Assessment of Technology Needs for Mitigation and Adaptation to Climate Change in Namibia

Final Report
February 2005

REPUBLIC OF NAMIBIA

MINISTRY OF ENVIRONMENT AND TOURISM

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Executive Summary

This report describes the Technology Needs Assessment (TNA) for climate change mitigation and adaptation in Namibia that was undertaken between August 2004 and February 2005.

In line with its obligations as a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), the Republic of Namibia has undertaken a number of actions since ratifying the convention in 1995. A national country study was finalised in 1998, a Namibian Committee for Climate Change (NCCC) was established in 2001, and an Initial National Communication (INC) was presented to the UNFCCC in 2002.

Under the UNFCCC, developing countries have been encouraged to assess and submit their technology needs for climate change adaptation and mitigation; and developed countries have committed to assisting with the technology transfer.

The Namibian TNA has followed a process recommended by the UNDP/GEF, and the Climate Technology Initiative (CTI). The guidelines published by these institutions are based on expert input, notably from the International Panel on Climate Change (IPCC), and on feedback obtained from countries who have undertaken TNAs in previous years.

In agreement with the IPCC's definition, 'technology' has been interpreted as "a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change"; therefore including both 'soft' and 'hard' technologies; where 'soft' implies knowledge-based systems and 'hard' refers to physical, hardware equipment.

The focus of the assessment has been on technologies that support Namibia's economic development in a sustainable manner, in line with the medium- and long-term priorities outlined in the *National Development Plan* (NDP2) and *Namibia's Policy Framework for Long-term National Development* (Vision 2030).

These national priorities can be summarised as follows: poverty reduction; employment creation; economic empowerment; sustained economic growth; reduced inequalities in income distribution; reduced regional development inequalities; gender equality and equity; environmental and ecological sustainability and combating the further spread of HIV/AIDS.

While opportunities for mitigation technology in the context of Namibia's development are an important component of the assessment, the INC recommends focus on adaptation technologies, based on the assessment from the country study that Namibia is most likely a net sink for greenhouse gases and is particularly vulnerable to climate change.

Under the Ministry of Environment and Tourism (MET), as the designated lead agency in the co-ordination of climate change activities in Namibia, a team of experts conducted the TNA in consultation with key stakeholders including the expert members of the NCCC.

An initial list of potential technologies was derived from the INC, interviews with stakeholders and additional expert input. This list was prioritised with the use of a decision-making tool that was developed with stakeholder participation during the first of two stakeholder workshops. The process involved prioritising national sectors and selecting key project evaluation criteria.

National priority sectors were identified and weighted as follows: water (23%); agriculture (23%); environment and tourism (21%); energy (20%) and industry (13%).

Three key criteria were determined to evaluate technologies: cost-benefit ratio with 'benefits' focusing on economic, adaptation, mitigation and employment potential (42%); reliability and sustainability (incl. social acceptance) (35%) and capacity building (23%).

With these priority sectors and project evaluation criteria defined, the initial list of technologies was ranked through a decision-matrix. Projects relevant to a sector were compared and given a comparative grade for each of the 3 evaluation criteria. Adding up the grades multiplied with the criteria weights allowed ranking all projects within a sector. Adding up each project's ranks per sector multiplied with the sector weights provided a global score per project.

A preliminary barrier analysis was undertaken to determine socio-economic and technical barriers to the transfer of appropriate technology to Namibia. The preliminary analysis was subsequently assessed and revised during the second stakeholder workshop. The resulting analysis consisted of the following grouping of barriers: awareness barriers; political and institutional barriers; policy and legal barriers; socio-cultural barriers and financial barriers.

A preliminary action plan, derived from the barrier analysis, with five components and nine sets of actions was presented to the stakeholders during the second workshop. The components are:

Component 1: Improve awareness regarding climate change, sustainable development and technology;
Component 2: Improve capacity in government, the private sector, and civil society to initiate and implement mitigation and adaptation technology transfer projects;
Component 3: Undertake priority research and capacity building projects;
Component 4: Improve access to finance for climate change mitigation and adaptation, desertification and biodiversity projects;
Component 5: Undertake priority mitigation and adaptation projects.

The plan was discussed and revised during the second stakeholder workshop. The components were approved, and under each component a number of coordinating actions was determined and added to the technology actions derived from the prioritisation matrix. This included recommendations for institutional requirements and suggested responsibilities. The suggested actions were the following:

Action 1: Strengthening of awareness and information centres;
Action 2: Implementing awareness projects;
Action 3: Implementing the meteorology capacity building project;
Action 4: GIS, satellite imagery, data analysing software and hardware capacity building;
Action 5: Strengthening of climate change coordination;
Action 6: Conducting research projects;
Action 7: Implement financial resources clearing house;
Action 8: Piloting a project for Clean Development Mechanism under Kyoto Protocol;
Action 9: Implementing the identified adaptation and mitigation projects.

The research projects under actions 6 and 9 were taken from the list of prioritised technology transfer projects determined during the first phase of the project.

While it will be necessary for each of the suggested priority actions to be designed more precisely to determine operational modalities and detailed costs, a tentative budget for the programme has been included in this report.

The TNA has concluded with an assessment of implementation potential and recommendations for action, specifically in terms of financial resources.

The following key recommendations are made:

- A request from the Government of Namibia should be submitted to UNDP/GEF to assist with the financing of a *Technology Transfer Programme for Climate Change Adaptation and Mitigation*.

- Since a grant to prepare a proposal for the second national communication to the UNFCCC has already been obtained, the programme coordination and a selected number of actions can be undertaken under the SNC.

- The coordination of the technology transfer programme should be among the responsibilities of a new national climate change office.

- Expert panels of stakeholders should supervise the implementation of the five programme components under the umbrella of the NCCC.

- The national climate change office should prepare and submit requests for grants to GEF and other donors for projects requiring more substantial funding. The UNDP office can provide assistance with this process. It is noted that a number of projects identified within the TNA are already planned under different programmes. The national climate change office will keep further track of such developments to avoid duplication and ensure effective collaboration.

- The 'financial resources clearing house' that is suggested under component 4 of the programme which would fall under the mandate of the Namibian Environmental Investment Fund (NEIF), should significantly improve opportunities for social actors to tap into available funding mechanisms to implement the smaller priority projects.

- Trading of carbon credits through the Clean Development Mechanism (CDM) is a vehicle that should be developed to allow the private sector to initiate the recommended developments. It is recommended that support from the international community (WB, UNDP/GEF, UNIDO, UNEP or bilateral donors) is sought to undertake a capacity building project to maximise benefit to Namibia from the CDM.

- Where appropriate Namibia's action under the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Convention on Bio-Diversity (UNCBD) could be integrated in a consolidated action plan. However this should not lead to reduced human and financial resources for climate change action, but rather to a bundling of resources.

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Acronyms

AHP	Analytical Hierarchy Process
AT	Appropriate Technology
CBO	Community-Based Organisation
CBNRM	Community-Based Natural Resource Management
CC	Climate Change
CDM	Clean Development Mechanism
CERs	Certified Emissions Reductions
COP	Conference of Parties
CTI	Climate Change Technology Initiative
CTIPSA	Co-operative Technology Implementation Plan for Southern Africa
DNA	Designated National Authority
GEF	Global Environment Facility
GHG	Green House Gas
GIS	Geographic Information System
GRN	Government of Namibia
INC	Initial National Communication
IPCC	International Panel on Climate Change
LA21	Local Agenda 21
LFA	Logical Framework Analysis
MET	Ministry of Environment and Tourism
MME	Ministry of Mines and Energy
NCCC	National Climate Change Committee
NDP2	Second National Development Plan
NEIF	Namibian Environmental Investment Fund
NGO	Non-governmental Organisation
NPC	National Planning Commission
OECD	Organisation for Economic Co-operation and Development
R3E	Renewable Energy and Energy Efficiency bureau
SD	Sustainable Development
SGP	Small Grants Programme
TNA	Technology Needs Assessment
ToR	Terms of Reference
TT	Technology Transfer
UNAM	University of Namibia
UNCBD	United Nations Convention on Biodiversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for Refugees
UNIDO	United Nations Industrial Development Organisation
WB	World Bank

1 Background to the project

The *United Nations Framework Convention on Climate Change* (UNFCCC)[1] was adopted in New York on 9 May 1992. The objective of the Convention is to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The Republic of Namibia ratified the UNFCCC on 16 May 1995 and this decision came into effect on 14 August 1995.

A country study consisting of a greenhouse gas (GHG) inventory, an overview of Namibia's vulnerability to climate change and a mitigation study with economic scenarios, emission scenarios and mitigation options was finalised in 1998.

The Namibian Climate Change Committee (NCCC) was established in 2001 to direct and oversee further obligations to the UNFCCC.

Namibia's Initial National Communication to the Conference of Parties of the UNFCCC was submitted to the UNFCCC in 2002 in accordance with the Convention.

Since 1992, further research[2] has confirmed that the entire world will be affected by climate change. In many countries the consequences for all human activities will be profound on agriculture and terrestrial ecosystems, on hydrology and water resources, on human health, on forests and wildlife, on coastal zones, and on finance, insurance, energy, commerce, industry and on urban and rural settlements.

In the Namibian context, in view of the evidence indicating that Namibia is a net sink of greenhouse gases (GHG), the INC recommends focusing action on technology for adaptation[3]. In view of this, technology transfer to Namibia should comply with the country's obligations to the UNFCCC while focussing on opportunities for economic development.

Projections in the INC indicate that in Namibia, mean annual temperature, and minimum and maximum monthly temperatures will increase by 2 to 6°C by 2100. Predictions of rainfall are highly uncertain, ranging from a small increase of 30 mm per year to severe decreases of 200 mm below the current annual average. The greatest impact is predicted for the central inland areas. Evaporation is also anticipated to rise by 5% per degree of warming, so even if rainfall is unchanged, the availability of water is likely to decrease. Sea level rises of 30 to 100 cm are anticipated by 2100.

The INC states that the water sector is the most vulnerable to climate change. Even without the threat of climate change, Namibia already faces absolute water scarcity by the year 2020. Water supply is below 300 m^3 per person per year, making Namibia a nation of absolute water scarcity. Even a moderate change in climate would cause severe additional pressure on the water resources for human consumption, livestock, crop irrigation and ecosystems.

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[1] United Nations Framework Convention on Climate Change, 1992

[2] e.g. IPCC. 2001

[3] Notably expressed in the foreword by the Hon. Minister of Environment and Tourism, Mr. P. Malima: "As a minor producer of greenhouse gases, Namibia will place more emphasis on our vulnerability and adaptation to climate change rather than mitigation."

Water scarcity will also affect crop irrigation and livestock watering; hydro-electricity and ecosystem maintenance – particularly the wetlands which are identified as Namibia's most threatened category of ecosystem.

Marine fisheries are threatened by possible changes to the ocean current on Namibia's west coast. The fisheries rely on nutrient-rich upwellings of the cold Benguela Current. Any change in the frequency, timing or distribution of the upwelling would influence production, with significant economic impacts due to the prominence of marine resource industries in Namibia. The predicted rise of 0.3 m or more in sea level would threaten coastal towns and certainly inundate significant parts of Walvis Bay, the main port of Namibia.

There are considerable health risks, due to increased prevalence of diarrhoea, under-nutrition, malaria and acute respiratory infections. Drought and the shortage of clean water will increase susceptibility to malnutrition, respiratory and gastro-intestinal infections.

Article 4.5 of the UNFCCC states that developed countries "shall take all practicable steps to promote, facilitate, and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention."

Technologies and practices for mitigating climate change and adapting to it are being developed worldwide. However, it is acknowledged that their development and use so far has been heavily concentrated in OECD countries.

The Conference of Parties (COP) to the UNFCCC has specifically recognised the importance of assessing technology needs as part of a combination of activities to enhance technology development and transfer. Measures have been put in place to assist countries undertaking Technology Needs Assessments (TNAs). By decision 4/CP.4, the COP urges non-Annex I countries[4] such as Namibia to submit their prioritised technology needs, especially those relating to key technologies to address climate change.

Several resolutions[5] from the consecutive COPs (Conference of Parties to the UNFCCC) directly refer to the need to promote technology transfer (TT) to developing countries and the manner in which to do this.

This *Assessment of the Technology Needs for Mitigation and Adaptation to Climate Change in Namibia* should be viewed as part of a wider set of activities to enhance technology transfer. The recommended UNFCCC framework[6] includes:

- technology needs and needs assessment;

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[4] Annex I countries are the OECD countries who have special obligations under the UNFCCC

[5] Notably Decision 7/CP.2, Para. 2b and 4f; Decision 9/CP.3 , Para. 5b; Decision 4/CP.4, Para. 5 and Para. 7c; Decision 9/CP.5, Para. 6; Decision 4/CP.7, several paragraphs and the Annex on "framework for meaningful and effective actions to enhance technology transfer"

[6] FCCC/CP/2001/13/Add.1, decision 4/CP.7, annex on "framework for meaningful and effective actions to enhance technology transfer"

- technology information;
- enabling environments;
- capacity building;
- and mechanisms for technology transfer.

'Technology transfer' is identified in the IPCC's *Special Report on Methodological and Technological Issues in Technology Transfer* as "a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organisations (NGOs) and research/education institutions". The IPCC adds that this "comprises the process of learning to understand, utilise and replicate the technology, including the capacity to choose it and adapt it to local conditions and integrate it with indigenous technologies".

It is within this interpretation that for the Namibian TNA, the word 'technology' therefore refers to both 'soft' and 'hard' technologies; where 'soft' implies knowledge-based systems and 'hard' refers to physical, hardware equipment. For example, a 'soft' technology may refer to a water conservation awareness program or a natural resources inventory. A 'hard' technology, on the other hand, may refer to a catalytic converter on an automobile that reduces greenhouse gas emissions or to photovoltaic cells as a rural energy source.

It is clear from the above that the five UNFCCC technology transfer steps listed above are very much intertwined. Issues such as information and capacity needs cannot be left out of the TNA; neither can an initial evaluation of possible TT mechanisms.

A number of international organisations have produced guidelines and indicative procedures for TNAs for climate change mitigation and adaptation, notably UNDP/GEF's *Handbook for TNA*[7] and the Climate Technology Initiative's (CTI)[8] *Methods for Climate Change Technology Transfer Needs Assessments and Implementing Activities: Experiences of Developing and Transition Countries*, which have been used as a basis for the Namibian TNA.

7 "A UNDP/GEF Handbook on methodologies for technology needs assessments", final draft, January 2003

8 CTI 2002, "Methods for climate change technology transfer needs assessments and implementing activities: Experiences of developing and transition countries"

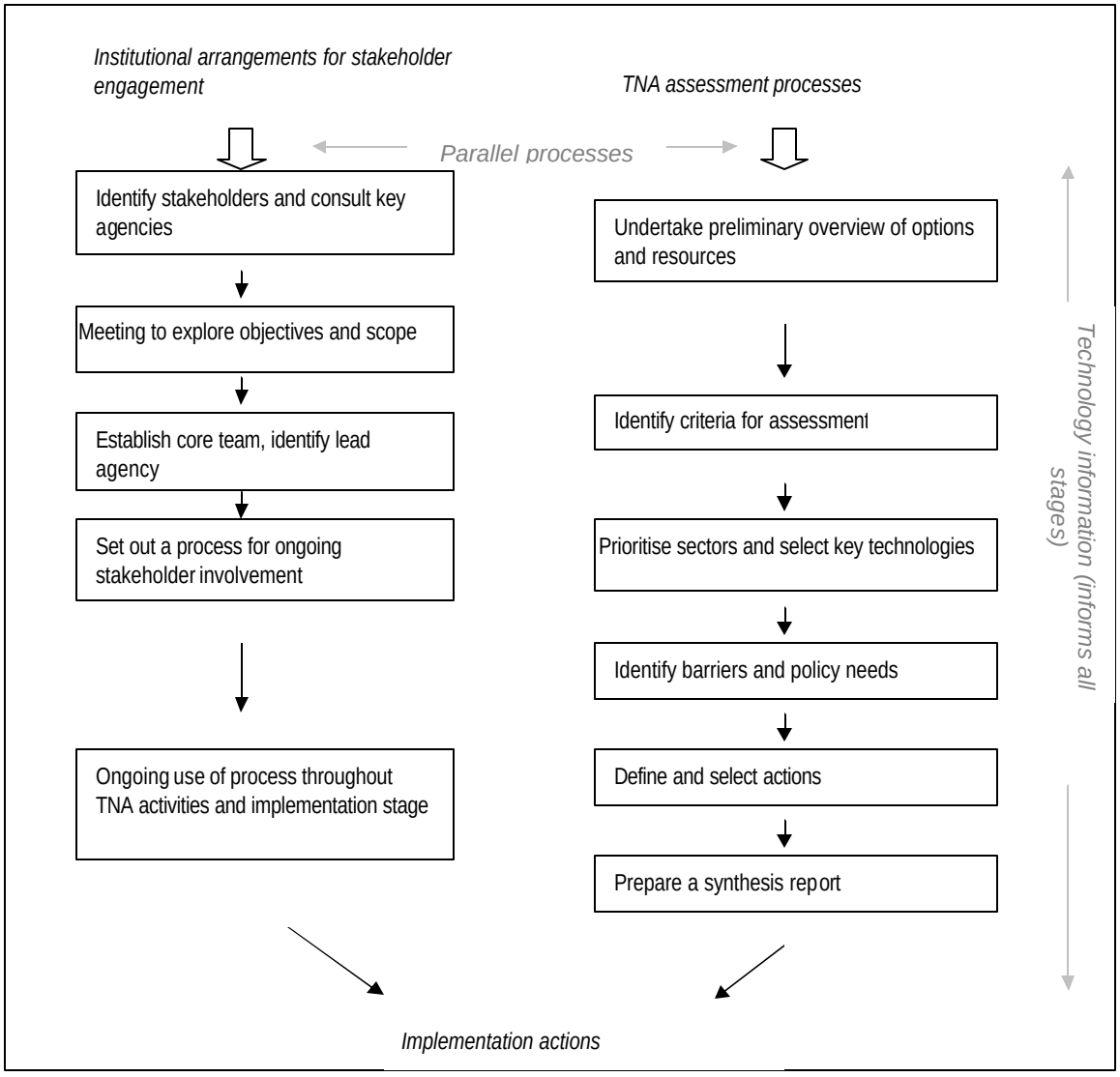
2 Method

2.1 Guidelines

The Namibian TNA has followed the guidelines from the UNDP/GEF *Handbook on methodologies for technology needs assessments* and the Climate Technology Initiative (CTI) publication *Methods for Climate Change Technology Transfer Needs Assessments and Implementing Activities: Experiences of Developing and Transition Countries*. In the remainder of this document these two key documents are further referred to as the GEF 'Handbook' and the CTI 'Methods'. These texts are the result of the combined efforts of worldwide experts in technology transfer, and extensive feedback from different countries where TNAs have been undertaken.

Figure 1 gives an overview of the action recommended by the UNDP/GEF 'Handbook'

Figure 1 - Recommended TNA process (source: UNDP/GEF(2003))



While the GEF 'Handbook' and CTI 'Methods' specify that no actions can be prescribed since technological conditions and priorities for development differ significantly throughout the world, both documents do provide a number of suggested components:

- Institutional arrangements and stakeholder engagement;
- Descriptions of TNA processes and activities;
- Implementation actions.

Various approaches to undertake each of these components are discussed in the remainder of this section. Subsequently, the process that has been followed in Namibia is outlined in the next section.

2.1.1 Institutional arrangements and stakeholder engagement

In terms of stakeholder engagement and institutional arrangements the recommended course of action is to identify representative members of the following categories:

- Government departments with responsibility for
  - relevant areas of policy – energy, environment and development;
  - regulation of relevant sectors – energy, agriculture, forestry, water, etc.;
  - promotion and development of industry and international trade;
  - coastal zone management and drainage;
  - finance.
- Industries and/or public sector bodies responsible for provision of utility services (energy, water, etc);
- Representative companies or bodies in other greenhouse gas intensive sectors (e.g. energy intensive industry);
- Companies, industry and financial institutions involved in the manufacturing, import and sale of climate response technologies;
- Households, small businesses and farmers using the technologies and practices in question, and/or who are experiencing some of the vicissitudes of climate change;
- NGOs involved with the promotion of environmental and social objectives
- Institutions that provide technical and scientific support to both government and industry (academic organisations, industry R&D, think tanks, consultants);
- Labour unions;
- Consumer groups;
- Country divisions of international companies responsible for investments of critical importance to climate policy (e.g. in the energy sector);
- International organisations and donors.

The GEF 'Handbook' distinguishes between the *wider group of affected and interested parties* who participate in workshops at specific milestones, and a *core team*, who will drive the TNA; lead by a *lead organisation* and assisted by a *lead technical institution*. The CTI Methods refers to *a technology transfer collaborative team* or *a collection of TT teams* and adds that "(…) the composition of such a team depends on an individual country's circumstances. However, one common element of these teams has been the central role of government in coordinating and focusing the team's activities toward achievement of national development and economic goals".

2.1.2 TNA processes and activities

In terms of TNA processes and activities the UNDP/GEF 'Handbook' distinguishes the following steps:

- Prepare a preliminary overview of options and resources;
- Identify criteria for technology assessment;
- Identify priority sectors and select technologies;
- Identifying barriers and policy needs;
- Define and select actions;
- Prepare a synthesis report.

The **preliminary overview of technology options and resources** is a data gathering exercise that must be undertaken before detailed technology evaluation can be undertaken. The GEF 'Handbook' recommends that this stage should not become a long and complex task as it need not provide a detailed picture of all technology options in all sectors. Rather, it should provide a broad overview to allow the best technology options to be pursued in the sectors with the greatest scope for initial actions.

The scope of the TNA needs to be identified in this phase. Suggested sectors in the GEF 'Handbook' are

- Electricity production, transmission and use;
- Other energy supply sectors – natural gas, LPG and other domestic fuels;
- Transport – fuels, vehicles, public and private transport infrastructure;
- Forestry;
- Agriculture;
- Energy intensive industries;
- Climate technology industries or industries with potential manufacture/supply climate response technologies;
- Waste management and recycling;
- Buildings and construction;
- Water management;
- Coastal zone management and defences;
- Health.

To **prioritise sectors** it is suggested to undertake the following steps:

- Brief review of current circumstances of key sectors – technologies in use, GHG emissions and financial conditions;
- Brief review of potential to reduce emissions and to contribute to adaptive response by sector;
- Brief review of country wide low carbon energy resources and main technology options, and adaptive responses and main technology options.

To identify **criteria for technology assessment** is to determine a criterion whereby actions may be judged against their contribution to national development goals. It also requires that

the cost effectiveness of so doing, in terms of the (possible) higher costs of new and alternative technologies, is considered. This requires some means by which the different goals can be prioritised, such that trade offs between objectives, should they occur, can be dealt with fairly and transparently.

