

DEVELOPING PERSPECTIVES ON CLIMATE CHANGE

Issues and Analysis from Developing Countries and Countries with Economies in Transition

Emissions Trading and Poverty Alleviation – The Role of Clean Technologies

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Emissions Trading and Poverty Alleviation – The Role of Clean Technologies

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Executive summary

i) Introduction

Clean energy technology offers a key to sustainable development in Southern Africa. Clean technology comes in various forms that include renewable energy technologies, energy efficient technologies and soft technology for design and construction of clean technologies.

Most Southern African countries are lagging behind in terms of technology development and their communities are becoming more exposed to the ravages of climate change. Successful implementation of clean energy technologies can alleviate this problem, but several barriers have to be addressed in the process.

ii) Climate change, clean technology and development

Climate change is expected to cause a rise in the average temperature and a reduction in the levels of precipitation in Southern Africa. The impact of climate change will result in food production requiring the use of irrigation as a way of improving food security. This will in turn demand that rural communities have access to modern energy and clean technologies. If the current technology design and implementation criterion as applied in the region is carried forward to implementing the climate change adaptation measures there will be a loss in the potential clean energy that can be produced in the region. The reason is the criteria for technology development that puts emphasis on simplicity of operation and maintenance as opposed to low cost and efficiency in energy use. Rural and urban poor communities can be said to hold a carbon “stock” in terms of emissions avoided by their limited levels of energy use. If this stock is converted to carbon certificates there would be significant revenue generated that can be used to develop clean energy supply systems for poor communi-

ties. In this case, clean energy will include electrification from grid electricity since rural communities are exposed to the threat of indoor pollution caused by use of fuel wood. Once poor communities are provided with the means to create wealth they can then be responsible for their activities in terms of environment protection including climate change mitigation. This same deduction applies to developing countries in general. Carbon intensity of production is a good measure for relative efficiency and matching energy intensity of production implies matching the responsibility to mitigate climate change. At present, Southern Africa has very poor energy intensity of production with the potential to reduce energy intensity by 30 per cent to 60 per cent. Consideration of reducing energy intensity of production as a way of improving efficiency helps in determining the time when Southern Africa can take responsibility for mitigating climate change while at the same time protecting its communities from the impacts of climate change.

iii) Recommendations

Barrier removal is an essential part of technology transfer and efficiency improvement. The private sector cannot be expected to carry the full transaction cost for barrier removal in Southern Africa. Public sector participation in technology upgrades should be seen as a way of buying the socio-economic benefits of clean technology. If these benefits are demonstrated clearly, policy-makers will be able to adopt appropriate policy measures to promote cleaner technology.

1 Introduction

The United Nations Framework Convention on Climate Change brings opportunity for additional investment in developing countries while helping to avoid the growth in greenhouse gas emissions that has seen the rate of climate change increase. The Convention acknowledges the disparity between

Table 1. Examples of Energy Initiatives Carried out by SADC-TAU

Project	Objectives	Coverage
UNDP, Financing Energy for Small Scale Energy Users, FINESSE.	Market assessment and production of business plans for small energy projects	Malawi and Namibia
Improvement of Fuel Wood Use in Informal Industries of Mozambique	To provide a proven methodology for firing bricks with an improved energy efficiency	Mozambique and Zimbabwe with dissemination for other SADC countries
Improved Energy Efficient Fish Smoking in Angola	To reduce the energy consumption in fish smoking	Tanzania and Angola with dissemination for other SADC countries
Future Energy Requirements for Africa's Agriculture	To estimate the future energy demand for agricultural production	Zimbabwe, Tanzania, Cameroon, Sudan and Mali
Market assessment for new and renewable energy technologies	To assess the potential renewable energy technologies and identify barriers to dissemination	Zimbabwe, Malawi, Botswana and Zambia

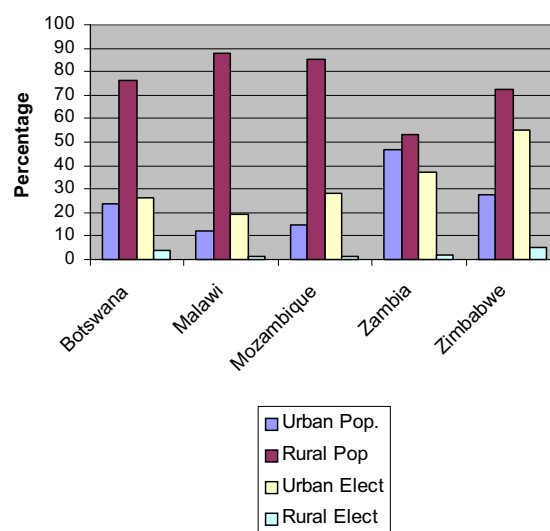
developed and developing countries in terms of capacity to respond to the needs of the Convention. The majority of the population in developing countries is preoccupied with survival needs such that, at local levels, attention to global priorities is virtually non-existent. This paper focuses specifically on clean energy technology, which could assist in the sustainable development of Southern Africa. This region includes Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe.

