

6) A Low Carbon Growth Strategy

In many sectors, Kenya is already on a low carbon pathway because of the significant renewable resources it has. This is particularly demonstrated in the low carbon intensity of the electricity generation system, the dissemination of renewable decentralised technologies (solar PV systems for homes), the widespread use of biomass and the significant forest resources (holding carbon stocks). This suggests that to a certain extent it is very much in the interest of Kenya to be low carbon e.g. due to the prevalence of renewable resources, this type of energy is more cost-effective than fossil-based alternatives.

Whilst Kenya has a relatively low carbon intensive economy, very high projected rates of economic and population growth may see carbon intensity increase. The question is whether it is in the interest of Kenya to push for lower carbon growth; clearly there will be global benefit due to lower future emissions. Fundamentally, this is likely to be based on whether the additional costs of an alternative low carbon growth path outweigh the benefits. In addition, there is also the question of whether the low carbon growth path is also as resilient to future climate impacts predicted, including extreme weather events (droughts and flooding) which appear to be more frequent even in recent years.

The apparent benefits of a low carbon growth path are firstly economic. This is demonstrated in the electricity sector, which is projected to remain relatively low carbon under the baseline because of the abundance of cost-effective renewable generation potential, both in-country (geothermal) and in neighbouring countries (hydro, particularly in Ethiopia). There are however concerns that a significant future reliance on hydro may leave the system vulnerable to shortages (due to reduced rainfall or water scarcity due to demand elsewhere), and a move to more reliable fossil generation. Therefore, the issue of climate resilience is key. The low carbon generation system will also provide low carbon electricity to a rapidly expanding consumer base, displacing biomass and kerosene in the household sector. This change in consumption and a continuing significant contribution from biomass means that this sector will remain relatively low carbon in future years.

Secondly, a move to a lower carbon pathway can also mean technology improvements; economic modernisation may well push technology advancement forward, realising this important synergy. Thirdly, lower carbon growth opens the door to carbon financing; while access to such financing needs to improve for lower income countries like Kenya, it is clear that a range of financing options are being discussed that could make lower carbon options more economically attractive. Fourthly, many lower carbon options offer a range of co-benefits to social welfare, health, energy security and wider environmental quality.

Finally, as Kenya develops and meets its objectives of becoming a modern economy with increased quality of life (as set out in the Vision 2030), it may be treated differently as a developed nation under any future climate agreement. This could include setting carbon reduction targets; therefore, the carbon footprint of large-scale investments (e.g. power plant, transport systems) in the next 10-20 years should include assessment of the risks of *lock-in* to higher carbon technologies, particularly for investments that last 40-50+ years. Such investments once made are sunk and very expensive to stop operating in a lower carbon world.

Recognising the benefits as outlined above, in particular that a lower carbon pathway does not necessarily lower growth and require significant additional financing, this and subsequent analyses should focus the mind of policy makers on the opportunities for low carbon growth, particularly as the 2nd implementation plan for the Vision 2030 is developed. Importantly, it also supports many of the policy objectives that need to be met for sustainable development as discussed.

Whilst the opportunities have been stressed, there are however significant challenges. One of the most significant is population growth and rapid urbanisation, which will put additional pressure on planning

(including spatial planning) for a lower carbon future. These drivers will increase demand on energy, food and water, leading to increases in emissions. This means that opportunities for implementing lower carbon alternatives needs to be an integral element of the planning and policy making system. This would in effect remove the need to balance climate objectives (adaptation / mitigation) against economic growth consideration because they would be inextricably linked.

Challenges of rapid urbanisation

High urbanisation rates now and in future years provides an important context for assessment of a lower carbon pathway. By 2030, most of the population are predicted to be living in urban areas, which means that any strategy to move to a lower carbon pathway also needs to reflect this demographic shift. In addition, this needs to be strongly linked with adaptation measures.

Developing urban transport systems that allow for urban growth whilst reducing carbon emissions will be critical. This includes public transport systems that can be developed to accommodate growing populations but also reflect how urban areas are foreseen to grown. Spatial and transport planning need to be wholly joined up. Lower emission vehicles and alternative transport fuels (CNG / biofuels) may also be part of a more sustainable urban transport system. There are also considerable co-benefits to be realised through this approach, including lower air pollution, less congestion and potentially safer roads.