The 'Handbook' puts forward the following factors on which the criteria for selecting sectors and technologies for TNA will depend:

- contribution to the wider policy goals of development;
- the contribution to climate change mitigation or adaptation;
- the market potential.

Examples of a breakdown of these factors are given as follows:

- Development benefits:
  - Food and agricultural security;
  - Health improvements;
  - Job & wealth creation for the poor;
  - Capacity building (human, institutional, physical, environmental);
  - Sustainable use of local resources;
  - Economic and industrial efficiency improvement.
- Reducing harm to the environment (non climate impacts);
- Social acceptability and suitability for country conditions;
- Contribution to Climate Change:
  - GHG emissions reduction potential;
  - Adaptation potential;
  - Enhancement of CO_2 sinks.
- Market Potential:
  - GHG emissions reduction potential;
  - Capital and operating costs relative to alternatives;
  - Commercial availability;
  - Replicability and potential scale of utilisation.
- Potential for policy intervention to improve uptake:
  - GHG emissions reduction potential;
  - The effects of pricing and regulatory policies on application;
  - Barrier identification.

To *prioritise* the criteria that will be used to assess projects, the weight and importance of these factors needs to be assessed. It is suggested that this can be done through a mixed approach of collecting input from

- independent experts;
- government experts;
- wider stakeholders such as industry, NGOs, etc.

The weight attributed to each opinion is country- and situation dependent. It notably depends on the capacity of specific stakeholders. One cannot prescribe the same process for a country with a weak government (e.g. as a result of war), a strong civil society and private sector with countries with strong government structures and a weak civil society.

The guidelines suggest that it is important to agree on the weight given to each of the opinions before starting the prioritisation.

In the process of assessing technology needs, series of conventional and general analytical tools can be useful to support decision-making. Among others, these include:

- analytic hierarchy process (AHP);
- existing information-based approach;
- cost-benefit analysis;
- cost-effectiveness analysis;
- risk-benefit analysis;
- and decision analysis.

An important comment that is made in the GEF 'Handbook' is the following:

"Some countries may wish to limit the extent to which simplistic techniques are used to account for complex, sometimes hard to quantify, factors. This is a matter for countries to decide. Ranking exercises can help to ensure that stakeholder priorities are understood and reflected, and can inform the selection process. However, it is important to note that this cannot provide all of the answers; in many cases judgments will still be required; for example, it is extremely difficult to make judgments about technologies that cut across highly diverse sectors – how are opportunities in the energy sector compared to those in coastal management? (…) Inclusion of the ranking matrix should not be interpreted as suggesting that the problems and uncertainties involved in technology selection and prioritisation can be reduced to a simplistic and mechanistic process."

Following the prioritisation, the CTI 'Methods' recommends undertaking a "detailed technology assessment for each priority technology". The following components are suggested:

- Identification of specific applications for the technology (by use and by location within the country);
- Estimation of the scale of implementation and market penetration that can be achieved for each of these applications;
- Analysis of the costs and development benefits (including contribution to climate change response goals) of each of these technology applications;
- Identification of in-country businesses, government representatives, and other stakeholders, and international businesses and institutions that can be partners in increasing investment and use of the technology.

Subsequently, the CTI suggests the following steps

- Identification and analysis of specific barriers (e.g. policy, regulatory, information, financing, capacity building, etc.) that would need to be overcome to achieve the full implementation potential;
- Evaluation of the effectiveness of existing country and donor programs and anticipated impact of planned programs;

- Identification of specific opportunities to accelerate implementation of these technologies through private and public investment in these technologies;
- Initial identification of potential actions to address critical implementation barriers while building on existing or planned programs and taking advantage of opportunities for additional business development and investment.

The identification of **barriers** to the transfer of technology for climate change adaptation and mitigation is a key step towards a plan of implementation. The GEF Handbook suggests the following categorisation:

- Policy barriers:
  - Regulations and standards that preclude new technologies;
  - Institutional and legal obstacles;
  - Distorting market interventions such as subsidies for polluting industries;
  - Regulated markets that create disincentives for new technologies;
  - Planning system issues.
- Social and cultural issues;
- Market structure:
  - Monopoly powers that reduce incentives to innovate and erect barriers to new entrants;
  - Dominant (oligopoly) interests that erect barriers to new entrants and may discourage innovation.
- Market barriers:
  - Split incentives (where investors are not the consumers of more efficient technologies – the classic example being the 'landlord-tenant' case, where the landlord is responsible for building investments that could improve energy efficiency but has no incentive to do so as he is not responsible for energy costs);
  - Access to capital (where new technologies are capital intensive, even if operating and lifetime costs are low, potential investors may lack the financial resources required to bear the 'upfront' cost);
  - Information barriers (this may take several forms; the simplest is where potential purchasers are ignorant of new technology possibilities and/or lack access to technology information. They may also be faced with multiple and conflicting information and have limited ability/time to absorb it, and choose a known option in preference to a new alternative);
  - Externalisation of pollution costs.

As is illustrated by the above, the focus of both the GEF and CTI publications is very much on market barriers. Neither document details what may be "social and cultural issues" and experiences to address them, or discusses issues of awareness, local research needs and structural capacity problems.

It could be inferred from this that the market barriers are the main barriers to be addressed; that countries should be sufficiently informed to have the will to change policies; that countries have the capacity to undertake such policy changes and implement a transfer programme, and that international research data is sufficient for countries to determine and monitor local potential climate change impacts and desirability of suggested technologies. Such conclusions were most likely not the intention of the authors and one can assume that such underlying barriers are intended to be addressed where necessary.

2.1.3 Implementation actions

The CTI 'Methods' suggests that the preparation and implementation of technology transfer actions and plans can involve several steps, including:

- Secure resources to support further design and implementation of high priority actions;
- Develop implementation strategies for high priority actions;
- Integrate of these implementation strategies with existing development programs and stakeholder activities;
- Prepare of technology transfer action plans;
- Implement the actions;
- Evaluate and refine the actions (ongoing).

The GEF 'Handbook' suggests the following requirements for successful TNA implementation:

- Adequacy of financial resources;
- Transparency of the implementation programme and its goals;
- Identification of potential synergies with existing government and donor sponsored activities and plans;
- Identification of barriers and policies for reducing these;
- Consistency with private sector investment priorities;
- Ongoing engagement with stakeholders (especially those engaged in the implementation);
- Flexibility and revision of plans and programmes in light of new information and/or changed circumstances.

2.2 Methodology for the Namibian TNA

2.2.1 Specific Namibian context

As has been noted in the previous section, the guidelines for TNAs that have been consulted have been designed from experiences in countries that have already undertaken TNAs. It is easy to see that countries such as Brazil, China, Egypt, Ghana, Korea, Mexico, and the Philippines have very different profiles than Namibia. They are medium to highly populated and are semi-industrialised or rapidly industrialising. In the context of the concern for global warming, these are also the countries where the international community has identified the largest potential for GHG reductions, and therefore has put pressure to implement FCCC commitments. Countries such as Namibia are now catching up and have less time and resources to undertake the recommended steps.

The small population in countries such as Namibia is also reflected in its own capacity to implement a TNA while fulfilling other commitments. The countries cited above all have large numbers of stakeholders in all categories. In Namibia the same small group of experts has to sit on panels related to environmental issues. NGOs are limited in number and human resources; often one staff member should participate in consultations on desertification, resource conservation, climate change, etc. The situation is similar in the private sector, only a few companies operate in a specific sector and are sufficiently large to spare the staff time to participate in consultations.

Most of the suggested actions for barrier removal are market-related, under the assumption that influencing prices, costs, etc, will have a major impact on businesses and customers to decide in favour of the adaptation or mitigation technology.

However, the underlying economic theories are all based on an 'ideal' market, which includes the assumption of a large number of competing producers and a large number of perfectly informed consumers. Namibia has a small market and information regarding products and prices is limited. No consumer watchdog alerts customers to better choices and the media have very little capacity to provide such a service.

2.2.2 Institutional arrangements and stakeholder engagement

The Namibian TNA has followed a limited version of the suggested consultative process, taking into account available resources such as financing and preferred timeframe.

No institutional structures were set up specifically for the TNA, nor were the ToR for the TNA derived from the outlined participatory process. As can be noticed from the GEF and CTI texts, such an 'ideal scenario' would have taken up to a year of preparation. The comment above regarding the lack of stakeholder capacity to participate due to the limited absolute numbers of experts is an additional factor that was taken into consideration.

While such a process has indeed been followed in a number of pilot countries, countries in Southern Africa follow a more direct 'top-down' approach. The CTI supported *Cooperative Technology Implementation Plan for Southern Africa* (CTIP SA)[9] followed a similar approach. It could be argued that while the experience in pilot countries showed that extensive participation contributes to the success of TNAs, these countries also had more time to undertake the comprehensive participatory TNA design. Countries that are now undertaking the TNAs are preparing second National Communications and are under more pressure to finalise the TNAs.

The NCCC is a stakeholder group, which has functioned as a core team. The lead agency for the TNA is de facto the Ministry of Environment and Tourism (MET) who is the designated lead agency in the co-ordination of climate change activities in Namibia. The lead technical institution for the TNA is a consultant appointed by the MET working on the basis of terms of reference designed by the NCCC/MET.

The Namibian TNA has benefited from the consultations undertaken for the preparation of the INC, which already included recommendations for TT. It has further incorporated a consultative process through interviews and contacts with a broad range of sample stakeholders (a list of references is presented at the end of the text), and many of these have also participated in two workshops to finalise the two main phases: the selection and prioritisation of sectors and technologies; and the design of an implementation plan.

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[9] See also "Climate friendly energy technologies investment needs in SADC; draft report on national consultations on technologies and investment action", CTI/ Southern Centre for Energy and Environment, 2000

Observations regarding the consultative process and recommendations for improved participation during the TT implementation[10] are included in the TNA.

2.2.3 TNA Processes and Activities

The Namibian TNA has followed the steps recommended in the GEF and CTI guidelines.

During the first project phase, a **preliminary assessment of technology options and affected sectors** was prepared, drawing on the work carried out during the preparation of the INC, the consultations held for the TNA, and studies of documents prepared by the specialist international institutions[11].

Given the available timeframe, it was decided to use a decision-analysis method based on the Analytic Hierarchy Process (cf. supra).

The method consists of deriving the following decision-matrix:

Table 1 Model prioritisation matrix

Technology Assessed	**Sectors and weights**				
	Sector 1 (w_1%)	**Sector 2 (w_2%)**	**Sector 3 (w_3%)**	**Sector 4 (w_4%)**	**Sector 5 (w_5%)**
T1	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
T2	R_{21}	R_{22}	R_{23}	R_{24}	R_{25}
….	…	…	…	…	…
Tn	R_{n1}	R_{n2}	R_{n3}	R_{n4}	R_{n5}

In this matrix, 5 priority sectors have been given a relative weight coefficient w_s, expressed in %, in such a manner that the sum ? w_s =100%.

Technologies are listed from T1 to Tn, and each technology Ti has a ranking associated with each sector s indicated by the element R_{is} of the matrix. This figure indicates how high a project is ranked within the projects relevant to each sector (highest rank = 1)

The grade of each technology Ti is easily obtained by making the sum of the ranking values multiplied with the respective sector weights: Total score = ? R_{is}*w_s. Technologies can then be prioritised with the technology associated with the lowest figure given the highest priority.

To assess the ranking of a project n within a sector s, i.e. to obtain the values of R_{1s}; R_{2s} up to R_{ns}, it was decided to identify three project assessment criteria with a relative weight. If the weights for these criteria are c_1, c_2 and c_3 (evidently ? c_i =100%) each project Tn will be rated according to each of these 3 criteria; obtaining 3 grades g_{1n}, g_{2n}, g_{3n} with values between 1 and 4, equivalent to grading from 'very good' to 'weak'. It should be noted that these are

[10] The Namibian culture of "Consultation" rather than "Participation" (or 'top-down participation' is acknowledged and is further discussed in the barrier analysis; for the Implementation of a Technology Transfer Programme a more participatory approach has been recommended.

[11] e.g. IPCC 1996; IPCC 2000

relative grades that depend on the other projects being assessed[12]; i.e. the best project will automatically get a high score since it is 'good' or 'very good' in comparison to the others.

Project Tn will then have a score within sector s of $c_1*g_{1n} + c_2*g_{2n} + c_3*g_{3n}$. This value could be utilised directly as its matrix entry (R_{ns}) but in the method used for the Namibian TNA, the grade was used to rank the technologies and use these ranks as values of R_{ns}. This emphasises the fact that the grades are comparative evaluations and should not be considered as values.

If technology n has the highest score within sector s, it will be ranked 1 and $R_{ns}=1$.
Since a low score implies preference, a technology n that is not relevant to a sector s, R_{ns} is given a (subjective) predetermined high value. Since the TNA worked with 50-60 technologies, a 'dummy value' of 12 was used for this[13].

The steps outlined above can be summarised as follows:
1. determine 5 priority sectors and weights
2. determine 3 priority criteria and weights
3. determine the technologies to be ranked
4. for a priority sector select a sub-list of technologies that are relevant to that sector
5. for this sector's sub-list, give each technology a grade (1 to 4) for each of the 3 criteria
6. for each project under that sector, add up the scores multiplied with the criteria weights
7. use the total score to rank projects under this sector
8. repeat steps 4,5,6,7 for the other 4 sectors and obtain 5 lists of ranked projects
9. determine the total rank for each project by adding up its 5 ranking positions multiplied by the weight given to the respective 5 sectors

To allow maximum flexibility and convenient presentation to stakeholders, the decision tool was incorporated in a spreadsheet.

The preliminary work was presented in an inception report that was discussed during a first stakeholder workshop, held on 20 October 2004. Most of the participants had already been consulted individually through interviews and individual consultations prior to the workshop.

No suggestions for weights were put forward to avoid bias. The stakeholders undertook the same prioritisation exercise for the sectors and project criteria and derived priority sectors and weights; and project evaluation criteria and weights.

Subsequent comments and suggestions were given regarding the prioritisation method and the scope of the 57 technology transfer projects that were included in the report. The

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12 For completeness it should be pointed out that an initial attempt was made to rank projects per criterion rather than give them a rating; but in prioritising with stakeholders it was agreed that it was too difficult to determine whether under a criterion such as "Cost-Benefit ratio" a project should rank 7th or 8th out of 20. Thus such a project would get a rating of "good" or "very good", i.e. 2 or 1, for C-B ratio.

13 This 'dummy' or 'N/A' value is relevant, since if it is too high, a technology that is ranked no. 1 in the sector with the highest priority would receive such high values for the other sectors that it cannot compete; while technologies that systematically rank very lowly but are relevant to most/all sectors would outscore it. If it is too low, a technology would actually benefit from not being relevant to a sector!

stakeholders decided to undertake an alternative 'rapid prioritisation' exercise where a quick round-table identified 23 'most promising projects' by means of vote.

During the second and final stakeholder workshop, held on the 27th of January, 2005, stakeholders were presented with the output of the various scenarios to assess whether the method converges[14]. Priority technologies were compared when determined from the priority sectors and criteria derived at the first workshop or when determined with weights shifted towards adaptation. In addition, a comparison was made using only the projects selected through the rapid prioritisation or including a number of other projects.

Based on stakeholder feedback, expert opinions and government perspectives, suggestions for a final determination of sector priorities, project evaluation criteria and ranking of priority projects, were put forward, discussed and endorsed by the stakeholders.

During the second phase of the TNA, in parallel with the revision of the technology prioritisation, a **barrier analysis** was undertaken.

A *Logical Framework Analysis* (LFA) method was followed, with a problem analysis undertaken on the basis that the current and/or anticipated technology transfer for climate change mitigation and adaptation is less than desired for Namibia. Through a break-down of this problem in sub-problems a 'problem tree' was derived.

The LFA method followed for the implementation plan design is the standard systematic design approach followed for GEF projects and used by a large number of other donors. Since this method is also generally well-known among the stakeholders in Namibia, it facilitates critical assessment both within the stakeholder community and subsequently by UNDP, GEF and/or other potential donors.

The LFA generally consists of a problem analysis and a response strategy. Within a reductionist paradigm, the specific global problem is broken down into sub-problems, which are then separately addressed through targeted actions that compose the eventual strategy.

Essentially this reflects a vision that all problems can be partitioned in sub-problems; and by solving the sub-problems the general problem will have been addressed. This approach has implicit limitations in a social context, and does receive criticism, notably from civil society actors[15]. It can indeed be argued that acclaimed documents such as the *Brundtland Report*[16] and development strategies such as *Agenda 21*[17] acknowledge the failure of this approach and advocate a holistic, integrated approach that is more in line with a structuralist sociological vision.

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[14] If small changes to the weights had generated radically different priorities the method would not be considered robust (or converging). In a similar vein, if projects that were not selected among 'most promising projects' would systematically rank high when included in the decision-matrix, the prioritisation would be inconsistent.

[15] e.g. Fowler 1997, p. 17

[16] "Our Common Future", report from the 1987 "Brundtland Commission" to the United Nations.

[17] Common name for the Declaration resulting from the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992

Since the LFA is the most widely used tool in modern development project design, this issue is not limited to the TNA method and has been incorporated in the barrier analysis.

The barrier analysis and technology priorities were combined in a series of recommended actions that were presented in a draft Implementation Plan that was the main focus of the second and final stakeholder workshop.

Following the workshop, feedback from stakeholders and recommendations from government were incorporated in the Implementation Plan.

2.2.4 Implementation actions

Within the definition of an implementation plan, a potential action strategy to achieve actual implementation was assessed and discussed during the second and final stakeholder workshop. This included:

- Assessment of financial resources;
- Recommendations for transparency of the implementation programme and its goals;
- Identification of potential synergies with existing government and donor sponsored activities and plans;
- Consistency with private sector investment priorities;
- Ongoing engagement with stakeholders (especially those engaged in the implementation);
- Need for flexibility and revision of plans and programmes in light of new information and/or changed circumstances.

A number of factors have been evaluated:

- Existing technical initiatives that incorporate some of the recommended actions;
- Planned action under the UNFCCC efforts in which the TT programme can be integrated;
- Further potential for synergies with other programmes (such as activities under the country's response to the other major Conventions);
- Potential for donor funding, specifically the role of UNDP and GEF;
- Potential for funding generated within the programme's actions, specifically through the component dealing with financial barriers.

As a result of this assessment a number of recommended steps were derived towards implementation of the programme.

3 Findings

As outlined in the previous section, in the Namibian TNA the word 'technology' has been interpreted as including both 'soft' and 'hard' technologies; where 'soft' implies knowledge-based systems and 'hard' refers to physical, hardware equipment.

The TNA has also been based on the premise that technology needs must be consistent with Namibia's national development goals, as outlined in 'Vision 2030' and in the Second National Development Plan (NDP2 – 2001/2002-2005/2006).

In these documents Namibia has established the following national development objectives:

- To reduce poverty;
- To create employment;
- To promote economic empowerment;
- To stimulate and sustain economic growth;
- To reduce inequalities in income distribution;
- To reduce regional development inequalities;
- To promote gender equality and equity;
- To enhance environmental and ecological sustainability;
- To combat the further spread of HIV/AIDS.

In addition to supporting national development goals, technology transfer must complement ongoing activities that seek to understand and adapt to climate change, or those that seek to mitigate climate change. Namibia's initial national communication to the UNFCCC recommends that technology transfer should focus on adaptation technology given the high probability that the country is a net 'carbon sink' and given the assessment that it is highly vulnerable to climate change.

It should be emphasised that there is no suggestion that this technology needs assessment and the eventual technology transfer programme are the first efforts towards introduction of mitigation and adaptation technology. There are a considerable number of ongoing efforts within Namibia and the region that promote, research or introduce technology for GHG mitigation and climate change adaptation.

The following projects are important examples:

- The UNFCCC activities, such as the NCCC, the country study and the INC;
- Related Local Agenda 21, UNCCD[18] and UNCBD[19] activities;
- The BCMLE[20] and related marine ecosystem monitoring programmes;
- The Barrier Removal to Namibian Renewable Energy Programme;
- The efforts to increase generation of hydropower;
- The natural gas programme (NamPower);

[18] United Nations Convention to Combat Desertification

[19] United Nations Convention for Biodiversity

[20] Benguela Current Large Marine Ecosystem

- The projects on wind-energy in Luderitz and Walvisbaai;
- The Solar Home Systems scheme;
- The Gobabeb hybrid power system;
- The Habitat Research and Development Centre;
- The R3E[21] initiatives;
- Community projects on promoting fuel briquettes, efficient stoves and biogas;
- Regional Biomass Energy Conservation Project
- Private sector initiatives such as Rossing Uranium's Khan Aquifer Recharge Scheme;
- NNF[22] research on impact of climate change on the environment;
- ZERI's[23] activities;
- The efforts towards capacity for the Clean Development Mechanism;
- The SADC-FINESSE[24] initiative;
- REINNAM[25].

3.1 Sector prioritisation

3.1.1 Preliminary options

During the inception phase of the TNA, a preliminary assessment of technology options and affected sectors was prepared, drawing on the work carried out during the preparation of the INC, the consultations held for the TNA, and studies of documents prepared by the specialist international institutions.

The preliminary list of technology projects presented to a stakeholder workshop on the 20th of October 2004 included 57 projects, each documented through a general outline.

During the stakeholder workshop, the following list of sectors to be considered was agreed:

- Environment and tourism;
- Agriculture and food security;
- Water;
- Energy;
- Health;
- Transportation;
- Cultural identity;
- Education;
- Industry;
- Science and technology;
- Communication;
- Housing.

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21 Renewable Energy and Energy Efficiency programme

22 Namibia Nature Foundation

23 Zero Emissions Research Initiative-Waste products are recycled and re-used again, thus reducing the amount of waste and GHG emissions.

24 Southern African Development Community- Financing Energy Services for Small-scale Energy Users

25 Renewable Energy Information Network of Namibia

The feedback obtained from the stakeholders after the workgroup sessions regarding prioritisation of sectors is shown in table 2.

Table 2 - Sectors prioritised by stakeholders

Priority Sector	**Value** (total from 3 workgroups)	**Weight** (top 5 only)
Food and Agriculture	49	23%
Water	48	23%
Environment and Tourism	43.5	21%
Energy	41.5	20%
Industry	28	13%
Housing	22.5	
Health	22	
Science and technology	16.5	
Transport	9	

The sectors that have not been classified as priority sectors are by no means irrelevant. For instance, the stakeholders are well aware that climate change will have considerable impacts on health, and this sector should receive support to be prepared for climate change adaptation. However, in terms of technological needs it is not assessed to rank among the five priority sectors.

In a similar manner, the transport sector offers important opportunities for greenhouse gas mitigation, but the main potential for improvement lies in energy use within the transport sector which is included in the energy sector.

The INC recommendation that technology for adaptation is currently Namibia's priority is reflected in the high scores for water and agriculture.

