South East Lincolnshire
Joint Strategic Planning Committee

South East Lincolnshire's Carbon Challenge.

(February 2015)

Background.

The Government has a target under the Kyoto Protocol of a 12.5 % reduction in a basket of greenhouse gases: Carbon Dioxide, Methane, Nitrous Oxide, Perfluorocarbons, Hydrofluorocarbons and Sulphur Hexafluoride from 1990 levels over the period 2008 to 2012. According to the UK's report under this Protocol, issued on 26 March 2014, we are currently delivering this target because emissions for 2012 have reduced to 24.8 per cent below the 1990 base line[1].

The Government has a domestic target of a 34% cut in all Green House Gases from 1990 levels by 2020 and an 80% cut in all Green House Gases by 2050 enshrined in the Climate Change Act 2008. The European Union have set the UK a target of achieving 15% of its energy use from renewable energy by 2020. The UK Renewable Energy Strategy has a target of 30% of our electricity to come from renewables by 2020[2].

Government advice on renewable energy is contained in the National Planning Policy Framework issued in March 2012 and Planning Practice Guidance issued in March 2014. A summary of these documents is in Appendix 1.

What does climate change mean for South East Lincolnshire?

The UK Climate Impact Programme reported in the summer of 2009. Their conclusions for the East Midlands for the 2080's are: Annual average temperatures rise by up to 3.2 degrees C and annual precipitation increases by up to 9% on the Lincolnshire coast. Sea levels rise by between 22 and 83cm on the East Anglian coast by the 2050's.[3]

Boston is identified within the Environment Agency's Strategy "Investing for the Future" 2009 (Flood and Coastal Risk Management in England) as having the highest proportion of properties in areas of significant flood risk in England. In response the Environment Agency is investigating constructing a barrier across the River Witham which will increase the standard of protection to 1 in 300. This is due to be completed in 2019.

The Lincolnshire Local Climate Impact Profile (LCLIP)[4] May 2009 found that in relation to Boston the most frequent weather type to impact services was heat waves and the most significant weather type to impact services was floods. In relation to South Holland, according to LCLIP, the most frequent and significant weather type to impact services was snow. These findings were based on a review of the local media for articles about extreme weather events since 2000 (or earlier in some cases) followed by interviews with managers.

The Kyoto Protocol, and other initiatives supported by Government, are committed to reducing mans impact upon climate change and minimising the severity of extreme weather events. It is considered that reducing greenhouse gas emissions will help reduce these possible future conditions.

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[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296152/38238_Un_Act_DECC_web_accessible_v2.pdf **accessed 300114**

[2] http://www.official-documents.gov.uk/document/cm76/7686/7686.pdf page 36 **accessed 070213**

[3] http://www.ukcip.org.uk/wordpress/wp-content/PDFs/EM_sum.pdf page 14 **accessed 070213**

[4] http://www.lincolnshire.gov.uk/residents/environment-and-planning/sustainability/climate-change/effects/steps-of-planning-to-adapt-project/1-a-local-climate-impact-profile/106935.article?tab=downloads page 16 **accessed 070213**

How much carbon is emitted in South East Lincolnshire?

Defra have issued the figures on carbon emissions by Local Authority[5]. The most recent are for 2005 to 2012 and were published in June 2014. Those relating to South East Lincolnshire are given in Table 1.

Table 1 South East Lincolnshire's CO_2 Emissions Estimates for 2012

LA / Year	Industry and Commercial	Domestic	Road Transport	Land Use Land Use Change and Forestry	Total	Population (mid-year estimate)	Per capita emissions (t)
BBC 2012	170,700	145,900	124,300	6,900	447,800	64,800	6.9
SHDC 2012	263,000	212,500	198,200	11,900	685,600	88,500	7.7
Total	433,700	358,400	322,500	18,800	1,133,400	153,300	Av = 7.3

For comparison the average per capita emissions for 2012 for Lincolnshire is 7.1 tonnes, for the East Midlands the average is 7.8 tonnes and the UK total is 7.1.

What are we doing to reduce the amount of carbon emitted in South East Lincolnshire?