Governments in this region, through development assistance, have attempted to improve access to capital by the rural and lower income communities. In this respect, there has been extensive work in improving policy response to the needs of the poor. Energy supply has been central to a significant number of these activities. The Southern Africa Development Community Technical Administrative Unit, SADC-TAU, has to its credit, a large number of projects that assess the market potential for renewable technologies (see Table 1). The studies have had limited impact in terms of creating actual investment given the volume of work undertaken. However, the success of the projects would have to be judged parallel to the achievement of awareness-raising done by SADC-TAU.

The population distribution of Southern African countries is such that, in each country, between 50 per cent and 90 per cent of the people reside in rural areas. Figure 1 shows Zambia as having the lowest

percentage of rural population with Malawi showing the highest. Levels of poverty are linked to the type of settlement with the highest levels of poverty being exhibited in rural areas.

Figure 1. Access to Electricity in SADC



Source: Southern Centre

It is also common knowledge that rural areas have the lowest levels of capitalization with basic infrastructure such as roads, piped water and energy being far below the urban areas. In turn, urban areas in Southern Africa have much lower levels of infrastructure development than developed countries. In this analysis, it

is not the level of infrastructure development but the effectiveness of the facilities in meeting basic socio-economic needs that is under consideration. Sustainable development requires that consumption levels be optimum hence the present trends in developed countries cannot be the model for shaping the trends for developing countries.

2 Energy intensity as a measure for commitment

The following table shows total primary energy supply in Africa compared to other regions. What the table does not show is the fact that most African countries consume more than 50 per cent of the energy in the form of biomass for household energy. This translates to the bulk of the energy consumed going into non-productive uses.

Table 3. Energy Use in Africa Compared to World Energy Use

Country/Region	Energy in PJ
World total	422,970
OECD Europe	73,924
OECD N. America	113,217
OECD Pacific	35,468
Middle East	15,924
Former USSR	38,566
Latin America	19,069
Asia	47,002
China	48,479
Africa	21,262
Mozambique	298
Namibia	43
South Africa	4,505
Zambia	261
Zimbabwe	428

Source: IEA

Africa consumes about 3.1 per cent of the world's primary commercial energy, and when the energy consumption of all developing countries is added together, it is only as much as North America (29.7 per cent) (World Energy Assessment, 2000). In comparison, the energy intensity of production per unit GDP was 14.4 MJ for Southern Africa in 1995 com-

pared to 12.1 MJ for North America. Given the relative output of the given economies, it is apparent that technology in Southern Africa is much more inefficient than in North America.

The above figures are also based on purchasing power parity as opposed to normal exchange rate. That means on an exchange rate basis, the technologies in Africa would fare even worse against developed countries. This is illustrated by year 2000 figures when North America consumed 11.01 MJ per unit GDP and Africa consumed 35.9 MJ per unit GDP all based on normal exchange rates (IEA, 2000).

In theory, Africa could reduce energy intensity by 60 per cent and still achieve the same output. In practice, the economies of the region are driven by raw material export and the processing of agricultural products which tends to be energy intensive and of lower value than high technology industries and services. Therefore, energy intensity of production can be reduced, but not to levels as low as OECD countries. Studies in SADC have shown that the regional industry can cut energy use by 35 per cent when compared to best international practice.

The reasons for poor energy efficiency levels in Southern Africa vary from lack of capital to poor policy environments. Nonetheless, it is logical to assume that the target for Southern Africa is to improve up to the intensity levels that will be achieved by developed countries on meeting UNFCCC commitments. This would increase the potential for emission reduction in Southern Africa. Figure 2 illustrates this point.

Figure 2. Convergence of Energy Intensity of Annex 1 and Non-Annex 1 Countries

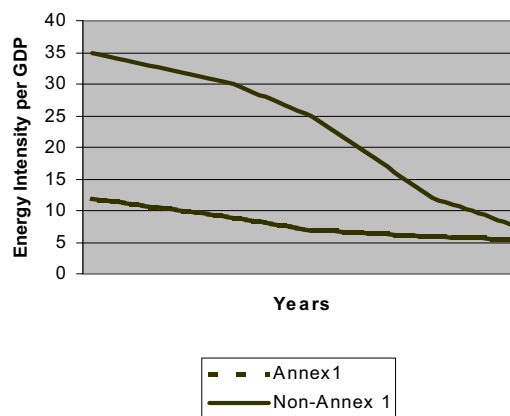
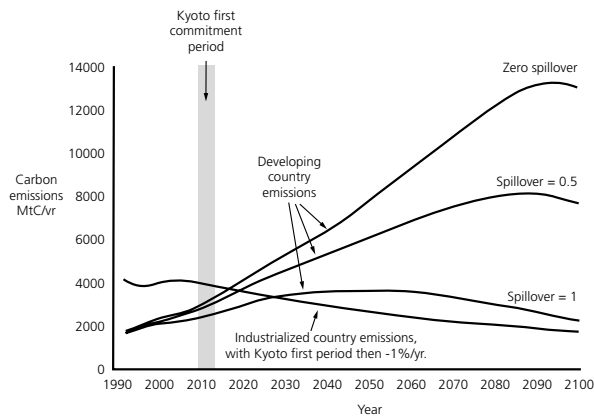