Housing planning should also integrate lower carbon objectives, such as promoting build that requires less cooling, and increasing green areas to reduce urban heat island effects. The needs of adaptation should also be considered e.g. built to enhance water collection (to reduce pressures on public systems). Effective planning and creative urban design are going to be key to ensure climate proof, low energy buildings. This of course extends to other urban infrastructure. Affordability will also be key, in addition to policies that will ensure poorer communities (e.g. slum dwellers) can also benefit from such sustainable urban growth.

Further work is required to better understand the urban aspects of a lower carbon pathway, and is an important recommendation of this study.

There are also barriers that need to be overcome to increase uptake of low carbon technologies. These are summarised by Grantham Research Institute (2009), and include (in order of most stated by countries surveyed):

- Economic / market barriers (e.g. no finance, poor commercial case)
- Low levels of information / awareness
- Policy / regulatory framework
- Technical problems of use in-country
- Lack of skills / know-how
- Limited institutional capacity

Identifying, acknowledging and overcoming such barriers is crucial in promoting and delivering a lower carbon strategy.

In conclusion, 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. A low carbon pathway is strongly in Kenya's self interest, and would also provide potential extra investment from carbon financing. This is also important given the goal to become a middle income country by 2030, as countries of this development level will need to be reducing GHG emissions from the planned baseline level, if the global target to limit global temperature change to 2 degrees is to be achieved.

Study recommendations

Specific recommendations from the study are as follows:

- In this initial study, emissions projections, consistent with Vision 2030 as far as possible, suggest significant increases in emissions in future years, particularly in the agriculture sector but also in a rapidly growing transport sector. There are, however, large uncertainties around Kenya's national emissions and growth path. Whilst the broad conclusions of large increases in emissions are relatively robust, further work is needed to improve these initial estimates and to give a degree of confidence in the analysis and this is a priority research areas.
- In many areas, Kenya is already initiating measures and policies that are consistent with low carbon development. This includes the electricity sector power emissions. However, the current plans do not maximise the economic potential that could be gained. In many sectors, the current plans are likely to 'lock-in' Kenya to a higher emission pathway, which will reduce future economic opportunities and are also likely to reduce future economic growth. An example already existing in the electricity sector with the planned implementation of coal fired generation. These need to be identified and ideally, alternatives considered.
- The study has outlined an alternative low carbon path for Kenya. This initial analysis projects very real economic, environmental and social benefits from adopting a low carbon development path. These include both direct economic benefits (no regret opportunities), additional economic benefits from carbon financing, and wider economic benefits from ancillary benefits of these policies, including reduced imports, improved air quality, improved energy security, reduced pressure on natural resources. The key aim for Kenya is to continue this switch to a lower carbon pathway, to further realise these benefits, and to maximise the potential for the flow of carbon credits under existing and future mechanisms. Further assessment of how far Kenya goes down the low carbon pathway is needed, to robustly assess the full costs and benefits.
- Unlike other countries, power generation is a very low proportion of total emissions, and will continue to be so in the future under the baseline Vision 2030 projections. It is therefore a priority to tackle these other sectors, because in contrast to the power sector, emissions from these sectors are already increasing, and are projected to rise dramatically in the future along the development pathway towards a middle income country. These must also be addressed to achieve low carbon growth – and we emphasize that addressing the electricity sector is only a small part of the overall story. A key conclusion and recommendation is for the need for Kenya to move beyond the narrow interpretation of low carbon in just the electricity sector, and progress at an economy wide level.
- While the electricity generation sector plans project a low carbon future, there are some risks, and therefore more work should be undertaken to consider the following:
 - Exposure to climate impacts. Kenya will be very exposed to regional variability in rainfall due to domestic and imported reliance on hydropower. There is a need to build climate risk screening into future low carbon plans across all sectors
 - Exposure to system reliability problems. A high renewable system can carry risks if specific resources do not achieve projected generation, hydro being the obvious example. Kenya maybe reducing exposure in future years by maintaining fossil based generation
 - Energy security concerns. Future reliance on imports are premised on large infrastructure projects being completed, and political stability in the region
- Agriculture and transport remain the large emission growth sectors. For transport, while efficiency gains offer significant opportunities, the demand for private transport is going to increase significantly. This is a much harder to problem to solve but will require a robust strategy that

considers improved public transport, demand management, and urban planning. Key barriers include large upfront costs associated with transport schemes, and costs to private individuals to purchase newer efficient vehicles, or more advanced technologies. The transport strategy that accompanies the Vision 2030 needs to be more robust in firstly assessing how the growth in transport demand will be met, taking account of sustainability issues. For agriculture, although low carbon options appear low cost, they are difficult to implement due to many small holdings and fragmentation of the land; therefore high transaction costs could be envisaged.