Agriculture remains a sensitive sector, although in economic terms its importance is declining[26] and is now less than mining and tourism[27]. With close to 50% of the labour force active in the agriculture sector, a large section of the population is affected. So improvements in sustainability of agriculture are indeed a priority. The choice of agriculture as a priority sector does not indicate support for increased agriculture but rather reflects the importance to improve technologies in this sector, which includes searching for sustainable alternatives to agriculture and water utilisation.

Environment and tourism have been grouped together in agreement with the portfolio of the Ministry of the same name. Sustainable tourism is felt to be a sector with good potential since tourism is growing and will increasingly impact on natural resources. Environment is perhaps too broad to be a focus sector, however in view of the prioritisation exercise its priority status is strongly linked to the desired sustainability of proposed technologies. Technologies that are reliable but not sustainable may score well under their specialised sector but should be

[26] NDP2, p. 184

[27] Based on figures for 1999, NDP2

ranked lower than more sustainable alternatives as a result of a bad score under environment[28].

In view of the required focus on adaptation, a revised sector prioritisation was presented to the stakeholders during the second and final stakeholder workshop. It is shown in table 3.

Table 3 - Revised priority sectors

Priority Sector	Weight
Food and Agriculture	25%
Water	25%
Environment and Tourism	20%
Energy	15%
Industry	15%

3.1.2 Conclusions regarding sector priorities

The stakeholder group did not consider this additional adjustment as necessary or appropriate. The stakeholders pointed out that the definition of the sectors and the subsequent prioritising and weighting, undertaken during the first workshop, had been quite thorough and there had been a general consensus regarding the result. In addition, it can be argued that in their deliberations, expert stakeholders were well aware of Namibia's vulnerability to climate change and the resulting importance of adaptation technologies. This would make an additional correction redundant.

In view of this, the suggested adjustment has not been retained, and the final sector priorities that were subsequently used to determine the priority technologies remain those of table 2.

3.2 Selection of technology evaluation criteria

3.2.1 Initial criteria and weights

During the first stakeholder workshop, stakeholders were presented with the following suggested list of project evaluation criteria and asked to rank these to obtain 3 key criteria:

- Social acceptance;
- Employment;
- Reliability;
- Capacity building;
- Cost-benefit ratio;
- Improvement Potential;
- Political will;
- Time to develop.

[28] e.g. if the total desirability of nuclear fission technology is assessed, it could score well under the energy sector but will have a low value under environment due to the high risks, radioactive waste problem, water consumption and limited lifespan of power plants.

The feedback from the stakeholders is shown in table 4.

Table 4 - Technology evaluation criteria obtained from stakeholders

Key Criterion	Value (out of 300)	Weight (top 3)
Capacity-Building	48	34%
Cost-Benefit Ratio	46	33%
Reliability	46	33%
Employment	41	
Improvement Potential	39	
Political will	34	
Social acceptance	27	
Time to develop	19	

While the results for priority sectors discussed in the previous section were quite clear, the outcomes of the technology criteria generated a lot of discussion. This was partly due to variable interpretations of the various criteria. A major issue was that without a strict definition of 'benefits' in 'cost-benefit ratio' one could argue that employment, improvement potential and capacity building are all covered under cost-benefit ratio.

The criteria and weights listed in table 5 were suggested to the stakeholders during the second workshop.

Table 5 - Revised technology evaluation criteria

Criterion	Weight
Cost:benefit ratio and improvement potential, including employment	47%
Capacity building	27%
Reliability and sustainability, including social acceptance	26%

As the entries in table 5 specify, 'benefits' focus on financial benefits such as return on investment, potential for income-generation, export, etc; the improvement potential for adaptation or mitigation; and the potential for employment creation.

Reliability has been extended to include sustainability, in order to discriminate against proven technological solutions that are not conducive to sustainable development. In addition, social acceptance has been included to reflect the fact that without social acceptance the introduction of any proven technology is doomed to fail[29].

3.2.2 Conclusions regarding evaluation criteria

[29] The example of water-efficient toilets was discussed, where the technology of dry toilets, compost toilets or low-flush toilets exists and has been proven to be efficient and is highly desirable for sustainable water use in Namibia; which would make it a priority technology if not for the fact that it is not likely to succeed due to the social reluctance to accept alternative sanitation.

The revised criteria listed in table 5 were adopted by the stakeholders and therefore retained.

The stakeholders further recommended that the eventual list of priority technologies should include the following categories:

- Capacity building projects;
- Awareness projects;
- Research projects;
- Hard technology projects.

3.3 Priority technologies

Subsequent to the decisions for priority sectors and evaluation criteria, the decision matrix was obtained through the process outlined in section 2.2.

Per sector the technologies relevant to it were listed. Each technology in this list was then given a grade between 1 and 4 for each of the evaluation criteria. A total grade for each technology relevant to that sector was then obtained by addition of grades per criteria multiplied by criteria weights. These grades allow ranking of projects per sector.

The row of the decision matrix for each technology is then its rank within all sectors.

The final score for all projects is obtained by adding up the matrix elements multiplied with the sector weights. Table 6 shows the final ranking of the 25 best projects.

Table 6 - Ranking of priority technologies

Rank	Technology
1	Build capacity to tap into international funding
2	Expand use of artificial recharge schemes
3	Construct desalination plants for brackish groundwater
4	Increase capacity for GIS, satellite imagery, data analysing software and hardware
5	Promote inland aquaculture, developing efficient and productive aquaculture techniques
6	Water and energy efficiency in public institutions
7	Farmer awareness and training on farming and diversification under drought conditions
8	Water-efficient technology for industries
9	Expand Namibia's climate observation system
10	Natural gas to generate electricity
11	Promote self-sustaining areas and eco-tourism
12	Water and energy-efficiency in the building sector
13	Upgrade vehicle inspection centres to allow engine efficiency and emissions testing
14	Transition from low-value grain crops to high-value crops in areas with sufficient water supply
15	Afforestation and agroforestry programme
16	Map wind velocity
17	Biomass, bush encroachment and deforestation monitoring
18	Calibrate crop models for Namibian conditions
19	Promote solar water heaters
20	Promote energy-efficient cooking techniques, efficient stoves, and charcoal kilns
21	Promote water conservation in rural areas
22	Promote tourism and environmental recovery rather than agriculture in arid areas, such as the veld

23	Develop financial incentives to remove barriers to mitigation and adaptation to climate change
24	Rural electrification R&D – PV mini grid
25	Waste fuel briquetting

As can be observed, in addition to 'hard' technology projects the list of technologies includes a number of projects focussing on capacity building, awareness and research.

The convergence of the method was shown when minor changes to sector weights and the addition of a number of projects that were not selected as 'most promising' caused minor shifts in ranking. With the addition of the projects ranked 3 and 10[30], with only one exception the 'top 12' contained the same projects than the initial 'top 10', with minor shifts in ranking.

This demonstrates that the approach resulted in a decision method that selects priority technologies in a manner consistent with the stakeholders' valuation. Additional suggestions for technologies can be evaluated by adding them and observing their ranking. This is consistent with the GEF and CTI recommendation that the technology transfer programme should be flexible/dynamic rather than static.

3.4 Barrier analysis

As described in section 2.2.3, the method followed for the design of the implementation plan is the standard approach for GEF projects known as Logical Framework Analysis or LFA.

The undertaken LFA consists of a problem analysis and a response strategy. A general problem is broken down in sub-problems, which are subsequently addressed through distinct actions that compose an action plan.

The inputs for the barrier analysis were obtained from the consultations with stakeholders, experts and government officials; as well as from studying relevant documents such as policies.

3.4.1 General Problem

The general problem can be expressed as follows:

> **The current and expected rate of climate change adaptation and mitigation technology transfer to Namibia is insufficient.**

While there has been no specific scientific analysis to confirm this working hypothesis, it is derived from stated needs in the INC[31], the ToR for the TNA[32], the general status of technology

[30] Other technologies that were added, such as a capacity building project in the health sector, and a sea level monitoring project, failed to impact on the ranking, which is consistent with their characteristics outside the priority sectors – even though they are important initiatives they are not among the highest priorities

[31] See Chapter 7, Namibia Initial National Communication to the United Nations Framework Convention on Climate Change, June 2002

[32] Terms of Reference for the Assessment of the Technology Needs for Mitigation and Adaptation to Climate Change in Namibia, Republic of Namibia, Ministry of Environment and Tourism, May 2004

transfer to developing countries as assessed in a number of UNDP/GEF reports[33], the analysis undertaken for the *Barrier Removal to Namibian Renewable Energy Programme*[34] and the consensus among stakeholders who were interviewed and participated in the initial TNA workshop[35].

Given the assessment from the INC that Namibia is currently a sink for greenhouse gases (GHGs) and is vulnerable to climate change, technology for adaptation is the main focus within this problem.

Insufficient TT (or anticipated insufficient TT) results from a number of existing barriers. From an initial classification, subsequently revised during the second stakeholder workshop[36], the analysis concluded that the following barriers can be differentiated:

- Insufficient awareness;
- Policy and legislative barriers;
- Political and institutional barriers;
- Socio-Cultural barriers;
- Financial barriers.

Table 7 - Barriers to technology transfer

Awareness and information barriers	Policy and Legislative Barriers	Political and Institutional Barriers	Socio-Cultural Barriers	Financial Barriers
Lack of awareness regarding CC P, D-M, D, PS	Inexistent/ inefficient policies D-M, D, (P), (PS)	Lack of financial commitment D-M, D, (P)	Poverty - P	Funding (quantitative and qualitative) D-M, P, (D)
Lack of awareness regarding sustainable development P, D-M, D, PS	Top-down (non-participatory) and reductionist design methods D-M, D, (P)	Weak policy implementation D-M, D, (P), (PS)	Culture – P	Information on financing D-M, P, PS
Lack of awareness regarding technology P, D-M, D, PS	Monitoring and Evaluation D-M, D, P	Negative lobbying (interest groups) D-M, PS, (P)	Health – P	Capacity to tap into financing D-M, PS, P
		Coordination D-M, D, (P), (PS)	Education – P	Access to private funding – P
		Lack of institutional readiness for Kyoto Protocol D-M, PS, P, D	Structural inequalities – P	Financial incentives D-M, P, PS, (D)
		Bureaucracy D-M, P, PS		

33 See e.g. Technologies, policies and measures for mitigating climate change, IPCC 1996; Methodological and technical Issues in climate change, IPCC 2000

34 Barrier Removal to Namibian Renewable Energy Programme, Project Document, PIMS 1232, UNDP/GEF 2001-2003

35 First workshop on TNA for climate change adaptation and mitigation, Safari Hotel, Windhoek, 20/10/2004

36 Second workshop, Safari Hotel, Windhoek, 27/1/2005

		Capacity to process D-M, PS, P, D		

Table 7 lists the most important barriers that were identified and the concerned parties. For each barrier various stakeholders are concerned parties, either directly or indirectly causing the barrier, or capable of having an impact on it. They are categorised as the Public (P); Decision-Makers (D-M); Donors (D); Private Sector (PS).

Listing of concerned parties between brackets indicates that they are not directly responsible for or affected by the barrier but fail to reduce it or are indirectly affected (e.g. the public can influence policies through lobbying and advocacy; a weak civil society is therefore a contributing factor).

3.4.2 Insufficient awareness

The general awareness regarding **climate change** and its potential impacts is very poor, as has been observed during the consultations for the TNA and confirmed by the stakeholders. The awareness raising campaign on Climate Change was initiated only during 2004; while that on biodiversity and desertification started earlier.

Non-specialist professionals have very limited awareness of **principles of sustainable development**. Namibia has a local Agenda 21 (LA21)[37] strategy but the majority of organisations or individuals indicated that they have no documentation on Agenda 21 or would be able to list some principles of sustainable development.

Awareness regarding **technology** is limited to specialists in the respective fields (energy, water, agriculture, etc). Specialists interviewed indicated that most of their sources of information lie outside Namibia and that an individual or organisation without the resources or contacts to tap into overseas information would not be able to gain it locally. Efforts within the tertiary institutions (the University of Namibia (UNAM) and the Polytechnic of Namibia) are acknowledged, but the general consensus is that these institutions focus on improving educational programmes and have limited capacity for research.

This absence of awareness or very limited awareness is relevant to all sectors of Namibian society:

- general public and civil society;
- private sector;
- government and public sector;
- the donor community.

Based on feedback from the persons interacted with during the project it appears that in all sectors awareness is limited to a small percentage of persons involved in innovative action or research in the area of natural sciences; environment and natural resources management.

[37] Some efforts have been undertaken by the Municipalities of Windhoek and Walvis Bay with local Agenda 21 projects

In civil society, specialised organisations and specialist individuals have an interest in learning about potential and predicted climate change impacts. Information is readily available on the internet, but a general observation is that local information is not available. Individuals, NGO staff and non-specialist professionals who were asked whether they felt they could easily obtain recent information from UN agencies, specialist NGOs or government departments replied negatively. Few of these entities prioritise information dissemination; and where information is available (documentation centres or websites) it is generally not recent.

In the private sector, managers working in the area of natural resources management may have an understanding of the potential impact of climate change on resources. The contacted private sector enterprises did not report any research or contingency plans taking on board climate change predictions. There is general awareness among the senior managers interviewed that CC is likely to affect Namibia during this century but given the long-term nature of the problem and short to medium objectives of most businesses, it is a problem that is not assessed to be of major importance. Information would be welcomed but will not be actively sought unless it concerns opportunities for business development. In this context, no significant awareness has been identified regarding carbon trading and its potential for the private sector.

Staff in household retail stores is generally not able to assist customers who have questions regarding the energy efficiency of household appliances. They indicate that customers do not ask such questions. This is consistent with a study undertaken in Botswana[38] where customers and retail staff were asked about choice of electrical appliances and awareness regarding energy consumption and associated costs of appliances was generally very low. In this same study it was observed that electric geysers are generally imported from South Africa with a standard high thermostat setting (80 or 85° - the optimal temperature is 65-70°) to avoid customers complaining of insufficiently hot water, which results in 30% more electricity consumption than necessary and shortens the lifespan of the heating element due to calcium deposits. It is likely that the situation is comparable in Namibia.

In public institutions the situation is similar. Experts in specific areas of natural resource management have a good understanding of potential impacts of climate change on their focal area but limited knowledge of developments in other areas. They report that most of their information is obtained overseas through contacts and publications. Local information exchange with local institutions such as UNAM or Polytechnic or with NGOs or specialists from the private sector is limited. While it is acknowledged that academic research, grassroots experience and private sector perspectives are important there is no systematic polling of these resources, only occasional contacts. In some instances there is a clear perception that it is more efficient to source information outside Namibia since these local organisations have little knowledge to offer.

Awareness is not a decisive factor for donors to decide on action, since their programmes are usually driven by foreign policies decided in their home country or multilateral institution. Local representatives are essentially administering funds along those policy guidelines. However, they do have an opportunity to provide feedback regarding local priorities to their home organisation. In this context, it is important to note that despite the emphasis of Agenda

[38] Household energy study, undertaken by Environment Watch Botswana with Botswana Technology Centre under the GEF-SGP

21 and other international agreements on the need for integration of all components of development, this is not the common practice.

In the health sector, programmes combating HIV, which are currently a high priority with donors, rarely include natural resource management as a programme component. International experience shows that HIV, poverty and depletion of natural resources reinforce and amplify negative impacts on one another[39]. While income generation is now part of some HIV programmes, programme components to allow communities living with HIV to adapt their natural resource management without depleting their environment are not integrated[40].

A separate concern is access to research for all stakeholders. While many stakeholders identify a need for research and are concerned about the lack of funding for research, thus increasing Namibia's reliance on external data, there is also a concern that research data is not available. Causes cited are decentralisation of libraries and documentation centres[41], no electronic bulletin board for locally undertaken research; and a degree of protectionism, i.e. some researchers may prefer to hold on to their research in order to avoid competition for grants for future research.

3.4.3 Legal and policy barriers

Namibia has white papers, policies or bills in place for all sectors identified as priorities for climate change adaptation and mitigation: water[42], energy[43], agriculture[44], environment[45] and industry[46]. Very few of these have completed the process of being converted into legislation (Act). This is a political issue and is included in section 3.4.4.

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39 The Red Cross *World Disaster Report 2002* asked: "Aids is both a root cause of poverty and its consequence. Is it morally tenable any longer for relief agencies to deal with this humanitarian disaster without addressing its causes?" The linkage between poverty and poor NRM is widely documented, see e.g. IUCN's regional training programmes on "People, Poverty and Natural Resources Management" and various publications on CBNRM.

40 An example of such 'positive' feedback is where people living with HIV/AIDS (who may suffer from opportunistic respiratory diseases) use open woodfires. The sick staying at home often tend the fire while others leave the house. Cutting of fresh wood near the house increases due to labour shortage, wood needs increase to care for the sick, the energy efficiency is worse, smoke increases, when wood is lacking water/food may no longer be properly cooked. Women and children may suffer increased risk of abuse for energy. However, fuel efficient stoves with chimneys to allow smoke-free cooking in a sheltered kitchen are generally not perceived to be a necessary component of an HIV programme.

41 A topical example here is the research undertaken under Namibia's commitments to the UNFCCC (Namibia Country Study on Climate Change, Volumes 1-3). This research is not readily available on the Internet, in the MET library, UNAM library or at the UN, where it can easily be consulted, photocopied or purchased. The data used for the reports is also not publicly available.

42 National Drought Policy and Strategy, 1997; Water Act, 2004

43 White Paper on Energy Policy, 1998

44 National Agriculture Policy, 1995; Green Scheme and Irrigation Policy, 2002

45 Environmental Management Act, 2002; Environmental Assessment Policy, 1995

46 Industrial Development Programme under NDP2

The *National Development Plan* (NDP2) and the government's long-term Vision 2030 make no mention of climate change or action to be taken and responsibilities of specific actors. The only sector listing 'environmental change' as a specific constraint is Fisheries and Marine Resources[47].

The water bill includes references to aquifer recharge, but only to be carried out by government. This means that any recharge initiatives need to be undertaken with government approval. Furthermore, the water bill makes no mention of the possible impact of climate change. However, it does state that the *National Water Master Plan* should assess "a water balance for each basin of Namibia that compares forecasted water demand with **data and information regarding water availability**". Such a forecast should include possible reductions in availability. Water harvesting for non-domestic purposes requires a permit, which may effectively discourage small farmers or households seeking to harvest rainwater for subsistence farming.

The energy white paper covers a large amount of recommendations under new and renewable energy. Criticism from stakeholders is that it should be revised to be less ambitious in terms of scope, but more targeted and detailed in selected policies.

Some stakeholders express concern that the emphasis of NDP2 on food security and the *Green Scheme* irrigation policy are barriers to sustainable development. Although the focus of the Green Scheme is on river water for irrigation, there has been debate as to whether Namibia as a country should use groundwater at all for irrigation as the value added is extremely low. This same concern is also reflected in a number of priority projects such as tourism and diversification selected during the stakeholder workshop, which promote economic alternatives to water-intensive agriculture.

None of the consulted policy documents explicitly incorporates the climate change predictions in its guidelines.

Monitoring and evaluation (M&E) is not a priority component of Namibian policies. Some stakeholders suggest that M&E follows the requirements of the entity financing the respective programme or project, without any genuine interest from the implementing agent to learn and disseminate. It is generally felt that reporting on failure is not encouraged, both in government and civil society, since there is a perception that it would reflect badly on the organisation.

Public participation is not very strong in Namibia. Policy and project design and implementation essentially follow a 'top-down' approach with stakeholders, at best, consulted at certain stages (as opposed to being involved from the needs assessment and design stages). The limited capacity of civil society to assist with policy design and lobby for improved implementation is acknowledged. There are only a finite number of organisations and people who typically participate as policy 'watchdogs' who would have to stay abreast of the entire range of government sectors.

Holistic approaches to development and resource utilisation are not yet common. Individual government sectors or departments tend to identify problems related to their own mandate

[47] NDP2, p. 234

and attempt to solve these problems under the assumption that if everybody does the same the general problem will be solved. Integrated action is often limited to personal initiatives.

3.4.4 Political and institutional barriers

In general, stakeholders comment that the **lack** of policy instruments is not a major barrier, nor is the financial commitment from government.

Concerns expressed relate to policy **implementation**. This includes the concern that policies take a long time to be translated into legislation and thus most policies are not legally binding. Capacity to implement policy is lacking, departments dealing with natural resource conservation are perceived to be understaffed; high staff turnover is quoted[48], with young staff members moving on to study and/or subsequently to the private sector; and short-term involvement of international staff and consultants is perceived not to build capacity.

As in most countries, there are a number of social actors with vested short-term interests in 'mining' (unsustainable use) of natural resources. Farmers may lobby against policies discouraging or prohibiting irrigation; the petrol industry against increased taxing of fossil fuel to encourage alternatives; tourism businesses against stringent 'zero-impact' rules. The EIA policy is a positive step towards sustainable natural resource use, since it will become a generally-known standard and should actually reduce risk for developers through better planning.

The ratification of the Kyoto Protocol, which became operational on the 16th of February 2005, offers opportunities for carbon trading, specifically under the **Clean Development Mechanism** (CDM) as Certified Emission Reductions (CERs) and therefore additional income from technology innovations undertaken in countries such as Namibia. However, there are potential negative impacts:

- Industrialised countries will now want to ensure they meet the required reductions. This may mean that a donor is less likely to fund a solar power or biogas project in the knowledge that the implementing organisation has every right to sell the carbon credits to the highest bidder – not necessarily the project funder.

- The carbon trading regulations are very strict and require a national mechanism for selection of appropriate projects through a Designated National Authority (DNA), and approval by the international Executive Board. Namibia has no capacity for this process, while other countries such as South Africa have already put structures in place. With donor countries' taxpayers pressure a donor may therefore have to choose between funding a US$1M project in Namibia or a US$1M project in South Africa that generates 50,000 carbon credits – currently worth in excess of US$250,000.

- CDM is essentially an economic instrument and at best the international community pays for approved carbon mitigation projects under the tacit assumption that the DNA has adequately represented the long-term interests of a country. However, this is already causing controversy since it may actually assist in funding unsustainable projects. For

[48] Staff constraints and turnover are listed as a constraint by several sectors in NDP2

instance, plantations with rapidly growing tree species are a popular type of CDM project but may be against sustainable use of groundwater and protection of biodiversity. As such, in South Africa the demand for high-grade paper for recycling has dropped significantly[49], possibly due to the assumption that pulp plantations will receive subsidies through the CDM.

Institutional barriers are referred here as instances where awareness and capacity exists, but due to inefficient institutional structures no progress is made.

Communities (civil society organisations or schools) who wish to implement natural resource management projects may eventually abandon the idea due to the complex **bureaucracy**. For example, the bureaucratic issues for a greywater or rainwater harvesting project at a school include the following issues:

- Is a permit needed?,
- Who requests it from the Department of Water Affairs?
- Can the school expect the Department of Works to handle this or should they go through the Education Department?
- Is there any entity out there that will assist them in designing the system?
- And in getting the necessary approval and possibly funding?
- Etc…

It can easily be understood that initial enthusiasm from any community member may quickly disappear. In view of this, awareness raising without offering assistance to get through the bureaucratic process will probably be ineffective.