Figure 2 shows how carbon intensity of production could be improved over time. In both cases there is an

autonomous improvement in carbon intensity due to the natural improvement of technology or spillover. Spillover refers to adoption of more efficient technologies by developing countries as a result of these technologies being more available (Michael Grubb). Climate change commitments bring in an additional increase in the rate of improvement with developing countries having to proceed at a much higher rate than developed countries. This is sometimes called leap-frogging. At some time in the future, the relative carbon intensity rates will be close enough to allow non-Annex 1 parties to take some further commitments.

Figure 3 shows the emissions growth with implementation of The Kyoto Protocol. Needless to say the rate of spillover depends on the availability of finance and technologies. In all cases shown, the developing country emissions per unit of GDP will converge to that of developed countries with the rate of convergence being influenced by implementation of The Kyoto Protocol. Success is when spillover is one or 100 per cent which implies barrier free technology transfer. By applying total emissions, as opposed to intensity of emissions, the graph stretches the time horizon for convergence. In Figure 2, the time horizon would be much shorter.

Figure 3. Convergence of GHG Emissions



Source: *Climate Policy Journal*, Vol 1. Issue 2, 2001, Michael Grubb, pp. 270.

Studies on climate change mitigation show that there are significant opportunities for equipment upgrading in Southern African countries resulting in carbon intensity reduction. Figure 4 shows the options for emission reduction in Zimbabwe. Boiler efficiency improvement, electric motor improvement, high effi-

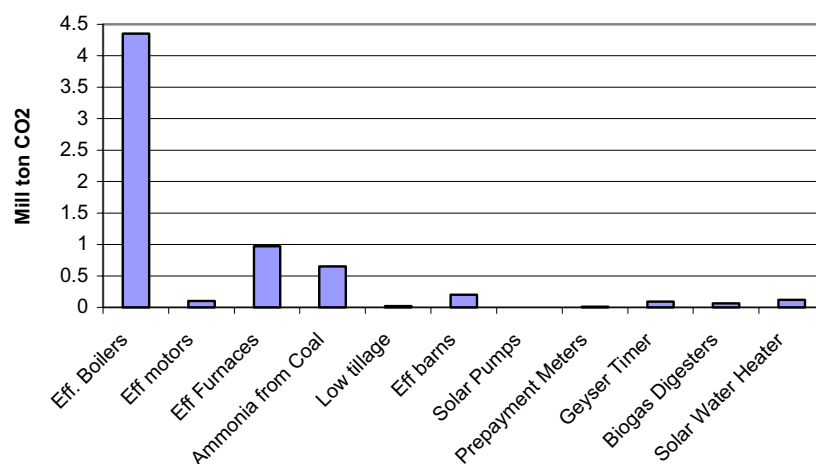
ciency lighting and increased ethanol use in motor vehicles all require new investment as opposed to repair and maintenance.

Since developing economies have consumption levels below the minimum threshold for social security there is also a need for increased output from the productive sectors. This will mean increased carbon emissions even though the intensity may be decreasing. Due to the low efficiencies in Zimbabwe, equipment retrofits can achieve significant emission reductions. Where a complete reconstruction is done, the potential for emission reduction credits would be higher but the transaction costs would need management to minimize risk. This means the bulk of emission reduction projects in the country, if carbon intensity of production is to be comparable to developed countries, would have to be through installation of higher technology in new production plants supported by technology transfer (both hard and soft technology).

It is also important to note that with a common market for plants and equipment there is a continual improvement on the performance of new plants and, with time, there will be less room for choice between different models by performance due to spillover of new technologies. This is most apparent in the transport sector where newer vehicles have similar performance levels in developing and developed countries with respect to energy efficiency regardless of the target market.

Figure 4 shows that equipment upgrades, which are inevitably capital intensive, generate the most emission savings. The current rules for trading emissions under the Clean Development Mechanisms (CDM), the developing country would have to raise the required capital and make the investment before the certificates can be issued. Even though financial arrangements can be made for advance purchase or lump sum payment there are only a few projects with the acceptably low risk that would encourage investors to consider these options. The Global Environment Facility, GEF and Prototype Carbon Fund (PCF) require co-funding for most of their projects and in most cases contribute less than 15 per cent of the total investment. Also, current analysis shows that the average CDM project will generate about 15 per cent in total revenue from CDM. It is, therefore, apparent that for developing countries, especially the least-developed countries, carbon trade is an option that can only be realized if other investment supporting mechanisms are put in place.

