



PRACTICAL EXPERIENCE AND LESSONS LEARNED IN THE CLIMATE RELATED-TRANSFER OF TECHNOLOGIES IN AFRICA

Editor's note: Please note that the views expressed in this paper are those of the author and do not necessarily reflect the position of the UNFCCC secretariat

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EXECUTIVE SUMMARY

It is mainly through the global environment facility and activities implemented jointly that developing countries, Africa included, have been able to participate in past climate-related technology transfer projects. Analysing such projects has provided insights into how African countries have performed in past climate-related technology transfer projects and how the experiences gained could be used to enhance Africa's future climate technology transfer process.

Past projects in Africa have mainly been concentrated on mitigating greenhouse gas (GHG) emissions through commercialization of renewable energy technologies, application of energy efficient technologies and enhancing greenhouse gas sinks through some forestry projects. Adaptation measures have just been dealt with at the analytical level but no implementation projects have been implemented in Africa under the above financing mechanisms. Even with regard to greenhouse gas mitigation, only fewer implementation projects were carried out in Africa (compared to other developing regions) as indicated by the low global environment facility budget allocation of only 9% for projects conducted in Africa. Seventeen projects funded by global environment facility (compared to 4 bilateral and 4 activities implemented jointly) considered in this study were well distributed across Africa except in those countries ravaged by civil wars. The region least involved in past climate-related technology transfer projects in Africa is Central Africa and yet this region has vast natural resources in form of water, fertile lands, wildlife, energy and minerals, which, if sustainably exploited, could cater for the needs of the continent. Both adaptation technologies and this region of Africa require special attention in future technology transfer projects.

In order to benefit from climate-related technology transfer, African countries have greater responsibility to ensure that they have the necessary skills to assess and screen technologies which can enhance development on the continent. Information most critical relates to what appropriate technologies are available, their sources and the economic and environmental performance of these technologies. Developed country companies will not easily surrender their competitive edge for the sake of the UNFCCC and in that regard they may not release the full information to African countries on how to adapt and improve on the technologies, unless it is also of benefit to them. Cooperation and collaboration with countries/technology suppliers in projects of mutual benefit will be imperative if Africa is to benefit. This has to be coupled with availability of financing mechanisms since suppliers will probably release their technologies on a willing to sell- willing to buy basis.

Past climate-related technology transfer project planning and priority setting were dominated by government institutions and non-governmental organizations (NGO) with little or no involvement of the private sector entities and civil society and yet these latter groups are the ones that can sustain technology transfer through supply and as markets respectively. It has been common that governments, energy utilities, NGOs and universities are the decision-makers on climate-related technology transfer projects and the private sector entities and civil society mostly participate at implementation stage. Involvement of private sector and civil society in new projects such as the climate related ones is however not automatic and requires clear indications of economic opportunities for the private sector and a cultural transformation for the civil society. The private sector would also not want to be involved in projects which expose them to business risk as was the case in some past renewable projects which expected the private companies to borrow from project funds to buy RETS kits for sale to an unestablished market. In some cases, local companies were subjected to competition from products imported from developed country firms. Such RETS kits were imported duty free thereby stifling the local technology development and supply industry since local firms are required to pay import duty on their imports. The project funds/loans were also given out to potential consumers at lower interest rates than the commercial rate which was probably intended to jump start the climate-related technology transfer process, but which distorts the market. It is therefore important to have well-established long term policies with regard to these climate-related technology transfer projects to ensure their future sustainability. The private sector entities also need to be involved in planning and setting the priorities of these

projects so that they can adopt approaches which they are able to sustain.

The prevailing decision-making process in past climate-related technology transfer projects tended to separate environment/climate change issues from the mainstream of the economic development agenda. As a result governments did not accord climate-related technology transfer projects the importance they deserve. Although most African countries are Parties to the convention, climate change issues have continued to be of low priority in Africa. The synergy that exists between addressing climate change and development issues like poverty alleviation have not been fully exploited. As a result past global environment facility projects were only seen as technical fixes which were not part of the overall national development agenda. Renewable projects were, however, comparatively more successful, because African governments were already pursuing RETS policies before the onset of the UNFCCC. Success in past RETS projects under climate change is shown by the prevalent replication of similar global environment facility-sponsored projects in other African countries. Governments therefore need to bring climate change issues into the national development plans so that they can be catered for in the national planning and setting of priorities.

Active participation by African countries in climate change activities seems to have influenced activity level in past climate-related technology transfer cooperation. South Africa, the largest economy on the continent, missed out on early climate-related activities because it delayed ratifying the UNFCCC, and yet the country has vast climate-related technology transfer opportunities in its various sectors. Those countries which started climate responses early, like Zimbabwe, Senegal and Egypt, have been more active in climate-related technology transfer projects and the presence of centers of excellence in those countries also acted as catalysts in such projects, as the expertise to make technology assessments and comparative analysis is available.

Africa generally suffers from lack of technology information compared to other developing country regions. The sources of information for such technology information are the conventional poorly-stocked libraries in governments, academic institutions and NGOs. At present these are cited as the main sources of climate change technology information with their well-known limitations. In some countries, such institutions do not even have facilities for tracking available technologies like the Internet. Countries which are just starting to respond to climate changes issues do not even have information on their past involvement in climate-related technology transfer projects.