The following table provides details of renewable energy schemes that are in operation, awaiting construction or yet to be determined. It contains data from Renewable Energy Planning Database December 2014.[6]

Table 2 South East Lincolnshire's Renewable Energy Schemes

Place	Capacity MW	Number of homes supplied	CO2 Tonnes saved	Annual electricity generated GWh
Existing				
Bicker wind farm[7]	26.0	14,592	37,466	61.7
Deeping St Nicholas wind farm[8]	16.0	8,980	23,056	37.9
Gedney wind farm [9]	12.0	6,735	17,292	28.5
Tydd St Mary wind farm[10]	14.0	10,000	Unknown	33.1[11]
Boston Landfill Scheme	1.3			
Staples anaerobic digester[12]	3.0	N/A	Unknown	23.7
Long Sutton PV[13]	2.75	602[14]	1,028[15]	2.38[16]

[5] https://www.gov.uk/government/statistics/local-authority-emissions-estimates open Local and Regional CO2 emission estimates 2005 - 2012 Full Data set **accessed 170115**

[6] https://www.gov.uk/government/statistics/renewable-energy-planning-database-monthly-extract **accessed 300115**

[7] http://www.windprospect.com/wf_project?wf=19&p=services&c=engineering_current&pa=e **accessed 300115**

[8] http://www.windprospect.com/wf_project?wf=23&p=services&c=engineering_current&pa=e **accessed 300115**

[9] http://www.windprospect.com/wf_project?wf=56&p=services&c=engineering_current&pa=e **accessed 300115**

[10] http://www.the-grange-wind-farm.co.uk/news.aspx **accessed 300115**

[11] Calculated 14 x 24 x 365 x 27 % / 1000 as the Bicker, Deeping and Gedney stations appear 27% efficient.

[12] Staples agent advised on 120612 that plant capacity is just under 3MW and produces 23,652 MWh/year of electricity and a similar amount of heat.

[13] http://www.sholland.gov.uk/doitonline/plandev/details.aspx?oref=h11-0206-11 & http://www.sholland.gov.uk/doitonline/plandev/details.aspx?oref=h11-0817-10 **accessed 300115**

Fen Road[17]	1.5	300	559[15]	1.3[16]
Leverton Ings[18]	12.0	3,500	5,800	10.4[16]
Nowhere Farm (under construction)[19]	10.0	1,600	3,732[15]	8.68[16]
Grange Farm (under construction)[20]	10.0	1,600	3,732[15]	8.68[16]
Installed PV under FIT[21]	8.45	1,237[14]	2,098[15]	4.89[16]
Installed wind under FIT[21]	0.22	137[14]	Unknown	0.52[22]
Installed Micro CHP[21]	0.001	Unknown	Unknown	Unknown
SUB TOTAL	117.22	49,283	94,763	221.75
Proposed with Planning Permission				
Boston gasification plant [23]	10.5	10,500	Unknown	88.2[24]
Decoy Farm (AD)[25]	1.8	Unknown	Unknown	Unknown
Friths Solar[26]	28.0	6,000	1,045[15]	24.3[16]
Fendyke Solar Farm[27]	17.6	3,410	9,858	16.7
Decoy Farm (Solar)[28]	13.8	3,100	7,590	12.0[16]
Long Sutton PV[29]	0.79	175[14]	298[15]	0.69[16]
SUB TOTAL	72.49	23,185	18,791	141.89
Domestic PV	133.7	29,337[14]	43,430[15]	116.0[16]
Proposed without planning permission				
Sutton Bridge renewable energy park[30]	48.0	55,000	140,000	403.2[31]
Holbeach Marsh windfarm[32]	16.0	7,500	21,024	37.8[11]
Delph Wind Farm[33]	18.0	8,940	mid point 24,000	41.9[11]

[14] Annual generation in KWh /3954KWh/yr for East Midlands Table 2 page 10 from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65999/7357-subnat-elec-cons-stats-2011-factsheet.pdf **accessed 030315**

[15] Annual generation in KWh x 0.43 kg / KWh from http://www.plugintothesun.co.uk/faq/#carbon-dioxide **accessed 300115**

[16] http://www.energygrants.co.uk/solar_power/solar-pv-feed-in-tariff-calculator.html#anchor select region 3 and input figure as kw **accessed 300115**

[17] http://www.boston.gov.uk/index.aspx?articleid=6208&ApplicationNumber=B/13/0345 **accessed 300115**

[18] http://www.boston.gov.uk/PlanningDocs/BBC/B-13-0306/Design_and_Access.pdf **accessed 300115**

