SEI STOCKHOLM ENVIRONMENT INSTITUTE

Economics of Climate Change
Kenya

2009

The Economics of Climate Change in Kenya:

EXECUTIVE SUMMARY AND KEY MESSAGES

November 2009

Key Messages

The economic costs of climate change

- Existing climate variability has significant economic costs in Kenya. Periodic floods and droughts (extremes) cause major macro-economic costs and reductions in economic growth.

- Future climate change will lead to additional and potentially very large economic costs. These are uncertain. However, aggregate models indicate additional net economic costs (on top of existing climate variability) could be equivalent to a loss of almost 3% of GDP each year by 2030 in Kenya.

- Costs include potential threats to coastal zones (sea-level rise), health burdens, energy demand, infrastructure, water resources, agriculture and loss of ecosystem services. The study has addressed the potential impacts and economic costs in these sectors.

- These highlight the importance of preparing for future climate change. While it is difficult to predict effects with confidence, there is a need to plan robust strategies to prepare for the future, rather than using uncertainty as a reason for inaction.

Adaptation

- Adaptation can reduce the economic costs of climate change but it has a cost. The costs of adaptation are still emerging. A number of categories of adaptation have been identified that relate to the balance between development and climate change.

- An initial estimate of immediate needs for addressing current climate as well as preparing for future climate change for Kenya is $500 million / year (for 2012). The cost of adaptation by 2030 will increase: an upper estimate of the cost is likely to be in the range of $1 to 2 billion / year.

- The study has also prioritised early adaptation across the sectors. These studies demonstrate that adaptation has potentially very large benefits in reducing present and future damages. However, while adaptation reduces damages, it does not remove them entirely. Residual impacts in Kenya, particularly for some regions and groups are expected and need to be managed.

Low carbon growth

- The analysis has considered future emissions for Kenya, consistent with planned development. Emissions of greenhouse gases (GHG) could double between 2005 and 2030. Moreover, plans across the economy could 'lock-in' Kenya into a higher emission pathway.

- The study has investigated a low carbon alternative pathway. This finds that a large number of 'no regrets' options that would enhance economic growth, as well as allowing further access to international carbon credits. They also have economic benefits from greater energy security and diversity, reduced air pollution, reduced environmental impacts.

- The study estimates energy related emission savings of 22% could be achieved by 2020, relative to the baseline, even for a small selection of options. Over 80% of these options can be realized at net negative cost. When carbon credits are included, this amount is likely to be even higher.

- Overall, because of its location, availability of resources and socio-economic conditions, the study concludes that there are significant economic benefits for Kenya in following a low carbon development path, as well as large environmental and social benefits.

- The study has outlined a number of recommendations and future priorities.

Executive Summary

This study has assessed '*the Economics of Climate Change in Kenya.* It was funded by DFID and DANIDA and undertaken by the Stockholm Environment Institute (in Oxford) working with local partners. It covers:

1. The impacts and economics costs of climate change;
2. The costs of adaptation; and
3. The potential for low carbon growth.

The study has advanced a number of approaches to investigate these areas, using aggregated analysis (top-down), sector assessment (bottom-up) and case studies. The key messages are presented below.

1. The Economic Costs of Climate Change Impacts in Kenya

The first key finding is that ***existing* climate variability has significant economic costs in Kenya.**