Lack of **institutional cooperation** is a worldwide problem in governments or large organisations. How much ownership do government departments have of policies of other departments? Do decisions made by the departments of works or transport incorporate recommendations made by the departments of water affairs or energy affairs?

Staff consulted in various departments acknowledges that they are not in possession of the policy documents from other departments; although they point out that when a policy becomes a bill it is legally binding for everyone. Therefore the problem lies with lower level documents such as white papers and policies that are not widely known and used.

Mechanisms need to be developed that allow departments to share expertise. An improved solar collector is not only to be recommended within the Energy Department, but is relevant to the Department of Works in connection with remote buildings and to the Department of Water Affairs in connection with water pumping.

A key role here can be played by the National Planning Commission Secretariat (NPCS). It already ensures that sectoral policies are incorporated in workplans and is therefore ideally suited to improve information exchange and inform Departments of developments that are relevant and should be acted on. The NPCS is believed to be the most suitable entity to take action to improve information exchange and cooperation between departments.

[49] The price of high-grade paper for recycling has dropped by 25% in 2004 and by 50% compared to 2003 (pers. comm.. Nampak Paper)

3.4.5 Socio-cultural Barriers

Vulnerable people, such as the poor, sick, uneducated or discriminated, will suffer most from climate change impacts, since they generally rely heavily on natural resources likely to be threatened; and because they have limited alternatives for income generation. Most of Namibia's poor rely on subsistence farming and the predicted increased variability in normal precipitation patterns that leads to increased incidences of both droughts and floods is likely to affect this group strongly. Unlike wealthy people, who can change jobs, neighbourhoods or even leave the country altogether, vulnerable groups have limited options.

Poor people are less likely to adopt new and appropriate technologies because they cannot afford them, but also because adoption of any new practice is an action that involves risk and the perception is that they cannot afford the risk. Alternative cooking devices like solar cookers will require an investment, and yet are not optimal for every situation. Thus when it rains or when there is a need for evening cooking an alternative is needed. People who can only afford one type of stove will not choose one that only functions part of the time[50].

An additional factor is 'technology stigmatisation', which occurs when a technology is perceived as 'for the poor'. Promotion of improved mud-stoves may offend the target population when they are aware that other communities use paraffin or gas stoves; promotion of compost or dry toilets can generate an interpretation of 'degeneration' (since it is perceived as the method used when we were undeveloped; and nobody in a wealthy suburb or 'developed' country is believed to live like that). In these circumstances, programmes with an overly technological focus often fail, while a programme that links its objectives to status aspirations –e.g. by suggesting brick stoves with chimneys to improve on open woodfires- has a better chance.

As can be seen from the latter example, technological issues are generally not the main bottleneck for technology adoption. In the same sector of domestic energy, women who are the main users of domestic energy for cooking and are targeted for fuel-efficiency programmes, often report that programmes ignore other social uses of the open woodfire, such as its use for heating, lighting and even simply to avoid neighbours thinking that the woman is asleep.

In addition to this problem of 'techno-focus' of project designers, the methods to remove financial barriers also face cultural barriers. It appears rational to project designers that a micro-lending system or rotating fund would be an excellent way to help communities to adopt new and appropriate technologies, but the practice of paying back a loan in this manner may not be part of the culture of a community, where a 'loan' given by someone who can afford it is considered a 'gift'.

Local priorities may differ from national priorities; and the pros and cons of a particular technology add up differently in different cultures. A well-known example in Namibia is the

[50] See e.g. *Domestic energy in refugee situations*, UNHCR, 2000, which is based on extensive efforts to introduce improved stoves or solar cookers to millions of refugees worldw ide, with limited success.

Epupa Falls hydropower project, where local valuation of resources differs from the project designers' interpretation[51].

It is now generally agreed that poverty, health and lack of education are clearly linked. The *Millennium Development Compact* included in the UNDP's 2003 *Human Development Report* refers to "impediments [that] leave countries stuck in poverty traps" and includes health and education in the first of six policy clusters to address poverty[52]. These impediments make it less likely that vulnerable target groups will adopt new technology even if it is available and subsidised.

Structural inequalities have to be recognised as an important barrier. Rural people are structurally disadvantaged when it comes to access to information; young people have less possibilities to access funding; women do not have the same possibilities than men, old or handicapped people also have less access to technological opportunities.

All societies have a certain 'inertia' when it comes to introduction of new technologies, or require an amount of 'enticement' before a technology becomes widely accepted, that is related to the culture of using old established practices. In addition, it is widely agreed that success of any development project relies on ownership and participation. Namibia has a relatively weak Civil Society and development occurs primarily through a 'top-down' approach that results in government and donors promoting development projects without participation of the target communities in needs assessments and project design.

3.4.6 Financial Barriers

Lack of financing for Technology Transfer is in itself a barrier. However, as transpired from the stakeholder consultations, the key problem does not appear to be availability. Indeed, consulted staff members from line ministries do not report major complaints about available funding. In some instances, it is agreed that lack of capacity to implement does not allow funding to be spent.

The **type and conditionality of funds** appears to be a more significant problem. Increasingly, donors focus on project funds rather than on institutional support. Total funding since the post-Rio boom of the1990s has also generally decreased or shifted from environment and sustainable development to areas such as relief and health[53]. Grants have become smaller, less flexible. Staffing, administrative costs and capacity building are generally perceived as overhead costs that should be kept to a minimum[54].

NGOs are struggling to obtain funding and maintain technical and methodological focus. Increasingly, donors approve of NGOs who include cost-recovery and/or service provision in

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51 See e.g. *A Case Study on the Proposed Epupa Hydro Power Dam in Namibia*, Andrew Corbett, Legal Resources Center, Namibia http://www.dams.org/docs/kbase/contrib/ins103.pdf

52 Human Development Report UNDP, 2003 (pp. 15-18)

53 Pers. Comm. Dr. P. Molutsi, Sociology Dept, University of Botswana

54 See e.g. Fowler, Earthscan Reader on NGO management, 2002

their action[55]. This can result in criticism from community members, private sector companies and government departments that NGOs are becoming consultancy companies. Alternatively, where funding is project oriented within strict areas, NGOs are forced to raise funding opportunistically and can then be accused of lacking focus[56].

Consultations with stakeholders have shown that **knowledge regarding funding opportunities** is limited, as is the capacity to write proposals and network with donors[57]. The problems cited with staffing and implementation capacity in section 3.4.4 affect fundraising capacity as well. An additional problem is mentioned where international technical advisors are seconded to line ministries and provide assistance to tap into funding without building institutional capacity to do so after their departure.

With the exception of dedicated programmes such as CBNRM and programmes where the stakeholders facilitate funding, consulted government department and NGO staff acknowledge that they have little or no role as 'intermediate' organisations in providing assistance to individuals or community organisations to tap into donor funding.

Stakeholders also consider access to funding difficult because of **rigid donor preconditions** with cumbersome procedures to follow.

As reported earlier, support for inappropriate development –e.g. irrigation programmes using groundwater- may form a barrier to sustainable technologies. In natural resource economics, **inefficient pricing** of resources is identified as a key factor leading to market distortion, as are explicit or hidden subsidies. In the water sector for instance, pricing is based on historic average costs rather than on marginal costs, and no scarcity rent is included. To make the water price efficient, the consumer should pay the marginal cost of supplying the last unit of water. In addition, the costs of running the water utilities operation should be calculated on the basis of current and prospective costs rather than on past costs[58]. Eliminating current policies that effectively support inefficient resource use should therefore be the first priority[59].

Introducing financial measures to promote appropriate mitigation technology is an option. However, it should be considered with caution. Introducing **incentives** to compete with hidden subsidies is a technique resembling shortening all the legs of a table when one is found too short. One should not forget that any subsidy is a deliberate distortion of the market and will have more effects than only the desired ones. Examples of failing initiatives in the region are the GEF photovoltaics project in Zimbabwe[60], which was eventually not sustainable and

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55 E.g. Pers. Comm. DANIDA

56 Fowler, ibid., pers.comm. DANIDA

57 A minority of consulted stakeholders is aware of funding areas of GEF -SGP, of mechanisms to attract funding from other UN organisations or bilateral donors. Generally stakeholders are aware of one or two sources of funding which they have used, but do not have an overview. Donors also report dissatisfaction with the standards of proposals received.

58 See e.g. Environmental and Natural Resource Economics, Tietenberg 2000, pp. 207-227

59 Price scales for water consumption as used in Windhoek are an incentive to discourage excessive use, but the prices may still be too low

60 See e.g. Choosing Financing Mechanisms for Developing PV Markets, Mark Hankins, paper presented at the 2003 GEF workshop on financing models for PV systems in Africa

temporarily flowed the market with low-cost technology offered by selected companies, thereby outcompeting others; the failure of Namibia's Solar Home Systems Revolving Fund[61]; and the distorting effect on the renewable energy sector of Botswana's support for SMME's through its Financial Assistance Programme and Central Economic Development Agency[62].

Namibia is a country with a small market and limited access to a medium-sized market (South Africa)[63]. The basic conditions for high price elasticity such as a large number of perfectly informed consumers are not met. Therefore it is not likely that subsidies (import duty reductions, interest free loans, etc) would significantly increase demand. In addition, one can note that public interest in resource-efficient technology is very low. Advertising for vehicles or appliances does not make any reference to energy-efficiency; gardens are watered at midday when most water evaporates, which makes a market for drip irrigation systems unlikely even with subsidies; etc.

As agreed among the stakeholders, the above does not mean that financial measures to remove barriers to adaptation and mitigation technology should be discarded. The above discussion emphasises the fact that the core problems in Namibia lie in awareness, information dissemination, know-how and capacity.

A specific and highly topical potential source of funding are **carbon credits**. Now that the Kyoto protocol becomes operational, private sector companies could derive a bonus from development projects by selling the carbon credits. The following practical examples should illustrate the potential[64].

Fuel substitution is one of the key examples of projects acceptable under the Clean Development Mechanism (CDM). Through the Kudu gas project, Namibia could replace some of its energy imports generated from coal by electricity generated by natural gas. A rough estimate is that currently imported energy has an associated carbon cost of nearly 1 million tonnes (1000 Gg) CO_2 equivalent per year. If this can be reduced by 10% (e.g. by replacing approximately 20% of the imported energy with electricity from natural gas) the carbon credits that can be claimed on the basis of this estimate would currently amount to N$3.5 – 4 Million[65].

Even at the scale of medium-sized companies the benefits can be considerable. One of the interviewed private sector stakeholders, Meatco, has steam generators in three locations, using coal and diesel oil fuel, generating an estimated 50,000 tonnes carbon equivalent annually. In addition, the company has a feedlot in excess of 10,000 heads of cattle, generating an estimated annual 5,000 tonnes carbon equivalent as CH_4 from manure[66]. Should this company invest in a solar water pre-heating system or convert to natural gas

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61 Pers. Comm. Prof. P. Jain, MME; Robert Schultz, R3E The Revolving Fund is currently under revision

62 Pers. comm. G. Jacobs, Solar International, Botswana

63 The UNDP Human Development Report considers a country with less than 40 million inhabitants as a country with a small population that is likely to face the structural challenge of a small market (Human Development Report, UNDP, 2003, pp. 67-75).

64 All figures are rough estimates and rounded to provide an order of magnitude

65 Current carbon price estimated at US$5-US$7 per tonne CO_2 eq. (Danish Embassy, Pretoria)

66 Meatco figures received from Mr. W. Roux; estimates only to give an order of magnitude.

and/or install a biogas digester in its feedlot, in addition to the savings on coal and through the use or sale of biogas, the potential carbon savings could currently be sold for up to N$1 Million[67].

While a number of countries such as South Africa have established the required Designated National Authority (DNA), have raised awareness among stakeholders (communities and private companies) and have initiated pilot projects, Namibia has not yet taken any steps to tap into this opportunity. In the absence of a DNA, no carbon sales can occur. The NCCC is currently looking at the possibility of having the DNA responsibility rest with the National Planning Commission Secretariat with a CDM office housed at the Ministry of Trade and Industry. However, establishment of a DNA does not automatically imply increased financing for sustainable technology. Without a thorough capacity building programme such as has been financed by UNDP and DANIDA in South Africa, there are significant risks that the proceeds of carbon trading will not benefit the specific technologies[68] and therefore will not be an incentive.

Access to **private funding** for more resource-efficient technology is a problem for many individuals in Namibia. Innovative technology may not be recognised or accurately quantified as extra collateral; e.g. a solar water heating system is less valued than a garage in the assessment of the value of a house; while its discount value may actually be higher. Loan institutions are inherently conservative.

Many Namibians also live outside the current standard requirements set by financial institutions for loan applications. Many are not formally employed with salaries transferred in a bank account; many do not possess formally recognised assets. Women still suffer from traditional practices in terms of proving ownership of assets against which they can obtain loans.

[67] Note that carbon credits are not project grants and that art. 3.3 of the Kyoto Protocol specifies that 'deliberate' carbon farming is requisite.

[68] International agents are now specialising in CDM and may guide a private company through the process without concern for actual sustainability, while reserving a large slice of the proceeds for themselves. In a similar vein, it is possible for a financing institution to sell the carbon credits for a project they have funded, without any obligation to share.

4 Action plan

In light of the barrier analysis described earlier, an action strategy has been derived. It has taken the following points into consideration:

- Stakeholder consultations and the stakeholder workshop have shown that while there is a general interest in transfer of 'hard' technology, sustainability is perceived as essential. Therefore it has been recommended that soft technology transfer such as awareness-raising, capacity building and removal of other barriers should have the greatest priority.

- Research projects are an integral part of capacity building if they are designed and implemented with capacity building in mind. Research contracts should ensure that local capacity is built by undertaken research and that research data is first and foremost disseminated and made available locally.

- A number of research and capacity building projects, such as projects on aquaculture and agroforestry function as 'upstream' projects, for which the output is a design for a 'downstream' 'hard' technology transfer project such as a specific aquaculture and/or agro-foresty micro-enterprise.

- Hard technology transfer priority projects, as derived from the prioritisation exercise, should include awareness and capacity building, since there is a concern that they may be implemented by overseas experts without any local capacity building. To the greatest extent possible, a participatory approach should be adopted to ensure awareness, ownership and capacity building.

- Key priority sectors identified are water; agriculture and food security; environment and tourism; energy; and industry. Three key criteria that should be used to assess technology transfer projects are cost-benefit inclusive of employment and improvement potential; reliability and sustainability inclusive of social acceptance; and capacity building.

- A number of required actions may already be planned within other programmes. This has not been seen as a reason not to include them here.

The following action framework has been derived as a result of the analysis and stakeholder consultations. Actions are listed in tables 8 to 13 below and discussed in the corresponding sections.

It is implicitly understood that the initial actions to be undertaken include submission of specific proposals accompanied by the action plan to the relevant governmental departments and subsequently to key donors for approval and funding. Given the UNDP/GEF mandate to support technology transfer under its UNFCCC support, it is suggested to approach UNDP/GEF for a grant to implement the Climate Change Technology Transfer Programme that includes funds for project administration, monitoring and evaluation. It is anticipated that the activities identified under the GEF grant for preparation of a proposal for the second national communication to the UNFCCC will aid this process.

The general and immediate objectives are shown in table 8 for completeness, since the analysis was undertaken through a logical framework analysis (LFA) approach. These objectives correspond to the objective of the Namibian climate change programme and the objective of the TNA and anticipated technology transfer programme.

Table 8 - Technology Transfer Action Plan – General and immediate objective

General Objective ***Comply with Namibia's commitments to the UNFCCC in terms of Technology Transfer***	Actions / Objectively Verifiable Indicators (OVIs)	Means of Verification (MoV)	Assumptions
Immediate Objective Implement Programme to facilitate Technology Transfer for adaptation and mitigation to climate change	Government and Donors presented with proposal for support for implementation of TT programme Government and donor commitments obtained	Document(s) Budgets allocated	Interest from government to put CC adaptation and mitigation in its development policy Donor commitment remains

Component 1

Awareness regarding climate change, sustainable development and technology

This component directly addresses the awareness barriers identified in section 3.4.

Table 9 - Technology Transfer Action Plan – Component 1

Component 1 Awareness regarding CC, sustainable development and technology improved	Action 1 Centres for information dissemination regarding CC, SD, AT strengthened and delivering Action 2 Farmer awareness/ capacity for diversification improved Awareness on Self-sustaining areas and eco-tourism rather than agriculture improved Promotion of energy-efficient cooking techniques/technology Promote water conservation in rural areas	 Materials disseminated, newsletters produced Information documents produced, number of farmers/farmer organisations workshopped; Awareness before and after programme evaluated Information brochures; number of people/organisations workshopped Documentation compiled; mobile workshop established; centres visited; visitors to workshops/demos Awareness package created; number of locations/ organisations visited; number of beneficiaries	 Existing information centres are used by public Interest of farmers and agricultural unions Interest of individuals/ businesses Id. Id.

Action 1 Awareness and information centres strengthened

The initially suggested action was to create a new awareness centre disseminating information on climate change, on sustainable development and appropriate technology, preferably at an institution such as UNAM.

However, during the stakeholder workshop it was agreed that the appropriate action is to strengthen existing information centres, such as information centres in extension offices, in government departments, and in environmental NGOs.

The information collection, generation and dissemination will be part of the mandate of the national climate change office recommended in action 8, as will the creation of a website with general information and relevant updated information on climate change.

Rural extension centres will cooperate with local NGOs and/or CBOs to ensure adequate information dissemination.

It is recommended that a baseline survey is carried out within the communities regarding usage of the centres prior to the project and that if necessary the centres' outreach policy is strengthened. Information should be actively disseminated to communities, schools, businesses and other institutions, rather than passively made available. Delivery has to be monitored and evaluated to assess the efficiency of these centres.

Information centres will receive and collect relevant research and make it publicly available, receive articles and press-releases for public information, and disseminate specific brochures and leaflets to inform target groups (schools, farmers, etc). Existing structures such as schoolnet will also be strengthened as an appropriate vehicle for information dissemination to schools.

It is suggested that the disseminated information would include CCD and CBD information.

Action 2 Awareness projects

The following specific awareness projects were derived from stakeholder meetings and discussed during the prioritisation workshop. These (types of) projects were judged preferential.

- Improve farmer awareness/ capacity for diversification;
- Improve awareness on self-sustaining areas and eco-tourism rather than agriculture;
- Promote of energy-efficient cooking techniques/technology;
- Promote water conservation in rural areas.

Relevant experts from interested organisations should be approached to cooperate and design detailed project documents for these projects[69]. It is recommended that local entities

[69] Given the limited time allotted for the TNA, preparing comprehensive project designs for the projects listed in this implementation plan was beyond the scope of the assessment.

should carry out the projects in cooperation with the national climate change office. Given the identified weakness of civil society and weak culture of participation, it is recommended to ensure NGO and CBO involvement in these projects. Any necessary capacity building in local organisations should not be seen as merely an extra cost but as an important extra benefit.

Component 2

Capacity in Government, Private Sector, Civil Society to implement mitigation and adaptation TT projects

Table 10 - Technology Transfer Action Plan – Component 2

Component 2 Capacity in Government, Private Sector, civil society to implement mitigation and adaptation TT projects improved	Action 3 CC monitoring capacity improved by implementing meteorology capacity building project Action 4 GIS, satellite imagery, data analysing software and hardware capacity building project Action 5 Climate change coordination strengthened	MoV Weather stations installed Needs assessment undertaken Soft/ hardware installed, persons trained National Climate Change Office established	

Action 3 Improve climate change monitoring capacity by implementing meteorology capacity building project

This project was one of the main recommendations of the INC to the UNFCCC. A proposal was designed and submitted to UNDP/GEF through the NCCC but is still under discussion and review. In order to raise awareness and lobby for improved technology for mitigation and adaptation to climate change, local data is essential. This includes the need for improved early warning capacity in view of the potential for irregular weather patterns.

Action 4 GIS, satellite imagery, data analysing software and hardware capacity building project

Local institutions dealing with natural resources management require improved capacity for use of modern data collection and analysis techniques. This includes the need for training of organisations in the potential usage of such data, since e.g. often the manager of a GIS only supplies maps, and the information system itself is underutilised.

In view of the current scattering of expertise, cooperation between different stakeholders should be an integral component of this capacity building programme, including an assessment of the current supply and demand for graphic data to determine capacity needs and appropriate institutional arrangements.

Action 5 Climate change coordination strengthened

Establish a national climate change office that improves national information dissemination and coordination of climate change activities.
To improve general implementation of departmental policies, an entity such as the NPCS should be approached to assist with an assessment of interdepartmental cooperation in the priority sectors relevant to climate change technology. Subsequently, a mechanism for improved cooperation and common awareness can be designed and implemented under the auspices of the NPCS.

The climate change office is also expected to undertake the monitoring and evaluation of the various projects. In order to address the social barriers, all project designs, monitoring and evaluation will have to be undertaken with participation of the target group. Evaluation should be seen broader than against project objectives. Project actors may have different objectives and evaluate each other.

Component 3

Priority research and capacity building projects

Table 11 - Technology Transfer Action Plan – Component 3

Component 3	Action 6	MoV	
Priority research and capacity building projects undertaken	Artificial Recharge Systems plan designed	Document	
	Wind energy feasibility study undertaken	Id.	
	Biomass, deforestation, bush encroachment monitoring	Report	
	Calibrate crop models for Namibian conditions	Id.	
	PV mini-grid R&D project	Mini-grid power station and M&E report	
	Research financial incentives to remove barriers to sustainable development	Report	

Action 6 Research Projects

- Design Artificial Recharge Systems plan;
- Undertake wind energy feasibility study (updating the NamPower study);
- Monitor biomass, deforestation, bush encroachment;
- Calibrate crop models for Namibian conditions;
- Implement PV mini-grid R&D project;
- Research financial incentives to remove barriers to appropriate technology transfer.

As indicated, the stakeholder consultations and workshop revealed that research projects should be a separate and important component of the implementation plan.

A brief outline for these projects is attached. Projects were derived from stakeholder meetings and discussed during the prioritisation workshop. These (types of) projects were judged preferential.

As with awareness projects, the lead authorities should be approached to cooperate and design detailed project documents for these projects with the help of interested researchers and institutions[70]. It is recommended that local research institutions should carry out the projects in cooperation with the CC/CCD/BCD awareness centre or climate change office. Research grants should include the condition that research and research data should be made publicly available through the information centres. Local researchers should be in charge of the projects. Any necessary capacity building in local organisations should not be seen as merely an extra cost but as an important extra benefit.