[19] http://www.boston.gov.uk/PlanningDocs/BBC/B-14-0267/NowhereFarmPV_ArrayNr_BostonPlanningAccessStatementFINAL.pdf **accessed 300115**

[20] http://www.sholland.gov.uk/PublishedRecords/PBC/DC/APP/6/H20-0937-13-H20-0937-13_V1116200204112013_6DNA.pdf **accessed 300115.** Owing to no homes, carbon dioxide and annual generation data, are using the Nowhere Farm data as an estimate, because they are same capacity

[21] https://www.gov.uk/government/statistical-data-sets/sub-regional-feed-in-tariffs-confirmed-on-the-cfr-statistics **accessed 020215**

[22] Calculated 0.22 x 24 x 365 x 27 % / 1000 as the Bicker, Deeping and Gedney stations appear 27% efficient.

[23] http://www.boston.gov.uk/index.aspx?articleid=3567 B/09/0477 **accessed 300115**

[24] Calculated 10.5 x 24 x 350 (Operating days)

[25] http://www.sholland.gov.uk/PublishedRecords/PBC/DC/APP/6/81cb6d70-18d5-11e0-a02b-005056960035.pdf **accessed 300115**

[26] http://www.boston.gov.uk/PlanningDocs/BBC/B-14-0287/FrithsFarmPVArrayNrBostonPlanningDesignAccessStatement.pdf **accessed 300115**

[27] http://www.sholland.gov.uk/PublishedRecords/PBC/DC/APP/6/H20-0764-14-Design%20and%20Access%20Statement%20-%20REV%201.pdf **accessed 300115**

[28] http://www.sholland.gov.uk/PublishedRecords/PBC/DC/APP/6/H02-0147-14-H02-0147-14_V415200420022014_6DNA.pdf **accessed 300115.** Note the CO2 saving has been divided by 25years for an annual figure.

[29] http://www.sholland.gov.uk/doitonline/plandev/details.aspx?oref=h11-0126-11 **accessed 300115**

[30] http://www.sholland.gov.uk/PublishedRecords/PBC/DC/APP/6/H18-0723-12-H18-0723-12_V1810300007092012_6SUP.pdf **accessed 300115**

[31] Calculated 48 x 24 x 350 to allow for some down time each year.

[32] http://www.holbeachmarshwindfarm.com/about.asp **accessed 070213**

[33] http://www.sholland.gov.uk/PublishedRecords/PBC/DC/APP/6/H14-0110-13-H14-0110-13_V914000815022013_6EIA.pdf **accessed 300115**

SUB TOTAL	82.0	71,440	185,024	482.9
Total	405.41	173,245	342,008	962.54

Sectoral progress.

The following analysis will try to highlight what progress has been made and what could be done to reduce CO_2 emissions. It is organised using the sectors given in Table 1. The Climate Change Act talks about all Green House Gases but the analysis will only consider CO_2. This will illustrate the scale of the task to reduce emissions by 34% by 2020 and 80% by 2050, as the Local Plan will be for the period up to 2036. Although the other gases have more harmful effects than CO_2, CO_2 is the most common of the gases and therefore the analysis is helpful.

Industry and Commercial.

This sector produced 433,700 tonnes of CO_2 in 2012, which represents 38% of South East Lincolnshire's total annual emissions. DECC Statistical Release [34] reports that 2012 figures show national emissions of CO_2 from Industry has fallen by 82% since 1990, Business has fallen by 25% and the Public Sector by 23%. This is an average of 43%.The 34% cut by 2020 has been achieved and to achieve the 80% cut by 2050 a further cut of 37% or 160,469 tonnes is required.

There are about 2132 businesses in Boston Borough[35]. South Holland has about 2715 businesses[36]. Institutions would include Council buildings, schools, colleges and Government buildings such as hospitals and other medical facilities, courts, DSS and tax offices.