Figure 4. GHG Emission Reduction Options in Zimbabwe



Source: Southern Centre

3 Future GHG emissions

Southern Africa's greenhouse gas emissions are bound to increase from current levels as lifestyles change with increased reliance on motorized transport and manufactured goods. This change will be driven by evolution of the economies with the additional push from climate change. In most countries, this will dictate technology intensive food security programs for adapting to climate related disasters.

Subsistence agriculture, as we know it today, and food processing will eventually have to change since farmers with limited capital will be unable to adjust to a more hostile climate. Distribution of basic commodities and storage of food and other goods will demand an increased use of energy. Non energy intensive options exist for improving food security, but the quest for industrialization and generation of export revenue is bound to see governments pressing for modern technology that adds value to agricultural and mining products. In the absence of a concerted effort to optimize energy use, energy intensity of production is bound to follow current trends where equipment resident times are long and systems are designed for low skills as opposed to low operation and maintenance costs.

On the other hand, if the same criterion for technology management is applied to renewable energy there will be a loss in potential emission reduction. Local investors will be seeking lower technology equipment

with lower skill requirements and lower conversion efficiencies—all in the interest of simpler technology management.

4 Barriers to industrial energy efficiency improvement

Energy efficiency improvement through technologies, in some cases, shows positive financial benefit. However, the options are not implemented because they do not meet the investment criteria of most companies. The criterion for investment is set by a company on the basis of available information. Even though the opportunities for energy efficiency improvement offer a potential gain in wealth, the available information on them does not convince the management of companies to take them up as investment opportunities. The reasons for this include;

- lack of analytical skills to demonstrate the benefits;
- limited access to technology;
- poor policy environment;
- constrained business environment; and
- sub-economic energy pricing.

Capital is often mentioned as a barrier, but is available for any viable investment provided the risk is low enough for the investor's needs. Most countries in Southern Africa tend to present a high risk environment such that venture capital is not readily an

option for investment except where government provides guarantees and other risk-reducing measures. In general, private investment does not receive government guarantees because it is often not clear what the public sector benefits are from the project that warrants the transfer of risk. Climate change mitigation, reduction of local pollution and social enhancement are some of the “goods” that government buys through guarantees and subsidies, but basic skills to assess and include such benefits in project documents are still lacking—especially in the private sector. Given that energy intensity of production is high in the region and the potential for improvement is measurable, it is possible to include quantified public sector benefits in private sector project documents.

As an example of where government could assist in new technology investment, boiler efficiency improvement in Zimbabwe has a potential for reducing greenhouse gas emissions by more than 13 million tonnes CO₂ per year which would equate to US\$130 million per year. This level of potential revenue is compounded by the fact that less coal would be used in the heating process, thereby reducing the public sector burden on coal transport and pollution abatement. Such cost saving measures should attract a significant drive for implementation from government. The transaction costs for some of the boiler efficiency improvement measures may be high but this is the nature of new technology where transaction costs are initially high, but reduce with the implementation experience of repeat projects. Hence, government assistance is needed in overcoming the initial cost. Even if the climate component is excluded from the equation and it is considered that the

public sector is spending about US\$10–\$20 to transport a tonne of coal giving an annual total of US\$10–\$20 million for the roughly 1,000,000 tonnes per year of coal that goes into industry. This alone, is sufficient to consider implementing measures that can save up to 25 per cent or more of this cost. However, industrial energy conservation and transport of fuels is seldom integrated and the benefits that accrue to entities outside industry are usually not counted. Because of this it is difficult for the government to implement appropriate policy measures.

5 Cleaner technologies and the rural household sector

The Delhi Declaration puts an emphasis on development as a condition for CDM. The heavier burden in developing countries is the uplifting of rural communities. Assessments have shown that rural communities hold a large volume of “carbon stock” in the form of current and future emissions of carbon resulting from their inefficient activities. In Southern Africa, land use change for the purpose of subsistence agriculture and harvesting of biomass for fuel are recognized as the major drivers for greenhouse gas emissions by the poor. These practices have become unsustainable due to population growth in areas of limited tenure and productivity. Lack of capital has placed the communities in a vicious cycle that they can only break out of with assistance. The following table shows energy use by a typical rural household in Zimbabwe. The information presented was collected from a survey and the presence of diesel power in some of the homes is an indication of isolated capacity that is the current source of goods and services.

Table 4. Sources of Energy Used by a Typical Rural Family

	A: Firewood	B: Paraffin	Candles	C: Diesel/Petrol	D: Gas
Units/month	200–400 kg	5–10 litres	6–12 pieces	100 litres*	19 kg*
Average time (hr) used/day	6–8	2–3	2–3	0.5	24
Used for automobile	–	–	–	All*	–
For cooking	All	20 litres*	–	–	–
For lighting	Negligible	5–10 litres	All	–	Negligible
For generator	–	–	–	–	–
Others	Beer brew*	Fridge*	–	Grinding mill*	Fridge*

*used by few to very few households

6 Energy choice and energy cost

Energy supply to rural households tends to be more costly than for urban households. The accounting process used to assess the energy cost by the households themselves tends to omit their own labour, environmental and opportunity cost or time. Table 4 shows some households using kerosene for cooking. The price of kerosene in Zimbabwe tends to be much more than electricity especially when one considers the distance traveled to purchase kerosene and the variety of services that electricity provides in an urban household. In a way, the limited variety of services provided by rural energy sources tends to drive the communities deeper into poverty. Needless to say, the pollution from the low-grade fuels increases expenditure on health care and reduces the available time for production such that the energy bill becomes an even bigger proportion of the household income. If one were to convert the above table into energy units it would be as follows.