Component 4

Improved access to financing for climate change mitigation and adaptation, desertification combating and biodiversity projects

Table 12 - Technology Transfer Action Plan – Component 4

Component 4	Action 7	MoV	
Access to financing for CC mitigation and adaptation, desertification and biodiversity projects improved	Financial resources clearing house established and delivering	Information newsletter on funding mechanisms delivered to stakeholders; proposals submitted to donors	
	Action 8		
	Pilot project for carbon financing under Kyoto implemented	DNA established Pilot carbon project submitted to international authorities	

Action 7 Clearing house for financial resources information established and delivering

Information and coordination efforts for environmental funding have been undertaken in many countries with variable success. Donor coordination efforts generally require a strong donor presence and a leading environmental donor to drive the effort[71]. The Namibian situation is not ideal for this, with a limited donor presence and virtually no donors focussing on environmental issues. Environmental funds have been tried and are often launched with enthusiasm but need careful planning, monitoring and evaluation to avoid stakeholder and donor disappointment[72].

[70] Id

[71] e.g. the Environmental donor group in South Africa that was operational between 1996 and 2000, spearheaded by DANCED

[72] An example is the Environmental Heritage Fund in Botswana, where the main donor (DANCED) pulled out in 2001 after the objectives were not met. However, new efforts are being undertaken in Southern Africa by IUCN in Botswana and DANIDA and DFID in South Africa.

An important issue is that the implementing organisation should not be a financing institution, but an entity equipped with the capacity and resources to actively source funding and disseminate information; and to design, evaluate and monitor projects.

A suitable entity will be identified to host a centre that disseminates information regarding donor financing for all sectors of society and assists entities with the formulation and submission of proposals. The Namibian Environmental Investment Fund (EIF) that is to be established has an appropriate mandate to undertake this. The National Planning Commission Secretariat (NPCS) is a suitable alternative.

The activities of this clearing house should be transparent. Guidelines regarding outreach and assistance should be clearly established to avoid creating a passive 'recipient' of proposals rather than a dynamic entity that actively sources funding, disseminates information and assists stakeholders with proposal design and submission. Support for civil society should be clearly and preferably quantitatively specified in these guidelines.

In addition, it will be necessary to establish adequate monitoring and evaluation mechanisms for the fund. This should involve establishing baseline data on access to financing and subsequent monitoring feedback from all stakeholders.

Action 8 Pilot project for CDM under Kyoto Protocol implemented

The project includes establishment of a Designated National Authority (DNA), capacity building and countrywide information dissemination. Currently, the NCCC is assessing the potential of having the DNA responsibility rest with the National Planning Commission Secretariat; with a CDM Office to be housed at Ministry of Trade and Industry. This would be appropriate given the focus of CDM on private sector initiatives.

However, in view of the observations made in the barrier analysis regarding the potential pitfalls of carbon trading for Namibia it is recommended to include a pilot CDM project in this action as a capacity building and demonstration case study. Such projects are being funded by UNDP, WB, UNEP, UNIDO and/or bilateral donors in several newly industrialised countries[73]. Even though in view of its limited contribution to greenhouse gas emissions and the resulting limited potential for improvement Namibia is not very attractive to the international carbon trade, it should be possible to obtain support for a capacity building project.

It is recommended that the implementation of such a project is undertaken by a carefully selected entity, preferably non-profit and/or without any local interests, given the potential for conflicts of interest[74]. It is not recommended to have this type of project undertaken by a regional or international consultancy or commercial entity with an interest in building its own capacity to act as a broker for CERs and to keep information dissemination at a minimum. An

[73] See e.g. Friedenthal, J. and Malmdorf, T. (2003) on Danish support for CDM in South Africa; and the Southsouthnorth website.

[74] Even donors have other than Namibia's development interests to consider in this matter: the World Bank's PCF and bilateral donors all attempt to get the cheapest CERs.

academic think tank focusing on natural resources such as the UK-based Natural Resources International[75] would be appropriate, with support from an international watchdog such as South-South-North[76], that is involved with CDM in South Africa.

It is recommended that the supervision of the project is carried out by the NCCC or one of its technical sub-committees.

Component 5

Priority mitigation and adaptation projects

Table 13 - Technology Transfer Action Plan – Component 5

Component 5	Action 9	MoV	
Priority mitigation and adaptation projects undertaken	Construct desalination plants for brackish groundwater	Project documents, M&E	
	Aquaculture project undertaken	Aquaculture development fund SMMEs initiated	
	Water and energy-efficiency in public institutions	Id.	
	Water efficient technology for industries	Id	
	Natural gas to generate electricity	Natural gas power plant	
	Water and energy-efficiency in the building sector	Project documents, M&E	
	Upgrade vehicle inspection centres to improve energy efficiency and emissions testing	Id.	
	Transition from low- to high-value crops in areas with sufficient water supply	Id.	
	Afforestation and agroforestry programme	Id.	
	Solar water heaters programme	Id.	
	Establish waste fuel briquetting plant	Industry set up.	

[75] NRI, owned by the University f Greenwich

[76] The South*South*North Project (SSN) is a network of organisations, research institutions and consultants grouped into one developmental organisation with considerable expertise to help public and private stakeholders develop the necessary confidence for dealing effectively with the Clean Development Mechanism (CDM). SSN operates in Brazil, South Africa, Bangladesh and Indonesia.

Action 9 Implementation of Adaptation and Mitigation Projects

- Construct desalination plants for brackish groundwater;
- Undertake aquaculture project;
- Improve water and energy-efficiency in public institutions;
- Promote water efficient technology for industries;
- Promote natural gas to generate electricity;
- Improve water and energy-efficiency in the building sector;
- Upgrade vehicle inspection centres to improve energy efficiency and emissions testing;
- Promote transition from low- to high-value crops in areas with sufficient water supply;
- Promote afforestation and agroforestry programme;
- Implement solar water heaters programme;
- Establish waste fuel briquetting plant.

A brief outline of these projects is attached. The stakeholder consultations identified these projects and the prioritisation workshop selected them as most appropriate.

Since these are all large projects, thorough project design will require a design mission that should include sourcing of funding if the climate change technology transfer programme does not have sufficient funds. Two of these projects are particularly suited to sell carbon credits: the afforestation and agroforestry programme and the solar water heaters programme.

As with the other projects, capacity building is a priority issue in technology transfer. It is therefore recommended that local institutions are involved as central actors in the implementation of these projects. The stakeholder workshop has also emphasised that in addition to local capacity building and participation, potential for employment is a key factor in selecting these projects. The fuel briquetting project and potential agro-forestry industries also involve establishment of new industries with good employment and export potential.

Recommendations for implementation

The following key recommendations are made towards the implementation of the action framework:

- Detailed proposals for a *Technology Transfer Programme for Climate Change Adaptation and Mitigation* should be prepared and submitted to UNDP/GEF for financing. An initial design grant should be requested.

- Alternatively, since a grant to prepare the proposal for the second national communication to the UNFCCC has already been obtained, the programme coordination and a selected number of actions can be undertaken under the SNC.

- The coordination of the technology transfer programme should be among the responsibilities of a programme coordinating unit, possibly a new national climate change office.

- Expert panels of stakeholders should supervise the implementation of the five programme components under the umbrella of the NCCC. This allows experts to focus on projects

within their area of expertise. Suggested focal areas are adaptation; mitigation and research, awareness and capacity building.

- The national climate change office should prepare and submit requests for grants to GEF and other donors for projects requiring more substantial funding. The UNDP office can provide assistance with this process. It is noted that a number of projects identified within the TNA are already planned under different programmes, such as the natural gas and the solar water heater projects. The national climate change office will keep further track of such developments to avoid duplication and ensure effective collaboration.

- The 'financial resources clearing house' that is suggested under component 4 of the programme which would fall under the mandate of the Namibian Environmental Investment Fund (NEIF), should significantly improve opportunities for social actors to tap into available funding mechanisms to implement the smaller priority projects. However, this requires the NEIF to adopt an active outreach approach, with equal attention given to various social sectors. Given the international experience with such funds, it is essential to collect baseline data and include monitoring and evaluation with stakeholder participation to assess whether the fund really has an impact.

- Trading of carbon credits through the Clean Development Mechanism (CDM) is a vehicle that should be developed to provide an incentive to the private sector to initiate the recommended developments. It is recommended that support from the international community (WB, UNDP/GEF, UNIDO, UNEP or bilateral donors) is sought to undertake a capacity building project to maximise benefit to Namibia from the CDM.

- Where appropriate Namibia's action under the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Convention on Bio-Diversity (UNCBD) could be integrated in a consolidated action plan. However this should not lead to reduced human and financial resources for climate change action, but rather to a bundling of resources.

Indicative Budget

The following table provides an indicative budget for the recommended climate change technology transfer programme.

Item	Year 1 (N$)	Year 2 (N$)	Year 3 (N$)	Total (N$)
Staff				
Coordinator	300.000	300.000	300.000	900.000
Support staff	200.000	200.000	200.000	600.000
Consultants	1.200.000	1.200.000	600.000	3.000.000
Subcontracts				
Component 1 Awareness				
Action 1 Awareness Centre	630.000	480.000	480.000	1.590.000
Action 2 Awareness Projects	400.000	400.000	200.000	1.000.000
Component 2 Capacity Building				
Action 3 Meteorology cap building	4.000.000	2.500.000	1.000.000	7.500.000
Action 4 Monitoring technology cap. Bld (GIS, sat. imagery, etc)	1.500.000	500.000	500.000	2.500.000
Action 5 Government coordination	300.000	300.000	300.000	900.000
Component 3 Research and capacity building projects				
Action 6 Research Projects	1.400.000	750.000	550.000	2.700.000
Component 4 Improved access to financing				
Action 7 Financ. res. clearing house	630.000	480.000	480.000	1.590.000
Action 8 Kyoto pilot project	1.800.000	600.000	600.000	3.000.000
Component 5 Mitigation and adaptation projects				
Action 9 Mitigation and adaptation projects	2.000.000	5.000.000	3.000.000	10.000.000
TOTAL	**14.360.000**	**12.710.000**	**8.210.000**	**35.280.000**

The estimated administrative budget only includes human resources. It is assumed that other operational costs (office space, transport, telecommunications) will be œovered under the regular budget of the implementing organisation (department).

Without detailed project designs for the specific projects it is impossible to break down the budget in great detail. It is suggested as is common for barrier removal and capacity building projects, to have a lump sum for project funding available.

REFERENCES

DOCUMENTS

Agricultural Statistics Bulletin. Windhoek, Studio Print.

Amweelo, M. (2001). Government Gazette (30 March 2001) No. 2503: **Commencement of Road Traffic and Transport Act,1999**. Windhoek, Ministry of Works, Transport and Communication.

Ashley, C. and Barnes J. (1996). **Wildlife Use for Economic Gain the Potential for Wildlife to Contribute to Development in Namibia.** Windhoek, Ministry of Environment and Tourism.

Ashley, C. and LaFranchi, C. (1997). **Livelihood Strategies of Rural Households in Caprivi: Implications for Conservancies and Natural Resource Management.** Windhoek, Ministry of Environment and Tourism.

Ashley, C., Barnes, J. and Healy, T. (1994). **Profit, Equity, Growth and Sustainability: The Potential Role of Wildlife Enterprises in Caprivi and other Communal Areas of Namibia.** Windhoek, Ministry of Environment and Tourism.

Ashley, C., Barnes, J., Brown, C. and Jones, B. (1997). **Using Resource Economics for Natural Resource Management: Namibia's Experience.** Windhoek, Ministry of Environment and Tourism.

Ashley, C., DEA, MET, Muller, H., GTZ, Harris, M., Dept. of Water Affairs and MAWRD (1995). **Population Dynamics, the Environment, and Demand for Water and Energy in Namibia.** Windhoek, Ministry of Environment and Tourism.

Auer, C. (1997). **Water Availability and Chemical Water Quality as Important Factors for Sustainable Wildlife Management in the Etosha National Park and for Domestic Stock in Farming Areas of Namibia.** Okaukuejo, Ministry of Environment and Tourism.

Bandyopadhyay, S. Shyamsundar, P., Wang, L. and Humavindu, M. N. (2004). **Do Households Gain from Community-Based Natural Resource Management? An Evaluation of Community Conservancies in Namibia.** Windhoek, Ministry of Environment and Tourism.

Banks, B. (2003). Photovoltaic System Delivery Methods for Rural Areas in Africa. Glenstantia, UNDP/GEF.

Barnard, P., Shikongo, S. T., and Zeidler, J. (2001). **Biodiversity and Development in Namibia: Namibia's Ten-Year Strategic Plan of Action for Sustainable Development Through Biodiversity Conservation.** Windhoek, Namibia.

Barnes, J.I. (1995). **The Value of Non-Agricultural Land Use in Some Namibian Communal Areas: A Data Base for Planning.** Windhoek, Ministry of Environment and Tourism.

Barnes, J.I. and Jager, J.L.V. (1995**). Economic and Financial Incentives for Wildlife use on Private Land in Namibia and the Implications for Policy**. Windhoek, Ministry of Environment and Tourism.

Barnes, J.I., Schier, C. and vav Rooy, G. (1997). **Tourists' Willingness to Pay for Wildlife Viewing and Wildlife Conservation in Namibia.** Windhoek, Ministry of Environment and Tourism.

Barnes, J.I., Zeybrandt, F., Kirchner, C.H. and Sakko, A.L. (2002). **A Review of the Economic Value of Namibia's Recreational Shore Fishery.** Windhoek, Ministry of Environment and Tourism.

Becker, K. and Francis, G. (XXXX). **Multifunctional Plants-Food, and Industrial Products. Department of Aquaculture Systems and Annual Nutrition.** University of Hohenheim.

Blackie, R. and Tarr, P. (1999). **Government Policies on Sustainable Development in Namibia.** Windhoek, Ministry of Environment and Tourism.

Brian Jones (2001). **SEA for Second National Development Plan,** Namibia.

CTI (2002). **Methods for Climate Change Technology Transfer Needs Assessments and Implementing Activities: Experiences of Developing and Transition Countries** Climate Technology Initiative

De Klerk, J.N. (2004). **Bush Encroachment in Namibia,** Ministry of Environment and Tourism, Government of Namibia.

Emu, (2004). **Emergency Drought Relief Report 2003/2004,** Government of Namibia.

Emu, (2004)**. Unpublished Report January 19-23,2004 Flood Assessment Report.** Government of Namibia.

Final Report (2004). **Operations to Mitigate the Flood Disaster in Caprivi Region.** Republic of Namibia

Fowler, (2002**), Earthscan Reader on NGO management**

Friedenthal, J. and Malmdorf, T. (2003). **Denmark Supports Clean Development Mechanism (CDM) Activities in South Africa.** Pretoria, Royal Danish Embassy.

Hankins, M. (2003). **Choosing Finance Mechanisms for Developing PV Markets: Experiences from Several African Countries**: Draft Paper. UNDP/GEF.

Humavindu, M. N. (2002). **Economics without Markets: Policy Inferences from Nature-Based Tourism Studies in Namibia.** Windhoek, Ministry of Environment and Tourism.

Humavindu, M.N. (2002). **An Econometric Analysis of Fixed Investment in Namibia.** Windhoek, Ministry of Environment and Tourism.

IEA PVPS (2003). **Developing of Photovoltaic Technologies: Co-operation with Developing Countries.** IEA- PVPS Publications.

IIED, (2001) **SEA for Second National Development Plan**, Namibia

Ji, Z. (2002). **Tools and Methodologies in Assessing Technology Needs: An Overview. Department of Environmental Economics and Management** Renmin University of China.

Jimenez, F., George, R. and Forsyth, T. (2002**). A Tool to Market Customer-Sited Small Wind System.** USA, National Renewable Energy Laboratory.

Jones B.T.T. (2001a): **Integrating Environment and Sustainability Issues into the Development of Namibia's National Development Plan 2. A Participatory Process for Developing a Sustainable Development Strategy.** Paper prepared for the OECDDAC project on Donor-Developing Country Dialogues on National Strategies for Sustainable Development

Jones B.T.T. (2001b**): Integrating Environment and Sustainability Issues into the Development of Namibia's National Development Plan 2. A Methodology for Carrying Out a Gap-Consistency-Conflict Analysis of Key Chapters.** Paper prepared for the

OECDDAC project on Donor-Developing Country Dialogues on National Strategies for Sustainable Development

Jones, B., Long, A., Murphy, C., Vaughan, K., Mulonga, S., and Katjiua, J. (2002). **Wildlife, Tourism and Livelihoods in Namibia: A Summary of Preliminary Findings.** Windhoek, Ministry of Environment and Tourism.

Jotzo, F. and Sari, A. P. (). **The Implications of Emission Offset Regimes on Indonesia and other Developing Countries. Publisher? City where published?**

Krause, M. and Nordstrom, S. (2004). **Solar Photovoltaics in Africa: Experiences with Financing and Delivery Models.** U.S.A., Global Environment Facility.

Krug, W., Suich, H. and Haimbodi, N. (2002). **Park Pricing and Economic Efficiency in Namibia.** Windhoek, Ministry of Environment and Tourism.

Krugmann, H. (2001). **Fundamental Issues and the Threats to Sustainable Development in Namibia.** Windhoek, Ministry of Environment and Tourism.

Krugmann, H., Cole, D. and Pierre du Plessis (2003). **Access and Benefit-Sharing Mechanisms for the use of Botanical Resources in Namibia.** Windhoek, Ministry of Environment and Tourism.

Lange, G. (2003). **The Value of Namibia's Commercial Fisheries.** Windhoek, Ministry of Environment and Tourism.

Lange, G., Barnes, J. and Motinga, D.,J. (1997). **Cattle Numbers, Biomass, Productivity, and Land Degradation in the Commercial Farming Sector of Namibia**. Windhoek, DEA Publications Department.

Li, B.M.L. and Vaughan, K. (2003). **Social Relations and Management in the Khoadi Hoas Conservancy of North-West Namibia**. Windhoek, Ministry of Environment and Tourism.

Long, S.A. (2004). **Livelihoods and CBNRM in Namibia: The Findings of the WILD Project**. Windhoek, Ministry of Environment and Tourism.

Matthey, J.(XXXX) **Cutting Vehicle Pollution Using Autocatalyst Technology**

Mendelsohn, J. and el Obeid, S. (2002). **The Communal Land in Eastern Namibia**. Windhoek, Raison.

Mendelsohn, J. and el Obeid, S. (2003). **Sand and Water: A Profile of the Kavango Region**. Windhoek, Struik Publishers & Raison.

Mendelsohn, J., Jarvis, A., Roberts, C. and Robertson, T. (2003). **Atlas of Namibia: A Portrait of the Land and its People.** Cape Town, David Philip.

Midgley, G., Hughes, G., Thuiller, W., Drew, G. and Foden, W. (2004). **Assessment of Potential Change Impacts on Namibia's Plant Species, Biodiversity and Ecosystem Structure and Function.** Cape Town, Climate Change Research Group.

MOHSS,(2004). **Namibia Demographical and Health Survey 2000**.Government of Namibia

Mshigeni, K.E. (2000). **Promoting Sustainable Human Development in Africa through Optimal Use Of Africa's Biota, other Natural Resources and Waste.**Windhoek: University of Namibia.

MWARD, (2004). **March 2004 Crop Assessment Report**. Republic of Namibia.

MWARD,(2004). June 2004 Namibia Crop Assessment Report,Republic of Namibia

National Drought Task Force,(1997)**. National Drought Policy and Strategy**, Republic of Namibia.

Noongo, N., Reinikainen, T., Willemse, N., and Smit, W. (2003). **Environmental Monitoring and Indicators Network.** Windhoek, Ministry of Environment and Tourism.

PMO, (1998). **National Disaster Plan.** Republic of Namibia.

Pratt, J. H., Henry, E. M.T., Mbeza, H. F., Mlaka, E., and Satali, L. B. (2002). **Malawi Agroforestry Extension Project Marketing and Enterprising Program Main Project.** USA, Washington State University.

Purvis, J. (2002). **Postharvest Fisherids on the Eastern Floodplains, Caprivi.** Windhoek, Ministry of Environment and Tourism.

Quan, J., Barton, D. and Colony, C. (1994). **A Preliminary Assessment of the Economic Impact of Desertification in Namibia.** Windhoek, Ministry of Environment and Tourism.

Quan, J., Barton, D. and Conroy, C. (1994). **The Economic Impact of Desertification in Northern Commercial Areas: Okahandja, Otjiwarongo and Grootfontein.** Windhoek, Ministry of Environment and Tourism.

Republic of Botswana (2001). **Botswana Initial National Communication to the United Nations Framework Convention on Climate Change.** Gaborone, Ministry of Works, Transport and Communications.

Republic of Botswana (2002). **Revised National Policy for Rural Development**. Gaborone, Ministry of Finance and Development Planning.

Republic of Namibia (2000). **Namibia Water Resources Management Review: Water Uses and: Theme Report**. Windhoek, Ministry of Agriculture, Water and Rural Development.

Republic of Namibia (2000). **Namibia Water Resources Management Review: Strategic Water Resources Assessment Theme Report.** Windhoek, Ministry of Agriculture, Water and Rural Development.

Republic of Namibia (2000). **Namibia's Program to Combat Desertification**. XXXXXXXX

Republic of Namibia (2001). **Macroeconomic, Sectoral and Cross-Sectoral Policies: Second National Development Plan (NDP2) Vol. 2.** Windhoek, National Planning Commission.

Republic of Namibia (2001). **Public Sector Investment Programme-Financing the Plan: Second National Development Plan (NDP2) Vol. 3.** Windhoek, National Planning Commission.

Republic of Namibia (2001). **Regional Development Perspectives: Second National Development Plan (NDP2) Vol.2.** Windhoek, National Planning Commission.

Republic of Namibia (2001). **Second National Development Plan (NDP2) Vol. 1: Macroeconomic, Sectoral and Cross-Sectoral Policies.** Windhoek, National Planning Commission.

Republic of Namibia (2002). **Initial National Communication to the United Nations Framework Conservation on Climate Change.**

Republic of Namibia (2002). **Namibian International Trade Policy and Agriculture: A Situation Report, 2002.** Windhoek, Ministry of Agriculture, Water and Rural Development.

Republic of Namibia (2003). **Restructuring of the Ministry of Works, Transport and Communication: Report on the Restructuring Workshop**. Windhoek, Ministry of Works, Transport and Communication.

Republic of Namibia (2004). **Namibia Vision 2030 Policy Framework for Long-Term National Development Main Document: Prosperity, Harmony, Peace and Political Stability.** Windhoek, AIM Publications.

Republic of Namibia (2004). **Namibia's Aquaculture Strategic Plan**. Windhoek, Namprint.

Republic of Namibia (2004). **Report on the Annual Agricultural Surveys 1996-2003**. Windhoek, Central Bureau of Statistics.

Republic of Namibia (2002). **Green Scheme Irrigation Policy. Windhoek**, Ministry of Agriculture Water and Rural Development.

Rodwell, T.C., Tagg, J. and Grobler, M. (1995). **Wildlife Resources in the Caprivi, Namibia: The Results of an Aerial Census in 1994 and Comparisons with Past Surveys**. Windhoek, Ministry of Environment and Tourism.

