1) Introduction

The DFID study *Economic Impacts of Climate Change in Burundi, Kenya and Rwanda* has a number of key aims, as set out in the Terms of Reference:

- To assess the potential impacts of climate change on key sectors on the economy and non-market sectors (such as health) so countries can understand what is at stake for them.
- To stimulate government, private sector and civil society actions to develop and implement policies to adapt to and mitigate (depending on international incentives) climate change.
- To provide an evidence base to inform and guide government's negotiation position for COP 15.

This report focuses on the second objective, assessing opportunities for low carbon growth that reinforce progress towards the ambitious development goals of Kenya. In addition, it assesses opportunities that are compatible with and where possible enhance adaptation goals and strategies, and benefit other policy areas (e.g. environment and health, energy security). In this way, Kenya can move towards being a low carbon society, ensuring strong economic growth, reducing reliance on fossil imports and benefiting from future international incentives on climate change. The UK Government in their recent *Road to Copenhagen* report stated that *by taking action now, developing countries have an opportunity to adopt a different growth path, leapfrogging outdated technologies to become some of the first movers towards a sustainable economy* (DECC 2009).

It is important that the rapid economic development that Kenya is aiming for is not compromised by low carbon growth, particularly because Kenya is a low emitter in absolute and per capita terms relative to other developed and developing countries. Even in future years, the level of emissions under a rapid growth scenario will still remain relatively low in absolute terms. Low carbon options must therefore not result in unsustainable cost increases, or in economic terms, any additional costs should not outweigh the additional benefits. This analysis attempts to focus on examples where low carbon options could be integrated into strategic economic planning, and to highlight the associated benefits (economic, social and environmental). It is therefore not a full low carbon strategy assessment but rather a first review of the opportunities that could lead to a lower carbon growth path.

An overview of the steps in this analysis is provided in Figure 1 below.

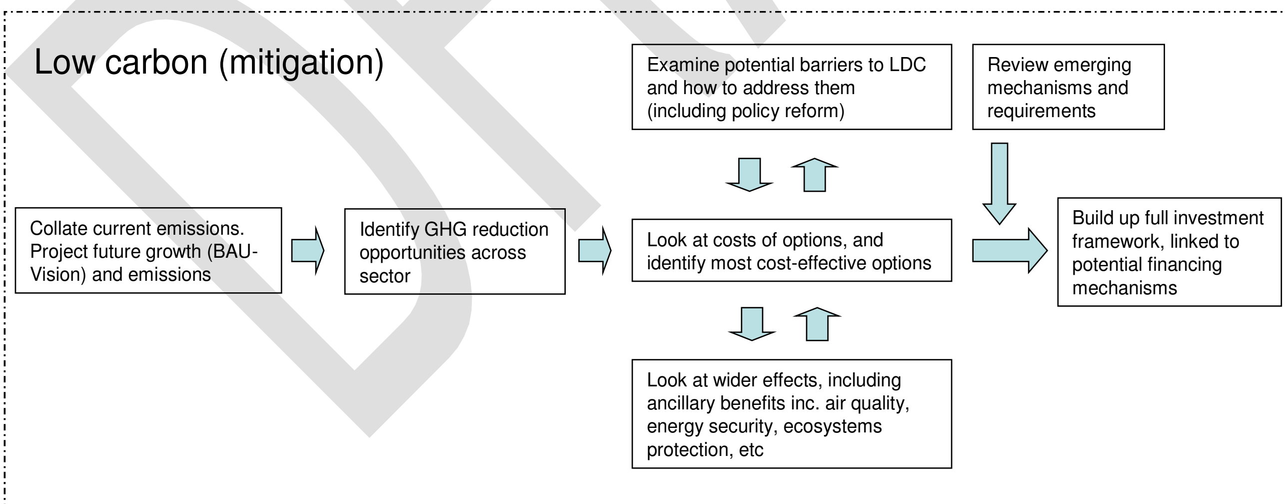


Figure 1. Schematic overview of low carbon growth analysis

Section 2 of the report describes the current GHG emissions level, provides an overview of the key emission sources and describes how they have changed since the first assessment under the First National Communication.

Section 3 of the report describes the emissions projections (for each sector) that are being developed to produce a reference scenario, for Kenya based on the assumptions around economic growth, population growth and urbanisation.

Section 4 outlines the potential options for emission reductions in future years, including case studies of options being implemented in Kenya. This section draws on the wider literature to examine the main options, and their cost-effectiveness plus a range of wider effects. It also seeks to identify the main barriers to implementation.

Section 5 presents possible low carbon growth pathways for Kenya, indicating the cost-effectiveness of different options.

Section 6 presents policy recommendations emerging from the analysis, to help inform the Kenyan position on low carbon growth prior to Copenhagen 09, with a view to developing a full investment framework.

2) Current GHG emissions in Kenya

In global terms, Kenya is a low emitting country, both on an absolute and per capita basis. In 2000, according to comparisons provided by WRI CAIT (Climate Analysis Indicators Tool), Kenya ranked 76th in the world in respect of total emissions (exclude LUCF sinks / sources), and 157th in the world on a per capita basis (1.5 tCO_2 per capita).[6]

The only national published estimates of GHGs in Kenya that the team has been able to find during the study are those submitted in Kenya's First National Communication (GoK 2002), and are for the year 1994. More recent work has been undertaken on the Second National Communication; however these estimates have not been available during the study period, scheduled for publication early next year.

GHG emissions reported under the First National Communication

Kenya's First National Communication (GoK 2002) provides estimates of GHG emissions for 1994 based on revised inventory guidelines published by IPCC in 1996. Total GHG emissions in 1994 were estimated to be 21,466 Gg CO_2 eq, excluding LUCF. Emission estimates by GHG are shown in Figure 2 and Figure 3 by sector, excluding and including the LUCF sector.

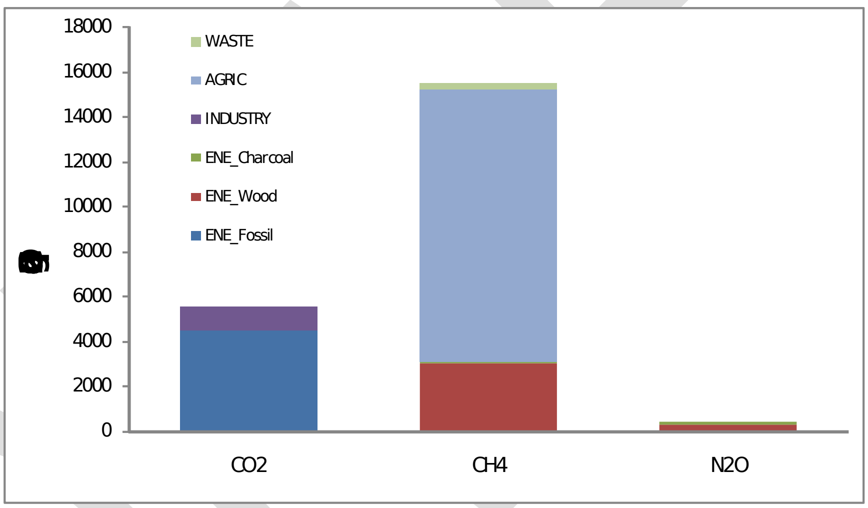


Figure 2. CO_2 eq. emissions (Gg) in 1994 by GHG (excluding LUCF)

[6] World Resources Institute Climate Analysis Indicators Tool (v6.0) http://cait.wri.org/ The 2005 CAIT value is much lower at 0.3 tCO2 / capita because the dataset only includes CO_2 emissions. In this project, emissions of 1.3 tCO2e / capita in 2005 have been estimated.

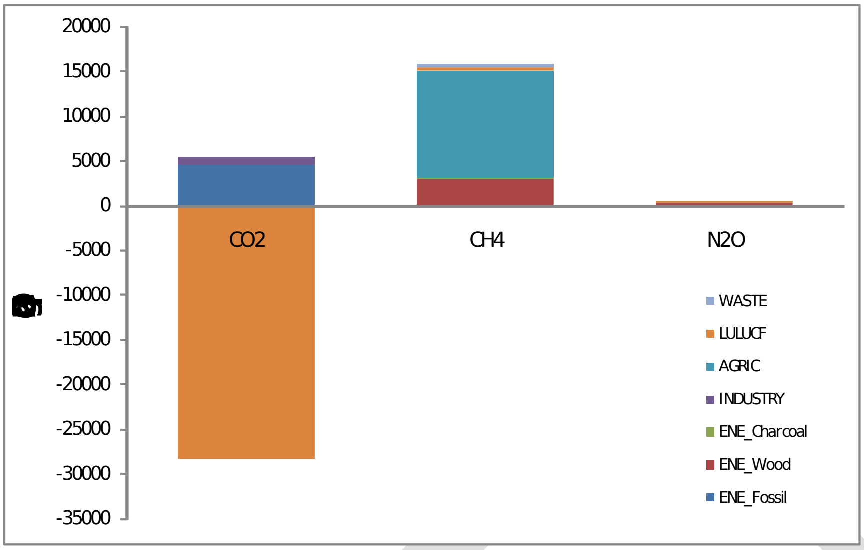


Figure 3. CO_2 eq. emissions (Gg) in 1994 by GHG (including LUCF)

This assessment estimates that emission removals from the LUCF sector total 28,000 ktonnes CO_2 eq. Approximately 34,000 Gg are sequestered and 6,000 emitted (due to forest removal and land use practices). This annual sequestration of CO_2 by forests shows Kenya to be a net sink of GHGs, with a total of -6,534 Gg CO_2 eq. According to the 1st National Communication, most of the removals were estimated to be from non-forest trees (e.g. farm grown trees) and plantations rather than natural forests (GoK 2002).