- Periodic floods and droughts (extreme events) already cause major socio-economic impacts and reduce economic growth in Kenya. Recent major droughts occurred in 1998-2000, 2004/05 and in 2009. Major floods occurred in 1997/98 and 2006.
- The economic costs of droughts affect the whole economy. The 1998-2000 event was estimated to have economic costs of \$2.8 billion from the loss of crops and livestock, forest fires, damage to fisheries, reduced hydro-power generation, reduced industrial production and reduced water supply. The 2004 and 2005 droughts affected millions of people and the recent 2009 drought has led to major economic costs from restrictions on water and energy.
- The 1997/98 floods affected almost 1 million people and were estimated to have total economic costs of \$0.8 to \$1.2 billion arising from damage to infrastructure (roads buildings and communications), public health effects (including fatalities) and loss of crops. The more recent 2006 event affected over 723,000 people in Kenya.
- The continued annual burden of these events leads to large economic costs (possibly as much as \$0.5 billion per year, equivalent to around 2 % of GDP) and reduces long-term growth. There is some indication that there has been an intensification of these extreme events over recent decades and these may reflect a changing climate already. However, these impacts also have to be seen in the context of changing patterns of vulnerability, for example from changing land–use patterns, rising populations, etc. Nonetheless, a key finding is that Kenya it is not adequately adapted to deal with existing climate risks.

The second key finding is that ***future* climate change will lead to additional and potentially very large economic costs.**

- Africa is predicted to have greater impacts than other world regions, because of higher vulnerability and lower adaptive capacity. Impacts could threaten past development gains and constrain future economic progress. Some regions and populations in Kenya have very high vulnerability. The study has investigated these effects using a number of different approaches.

Top down aggregated estimates

- The study has undertaken top-down aggregated assessments of the economic costs of climate change using global models. These future economic costs are very uncertain. However, aggregate models indicate that the additional net economic costs (on top of the costs of existing climate variability) could be equivalent to a loss of 2.6% of GDP each year[1] by 2030 in Kenya.

[1] Central net values (sum of positive and negative) for market and non-market effects. The results exclude future extremes (floods & droughts) and do not capture a large range of potential effects including all ecosystem services.

- In the longer-term, after 2050, the economic costs of climate change in Africa and Kenya are expected to rise, potentially very significantly. However, the aggregate models report that global stabilisation scenarios towards a 2ºC target could avoid the most severe social and economic consequences of these longer-term changes. This emphasises the need for global mitigation.

Sector (bottom up) assessments

- The study has also undertaken bottom-up assessments of the impacts and economic costs of climate change for a number of sectors, using climate and socio-economic projections.
- Kenya already has a complex existing climate, with wide variations across the country and very strong seasonality. It has two wet seasons and has strong patterns of climate variability and extremes, not least due to the periodic effects from ENSO: El Niño and La Niña, which are associated with extreme rainfall and flooding and droughts (respectively).
- The study has considered projections of future climate change from a suite of downscaled global models for Kenya.
    - *Temperature*. The projections indicate future increases in mean annual temperature (average monthly temperatures) of broadly 1 to 3.5 ºC over the range of models by the 2050s (2046 -2065). There will also be increases in sea level.
    - *Rainfall*. The changes in precipitation are more uncertain. All the climate models show that rainfall regimes will change but these vary with season and region. Most models project rainfall will increase on average, though some models project rainfall reductions in some months for some areas.
    - *Extreme events*. The information on extreme events (floods and droughts) is much more variable and future projections vary widely. Many models indicate an intensification of heavy rainfall in the wet seasons, particularly in some regions and thus greater flood risks. Droughts are likely to continue but the projections are more varied - some models project an intensification of these events, particularly in some regions, though other models indicate reductions in severity.
- The range of model results highlights the considerable uncertainty in predicting future effects, especially in relation to scenarios of future rainfall, floods and droughts, though also due to future socio-economic conditions and environmental services. Nevertheless, the analysis here does reveal potential areas of concern and helps focus priorities. Furthermore, it is essential to recognise this uncertainty, not to ignore it. There is a need to plan robust strategies to prepare for uncertain futures, rather than using uncertainty as a reason for inaction. The study has applied available projections to sectoral assessments, outlined below.
- *Coastal zones*. The study estimates potentially large economic costs from climate change in Kenya in the absence of adaptation. The study has considered the range of projections for sea level rise from the IPCC, plus an additional scenario based on some of the more recent literature, which reports potentially higher values. The analysis shows that coastal flooding from sea level rise is estimated to affect 10,000 to 86,000 people a year by 2030 (across the scenarios), as well as leading to coastal wetland loss and coastal erosion. The associated economic costs in 2030 are estimated to be $7 - 58 million per year (current prices, no discounting) including flooding. By 2050, these costs could increase to $31 - 313 million per year.
- *Health*. The study estimates in the absence of adaptation, there could be a potentially large increase in the rural health burden of malaria in Kenya. This arises because a large part of the rural population lives at higher elevations, where the disease is currently restricted by temperature. The study has applied a new malaria risk model, based on altitude, and finds that climate change could increase the rural population at risk for malaria by between 36% to 89% by the 2050s affecting an extra 2.9 to 6.9 million people (across the range of temperature projections). The economic costs of this additional burden are estimated at $45 to 99 million annually in terms of direct costs, but rise to $144 - $185 million if full economic costs are considered (including disutility from pain and suffering). The study has also identified other possible direct and indirect health effects from climate change.