Existing sources of climate-related technology transfer project financing seem to have limited Africa's participation. Global environment facility (GEF) project financing requires skills for packaging acceptable projects which also take a long time to be approved. Involvement of global environment facility consultants often becomes necessary to package 'GEFable' projects. The elaborate application process and requirement of specialized skills has limited the extent of African country participation. The high dependence on foreign capital and poor mechanisms for mobilizing local capital often limits the capacity of African countries to acquire climate-related technologies. The conventional sources of financing like the African Development Bank do not have windows for climate-related technology transfer projects and are thus irrelevant in promoting climate-related technology transfer in Africa. African countries also find it difficult to get financing of local simple technologies, as developed country Parties would rather finance those technologies originating in their own countries, especially if the climate-related technology transfer projects are under bilateral financing.

Below is a summary of the successes, constraints and failures registered in past climate-related technology transfer processes.

Successes

- UNFCCC financing mechanisms, particularly global environment facility, have enabled initiation of an important process and change of culture to implementation of environmentally sound sustainable development.

- Past projects have ‘energized’ the market for climate technologies by buying out risks and awareness campaigns at national level as was the case in the Tunisia and Zimbabwe project cases.
- Some private sector entities are starting to be aware of investment opportunities in climate related technologies through their involvement in past projects like in the case of the sugar bio-energy project of Mauritius.
- Projects already aligned to national development policies like renewable technologies have comparatively proved successful through the UNFCCC process.
- Presence of centers of excellence and induced active government involvement has helped to promote climate-related technology transfer in some countries like Zimbabwe, Egypt, Senegal and Tunisia.
- Number of private sector companies dealing with climate related technologies increased in countries as a result of past climate-related technology transfer projects, as was the case in Zimbabwe where solar companies increased from 4 to 50, thereby increasing employment opportunities.

Constraints

Constraints have been brought about by:

- Lack of flexible financing to cater for even local technology development or promotion.
- Some of the multilateral and bilateral sources of financing have discouraging conditionalities and do not have “windows” for climate-related technology financing like the African Development Bank.
- Lack of technological information and analytical skills to package “GEFable” projects.
- Capacity which is limited and confined to government institutions, NGOs and universities but not extended to private sector entities.
- Lack of established markets for climate-related technologies has not encouraged private sector to sustain technologies beyond the life of the global environment facility projects.
- Lack of consistency of climate initiatives with national development agenda limited the priority accorded to past climate related projects.

Failures

Failures identified in past climate related projects were as follows:

- Little or no involvement of the private sector in past project development.
- Failing to capitalize on economic and environmental synergy in climate-related technology transfer.
- Failing to enforce measures for future sustainability of climate-related technologies beyond the life of the projects.
- Preferential policies accorded to some of the projects only managed to distort the market, for instance through duty free importation and loan interest rates below the commercial rate.

- Responsibility of some past projects was given to weak government ministries.
- No measures to sustain companies emerging during climate-related projects after the end of the projects, as in Zimbabwe where 75% of the installation companies were expected to go down after the global environment facility project.

The way forward

In view of the foregoing, African countries should focus on the following for the enhancement of future cooperation in climate-related technology transfer:

- Bringing climate change policies in line with the mainstream development agenda. Such policies should also be formulated in consultation with all key stakeholders, including the private sector and civil society.
- Involvement of private sector and civil society is crucial but innovative measures are required to make climate-related technology transfer projects attractive to them.
- Since technology information is critical to planning and priority-setting of climate-related technology transfer projects, African countries need to establish credible sources of information for technology assessment and screening. African countries need to have an information network among themselves and with developed country institutions and suppliers as a means of sharing technological know how and building skills.
- Skills are required to package projects which qualify for global environment facility financing. Additional flexible and easily accessible financing is also required to increase Africa's participation in climate-related technology transfer projects.
- Private sector ought to be encouraged to invest in climate-related technologies thereby ensuring sustainable supply and continued upgrading of the technologies. Private sector entities can also promote local technologies for both national and regional markets.
- For monitoring progress in the adoption of climate-related technologies, African countries are to set targets for achieving climate-related technology transfer and formulate indicators for such monitoring and evaluation of progress at a later date.

In realizing the difficulties developing countries, like those of Africa, would face to shift to cleaner technologies, the convention requires developed countries, apart from taking care of their own transition to low greenhouse gas emission levels, to take *practical steps to promote, facilitate and finance as appropriate the transfer of or access to environmentally sound technologies and know-how to developing country Parties* (see Article 4.5 of the Convention (1992)). This has led to some of the climate-related technology transfer projects being financed at bilateral level. To this end the Global Environment Facility (global environment facility) was also formed to which developed country (ANNEX I) Parties contribute financial resources for such purpose.

The other financing mechanism created for similar purposes is that of activities implemented jointly (AIJ), which has sponsored some projects worldwide, but not comparable to global environment facility and not that successfully in Africa. Activities implemented jointly is believed to have sponsored 4 projects in Africa, three in energy efficiency and the fourth one on renewable energy but these projects may still be in proposal stage.