It is important to stress that LUCF estimates from the 1994 inventory are subject to significant uncertainties due to lack of data on the forestry stock, and the use of a simple tier estimation approach. New estimates should soon emerge as part of the 2nd NC publication, which should provide more robust estimates based on a more up-to-date IPCC guidance and improved stock information.[7] In addition, since 1994, rates of deforestation will undoubtedly have reduced

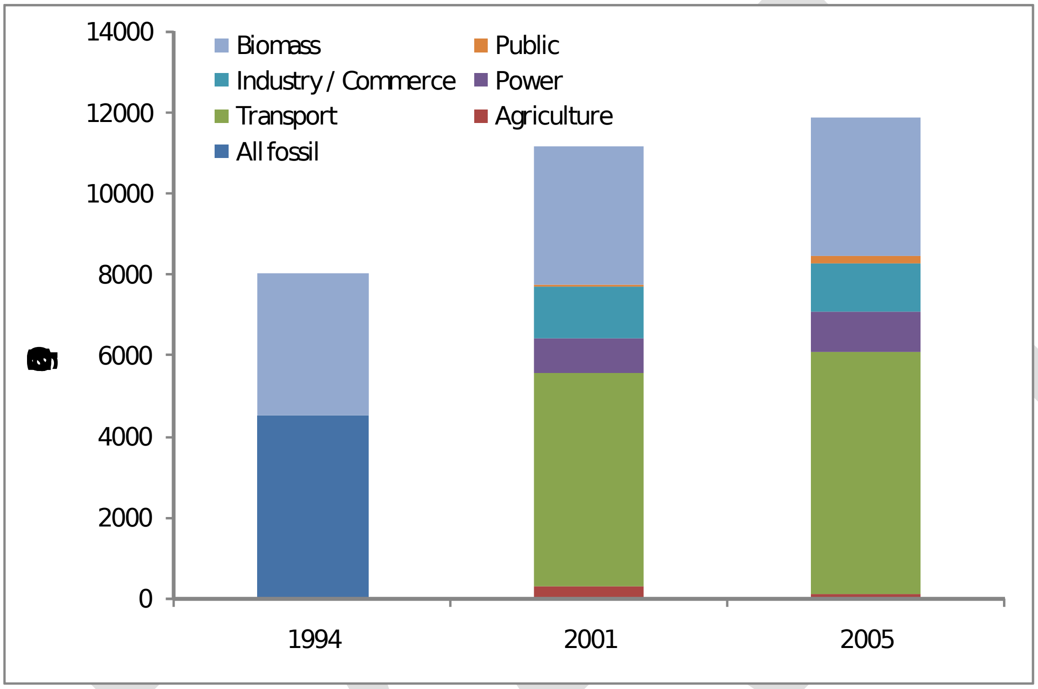
In terms of total national emissions of greenhouse gases, agriculture is estimated to be the largest source, due to methane emissions from enteric fermentation in livestock (accounting for 95% of total emissions). Sugar cane and rice production account for most of the remaining methane emissions. N_2O emissions from this sector are low due to the limited application of fertilisers in Kenyan agriculture. Energy is the second largest source, with the majority of emissions from the transport sector (emitting 65% of total CO_2 through consumption of oil based products) but also some emissions arising from household / cottage industry biomass burning (CH_4 emissions). CO_2 emissions arising from the burning of biomass are not included in the official inventory, as these are viewed as a renewable source, and carbon-neutral. The third largest source of emissions (although much smaller than agriculture and energy) is the industry sector, primarily due to CO_2 process-based emissions from cement and lime production.

A major missing sector appears to be N_2O emissions from agricultural soils, which are not reported. This is particularly apparent given that Kenya has such a large agriculture sector. The MNP EDGAR dataset (Olivier et al 2005), one of the sources used by the CAIT database, puts Kenya's emissions of N_2O at 19,600 Gg CO_2 eq. This equates to 40% of the CAIT estimate of 48,100 Gg CO_2 eq.

[7] Recent estimates of forest stocks still appear to be highly uncertainty (Kenya Forest Service (2009))

Revised GHG estimates for the energy sector

The Second National Communication is under development although these numbers have not been available for use in this analysis. Some work has been done in the course of this analysis to update the energy sector emissions, using published energy statistics from the Government of Kenya[8], and a basic Tier 1 estimation approach, based on the latest IPCC inventory guidelines (IPCC 2006). These updates have been compared to those from the 1st National Communication (for 1994) in Figure 4.



*** Biomass value used for 2001 / 2005 sourced from 2000 consumption data**

Figure 4. CO_2 eq. emissions (Gg) from energy sector (petroleum products and biomass) (1994-2005)[9]

The revised estimates show a significant increase from 8,000 to 12,000 Gg CO_2 eq. The largest contributor is the road transport sector, as was probably the case in 1994 (although the sector splits for 1994 are not available). Estimates of biomass between 1994 and 2000 (shown in the 2001 / 2005 columns in the absence of more recent information) are at a similar level, at around 3.5 Mt CO_2 eq. The comparison of these estimates is reasonable, as there have been limited changes in Tier 1 inventory approaches for these energy sectors.[10]

[8] Kenya National Bureau of Statistics, http://www.cbs.go.ke/

[9] Non-biomass estimates from the energy sector are based on aggregated petroleum product data (without the product split) using a Tier 1 estimation approach; they have been estimated in the absence of information from the Second National Communication

[10] 1994 estimates are based on IPCC Revised 1996 guidelines whilst estimates for this study use 2006 guidelines (IPCC 2006)

3) Projected GHG emissions for Kenya

Vision 2030

The blue print for the development of Kenya over the next 20-25 years is set out in the Government's Vision 2030 document (GoK 2007). In this document, the Government states that Kenya aims to be a *globally competitive and prosperous country with a high quality of life by 2030* and a *middle-income country providing high quality of life to all its citizens.* The economic growth targets set are high (compared to recent growth rates achieved), with an aim to achieve an average GDP growth rate of 10% per annum by 2012. Millennium Development Goals (MDGs) are expected to be met by the 2015 deadline. The Vision 2030 is planned to be implemented in successive five-year Medium-Term Plans, with the first such plan covering the period 2008 – 2012 (GoK 2008).

Note that alternative projections of economic growth will affect the potential level of emissions, and the potential for low carbon growth opportunities. For the study, the primary baseline used has been consistent with the Vision 2030 document. However, some sensitivity analysis has been undertaken to investigate the likely implications of alternative economic projections.

The purpose of economic growth is to increase the level of development, crucially reduce poverty levels and increase standards of living for a large part of the population. The specific economic objectives will be supported by improved and expanded infrastructure and greater provision of modern energy services that are affordable. In addition, increased investment in social provision – sanitation, health, education, and housing – will be strengthened. Strengthening political institutions and democratic process are also key to realising the Vision.

The projected economic growth is predicted to be driven by key sectors including tourism, agriculture, wholesale / retail, manufacturing, BPO, and financial services (see Box 1).[11]

[11] Note that many of the specific targets in the Vision 2030 document relate to the short term, as set out in the 1st Medium Term Plan (2008-2012). Few quantitative targets / indicators are provided for the longer term.

Box 1. Vision 2030: Key sector for economic growth

Expand tourism sector: by 2012, quadruple tourism's GDP contribution to more than KShs. 200 billion; and raise international visitors from 1.6 million in 2006 to 3 million; *implies potential doubling of aviation emissions*. Kenya wants to be in the top 10 long haul destinations.

Increasing value in agriculture through greater processing of products and increasing yields, increasing productivity and utilization of medium / high potential land (only 31% used for agriculture or 5% of land area) and developing ASAL areas (84% of Kenya) for livestock / crops. A growth rate of 7% (currently 5%) over the next five years is the near term objective.

Modernisation of wholesale and retail sector, including developing informal businesses into formal sector modern business, and creating a duty-free zone to promote Kenya as business hub in East Africa. Improving infrastructure and business environment also key.

Increasing manufacturing goods share in regional market, from 7 to 15% and create global niche products e.g. in the agro-industry sector and increase local production capacity. Currently, largest sectors (in GDP contribution terms) are food processing (29%), refining (11%) and textiles / apparel (7%). Most industries produce basic products rather than skill-intensive products e.g. pharmaceuticals.

Provision of business services to rest of the world – known as Business Process Offshoring (BPO), and development of financial services sector

Source: GoK (2007)

Higher GDP levels and a rapidly expanding population will drive increased demand for energy, transportation and food, inevitably leading to significant increases in GHG emissions and other associated environmental problems unless energy or emissions can be decoupled from growth. The population in 2030 is projected to be more than double that of today, with very high levels of urbanisation (+60% by 2030), as shown in Figure 5 below. Nairobi, with 3 million inhabitants, is projected to have more than 14 million inhabitants by 2030 (according to Vision 2030). It is suffice to say that any country would face significant challenges of addressing environmental issues when faced with high economic growth and rapid population.

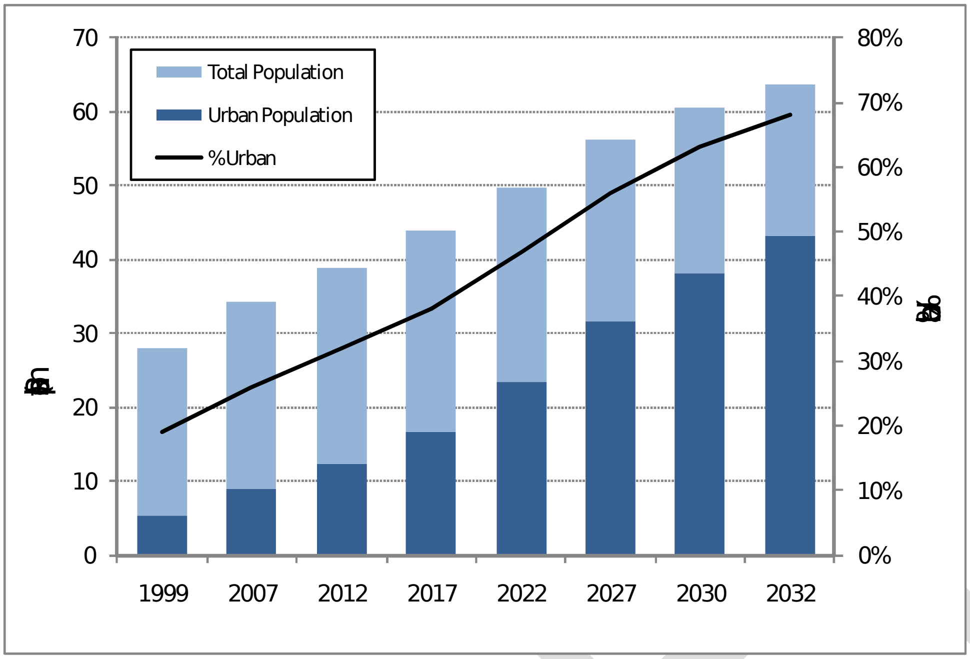


Figure 5. Population growth and rate of urbanisation in Kenya, 1999-2032

Note that the estimate of the total population is similar though slightly lower than the United Nations[12], which estimates a population of 41 million in 2010, 52 million in 2020 and 63 million in 2030 for Kenya (median variant). However, there are greater differences for urbanisation rates and the population growth of Nairobi. The 2007 UN World Urbanization Prospect Revision[13] estimates that the urban population of Kenya will grow from around 8 million currently to 13 million by 2020 and 20 million by 2030. It predicts a much lower population growth for Nairobi than predicted in the Vision, rising from around 2.8 million currently (2005) to around 4.9 million by 2020 and only 5.9 million by 2025. These different growth projections are important when looking at the potential uncertainty in future emissions and also abatement potential.

As highlighted above, the Vision 2030, as far as possible, provides the basis here for assessing future growth in GHG emissions. This seems reasonable, given that this is setting the broader ambition and goals for Kenya's development, which are being implemented through the 5-year Medium Term Plans. However, for some sectors this has proved difficult because there is limited quantification of the longer term (2030) ambition in the current Vision document, with greater focus on near terms activities (pre-2012) in the MTDP.

Projections for each sector are now assessed in turn.

Electricity Generation

In the context of enabling future economic growth in Kenya, the electricity generation sector has a pivotal role to play, in delivering modern energy services that are affordable. Future generation also has the potential to be low carbon, given the wealth of renewable sources in Kenya and sub-Saharan Africa. A low carbon generation system could have significant benefits for ensuring prices are affordable in the medium and long term,[14] enhancing energy security, reducing payments for fossil fuels and reducing air pollution and

[12] World Population Prospects, 2008 Revision Population Database (Median variant)

[13] http://www.un.org/esa/population/publications/WUP2005/2005WUP_DataTables3.pdf

[14] Prices may go up in the short term. The average price of electricity is expected to increase because new power development is carried out on the basis of a rolling 20-year Least Cost Power Development Plan. The Plan requires that the next least cost project be brought into production. This has implications on future tariffs, which are likely to increase over time, and it also means that new sources of electricity to be developed are likely to be more expensive than those already developed *ceteris paribus* (Mwakubo et al. 2007).

also other environmental burdens. These benefits of course will only be ensured if the supply of electricity is reliable, and system operation is not compromised (e.g. by a renewable-dominant system). In this context, the resilience of the energy system to future climate change itself is important. This is assessed in the main climate change impacts and adaptation section, which has investigated the potential effects of climate change on the main hydro system of the Tana river.

