The current political and technological drivers environmental sciences essay

Introduction

Carbon dioxide is found in the earth’s atmosphere. It is organic in nature and can be produced through decomposition of organic compounds, respiration and combustion of compounds containing carbon. The atmospheric levels of emission of carbon dioxide have increased steadily over the years since the onset of the industrial revolution. Significant climatic changes are anticipated, especially due to the increased emissions of carbon dioxide gas. Practical action is warranted due to the sufficiently long time scales of responses of resultant changes in climate (Ashby & Johnson 2002, p. 78). The carbon dioxide emissions in UK take various forms. These include emissions relating to the production of goods and services produced by the various businesses, emissions from household generation through private motoring and heating, and the emission related to imported goods and services. The carbon dioxide emission reached the peak in 2004, after which it has fallen considerably. Emissions from agriculture and food services have decreased. Some key products groups that have shown an increase in carbon dioxide emissions include the warehousing and imputed rent services, fabricated metal products and the publishing services. The increased emissions from goods and services is related to the increased rate of spending offset by carbon efficiency during production and the shift to low carbon intensive products (Dixon & Bahleda 2008, p. 56). Over the years, the household emissions associated with imports, either for individual consumptions or businesses contribute considerably to the increased carbon dioxide emission in UK. However, the direct total emission from the household consumption is relatively constant, with emissions from heating

fluctuating depending on the severity of winter. Being mobile in motors increases the level of carbon dioxide emissions due to increased travel by cars, which has been offset by the introduction of highly fuel efficient vehicles (Edmunds & Wise 2011, p. 90).

Carbon Emission in UK

The emission of carbon dioxide in UK has shown remarkable decrease due to the displacement of coal, which is the main source of carbon emission, with other fuels like electricity and nuclear power. However, there has been annual variation in the level of carbon dioxide emission since 1990s, with no defined upward or downward trend. In 2006, the emission from energy supply was the highest followed by emissions from road transport. Emission from business and household emissions formed the lowest percentage. The emissions from the energy sector are reallocated to the consuming sector while the residential and business sectors increase their contribution due to the use of electricity (Edmunds & Wise 2011, p. 90).

Carbon Dioxide Emission by Source Sector

Carbon dioxide accounts for approximately 84% of the greenhouse gas emissions in the UK in 2010 and 2011, the emissions from the energy sector were estimated at 40%, transport, 26% and 15% from each; residential and business sectors. Based on the data between 2010 and 2011, carbon dioxide gas in the residential sector has decreased significantly. Since 1990, the emission of carbon dioxide in UK has decreased to about 23%. The fall in emission is accompanied by the decrease in the overall consumption of energy. The energy consumption decreased by 5% between 1990 and 2011. The decrease is caused by several factors, like changes in the electricity

generation efficiency as well as a replacement of carbon high intensive fuels such as coal by gas (Edmunds & Wise 2011, p. 90).

Trends in Carbon Dioxide Gas Emission in UK

In 2010, the carbon dioxide emitted was 495. 8 Mt. This was an increase from 477. 8 Mt in 2009. Based on the source, 91% of the total emitted carbon dioxide are from transport, business and residential sectors; 28% from transport, 30% from business, and 33% from the residential sectors. Significant increases in carbon dioxide emissions have been recorded from business and residential sectors since 2009. The emissions from other sectors are relatively constant, especially between 2009 and 2010 (EIA 2011, p. 10). The falling traffic during recession led to fall in the transport emissions in UK between 2007 and 2009. Further decrease in traffic could have led to decreased levels of carbon dioxide. The fall in the carbon dioxide emission has fallen due to increased fuel economies. New cars have entered the market, and less efficient cars have been replaced. This has led to the increased efficiency in fuels. Between 1998 and 1999, UK signed a voluntary agreement with automobile manufacturers from Japan to reduce the emission of carbon dioxide on fleet averaged new cars. The graduated vehicle exercise duty was introduced in UK in 2005. This taxed highly the high carbon producing cars in order to encourage the purchase of vehicles that had high fuel efficiencies (EIA 2011, p. 11). Mandatory targets for manufacturers were introduced in 2009 for every new car bought. The regulation in UK established a limit curve that specified the gCO2/km, and the curve was set up to enhance a fleet of 130gCO2/km. This target was phased in between 2012 and 2015. This regulation set out the financial

penalties for any nonconformity (EIA 2012, p. 4). The target for 2020 is 95gCO2/km through the details on accomplishing this have not been achieved. The increased efficiency of new cars has been achieved through light weighting, aerodynamic improvements, and the improvement in lubrication engines (EIA 2011, p. 13). The main forecast in carbon dioxide is that the emission will slowly fall and stabilise slightly below the present levels. Reduction in emission reflects strict targets on the efficiency of fuels and biofuels. Levelling off in carbon dioxide emissions reflects a no target for the vehicle efficiency (EIA 2012, p. 5).