- The domestic sector remains a large consumer of biomass due to population growth, but has a much lower per capita usage. This is largely due to large-scale access to electricity, enabled by increasing urbanisation but also efforts to expand rural electrification. More research is needed to establish alternative pathways that do not see large scale electrification.
- The strategy for the forestry sector is also very important; large scale afforestation is planned as is the need to protect existing cover. New financing schemes such as REDD / REDD+ will be critical in ensuring that this happens due to the significant investment required. Kenya needs to be well positioned to take advantage of the schemes that may emerge post-Copenhagen.
- To realise the many low carbon opportunities requires the mainstreaming of mitigation policy across all part of the economy and across all of Government. Following from the points above, it would be extremely beneficial for Kenya to undertake a detailed assessment of a low carbon strategy including a detailed investment and financial flow analysis. This would identify no regret and low cost options that are justified on the basis of ancillary benefits. It would also be advisable for Kenya to strengthen its capacity to develop and implement proposals for any future schemes (programme CDM, NAMAs, REDD, etc). This would also require significant development of projections, which form the basis of understanding cost-effective potential. In combination, there is also a need to investigate the potential for further funding by exploiting synergies with adaptation.
- Related to this there is a need to re-assess the Vision 2030 document in light of the potential for low carbon growth and opportunities for growth, but also potential barriers to growth that might arise from the future global carbon market, particularly in relation to key growth sectors that have high carbon intensity or international links.

Research priorities

There are a number of research priorities emerging from this work:

- Establishing robust and up-to-date base year emissions, including for the LUCF sector. This is presumably happening as part of the 2nd National Communication activities.
- Development of robust projections, taking detailed account of different drivers in sectors, and likely structural change in the economy. This is fundamental to being able to understand what future year emissions may look like, and the potential reductions.
- Sensitivity analysis around the different projections, for example if Vision 2030 assumptions on growth are much lower. In addition, incorporation of changes resulting from climate impacts / adaptation.
- Investment and financial flow analysis for mitigation (as part of a joint mitigation-adaptation analysis). This should follow the recent guidance from UNDP on IFF analysis.
- More comprehensive view of mitigation potential, building on the MACC analysis already developed, and consideration of wider economic impacts through macro economic analysis and modelling. There would also be considerable benefit in extending the analysis time horizon out to 2030 and perhaps even to 2050. Also, there should be additional focus on implementation, including the

capital intensity of projects (measuring upfront capital requirements) and other barriers (feasibility, scale-up etc)

- More quantification of the co-benefits of low carbon pathway; for example, estimates of reduced energy security risks, or lower air pollution in urban areas / households. In addition, more consideration needs to be given to equity issues and distributional impacts of a lower carbon pathway e.g. does it benefit certain groups while disadvantaging others?
- Increasing focus on urban issues in the context of lower carbon growth due to rapid urbanisation in future years
- Further development of the analysis of linkages between adaptation and mitigation, exploring the synergies but also potential conflicts

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References

AFP (2009), Carbon finance in Africa / Financial Resources and Investment for Climate Change, Africa Partnership Forum, Special Session on Climate Change, September 2009, Addis Ababa

Bailis R, Ezzati M and Kammen D (2007), Health and Greenhouse Gas Impacts of Biomass and Fossil Fuel Energy Futures in Africa, Published in Boiling Point No 54, 2007

Barker T., I. Bashmakov, L. Bernstein, J. E. Bogner, P. R. Bosch, R. Dave, O. R. Davidson, B. S. Fisher, S. Gupta, K. Halsnæs, G.J. Heij, S. Kahn Ribeiro, S. Kobayashi, M. D. Levine, D. L. Martino, O. Masera, B. Metz, L. A. Meyer, G.-J. Nabuurs, A. Najam, N. Nakicenovic, H. -H. Rogner, J. Roy, J. Sathaye, R. Schock, P. Shukla, R. E. H. Sims, P. Smith, D. A. Tirpak, D. Urge-Vorsatz, D. Zhou, 2007: Technical Summary. In: *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [B. Metz, O. R. Davidson, P. R. Bosch, R. Dave, L. A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Bernstein, L., J. Roy, K. C. Delhotal, J. Harnisch, R. Matsushashi, L. Price, K. Tanaka, E. Worrell, F. Yamba, Z. Fengqi, 2007: Industry. In *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

DECC (2009), The Road to Copenhagen: The UK Government's case for an ambitious international agreement on climate change, Department of Energy & Climate Change, June 2009

ECA Working Group (2009), Economics of Climate Adaptation: Shaping climate-resilient development, Economics of Climate Adaptation Working group based on a partnership between the Global Environment Facility, McKinsey & Company, Swiss Re, the Rockefeller Foundation, ClimateWorks Foundation, the European Commission, and Standard Chartered Bank

ESD (2005), Kenya Energy Atlas, 2005. Sponsored by UNDP and Global Village Energy Partnership, Compiled and written by ESD Africa.