Energy consumption data for 2011[37] shows that the Industry and Commercial sector in South East Lincolnshire used 469 GWh of electricity and 327 GWh of gas. Given the general complexity of industrial premises specific data from each premise would be required to devise a programme of energy saving. Energy prices continue to fluctuate and companies will seek to reduce operational costs. Government is encouraging further improvement through the building regulations, which were amended in 2006 to require a 20% improvement in carbon emissions over the previous standards for new buildings. They were amended again in 2010 to reduce CO_2 emissions by a further 25% and in 2013 to reduce CO_2 emissions by a further 9%. The intended target date for newly constructed zero carbon commercial buildings is 2019. In addition, where alterations are carried out to existing buildings and that work is carried out to the thermal elements (walls, floors and roofs) the building fabric should be upgraded where it is technically and economically feasible. Where a building greater than 1000m^2 is extended or altered, measures should be adopted to upgrade the thermal elements, controlled services or controlled fittings within the existing building to a value that is not less than 10% of the cost of the principal works (ie. upgrading heating plant, cooling plant or air handling plant that is more than 15 years old). Industrial emissions may also reduce if the structure of the economy changes. In April 2012 the permitted development allowances for non domestic buildings were extended to enable solar thermal panels, photo voltaic panels, ground and water source heat pumps, flues for biomass heating and

[34] https://www.gov.uk/government/publications/uk-greenhouse-gas-inventory-summary-factsheets **accessed 020215.**
[35] Boston Borough Council Tax Department **received 020215**
[36] South Holland DC (Compass Point) **received 160215**
[37] https://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics-2005-to-2011 & https://www.gov.uk/government/statistical-data-sets/sub-national-gas-consumption-statistics-2010-11 **accessed 020215**

combined heat and power plants to be installed without the need for planning permission.

Domestic.

Insulation standards are improved regularly in the building regulations and it is intended that by 2016 all new houses will be constructed to a zero carbon standard[38]. In 2008 the permitted development allowances for dwellings were extended to enable solar thermal panels, photo voltaic panels, ground and water source heat pumps, flues for biomass heating and combined heat and power plants to be installed without the need for planning permission. Reducing the energy used by lighting and appliances will also help to reduce emissions.

This sector produced 358,400 tonnes of CO_2 in 2012 which represents 32% of South East Lincolnshire's total annual emissions. The DECC Statistical Release[34] reports that CO_2 emissions have fallen by 4% since 1990 and so to achieve the 2020 target 30% or 107,520 tonnes reduction is required. To achieve the 2050 target a 76% or 272,384 tonnes reduction is required. The 2011 census[39] shows that there were 64,600 dwellings in South East Lincolnshire, which means that each dwelling needs to cut 1.66 tonnes per year to achieve the 2020 target and 4.22 tonnes to achieve the 2050 target.

The Housing Energy Fact File (2012)[40] shows that most domestic energy is used for space heating. In 2009 this was approximately 61% with a further 18% used for water heating. The data also shows that solid fuel has reduced significantly, to 2% of energy supplied, although this may increase with the increased popularity of biofuel. About 66% of energy is supplied by gas. Carbon emissions per household have fallen by 40% since 1970.

The Boston Borough and South Holland District Council Private Housing Condition Survey 2010 include the data contained in Table 3 below. It is currently being updated (2015).

Table 3 All energy efficiency measures that could be carried out within the private sector housing stock

Measure	Dwellings		Percent of stock	
	BBC	SHDC	BBC	SHDC
Loft insulation (to 270mm)	11,300	18,100	49.1	53.4
Wall insulation	5,200	7,600	22.6	22.4
Double glazing	2,400	3,900	10.4	11.5
Cylinder insulation	6,800	7,000	29.5	20.6
New boiler	4,900	7,200	21.3	21.2
New central heating	800	1,100	3.5	3.2
Any measures	**17,400**	**24,900**	**75.5**	**73.4**

[38] https://www.gov.uk/government/policies/improving-the-energy-efficiency-of-buildings-and-using-planning-to-protect-the-environment **accessed 020215**
[39] http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-257414 **accessed 020215**
[40] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/201167/uk_housing_fact_file_2012.pdf **accessed 020215**

It is therefore clear that space heating and water heating need to be given significant attention. The Housing Condition Survey also advises:

"By 2015, it is the government's aim to have insulated all the lofts and cavity walls where it is practicable to do so. Although it is considered that this will not be enough to achieve the ambitions for the 2050 target of cutting emissions by 80%. Once these options have been exhausted, more substantial changes are being considered, such as small-scale energy generation and solid wall insulation, with the aim of helping up to seven million homes by 2020".

To illustrate the progress made DECC in September 2013[41] reports that by July 2013 70% of homes with cavity walls were insulated, 68% of homes with a loft were insulated to a minimum of 125mm and 3% of homes with solid walls were insulated.