Currently, the electricity generation sector is viewed as acting as a barrier to economic growth, with high costs cited as one of the main problems (UNEP 2006). The cost of electricity in Kenya is four times that of South Africa, and more than three times that of China. Unreliability of supply compounds the problem of high cost. On average, Kenyan companies lose 9.5% of production because of outages and fluctuations (excluding the losses from damaged equipment). These issues have come to the fore this year due to the prolonged drought, and this has led to significant power restrictions, and high economic costs (from outages). This repeats a pattern seen in previous extreme seasons, and is discussed and assessed in the main climate change impacts section of the study.

Network problems also result in large amounts of unmet demand. Many people have paid connection fees and are yet to receive electric power. In 2000, the unmet demand for electricity was approximately 25% (Mwakubo et al. 2007).

Box 2. Summary of issues with current electricity system in Kenya

Relatively high energy costs. Energy cost in Kenya is US$0.150 per KWh. This is high compared with Mexico (US$0.075), Taiwan and China (US$0.070), Colombia (US$0.064) and South Africa (US$0.040)

Losses due to power outages. Due to over-reliance on hydroelectricity, the frequency of power outages is high (33 per cent compared with the average for Mexico, China and South Africa, which stands at 1 per cent). Production lost due to these outages is approximately ~9.3% (compared with the average for Mexico, China and South Africa, which stands at 1.8 per cent)

Long wait for connection. It takes approximately 66 days to obtain electricity connection in Kenya (compared with an average of 18 days in Mexico, China and South Africa)

Grid losses. Losses are estimated to be 18.4%, inclusive of distribution and theft, which is considered high relative to other countries. This figure is expected to decline to 15% by 2007 and 12% by 2025

Source: GoK (2007), UNEP (2006)

Existing system

The current system size is small relative to the population, at 1.3 GW installed capacity (in 2006/07). This is reflected by the very low per capita electricity consumption levels. Generation is dominated by hydropower (57%), primarily from hydro stations on the Tana River, followed by thermal power, primarily diesel (33%), and finally geothermal (10%) (KPLC 2008).

Installed capacity for the year 2006/07 is provided in Table 1 below.

Table 1. Capacity of electricity generation plants in Kenya, 2006/07

Generation type	***Installed capacity (MW)***	***Effective capacity (MW)***	***% Effective capacity***
Hydro	737.3	719.4	57%
Geothermal	128	128	10%
Wind	0.4	0.4	0%
Diesel (Central)	205	190	15%
Diesel (Rented)	150	146	12%
Gas	73.5	70	6%
Cogen	2	0	0%
Total system	**1296.2**	**1253.8**	**100%**
Diesel (Isolated, Off grid)	11.3	9.7	

Electricity purchased in 2006/07 was 6,169 GWh in 2006/07, across 924,520 customers (across all sectors). Access to grid based electricity is limited, with the distribution system primarily limited to urban areas. The % of rural households using electricity is <4%. For the low income urban population, it is 26%, while for higher income groups it is >80%. It is estimated that 15.3% of the 33 million population have access to commercial electricity, putting per capita consumption at 121 kWh (ESD 2005). Rural access is increasing rapidly, albeit from a low base; under the Rural Electrification Programme (REP) customers increased by 22,323 to reach 133,047 in 2006/07, representing a 20% growth from the previous year.

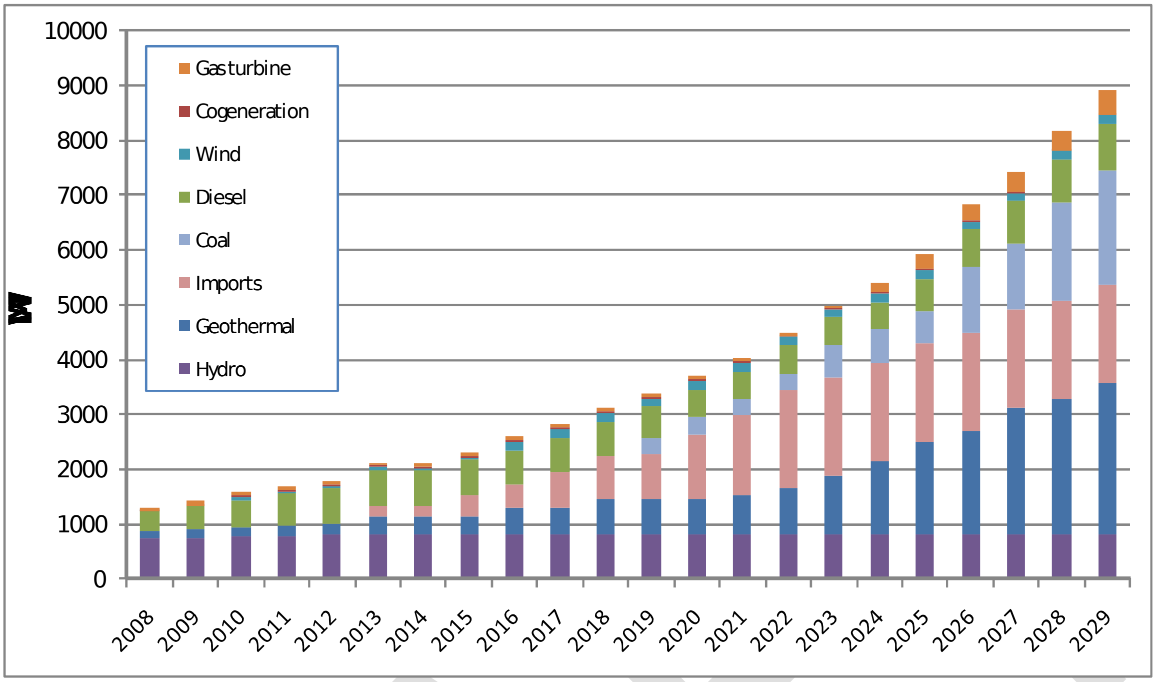
Other renewable resources (solar and wind) are also being used to produce electricity, albeit it at a low level at present; current wind installed capacity is 750kW, 600 kW of which is grid connected. However, the potential is much greater, with identified 'good' sites (>7m/s) providing up to 100 MW, with the best resources in the north of the country (see Turkana Wind Farm project Case Study). Some 120,000 rural households have solar systems; combined with other systems, this equates to over 4MW capacity (ESD 2005).

The Least Cost Power Development Plan (LCPDP)

The Kenyan government has put in place a Least Cost Power Development Plan (LCPDP), which plans for new build of generation capacity out to 2030 based on the forecasted growth in demand for electricity. The growth targets outlined in Vision 2030 provide the basis for this growth in demand. The plan takes into account planned projects and formulates the mix based supply mix requirements, costs of generation and resource availability (KPLC 2008). The LCPDP is consistent with Vision 2030 and provides an official view of new capacity requirements in the future. It has therefore been used as the basis for emission projections used in this study.

Total generation is projected to increase from 6,928 GWh in 2008/09 to 47,913 GWh in 2028/29 based on an average growth rate of 10% in the forecast period.[15] This requires an additional 7.6 GW on current installed capacity (of 1.3 GW) between 2008 and 2029 (as shown in Figure 6 below). The main growth is through imports (an additional 1790 MW in 2029 relative to 2008), geothermal (an additional 2640 MW) and coal (an additional 2100 MW). Imported power is primarily sourced from Ethiopian hydropower. Gas was not considered due to lack of regional resources for supply.

[15] Supplied electricity is about 18% lower due to plant own use (1.2%) and system losses (16.8%). In later years, losses are assumed to be lower, at 14.5%.



* Small cogeneration capacity level is bagasse cogeneration at Mumias sugar

Figure 6. Growth in installed capacity by generation type (2008-2029), LCPDP (KPLC 2008)

The generation by plant type has been calculated as part of this study to try and match the profile provided in the LCPDP and is shown below. It is therefore an approximation, as the assumed utilization factors are not provided in the LCPDP. Geothermal is used as a baseload plant whilst new coal plant are not, but presumably a back-up when other plant are offline. Hence, for coal, a 20% utilization factor has been assumed while for geothermal this is set at 85%.

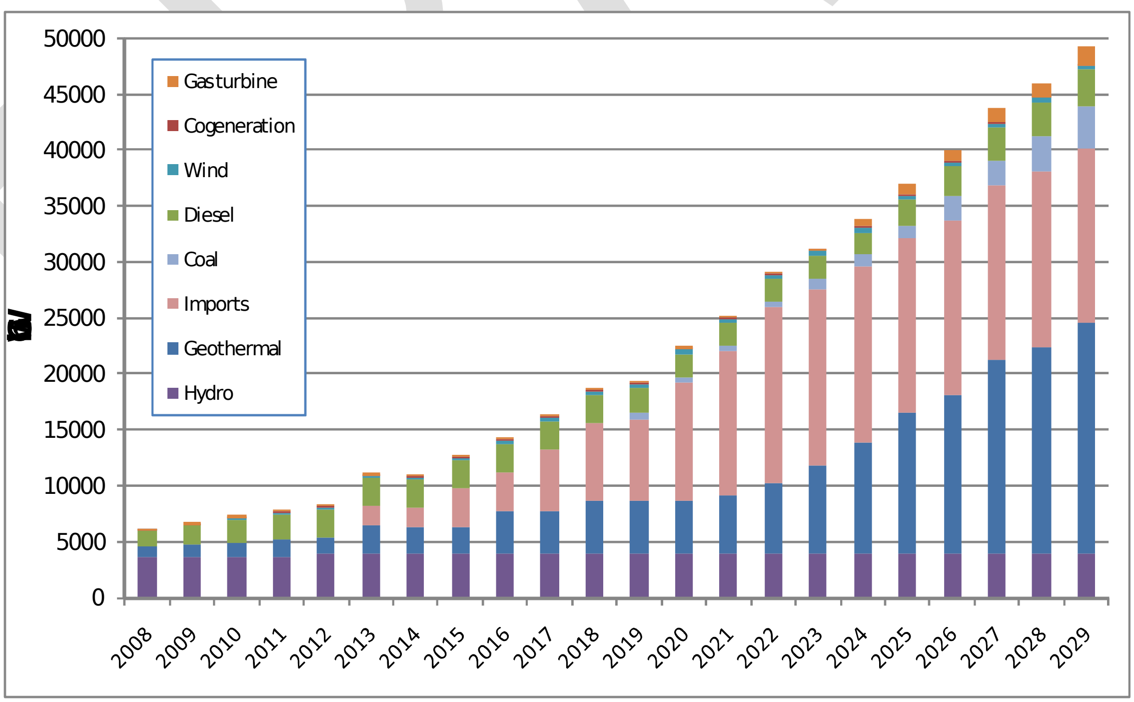


Figure 7. Projected generation levels by type (2008-2029)[16]

Grid system development and integration

The increase generation capacity will require a significant amount of upgrade and extension work to the current transmission and distribution system. This is to ensure the system can deal with the greater load, improve reliability, increase access to regional markets / providers (through additional interconnectivity) and increase the customer base, particularly in rural areas. Many different grid system projects are already committed, as set out in the LCPDP (KPLC 2008).