ESD (2007), Energy Planning in Sub-Saharan Africa – facing the challenges of equitable access, secure supply and climate change, Led by Energy for Sustainable Development Ltd (ESD) and Environmental Change Institute, University of Oxford; with Energy for Sustainable Development Africa Ltd (ESD A); Palmer Development Group (PDG), South Africa; and the Centre for Energy, the Environment and Engineering in Zambia (CEEEZ). Funded by UK DFID, May 2007

ESMAP (2007), Technical and Economic Assessment of Off-grid, Mini-grid and Grid Electrification Technologies, [Energy Sector Management Assistance Program](#) (ESMAP) Technical Paper 121/07, December 2007

ETC (2007), Promoting Biogas Systems in Kenya – A Feasibility Study, Biogas for a Better Life Initiative, Funded by the Shell Foundation, October 2007

GEF (2006), Cogen for Africa, Project Brief, Agency Project ID GFL/2328-2721-4868, GEF Agency - UNEP

GEF (2006b), Greening the Tea Industry in East Africa, Project Brief, Agency Project ID GFL/2328-2721-PMS: GF/4010/5-, GEF Agency - UNEP

GEF (2005), Market transformation for efficient biomass stoves for institutions and small and medium-scale enterprises in Kenya, Medium-sized Project proposal: Request for GEF Funding, Global Environment Fund, October 2005

GEF (1998), Removal of Barriers to Energy Conservation and Energy Efficiency in Small and Medium Scale Enterprises (SME), Project brief, January 1998

Geoghegan T, Anderson S and Dixon B (2008), Opportunities to achieve poverty reduction and climate change benefits through low carbon energy access programmes - A review of the portfolio of the Ashden Awards for Sustainable Energy, for the Department for International Development, April 2008

GoK (2009), Transport sector plan for Vision 2030 (Final Draft), Ministry of Transport, Government of Kenya, February 2009

GoK (2008), Kenya Vision 2030: First Medium Term Plan (MTP) 2008-2012, Government of Kenya

GoK (2007), Kenya Vision 2030, Government of Kenya, Ministry of Planning and National Development and the National Economic and Social Council (NESC)

GoK (2006), Developing Small Hydropower Infrastructure in Kenya, Paper presented by James Muriithi (Ministry of Energy) at the 2nd Small Hydropower For Today Conference IN-SHP, Hangzhou, China, April 2006

GoK (2005), Kenya's climate change technology needs and Needs Assessment Report under the United Nations Framework Convention on Climate Change (Draft Report), November 2005. National Environment Management Authority, Ministry of Environment and Natural Resources, Nairobi, Kenya

GoK (2005b), Report on Kenya's capacity needs to implement article 6 of the United Nations Framework Convention on Climate Change (Draft), 2005. National Environment Management Authority, Ministry of Environment and Natural Resources, Nairobi, Kenya, May 2005

GoK (2002), First National Communication of Kenya to the Conference of the Parties to the United Nations Framework Convention on Climate Change, 2002. Ministry of Environment and Natural Resources, Government of Kenya (GoK), Nairobi, Kenya, June 2002

Grantham Research Institute (2009), Possibilities for Africa in global action on climate change, Grantham Research Institute on Climate Change and the Environment, July 2009

Gross, R., Dougherty, W., and Kumarsingh, K. (2004) *Conducting Technology Needs Assessments for Climate Change*, UNDP, New York, US, 26 pp, July 2004

GTZ (2004), Efficient Use of Biomass for Cooking, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, <http://www.gtz.de/de/dokumente/en-ir-efficient-use-of-biomass-for-cooking-2004.pdf>

Habermahl H (2007), Economic evaluation of the improved household cooking stove dissemination programme in Uganda, On behalf of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German Technical Cooperation), Household Energy Programme – HERA, May 2007

IEA (2008), Energy Technology Perspectives 2008: Scenarios & Strategies to 2050, International Energy Agency, Paris

IPCC (2006), 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T., and Tanabe K. (eds). Published: IGES, Japan

IWG-IFR (2009), Report of the Informal Working Group on Interim Finance for REDD+ IWG-IFR, Discussion Document