SADC (2000). **Climate Friendly Energy Technologies Investment Needs in SADC**. South Centre for Energy and Environment.

Schachtschneider, K. (2002). **Water Demand Management in the Namibian Tourism Sector.** University of Cape Town.

Schachtschneider, K., Nashipili, N. and Marais, N. (2000). **Water Resources Management: A Guide for Tourist Sites.** Windhoek, Department of Water Affairs.

Schiffer, E. (2004). **How Does Community-Based Natural Resource Management in Namibia Change the Distribution of Power and Influence?** Preliminary Findings. Windhoek, Ministry of Environment and Tourism.

Shikongo, S. and Barnard, P. (2002). **Conservation and the Environment in Namibia**. Windhoek, Travel News Namibia.

Storm, J.K. (2001). **Namibia Nature Foundation: Annual Report 2001/2002**. Windhoek, Namibia Nature Foundation.

Suich, H. (2001). **Development of Preliminary Tourism Satellite Accounts for Namibia**. Windhoek, Ministry of Environment and Tourism.

Tietenberg, T. (2000). **Environmental and Natural Resource Economics,** Addison-Wesley

UN (1992). **United Nations Framework Conservation on Climate Change**.

UN (1992) **Report to the United Nations Conference on Environment and Development**

UNDP (2003). **Human Development Report: Millennium Development Goals: A Compact among Nations to end Human Poverty.** New York, Oxford University Press.

UNDP (2003). **The Clean Development Mechanism: A Users Guide.** New York, Energy and Environment Group.

UNDP (1997). **Report to COP 3 : Measures Undertaken by UNDP to Support Implementation of Convention to Combat Desertification (CCD) in Africa.**

UNDP/ GEF (2003**). Handbook on Methodologies for Technology Needs Assessments**.

UNEP (1992). **Report on UNEP Activities to Support Implementation of the Convention to Combat Desertification (CCD) for COP3.**

UNIDO (2001). **Energy for Poverty Reduction: The Concept of the Multi-Functional Platform (MEP) as a Regional Project.**

Violetti, D. (2003). **Technology Diffusion in Eastern Europe and Central Asia** Vienna. UNFCCC.

Ward, S. (2002). **The Energy Book for Urban Development in South Africa.** Noordhoek, Sustainable Energy Africa.

Watson, R., T., Zinyowera, M., C. and Moss, R. H. (1996). **Technologies, Policies and Measures for Mitigating, Climate Change.** USA, Intergovernmental Panel on Climate Change.

WMO and UNEP (2000). IPCC **Special Report: Methodological and Technological Issues in Technology Transfer, Intergovernmental Panel on Climate Change**.

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GLOSSARY

Adaptation- Adjustments in practises, processes, or structures of systems to projected or actual changes of climate. Adaptation can be spontaneous or planned, and can be carried out in response to or in anticipation of changes and conditions.

Anthropogenic climate change- Climate change caused by increase in the atmospheric concentration of greenhouse gases which inhibits the transmission of some of the sun's energy from the earth surface to outer space. The gasses include carbon dioxide, water vapour, methane, chlorofluorocarbons and other chemicals. The increased concentrations of greenhouse gasses result from human activity--- the burning of fossil fuels such as gasoline, oil, coal and natural gas; deforestation; and the release of CFCs, HFCs and PFCs from refrigerators, air conditioners, aluminium production, etc.

Carbon Dioxide (CO_2) - A greenhouse gas that is primarily released from burning fossil fuels e.g. machines and motors that use coal, oil and natural gas, and also by deforestation. Carbon dioxide is a major contributor to the greenhouse effect.

Certified Emissions Reductions- CERs are verified and authenticated units of greenhouse gas reductions from abatement or sequestration projects which are certified under the CDM

Clean Development Mechanism - A provision within the Kyoto Protocol that will allow countries to obtain credit for greenhouse gas reduction projects undertaken in developing countries.

Climate change - means a change of climate, which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Climate Technology Initiative- The CTI was established by COP1. It is a linked set of national and international measures, including voluntary private sector activities, designed to accelerate the development, application and diffusion of climate-friendly technologies in all relevant sectors of the economy: *energy production and conversion, transport, manufacturing, agriculture, forestry and waste management*. Its primary purpose is to promote the adaptation of technologies that reduce greenhouse gas emissions.

Conference of (the) Parties - The Conference of the Parties (COP) - the supreme body of the Convention - held its first session in early 1995 in Berlin. At its third session in December 1997 the COP adopted the Kyoto Protocol, which commits developed countries to reducing their collective emissions of greenhouse gases by at least 5% by the period 2008-12.

Credit- Originally defined as "quantifiable and verifiable recognition of the reduction, avoidance or sequestration of carbon dioxide or other greenhouse gasses as a result of a carbon offset project".

Emissions Credits - A provision in the Kyoto Protocol that allows countries with legally binding targets to trade emission credit entitlements with another country.

Emissions - mean the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time.

Global Warming - An increase in the average global temperature. Global Average Temperature Change - Measurement records indicate a warming of 0.3-0.6 °C in global average temperature since 1860.

Greenhouse Effect - An analogy comparing the heat trapping ability of atmospheric gases to a greenhouse. The 'natural' greenhouse effect is essential for life as we know it. The

'enhanced' greenhouse effect is caused by increasing concentrations of greenhouse gases and is responsible for global warming.

Greenhouse Gases - Greenhouse gases means those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation. Atmospheric gases such as water vapour, carbon dioxide, methane, nitrous oxide, CFCs and ozone which have the ability to trap heat at the Earth's surface. Greenhouse gases contribute to the greenhouse effect and global warming.

IPCC - The Intergovernmental Panel on Climate Change (IPCC)

Kyoto Protocol - The first international legally binding agreement for the reduction of, greenhouse gas emissions. Negotiated in Kyoto, Japan in December 1997.

Methane (CH_4) - A greenhouse gas that is primarily released from agricultural activities such as intensive livestock raising and flooding of rice paddies, and also from waste dumps, coal beds and leaks from gas pipelines.

Mitigation- Human intervention to slow the projected rate of anthropogenic climate change, by purposefully reducing emissions of GHG or enhancing their sinks.

Nitrous Oxide (N_2O) - A greenhouse gas that is primarily released from intensive agriculture, and in automobile exhausts

Ozone Layer - Ozone (O_3) in the upper atmosphere (the ozone layer) protects us from harmful ultra-violet radiation from the sun. Certain chemicals, such as CFCs, deplete the ozone creating 'holes' in the ozone layer. The Montreal Protocol is an international agreement restricting the production of CFCs to protect the ozone layer.

Sequestration- The process by which a substance is removed from the free state and tied up in some other material. For example, carbon dioxide is sequestered- removed from the atmosphere-when it is used by green plants to make carbohydrates during the process of photosynthesis.

Sinks - Within the Kyoto Protocol sinks include land-use change and forestry activities. Countries may secure credits from reforestation and afforestation activities but they also have to report emission from deforestation.

Sink - means any process, activity or mechanism, which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere.

Technology Transfer- Process by which adaptation and mitigation technologies and processes developed by industrialised nations are made available to the less-industrialised nations. These transfers may be conducted solely through the efforts of private parties, or may involve governments and international institutions.

UNFCCC - The United Nations Framework Convention on Climate Change was established in 1992. It set an ultimate objective of stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system.

Vulnerability - Vulnerability often refers to four sectors (forests, water, livestock, agriculture, and people) that will suffer due to potential climate change.

Zero Emissions - The term zero emission refers to zero release of greenhouse gas (GHG) into the atmosphere. Example, generation of electric power using renewable energy (RE) sources e.g. solar panels, wind turbine, hydro, ocean or wave energy, etc.

APPENDICES

APPENDIX A - TERMS OF REFERENCE

TERMS OF REFERENCE FOR THE ASSESSMENT OF THE TECHNOLGY NEEDS FOR MITIGATION AND ADAPTATION TO CLIMATE CHANGE IN NAMIBIA

BACKGROUND

Namibia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and became legally obligated to adopt and implement policies and measures designed to mitigate the effects of climate change and to adapt to such changes. The Ministry of Environment and Tourism (MET) is the government agency responsible for the coordination and implementation of climate policies and measures with respect to the fulfillment of the country's obligations under the convention.

The Initial National Communication (INC) of Namibia presented to the UNFCCC in 2002 identified a number of potential projects and activities that Namibia could undertake or implement that could assist its development process while contributing positively to its response to climate change. Areas and sectors covered include agriculture, energy (including renewable), health, transportation, water conservation, land use and forestry and tourism. The technologies and practices required for the above can also contribute to economic and social development. For Namibia, technologies in mitigation such as in energy and transportation as well as adaptation technologies in the areas of water conservation, improving and sustaining agricultural and livestock production, reduced incidence of malaria and upper respiratory diseases and the management and conservation of biodiversity, including forestry, are crucial if we are to achieve sustainable development objectives.

Technology for implementation of activities in the above-mentioned areas and sectors vary in terms of appropriateness and cost. In order to use scarce and valuable resources as efficiently as possible there is a need to do an assessment of available technology and the cost of transfer and adaptation. This is also consistent with decision 4/CP.4 of the UNFCCC requiring non-Annex I countries to submit their technology needs for addressing climate change in a prioritized manner.

The purpose this terms of reference is to conduct an assessment (identification and evaluation) of the available technologies that could support economic development while meeting the climate change obligations and responses of Namibia. The assessment will identify/select suitable technologies, prioritize them and make recommendations on transfer methodologies.

THE TASK

The Namibia Climate Change Committee (NCCC), chaired by the Ministry of Environment and Tourism and with the support of the United Nations Development Program requires the services of a consultant or an institution or consortium to conduct an assessment of the available technologies that could support economic development while meeting the climate change obligations and responses of Namibia.

Consultants, institutions or consortia with proven capabilities in the conduct of technology assessment and related maters for climate change are encouraged to apply. The selected entity must demonstrate a thorough understanding of and familiarity with the subject matter, practical experience in the field and knowledge and familiarity with UNFCCC and GEF requirements and methodologies for the conduct of such assessments.

Specific Tasks

The selected consultant, institution or consortium must demonstrate capabilities and experience in the conduct of multi-sectoral and multi-stakeholder reviews and analysis. The activities to be undertaken will result in two major outputs as follows:

1. A comparative review (including financial and economic analysis) of the various technologies that are currently available to meet climate change objectives while contributing to national development.

2. Recommendations on the possible mechanisms or modalities for transfer of technologies based on priorities identified in 1 above.

At a minimum the selected consultant, institution or consortium will do the following:

1. Conduct a review and analysis of the current information/data and the technology available and appropriate to Namibia. This should result in a broad overview and identification of options, opportunities and resources available as well as constraints and challenges. Sectors to be included in the overview include electricity production, transmission and use; natural gas production and use; transportation; forestry; agriculture; waste management and recycling; health; buildings and construction; coastal zone management; and climate technology industries resulting in local manufacturing among others.
2. Engage key stakeholders in the assessment process; through identification of stakeholders, assignment of roles to key stakeholders and facilitation of continuous participation by all stakeholders.
3. Identify criteria and develop a matrix for use in the assessment especially as it relates to prioritizing the technologies. The criteria should be heavily weighted in their potential to contribute to national development and climate change goals and objectives. Criteria could include development benefits, reduction of negative impacts on the environment and biodiversity, contribution to climate change, market potential, and potential for policy intervention among others.
4. Prepare a preliminary assessment report of the overview to be used as the working document for the first of two workshops with stakeholders. The report should include the following: current status of sectors and technologies in use; financial constraints; potential for fuel switching and improved efficiency; low carbon energy sources and their suitability within the country; and adaptation options and the suitability of these options.
5. Facilitate a workshop to review the overview and begin prioritizing and selecting options for more detailed review and prepare a report on the selections and priorities.
6. Identify barriers to the adoption of technologies as well as policy instruments and environments that could facilitate adoption. Relate the identification process results to priorities and selections made at 5 above.
7. Develop a program to facilitate technology transfer and adaptation. This will include a final selection/recommendation on technologies including transfer mechanisms and costs, capacity building measures, recommendations on policy and other interventions and identification of sources of funding among others.
8. Facilitate a second workshop of stakeholders to review recommended program for implementation.
9. Prepare a final synthesis report which should include the following:
    - Preliminary summary of technology options;
    - Evaluation of sector needs and opportunities;
    - Data gaps
    - Selection criteria and evaluation of technologies;
    - Overview of assessment of technologies based on priorities;
    - Priority sectors and technologies for action;
    - Review of barriers and policy environment
    - Plan of action for technology transfer;
    - Discussion on implementation plans; and
    - Recommendations for future stakeholder involvement.

The selected consultants, institution or consortium will be responsible for the facilitation of the two consultative workshops/seminars with stakeholders where findings, conclusions and recommendations will be presented and comments and views recorded for inputs into final reports. The workshops will be coordinated by the NCCC with respect to invitations, logistics and venue.

The selected institution or consortium will be responsible for the development of a plan of implementation for the work to be done and this is to be agreed with the NCCC before implementation commences. This plan should include but is not limited to the following:

- Development of work plan to be agreed with the NCCC
- Data requirements and personnel/information sources and key stakeholders to be consulted
- Field visits and conduct of survey/assessment
- Workshops
- Presentation of draft and final reports

REPORTING

Thirty (30) copies of the draft report on the overview will be presented to the NCCC and other interested parties at a workshop/seminar to be organized and facilitated by the contractor.

The selected consultants, institution or consortium will be responsible for the preparation and delivery to the Director of the Directorate of Environmental Affairs (DEA), in his capacity as Chair of the NCCC, a comprehensive report of the activities undertaken and completed within the terms of this consultancy including those reports described above. The final synthesis report will include but is not limited to sections on the geographic areas covered, institutions, data, findings and recommendations arising from the work and must include the headings described elsewhere in this terms of reference. The report will include an executive summary, the report body and annexes. The contractor will incorporate comments from interested parties and the NCCC into the final report. Twelve (12) hard copies of the final synthesis report and an electronic version using appropriate software (preferably Microsoft Office) must be delivered to the Director of the DEA upon completion of this assignment

DURATION

It is expected that the implementation of this activity will be completed over a six-month period commencing in June 2004 ending in November 2004 and will not exceed sixty (60) actual working days.

BUDGET

The selected consultant, institution or consortium must submit a budget detailing estimated cost of the expected implementation of this activity. This budget must be in the form of a complete breakdown detailing costs of key personnel and the amount of time allocated to each key person, transportation, materials and other items. A payment schedule should also be included that links payments with performance milestones. The budget should be submitted in the form of a financial proposal separately from the technical proposal in different envelopes. A fixed price contract will be entered into with the selected contractor.

APPLICATIONS

Interested consultants, institutions or consortia should submit a technical and a financial proposal separately and in duplicate indicating their interest in and capability to implement the above work in separate sealed envelopes marked **TECHNICAL PROPOSAL FOR TECHNOLOGY NEEDS ASSESSMENT** and **FINANCIAL PROPOSAL FOR TECHNOLOGY NEEDS ASSESSMENT** respectively to the either of the following addresses by **MAY 31, 2004:**

Mr. Joseph McGann
Climate Change Program Coordinator
Directorate of Environmental Affairs
Ministry of Environment and Tourism
6th Floor Capital Center Building
Private Bag 13306 Windhoek
Email: joemcg@dea.met.gov.na
Tel: 061-249015

or

The Environment Unit
UNDP Namibia
Contact: Catherine Odada
13th Floor Sanlam Building
Private Bag 13329 Windhoek
Email: catherine.odada@undp.org
Tel: 061-204-6232

Applications must state the period during which the bid will be valid. No facsimile tender documents will be considered.

APPENDIX B - TECHNOLOGY TRANSFER PLAN

General Objective ***Comply with Namibia's commitments to the UNFCCC in terms of Technology Transfer***	Actions / Objectively Verifiable Indicators (OVIs)	Means of Verification (MoV)	Assumptions
Immediate Objective Implement Programme to facilitate Technology Transfer for adaptation and mitigation to climate change	Government and Donors presented with proposal for support for implementation of TT programme Government and donor commitments obtained	Document(s) Budgets allocated	Interest from government to put CC adaptation and mitigation in its development policy Donor commitment remains
Component 1 Awareness regarding CC, sustainable development and technology improved	Action 1 Centres for information dissemination regarding CC, SD, AT strengthened and delivering Action 2 Farmer awareness/ capacity for diversification improved Awareness on Self-sustaining areas and eco-tourism rather than agriculture improved Promotion of energy-efficient cooking techniques/technology Promote water conservation in rural areas	Baseline evaluation undertaken Centres provided with materials Information documents produced, number of farmers/farmer organisations workshopped; Awareness before and after programme evaluated Information brochures; number of people/organisations workshopped Documentation compiled; mobile workshop established; centres visited; visitors to workshops/demos Awareness package created; number of locations/ organisations visited; number of beneficiaries	Existing information centres are used by public Interest of farmers Interest of individuals/ businesses Id. Id.
Component 2 Capacity in Government, Private Sector, civil society to implement mitigation and adaptation TT projects improved	Action3 CC monitoring capacity improved by implementing meteorology capacity building project Action 4 GIS, satellite imagery, data analysing software and hardware capacity building project	Weather stations installed Needs assessment undertaken Soft/ hardware installed, persons trained	

	Action 5 Climate change coordination strengthened	National Climate Change Office established	

Component 3 Priority research and capacity building projects undertaken	Action 6 Artificial Recharge Systems plan designed Wind energy feasibility study undertaken Biomass, deforestation, bush encroachment monitoring Calibrate crop models for Namibian conditions Research financial incentives to remove barriers to sustainable development PV mini-grid R&D project	 Document Id. Report Id. Mini-grid power station and M&E report Report	
Component 4 Access to financing for CC mitigation and adaptation, desertification and biodiversity projects improved	Action 7 Financial resources clearing house established and delivering Action 8 Pilot project for carbon financing under Kyoto implemented	 Information newsletter on funding mechanisms delivered to stakeholders; proposals submitted to donors DNA established Pilot carbon project submitted to international authorities	

Component 5 Priority mitigation and adaptation projects undertaken	Action 9 Construct desalination plants for brackish groundwater	Project documents, M&E	
	Aquaculture project undertaken	Aquaculture development fund SMMEs initiated	
	Water and energy-efficiency in public institutions	Id.	
	Water efficient technology for industries	Id	
	Natural gas to generate electricity	Natural gas power plant	
	Water and energy-efficiency in the building sector	Project documents, M&E	
	Upgrade vehicle inspection centres to improve energy efficiency and emissions testing	Id.	
	Transition from low- to high-value crops in areas with sufficient water supply	Id.	
	Afforestation and agroforestry programme	Id.	
	Solar water heaters programme	Id.	
	Establish waste fuel briquetting plant	Industry set up.	

APPENDIX C – PRIORITY PROJECT SHEETS

ACTION 2 (P1) - Farmer awareness and training on farming and diversification under drought conditions

Focus: Adaptation

A future climatic regime that is hotter, drier and more variable will have severe consequences for local and regional food supply, land use options, production profitability, poverty, employment potential and economic sector competitiveness. As marginal conditions have prevailed in Namibia for several decades, the overall impacts of climate change under a general aridification scenario are likely to be less detrimental for the local commercial farming sector than in other parts of SADC.

However, impacts on household food security amongst subsistence farming communities could be dramatic. Consequently, studies on the vulnerability of subsistence crops in Namibia should form the focal point of future investigations into climate change impacts on the country's food security.

Possible consequences of global warming include

- Geographical shifts in the areas suited to crop growth are highly probable. Based on the influence of increased CO_2 and temperature alone, Namibia's maize triangle and Caprivi region could experience an increase in maize yields of up to 5% under Hulme's 'core' climate change scenario. However, if rainfall is reduced and becomes more variable, fewer areas will be suitable for cultivation.
- The growing season of maize is likely to shift to an earlier date and, as a result of increased temperatures, shorter growing seasons and reduced yield quality are likely. Altered prevalence of weeds and crop pests are also expected. A decline in surface water availability will be accompanied by fewer opportunities to develop irrigation schemes.

Studies on economic impacts of desertification in Namibia have shown that subsistence farmers are least resilient.

Given Namibia's arid conditions, the existing knowledge needs to be harnessed and disseminated; it is likely that it will have an increasing value for other countries. Continued support needs to be given to subsistence farmers to diversify and look for alternatives to farming.

Costs

Estimated US$50000 to undertake awareness and training programme.

Benefits

Poverty alleviation, rural local economic development.

Reliability:	Moderate-good, high sustainability potential
Capacity building:	Good
Social Acceptance:	Moderate (reluctance to change; only if demonstrably successful)
Political Will:	Moderate (main interest lies in commercial farming)

ACTION 2 (P2)- Promote tourism and environmental recovery rather than agriculture in arid areas, such as the veld

Focus: Adaptation

In many areas of Namibia, agricultural areas interface with sensitive environmental areas, such as veld regions. While crop production reflects a permanent displacement of the natural environment by arable land, grazing livestock are allowed in most cases to encroach on these areas. The veld has some resilience to handle grazing and tends to recover quickly during wet periods. However, during drought periods, the environment becomes increasingly fragile and susceptible to destruction. Under climate change conditions when droughts are expected to become longer, or more frequent, livestock pressures may so severely deplete the veld that it cannot recover during rainy periods. Without livestock pressures much of the environment, and especially the veld, has an innate ability to adapt and withstand drought. Livestock, on the other hand, have very little ability to adapt to drought without significant human intervention. Many stakeholders have noted that many ranchers and smaller-scale cattle owners in Namibia are reluctant to sell their cattle during drought years. There are cultural reasons for many owners maintaining large herds, and accepting the fluctuations in their herd size in response to drought and rainy seasons. Unfortunately this indigenous cattle management practice may not be able to cope with extended and more frequent droughts.

Alternative options are to a) promote the concept of selling cattle to the abattoirs during drought, effectively removing livestock pressures from the environment when they are most sensitive and b) promoting tourism in sensitive environmental areas rather than agriculture. Economic data suggests that the contribution of tourism to the GDP is continuing to increase at 8% per annum, whereas livestock production is decreasing. The data suggest that the economic return of allocating portions of the environment for tourism is much greater than converting it to agriculture. The more simple argument is that the environment is much better suited to handling climate change than agriculture, and that environment preservation serves as a growing source of income. Why not, then, take advantage of impending climate change to promote tourism? This can only be achieved, however, by removing the pressures of agriculture.

Costs: A thorough economic analysis that compares the costs and benefits of both livestock and environmental preservation (tourism draw factor) in various environmental areas would need to be conducted. Either a compensation scheme or an alternate income source for indigenous farmers and ranchers in these areas must be identified and developed.

Benefits: The benefit of increased tourism should theoretically offset the costs of abandoning agricultural practices. Additionally, a recuperation of the environment should allow for alternative income sources from this resource, though it is difficult to quantify this benefit.