- *Agriculture*. The study has considered the potential effects in the agricultural sector, though this is one of the most challenging areas to investigate due to the complexity of analysis and the wide variations with geographical location. Existing studies report that the economic effects for agriculture vary with the range of climate projections and the analytic models used. Under some futures and with certain models, modest impacts on agriculture are predicted in the medium term (with some regions even experiencing increased agricultural yields). However, under other scenarios and other models there are high economic costs projected. Moreover, a range of additional factors are also important, which are not included in these assessments, including extreme events, pests and diseases, etc.

- The study has commissioned new studies on shifts in agro-ecological potential, which consider agro-ecological zones, future land use change and productivity, exploring the sensitivity of agricultural and pastoral lands to climate change, within a GIS environment. The analysis assessed the potential shifts in the value of agricultural land, evaluating some 150 land units that are potentially sensitive to climate change. This provides information on the potential changes in land value as a result of climatic events and longer term climate change, under two scenarios. The first assumes a national drought occurs with the most severe impacts in the drylands and relatively modest impacts in the humid highlands. This reduces maize production dramatically and the total value of agricultural land in Kenya is reduced to about two-thirds of the average value. The second investigates the longer term consequences of climate change, assuming wetter conditions prevail, which increases land value in the central zones but not the highlands, with an overall 10% increase in the value of agricultural land.

- *Extreme events*. Even in the absence of climate change, the economic costs of the periodic floods and droughts that affect Kenya could rise significantly in future years, due to socio-economic change (population and economic growth). The study has assessed these changes and finds that in the absence of adaptation, these drivers could increase the costs of events by a factor of five by 2030, i.e. a periodic large-scale event could have direct economic costs of $5 to 10 billion. A key priority therefore is to increase the resilience of Kenya to cope with these extreme events. Climate change is likely to further increase the economic costs of these events. Many of the projections indicate a change in heavy precipitation events for Kenya. These increases in intensity would increase the economic costs of periodic flood events significantly, because the costs rise very sharply with flood depth and strength. They would also mean a reduction in the return period of larger events, i.e. more significant floods would occur more frequently. Even when annualised, these indicate significant increases in economic costs. The effects on droughts are more uncertain, but the range of model projections does include changes that would exacerbate existing periodic events for some regions of the country, which would further increase economic costs.

- *Water resources*. The study has investigated the potential multi-sectoral effects of water resources and climate change using a case study for the Tana River basin using a water planning model. The results vary strongly with the climate projection. The economic impact of climate change (without adaptation) for this one river basin ranges from a benefit of $2 million to a cost of $66 million for hydropower, irrigation and drinking water across the range of projections.

- *Energy.* The study has investigated energy demand. The trend in average temperatures will increase the number of hotter days and increase the cooling burden, particularly in urban areas. These are important for building comfort levels and potentially effects for health. The projected higher temperatures, combined with higher incomes, will increase electricity demand and have high economic costs: as an example the burden of cooling demand could increase by 240 – 340 % in Mombasa by the 2050s. This will increase electricity demand for cooling and have economic costs, particularly to certain sectors (e.g. tourism).