KPLC is implementing a plan to increase its customer base by 1 million through a scale up policy in five years from 2009/10, having just registered its one millionth customer in January 2008. In addition to the Rural Electrification Programme, the Energy Access Scale-Up Project aims to increasing access to electricity in rural areas in Kenya from the estimated 5% to 20% by 2010 and 40% by 2020.

Regional markets will become increasingly important if Kenya's forecast demands are to be adequately met. Based on our calculations (as above), imports could meet 35% of total demand in 2017, rising to over 50% by 2021. This then drops to 43% by 2025 and 32% by 2029 as the contribution from domestic geothermal generation increases. A major source of the imports will be Ethiopia, the proposed interconnector for which is at the feasibility assessment stage. This regionalisation of the electricity network may also hold prospects for countries being able to benefit from the sale or use of low carbon electricity in reducing per capita emissions.

Some imports to Kenya already come from Uganda (between 30-50 MW); however, much greater regional integration is being considered by the East African Community (EAC). A study has been undertaken by Kenya, Uganda and Tanzania, assessing the viability of interconnected grids. Based on this study, a pooling arrangement is being pursued under the EAC and the proposed East African Community Power Pool (EACPP). In the wider Eastern African region, increased regional power grid integration through the Eastern African Power Pool (EAPP) is also being considered. There has been assessment of linking in with the Southern African Power Pool (SAPP); an interconnector project with Tanzania is near inception using Dutch funding. Both this interconnector and the Ethiopia project are projected (in context of the LCPDP) to be completed between 2012 and 2014. Another important regional initiative called the Nile Basin Initiative (NBI) has been assessing the feasibility of greater integration of electricity distribution systems across NELSAP countries.[17] Pertinent to Kenya under this initiative is the second interconnector with Uganda, which will enhance power exchange between the two countries particularly after Uganda increases its capacity through planned hydropower projects.

Projected emissions

The electricity projections above have been used to estimate the potential CO_2 emissions from the system, calculated using the forecast generation levels, using typical assumptions to characterise generating efficiency (on an annual basis). The emissions are shown below. Emission levels increase markedly after 2020, due the use of coal generation, increasing by about three times from a level of 2000 Gg CO_2. This is shown in Figure 8, on the left hand axis.

The analysis has also calculated the average carbon intensity of generation, estimated from dividing the total emissions by total electricity generated. This gives an estimate in terms of gCO_2/kWh. This estimate provides a means to show the relative carbon emissions per unit of generation over time, and so map

[16] Estimated based on assumed utilisation factors, approximated to generation levels observed in the LCPDP

[17] Nile Equatorial Lakes countries (NELSAP) covering Uganda, Rwanda, Burundi, Tanzania, Democratic Republic of Congo (DRC) and Kenya

whether the overall system is following a lower carbon path. This is shown on the right hand axis and on the red line in the graph.

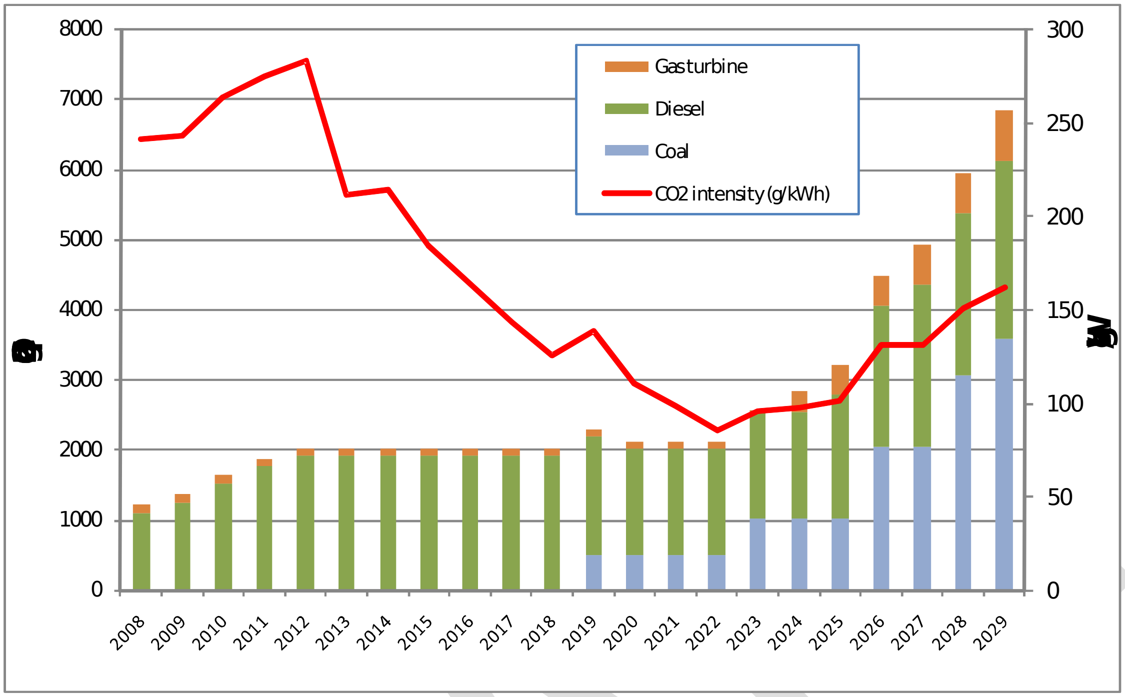


Figure 8. Projected CO_2 emissions by generation type (2008-2029)[18], and CO_2 intensity of generation (g/kWh)[19]

The carbon intensity of the generation system is relatively low in 2008, due to the high contribution from hydropower (230 gCO_2/kWh). This drops to very low levels by 2022 because the increasing system capacity is primarily driven by imports and new geothermal plant. Only after this point does the intensity start to increase due to coal and additional oil-based generation though still remains at a relatively low level (150 gCO_2/kWh), and below that observed for the current system. However, the increases post 2020 are important because they correspond to a time when there is likely to be much greater pressure on global carbon reduction, and also far greater opportunity (in terms of total and price per unit) for carbon credits.

A choice of coal in the generation mix to introduce coal in early year, and the planned increase in a decade or so, therefore has the potential to '**lock-in' high carbon coal plants** into the Kenyan generation mix. We consider that this might significantly reduce future carbon reduction potential, for example associated with programmatic or national mechanisms.

There are a range of uncertainties and issues that require further consideration in the above projections (although beyond the scope of this assessment). These include:

- **Heavy reliance on imported electricity from hydropower primarily from Ethiopia.** The LCPDP estimates that up to 1,000 MW can be imported from Ethiopia before the year 2020. Phase II of the project (post 2020) would see imports increase to a maximum total of 2000 MW. An important aspect of the LCPDP analysis that seems to be missing is the impact of future climate change on hydropower resources. Current evidence appears to suggest greater variability in rainfall although

[18] Assumed efficiencies: gas (45%), coal (35%), diesel (35%). All oil based generation assumed to be diesel not HFO, so emissions might therefore be underestimated.

[19] Generation levels adjusted for losses before intensity calculation

not reductions in annual averages. Greater variability could have significant impacts for given years, particularly with Kenya already heavily dependent on domestic hydropower. In the 2000 drought, the worst since 1947–51, the contribution of hydroelectric energy to the national grid was reduced by 41 percent, from 3,063 GWh in 1999 to 1,794 GWh (Mogaka et al 2006). Vulnerability is increased as most domestic hydropower is on the River Tana, which means that problems in this catchment area could threaten overall hydro potential.[20] Only Turkwel power station is on a different water catchment basin. Risks will be reduced once the Sondu Power project is completed and online (Mwakubo et al 2007). [21] The Vision 2030 document (GoK 2007) already highlights the high reliance on hydropower (and vulnerability to drought), stating that the frequency of power outages is higher than other countries.

The energy security issues are also significant; climate variability and the lower availability of water for hydro generation could be compounded by political turbulence which disrupts electricity imports. In addition, the potential of hydro resources will only be realised if the significant infrastructure investment in Ethiopia go ahead. shows a situation whereby a forecasted 30% reduction in imports from Ethiopia is replaced by diesel (30%) and coal generation (70%).

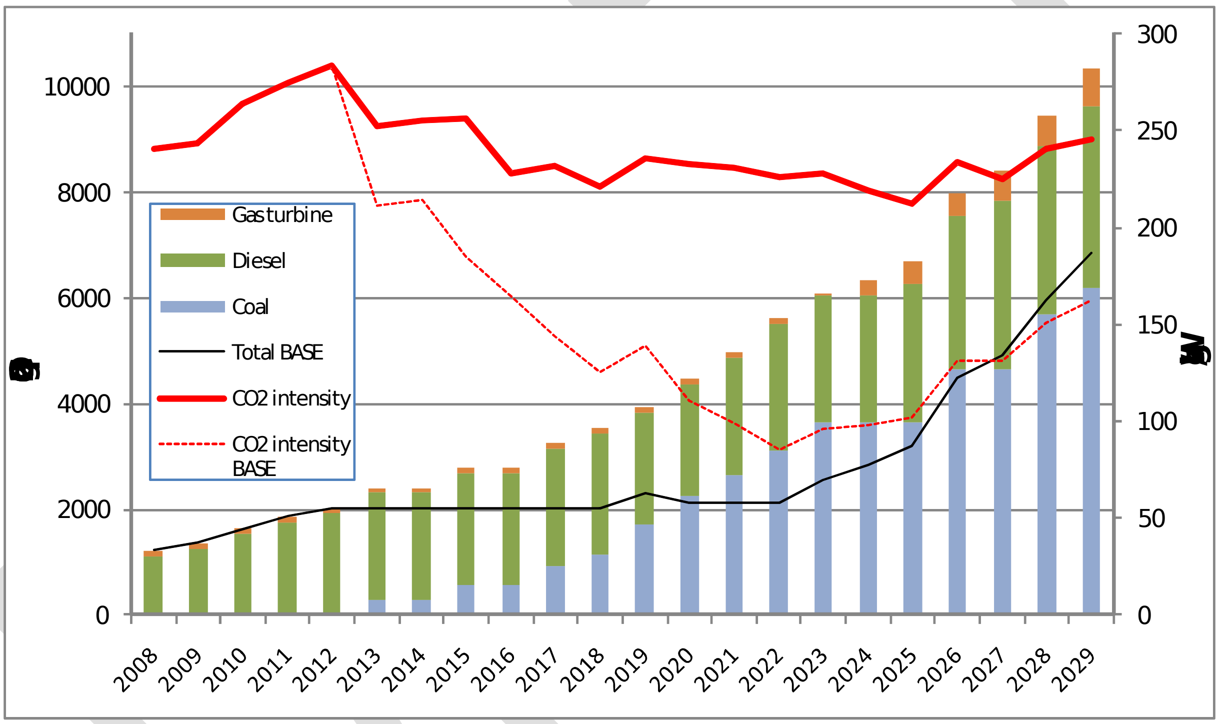


Figure 9. Projected CO_2 emissions by generation type (2008-2029), and CO_2 intensity of generation (g/kWh)[22]- <u>Lower Import sensitivity case</u>

In this Lower Import case, the emission intensity of generation is at a similar level to that observed in 2008, and significantly higher than the reference case (shown by the dashed red line). Total emissions are about 50% higher in 2030 than the reference case (level shown by black line), as

[20] In July 2009, the Kenya Electricity Generating Company said poor and late rains had forced the closure of the 14 megawatt Masinga plant on the Tana River, the country's largest plant. http://news.bbc.co.uk/1/hi/world/africa/8128681.stm

[21] An assessment of power development options in the Nile Equatorial Lakes region has been undertaken through NELSAP (2006); for the Lakes regions in Rwanda and Tanzania, modelled changes in precipitation and temperature did not adversely affect runoff required for hydro electricity generation.