Reliability:	Average (not explicity proven), sustainability potential good
Capacity building:	Average-good (secondary objective)
Social Acceptance:	Poor (i.e. rural communities will resist giving up cattle ownership even with a generous compensation package)
Political Will:	Poor (i.e. little political will to alienate affected rural communities or dilute cultural identity; NDP and Green scheme maintain objective of local food sufficiency)
Time to Develop:	10-20 years
Likelihood of occurring:	Low-moderate (i.e. if economics bear out, people should gradually tend towards higher paying tourism market, younger generations

ACTION 2 (P3) - Promotion of Energy-efficient Cooking Techniques and Technology

Focus: Mitigation

In the past decades a lot of international research has gone into energy-efficient cooking technology for rural areas. In Namibia, more than 90% of rural domestic energy use is firewood. It is known that simple improved cooking techniques such as proper utensil sizing, lids, reduced amounts of water, wood preparation, etc can reduce fuelwood use by as much as 30%. In addition, depending on locally available materials, improved stoves can be made of clay / mud; bricks or metal (e.g. car rims) and can save an additional 50%. Other technology that is used within the region includes fuel-less cooking / heat storage devices (commonly called hotbox, haybox or magic cooker), which can reduce the energy needed to cook a meal by as much as 90%.

International experience shows that socio-cultural barriers are the main obstacle to introduction of these techniques and technologies. Participatory development of appropriate solutions for specific communities has been more successful than the launching of a nationwide campaign for one specific technology.

Barriers include lack of understanding of the social functions of woodfire (light, social factors, heat); suspicion that alternative cooking methods will not provide the same food quality; low status of improved stoves as stoves for the poor. There is some evidence that the vulnerable, sick (HIV) and elderly are particularly entrusted with the task of tending fires and therefore exposed to smoke.

A number of initiatives exist to produce charcoal from bush clearing. The charcoal is exported within the region. The project will target improvements in efficiency of charcoal kilns.

The Project will focus on capacity building for community initiatives to test and develop energy-efficient techniques and technology. A national resource centre will provide training in principles of fuel-efficiency and assist communities to develop solutions in a creative manner, and will assist communities to test the efficiency of their solutions. An organisation such as R3E would be well-suited for this purpose.

Costs

Estimated cost for a national programme coordinated by a resource centre is US$50.000 / year for a period of 3 years.

Benefits

In addition to the mitigation potential, potential gains in time –specifically for women and children - are considerable and result in improved livelihoods. Health improvements related to reduced and / or removed smoke and possibly better nutrition are an important consideration.

Reliability:	Average-good, sustainability good
Capacity building:	Average (secondary objective)
Social Acceptance:	Moderate (only when participatory)
Political Will:	Moderate (technology is encouraged but not as a priority)
Time to Develop:	3 years
Likelihood of occurring:	Moderate – mechanisms exist (SGP) – implementing capacity limited
Likelihood of success:	High (when knowledge, capacity building and empowerment are counted in the benefits)

ACTION 2 (P4) - Promotion of Water Conservation in Rural areas

Focus: Adaptation

There is a certain paradox in identifying the need to raise awareness on water conservation in rural areas in a country such as Namibia, where water conservation has been part of daily life for thousands of years. However, improved access to water, especially at a subsidised cost fosters the perception that there is more water available. Local conservation practices are actually eroded, and technology to conserve is not as much in demand as technology to increase supply.

In view of the potential climate change impact on water resources with more irregular and less total rainfall; in view of projected population increases, the pressure on urban environments from migrants and the resulting need to continue to develop a rural alternative requires urgent action to regain and support focus on local water conservation. This includes the need to make use of indigenous knowledge (IK) in the area of water conservation.

In addition, rural areas with water systems are likely to suffer important water losses. Unaccounted water losses are inherent to all water reticulation systems. There are two common causes for this, namely 1) unauthorized, or illegal, water connections, and 2) pipe leaks. Very well managed reticulation systems have losses of less than 10%, most systems operate in the 15 – 25% loss range, and poorly managed reticulation systems can have losses in excess of 50%. Leaks are usually the greatest factor for the losses. Poor management is not necessarily a reflection of the expertise or knowledge of how to supply water, but is rather a reflection on the financial and technical capability of a utility to properly identify problems, maintain, and replace portions of the system as they age. Large reticulation systems should have a dedicated leak detection programme.

By placing flow meters at strategic locations, following standardised procedures, and involving communities, leak detection programmes provide a systematic method of identifying portions of a reticulation system that have unaccounted water losses. Replacing problem portions of the pipe network is usually achieved at low cost, especially when compared to the opportunity costs of the lost water.

Costs

Estimated cost for an awareness programme is US$50000 over 3 years.

Benefits

Currently limited financial benefits, adaptation benefits

Reliability: Good, sustainability very good

Capacity building:	not a primary objective
Social Acceptance:	Good-Moderate (older generations should be positive, younger may need to be convinced)
Political Will:	Low (not a priority)
Time to Develop:	3 years
Likelihood of occurring:	Moderate – mechanisms exist (SGP) – implementing capacity limited
Likelihood of success:	High (when knowledge, capacity building and empowerment are

ACTION 3 - Expanding Namibia's Climate Observation System

Focus: Adaptation and Mitigation

The Initial National Communication (INC) indicated that in 1994 the Namibian Meteorological Services (NMS) used 6 synoptic weather stations collecting data on an hourly basis, and 8 stations operated by volunteers collecting data 3 times per day. NMS operates a current network of approx. 300 rainfall stations. The synoptic stations are not evenly distributed across the country, especially in the north, where there is only one station that cannot be considered representative of the entire region. To increase the accuracy of climate change monitoring and prediction, a representative network across the country is needed. 9 additional synoptic stations will be required to support environmental monitoring and climate change detection research needs.

As outlined in the INC, technological support is needed to replace the current manual system with an automated system. The replacement of this system, plus the expansion of the overall monitoring network would require more staff, appropriately trained to maintain the systems and to analyse the data. Support is also needed to convert hard-copy archived data into digital format. A project proposal was submitted to UNDP/GEF in 2002 but has not yet been processed. Objectives are:

- To acquire country-wide baseline climate data needed for Namibia Climate Change Detection and Attribution Studies (NCCDAS), by extending coverage of climate observing stations to all parts of the country;
- To decentralise the systems for acquisition and processing of climate data, as well as dissemination of user products in order to ensure timeliness and efficiency in service delivery
- To contribute towards achievement of an inter-station horizontal resolution of about 250 km – the recommended optimum upper limit by WMO; and
- To put in place a national capacity for climate analysis, including climate change scenarios development, by training staff to professional meteorologist and advanced technician levels

Costs

Laboratory/Observation Equipment: US$500.000
Office Equipment, Computers, Software: US$50.000
Establishment of New Stations: US$300.000
Long-term Training: US$350.000
Short-term Training: US$55.000

Benefits: The economic benefit of weather data is difficult to quantify. Evaluating any climate change mitigation and adaptation project requires a thorough knowledge as to what the extent of climate change will be. The expansion of the NMS climate observation system will increase the accuracy of global climate change models and lead to better predictability of the affect of climate change in each of Namibia's four climate zones. Other benefits are that increased rainfall and temperature gauges will lead to better annual water demand and agricultural production figures that are relevant to food security and water management.

Reliability:	Good (proven technology) sustainability impact average (indirect)
Capacity building:	Good
Social Acceptance:	N/A (i.e. public not pro or anti weather monitoring)
Political Will:	Moderate (Government willing to co-fund improvements)
Time to Develop:	5-10 years
Likelihood of occurring:	Moderate (a GEF US$1.000.000 medium grant proposal has been submitted with Co-[illegible] committing US$ 210.000)

ACTION 4 - GIS, satellite imagery, data analysing software and hardware capacity building

Focus: Mitigation and adaptation

Graphic information and information systems are important tools in a vulnerable environment, for monitoring, evaluation, decision-making and early warning.

A number of governmental and private sector organisations have the capacity to provide such information, but the TNA assessed that this technology is not optimally used. Factors that may result in this are lack of equipment, lack of capacity to use the technology, lack of coordination between units (especially government), lack of demand due to lack of awareness of the applications of the technology. The latter is generally translated in high demand for maps, that are subsequently used to reach a decision in a 'traditional' way. Few departments or organisations systematically feed new developments in a GIS. Even where a GIS exists, decision-makers may not consult it. An example was given of a selection of a suitable site for a borehole in Etosha NP, where a GIS can generate a display of suitable locations based on the multiple criteria for new boreholes (proximity of existing boreholes, fences, roads, etc).

The project will evaluate existing suppliers of GIS and other graphic information and assess the technology needs, as well as initiate and/or improve cooperation between experts in different organisations.

An important component will be raising awareness of the application of GIS for efficient management of natural (and other) resources, by carrying out pilot projects in various sectors. This will include a pilot school-based training programme for teachers and students that can be undertaken in partnership with an organisation such as UNESCO.

Costs

Estimated cost is US$100.000, although this could vary with the 'hard' technology needs.

Benefits:	No direct financial benefits; no direct mitigation/adaptation benefits, eventual increase in management efficiency (indirect)
Reliability:	Technology is proven, now widely used. Improves capacity for sustainable development (indirectly)
Capacity building:	Primary objective
Social Acceptance:	Average-Good (awareness needs to be included, people are slow to accept new decision-making tools)
Political Will:	Poor (no priority)
Time to Develop:	2 years
Likelihood of occurring:	Low (technology will be acquired but capacity building for efficient application is not likely to happen)
Likelihood of success:	Average (it may take another generation for this technology to be mainstreamed)

ACTION 6 (P1) - Expanded Use of Artificial Recharge Schemes

Focus: Adaptation

Artificial recharge requires capturing water, treating it, and transferring it via boreholes or infiltration basins to an aquifer. Common water sources include dams, rivers, municipal wastewater and storm runoff. Possibly the greatest potential value of artificial recharge is having a dependable quantity of water held in a "water bank". In areas with limited or erratic rainfall, and with climate change predicted to increase the variability of rainfall, this technology offers a cost-effective option for providing water security. Given Namibia's high temperatures and low humidity, approximately 80% of all water stored in surface reservoirs and dams is lost to evaporation. Another way of looking at it, for every litre of dam water that is treated for municipal consumption, four litres have been lost to evaporation. Under global climate change conditions, the available water resources may be reduced at the same time demand due to population growth and the government's "Green Scheme" (which aims to develop the agricultural sector) is increasing. Artificial recharge offers an opportunity, in those areas where the geology is favourable, to transfer surface storage into groundwater storage and maximise the use of available water resources.

Artificial recharge programs are already being successfully implemented in Windhoek and Walvis Bay, and there is an ongoing effort to expand the operation in Windhoek. Development of artificial recharge programs requires exhaustive geological surveys, pump testing, and groundwater modelling.

Costs

It is important when undertaking a cost benefit analysis on various water supply options to ensure that all the costs are being considered. These costs should not only include the costs associated with development and operation, but also the savings from minimising water losses, particularly due to evaporation. Until a county-wide study is conducted, potentially at a cost of US$5 million, there is no way of estimating the opportunity costs from minimising water losses. An estimated cost of US$250000 for a pilot programme is used here.

Benefits

The expectation is that an extensive artificial recharge program could be developed, in conjunction with ongoing surface water capture and groundwater extraction programs, to provide long term water security for the major population centres in the country. The economic benefit of this has not yet been estimated.

Reliability:	Good (proven), highly sustainable
Capacity building:	Good
Social Acceptance:	Very Good (i.e. doesn't require a lifestyle change and people always happy to have water)
Political Will:	Good (i.e. cost-effectiveness of Windhoek and Walvis Bay schemes have already been demonstrated)
Time to Develop:	10-15 years
Likelihood of occurring:	Moderate (funding not yet identified)
Likelihood of success:	High (i.e. developed technology, large potential, and previous successful schemes)

ACTION 6 (P2)- Mapping Wind Velocity

Focus: Mitigation

Efforts are made to remove barriers to Renewable Energy in Namibia. This includes research on wind energy and pilot projects in Luderitz and Walvisbaai. International experience shows that whereas regional assessments of wind speeds conclude that the wind velocity is inadequate to warrant wind power generation, local conditions may differ.

This has been confirmed through recent research undertaken at the Gobabeb research station, by the Polytechnic of Namibia in cooperation with R3E and the Desert Research Foundation.

There is a need for more accurate wind monitoring and research. Until recently, the only way to evaluate the wind energy potential over a large area and to identify attractive sites for wind projects was to travel around with topographic maps, find some promising spots, and take measurements—a costly, time-consuming process that often leaves large gaps in knowledge. Today, commercial products provide an accurate, high-resolution assessment of wind resources to identify and characterise the most attractive wind project sites. Typical resolutions are 1 Ha. Complex wind flows can be simulated without the need for onsite wind data. High resolution wind resource maps and atlases have been produced for the United States, Brazil, Ireland, the United Kingdom, and over 30 other countries and regions.

Combined with the technological capacity built through the ongoing wind power pilot projects, accurate identification of suitable areas for wind power stations will greatly increase the potential for this renewable energy source.

Costs

Selected mapping of promising areas would require an estimated cost of US$50000 (not including pilot projects funding) for an 18 month project.

Benefits

Optimal planning of wind as a RE source; since initiatives are being undertaken this will greatly improve the cost-benefit of such projects and provide valuable input for any CBA

Reliability:	Moderate, sustainability good
Capacity building:	Good
Social Acceptance:	Good (i.e. people typically support industries that benefit their communities)
Political Will:	Poor (i.e. increased transparency may not be desirable, political incentive to attract industry and jobs will be more difficult)
Time to Develop:	5-10 years (to implement wind industry)
Likelihood of occurring:	Low-Moderate (potential from the Barrier Removal to RE Programme; interest from a number of donors, limited effort to date from Government)
Likelihood of success:	High (interest in wind technology exists, more accurate wind data will improve design and likelihood of success for wind farming)

ACTION 6 (P3) Biomass, Bush Encroachment, Deforestation Monitoring

Focus: Adaptation and Mitigation

There is an ongoing effort by the Ministry of Environment and Tourism (MET), the Namibia Nature Foundation (NNF) and the National Botanical Research Institute (NBRI) to monitor changing trends of the biome boundaries. These biome boundaries, e.g. where woodlands transition to savanna, have changed over time as land has been cleared for agriculture and other human needs, and to some degree due to ongoing climate change. There has been a noticeable retreat of the woodlands in the northeastern part of Namibia due to deforestation. Often, land clearing of both woodlands and savanna results in bush encroachment which negatively impacts the integrity of the original ecosystem. An unexpected benefit of bush encroachment is that it has led to a net increase in biomass which in turn leads to increased carbon sequestration. As a result of bush encroachment, Namibia has become even more of a "sink" for greenhouse gases.

In regards to adaptation, bush encroachment and deforestation compromise the environment, which may lead to ecosystem disruption. Under climate change scenarios, coupled with ongoing human influences, the woodlands in northeastern Namibia may retreat entirely from the country, thus compromising the economic gains that come with a sustainably managed forest. Tourism may be affected, as would the livelihoods of people who rely on the forest for raw materials. Wildlife endemic to the woodland areas may disappear. An additional issue is the affect of deforestation on the hydrologic cycle. The hydrologic cycle is strongly influenced by ground cover characteristics, and it is not certain at this time how much of an impact deforestation, coupled with bush encroachment, would have on total runoff, groundwater recharge, and erosion. In regards to mitigation, a thorough analysis of change in biomass would assist Namibia in demonstrating to the UNFCCC that it is still serving as a sink for global greenhouse gas emissions, and lends weight to the need to focus on adaptation rather than mitigation.

Costs

The economic cost of deforestation and bush encroachment is difficult to identify. The percentage of total tourism dollars spent on the forest areas has never been estimated. It may be assumed that this revenue may be halved under total deforestation. The total revenue from forest products has also never been accurately estimated. The MET, NNF, and NBRI currently use satellite imagery to measure biome boundary shifts, though it has been acknowledged that more ground truthing is needed to verify these results. DEA commissioned the Bush Encroachment Research and Monitoring and Management Programme (BERMMP), during 2003.

Benefits

Increased awareness of deforestation and bush encroachment would lead to a better understanding of how to manage and prevent changes to the biome boundaries. Such preventative measures would preserve the tourism capital and forest-derived income of local communities.

Reliability:

Capacity building:

Social Acceptance:	Good (i.e. local communities would probably welcome monitoring program)
Political Will:	Good (i.e. any effort to preserve local community natural resources base would be welcome)

ACTION 6 (P4) Calibrate Crop Models for Namibian Conditions

Focus: Adaptation

Approximately 70% of Namibia's population practices subsistence farming. Even in the wettest parts of Namibia, the climate is only characterised as semi-arid. Water availability for irrigation must come from perennial water sources, although many subsistence farmers do practice dry-land farming. Average rainfall amounts are barely sufficient to develop a crop. Any reductions in rainfall, or increases in temperature may severely jeopardize subsistence farming communities where there are no perennial water sources.

As outlined in the Initial National Communication, Namibia has the capacity to use crop models, but does not have the capacity to develop them. Crop models that have been developed elsewhere, such as the United States, do not precisely predict crop yields elsewhere. There is need to develop calibrated crop models for the drought resistant crop cultivars in Namibia. Calibrated crop models provide the user a means by which they may simulate crop yield under a variety of agricultural conditions, such as under deficit irrigation (under-watering) and higher temperatures that are applicable to climate change conditions.

By simulating crop yield using calibrated models, the Ministry of Agriculture, Water and Rural Development (MAWRD) could use the results of their simulations to assist farmers, via existing Extension Services, by selecting crop cultivars and varieties that will maximize their profits under climate change conditions.

Costs

Costs for drought relief and economic costs associated with malnutrition due to drought incidents have been requested but the information is not yet available.

The costs of acquiring models and calibrating them is related to time and effort. The MAWRD maintains a crop modelling unit comprised of one scientist, one technician, and two labourers. The preference is to triple this manpower to meet Namibia's crop modelling needs.

Benefits

The results from calibrated models may be used to estimate maximum achievable yields for different crop cultivars under climate change scenarios. Such estimates will aid in crop selection, in the promotion of different farming techniques, and ultimately in better estimating food security in subsistence farming areas. The economic benefits associated with having working calibrated crop models is difficult to assess, but it has been roughly estimated that the economic benefit to the agricultural sector could reasonably be expected to increase by US$2-3 million per year in increased profits alone. Other economic benefits include a reduction in drought relief expenditures and a reduction in emergency food assistance monies and a reduction in malnutrition.

Reliability:	Moderate
Capacity building:	Good
Social Acceptance:	Moderate (i.e. some farmers will not switch to new crop varieties)
Political Will:	Strong (i.e. government has an established extension service and is trying to promote the agricultural sector)
Time to Develop:	10-15 years
Likelihood of success:	Moderate (i.e. model calibration is achievable, and the extension service will succeed in influencing a large portion of the commercial farming sector, and to a lesser extent the subsistence farmers)

ACTION 6 (P5) - Rural electrification R&D – PV mini grid

Focus: Mitigation

With ideal sun conditions, Namibia is highly suitable to become a centre of excellence for PV power. With rapidly improving technology and interest throughout the world; and increased criticism of the adverse impacts of alternatives such as hydropower, Namibia has an opportunity to lead the PV sector in the region.

Rural electrification through the grid is not cost-effective for small villages situated at large distances from the existing grid. This results in lack of development potential for these areas, thus negatively impacting on employment, poverty, urban migration and other social problems.

Stand-alone solar systems (SHS) are promoted in Namibia with limited success. Renewed efforts will be undertaken to improve adoption (notably with the UNDP-GEF/MME Barrier removal project). These systems have the disadvantage that power generated is not efficiently stored, i.e. demand for individual users fluctuates but systems are isolated and therefore provide no compensation (one system may be low while another system is not charging because batteries are fully charged).

For a group of users and institutions a Centralised PV power System offers an attractive solution. The project will design a system for a remote village that will not be connected to the grid within 10 years. The system will provide power for the village institutions, such as local government, hospital and school; and allow individual users to connect. The project will include a remote monitoring system to provide research data for potential replication.

Costs

Depending on the selected system size, estimated cost for a 10kW PVPS and adequate monitoring system is US$300000.

Benefits

Off-grid rural development potential; urban migration reduction.

Local technical/know-how capacity building for future regional and international developments.

Potential demonstration to decision-makers that this is an economically valid alternative for rural electrification.

Reliability:	Average-good; sustainability good
Capacity building:	High
Social Acceptance:	Moderate (misconception that PV is limited to lights and will deter grid extension to the PV-user community)
Political Will:	Poor (main interest lies in hydropower and natural gas)
Time to Develop:	2 years
Likelihood of occurring:	Moderate (potential within phase 2 of the Barrier removal to RE project)
Likelihood of success:	Moderate (costs for PV rural electrification remain very high; without removal of financial barriers replication is unlikely; capacity building will be an important likely success)

ACTION 6 (P6) - Development of Financial Incentives to Remove Barriers to Mitigation and Adaptation to Climate Change

Focus: Adaptation & mitigation

Natural resource economics and environmental economics have greatly progressed in the past decades. A number of financial tools have been designed and tested internationally. These include pollution taxes; pollution credits; duty-free imports; financial support for clean development investments, etc.

Implementation of such measures in Namibia requires trans-sectoral research led by national development decision-makers with technical support and commitment from sectoral stakeholders. Currently some incentives exist, such as duty-free import of some goods, support for local manufacturing / assembly, low-interest schemes (SHS).

The project will research current international experience and lessons learned in financial barrier removal to climate change adaptation and mitigation, and recommend measures for Namibia, including institutional requirements.

Costs

Commitment from Government to own the process and take on board the eventual recommendations will be a prerequisite. Project costs will be administrative costs for 1 year, estimated at US$30000

Benefits

Capacity built with financial tools to promote sustainable development will be of cross-sectoral benefit. A range of options and flexible decision-making has the potential to stimulate development.

Reliability:	Moderate
Capacity building:	Moderate-good
Social Acceptance:	Moderate (some measures will be perceived as negative – extra tax, unfair advantages to competitors)
Political Will:	Moderate (limited cross-sectoral capacity and interest, preference for status quo)
Time to Develop:	1-2 years
Likelihood of occurring:	Low (research is done at academic level but not likely to be taken on board by decision-makers)
Likelihood of success:	Moderate (i.e. standardised process can be developed, but lack of cross-sectoral co-operation may derail implementation)

ACTION 7 - Building Capacity to Tap into International Funding

Focus: Adaptation and Mitigation

As a non-Annex I country, Namibia has opportunities to request funding from Developed countries for adaptation and mitigation projects. The GEF - Special Climate Change Fund (SCCF), will fund projects relating to capacity building, technology transfer, climate change mitigation activities, economic diversification for countries highly dependent on fossil fuel. (FCCC / SBI / 2003 / INF.12 / Add.1).

Since Namibia has ratified the Kyoto Protocol in 2003, the country can also submit projects for carbon credits through bilateral and multilateral initiatives. Development of this capacity is listed as Action 8.