The typical rural household uses wood for cooking and kerosene for lighting. Adding up the energy used shows that each household uses about 4,340 MJ per month. The average household electricity bill in urban areas is about based on usage of 600kWh or 2,160 MJ. A typical urban household with grid electricity has electric light, an electric cooker, refrigeration, radio and television as well as other small appliances. The energy intensity of urban households is therefore much lower (per unit of service).

Examining the difference between an urban and rural source of household of light makes a useful contrast to illustrate energy usage. The following is based on the author's estimates. If an open fire has an efficien-

cy of about 15 per cent and a kerosene lamp 50 per cent (which is equivalent to that of a 40 watt incandescent bulb) it can be argued that rural homes are getting only 770 MJ of service per month. On the other hand, grid electricity is mainly from coal fired plants and transfer losses are about 10 per cent, therefore, we can say the urban household is using 9,600 MJ per month of energy from coal. The hydroelectric power in the grid is normally on base load because it is not easy to store except during times of low flows in the river, hence the assumption is made that any reduction in grid electricity can be made only on the coal-fired plant. If a rural household was to obtain the same service from grid electricity it would only need about 3,422 MJ of coal compared to 4,340 MJ that is being used in the form of wood and kerosene. As well, about 50 per cent of the trees cut and used for firewood fail to regenerate thereby degrading the area's biodiversity and diminishing the potential as a carbon sink. Grid electricity is also much cleaner with virtually no indoor pollution; however, the global as well as the regional pollution would be much higher.

Based on this assessment, it can be argued that rural households are holding a monthly stock of 587kg of carbon dioxide by not using the same energy as urban households. Here we assume that by converting to the use of grid electricity there would be some standing biomass regeneration that would absorb the excess CO₂ from current activity. The avoided amount of CO₂ could be traded for about US\$6 per month if the CO₂ price was US\$10 per tonne. This revenue would be sufficient to cover about three times the average Zimbabwean urban household electricity bill at current tariffs per cent. There is, therefore, scope for a carbon fund that electrifies rural households on the basis of carbon avoided. It can be

Table 5. Energy Balance of a Rural Home in Zimbabwe

	A: Firewood	B: Paraffin	Candles	C: Diesel/Petrol	D: Gas
Units/month	4,000 MJ	340 MJ	–	3,300 MJ	899 MJ
Average time (hr) used/day					
Used for automobile	–	–	–	All*	–
For cooking	All	6,800 MJ	–	–	–
For lighting	Negligible	340 MJ	All	–	Negligible
For generator	–	–	–	–	–
Others	Beer brew*	Fridge*	–	Grinding mill*	Fridge*

*used by few to very few households

argued that once electricity is provided, the households will tend to increase energy use resulting in higher emissions. However, this can be considered as the normal process of electrification of households which would have been leveraged by the subsidy and normal tariffs can be applied.

The theory behind this analysis is equity and social development. All households have an economic contribution to make and national resources should be shared equitably—especially for provision of basic amenities. Wood use is causing forest loss which has a positive carbon emission that affects all communities. Even though the potential for greenhouse gas emissions is increased by electrification the ability for households to respond to climate change and to minimize the emissions is also increased by giving access to modern energy. It would seem apparent then, that growing rural populations together with shrinking environmental resources now make it almost compulsory that modern energy be supplied to rural communities.

7 A changing climate forces modern energy

Renewable energy has for a long time been considered the ideal option for rural development. However, this option has met several obstacles even though some success stories can be documented. In a typical renewable energy project, the technology is resident in the rural community which makes a requirement for a pool of technical resources to own and manage the technology. The basic environment that attracts investors is lacking hence entry of the private sector is restricted to turnkey or equipment supply. The issue of capital availability and security of investment tends to dominate the barriers to adoption of renewable energy in developing countries. This is not likely to change in the near term since rural areas remain poorly capitalized especially in terms of basic energy supply systems. The State remains the appropriate first entrant into rural areas with capital and new technologies.

Developing countries are generally constrained on capital for social development hence a carbon based subsidy can be a valuable asset. There is great potential for development of carbon sinks in rural areas, but these are not easily realizable because of poverty. With a reduction in poverty levels will come the ability to use land optimally thereby freeing some currently food producing lands to biodiversity and

afforestation. Rural electrification is seen in countries like Zimbabwe as a food security option as it allows for irrigation and intensive farming. The carbon fund would also serve as an adaptation fund which would enable rural communities to live in a changing climate. As has been demonstrated, modern energy is a necessary ingredient for stimulation of poverty reduction.