- *Ecosystem services*. Kenya has exceptional biodiversity. These ecosystems provide multiple benefits to society, which in turn have economic benefits, though these are rarely captured by markets. These benefits are known as ‘ecosystem services’ and include provision of food, supporting services such as nutrient recycling, regulatory services including flood protection and recreational and cultural services. The study has mapped the potential ecosystem services in Kenya and considered (qualitatively) the potential additional pressures from climate change. The study finds that ecosystem services are integral to the Kenyan economy and underpin large parts of GDP, foreign revenue and export earnings, as well as sustaining a very large proportion of the population. There are many stresses on these systems already and climate change will add to these pressures.

- The study has undertaken a number of case studies to provide more detailed local analyses. This has included a case study on sea level rise in Mombasa, flood events, vulnerable groups and iconic ecosystems (including wildlife parks).
- Overall, the bottom-up sectoral analysis indicates that in the absence of adaptation, the aggregated estimates of economic costs - which occur on top of the existing effects of current climate variability - could potentially be very large. **Detailed analysis for coastal zones and health alone indicate future economic costs could be several hundred million dollars a year by the 2050s under some projections**. There are also potential effects on ecosystem services, which whilst difficult to estimate in economic terms, could be as important. The analysis of future costs of extreme events indicates large increases in the economic costs of these events are possible. Finally, there are some possible scenarios of climate change on the water and agricultural sector which would lead to high economic costs and have very significant effects on rural livelihoods. **Overall, the bounded range of economic costs could potentially be very large, in terms of the equivalent costs to GDP**. **There is also likely to be a strong distributional pattern of effects, with some sub-regions and some groups affected more than others.**

2. The Economics of Adaptation in Kenya

Adaptation can reduce the economic impacts of climate change but it has a cost. The costs of adaptation are still emerging and are uncertain. However, this does not mean that no action should be taken. Instead it requires more robust strategies.

Four categories of adaptation have been identified that relate to the balance between development and climate change.

Two of these are development activities and are targeted towards the large economic costs of current climate variability. They are:

1) Accelerating development to cope with existing impacts, e.g. integrated water management, electricity sector diversity, natural resources and environmental management.

2) Increasing social protection, e.g. cash transfers to the most vulnerable following disasters, safety nets for the most vulnerable.

The second two are associated with tackling future climate risks and are

3) Building adaptive capacity and institutional strengthening, e.g. developing meteorological forecasting capability, information provision and education.

4) Enhancing climate resilience, e.g. infrastructure design, flood protection measures.

The overall costs of adaptation vary according to which of these categories is included. Sources of finance and the balance of public and private costs of adaptation differ between these four categories.

Top down aggregated estimates

- The study has investigated the top-down aggregated estimates of the costs of adaptation. This has used estimates for Africa/East Africa and scaled these to Kenya.
- The immediate needs (for 2012) for building adaptive capacity and starting to enhance resilience (immediate priorities) are estimated at \$100 – 150 million/year. However, a much higher value of \$500 million/year or more is warranted if the categories of social protection and accelerated development (to address the current adaptation needs) are included. As highlighted above these categories are associated with current climate variability – such as the existing vulnerability to droughts and floods - and are therefore associated with development, rather than with future climate change. However, investment in these areas provides greater resilience for future change and they are essential in reducing future impacts.

- The estimated costs of adaptation will rise in future years. The aggregated estimates provide a possible range, with implications for the source and level of finance required. Estimates of medium-term costs to address future climate change are typically of the order of $250 – 1000 million per year for Kenya by 2030, focused on enhancing climate resilience. Note that the investment in 2030 builds resilience for future years when potentially more severe climate signals occur. However, higher values (a total of up to $2000 million /year) are plausible if continued social protection and accelerated development are also included, noting that these are primarily development activities.
- The totals are shown in the table below.