Climate change technology lessons for Africa have therefore been learnt from such climate-change related projects recently carried out in Africa under these financing mechanisms, **and global environment facility has been the mainstream through which climate-related technology transfer projects (under pilot stage) have so far been financed in the different developing parts of the world including Africa.**

Most of the technologies tried so far are concentrated in greenhouse gas (GHG) mitigation emphasizing the adoption and commercialization of renewable technologies, energy efficiency and forestry (CO₂ sink). Most of these climate technology opportunities have been identified in the energy sector and this is not surprising, considering that this sector is better understood in terms of technology processes than the non-energy sector.

Adaptation projects have so far been assessed mostly at analytical level, although some global environment facility initiatives are underway to carry out stage II of the decision on adaptation measures and capacity-building as envisaged by Article 4.1(e) of the UNFCCC. UNEP is initiating this activity at the request of the member states in the various regions of Africa.

Compared to other regions, Africa has benefitted the least from the UNFCCC financing mechanisms for climate change technologies, judging by Africa's 9% budget share in the past global environment facility full projects (global environment facility, Feb 1998). Africa is lagging behind in exploiting UNFCCC/global financing, probably due to lack of awareness on available technologies and skills to package projects acceptable for these financing mechanisms. Most of the technologies involved so far under the climate change paradigm originate in developed countries and **the current principle of climate-related technology projects is therefore mainly of technology transfer rather than technology development within Africa.** This is on the premise that developed countries will be happy to create a market for their current technologies to make way for newer technologies in their economies. African countries also lack skills and financing to be able to leap frog to the up-market technologies to be at par with their developed country counterparts. This scenario suggests that African countries will only be benefiting from public domain and outgoing technologies as the ANNEX I countries and companies would want to maintain their competitive edge. It is Africa's responsibility to break away from this technology bondage.

With respect to planning and priority setting of climate-related technology transfer projects, it is quite apparent that so far governments and non-governmental organizations have dominated participation in these projects with little or no involvement of the private sector entities (industries and bankers). Apart from the fact that private sector entities are responsible for the major sources of greenhouse gas emissions and other environmental damage, these entities can be the ones to produce, adapt and finance climate technologies for sustainable supply and use. A representative stakeholder participation by the private sector, different levels of government, academia and affected communities at all stages of project development and implementation are considered important in the adoption of climate-related technologies. The involvement of these institutions in decisions about matters that affect them are therefore critical in this respect. Although most global environment facility projects are supposed to be country-driven, the pilot phase projects may not have fully benefitted from the broad views of the various stakeholders at both national and regional level.

Climate technology adoption will also be successful if it is either consistent with national policies or provides experience on which to base policy changes that are in the national interest of participating countries. Introduction of climate-related technology transfer projects in the absence of coordinated national strategies/policies will limit government support for the projects as they are viewed in isolation from the mainstream of the development agenda. The way the projects are structured and managed involving temporary and sometimes biased policies in favour of such temporary projects, have affected the success of past climate-related technology transfer projects.

Hence this analysis has focused on the above problem areas to provide insights on what practical experiences and lessons have been learnt that can enhance future technology transfer in Africa under the UNFCCC.

Global environment facility financing is continuing with an even bigger budget (US\$ 2.75 billion) compared to US\$ 2 billion in the pilot phase so opportunities exist for Africa to benefit in the form of climate technologies. The clean development mechanism stipulated in the Kyoto Protocol with emphasis on sustainable solutions for developing countries is also likely to yield more technologies. The pilot phase of activities implemented jointly (AIJ) is due for review in the year

2000 and that evaluation will determine whether the mechanism matures into joint implementation (JI) or not. Bilateral financing also continues where countries can identify economic and environmental opportunities of mutual interest. Other initiatives like the climate technology initiative (CTI) are also being promoted for similar climate technology transfer.

Future prospects should therefore concentrate on how African countries can position themselves to benefit from climate technology transfer through these financing mechanisms which can also act as a springboard for local and regional technology development.

1. APPROACH

1.1 Objectives

The issues which were deemed important as experiences and lessons, and were considered in this analysis of past climate related technology transfer are the following:

1. Climate-related technology transfer projects conducted in Africa and their focal areas, geographical distribution and the level of participation by Africa countries in climate-related technology activities;
2. Climate initiative planning and decision-making framework, policies and priority-setting which could create a conducive environment for reception of climate-related technology transfer in the African countries;
3. Stakeholder participation and public- private sector partnerships in climate-related technology transfer projects;
4. Channels of information flow for climate-related technology transfer;
5. Financing sources and accessibility; and
6. General successes, constraints and failures experienced.

Information sources

The derived practical experiences and lessons were principally drawn from analyzing global environment facility pilot phase projects and other climate-related projects on Africa documented in readily available sources like web-sites and reports. The survey conducted by IVAM (1998) on *Transfer of Environmentally Sound Technologies and Practices under the Climate Convention*, included Country Fact Sheets for 13 African countries and this was also an important source (Website) of information on past technology transfer process in Africa.

Consultation was also made with some African and international experts on their involvement and views on past climate-related technology transfer in Africa. The International Institute of Energy Conservation, which has been involved with pushing AIJ project proposals in Africa, provided information on the extent of AIJ as a financing mechanism so far.