[22] Generation levels adjusted for losses before intensity calculation

would be the investment requirements due to the significant additional indigenous generation requirements.

Given the level of reliance on imported electricity, and predicted climate impacts, this issue requires additional analysis particularly from an energy security and systems reliability perspective. The risks of a high hydro future are considered again in section 5, when discussing options for a lower carbon future, with reference to recent analysis undertaken for Tanzania (ECA Working Group 2009).

- **Increasing scarcity and demand for water resources.** Another important factor will be the increase demand for water in future years (competing with electricity generation), due to population growth, agriculture demand. One of the medium term aims of the Vision 2030 (GoK 2008) is to exploit the agriculture potential in Kenya. Specifically, the amount of land under irrigation will be increased by 30 per cent by establishing additional 25 small-scale irrigation schemes throughout the country and several large-scale irrigation schemes mainly in the Tana River, Athi River, Mwea, Yatta, Nyando, and Nzoia basins. Careful consideration will need to be given to the competing needs of the agriculture sector, and generation from hydro electricity, and how greater demands on water are managed i.e. the seasonal release of water from dams to meet generation needs versus agriculture sector irrigation requirements.

- **Grid system stability.** It is not clear from the LCPDP how much work has been undertaken to look at grid system operation as both the supply and demand profile changes over time. On the supply side, there is greater reliance on imports and baseload geothermal plant; how well this supply mix can cope with changing patterns of demand is unclear. For example, will the thermal plant be able to cope with a more variable ('peaky') demand profile? Increasingly urbanized, higher income populations with access to electricity may result in a system with more severe peak demand periods, perhaps driven by evening use of air conditioning and other appliances. A warming climate may compound such an issue.

It is clear that the future Kenyan system, as set out in the LCPDP is relatively low carbon due to the large amount of renewable generation. This could of course change if less imported electricity is available, and coal resources (indigenous and from Mozambique) are exploited. In view of the above uncertainties, realising such a system will require further system planning, perhaps including the use of integrated energy system tools (MARKAL-TIMES / MESSAGE), and significant levels of investment. The role of decentralised generation could also be integrated into this planning, as this also can offer cost-competitive low carbon electricity, particularly in rural areas.

<u>The role of decentralised generation</u>

The LCPDP (KPLC 2008) does not consider the role of other (often smaller scale) renewable technologies (such as wind, solar, biomass and small hydro) in any great detail although it does state that *they are expected to play a role in the country's future energy supply balance*. It also mentions that a Feed-In Tariff (FIT) scheme is being adopted by the Ministry of Energy which will guarantee electricity prices and encourage investment. Current renewable projects implemented or planned are described in Section 4 of this report.

Domestic sector and traditional industry / commerce

<u>Current situation</u>

Firewood and charcoal[23] account for almost 75% of final energy consumption, and meet most (>90%) of the energy needs of the urban poor and rural communities, as well as traditional industries. Such sectors have very limited access to electricity[24] or other modern fuels, often due to availability but also high poverty levels resulting in such alternatives being unaffordable.

Biomass is sourced from many different forest types, including closed and protected forest. Only 3% of Kenya's land area is covered by forest, which produce about 45% of the biomass energy resources including wood wastes (GoK 2005). The balance is derived from farmlands in the form of woody biomass as well as crop and animal residues.

Unsustainable harvesting, with limited effort on reforestation, has led to significant soil degradation, and deforestation. Demand for wood fuel is higher than supply; in 2005, the country was projected to have a wood fuel deficit of 4.1 million tonnes in 2005. About 47% of the Kenyan households use charcoal. Some 82% of urban households use the fuel compared to only 34% of households in rural areas. Total charcoal production is about 2.4 million tonnes (UNEP 2006).

<u>Developing projections</u>

Projecting future use of biomass is problematic because it is dependent on resource availability (set against growing population, land-use changes, etc), switching to alternatives, urbanization and income levels. Many of these variables are set by assumptions made for other sectors:

- Resource availability. At present there is a wood fuel deficit; however, if forestry targets are met as set out in Vision 2030, there will no longer exist. However, population pressures will also increase over time, and there will be pressures on land-use.
- Switching to alternatives. Electricity generation is projected to increase significantly, due to population growth, improving access (particularly in rural areas but also because of rapid urbanisation), and increasing middle and high income consumers. The use of alternatives in this sector is also increasing, such as LPG and kerosene. Relative affordability of different options is also an important factor.
- Technology improvements. Another factor will be the number of efficient stoves and proposed programmes to enhance overall efficiency of the stock.

Long term projections for this sector have been developed in a UNEP (2006) analysis, which also focuses on transport sector (as described in the next section). Under a business as usual scenario, future fuel consumption is estimated as follows:

Table 2. Consumption of household fuels (Terajoules) under a BAU scenario in UNEP 2006 analysis

Household fuel	*2004*	*2030*
Agr. Residues	68,666	252,979
Wood	246,764	199,439
Charcoal making	170,720	128,000
Charcoal consumed	25,600	12,800
Kerosene	10,750	16,644
LPG	1,987	3,311

[23] Production and trade of charcoal is actually illegal but still accounts for a large part of the energy sector

[24] Consumption in Kenya is extremely low standing at 121 kilowatt hours (KWh) per capita (compared to 503 in Vietnam or 4,595 for South Africa). The national access rate stands at approximately 15%, while the access rate in the rural areas is estimated at 4% (GoK 2008).

Total biomass increases overall, remaining the dominant source of household energy. Wood fuels (including charcoal) reduce due to ongoing shortage of supplies, with growing demand met by significant increases in agricultural residues.

However, the projections in the UNEP study above are inconsistent with the Vision 2030 assumptions that assume large scale reforestation (presumably reducing the wood fuel deficit) and rapid electrification. In the UNEP study, urbanization rates are fixed at the level seen in 1999 (35%), while Vision 2030 projects almost double this number by 2030. Therefore, the UNEP projections have not been used directly, but instead built on to develop a set of projections that are more consistent with Vision 2030 development.

Indicative projections have been made for this study. These are based on a number of assumptions

- It uses the UNEP (2006) fuel totals in 2004; based on Kenyan energy statistics (for 2000) and additional 3% demand is met by electricity.
- It assumes a rate of switching to electricity that is critical to the overall projection. This will be influenced by the rate of urbanisation, expansion of the grid system, particularly rural provision, and to a lesser extent the uptake of decentralised technologies. This will also be a function of access versus consumption, which will be influenced by cost of connection / electricity tariffs.

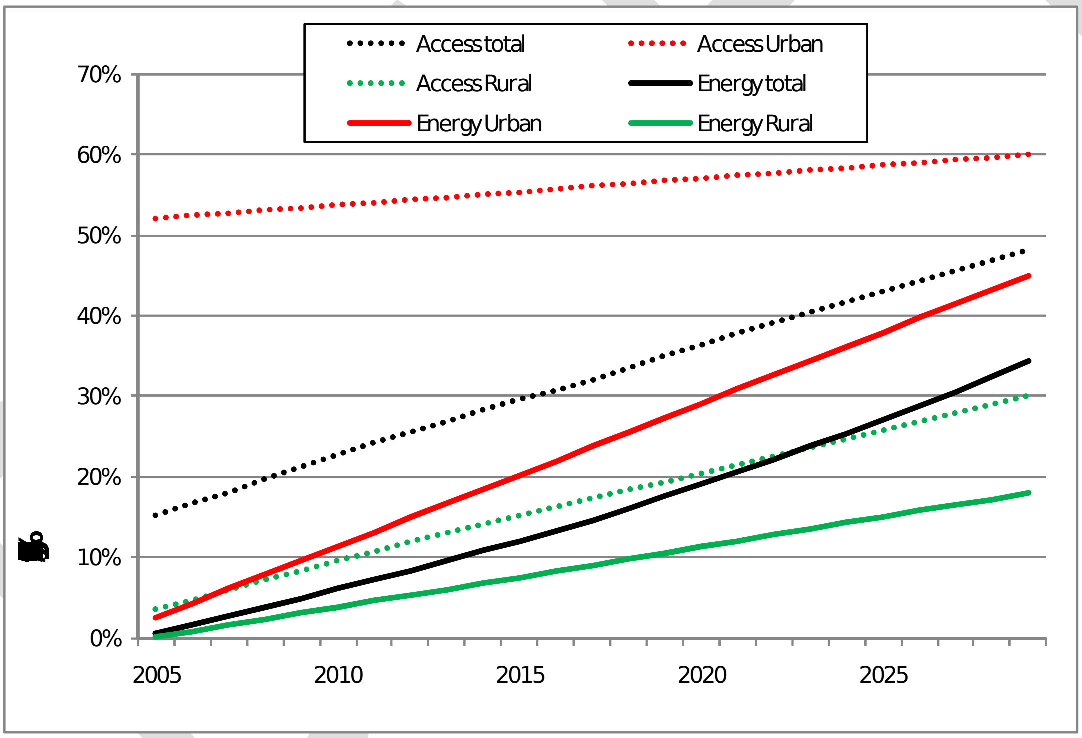


Figure 10. Population access rates to electricity (dashed line), and % contribution of electricity to household demand (solid line)

Access rates to electricity are shown in Figure 10 above, with total access at 15% (black dashed line) but consumption only accounting for around 1% of household demand in 2005. In rural areas, we assume that access increases from 4% to 30% by 2030 while in urban areas this rises from 52% to 60%. The urban access does not increase markedly due to the rapid urbanization taking place. This is illustrated by 52% of urban population in 2005 equating to 4.1 million and 60% of the urban population in 2030 equating to 21.6%.

It is then assumed that 60% of the rural population with access use electricity as their primary energy source, while 75% do so in urban areas. This assumes that electricity is much more affordable; in 2005, the equivalent shares are 3% (rural) and 5% (urban). The assumption is that most of the electricity is from centralized generation.