	Adaptation Needs	$ Million/year
Adaptation Strategies	**2012**	**2030**
Development related **1) Accelerating development &** **2) Increasing social protection**	$500 million/year	$500 – 1000 million/year
Climate Change specific **3) Building adaptive capacity &** **4) Enhancing resilience**	$100 – 150 million/year	$250 – 1000 million/year

- Using these numbers, **the study concludes that a conservative estimate of immediate needs for addressing current climate as well as preparing for future climate change is $500 million / year (for 2012). The cost of adaptation by 2030 will increase: an upper estimate of the cost is likely to be in the range of $1 to 2 billion / year.**

Sectoral (bottom-up) assessments

- The study has also assessed the costs of adaptation for Kenya using a sectoral bottom-up approach. This tests the estimates above and gives greater insight into sectoral planning.
- The study has advanced a framework to prioritise early adaptation in the sectoral analysis, which considers uncertainty within an economic framework. This identifies early priorities for adaptation of:
  - Building adaptive capacity;
  - Focusing on win-win, no regret or low cost measures (justified in the short-term by current climate conditions or involving minimal cost);
  - Encouraging pilot actions to test promising responses; and
  - Identifying those long-term issues that require early pro-active investigation (though not necessarily firm action).
- The study has considered these adaptation responses as a series of steps, together forming an ‘adaptation signature’. These identify actions in each of the four strategies by sector. The broad outline of steps is the same in each sector. However, the exact activities vary, hence the use of a ‘signature’ concept that considers options on a case by case basis. These signatures have been used to develop sector strategies, key actions and indicative adaptation costs. These have been complemented by case studies which include examples of adaptation projects and costs.
- For coasts, the study has assessed the costs of adaptation and finds that the potential impacts and economic costs in this sector can be significantly reduced. Adaptation has large potential benefits in reducing coastal erosion and inundation and the number of people potentially flooded could be dramatically reduced.

- For <u>health</u>, the study has assessed the potential costs of adaptation to address the potential increasing burden of malaria and has found that epidemic detection and prevention would be very cost effective.
- For <u>water resources</u>, the study has assessed sectoral activities for climate resilient development and adaptation mainstreaming. It has also investigated adaptation with the Tana River basin case study, assessing the costs and benefits of adaptation strategies. This finds economic impacts of demand-side measures (e.g. increased end use efficiency) are always positive across the range of climate scenarios, but that supply-side and ecosystem interventions only have net benefits under more adverse (highest temperature, lowest precipitation) projections of climate change.
- For <u>agriculture, energy and for extreme events</u>, the study has assessed the scale of effort that may be required and some of the urgent priorities.
- A large number of immediate priority areas and no regrets options have been identified from these assessments. As examples, they include the strengthening of effective surveillance and prevention programmes for health linked to enhanced meteorological systems and similar strengthening in other areas (e.g. expanded monitoring of key ecosystems). They also include capacity building to strengthen the meteorological analysis and forecasting for seasonal outlooks (agriculture) and extreme events (flood risk), with the latter linked to the strengthening of early warning and disaster risk reduction, as well as risk mapping and basic screening in planning. Finally, they include pilot actions across all sectors and for promising options the potential scaling up of sectoral programmes.
- The sectoral assessments and the case studies show relatively high adaptation costs, which re-enforce the top down adaptation estimates for 2030 and justify investment needs. They also demonstrate the potentially much larger costs when development-adaptation needs are included (the categories of accelerating development to cope with existing impacts and increasing social protection outlined above). Finally, the studies demonstrate that adaptation has potentially very large benefits in reducing present and future damages.
- However, while adaptation reduces damages, it does not remove the impacts of climate change entirely. **Residual impacts in Kenya, particularly for some regions and groups of society, are expected and will need to be managed**. They will also be important for recovery after climatic disasters and for future impacts. It is also highlighted that these residual impacts – and their economic costs – are additional to the costs of adaptation. This is important for international negotiation discussions which have tended to focus only on the latter to date.
- Finally, while there is a large need for adaptation finance, **accessing adaptation funds will require the development of effective mechanisms, institutions and governance structures**. There is a need for Kenya to agree on next steps, the future focus and to build capacity, including national and sectoral planning objectives, enhanced knowledge networks and verifying outcomes of adaptation strategies and actions.
- **Uncertainty is a reason for action**. The future cannot be predicted, but sound national policy, shared knowledge, robust sectoral strategies and capacity for adaptive management are the necessary foundations for being prepared.