In Lincolnshire the Home Energy Lincolnshire Partnership has been operating since September 2010 insulating cavities and lofts. The insulation scheme finished in March 2012. 1486 households in Boston Borough have benefitted from 1877 measures (1258 Loft and 619 Cavity insulation). 1109 households in South Holland have benefitted from 1330 measures (921 Loft and 409 Cavity insulation).

The Housing Energy Fact File (2012) also shows that 15% of domestic energy is used by lights and appliances. With the introduction of Feed in Tariffs the amount of energy that could be provided by photovoltaic panels needs to be considered.

Space heating

Space heating demand is reduced by improving the insulation of the dwelling. The Building Regulations with respect to insulation were amended in 2006 to require a 20% improvement in carbon emissions over the previous standards for new buildings and were amended again in 2010 to reduce CO_2 emissions by a further 25%[42]. A further update was issued in 2013 for a further 6% improvement.

Improvements to the existing housing stock that improve thermal performance could include: wall insulation, loft insulation, or a condensing boiler. The table in Appendix 2 shows the CO_2 savings per year for these improvements to a semi detached dwelling. The savings per dwelling per year is between 2.4 and 2.9 tonnes, depending on the wall construction and using an average of these two figures produces a saving of 171,190 tonnes per year for South East Lincolnshire. This shows that the 2020 per dwelling target referred to above of 1.66 tonnes is possible and progress towards the 2050 target of 4.22 tonnes can be made.

41 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/240190/statistical_release_estimates_home_insulation_levels_gb_july_13.pdf **accessed 020215**

42 http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partl/approved#Download **accessed 030315**

Water heating

For the average household one evacuated tube solar panel approx 2.25m^2 area is sufficient to produce domestic hot water for the majority of the year. Genersys[43] advise that a solar panel can save 0.5 tonnes per dwelling per year. Solartwin advise "of the 24 million homes in UK, under 0.1 million use solar water heating. Of the remainder, over 90% have a suitable roof and over two thirds have suitable plumbing. This means that approximately 15 million homes could have solar"[44]. The national housing stock is 23.2 million[45] and so this is about 65% of the national housing stock. The housing stock in South East Lincolnshire is about 67,530[46] and so 65% is 43,895 dwellings. Therefore if all of these had a solar panel about 21,947 tonnes of CO_2 could be saved each year.

Electricity Generation

The above suggests 90% of dwellings in South East Lincolnshire have a suitable roof for solar energy. This is 60,777 dwellings. A 2.2KWp system would cost £4,280 and provide a 10.5% return on investment over 20 years. It might generate 1910KWh per year[16]. This produces a total of 116 GWh/year if all the suitable dwellings in South East Lincolnshire installed a photovoltaic system, with a combined installed capacity of 133.7 MW. DECC[47] shows that average domestic consumption in the South East Lincolnshire in 2013 is 4,511KWh/year. Therefore, the 116 GWh/year would supply about 25,715 dwellings, about 38% of South East Lincolnshire's dwellings.

Road transport.

The DECC Statistical Release[48] shows transport accounts nationally for 21% of total emissions in 2013. It also shows that emissions have decreased by 3% between 1990 and 2013. For South East Lincolnshire, using the 2012 figures in Table 1, transport accounts for 29% of total emissions. Therefore, to achieve the 34% cut in CO_2 emissions by 2020 will require a further 31% cut of 99,975 tonnes. The 2050 target is a cut of 248,325.

The 2011 Census provides the most recent data on car ownership. It shows that there are 86,638 cars or vans in South East Lincolnshire[49]. 48,669 people or 44% of the population drive a car or van to work and 6,336 or 6% are a passenger in a car or van. 490 or 0.4% travel by motorcycle. Public Transport moves 1,290 or 1%, 3,777 or 3% use a bicycle and 6,723 or 6% walk. 3,840 or 3% work from home[50].