Kahn Ribeiro, S., S. Kobayashi, M. Beuthe, J. Gasca, D. Greene, D. S. Lee, Y. Muromachi, P. J. Newton, S. Plotkin, D. Sperling, R. Wit, P. J. Zhou, 2007: Transport and its infrastructure. In *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Karekezi S, Lata K, Coelho S (2004), Traditional Biomass Energy: Improving its Use and Moving to Modern Energy Use, Thematic Background Paper, International Conference for Renewable Energies, Bonn, January 2004

Kirubi, C. et al., Community-Based Electric Micro-Grids Can Contribute to Rural Development: Evidence from Kenya, *World Development* (2009), doi:10.1016/j.worlddev.2008.11.005

Kenya Forest Service (2009), Towards a Forestry Resources Account for Kenya: Preliminary Forestry Resources Account, Kenya Forest Service and Kenya National Bureau of Statistics, Version 3, June 2009

Kirai P (2008), The GEF-KAM Project from Kenya, Presented at UNIDO expert Group Meeting Washington 22-23 september 2008

KPLC (2008), Update of the Least Cost Power Development Plan (LCPDP), The Kenya Power & Lighting Co. Ltd. / Kenyan Ministry of Energy, March 2008

Lake Turkana Power Ltd (2009), Environmental and Social Impact Assessment (ESIA) Study of the Lake Turkana Wind Power Project (Executive Summary), Project Number P-KE-FZ0-001, April 2009

McKinsey (2009), Pathways to a low-carbon economy: Version 2 of the global greenhouse gas abatement cost curve, McKinsey & Company, January 2009

McKinsey (2009b), Roads toward a low-carbon future: Reducing CO₂ emissions from passenger vehicles in the global road transportation system, McKinsey & Company, March 2009

MEMR (2009), Brief on forest sector and climate change interventions, Ministry of Environment and Mineral Resources, June 2009

Mogaka H, Gichere S, Davis R, Hirji R (2006), Climate variability and water resources degradation in Kenya: improving water resources development and management, World Bank working paper no. 69, World Bank, Washington D.C.

Mwakubo S, Mutua J, Ikiara M, Aligula E (2007), Strategies for Securing Energy Supply in Kenya, Kenya Institute for Public Policy Research and Analysis (KIPPRA) Discussion Paper No. 74, September 2007

Mwirigi J, Makenzi P, Ochola W (2009), Socio-economic constraints to adoption and sustainability of biogas technology by farmers in Nakuru Districts, Kenya, *Energy for Sustainable Development* 13 (2009) 106–115

Nabuurs, G. J., O. Masera, K. Andrasko, P. Benitez-Ponce, R. Boer, M. Dutschke, E. Elsidig, J. Ford-Robertson, P. Frumhoff, T. Karjalainen, O. Krankina, W. A. Kurz, M. Matsumoto, W. Oyhantcabal, N. H.

Ravindranath, M. J. Sanz Sanchez, and X. Zhang, 2007. "Forestry." In B. Metz, O. R. Davidson, P. R. Bosch, R. Dave, L.A. Meyer, eds., *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press, Cambridge, United Kingdom and New York, USA.

NELSAP (2006), Climate change and impacts on runoff (Interim report), A supplemental analysis - Climate change and potential impacts on hydro generation – to the Strategic / sectoral, social and environmental assessment of power development options in the Nile Equatorial Lakes region, Analysis undertaken by SNC-Lavalin International Inc. and Stratus Consulting Inc, August 2006, Nile Basin Initiative

Olivier, J.G.J., Van Aardenne, J.A., Dentener, F., Ganzeveld, L. and J.A.H.W. Peters (2005). Recent trends in global greenhouse gas emissions: regional trends and spatial distribution of key sources. In: "*Non-CO2 Greenhouse Gases (NCGG-4)*", A. van Amstel (coord.), page 325-330. Millpress, Rotterdam, ISBN 90 5966 043 9

R.E.H. Sims, R.N. Schock, A. Adegbulugbe, J. Fenhann, I. Konstantinaviciute, W. Moomaw, H.B. Nimir, B. Schlamadinger, J. Torres-Martinez, C. Turner, Y. Uchiyama, S.J.V. Vuori, N. Wamukonya, X. Zhang, 2007: Energy supply. In *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Smith, P., D. Martino, Z. Cai, D. Gwary, H. Janzen, P. Kumar, B. McCarl, S. Ogle, F. O'Mara, C. Rice, B. Scholes, O. Sirotenko, 2007: Agriculture. In *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Sperling D and Salon D (2002), *Transportation in Developing Countries: An Overview of Greenhouse Gas Reduction Strategies*, University of California, Davis, Prepared for the Pew Center on Global Climate Change, May 2002