<u>3. Low Carbon Growth in Kenya</u>

Emission projections

- **The analysis has first considered current emissions. Kenya currently has relatively low emissions of greenhouse gases (total and per capita). Moreover, Kenya has already introduced a range of low carbon options across many sectors**. These include renewable energy in the electricity sector, more efficient use of biomass and sustainable land use management.
- The study has then considered the potential change in emissions consistent with planned development in the Vision 2030 plan and developed a future emissions profile for Kenya. This

projects that the strong growth planned in the Vision document, as well as other changes from population and urbanisation, will increase future total and per capita GHG emissions significantly, even though Kenya is initiating some options that are consistent with a low carbon development path.

- **Under the future 'business as usual' development scenario, the study estimates that total emissions of greenhouse gases will double between 2005 and 2030**. These future increases are driven by the transport and agriculture sectors, which are likely to become the dominant sources of future emissions. However, even in the electricity sector, which currently has a high share of renewables (hydro), the current plans for coal development will increase the carbon intensity of generation.
- **The current plans across the economy (or for some sectors, the lack of plans) could 'lock-in' Kenya into a higher emission pathway**. The increases from the transport, agricultural and electricity sectors, and the associated increase in national emissions, would occur at exactly the time when there are likely to be greater economic opportunities for international carbon credits, particularly if national level GHG mechanisms emerge. Following these higher carbon pathways will therefore lead to an opportunity loss for Kenya. They could also lead to other economic, social and environmental costs: an example would be the increased congestion, higher fuel costs, greater fuel imports and higher air pollution that would occur unless private car transport is tackled in Nairobi.

Low carbon options

- The study has investigated low carbon options across the economy, developing a low carbon alternative pathway. This shows that **there are a large number of 'no regrets' options, particularly from improvements in transport efficiency, domestic stoves and agriculture, as well as for the electricity sector**, which would enhance economic growth, as well as allowing further access to international carbon credits. These options produce significant emission savings and can be realized at negative cost, i.e. the economic benefits outweigh the costs. An example is potential energy efficiency measures that actually save the individual or company money (e.g. from reduced fuel costs) when compared to the current baseline. These options also have wider economic benefits from greater energy security and diversity, reducing air pollution and reducing environmental impacts. Many of the options also increase the resilience of the system to future climate change, e.g. such as geothermal offering diversity away from hydro generation (which is vulnerable to droughts).
- The study has evaluated the emission reduction potential for a sub-set of potential sectors and options and compared this against the 2030 baseline. This shows **these options have the potential to produce emission savings of 22% for energy related emissions, relative to the baseline**. Over 80% of these options can be realized at net negative cost. When carbon credits are included, this amount is likely to be even higher.
- **The study also highlights the need to widen this analysis and to develop a longer term strategy up to and beyond 2030**. This needs to consider how international action by developed countries to address climate change might affect Kenya, notably in relation to its planned economic growth in areas such as tourism, agricultural exports, etc.
- Finally, it is essential to consider how best to co-ordinate co-operative regional (East African) responses to enhance opportunities for carbon credits and regional resilience (e.g. electricity transmission networks).
- Overall, **because of its location, availability of resources and socio-economic conditions, the study concludes that there are significant economic benefits for Kenya in following a low carbon development path, as well as large environmental and social benefits**. Such a pathway is strongly in the country's self interest, and would also provide potential extra investment from carbon financing. The low carbon path investigated produces very real economic, environmental and social benefits, including ancillary benefits of reduced fuel imports, improved air quality, improved energy security, and reduced pressure on natural resources.