8 Options for encouraging uptake of cleaner technologies

Technology improvement is a function of policy and skills. Policy shapes the economic environment including legal structures that promote competitiveness and corporate responsibility. In a skills and technology deficient situation, as prevails in developing countries, the initial task in introducing new technologies is to overcome the psychological inertia that resides in owners and managers of plant and equipment. Traditionally, a poor economic environment encourages short term decision making and maximization of technology resident times beyond manufacturer's recommendations.

9 Market forces and small enterprises

In Zimbabwe, most of the industries are based on resource beneficiation and semi manufacturing. The issues of optimum value addition and quality assurance are limited to providing acceptable feedstock for the next stage of production which is normally in a developed country. Examples are production of cotton lint for export, tobacco curing, timber production, refinery for minerals and sugar milling and refining. Given that the energy prices are low there is limited scope for energy intensity optimization for products that will be processed to a much higher value. Commodities like sugar enjoy preferential treatment through export quotas and negotiated prices such that those countries with lower energy prices do not have to fine tune their systems extensively because they retain their market share anyway.

Analysis may show major potential benefits in energy conservation but the risk associated with the economic environment bars the decision for efficiency improvement in favor of short term capital recovery. Due to the small sizes of the individual economies there is little room for multiple players in the base industries. Major manufacturers tend to flood the market and any new players are either affiliates or

minor competitors. An example is the brewing industry, where there is only one major player in almost all countries in Southern and Eastern Africa. The sugar mills have a similar structure as well as the industries in the agro-processing and agricultural input supplies. Small scale enterprises are viewed as an option for breaking monopolies and introducing competition. This is potentially true but small scale enterprises rely on major industries for the supply of pre-manufactured inputs for their processes such as formed metal, chemicals, tools and packaging. In several known examples major manufacturers have teamed up with their suppliers of inputs to thwart the effort of small scale enterprises. Textile factories retail specific designs through a single supplier, metal suppliers set minimum order levels which are too high for small producers so that material is only available through a third party and some plastic manufacturers limit a minimum order to one shift's production.

All of these constraints can be justified by cost cutting principles but they create a barrier for competition which is a fundamental principle for energy conservation and cost optimization. Legal instruments can go a long way in curing these problems but the risk of over-regulation of industry then ensues. The cost of policing these regulations is in most cases prohibitive and the sector is left to rely on self regulation and corporate responsibility. It is true that some of the major enterprises in the region are also major international players with the skills and interest to apply the best technologies. There is however no limit to efficiency improvement and one wonders to what level they would perform if there was competition?

10 Energy prices

Energy pricing is often viewed as an option for encouraging conservation. The dilemma is that in small economies where energy sector players are mainly public entities the responsibility for maintaining a social component to the service distorts the pricing principles that are applied. Secure employment, access to clean energy, availability of energy for health and education all compel the pricing to rely on subsidies. Tariff structures are kept simple and as a result limit the ability of utilities to target subsidies. There are programs in almost all countries in the region to restructure the energy sector with utilities coming under greater pressure to allow private sector participation. However, the sector is poorly capitalized and the risk of reduced access to energy by the poor is very

real. The restructuring is likely to leave supply of some social services as a legal or institutional responsibility where the public sector remains a major player in energy supply. The question of insufficient infrastructure development cannot easily be solved in an environment of sub-economic energy prices. The global market for energy supply equipment is fairly standardized and the minimum tariffs for capital recovery are similar in all countries such that differences in energy prices become a function of local policy differences.

10.1 Energy prices and access to energy by the rural poor

Energy prices, especially electricity prices are considered the major factor influencing access to modern energy by the poor. Work done in Zimbabwe however, shows that the up-front cost for appliances and house wiring are a much bigger barrier than the price of electricity. Rural low-income households have limited access to used appliances and have to raise the full cost of mostly new appliances when compared to their urban colleagues. The result is continued use of fuel wood alongside the electric fridge, light and television. The power utilities do not consider appliance supply as their responsibility, so the rural energy market remains dominated by biomass fuels. Agriculture tends to receive more attention in terms of negotiation for favorable tariff structures whereas rural agricultural energy customers tend to be much wealthier even than some urban high-income households. The ability to pay, even though payment comes at monthly intervals, allows the utility the freedom to employ tariff structures that acknowledge the seasonal nature of agricultural incomes.

Prices and access to energy by the urban poor

The urban poor are difficult to support in terms of energy prices except in cases where off grid energy such as kerosene and gas are in use. The urban poor usually dwell in rented accommodation so they are often not the owner of the service provided. In extreme cases, the urban poor do not stay in legal structures so energy supply contracts cannot be linked to physical addresses. It is for this reason that energy tariffs for the urban poor are general and often inefficient in terms of reaching the target. It is only in those cases where assisted accommodation is provided that there is the possibility for integrating energy in the housing program, but then this only reaches part of the urban poor households and typically those

with a steady income. It is in this regard that the urban energy problem can only be addressed in a general and inefficient manner.