UNEP (2009), "Kenya: Atlas of Our Changing Environment." Division of Early Warning and assessment (DEWA), United Nations Environment Programme (UNEP), Nairobi, Kenya

UNEP (2006), Kenya Integrated assessment of the Energy Policy *With focus on the transport and household energy sectors*, <http://www.unep.ch/etb/areas/pdf/Kenya%20ReportFINAL.pdf>

UNDP (2006), *Expanding access to modern energy services: Replicating, Scaling Up and Mainstreaming at the local level*, Editors: Stephen Gitonga and Elisabeth Clemens, United Nations Development Programme, May 2006

USEPA (2006), *Global Mitigation of Non-CO2 Greenhouse Gases*. United States Environmental Protection Agency, EPA 430-R-06-005, Washington, D.C.

WHO (2006) *Fuel for life: Household energy and health*, ISBN 92 4 156316 8, World Health Organisation, Switzerland

World Bank (2008), *Low-carbon Energy Projects for Development in Sub-Saharan Africa - Unveiling the Potential, Addressing the Barriers*, Authored by Christophe de Gouvello, Felix B. Dayo, and Massamba Thioye, The World Bank, Washington D.C

Appendix 1. Key low carbon projects and organisations working in the energy sector

Project	Period		Contribution
MOE Installation of Solar PV Systems in schools and health facilities in ASAL areas. 134 Institutions already benefited	2005	2012	460 million Kenya shillings
MOE Installation of Solar PV Systems in schools and health facilities in ASAL areas, 54 institutions benefited in this period	2008		130 million Kenya shillings
SIDA, Swedish Energy Agency (STEM), Programme on Capacity Building for CDM (East Africa). The project focus is on training DNAs of the three countries Kenya, Tanzania and Uganda	August 2007 –	November 2009	
UNDP Renewable Energy Technology Assistance Programme (RETAP). Market transformation for highly efficient biomass stoves for institutions and medium scale enterprises in Kenya.	2007	2010	USD 975,000
World Bank Capacity Building and Bio Carbon Fund Pilot Implementation	2006	2008	USD 462,250
French Development Agency Funding of Kipevu Combined Cycle - KenGen CDM pipeline	2008	2010	USD 90 Million
French Development Agency Re-forestation of the Aberdare -- Purchase Agreement signed with Bio Carbon Fund in 2006. 300 ha of AFD sites are part of the agreement			USD 49 Million
French Development Agency Olkaria II 3rd Unit (Geothermal Plant) KenGen CDM pipeline	2008	2010	EUR 1.3 Million
Kenya Energy Sector Environment Programme (KEEP) MOE - sponsored programme to conserve water for HEP generation, wood fuel production, pole treatment of electricity transmission, carbon sink and (liquid) biofuels production	Ongoing		30 million Kenya shillings
Bamburi Cement (Lafarge East Africa) Development of 2 to 3 CDM projects through fuel switching from fossil fuel to sustainable biomass	2008	2010	USD 20 million
Energy Efficiency & Conservation	Ongoing		
KAM Energy efficiency & Conservation Support for manufacturing industry in improving energy efficiency			20 million/year
East Africa Portland Cement (EAPC) Energy Efficiency leading to Reduction of the more expensive clinker, main raw material in the making of cement, leading to lower consumption of fuel in the firing process.			

Organization and address	Field of Interest
JP Morgan Climate Care. Eden Square Business Center, Westlands P.O. Box,	Climate Care wants to tackle climate change today by providing carbon offsets by helping people have an impact, lowering business emissions and individual carbon