Sources of Carbon Dioxide Emissions

Carbon dioxide can be produced by various sources like the energy sector, transport, residential, business, industrial, and public, agriculture, land use, forestry and waste management. The Energy sector was the second contributor to the decrease in emission of carbon dioxide between 2010 and 2011. In 2011, the emission from energy supply was estimated as 183. 8 Mt. This represented a 6% decrease when compared to 2010. The decreased carbon dioxide emissions are credited entirely to power stations. The electricity demand in 2011 was 3% lower than it was in 2010. However, the fuel mix in electricity generation power stations remained constant. Use of gases in generating electricity decreased by 17% while use of nuclear energy increased by 11%. This resulted to an overall carbon dioxide emission decrease of 7%. In 2011, the carbon dioxide emissions accounted to a third of all the carbon dioxide emissions (EIA 2011, p. 14). The emission of carbon dioxide from aviation has attracted substantial attention in UK. Though the contribution to the climatic change is minimal, it is increasing at a faster rate

than other emission sources. Travelling by air has increased due to increased income levels and decreased travel costs. Quantifying the emissions from aviation is based on the travel patterns. The carbon dioxide emissions are estimated at 6. 5 kg for every passenger during take-off and 0. 02 kg per passenger during landing. The emissions have fallen by 6. 7% due to increased efficiency of fuels. The holidays are estimated to be over 5000km away, and the fraction of emitted carbon dioxide increases with the increase in distance (EIA 2012, p. 6). Taking data from the tourism industry, the island nations are estimated to be a distance of 0 to 500km apart. The total carbon emission from long distance holidays and island holiday air travel is approximately 129 metric tonnes. The aviation industry contributes 3% of the total global emissions. The transport sector in UK contributes significantly to the carbon dioxide emissions. The government cut the road building programme during the review of the Truck Roads, and this prompted expansion of the road capacity. With the increased expansion of the roads, the carbon dioxide emissions would increase (Zavadil, Miller, Ellis & Muljadi 2011, p. 47-58). In 2011, the transport sector accounted for 119Mt of carbon dioxide emissions. This represents a quarter of all the carbon dioxide emissions in UK. Emission decreased by 1. 4% between 2010 and 2011. The consumption of petrol was low, and it outweighed the low increase in consumption of diesel. However, unlike other sectors, the carbon dioxide emissions from the transport sector are roughly constant since 1990. The increase has been general throughout the period (Fargione, Hill & Tilman 2012, p. 1235-1238). Carbon dioxide is also emitted by the diesel trains. The consumption of the rail gas oil is converted directly to carbon dioxide emissions. Previously, the consumption of the rail gas oil is based on

assumed engine mix and the fuel consumption factors. These emissions originate from gas oil processing by the diesel trains as well as electricity generation emissions from the electric trains. While including the carbon dioxide emission from the use of electric trains, the emission for the passenger rail decreases significantly due to increased renewable energy. Carbon dioxide emission figures from marine fuel consumption are based on both the fuel and gas oils. The carbon emission depends upon best estimates by the refiner on how the fuel is sold (Fargione, Hill & Tilman 2012, p. 1235-1238). The residential sector accounts for 67 Mt and this can be regarded as 15% of all the carbon dioxide emission. There was a 22% decrease in carbon dioxide emissions between 2010 and 2011. This was the highest decrease from a single sector. This was due to the decrease in use of fossil fuels, particularly gas. The emissions from residential sources depend mostly on the external temperature. The warmer season record decrease in the amount of carbon dioxide emission due to decreased use of the fuels in heating while, for the cold season, the level of emission is usually high (GWEC 2012, p. 1). The emissions of carbon dioxide from the business sector accounts to about 70 Mt and this forms 15% of all the carbon dioxide emission. It decreased by 8% from 2010. However, the emissions from businesses are provisionally estimated to a 37% decrease since 1990. The carbon dioxide emissions from industrial processes accounts for 9 Mt and this represents a decrease of 4% as compared to 2010. However, the industrial emissions of carbon dioxide from 1990 to 2011 have decreased by 47%. The emissions of carbon dioxide from the public sector accounts for 8 Mt and this represents a decrease of about 8% from 2010 to 2011. Nevertheless, the overall reduction from 1990 to 2011 is 39% (EIA 2011, p.

15). The carbon dioxide emissions from the agricultural sector are about 4 Mt, and this represents a decrease of 21% from 1990 to 2011. The waste management emission was estimated at 0. 3 Mt in 2011. This is a decrease from 1. 2 Mt. in 1990. However, the land use, change in land use, and the forestry emissions increased from 3 Mt in 1990 to 5 Mt in 2011 (EPRI 2011, p34). The amount of carbon dioxide emitted from unit consumption of energy is highly dependent on the fuel type. For instance, the percentage emission of carbon dioxide from burning one unit of coal is high than when one unit of gas is combusted. In 2011, the emissions for every unit of electricity supplied by the main fossil fuels were estimated at 582 tonnes carbon dioxide per GWh (EPRI 2011, p. 36). Overall, for the electricity generated from fossil fuels, 887 tonnes carbon dioxide constituted coal emissions. This was two times higher than electricity generation from gas. All the sources of electricity emitted 528 tonne of carbon dioxide per GWh of electricity supplied in 2011. The emissions of carbon dioxide from fossil fuels were estimated at 447 Mt in 2011, and this was 8% lower than in 2010. The greatest decrease in emission was from 226 Mt in 2010 to 191 Mt in 2011. The decrease was reflected due to decreased consumption of gas in electricity generation in power stations and domestic combustion (Union 2012, p. 23). Between 1990 and 2011, the emissions of carbon dioxide from combustion of fossil fuels decreased by 21%. The overall consumption of the fossil fuels remained relatively constant during this period. The decrease in carbon dioxide emissions is due to the increased use of gas and decreased use of coal. The proportion of gas as a component of consumption of fossil fuel increased from 26% in 1990 to 42% in 2011, and the use of coal has decreased from 34% in 1990 to 16% in 2011. The consumption of oil