Figure 11 below shows the resulting shares of electricity versus biomass taking the above assumptions into account. Essentially, biomass accounts for cooking and heating needs not met by electricity generation. **These projections are indicative for this study and provide one potential perspective on future household consumption; further work is needed to establish how these patterns compare to household consumption as modeled in the LCPDP.**

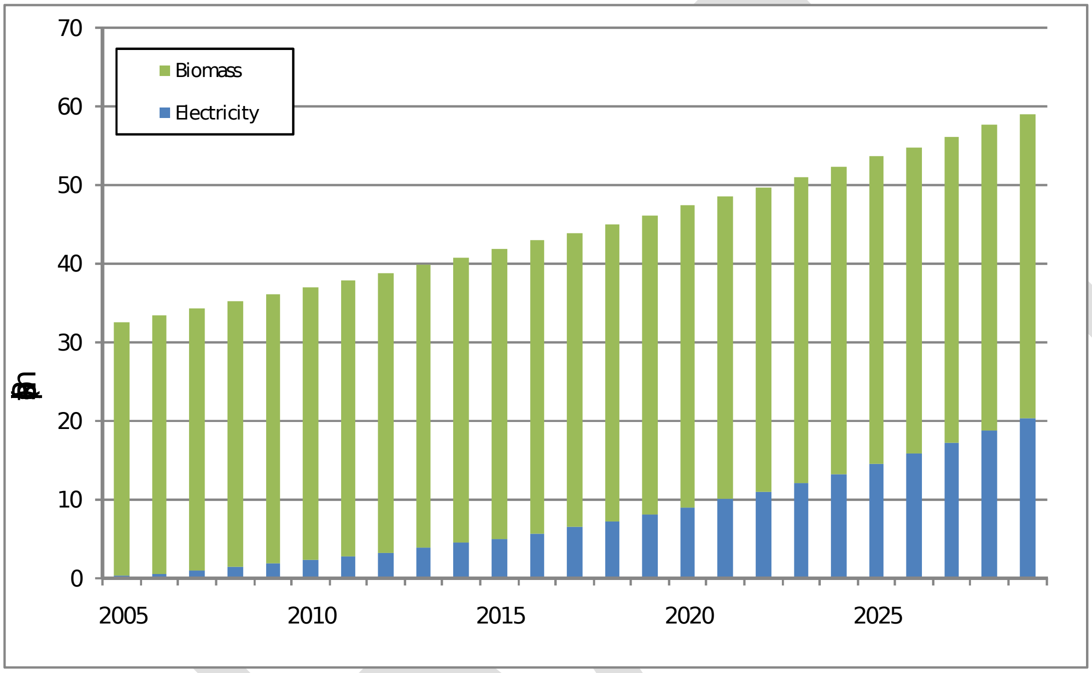
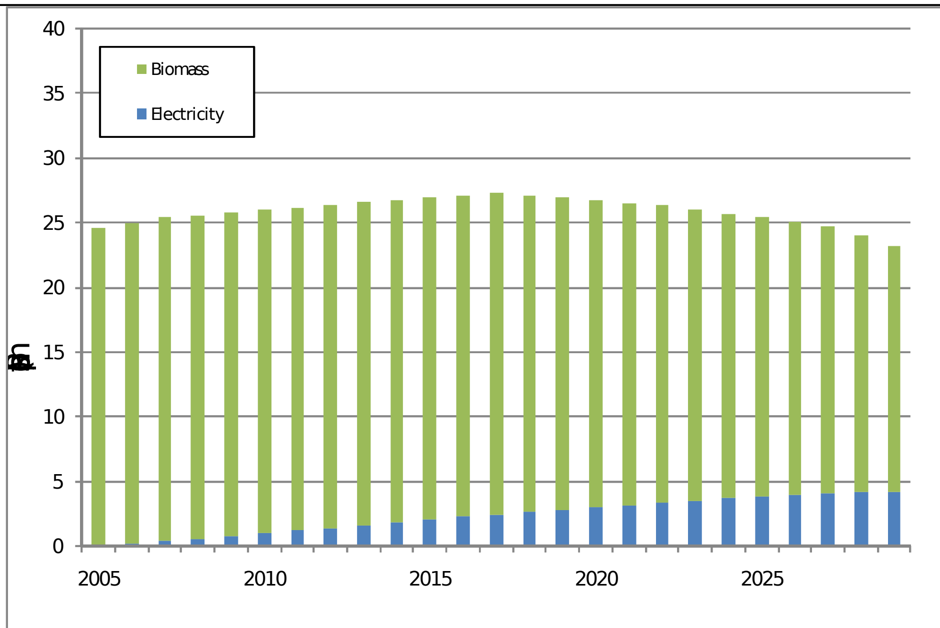
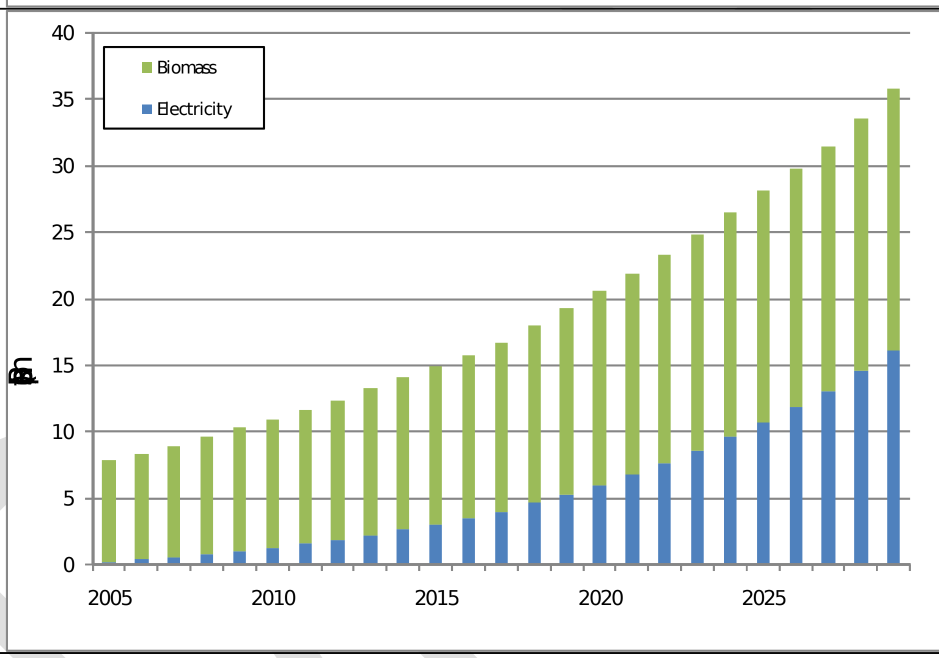


Figure 11. Population use of household energy by primary type

The urban / rural breakdown of the above figure is shown in Figure 12 below.



Rural



Urban

Figure 12. Rural / Urban population use of household energy by primary type

Based on the above trends, reliance on biomass (assuming the same per capita consumption) increases by 18% on 2005 in absolute terms; population is projected to increase by 82%. This suggests that even with significant expansion of modern energy services, Kenya is still going to heavily reliant on biomass energy.

Emission projections have been calculated on the basis of the same per capita use as observed in 2004 (UNEP 2006), with efficiency improvements in stove stock for biomass use, as set out in Government policy– 30% of wood burning stoves improved types. The shares between biomass types are also fixed based on 2004, assuming that the deficit in fuelwood supply is reduced by afforestation / reforestation activities. Resulting emission projections are shown in Figure 13 below. As is the current inventory practice, CO_2 emissions from biomass are not included.

Kerosene and LPG use is estimated separately, with kerosene primarily meeting the lighting needs of households without electricity, while LPG is used by middle to high income for cooking. Kerosene emissions remain at a similar level to 2005 due to limited growth in the rural population, while LPG emissions increase with urban demand increasing.

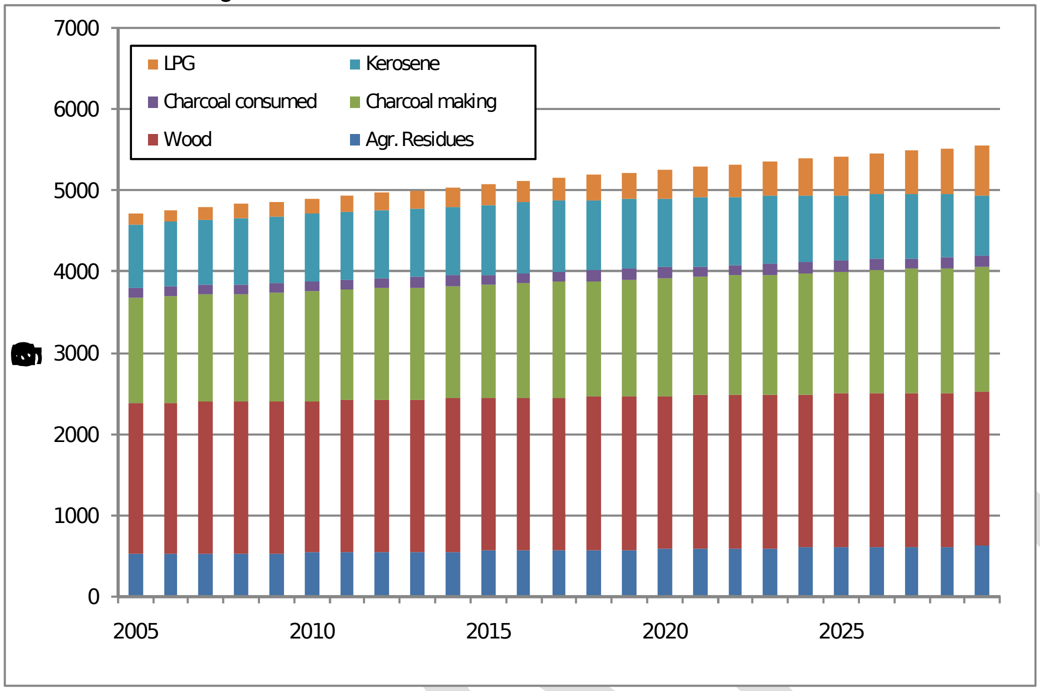


Figure 13. Projected GHG emissions (Gg CO_2 eq.) for the household sector (2008-2029)
(Note that emissions from electricity are captured in the electricity generation sector, and therefore not reported by end use sector))

There is no significant rise in emissions from this sector due to the increased use of electricity in both urban and rural populations. Note if significant expansion of access to electricity did not occur, it is likely that emissions from biomass and kerosene would be much higher. In addition, it is also assumed that the wood burning stove stock becomes much more efficient, again ensuring emissions from biomass use in 2030 remain at a similar level to that observed in 2005. Total emissions do increase by around 17% primarily due to increased uptake of LPG in the urban population.

Whilst significant uncertainties mean that emissions could be much higher than projected, based on these projections, significant potential remain to improve the efficiency of both charcoal making and wood fuel burning, further reducing emissions and reducing pressure on these biomass-based resources.

Transport

Current situation

The road transport sector accounted for nearly 50% of petroleum products consumed in Kenya in 2005, with transport as a single sector accounting for 70%.[25][26] Road transport is a rapidly growing sector, with 700,000 road vehicles in 2004 compared to 386,000 in 1992, increasing by 30,000 vehicles each year (GoK 2002, UNEP 2006).

[25] Kenya National Bureau of Statistics, http://www.cbs.go.ke/
[26] The majority of the remainder is consumed by the power and industry sectors

No specific estimates of future demand for the transport sector have been made in Vision 2030; however, based on the population and GDP growth forecasts, and recent experiences both in Kenya and other developing countries, it is clear that demand, primarily for private vehicle transport, will increase significantly. This rapid expansion in future years has significant implications for energy demand, infrastructure and urban planning, and associated issues of noise, congestion, pollution etc,. It will be driven by rising incomes, rapid population growth and urbanisation. Vision 2030 (GoK 2007) states that poor urban transport systems and the congestion they cause in Nairobi already cost 2% of GDP (NB. Nairobi accounts for 40-50% of national GDP).