A large number of international mechanisms for funding exist that can be used for adaptation and mitigation projects by CBOs, NGOs, local and national Government, micro-enterprises and educational institutions. Examples are GEF-SGP, EU-MPP, UNESCO-PP and a number of bilateral assistance funds.

Namibian institutions and organisations generally lack the capacity to tap into this funding. Suggested causes for this are the lack of exposure to the existence of funding potential and the lack of capacity to submit quality proposals.

A Climate Change Resource Centre will act as a clearinghouse for information regarding international donor funding and assist institutions and organisations to submit proposals. The RC should be based at an existing institution, which could be public or civil society. The centre will also act as a watchdog for proposals that are not efficiently processed by the international system.

Costs

Estimated costs US$150000 over 3 years

Benefits

This Project is included in response to one of the barriers to technology transfer. A detailed assessment can be made with existing funding programmes to compare the usage by Namibia to other countries.

Currently used funds from various grant programmes can be compared with their funding potential. It is estimated that the annual benefit in terms of increased funding for projects in Namibia would far outweigh the annual cost of approx. US$50.000. The benefits in terms of capacity building for project design and implementation are difficult to quantify.

Reliability:	Good
Capacity building:	Good
Social Acceptance:	Good, public would welcome information regarding international funding
Political Will:	Low (has not been initiated by Government)
Time to Develop:	2 years
Likelihood of Occurring:	low (dependent on foreign funding)
Likelihood of success:	high (relatively low investment with good potential benefits)

ACTION 8 - Building Capacity for Clean Development Mechanism (Kyoto)

Focus: Mitigation

Since Namibia has ratified the Kyoto Protocol in 2003, the country can submit projects for carbon credits through bilateral and multilateral initiatives.

The Kyoto protocol becomes operational in February 2005, and Certified Emissions Reductions (CERs) can be traded under the Clean Development Mechanism (CDM).

To allow submission of projects, a Designated National Authority (DNA) needs to be established. The Namibian Climate Change Committee is considering hosing this at the Ministry of Trade an Industry, which would be an appropriate choice. The DNA office can be supervised by an independent advisory board, consisting of stakeholders from all sectors of society.

The issues related to carbon trading are complex and in the pilot countries (including South Africa) capacity building projects have been undertaken. Such a project will establish the DNA, build capacity of DNA staff to undertake preliminary and final project evaluations; raise awareness among stakeholders –in particular businesses; and undertake a pilot CDM project.

To avoid conflicts of interest occurring, the capacity building project should be undertaken by an experienced international entity without local or regional business interests. An academic think tank or international NGO with focus on natural resources management is recommended.

Costs

Estimated costs US$150000 over 3 years

Benefits

This Project is included in response to one of the barriers to technology transfer. Namibia offers limited potential for carbon trading given its low GHG contribution and potential for mitigation. However, per capita the potential is still considerable. Given that the capacity building costs are relatively high donor support is required, but subsequently the benefits should be considerable for a number of private sector companies.

Reliability:	Good
Capacity building:	Good
Social Acceptance:	Good, public would welcome information regarding international funding
Political Will:	Average (has not been initiated by Government)
Time to Develop:	2 years
Likelihood of Occurring:	average (DNA is likely but there is a risk that no capacity building is undertaken)
Likelihood of success:	high (relatively low investment with good potential benefits)

Action 9 (P1) - Construct Desalination Plants for Brackish Groundwater

Focus: Adaptation

Desalination refers to the removal of salts from water, usually through reverse-osmosis membranes. The technology of desalination has advanced quite rapidly over the years, and the high costs once associated with this technology have been significantly reduced.

Given climate change predictions that rainfall will become more variable, extended droughts may severely affect those rural areas or subsistence farmers that rely on rainfall. Many of these communities and farmers already suffer tremendous hardships during droughts; this will be exacerbated by climate change. The majority of stakeholders interviewed as part of this project have identified water security in rural, subsistence farming areas as their primary concern.

Ironically, many of these rural areas a are actually located on top of large volumes of groundwater, though that water is saline, or brackish. Being able to harness this water for household uses, especially during drought cycles, would prevent these communities from literally "drying up". The high capital and operations costs associated with desalination plants have prevented the development of treatment plants in these areas in the past. However, with new technologies and lower treatment costs, desalination of small to medium-sized communities may be affordable. At Robben Island, located offshore of Cape Town, they now have a small, self-cleaning desalination plant with treatment costs of approximately US$0.80/cubic meter which is very comparable to conventional water treatment plants.

Costs: It is important when undertaking a cost benefit analysis on the feasibility of desalination plants in rural areas that these costs should also include the socio-economic savings due to preserving entire communities, which may otherwise be abandoned. The number of small to medium-sized rural communities that are coincidentally located above brackish groundwater has not been conducted in Namibia, though this would be relatively easy to do. Additionally, the susceptibility of these rural communities to prolonged drought has not yet been quantified. As such, the economic cost of not implementing a secure water source for these areas can not be identified at this time. However, it may be safely assumed that the social costs of not providing a secure water source under climate change conditions would be extremely high. A feasibility study for implementing a widespread desalination program could cost approximately US$2 million, though this cost has not been verified.

Benefits: There is a tremendous socio-economic benefit in preserving small and medium-sized rural settlements in Namibia. These communities form the backbone of rural life in Namibia. The economic benefit of constructing desalination plants to help these communities in adapting to climate change and the increased variability of rainfall has not been determined.

Reliability:	Good, sustainability high
Capacity building:	Average/good (secondary objective
Social Acceptance:	Very Good (i.e. doesn't require a lifestyle change and people always happy to have water)
Political Will:	Good (i.e. preserving local communities would be very popular)
Time to Develop:	5-10 years
Likelihood of happening:	Moderate (funding not identified)
Likelihood of success:	High (i.e. developed technology, large potential, and strong political will)

ACTION 9 (P2) Promoting inland aquaculture, developing efficient and productive aquaculture techniques

Focus: Adaptation

Climate change-induced rainfall variability and extended droughts are expected to severely affect rural areas and subsistence farmers. Water scarcity in rural, subsistence farming areas is a major concern, especially as it relates to reduced agricultural production and food security. Many stakeholders have identified a need to develop methods of producing food more efficiently and with less water.

Inland aquaculture is an expanding industry around the world, whereby fresh-water fish are farmed in man-made ponds. In the past, conventional aquaculture farms have been developed in areas with ample fresh water supplies, e.g. downstream of dams, and have somewhat high water demands. A constant refreshment of the water has typically been needed to maintain the correct temperature, to carry away wastes, to prevent disease, and maintain oxygen levels. However, reduced water-use techniques are increasingly being used to generate large volumes of fish and vegetables in greenhouse-based environments. These intensive operations cycle water from large above-ground fish tanks through vegetable hydroponics systems. The waste from the fish helps fertilise the plants, and plant cuttings help feed the fish. Because water is recirculated, operational water needs are equal to the evaporation losses from the fish tanks and evapotranspiration losses from the hydroponics systems, both of which are quite limited in greenhouse environments.

Indoor aquaculture production facilities that have a reliable electrical source and only a moderate supply of fresh water would be able to achieve high production rates even under hotter and unpredictable climate patterns as expected in Namibia. Using far less water and area than a conventional farm, such an operation would be able to generate much larger quantities of food.

Costs: Rural areas with adequate electrical and water supplies need to be identified. Fish varieties should be identified that are capable of dealing with the temperature fluctuations that will be experienced in fish farm environments in Namibia. A government-sponsored hatchling program should also be developed to identify and supply successful strains of aquaculture–suitable fish to local producers. Additionally, ongoing support an training should be facilitated by an inland aquatic fish farming research programme, perhaps through cooperation with other neighbouring countries, like South Africa, that already have an established fish farming industry. A financing program (Aquaculture development fund) should be developed to entice rural producers to begin operations, as well as assist in defraying the initial high setup costs.

Benefits: The increased food production potential of this technology is tremendous. Profits are high and offset the high initial capital costs. Ongoing production operations outside of Namibia show that several tons of fish may be produced annually in a greenhouse area no larger than 15 square meters. There is also opportunity for export.

Reliability: Moderate, sustainability moderate

Capacity building: Moderate-good

Social Acceptance: Moderate (i.e. encouraging rural communities to change their eating habits and to start eating fish may be difficult, unconventional production methods may not attract many willing producers)

Political Will: Very Good (i.e. aquaculture strategic plan; increasing food security, consistent with Green Scheme objectives)

Time to Develop: 5-10 years

Action 9 (P3) - Water and Energy Efficiency in Public Institutions

Focus: Mitigation and adaptation

Few public buildings have been constructed with concern for reduced energy and water use.

Lights and air conditioning should be monitored or controlled by timers; the benefits can be estimated by observing the government lights of Windhoek by night. CFLs should be introduced where appropriate, timers placed on stand-by equipment such as copiers, printers and video equipment. Water efficient toilets should be introduced. Institutions such as UNAM could reuse shower water to irrigate gardens and sportsfields.

The programme will undertake water and energy audits in public institutions in Windhoek, make recommendations and carry out agreed improvements. To ensure genuine interest and capacity building participating institutions will be expected to share the cost of improvements.

Impact of pilot interventions will be evaluated and the information disseminated to lobby for general implementation.

Costs

Audits estimated US$25000

Improvements US$100000

Benefits

Reduced water and electricity use; awareness, mitigation and adaptation.

Reliability:	Proven technology, sustainable
Capacity building:	Moderate (secondary objective)
Social Acceptance:	Moderate (skepticism, no visible interest in saving resources)
Political Will:	Poor (currently no incentives, guidelines)
Time to Develop:	2 years
Likelihood of occurring:	Low in the short to medium term without overseas funding
Likelihood of success:	High (basic audits and a few interventions can significantly reduce water / energy costs)

Action 9 (P4) – Water-efficient technology for industry

Focus: Adaptation

Namibia's medium and long-term vision (NDP2 and Vision 2030) focus on stimulating local industrial development.

Many potential industries have a considerable effect on water quantity and quality. Support for industrial development and inefficient pricing of water may have a dramatic effect on water resources, that would be exacerbated with climate change impacts.

While industrial development projects therefore need to go through environmental assessments, it is also important to provide potential entrepreneurs with technology options for improved water management. Arid and semi-arid countries have successfully developed technologies to minimise water consumption, reuse and recycle waste water. Examples in the region are the efforts made in the mining industry (e.g. Debswana).

The project will research and disseminate information regarding appropriate technologies for water conservation in industries, and undertake a number of pilot projects to demonstrate the potential and raise awareness. Any technological innovation should be undertaken with local capacity building in order to avoid reliance on overseas experts (e.g. for maintenance or expansion).

Costs

US$100.000 over 2 years, including seed funding for technology (private sector partners should participate in these costs).

Benefits

Financial benefits due to reduced production costs if water is correctly priced; adaptation benefits

Reliability:	Many technologies are proven, other have variable success. Highly sustainable
Capacity building:	Should be project objective
Social Acceptance:	Low-average
Political Will:	Poor (industrial development is a priority, unsustainable use of water resources may not be a reason to halt it)
Time to Develop:	2 years
Likelihood of occurring:	Low in the short to medium term without this project
Likelihood of success:	High (when industries are presented with more efficient technology they adapt very quickly)

Action 9 (P5) – Natural gas to generate electricity

Focus: Mitigation

Namibia's electricity demand is currently estimated between 350 and 400MW and estimated to grow at approximately 4% per year. The main local source of electricity is the Ruacana hydro-electric power station, with a capacity of 249MW, that depends on variable water flows. In dry winter months, Namibia imports up to 50% of its electricity from South Africa.

Testing at the Kudu gas field off the southern coast has indicated that there are sufficient proven natural gas reserves to develop a 750-800MW power plant that can operate for a minimum of 20 years.

A combined cycle gas-fired turbine power station will be situated in Oranjemund.

Costs: Total costs of the first phase are estimated at US$400 million.

Benefits: Economic benefits include cheaper electricity production in the long-term, when South African demand is expected to exceed supply and prices are expected to rise. The project will supply a larger than necessary output and an additional income is expected from export to South Africa. This type of arrangement needs to be carefully agreed. Mitigation effects are considerable, since coal-generated electricity is substituted with natural gas, which has a carbon-equivalent per unit of energy generated that is 30% lower. Employment benefits should be considerable. The project may apply for CERs under the Kyoto CDM, although the reductions will be regional.

Reliability: Power stations of this type are proven technology, the gas surveys can be judged reliable. Gas is a (non-renewable) fossil fuel so this is not a technology that should be seen as sustainable in the long term. It may actually cause the country to abandon research in renewable energies.

Capacity building:	Capacity building is not a major objective. It is likely that mainly foreigners will be involved
Social Acceptance:	Good (no difference will be noted)
Political Will:	Good
Time to Develop:	3-5 years
Likelihood of occurring:	Average in the short to medium term without overseas funding
Likelihood of success:	High

ACTION 9 (P6) – Water- and Energy-efficiency in the Building Sector

Focus: Mitigation

A number of efforts have been undertaken to raise awareness regarding energy-efficiency in Namibia, notably through the R3E project under a cooperation between MME and the Polytechnic. The Habitat centre is another effort aiming at raising awareness regarding building technology.

However, no appropriate building method is being promoted nationally, both private and public developments are dominated by imported building styles without consideration for local conditions. Air-conditioning systems are subsequently required to compensate for absence of natural cooling or heating techniques.

Water-efficiency is hardly a consideration. Proposed designs for large buildings rarely include underground rainwater storage systems for irrigation and cleaning or more creative systems such as insulating water-walls. Greywater systems are also never included. For instance, large hotels could easily water their gardens with shower water at a fraction of the cost of tap water.

A large amount of international research is available in the engineering and architecture sector that needs to be incorporated in the building sector in Namibia. Examples include the efforts undertaken in Australia for the 2002 Olympics, where strict energy and water management was a requirement for participating hotels and other businesses.

The true life-cycle cost of a building needs to be evaluated and publicised.

Government and the public need to be made aware of the energy cost of inefficient constructions and the true cost of tap water for irrigation and cleaning as compared to rainwater harvesting and/or greywater recycling. Insulation, passive heating and cooling techniques and solar water heating are cost-efficient techniques that should be standardised.

Costs

The cost of the capacity building programme in the building sector and in the relevant departments, with a number of pilot interventions is estimated at US$250000

Benefits

Capacity building, life-cycle cost reduction of buildings, mitigation.

Reliability:	Proven technologies, large potential for adaptation and mitigation
Capacity building:	Average-Good (secondary objective)
Social Acceptance:	Moderate (fashionable building styles)
Political Will:	Poor (currently no coordination or political will)
Time to Develop:	3 years
Likelihood of occurring:	Low in the short to medium term without overseas funding
Likelihood of success:	Average (building sector also depends on the client)

Action 9 (P7) - Upgrading Vehicle Inspection Centres to allow Efficiency and Emissions Testing

Focus: Mitigation

A number of stakeholders have indicated the need to improve the standard of vehicles in Namibia. There is some concern that old, unreliable and inefficient vehicles are imported. The Government restricts importation of old vehicles, but no testing facilities for fuel-efficiency or exhaust quality exists. Inefficient combustion causes CO emission, which is toxic and is 3 times as potent a Greenhouse Gas than CO_2. With the gradual introduction of unleaded fuel, catalytic converters can be required for vehicles.

In the US state of Colorado, at the introduction of an emissions test (IM240), it was observed that failing vehicles emitted an average of 50g CO / km, while for a typical new car this is around 2.5g / km. Sine transport is the main contributor to GHG in the energy sector, this is a considerable contribution; potentially equal to that of all household energy. Improved testing facilities would therefore provide accurate data to assess environmental impacts and provide feedback to car owners.

The project will see an improved testing facility in testing centres in the main urban areas.

Costs

An average cost of US$50000 per testing station is estimated. Data monitoring to feed into pollution statistics will require an additional US$10000. In addition there will be training costs.

The costs for catalytic converters and vehicle repairs are not included in this estimate, since they will be at the expense of the vehicle owners.

Benefits

In addition to the mitigation potential (indirect, since testing alone does not reduce emissions), the health benefits will be considerable, specifically when one considers the growing traffic in Windhoek. More efficient engines will also benefit the vehicle users. Additionally, the capacity / know-how would provide opportunities for regional assistance when other countries seek to introduce measures.

Reliability:	Proven technology, offers opportunities for introduction of catalytic convertors; sustainable
Capacity building:	Primary objective
Social Acceptance:	Low (people typically object to additional vehicle testing)
Political Will:	Poor (current transport policies have other priorities)
Time to Develop:	3 years
Likelihood of occurring:	Low in the short to medium term without overseas funding
Likelihood of success:	High (introduction of exhaust and efficiency standards has been very successful internationally)

Action 9 (P8) – Transition from low-value grain crops to high-value crops in areas with sufficient water supply

Focus: Adaptation

As (one of) the most arid countries in Africa, Namibia has a limited number of geographical areas that have sufficient water supply without relying on ground water, especially situated in the north of the country. Many of these areas are inefficiently used, typically with grain crops.

Priority areas will be determined to undertake transition projects to introduce high-value crops (cash crops) and vegetables.

Costs:

Estimated at US$150000 over 3 years

Benefits: income increase, food security improved, social benefits; adaptation potential

Reliability: average, not guaranteed; sustainability good

Capacity building:	Average-good (secondary objective)
Social Acceptance:	Low (people typically object to changes in agriculture, except commercial farmers)
Political Will:	Poor-average
Time to Develop:	3 years
Likelihood of occurring:	Low in the short to medium term
Likelihood of success:	Medium (people have been found to revert to former crops)

ACTION 9 (P9) – Afforestation and Agro-forestry Programme

Focus: Mitigation

Given the acknowledged problems with deforestation and bush encroachment, a number of small initiatives have been taken in the field of afforestation in Namibia.

Potential for agro-forestry is also considerable, given the poor soil quality and potential depletation through traditional agriculture and/or monocultures.

A number of regions in Namibia are particularly suited to an afforestation and agroforestry programme. Local and regional projects have shown good results with trees such as the Manketti, Jatropha, African chestnut, Marula, Moringa, Tephrosia and Neem. Products include food products, medicinal, biocide and non-food industrial products.

Most of these trees are suitable to (semi-)arid conditions. Potential for creation of industries such as oil production (including the production of diesel and fuel from the jatropha, which is a candidate for carbon funding), soap production and skin care products.

A specific project to set up a biofuel plant using the jatropha was initially included in the list of potential projects, but it is felt that the current information regarding the fuel quality is inconclusive and research should be part of an initial broad programme. Alternatives to be considered are a moringa domestic oil plantation; in addition the fast growing tree has leaves that can be eaten and the seed has been used for water treatment.

Costs

The cost of a national afforestation and agro-forestry programme is estimated at US$350000, however an initial regional demonstration programme is estimated to cost US$100000.

Benefits

Capacity building, life-cycle cost reduction of buildings, mitigation.

Reliability:	Moderate (relies on actual usage of products); sustainability moderate (risk of affecting water table)
Capacity building:	Moderate, secondary objective
Social Acceptance:	Moderate (lack of knowledge and awareness, agricultural conservative reflex)
Political Will:	Moderate-poor Poor (currently no coordination or political will)
Time to Develop:	3 years
Likelihood of occurring:	Low in the short to medium term without overseas funding
Likelihood of success:	Moderate (afforestation programmes not always very successful; (community) ownership and management issues for forests; issue of endemic or exotic species is barrier- agroforestry prospects are good)

ACTION 9 (P10) - Promotion of Solar Water Heaters

Focus: Mitigation

Up to 40% of the electricity used by a household with an electric geyser goes to cover its consumption. Recent studies have confirmed that promotion of SWH is economically efficient.

The bottleneck to global introduction of SWH is the initial investment cost. This will be addressed by providing awareness regarding the true life-cycle cost of an electric geyser and through the creation of a SWH financing scheme and introduction of other financial incentives.

The programme needs to avoid introducing low-cost / low-quality SWH and needs to ensure proper maintenance capacity, as international experience has shown that low quality will result in social rejection of the technology. The programme will therefore focus on imported convection heaters with a separate heating circuit.

After the breakthrough of the technology the option of locally manufacturing / assembling SWH, and introducing the options of single-circuit heaters and low-end batch heaters can be assessed.

This programme will be started under the UNDP / GEF funded Barrier Removal to Renewable Energy Programme implemented by MME

Costs

Programme estimated to cost US$50000 per year over 3 years, in addition to the necessary capital for a rotating fund or other financing scheme.

Benefits

Substantial reduction of household electricity consumption. Net benefit for individual users. When market has been established potential for local production, employment and export potential.

Reliability:	Moderate (highly reliable systems are costly); sustainable
Capacity building:	Moderate (should be an eventual objective but initially import)
Social Acceptance:	Moderate (perception that water is not hot and system is costly)
Political Will:	Moderate (public institutions have not led by example)
Time to Develop:	3 years
Likelihood of occurring:	Moderate (recent initiatives show interest, but financial incentives are a barrier)
Likelihood of success:	High (technology tested, ideal conditions in Namibia)

ACTION 9 (P11) - Waste Fuel Briquetting

Focus: Mitigation

Namibia has some local efforts to generate fuel from organic waste in rural areas. The technology used is labour-intensive and produces inefficient fuel briquettes. Stove development for this specific fuel is inexistent. The situation is similar in other countries in the region, currently no large-scale briquetting plants exist.

The project will investigate the potential for the creation of a medium-sized local briquetting plant using extrusion or comparably efficient press technology. The raw material needs will be investigated, from agricultural waste to household organic waste, industrial waste such as sawdust.

A combined shredding-extrusion plant allows most organic waste to be briquetted. Press technology may require specific raw materials (e.g lignin content such as wood or paper)

Since Namibia is currently exporting charcoal, there is also potential to export biomass briquettes.

The technology for briquetting is well advanced internationally, particularly in India

This project has been rated 25th out of 25 selected projects included in the action plan. However, with the natural gas project, it is the only downstream industry project..

Costs

Cost of a medium-sized extrusion plant is US$100000.

Benefits

Provide a substitute fuel; provide long-term employment; reduce waste stream to landfills by reusing organic waste. Minor potential of securing carbon funds – only when landfill generates significant CH_4 (unlikely)

Good benefits in terms of employment and environmental sustainability. An additional income can be derived by charging for collection of garden waste.

Reliability:	Moderate-good reliability (briquettes moderately efficient); sustainability average
Capacity building:	Good
Social Acceptance:	Moderate (charcoal briquettes are being used, so acceptability should be in function of fuel quality and presentation / marketing)
Political Will:	Poor – not a current priority. Fits with employment and industrialisation priorities of NDP1 / NDP2 and Vision 2030
Time to Develop:	3 years
Likelihood of occurring:	Low in the short to medium term without overseas funding
Likelihood of success:	Moderate (technology works well but market is limited and transport to neighbouring countries will limit export potential)