The study may not have exhausted other important sources of information, but since this paper is intended to present an overview of past climate-related technology transfer process, it has been considered sufficient to draw its findings from these readily available sources of information in the form of Websites, global environment facility reports and views/reports of other institutions active in climate-related projects in the region. The key sources of information used are listed as references.

The analysis only considered experiences and lessons from implementation projects on climate-related technology transfer and not climate enabling activities. Participation of countries in climate change enabling activities was however considered an important precursor to climate-related technology adoption.

2. EXPERIENCES AND LESSONS OF PAST TECHNOLOGY TRANSFER PROCESSES

2.1 What to watch for in technology transfer

Technology transfer in its basic definition is the communication of knowledge, skills and methodologies involved in the production, consumption and distribution of goods and services in an economic development process, and yet it is often thought of only in the context of the transfer of equipment from one country to another.

The process of technology transfer is therefore complex, entailing disseminating information on available technologies to cultural transformation in recipients countries, apart from importing and exporting technical equipment and skills. The recipient of technologies have to make a conscious decision to master the technology being transferred and to develop necessary capacity to unpack the technology for effective use, maintenance and adaptation to operate under local cultural, socio-economic and environmental conditions. Selected technologies have to match the needs, skills, training, financial means, institutional framework and natural environment of the recipient country. Preparing a framework with such technology transfer elements is a prerequisite for Africa's success in the climate-related technology transfer process. Demanding state of the art technologies without such preparedness will not yield any technology transfer regardless of the mechanisms for financing and transferring technologies suggested under the UNFCCC. Negotiators from Africa should anticipate that developed country Parties will not surrender their technologies on a "silver plate". If anything they would be tempted to dump obsolete technologies in unsuspecting countries. Therefore greater responsibility lies with potential recipient countries to ensure that proper climate-related technology transfer takes place.

It should also be borne in mind that the past requirements for technology transfer still apply to climate-related technology transfer, for example that it is the private sector marketing the technologies and hence, some of these technologies are protected by patent. There is however a significant share of the technologies on public domain which Africa will need to assess and screen for their use. Such technologies are also changing and some are becoming obsolete in countries of origin, and the recipient countries have to ensure that they are acquiring technologies with long term applicability.

The extent to which a recipient user will benefit from the technology will also depend on how willing the technology suppliers (Annex I countries in the case of climate-related technology transfer) are to surrender information on technology. The element of competitive edge continues to be an issue so, in as much as possible, Northern industries will not surrender their hard-won superiority and the Convention cannot force them. They can however sell it on a willing to buy basis to those who can afford to buy the technology. Buying the technology is one thing but mastering how to benefit from it will be the onus of the recipient to build such capacity. It will therefore be critical to identify technology opportunities of mutual benefit to both non-Annex I and Annex I entities to provide fertile ground for exchange of technology know-how.

In the recipient country, negotiators are not the ones likely to use technologies, so they ought to represent the interests of technology users who are mainly the private sector and the consumers. Climate-related technology transfer will not be achieved only for the sake of greenhouse gas reduction, but if there are also business opportunities for potential users of technologies who are mainly in the private sector. Governments can also encourage adoption of environmentally clean technologies by private sector if there is legislation in place like the polluter pays principle or carbon taxes.

Sustainability issues are also very critical in climate-related technology transfer. The UNFCCC is only acting as a jump-starter by financing environmentally sound technologies, so there is need for lasting financing mechanism of newer technologies and Research and Development for continued availability. When the private sector sees that business opportunities and technology markets are established, then climate-related technologies can be sustained. It is therefore critical at the technology adoption stage to create the necessary capacity, increase stakeholder participation and have the necessary financial structures in place for sustained technology transfer.

The next sections present how African countries have so far fared in the past climate-related technology transfer process.

2.2 Past Priority Areas

For the past twenty five (25) climate-related technology transfer projects conducted in Africa and considered in this study, 92% were in the energy* sector with 56% in energy supply and 36% in energy demand. Of the 17 global environment facility sponsored climate-related technology transfer projects, only four were in energy efficiency and the rest were on renewable energy supply mainly in form of solar photovoltaics, wind energy, micro-hydropower, biogas and bagasse. Africa is generally endowed with solar resources hence the prevalence of solar energy related projects but the other RETS projects were limited to one or two countries. One project involved using domestic and industrial waste for power generation which is an important aspect for Africa where waste management is a common problem. It is not surprising that renewable technologies (RETS) were a priority area for past climate-related technology transfer because RETS had already been on priority of governments before the climate change paradigm. Energy efficient projects ranged from efficient cook stoves, building energy efficiency, lighting and retrofitting power plants. Only two of the global environment facility projects were on forestry involving afforestation and rehabilitation of woodlands.

Four projects were sponsored through bilateral arrangements and another four (probably still in proposal form) through Activities implemented jointly showing that global environment facility so far offers the best opportunities for financing climate-related technology transfer projects in Africa.