To tackle transport emissions we need to look at two aspects, reduction of vehicle movements and / or conversion to biofuels. Biofuels are considered carbon neutral because emissions will be absorbed by the growing crop. However, Friends of the

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[43] http://www.genersys-solar.com/carbon-savings/carbon_footprint_solar-panel_home-carbon-savings.asp **accessed 040215**

[44] http://www.solartwin.com/PDF/Best_practice.pdf **accessed 040215**

[45] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/285001/Dwelling_Stock_Estimates_2013_England.pdf **accessed 040215**

[46] https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants **accessed 040215**

[47] http://www.research-lincs.org.uk/LROPresentationTools/UI/Pages/MappingTool.aspx?dataInstanceID=5197 **accessed 090215**

[48] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/400394/final_emissions_statistics_final.pdf **accessed 040215**

[49] http://neighbourhood.statistics.gov.uk/dissemination/LeadTableView.do?a=3&b=6275026&c=boston&d=13&e=62&g=6445706&i=1001x1003x1032x1004&o=1&m=0&r=1&s=1360679213766&enc=1&dsFamilyId=2483 & http://neighbourhood.statistics.gov.uk/dissemination/LeadTableView.do?a=3&b=6275241&c=south+holland&d=13&e=62&g=6446960&i=1001x1003x1032x1004&o=1&m=0&r=1&s=1360679312969&enc=1&dsFamilyId=2483 **accessed 120213**

[50] http://neighbourhood.statistics.gov.uk/dissemination/LeadTableView.do?a=3&b=6275026&c=boston&d=13&e=61&g=6445706&i=1001x1003x1032x1004&o=1&m=0&r=1&s=1360679465484&enc=1&dsFamilyId=2567 & http://neighbourhood.statistics.gov.uk/dissemination/LeadTableView.do?a=3&b=6275241&c=south+holland&d=13&e=61&g=6446960&i=1001x1003x1032x1004&o=1&m=0&r=1&s=1360679412703&enc=1&dsFamilyId=2567 **accessed 120213**

Earth have reported that biofuels may increase CO_2 emissions owing to land use change[51]. The Society of Motor Manufacturers and Traders (SMMT) says average CO2 emissions for new cars fell to 128.3 grams of CO2 per kilometre (g/km) in 2014[52]. Assuming an average mileage of 19,000 Km (12,000 miles) the average car emits about 2.4 tonnes of CO_2 per year. To achieve a reduction of 99,975 tonnes is the equivalent of about 41,656 average cars per year not been used. This is about 48% of the number of cars or vans in South East Lincolnshire reported by the 2011 census.

Over the last 5 years a new into town bus service has been introduced in Boston, which serves the residential outskirts of the town. The most recent data shows that from July 2010 to January 2011 patronage was on average 23,563 people per month[53]. Some of these will be choosing not to use their car for the trip. Spalding has a similar service but no data is available. Also during the course of 2009 the Government encouraged car owners to replace cars that are over 10 years old with a new more fuel efficient model. Together these will help to reduce the CO_2 emissions in South East Lincolnshire. It is unknown by how much but it is unlikely to be by 34%. The Coalition Government has made significant spending cuts and this will impact on subsidised bus services. There will be a consequent impact on CO_2 emissions.

Land Use, Land Use Change and Forestry.

This sector emits 18,800 tonnes per year, which is about 1.7% of South East Lincolnshire's total emissions. The DECC Statistical Release[34] shows emissions from land use, land use change and forestry have changed from emitting 1.88 $MtCO_2$ in 1990 to removing 6.98 $MtCO_2$ in 2012. Therefore nationally removals exceed emissions. There is some afforestation through the Boston woods project and the benefits of this are discussed below.

Carbon Sequestration and Green Infrastructure.

The Forestry Commission have reported that owing to the maturing of our forests and a slow down in afforestation the carbon sink that forests provide is reducing. They advise that if an extra 4% of the UK's land area was planted with new woodland over the next 40 years, it could be locking up 10% of the nations predicted greenhouse gas emissions by the 2050's.[54] Four percent of South East Lincolnshire's land area is 4676 hectares [55].

The natural and semi natural green space that is referred to in the Ploszajski Lynch Sports Provision and Open Space Assessment is predominantly grassland. It is estimated that 63 Ha or 10% of the area is woodland. About 6 Ha may be grassland and about 560Ha may have woodland on it but it is predominantly grass. We will assume that the breakdown of this 566Ha is also 10% woodland and 90% grassland. Therefore, the amount of woodland in South East Lincolnshire is about 120 Ha and the amount of grassland is about 514 Ha.