Recommendations

The study has outlined a number of recommendations and future priorities.

A key recommendation is the need for Kenya to get ready and act now

Key elements are to improve estimates; advance institutional and policy development; explore sectoral pilot tests; undertake investment analysis, revisit Vision 2030, to advance low carbon growth paths and to enhance regional co-operation. Specific actions are outlined below.

- *Improving the estimates*. Further work is needed to improve these initial estimates and to give a degree of confidence in the analysis. Such a follow-on phase might include:
  - A broader consideration of additional risks not yet covered, e.g. within existing sectors (such as assessing additional health risks), for additional sectors yet covered (e.g. tourism and industry) and for cross-sectoral issues and indirect effects.
  - For the key priorities identified here, a deeper analysis by sector, i.e. to further explore coastal risks, health burdens, agriculture, water/flood risks, energy supply and demand and ecosystem services. This would need a multi-stakeholder assessment of adaptation pathways at different scales, with estimates of costs, focused on short- and medium priorities that are most relevant for policy.
  - On the low carbon side, it would be useful to undertake a more comprehensive analysis of future emission projections and potential opportunities, with full marginal abatement cost curves and analysis of urgent priorities across all sectors.
  - For both adaptation and mitigation, analysis of the costs, including government, the sector and individuals. This step would provide both adaptation and low carbon costs in detail and as part of an investment and financial flow analysis (by sector). Matching the costs against the wide range of potential finance is a prerequisite for a viable investment plan.
  - Taken together, this analysis could form the basis of an expanded climate strategy that links national policy to sectoral objectives and targets, with effective mechanisms for implementation, monitoring, reporting and verification.
- *Urgent priorities*. There are a number of urgent priorities for building adaptive capacity in Kenya that should be fast-tracked, notably in relation to monitoring, forecasting and information (as these underpin future prediction and analysis) and early warning systems, as well as information provision, monitoring (indicators), and supporting science-policy networks and sectoral focal points. These early priorities are part of a broad strategy to increase the knowledge base, including education and training and strengthening existing programmes.
- *Climate change risk screening*. There is a need to build future climate change risk screening into development and planning, at a sectoral and regional level. Information on climate, resources and adaptation strategies and options should be mainstreamed into all sectoral plans.
  - The study recommends that a **national knowledge management system** be developed; with easy access by all stakeholders.
- *Building Capacity*. Access to substantial adaptation funds must be assured. However, **mechanisms, institutions and governance systems for effective use must be developed** to allow Kenya to access these funds. This requires early and concerted action to build capacity across stakeholders and with the affected communities themselves. This is an early priority.
  - **A national adaptation facility should assess the potential for climate resilient growth across all areas of the economy** and to mainstream adaptation into government departments and with Kenya's development partners.
  - A multi-stakeholder trust fund would enable early and timely action and is an early priority, encouraging learning by doing and establishing the basis for scaling up to sectoral resilience.

- *Low carbon pathways*. There are many benefits if Kenya switches to a lower carbon pathway. However, this will not happen on its own and steps are needed by Government, business and civil society to realise these benefits and to maximise the potential flow of carbon credits under existing and future mechanisms. Specifically:
    - **Low carbon plans** should extend beyond the power generation sector. This will necessitate a greater focus on transport and agriculture.
    - There is a particular need to **consider areas of future development** that might 'lock-in' Kenya into higher emissions pathways, notably in energy, transport and urban environment. It would be useful to specifically address these threats and to identify alternatives.
    - All future plans and policies, including low carbon investment, should consider future climate change, which necessitates **climate risk screening in future low carbon plans across all sectors. Potential linkages between adaptation and low carbon development (especially in finance) should be explored.**
- *National policy and Vision documents*. Planned revision of national policy should **examine the potential effects of climate change and the potential for adaptation and low carbon growth**. There is also a need to build on existing government and donor activities. There is a need to develop a new strategic vision for Kenya that addresses these areas, for example, with **further development of the Vision 2030 document**, including both domestic and international aspects.
- *Regional collaboration*. There is also a need for **regional collaboration and co-operation** across the areas of low carbon growth and adaptation, to benefit from economies of scale and to enhance regional resilience.
- The steps above would provide national action on a low-carbon, climate resilience investment plan and **would establish Kenya as an international leader, with 'early mover advantage' in negotiations and securing finance.**