<p>856, 00606, Nairobi Tel: +254 (0) 20 367 3183 Fax: +254 (0) 20 367 3183 Email: jpcc.projects@jpmorganclimatecare.com</p>	<p>footprints through carefully sourced carbon reduction projects</p>
<p>Carbon Positive has offices in Netherlands, Brazil, Kenya, China, Brazil, UK and Australia www.carbonpositive.net</p>	<p>Carbon Positive arranges and manages sustainable energy and reforestation projects to cut greenhouse emissions and generate tradable carbon assets that customers can sell for cash.</p> <p>The projects are in developing countries and benefit local communities as well as global climate. Carbon Positive has offices in The Netherlands, Australia, Kenya and Brazil and is run by business professionals dedicated to sustainable development, allied with like-minded companies and charities.</p>
<p>Camco Advisory Services (K) Limited Muringa Road off Elgeyo Marakwet Road PO Box 76406-00508 Nairobi Kenya</p> <p>Tel: +254 20 387 5902 Fax: +254 20 387 5902</p>	<p>Camco is a leading climate change and sustainable development company. It provides world class strategic, technical and financial solutions for all carbon related issues. Camco is able to provide solutions for the public and private sectors, in the developing and developed world and across all the stages of the carbon management process.</p>
<p>UNDP SGP KENYA</p> <p>UNDP, P.O. Box 30218, Nairobi, 00100 Phone: (254-20) 7624474 Fax: (254-20) 7621076 Email: nancy.chege@undp.org</p>	<p>GEF projects in climate change help developing countries and economies in transition to contribute to the overall objective of the UNFCCC. Climate change could have devastating effects on the well-being of people already living on the edge of poverty - with limited financial and technical capacity, yet dependent on climate sensitive sectors for their life and livelihoods, communities must rely on their own ability to adapt and survive in constantly changing conditions.</p> <p>Projects are implemented according following GEF Operational Programmes</p> <p>OP11- Promoting environmentally sustainable transport OP5 – Removal of Barriers to Energy efficiency and Energy Conservation OP6 – Promoting the adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs</p>
<p>Practical Action - Eastern Africa (formerly ITDG)AAYMCA Building (Second Floor) Along State House Crescent P.O. Box 39493, Nairobi, Kenya Tel: +254 20 715293 / 719313 / 719413 Fax: +254 20 710083 E-mail: ITDGEA@...</p>	<p>Practical Action - Eastern Africa aims to build technical skills of poor people and enabling them to improve the quality of their lives and those of future generations. The programme sectors include - Energy, Rural Agriculture and Pastoralism, Transport and Manufacturing, Fund-raising and Marketing, Building Materials and Shelter Programmes.</p>
<p>GTZ Office Nairobi</p> <p>P.O.Box 41607 00100 GPO Nairobi Kenia</p>	<p>GTZ operates on themes such as promotion of renewable energy and efficiency, rural development, good governance, economic development and employment, social development among others</p>
<p>African Center for Technology Studies (ACTS)</p> <p>Gigiri Court, Off United Nations Crescent, P.O.Box 45917 - 00100, Nairobi, Kenya. Tel: +254-20 712 6889/90/94/95 Fax: +254-20 233 9093</p>	<p>ACTS is a Nairobi-based international intergovernmental science, technology and environmental policy think-tank that generates and disseminates new knowledge through policy analysis, capacity building and outreach. Its programmes include Biodiversity and Environmental Governance, Energy and water security, Agriculture and</p>