All the past projects were conducted in the context of either reducing greenhouse gas emissions in the energy sector or increasing sinks for carbon emissions. What is critical is the lack of activities in the other critical sectors of the economy, particularly agriculture which is a major contributor to GDP and livelihood in most African countries. The transport sector is also the major consumer of petroleum products and opportunities for efficiency improvements are prevalent considering the old vintage, and poorly and inadequate infrastructure. There were also no projects conducted in past climate-related technology transfer for climate change adaptation purpose unless if they were addressed as part of bio-diversity projects. Critical areas of concern with regard to adaptation in Africa indicated by some governments respondents are related to management of low lying coastal zones, management of water resources and quality, fisheries management and achieving food security e.g. through drought resistant crop varieties. These focal areas therefore require special attention in future technology cooperation and collaboration. The choice of projects in the energy sector follows from concentration of past climate change costing studies in this sector. There is better understanding of the energy technology processes and there are also adequate data for technology analysis. Costing for adaptation is not as well developed as for mitigation although the realization is there now within IPCC/UNFCCC framework to increase efforts to carry out adaptation projects. African countries should therefore endeavour to participate fully in any future adaptation initiatives to be able to benefit from climate-related technology transfer in this area.

Past climate-related technology transfer projects were fairly distributed in the continent including in countries of the Magreb (Egypt, Tunisia, Morocco), West Africa (Senegal, Mali, Ghana, Côte d'Ivoire, Mauritania), East Africa (Tanzania, Kenya, Uganda, Sudan, Eritrea) and Southern Africa (Lesotho, South Africa, Zimbabwe, Malawi and Mauritius). The region of Africa which was not involved in past climate-related technology transfer projects is the Central African region. This region is also presently politically unstable and that may have affected its opportunities for participation. Financing organizations may have found the countries with civil wars to be too risky and decision makers in those troubled countries are also probably preoccupied with the turmoil of their countries. This region is one of Africa's regions which is well endowed with natural resources in the form of water, fertile agricultural land, bio diversity, energy and minerals (metal, precious stones and oil) all of which if sustainably exploited can cater for most of Africa's

needs. The region could therefore be considered an area of focus in the future climate-related technology transfer process.

2.3 General project setting and stakeholder participation

It is apparent from most of the country fact sheets that past climate-related technology transfer projects were initiated by Government institutions. **Governments sometimes with the assistance of research-oriented NGOs and universities have mostly been engaged in the planning and priority-setting of projects** and general consultation on climate change issues. Decisions on Climate related issues are made by many government Ministries and in some cases power utilities have also become actively involved and well represented in UNFCCC fora. In Zimbabwe only the Department of Energy and the Zimbabwe Electricity Supply Authority were indicated as the most active participants in Climate change activities. In other countries most planning and priority-setting is said to be carried out by many government institutions (Democratic Republic of Congo - 7 Ministries; Lesotho - 4 Ministries and University experts). South Africa's Electricity utility, ESKOM is even involved in UNFCCC negotiations. These institutions are necessary for decision-making but there has been a general lack of private sector and civil society entities in the framing of climate-related technology transfer projects. Only government ministries, university and research centres are involved in decision-making while both the private sector and civil society are on the periphery of activities or are expected to participate at the implementation stage. Generally climate-related technology transfer analytical skills and information on climate-related project opportunities are also concentrated in government, NGOs and universities, but limited in the private sector.

The climate-related technology transfer conducted in Mauritius on *sugar bio-energy technology* was a good case which involved sugar estates and sugar producers in the projects. This approach captures private sector confidence from the beginning, thereby increasing potential for technology sustainability.

What is common to all past African climate-related technology transfer projects is lack of partnership with civil society. The national focal points indicated that public interest groups are never consulted (e.g. Niger, Tunisia) in the framing of climate-related projects. In some cases public interest groups (e.g. case of Togo) have been consulted but not included in project planning. In the case of the bilateral afforestation programme of Lesotho, the rural population was not involved and yet this is the key population segment which, when equipped with the necessary skills, can sustain forest projects.

There are however some good cases like in Guinea where equal numbers of decision-makers are selected from government, private sector and academia for regular climate change consultations. Mali has also a well-developed consultative process involving large representation from the private sector.

Involving the private sector in all stages of project development and implementation is essential but often remains difficult to do in practice (global environment facility, Jan, 1998). The private sector participation cannot be expected to be automatic and cannot be based on concepts of climate change only. Private sector participation in climate-related technology transfer can be attracted by development opportunities or if the projects address issues that affect their current business operations, like averting risks or complying with a legislative obligation.

In the past sometimes the private sector was expected to participate in projects which exposed them to operational risks and hence they could not participate in the projects. Examples are those renewable projects where the private companies (suppliers) were expected to borrow from project funds for kits to sell to an un-established market. Such a circumstance cannot be attractive to the private sector unless if governments or project funds first buy out the risks or remove barriers by establishing a viable market. The Zimbabwe Solar photovoltaic global environment facility project was successful because customers got loans directly from the government bank and purchased systems from private sector companies who got assured of payment. In comparison, in India, where the private sector was required to borrow from the bank

to buy systems and sell to customers, the project was not successful in spite of the attractive interest rates due to the risk to private sector of collecting repayments.