Developing projections

There are no projections for the transport sector in the Vision 2030 document. However, a published source of fuel consumption and emission projections is the UNEP (2006) assessment, which projects that petroleum demanded by the transport sector will rise from 1.9 million tonnes in 2004 to between 5.3 - 8.6 million tonnes in 2030. This is based on a lower population in 2030 than projected in Vision 2030 (55 vs. 63 million in the vision), and lower annual GDP growth (3-5% vs. 10% in the Vision). The implication is that the projections in the UNEP study are therefore likely to be at the lower end of likely future transport demand.

The estimates in this study build on this UNEP analysis, although they build in some efficiency improvements in the road vehicle stock. Overall, road vehicle numbers increase from 0.75 million in 2005 to 4.4 million in 2030. Total transport fuel use rises from 2 to 10 million tonnes of petroleum products. It is probable that the above projections could still be higher under the Vision 2030 assumptions, due to the higher economic growth and population increases assumed. If growth rates are increased by 35% post-2015, road vehicles increase to 6.5 million whilst fuel consumption increases to 14 million tonnes.

Projected emission estimates of CO_2 for the transport sector are shown below (Figure 14). This initial projection shows the emissions growth from the car sector is higher, given the large increases in demand for private cars as incomes rise. Growth by transport type is simply a function of base year vehicle splits (which are not assumed to change), vehicle specific growth rates and efficiency improvement assumptions.

The aviation sector estimates are based on energy use statistics; however, it is not clear whether this accounts for domestic aviation only or also includes the fuel consumed by international airlines (purchased in Kenya). This distinction is important from an emissions inventory context, and in thinking about future targets within an international agreement. In addition, these estimates do not necessarily include projected increases in aviation travel as the tourism sector grows. Further work is needed to better understand the future growth of aviation emissions, and the allocation of (responsibility for) domestic / international emissions from this sector.

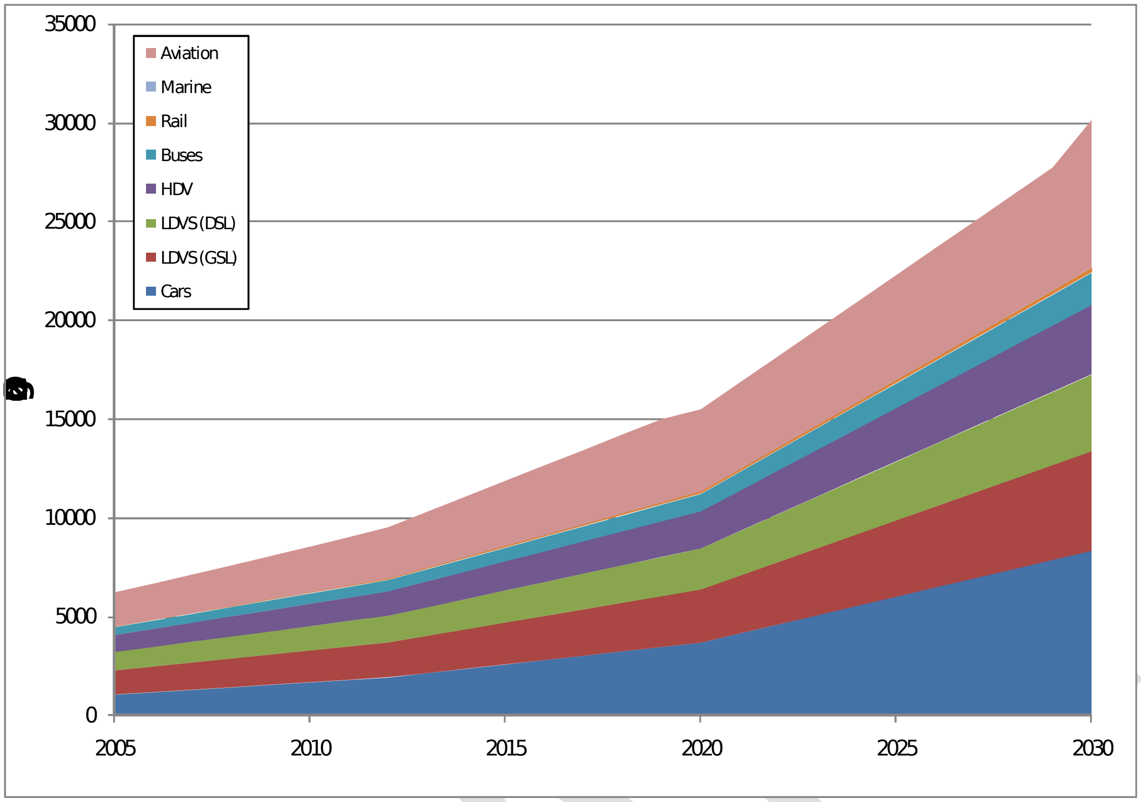


Figure 14. Projected CO_2 emissions for the transport sector, 2005-2030[27]

This is a critical sector for future emissions; whilst the above provide indicative emissions, it is important that projections are significantly developed using more robust methods, taking account of rising incomes and how that affects demand, future public transport provision, urban planning issues, transport / energy policy etc.

In conclusion, it is likely that emissions will increase significantly in future years given population growth and projected rising incomes. However, significantly more work is required to produce robust estimate on which basis policy options can be appraised.

Industry

Kenya's industrial sector is one of the largest in Sub Saharan Africa. Manufacturing accounts for 13% of the Gross Domestic Product (GDP), a share that has remained constant since 1998. The sector accounts for over 27 percent of Kenya's total export earnings (2001). By the end of 2000, the sector had nearly 700 medium sized and large-scale enterprises, and 1.3 million micro and small enterprises, employing about 300,000 people in the formal sector and 3.7 million in the informal sector (GoK 2005). The largest single sector is food, beverages and tobacco, accounting for 29% of sector GDP, and 35% employment. Textile and apparel sector is also an important sector, at 7% of sector GDP, and 25% employment. Much of the rest of the sector is fragmented, with many smaller subsectors (GoK 2007).

There is no doubt that industrial sector emissions will grow in future years, although much of the economic growth is likely to be in lower carbon intensive service sectors, based on the Vision 2030. In addition, the Vision describes an aim for a much more competitive and productive manufacturing sector, which presumably would include the adoption of more efficient technologies and practices.

[27] Emission projections do not include CH4 and N2O emissions in absence of detailed understanding of stock breakdown.

In the absence of published estimates of projected fuel demand for this sector, predicted changes in industrial efficiency and sector specific growth rates are extremely challenging to develop. Indeed, it has not been possible to develop detailed projections. However, a scoping analysis has been undertaken to investigate the potential emissions growth, as this is potentially an important sector for low carbon options. Indicative, estimates have been made based on:

- An overall 10% growth rate, an ambition for the sector in Kenya's current Medium Term Plan (GoK 2008). Note that a lower growth rate would be expected to lead to lower emissions than outlined below. Therefore, we have also included a sensitivity case using a 7% growth rate.
- This growth rate is applied to the industrial / commercial oil consumption value for 2005, and does not take account of the use of other fossil fuels nor switching to electricity in future years.
- A reduction factor in energy consumption (linearly extrapolated) of 10% in 2020 and 15% in 2030 in the baseline is assumed, taking account of the move to less energy intensive industries. The Vision 2030 document describes the Kenyan economy moving towards a higher value, services-based economy; therefore, the reduction factors try to reflect this lower energy intensity production.

The resulting emissions projection is shown in Figure 15 below.

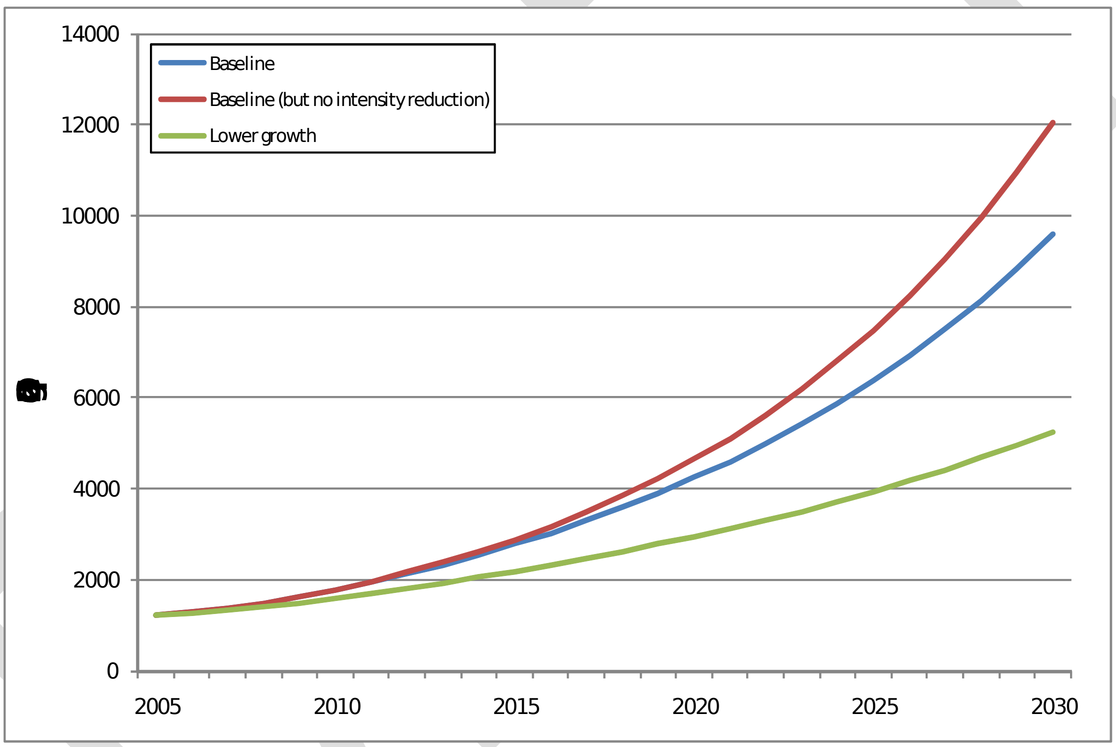


Figure 15. Projected CO_2 emissions for the industry sector, 2005-2030

Assuming lower annual industrial growth significantly reduces future emissions (as shown by the green trend line). The assumptions around energy intensity of production also have a significant effect, as shown by the difference between the blue and red line, the red line indicating no improvement.

Further information is required to develop these projections, including growth rates for different subsectors, current energy intensity of production (and therefore potential for efficiency improvements) and understanding about future energy use by type; the above projections assume continued use of petroleum products only. In addition, the structural changes to the future Kenyan economy need to be understood, including the emergence of new industries.

Agriculture

Agriculture is an important sector in the economy, contributing 24 % of GDP. Over one third of agriculture produce is exported, accounting for 65% of Kenya's exports. Horticulture and industrial crops are particularly important products for export (GoK 2007). The sector is one of the major employers in rural areas, with an estimated 3.8 million people directly employed while another 4.5 million are employed in the informal agriculture sector (GoK 2008). As stated in the 2030 Vision Medium Term Plan (MTP), as the largest sector in the economy, it is likely that it will remain the main driver for growth in the short to medium term.

Currently, about 75% of the sector is made up of smallholding farms, with low inputs (fertilisers) and yields. In the 1st National Communication (GoK 2002), there is recognition that increasing pressures on the agricultural sector from population and economic growth could lead to increasing GHG emissions and pressures on the land as the sector changes over time. Examples include the increase in fertiliser application, currently at very low levels, which could lead to increased emission of N_2O, or growth in meat demand increasing livestock numbers, and as a result CH_4.