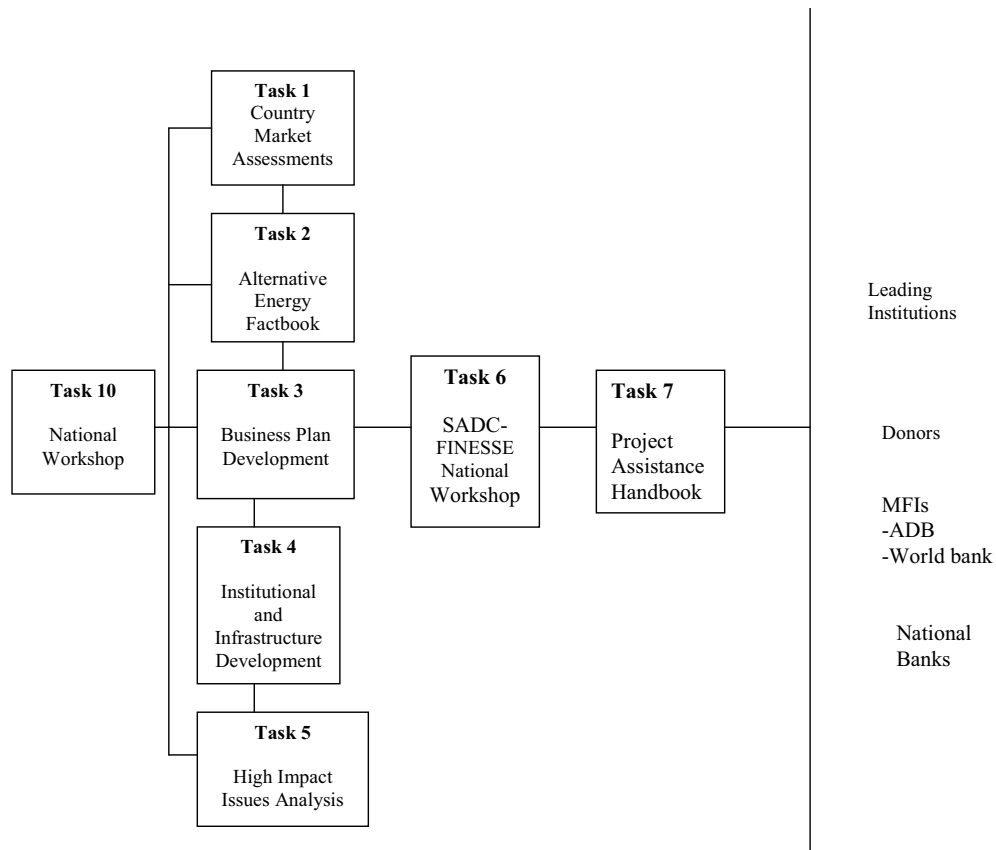
11 Renewable energy market development

Renewable energy offers an opportunity for entry into the energy sector by smaller enterprises. The reason being the infancy of the technology allows for entry of small high technology players supported by the presence of public sector finance. The view in the region, especially by governments, is that renewable energy technologies can solve the problems of access to energy by the poor. This forces the new players to trade with energy end-users who in most cases are not able to pay. The scale of technologies being applied remains small and this raises the transaction cost as minimum thresholds by the major sources of low cost finance are high and the individual projects would

need to be bundled. Experience has shown that bundling introduces major administrative costs and, if used to finance energy for social services, it requires constant public sector administration. This is not to say small energy projects cannot be bundled but the process has not been perfected for countries in the region.

Renewable energy falls within the realm of infrastructure development. The payback periods for most such projects are long and concessionary funding is almost always a necessity for project success. The UNDP FINESSE, Financing Energy for Small Scale Energy Users, initiative has demonstrated that in Southern Africa small energy projects require major barrier removal if any cases are to succeed. The initiative identified potential projects in South Africa, Zimbabwe, Malawi, Namibia, Lesotho and Angola. As a start, only two or three countries could receive the major funder's investment finance due to the

Figure 5. SADC/UNDP FINESSE Project Process



Source: UNDP-SADC FINESSE Project Document

bank's screening criteria for countries. In addition to that screen, the potential investors did not exert sufficient "pull" to be able to give the projects the required momentum for implementation. Potential investors expect risk sharing and they look for partner confidence before they can consider making financial commitment.

The UNDP initiative did not secure this confidence. Admittedly, the FINESSE approach ignored the traditional approach to investment where the potential investor has an idea and decides on whom to ask for assistance in developing it. The FINESSE approach in the region, as shown in Figure 5 above, was to get consultants to identify viable opportunities with potential owners. Given that, any serious investor would adopt a promising venture and investigate the further potential viability of the project. In this case investment in small scale energy projects was a new concept to the private sector and most partners were not sure how to assess the projects.