However, incentives which are intended to buy out project risks sometimes do not encourage private sector entities to participate beyond the duration of the project. **Most of the RETS kits used in past climate-related technology transfer were procured on subsidized importation and warehousing and that weakened local supply and manufacturing capacity, thereby also reducing potential for local technology development.**

Past RETS projects also threatened existing companies with closure as they faced competition from developed country firms in form of these imported kits. **When the private sector is involved in the planning and priority-setting of climate-related technology transfer projects then they can probably assist in the selection of approaches and technologies which can enhance their local capacity.**

For new technology as is involved in climate change activities, new and small private sector enterprises join the industry concerned without adequate business and marketing skills and/or technical know how. Past solar photovoltaic projects were typically affected as small installation firms became more involved alongside the established solar photovoltaic suppliers. Such small enterprises cannot survive beyond the duration of the project due to lack of various skills. In the Zimbabwe solar photovoltaic project, although solar companies had grown from 4 to 50, about 75% of them were expected to go down soon after the global environment facility project. The requirement is that these emerging companies be assisted to build the necessary capacity so as to survive competition in the industry.

Those private sector entities which participated in past climate-related technology transfer like in the case of the solar water heater project in Tunisia and the solar photovoltaic project in Zimbabwe became successful in raising awareness of their new products and the services they offered. This instilled private sector confidence and together with government set quality and performance standards created confidence in the market. Such good cases have helped to promote widespread adoption of these sound practices/technologies in those and other countries. Widespread dissemination is shown by replication of similar RETS projects in other African countries through global environment facility financing and this could be considered an indicator that technology transfer is taking place in that focal area.

It is necessary to involve civil society in such emerging technologies as a goal to perpetuate practices, as society is also an important part of the market for technologies. **The process of capturing the interest and confidence of society at large to adopt new technologies, however, is a protracted process as it involves changing the mindset or cultural transformation.** To gain the confidence of society, it is also important to understand how decisions are made in that society and the entry point for information dissemination. Project managers and governments often fail to identify the actual persons who represent communities, thereby failing to fully capitalize on the involvement of society.

2.4 Project-policy match
In order for new projects to gain government support, the new projects should be in line with the national development objectives as stipulated in the national development plans or any of the established national policies. Although most African governments are Parties to the Convention, climate change issues have not been brought into the mainstream of development agenda and hence they continue to be accorded low priority. The synergy between these climate change projects and mainstream development has not been fully recognized. The evidence is in the low number of countries who have completed their first national communications. Whilst most (56%) of the countries are engaged in global environment facility's enabling activities since 1998, most African countries are still grappling with producing their first national communication. Decision 4/CP.4 expects Parties to include their technology needs, where necessary, and to report of any technological cooperation and transfer activities in these national communications for consideration under the UNFCCC. In this respect, African countries are delaying being part of the technology transfer communication process channeled through these national communications.

There is general lack of priority-setting and climate relevant policies for the potential climate-

related technology transfer projects in most African countries.

Planning and priority-setting of focal areas for climate-related technology transfer have been influenced by the level of participation in climate change projects the countries have experienced. Egypt, Zimbabwe and Senegal, who started climate studies earlier, have tended to benefit more from climate-related technology transfer projects. Their project identification also closely followed results of their climate studies and the cost curves produced in these studies. As climate studies are conducted by research institutions, it is therefore important that results of such studies are communicated to government to ensure informed project prioritization at government level. Some of the countries are in the very early stages of formulating a response to climate change and have thus not yet benefited from international support for climate change projects (e.g. Guinea Bissau, DRC) and information on climate-related technology transfer is therefore not available.

Global environment facility projects under the pilot phase are blamed for having a fast track inclination and of being technical fixes which ignored social and sustainable developmental issues. This is attributed to general lack of alignment with existing national policies. It is also not surprising that renewable projects fared well in past climate-related technology transfer projects, because there was already some development objective defined by most African countries for this energy sub-sector.

There is a view that past global environment facility projects lacked proper planning and involvement of policy planning thereby failing to ensure sustainability of technologies introduced in past climate-related technology transfer projects.

Global environment facility projects may have also been coined with prescribed notions of what stakeholder participation should be like without recognizing that sometimes governments, private sector entities and consumers do not necessarily behave in that preconceived manner.

For global environment facility projects to be sustained and replicated achieving technology transfer, they should be in line with national development objectives/policies. The tendency has been for governments to agree to give incentives to global environment facility projects when such incentives are not operative in the general economy like duty free for solar photovoltaic imports and low interest rates for project loans. This distorts the market although the intention is to buy out risks. This was the case in the Zimbabwe solar photovoltaic project and yet existing solar companies still paid duty on their imports, independent of the global environment facility project. What is required is then a lasting solution or policy for sustaining similar technology transfer efforts.

Some good practices exist where African countries have already prioritized climate-related activities in their environmental action plan (e.g. Guinea) or have a consultation process through a national plan for environment and sustainable development (e.g. Senegal). Egypt, Mali and Togo also express their initiatives undertaken by governments to facilitate transfer of climate related technologies through:

- general awareness and information dissemination on technologies and/or national communication processes.
- Conducive fiscal environment like removing subsidies on energy and imposing high import duty for heavier engine vehicles. A fiscal environment involving duty/tax exemption as was the case for solar equipment should however be considered negative as it will not sustain the industry unless if the policy applies across the whole industry.
- providing technical assistance for waste utilization.