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[51] http://www.foe.co.uk/page/disadvantages-biofuels **accessed 040215**
[52] http://www.smmt.co.uk/co2report/ **accessed 040215**
[53] Data from Mr P Drury 080411
[54] http://www.tsoshop.co.uk/gempdf/Climate_Change_Synthesis_Report.pdf page 1 **accessed 040215**
[55] http://neighbourhood.statistics.gov.uk/dissemination/LeadTableView.do?a=3&b=277037&c=boston&d=13&e=8&g=467012&i=1001x1003x1004&o=230&m=0&r=1&s=1298984457278&enc=1&dsFamilyId=1201 &
http://neighbourhood.statistics.gov.uk/dissemination/LeadTableView.do?a=3&b=277041&c=south+holland&d=13&e=8&g=468406&i=1001x1003x1004&o=230&m=0&r=1&s=1298984633618&enc=1&dsFamilyId=1201 **accessed 040215**

The Forestry Commission[56] advises that a realistic average carbon accumulation over a commercial forest rotation is about 3 tonnes of carbon per hectare per year. This is about 11 tonnes of CO_2[57]. As a result the amount of woodland in South East Lincolnshire would sequestrate about 1,320 tonnes of CO_2 per year. Research from 1990 quoted in academic research[58] suggests that the conversion of agricultural land to grassland sequestrates 0.33 tonnes of Carbon/acre/year . This is about 0.79 tonnes/hectare/year or 2.9 tonnes of CO_2 and therefore about 1,491tonnes would be sequestrated. This produces a total of 2,811 tonnes of CO_2 per year.

The Boston Woods project seeks to plant a mix of woodland and grassland around the west and south of the town and this will sequestrate carbon. The Boston Woods project covers about 724 hectares. At present 41Hectares have been bought which is about 50% grassland and woodland. The development of the Boston Woods area of search would sequestrate a further 5,032 tonnes of CO_2 per year

The creation of Green Infrastructure provides other benefits in terms of securing a network of multi use spaces and corridors for recreation and wildlife, which can also include shade, for urban cooling, and sustainable drainage schemes for flood alleviation.

Results.

The following table summarises the above discussion.

Table 4 Assessment of sectoral impacts and potential.

Sector		Current Emissions (Tonnes)	Required 2020 Saving (Tonnes)	Required 2050 Savings (Tonnes)	Potential Savings (Tonnes)
Domestic		358,400	107,520	272,384	
	Space heating existing stock				171,190
	Water heating				21,947
					193,137
Industry and Commercial		433,700	0,000	160,469	
Road Transport		322,500	99,975	248,325	
Land use, land use change and forestry		18,800	0,000	0,000	
Carbon Sequestration existing and Boston Woods					7,843
Existing renewables					94,720
Renewables with planning permission					18,791
Totals		1,133,400	207,495	681,178	314,491

Energy Use[59]		Demand GWh	Supply GWh
	All Sources (2012)	3,509	
	15%	526	

[56] http://www.forestry.gov.uk/pdf/fcin048.pdf/$file/fcin048.pdf **accessed 040215**
[57] http://cdiac.ornl.gov/trends/emis_mon/emis_mon_co2.html **accessed 040215**
[58] http://library.state.or.us/repository/2008/200806051526094/index.pdf **accessed 040215**
[59] http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/regional/total_final/total_final.aspx **accessed 120213**

	Electricity (2012)	832	
	30%	250	
	Existing Renewables 117 MW		222
	Proposed Renewables 72.5 MW (with PP)		142
	Potential PV on suitable domestic roofs 134 MW		116
	Proposed Renewables 82 MW (no PP)		483
	Total		963

The results show that the required domestic saving is 107,520 tonnes by 2020 and 272,384 by 2050. The analysis has identified 193,137 tonnes, which is about 180% of the 2020 domestic requirement and 71% of the 2050 domestic requirement. With the introduction of the Help scheme that is being implemented in the whole of Lincolnshire coupled with the progress made by the CERT scheme this target is achievable and many homes will benefit from improved insulation. The Feed in Tariff has also encouraged small scale renewable energy generation. The RHI scheme commenced in 2014 for domestic schemes and so the amount of heat pumps and solar hot water panels may increase.

Identifying savings in Industry and Commercial buildings requires detailed analysis of each premises and the data for this is not available. The data from DECC Statistical Release[34] indicates that significant savings have occurred since 1990, mostly due to changes in emissions from the chemical production and metal processing industries.