In developing projections, there are a number of factors that are likely to lead to increased emissions:

- Increased livestock emissions due to food demands from a growing population. Livestock are an important source of methane emissions, resulting from enteric fermentation and from manure (particularly in less intensive farming)
- Increasing agricultural land area, with only 31% of high and medium potential land in use (or 5% of total land area), and increasing use of ASAL areas.
- Increasing fertiliser use to increase yields. The Kenyan government is investing in a programme which will see domestic production soon after 2010, and lead to much lower costs for the sector. Nitrogen based fertilizer use important are a significant source of N_2O emissions, but are also energy intensive to produce. Therefore additional emissions will occur due to production and application on agricultural land.

The projections methodology is very simplistic but has been undertaken to ensure completeness, and include a very important sector in assessing low carbon potential. Livestock emissions are driven by cattle number projections, increasing by nearly 40% by 2030 (provided by ILRI - International Livestock Research Institute). N_2O emissions are projected to grow by 20% between 2005 and 2030, driven primarily by increasing use of nitrogen based fertilizers, as productivity rates are increased. These projections do not take account of how climate impacts may affect predicted sector growth, nor the changing practices or structure of the sector in future years.

It is very difficult to make detailed projections of the potential for the export market on which Kenya is so heavily reliant, due to the global nature of this market. There is also an extremely strong potential influence on agriculture from future climate change, discussed in the main climate change impacts and adaptation of the report. Further consideration of these potential effects in light of projections is essential for future work.

Within Vision 2030, the general assumption seems to be that this export market is maintained. As well as the issues associated with climate change itself (above), there are also potential challenges in relation to the use of air transport for many goods and the issues with fuel prices, climate legislation, consumer choice, etc. This linkage between international mitigation and Kenya is another area that warrants further consideration, and this feeds though to one of the key overall study recommendations, that there is a need to re-assess Vision 2030 in light of the dual challenges of mitigation and adaptation at both domestic and international level.

There are quantitative targets for the Agriculture sector in 2012 given in Vision 2030 (GoK 2007), including: achieving an average growth rate of 7 per cent per year to 2012. It is proposed that this can be achieved by a series of measures, including productivity yield increases, land use transformation with at least 1 million additional hectares being brought into production and an extra 600,000 –1.2 million hectares being put under irrigation in arid and semi arid lands (ASALs). However, the projected longer term trends are not known. There are significant implications in relation to climate change, in terms of water availability, yields, etc in these projections. These are discussed in the main section on climate change impacts.

Agriculture is a key emitting sector currently and in future years. Developing robust current inventory estimates and projections is key to understanding future emissions and mitigation opportunities, but also for understanding a range of other issues with respect to water needs, land use change and future climate impacts, and associated adaptation needs. Currently, the future challenges for this sector are poorly understood.

Forestry

The inventory data in the 1st National Communication shows how forests play a key role in reducing CO_2 in Kenya. However, much of the forest cover is at risk from the increasing resource needs of the population (demand for land and forestry products). For example, the area of closed canopy forests has been reduced from 3% to 1.7% of the total land area since Kenyan independence. At the same time, key economic sectors, including cash and subsistence crop production, tourism and energy generation, have increasingly relied on the environmental services provided by indigenous forests (GoK 2005).

Kenya loses at least 5,000 hectares of forestland annually through excisions. This is from both plantations and indigenous forests within forest reserves but does not take into account what happens to non-gazetted forests i.e. those not surveyed, demarcated and declared forests reserves. In the last decade, of the estimated loss of gazetted forestland of 125,405ha, over 85% is indigenous forest and 15% plantations (GoK 2005).

Forest decline can be explained by a number of key pressures and issues (MEMR 2009):

- Demand for sustainable wood and fuelwood outstrips supply. With an annual per capita wood consumption of 1 m^3, the current demand stands at 37 million m^3 (or 148 million mature trees). However, the estimated sustainable wood supply is about 30 million m^3 thus creating a deficit of 7 million m^3.
- Pressure for conversion of forest land to other land uses
- Forest encroachments, illegal tree harvesting and charcoal burning
- Poverty and lack of alternative livelihoods
- Incomplete forestry policy
- Lack of adequate information on forests
- Fires due to arson or traditional management techniques
- Limited knowledge of the economic value of forests, and contribution to GDP

In Kenya's Vision 2030, protecting existing forest covers and increasing reforestation and afforestation activities are given high priority. Many of key forests are in the upper catchments of the main rivers, and therefore are critical to water catchment management, and reducing flood risk. Forests are have high biodiversity, and are therefore important for protecting for sustaining associated ecosystem services (economic production from natural systems), in particular tourism and forest products. In carbon mitigation terms, they are important sinks and help protect soils, also an important carbon store. The main section on climate impacts has a section on the role of forest ecosystem services in the Kenyan economy, and also investigates the potential effects of climate change on these.

Under its Vision, Kenya intends to achieve 10% forest cover by 2030. In the near term, the objective is to increase cover from 3% to 4% by 2012. If these objectives were realised, Kenya could in theory remain a net sink in emission terms. However, such targets are extremely challenging, with pressures on these resources projected to increase significantly due to economic and population growth. In addition, this objective requires significant investment recently estimated at KSh 578 Billion.[28]

The study has not made estimates of future projections for the forestry section, but it has discussion of the options and costs in relation to mitigation and REDD in the later sections of this report.

Projected GHG emissions for the overall economy

The projections developed for this study are brought together in Figure 16. This shows total emissions (left hand axis) by sector. The graph also plots the per capita emissions, i.e. total emissions divided by population in that year, shown on the right hand axis. The following key points can be made:

- Total emissions in Kenya are projected to increase by 120% by 2030, largely driven by increases in the transport sector
- Per capita emissions (excl. LUCF) increase by approximately 0.5 tCO_2/ capita over the 25 year time horizon but remain significantly below a 2tCO_2 per capita level
- The growth in emissions is relatively modest considering the high population and economic growth, due to the low carbon intensity electricity, household and industry sectors
-

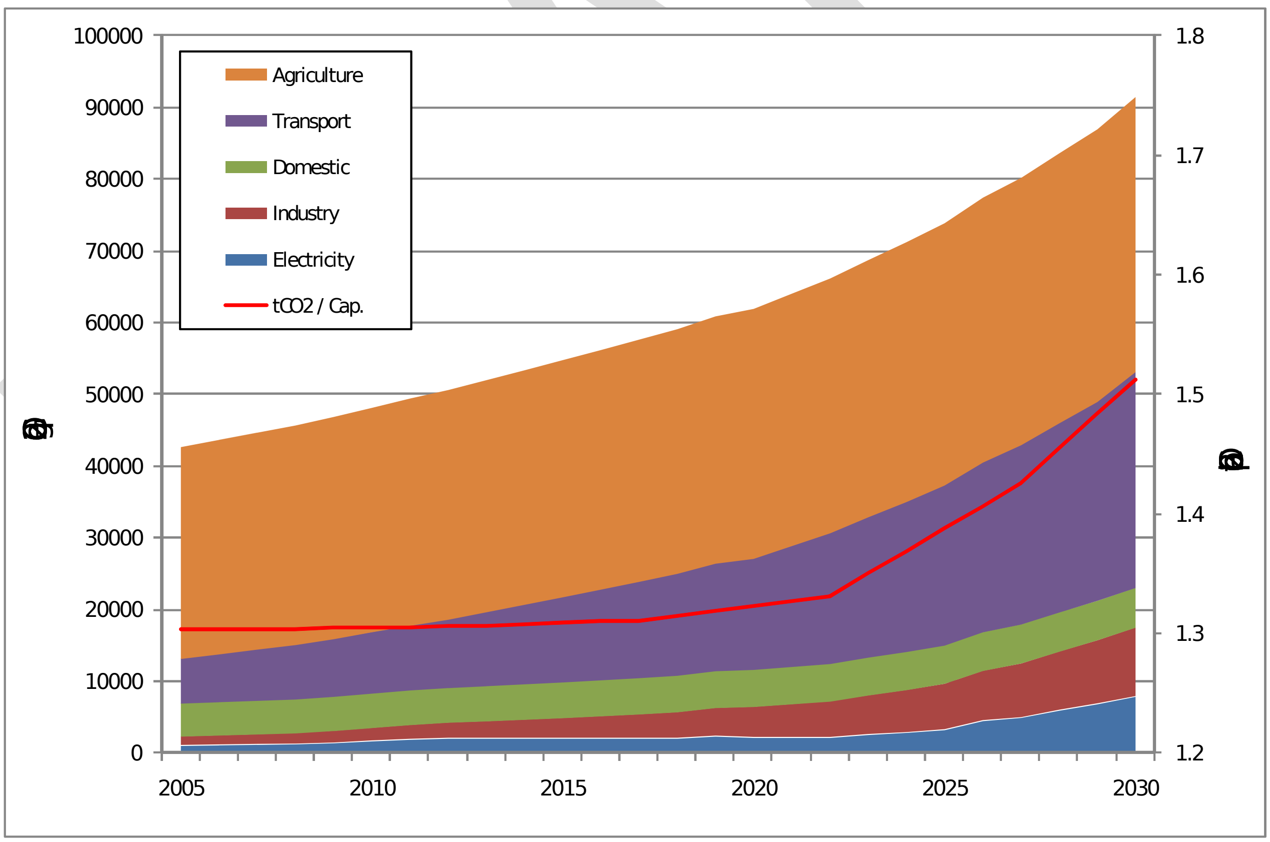


Figure 16. Projections of Kenya's GHG emissions (Gg CO2 eq.), 2005-2030

[28] Ministry of Environment internal estimates

For this assessment, a very simple projections approach has been used, which attempts to reflect the economic growth and development associated with Vision 2030. It illustrates that growth in emissions will be significant, projected to increase by 120% between 2005 and 2030 (or 42 to 91 Mt CO_2 eq.). It is also estimated that Kenya's per capita emissions could increase to 1.5 tCO_2 by 2030, kept at this level by significantly increasing population growth.

As shown in the figure above, electricity generation emissions are a small proportion of future Kenya GHG emissions albeit rising in later years due to the uptake of coal (2.4% in 2005, rising to 8.6% in 2030). Therefore a much wider economy-wide view beyond electricity generation is needed to advance low carbon growth. <u>A focus on the electricity sector alone will not move Kenya to a low carbon pathway.</u> For this to occur, larger emitting sectors needs to be addressed, particularly transportation and agriculture.

There are a range of assumptions that if revised could change the outlook significantly. Net emissions could rise if Kenya does not maintain a low carbon electricity system (e.g. coal became more prevalent) or does not deal with deforestation rates / increase forest cover. Emissions on the other hand may be lower if the projected population or economic growth does not materialise, and energy demand, for example, remains lower.

The analysis above is based on the Vision 2030 document, but this does not take into account the effects of climate change. There is a need to assess how the projections above would be influenced by climate change, and there is a need, as highlighted in the main climate change impacts section, to introduce climate risk screening into future low carbon plans in all sectors. There is also a need to re-assess the Vision document in light of the future domestic issues with mitigation and adaptation, but also in the context of changes at the international level that would in turn affect Kenya.