Another policy-related issue which was not obviously evident in past climate-related technology transfer projects was the political support for projects from **political leaders and other policy champions**. Members of organizations like the Global Legislators Organization for Balanced Environment (GLOBE), which mainly consists of members of parliaments in Southern Africa,

could promote climate-related technology transfer projects in their constituencies. The projects themselves should, however, remain politically neutral in order to be sustainable in the event of governments changing.

The foregoing therefore points at the opportunities which have been missed in past climate-related technology transfer projects due to lack of proper government policy orientation. For future climate-related technology transfer, countries have to define their priority areas and to develop policies/strategies in support of these climate related projects. Another important prerequisite would be for African countries to actively participate in climate related projects and to incorporate the climate change policy within the mainstream of economic development.

2.5 Sources of technology information

The information indicated in table 2.5.1 is of critical importance when considering climate-related technology transfer but it is apparent from past technology cooperation that African countries have no easy access to that information. There is also an indication that sourcing information for climate-related technology transfer is not accorded the importance it deserves.

Table 2.5.1. Information relevant for climate-related technology transfer

Information types	Countries perceiving: relevance and ranking*
Inventory of technological options for greenhouse gas mitigation and adaptation to climate change	high=8 mid= 1 Low=2
Comparative assessment of socio-economic, technical and environmental performance of alternative climate-related technologies	high=8 mid= 1 Low=2
Inventory of policy options to foster uptake of certain categories of climate-related technologies	high=8 mid= 2 Low=1
Inventory of financing opportunities for climate-related technology transfer projects in various sectors	high=8 mid= 1 Low=2
Inventory of vendors, suppliers and other experts for specific categories of climate-related technologies	high=3 mid= 3 Low=3 NR=2
Examples of climate-related technology transfer projects and/or capacity building actions	high=7 mid= 2 Low=2

*perceived relevance of climate-related technology transfer information from sampled country fact sheets -, IVAM, 1998.

The national sources of such information currently are linked to governments and yet some of these government institutions depend on conventional sources of information like libraries which are poorly stocked and have no facilities for tracking technological changes. Some of the countries whose country fact sheets were consulted showed that some of the national information centers do not even have facilities like the Internet or technology networks which can assist them to search for technological options.

About 30% of national focal points consulted on relevance of the information in climate-related technology transfer (table 2.5.1.) considered the information to be of low to moderate priority in their countries. This was mostly true in the case of countries which had little or no involvement with climate change implementation projects, except in the case of Egypt, which also indicated that the information was of moderate relevance to climate-related technology transfer. It was not surprising that information on transfer of climate-related technologies in countries starting to respond to climate change issues are not available and in these countries one could not make proper assessment of past climate-related technology transfer.

Those countries that have had successful experience with some climate-related technology transfer, like Tunisia, perceive national and international experts as one of the most useful sources of information for climate-related technology transfer.

2.6 Sources of financing

High dependence on foreign capital by African countries and poor internal/local mechanisms for mobilizing local capital often limits capacity of African countries to acquire technology (SEI/ACTS, 1995).

Some of the available sources of financing from which African countries can source finance in form of multilateral funding like the African Development bank or national soft loans and bilateral/ODA sources are not relevant for climate-related technology transfer. Importance of international sources of finance for climate-related technology transfer is perceived to be low in some countries like Senegal, because, in comparison with other development projects, climate-related technology transfer projects still do not receive high priority and hence governments do not make serious efforts to search and utilize such sources of financing.

Those countries that lay behind in climate change response policies (e.g. Togo) have not yet received any direct assistance for climate-related technology transfer projects from the known sources like GEF.

Some African countries are generally not that well developed and may still require low level technologies first (e.g. Mali) but they find it **difficult to access finance for development, implementation and dissemination of local technologies**. It is then apparent that climate-related technology transfer under present finance mechanisms is geared to promote importation of technologies from Annex I countries. This will be a hindrance to local development of climate-related technology transfer. **The small size and weak financial capacity of local markets also limit capacity of locally developed technologies to compete internationally**. Efforts must be made then to develop technologies for local and regional markets.

3. ENHANCING FUTURE CLIMATE-RELATED TECHNOLOGY TRANSFER IN AFRICA - THE WAY FORWARD.

Analysis of past climate-related technology transfer projects in Africa has revealed a number of specific issues which are critical to the enhancement of future climate related technology transfer by African Parties and these are as follows:

- **African countries should set clear climate change-related policies through consultation of all key stakeholders in the country and bring these climate change activities in line with the national development plans. In this manner climate-related technology transfer projects will be accorded the importance they deserve.** It also imperative for the countries to be fully involved in the national, regional and international climate-related initiatives as it is through such cooperation that African countries can benefit more from sharing of technology know how. Evidence is there that those countries which participated more in climate change projects benefited more from projects of past pilot phases of the existing UNFCCC financing mechanisms.
- **Involvement of the private sector and civil society entities cannot be overemphasized, but it is critical to create innovative measures that will make climate-related technologies attractive to them.** These entities need to be involved from the planning, priority setting and implementation stages. The role of these stakeholders will ensure the complete adoption and sustainable supply and use of climate-related technologies. These are also the entities which will determine local technology adaptation, development and enhancement, and technology markets.
- **Appropriate information is key to any climate-related technology transfer planning and priority-setting and thus the establishment of sources of technology information with national, regional, and the international networks is critical to future climate-related technology transfer enhancement in Africa.** Generally the continent is the one most affected by the lack of important information on available technologies, their sources, and the environment and economic performance of the technologies. In the same vein, the capacity for technology tracking, assessment and screening will be required.
- **Since climate-related technologies are developed, manufactured and commercialized in a few countries, there is need for technology cooperation of African countries with developed country Parties or suppliers in order to benefit from sharing of**

technology know-how and building economic, technical and managerial skills.