A summary of key next steps is presented in the tables over the page.

Adaptation Strategies	Priority Actions
Immediate needs & capacity building	• Expanded research assessment into effects, adaptation and economics. Early capacity building and early warning systems • Develop national climate change strategy including knowledge management and screening of sectoral and regional plans for climate risks and adaptation opportunities. Include in national policies. Build into long-term vision (e.g. Vision 2030) • Prepare plans for a national adaptation authority or facility to improve sectoral coordination, link to international finance, and support private sector. Enhance links between adaptation and low carbon.
Climate resilience	• Climate resilient strategies, objectives and targets for immediate concerns (for example, linking cross-sectoral climate monitoring with exposure, impacts and adaptation actions; knowledge management; health and vector-borne disease responses; drought and flood risk screening for new projects) • Develop prototypes of sectoral actions (pilots) and pathways for scaling up to cover all vulnerable regions and populations
Social protection	• Protect vulnerable livelihoods and strengthen existing social protection programmes, expanding the coverage to consider climate change.
Accelerated development	• Adapt existing development projects to include 'no regret' measures to reduce climate risks and opportunities to develop adaptive capacity • Scale up successful prototypes to sectoral development plans

Mitigation Strategies	Recommended Actions
Low-Carbon Growth (LCG)	• Full analysis of baseline projections, low carbon options, costs and potential for prioritisation and development of strategy for mechanisms. • Develop national strategies to mainstream LCG in planning. Build into long-term vision (e.g. Vision 2030), including potential effects from international action. • Facilitate carbon finance opportunities in voluntary and compliance carbon markets (VCM, CDM) • Prioritize agriculture, transport and electricity generation low carbon measures, considering short-term opportunities but also longer-term areas where potential 'lock-in' and identify alternatives. Improve sectoral co-ordination. • Look for synergistic adaptation – low carbon project opportunities, e.g. agro-forestry and sustainable land-use
Climate resilience & co-benefits	• Climate risk screening of low carbon growth pathways • Explore opportunities in case studies of major low carbon strategies such as geothermal, biofuels and on-farm carbon management and how they might be scaled up to achieve both reductions in future emissions and adaptive development.

Project Description and Project Team

The **Stockholm Environment Institute** (SEI Oxford Office) led the study. SEI is an independent, international research institute, engaged in environment and development issues at local, national, regional and global policy levels. The SEI has a reputation for rigorous and objective scientific analyses of complex environmental, developmental and social issues. The Oxford office leads development of the weADAPT.org platform, managed by the Global Climate Adaptation Partnership (www.ClimateAdaptation.cc).

This study was commissioned under DEW Point, the DFID Resource Centre for Environment, Water and Sanitation (Bruce Mead) which is managed by a consortium of companies led by Harewelle International Limited. The project team for the study included.

- SEI Oxford, UK.
- SEI Nairobi.
- IGAD Climate Prediction and Applications Centre (ICPAC).
- Metroeconomica.
- London School of Hygiene and Tropical Medicine.
- ILRI
- School of Civil Engineering and the Environment, University of Southampton.
- SCC-VI Agroforestry.
- Oxfam Kenya.
- IIED.
- Camco.

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Full project reports and detailed technical annexes to support this document are available on the project website:
http://kenya.cceconomics.org/
see also the FAQ and supporting material on the economics of climate adaptation in weADAPT.org.

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