<p>Email: info@acts.or.ke Web: http://www.acts.or.ke</p>	<p>food security, Science and technology literacy.</p>
<p>Green Africa Foundation, Kenyatta International Conference Centre (KICC), Lower Ground floor, room13 Post Office Box 9164-00200 Nairobi, Kenya Telephone: +254 20 224 8768/9 +254 20 224 8846 Fax no. +254 20 224 8768 Email: info@greenafricafoundation.org</p>	<p>Kenyan organization founded in 2000 to support ecological and environmental conservation with a particular focus in arid and semi arid lands of Kenya where poverty is most prevalent. The Foundation focuses on capacity development of poor communities through a partnership approach that integrates environmental conservation and community livelihoods. Their main focus is on Biodiesel production projects (from Jatropha), environmental conservation through sports, among others</p>
<p>Vanilla Jatropha Development Foundation (VJDF) P.O Box 13828 GPO 00100 Nairobi Kenya Phone: +254-20-608456</p>	<p>To enhance the productivity, profitability and sustainability of Vanilla-Jatropha production-consumption value chain in eastern Africa sub-region based on an integrated / efficient Vanilla-Jatropha production system</p>
<p>Kenya Industrial Research Institute (KIRDI). P.O. Box 30650. Tel: 254-20-603842/609440. FAX: +254-20-607023 Email: dir@kirdi.go.ke, info@kirdi.go.ke</p>	<p>This is a national research institute established in 1979 under the Ministry of Trade and Industry and mandated to undertake multidisciplinary research and development in industrial and allied technologies. The major R&D departments are the engineering, energy and environment, ICT, leather and textiles, and food technology divisions. KIRDI has developed over 40 technologies in these fields.</p>
<p>Kenya Electricity Generation (KenGen) Stima Plaza, Phase III, Kolobot Road, Parklands P.O. Box 47936 – 00100 GPO, Nairobi, Kenya Tel: +254 20 3666000 Fax: +254 20 248848</p>	<p>Kenya Electricity Generating Company Limited, KenGen is the leading electric power generation company in Kenya, producing about 80 percent of electricity consumed in the country. The company utilizes various sources to generate electricity ranging from hydro, geothermal, thermal and wind. Hydro is the leading source, with an installed capacity of 677.3MW, which is 72.3 per cent of the company's installed capacity.</p>
<p>Appropriate Technology Centre Kenyatta University, P.O. Box 43844, Nairobi</p>	<p>Renewable energy technologies, post harvest & food preservation technology, energy saving wood and charcoal cookstoves, water storage.</p>
<p>Renewable Energy Technology Assistance Programme (RETAP). P.O. Box 28201, 00200 Nairobi, Kenya. Westlands, Waumini 1 st Floor Tel/Fax +254 20 3002344, 2033867 E-mail: info@retap-africa.org</p>	<p>The programme aims to transform markets for highly efficient biomass stoves for institutions (schools and hospitals) and medium-scale enterprises (restaurants, hotels) in Kenya by: * promoting highly efficient improved stoves; * establishing woodlots owned and managed by the institutions and private sector; and * removing policy and financial barriers to the widespread adoption of stoves.</p>
<p>Kenya Power and Lighting Company (KPLC) P.O Box 30177, Nairobi</p>	<p>It owns and operates Kenya's interconnected power transmission and distribution network.</p>
<p>AFREPREN AFREPREN/FWD House, Elgeyo Marakwet Close P.O. Box 30979 GPO 00100 Nairobi, Kenya Telephone +254-722509804 +254-720973610 +254-020-2535266 afrepren@africaonline.co.ke</p>	<p>Energy, Environment and Development Network for Africa is a registered Non-Governmental Organization based in Nairobi, Kenya, with vast expertise on energy in East and Southern Africa and some experience in West and North Africa. Among their activities include examining initiatives for providing least-cost clean energy services to urban and rural poor households and small scale enterprises.</p>
<p>Renewable Energy Engineering Contractors (REECON) Ngong road, Nairobi, Kenya Telephone: 045-40557</p>	<p>Consultants and retailers of wood burning stoves and furnaces, biomass energy systems, composting systems, energy efficient homes and buildings, hydro energy system components (small), solar cooking systems, Biogas plant,</p>

	waste water, incineration, energy efficiency.
Photovoltaic Market Transformation Initiative (PVMTI) Bandari Plaza, 2nd Floor Woodvalle Groove, Westlands P.O. BOX 11463, 00606-Sarit Centre NARIOBI, KENYA Tel: ++254 (20) 4452593 Fax: +254 (20) 4452594	PVMTI is an initiative of the International Finance Corporation (IFC) and the Global Environment Facility (GEF) with the aim of accelerating the sustainable commercialization and financial viability of PV technology in the developing world and to provide successful examples of sustainable and replicable business models that can be financed on a commercial, basis.
Think Solar Technics P.O. Box 64057-00620, Nairobi. Tel: +254 20 3567916. FAX: 3567916	Consulting, design, installation, education and training services, contractor services, maintenance and repair services
Appropriate Technologies for Enterprise Creation: ApproTEC - KENYA P O Box 64142 Nairobi, Kenya Tel / Fax: 787380/1, 783046, 796278 e-mail: ApproTEC@ApproTEC.org website: www.ApproTEC.org	Their aim it to promote sustainable economic growth and employment creation in Kenya and other countries, by developing and promoting technologies which can be used by dynamic entrepreneurs to establish and run profitable small scale enterprises
Sahar Auto Fitters Konza Road, Machakos, Eastern Kenya 90100 Telephone: 044-24083	Wood burning stoves and furnaces
Solar World Ea Ltd P.O Box 78516 00507, Ring Road Parklands and General Mathenge Rd Junction, Westlands, Nairobi, Kenya	Consulting, design, installation, engineering, contractor services, maintenance and repair services of solar electric power systems, backup power systems, batteries lead acid deep-cycle, solar water heating components, photovoltaic module components, led lighting, solar torches, solar lanterns, solar caps, radios, solar mobile chargers, wind turbines.
Craftskills East Africa Limited. Telephone: (+254) 20 2394414, 20 2390848, 733 649401, 724 324273	Manufacturer and retailer of Wind Power Turbines, Wind Power water pumps. Batteries. DC and AC LED Lights. Solar Panels Inverters