- Technology cooperation between suppliers and recipients will build successful and long-term partnerships through systematic training and capacity-building at all levels of the climate-related technology transfer process. Similar partnerships are to be forged with civil society through awareness and participatory approaches in order to build a long-term market for climate technologies.
- **Existing sources of financing have not yet been exhausted but require elaborate project packaging skills, which are generally lacking in Africa.** Most GEF projects end up involving GEF consultants to meet approval. The process makes it difficult for African countries to access financing and hence to participate fully in the climate-related technology-transfer processes. African countries may have to create a network to advocate easier access to financing and for developed countries to finance local technology replication/advancement rather than only to depend on technologies imported from developed country Parties.
- **Additional sources of climate-related technology transfer financing which are more flexible and accessible are therefore required** to increase Africa's participation in the climate-related technology transfer process under the UNFCCC.
- There is also need to encourage **private sector entities to invest in climate-related technologies to ensure sustainability of supply of these technologies** since UNFCCC mechanisms are only jump-starting the transformation to cleaner technologies. Such private sector entities should be supported to manufacture high quality products to eventually compete on the international market. African countries also need to create a conducive environment for **developing their own technologies for regional markets.** Such an arrangement will require a cultural transformation for consumers and the removal of trade barriers for the distribution channels. African negotiators will have to consider priority areas for local technology development and markets for which they will need UNFCCC financing. This could be negotiated as a window for local technology development within the GEF structures.
- Technology assessment and screening skills or using a clearing house becomes necessary in the case where technologies are sourced from developed countries or other developing regions.
- It has not been easy to assess how much technology transfer has taken place in past climate-related projects because there were no goals and indicators set for evaluating progress. **African countries should therefore set targets for themselves with regard to what climate-related technology transfer they aim to achieve in some time frame and to develop indicators for monitoring and evaluation at a later date.**

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5. Annex

Table 1 List of climate-related technology transfer projects carried by GEF in Africa

Country	Project	Focal area	Stakeholders involved	Sponsor
Zimbabwe	1. Photovoltaics for household and community use 2. Hydro-electric power project	Energy supply Energy supply	Government (Ministry of Transport and Energy - DOE), bank, solar companies and small installation companies	GEG/UNDP
Lesotho	1. Afforestation	Forestry		Bilateral (Sweden)
West Africa - Senegal and Côte d'Ivoire	1. Energy efficient buildings - retrofitting and CB	Energy		GEG/UNDP
Egypt	1. Energy conservation and efficiency 2. Egyptian air pollution abatement 3. Cairo Air	1. Industry-energy demand 2. Industry-energy demand 3. Industry and energy		USAID FINNIDA USAID
Tunisia	Solar water heater	Energy supply	AME and private sector water users	GEF/UNDP
Sudan	Community-based rangeland rehabilitation for carbon sequestration	Forestry	Ministry of Agriculture, Natural and Animal Resources	GEG/UNDP
Mauritius	Sugar bioenergy technology	Energy supply	Central Electricity Board, Mauritius Sugar Authority and Union St. Aubin Sugar Company	GEG/UNDP
Senegal	Sustainable and participatory energy management	Energy demand	Ministry of Environment and Protection of Nature. Ministry of Industry and Energy. Communities, Charcoal entrepreneurs, NGOs.	GEF/UNDP
Morocco	Repowering of power plants	Energy supply	Office nationale d'Electricite	GEF/UNDP

South Africa	Catalyzing energy-efficient lighting markets	Energy demand		GEF/UNDP
Kenya/ Morocco	Photovoltaic market transformation	Energy supply		GEF/UNDP
Eritrea	Wind energy application in coastal areas	Energy supply		GEF/UNDP
Ghana	Renewable energy-based electricity for rural, social and economic development	Energy supply		GEF/UNDP
Malawi	National sustainable and renewable energy programme	Energy supply		GEF/UNDP
Mali	Household energy-stoves	Energy demand		GEF/UNDP
Mauritania	Decentralized wind electric power for social and economic development	Energy supply	UNDP for Projects Services	GEF/UNDP
Tanzania	Electricity fuel and fertilizer from municipal and industrial waste: a biogas plant for Africa	Energy supply		GEF/UNDP
Uganda	Photovoltaic for renewable energy	Energy supply	UNDP for Projects Services	GEF/UNDP
Burkina Faso**	Energy efficiency	Energy demand		AIJ
Mauritius**	Renewable energy	Energy supply		AIJ
Morocco**	Energy efficiency	Energy demand		AIJ
South Africa	Energy efficiency	Energy demand		AIJ

** These may still be in proposal form - with the possibility of implementation in the future.