compiled by Martin Widden using data from the Department of Energy and Climate Change, *Energy consumption in the UK,* 26 July 2012, available at https://www.gov.uk/government/publications/energy-consumption-in-the-uk, and conversion factors given by The Carbon Trust*, Factsheet Conversion Factors - energy and carbon conversions, 2011 update*, available at http://www.carbontrust.com/media/18223/ctl153_conversion_factors.pdf

[xlii] From DUKES 5.1 available at https://www.gov.uk/government/publications/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes

[xliii] Coal and gas figures are from Page 9 of 2012 *UK GREENHOUSE GAS EMISSIONS, PROVISIONAL FIGURES AND 2011 UK GREENHOUSE GAS EMISSIONS, FINAL FIGURES BY FUEL TYPE AND END-USER* DECC, Statistical Release, 28 March 2013. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/193414/280313_ghg_national_statistics_release_2012_provisional.pdf

Oil figure from p.2 of *CARBON FOOTPRINT OF ELECTRICITY GENERATION,* Parliamentary Office of Science and Technology, October 2006. Available at: http://www.parliament.uk/documents/post/postpn268.pdf