remained relatively constant between 1990 and 2011; 40% in 1990 to 45% in 2011. The carbon dioxide emissions from all sectors decreased over the years except the emissions from the transport sector that remain relatively constant (GWEC 2012, p. 5).

Carbon Footprint

Carbon footprint has been widely used in UK in public debate on reduction action and responsibility against the threats of the global climate. Carbon footprint is associated with gaseous emissions that cause climatic changes. It is a technique that identifies and measures emissions from emissions of individual greenhouse gases in the supply chain and is expressed in terms of energy equivalents. It is a direct or indirect measure of exclusive total carbon dioxide emissions accumulated over the life cycle of a product or caused by an activity (MIT 2008, p. 41)The carbon footprint study in schools from UK indicates a value of 9. 2 Mt of carbon dioxide in 2001. This is equivalent to 1. 3% of the total amount of carbon dioxide emissions in UK. 26% of the emission is attributed to the heating processes, while three quarters if from indirect emission sources, like electricity. The carbon footprint for households in UK accounts for both direct and indirect emissions embodied in the UK’s imports. In 2001, UK household had an average carbon footprint value of 20. 7 Mt. Direct emissions occur during heating and motor use while the indirect emissions result from generation of electricity and production of goods and services. These make up 70% of the total carbon dioxide produced. The carbon footprint should include both direct and indirect carbon dioxide emissions, and other greenhouse gases should not be included (Jaramillo & Griffin 2007, p. 6290 -6296).

Reducing Carbon Dioxide Emission

The White Paper by the Government Energy is aimed at reducing the carbon dioxide emissions by 10%. This will incorporate the use of renewable resources. Relationship between the renewable sources and production of carbon dioxide has not been fully exploited in UK. The wind turbine technology has contributed to the decreased carbon dioxide emission (Kats, Leon & Adam 2003, p. 90). The UK government is working towards a generation of electricity using renewable sources. Renewable sources have extremely low emission of carbon dioxide. According to the report by DTI, the UK government is targeting to produce electricity from non-carbon sources. In recent Climatic Change Programmes, the government has restated its commitment in reducing the impact on environmental travel and has set out policies to reduce the emission of carbon dioxide by the fossil fuels, increase the efficiency of fuels as well as encouraging the forms of transport that are more environmental friendly transport. Other measures by the government include the voluntary agreement package and the wide policies on the transport sector so as to reduce the level of carbon dioxide emissions (Kats, Leon & Adam 2003, p. 90).

Carbon and Capture Technologies

These technologies have the ability of considerably reducing emissions from combustion of fuels through their full scale use is yet to be proven. Coal fired generators have been designed using carbon capture technologies that have seen reduced carbon footprint (Khurana & Banerjee 2002, p. 485-494).

Low-carbon technologies

The low carbon technologies include solar, geothermal, nuclear, and marine and wind energy. Solar energy gives relatively low amounts of carbon footprint. Carbon footprints for PV cells have decreased due to improvements in production technologies. Other novel alternatives to the mono-crystalline silicon technology have reduced the carbon footprints. Geothermal plants rely on heat from underground in driving turbines. The footprints for geothermal generators are low. However, value of the footprint depends on the geological conditions at the location of the plant (Kutscher 2007, p. 67). Nuclear energy has relatively low level of carbon footprint. Most of the estimates are below 26gCO2eq/kWh. The variation is highly dependent on the grade of uranium ore and enrichment process. Marine energy uses technologies of the wave power. The marine energy has relatively low carbon footprint; baseline estimate of 23gCO2eq/kWh. However, researchers have included recycling for devices to reduce the carbon footprint of every device. Recycling saves on carbon since it uses less energy in producing recycled materials than the raw materials. Tidal barrages in marine electricity have their carbon footprints ranging from -20 to 50gCO2eq/kWh. Negative footprints result due to high levels of assumed confiscation from deposition of the silt in upstream of a barrage (Mason 2003, p. 65). The carbon emitted depends on local energy resource. Mostly, location plays a key role in influencing the value of the carbon footprint. Figures from UK study indicate a value of 38gCO2eq/kWh footprint for locations with wide speed of 4. 5 m/s. Locations with higher wind speeds, 6 m/s, give relatively lower footprints; an average of 20gCO2eq/kWh (Metz 2007, p. 12-20).

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