Road transport is the hardest because it is the equivalent of a 48% reduction in the use of private transport to achieve the 2020 target of a 34% cut. Although there has been action on public transport and improvements to walking and cycling provision are being investigated the scale of the reduction in CO_2 emissions is unlikely to occur. It must also be realised that a 34% reduction in all Green House Gases is just the start, because the Climate Change Act requires an 80% cut by 2050.

Land use, land use change and forestry provides a small amount of the Borough's total CO_2 emissions and some of the actions that cause the emissions are not controlled by planning regulations. However, national data indicates that sequestration is greater than emissions. Habitats such as Boston Woods could sequestrate 7,843 tonnes.

Overall the savings that can be made from the domestic sector, existing renewables and those with planning permission as well as carbon sequestration would meet the 2020 target for all sectors.

From Table 2 the target of providing 15% of all energy used from renewable sources will not be achieved from existing and proposed renewable projects with planning permission or the estimate of domestic PV. It would require the development of the Peterborough Renewable Energy Ltd energy from waste plant, which provides most of the 484 GWh's possible from the schemes without planning permission, or both of the wind farms. The UK Renewable Energy Strategy target of 30% of electricity

demand coming from renewable energy is almost achieved from existing capacity. It will be achieved if any two of the three larger proposed PV projects with planning permission are constructed.

An alternative way of looking at this issue is to look at the work undertaken by Land Use Consultants for the East Midlands Region, which investigates the low carbon energy opportunities. It is theoretical and does not represent deployable potential. For South East Lincolnshire it shows for electricity generation that most potential is from wind, but biomass and building integrated solar PV also contribute. For heat it shows that most potential comes from heat pumps, but biomass also contributes. Although the study appreciates that the figures are a considerable overestimate for 2020 they are as follows.

Table 5 South East Lincolnshire's Electricity and heat potential

	Boston BC GWh	South Holland DC GWh	Total GWh
Electricity	1,003.99	2,192.08	3,196.07
Heat	308.10	515.95	824.05
Total	1,312.09	2,708.03	4,020.12

It is interesting to note that in order to achieve the 15% of all energy use from renewable energy sources would only require 13% of this theoretical potential to be developed. In order to meet the 30% of electricity from renewable sources it would only require 6% of the theoretical potential to be developed.

Appendix 1.

NPPF (March 2012)

- Secure greenhouse gas reductions through appropriate location and layout of development, support energy efficiency improvements to existing buildings and deliver renewable and low carbon infrastructure.
- Adopt proactive strategies to mitigate and adapt to climate change.
- To support the move to a low carbon economy LPAs should plan for new development in places and ways that reduce greenhouse gas emissions.
- When setting local sustainability targets be consistent with national zero carbon policy.
- LPAs should recognise the responsibility of communities to contribute to energy generation from renewable and low carbon sources. They should:
    - Have a positive strategy to promote energy from renewable and low carbon sources
    - Design policies to maximise renewable and low carbon development but address adverse impacts satisfactorily
    - Considerer identifying suitable areas for renewable and low carbon sources where this would help secure their development
    - Support community led schemes
    - Identify decentralised energy opportunities, co locate potential energy heat customers and suppliers.

For identifying suitable areas for renewable and low carbon energy sources LPAs should follow the approach in National Planning Statement on Renewable Energy and the over arching National Planning Statement on Energy.

The Renewable Energy Statement says that on shore wind will continue to play an important role in meeting renewable energy targets. The site selection criteria for developers are: wind speed, proximity to dwellings, how many turbines the site can take, grid connection and access. Other issues to be considered as part of the application are: biodiversity and geological conservation, historic environment, landscape and visual impact, noise and vibration, shadow flicker, transport and traffic.

PPG (March 2014) provides further advice on:

- Developing a strategy for renewable and low carbon energy
- Planning considerations for hydro, solar (including solar farms) and wind turbines.

Appendix 2

Measure	Saving (£/yr)	CO2 saving (kgCO2/yr)
Cavity wall insulation[60]	145	600
Solid wall insulation[60]	270	1100
Roof insulation (0 – 270)[60]	150	620
Replacement condensing boiler[61]	305	1200
Total		3520

Note: All figures are based on a gas heated, 3-bedroom house.

[60] http://www.nia-uk.org/householder/index.php **accessed 040215**
[61] http://www.energysavingtrust.org.uk/content/our-calculations **accessed 040215**