12 Public benefits and cleaner technologies

Besides all other technical barriers to adoption of clean technologies there is the limited appreciation of the benefits of clean technologies that forms the basis for policy-maker's inaction.

Figure 6 shows the input and output of a typical cleaner technology project implemented in a developing country. The benefits in most cases are wide ranging with some of them quantifiable in the various sub-sectors of the economy. In the absence of economic models or demonstrated linkages between sectors the amount of searching required for the policy-

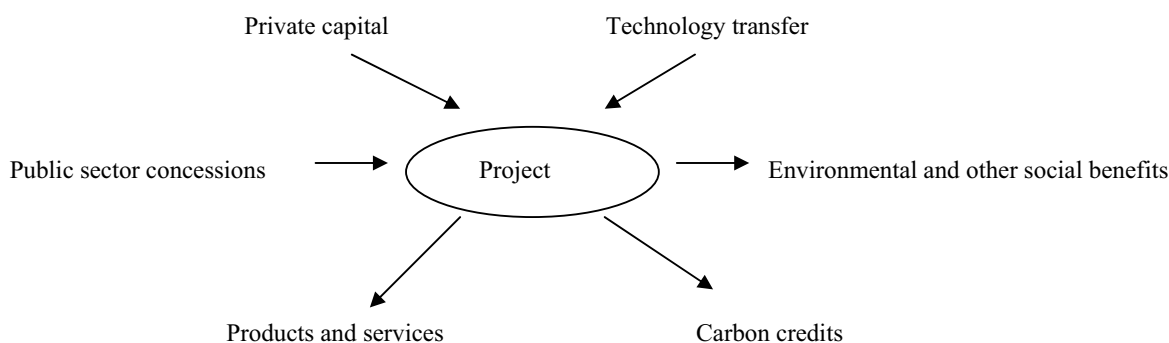
maker to appreciate the sectoral benefits is overwhelming, so the technology options are given a superficial treatment by policy-makers. As an example, access to electricity is justified from the perspective of reduced tree loss and enhanced opportunities for rural business. Reduced expenditure on health and retention of a healthy and productive community is seldom quantified. Policy-makers would go on to vote for increased budgets for rural health care without considering a complementary budget for renewable energy or electrification programs. This does not demonstrate poor performance on the part of policy-makers but highlights the need for a pool of skills and resources for assisting policy-makers in justifying decisions taken in the process of planning rural development.

13 Renewable energy technologies and rural and urban markets

The tendency in South African countries is to rank rural poverty lower than urban poverty. This perception results in emphasis being placed on support for rural energy supply even though urban energy abuse has worse impacts than rural energy abuse. As is the case with all new technologies there is a need for a "cost carrier"* for renewable energy technologies that are recommended for rural applications. Urban communities can provide such support since there is more cash available amongst the urban rich as well as the urban poor than amongst the rural poor. Cost carriers help in meeting the cost of initial research and

* A cost carrier is the initial, usually wealthier, market for a technology that is developed and eventually used by lower income communities.

Figure 6. Cost Benefit of a Cleaner Technology Project



development and by designing renewable energy technologies to meet the needs of urban and rural communities, so that it will be possible to expand the market for new technologies and as a result be able to employ cross subsidies for the benefit of the rural poor. In addition, cost carriers are part of the market and by expanding the market the production scales increase and the cost per unit decreases. In some of the countries in Southern Africa, the telecommunication industry as well as some of the up-market urban buildings and the military carried the cost of research into solar photovoltaics and the rural poor are now getting the benefits of the proven technology even though the technology is still too expensive for most communities. By expanding the market for solar pv systems to include urban households, the per unit cost is bound to reduce much faster than when the target is solely rural households. Subsidies can be applied to achieve similar results, but delivery of the technology to a wider market that includes cost carriers is most appropriate as the delivery mechanisms and infrastructure can be applied for the whole market including the poorer segments without putting a strain on the fiscals.

14 Conclusions and recommendations

Clean technologies offer a real solution to development needs in poorer communities. However, the options for promoting the adoption of clean technologies that are being applied leave a lot of gaps. The fundamentals in successfully delivering clean technologies include:

- development of resident skills;
- management of risk by the local authorities;

- provision of the minimum rural investment to support the new initiative; and
- providing a clear analysis of the real benefits of the technology for policy-makers.

Climate change mitigation offers an opportunity for leveraging delivery of clean technologies in Southern Africa. However, it is important that barriers to introduction of these technologies be addressed before steps can be taken to deliver the technologies. CDM alone will not be able to support this process since CDM can only fund a small proportion of the capital requirements. The public sector can provide this additional capital but the support should be structured so as to promote private sector administration of the initiatives.

The most appropriate way to measure climate benefits of clean technologies is to determine the improvement in carbon intensity of production. The alternative is to measure the volume of emission reduction in physical units which does not easily show efficiency improvement since developing countries need room to increase energy use and economic development. Once developing countries have reduced their carbon intensity of production they will be in a position to carry their own burden of climate protection.

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