Ethiopia

Impact of macropolicies on deforestation and land degradation

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Foreword

The Nile Basin Initiative (NBI) is a partnership between riparian countries of the Nile; namely Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. The NBI's shared vision is to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from the common Nile Basin water resources". To translate this shared vision into action, there are two complimentary programmes: the Shared Vision Program (SVP) which creates a basin wide enabling environment for sustainable development; and the Subsidiary Action Programmes (SAPs) engaged in concrete activities for long term sustainable development, economic growth and regional integration of the Nile Basin countries.

The Nile Transboundary Environmental Action Project (NTEAP), one of the seven projects under the Nile Basin Initiative's (NBI) Shared Vision Programme, is mandated to provide a strategic environmental framework for the management of the trans-boundary waters and environmental challenges in the Nile River Basin.

As part of a broader plan of raising environmental awareness, NTEAP seeks to enhance the understanding of common and high priority policy issues that affect the environment of the Nile Basin. This will be done through policy studies of the patterns of economic development and priority transboundary environmental issues. The Nile Transboundary Environmental Analysis which was developed by the riparian countries in collaboration with the World Bank, UNDP and GEF identified priority environmental issues and threats in the Nile Basin. Better understanding of how these environmental threats are influenced by macro and sectoral policies and identifying the root causes is essential to explore possibilities of jointly addressing the threats.

In August 2006 the NTEAP held a planning workshop in Tanzania on the impact of macro-sectoral policies on the Nile Basin environment. The workshop discussed the concept note on macro policies prepared by NTEAP, reviewed country papers and decided on the kind of studies that could be carried out in line with macro and sectoral policies. Topics were selected on the basis of their relevance to the Nile Basin, significance of trans-boundary aspect and where policy intervention/policy reforms will be required. Four research themes/topics emerged. These focused on the macro/sectoral policies: on soil erosion; non point pollution/pesticide pollution; exploration and development of oil projects; and deforestation in the Nile Basin.

This report examines the impact of macro and sectoral policies on the environment, particularly on deforestation in Ethiopia. The report examines the severity and extent of deforestation. It also discusses the required policy interventions and /or policy reforms in Ethiopia. The report identifies the various macro/sectoral policies which have negatively affected the environment. It also recommends remedial measures where policy interventions or reforms are need. It is our belief that better understanding of how these environmental threats are influenced by macro and sectoral policies and identifying the root causes is essential to explore ways of addressing them.

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Executive Summary

Ethiopia is endowed with rich natural resource base. However, the rich and valuable resources are subjected to various environmental threats with significant consequences for the country's sustainable development. Land degradation, deforestation, overgrazing, desertification, and sanitation, loss of biodiversity, flood and drought are the major environmental threats of the country. Land degradation and deforestation are the main environmental threats affecting the natural resources and biodiversity of the country. Studies have shown that the 52% of the highlands are highly deforested. The deforestation rate of the country varies from 150,000 to 200,000 hectares per year.

Due to the increasing demand for fuel wood and the rapid depletion of resources, millions of people in Ethiopia could fail to meet energy needs which are mainly from fuel wood. The rate of fuel wood consumption is faster than the rate of replenishment. Degradation of forest, woodland and shrub land is caused by harvesting of wood (mainly for fuel) in excess of the natural yield and results in a reduction in woody biomass. In addition to scale deforestation, soil erosion and reservoir sedimentation problems are also prevalent and affect both upstream as well as downstream regions of the Nile Basin.

Even though not directly, the implementation of the energy policy in the country somehow adversely impacts on Nile environment. The policy requires 'cost-effectiveness' as the criterion to set energy development priorities. As a result, the energy supply practice in the country implicitly accepts that cost-effective grid-based large hydropower generation is sufficient to cater for all energy needs in the country. As a result of this, other alternative forms of renewable energy are not explored. Therefore, the potential of renewable energy to abate the large scale environmental degradation in the Ethiopian highlands is almost zero.

Recommendations

- There is a strong need for a regular review of the various policies to reflect on new developments in the country.
- Need to establish strong enforcement arms to control the massive land degradation and deforestation problems.
- Policies for environmental protection and prevention of land degradation should be designed to promote an integrated approach with the provision of suitable and alternative source of energy as a prerequisite.

Due to the increasing demand for fuel wood and the rapid depletion of resources, millions of people in Ethiopia cannot get sufficient fuel wood to meet their minimum energy needs. Fuel wood resources are consumed faster than they are being replenished. Degradation of forest, woodland and shrub land is caused by harvesting of wood (mainly for fuel) in excess of the natural yield and results in a reduction in woody biomass. In the Abbay (Blue Nile) Sub-basin an estimated 14 million tons of wood are unsustainably harvested as fuel wood and charcoal each year. This represents an annual accumulating loss of sequestered carbon of approximately 7 million tons valued at ETB 189 million/yr (US$ 21 million/yr). Other unquantifiable losses are of non-timber forest products (fruits, medicinal products, gums and resins, etc) and biodiversity.

Causes of deforestation and land degradation

In his study on "Linkages between deforestation, increase in fuel market demand, macro policy issues and the need for developing alternative renewable energy sources, in Ethiopia", Mulugeta (2006) identified that the current and future pressing need of energy supply and its linkage to deforestation and environmental problems is not fully appreciated and addressed in Ethiopia. After examining macro and sectoral policies he correctly recommended that policy issues related to environmental rehabilitation programs will work more effectively if they run parallel with development of renewable energy sources such as hydroelectric power.

The purpose of this study is to identify and assess the various Macro/sectoral policies which have negatively affected the environment and to recommend remedial measures where policy interventions or reform is needed, that can improve the potential to reverse the adverse environmental impact prevailing in the Nile Basin.

Better understanding of how these environmental threats are influenced by macro and sectoral policies and identifying the root causes is essential to explore possibilities of cooperatively addressing the threats. Very essential in this regard is the need to revise the macro as well as sectoral policies such that they could actively (rather than passively as the case is now) support the promotion of renewable energy in Ethiopia. This is so because the redemption of the degraded land and the prevention of further degradation depend heavily on recognizing the value of and in actively utilizing the renewable energy resources of the country. The pivotal role that the technology could play to reverse the existing situation is fully recognized and emphasized throughout the entire section of the study. Finally, recommendations are made on the necessary amendments of the macro/sectoral policies in order to foster renewable energy and thereby support environmental rehabilitation efforts.

The Environment of the Nile Basin Regions of Ethiopia

The Nile Basin Regions of Ethiopia include five regional states namely, Tigraye, Amhara, Bensahngule - Gumuze, Gambella and Oromiya regions.

Tigray Region

Tigray is one of the five regional states of the Nile basin regions of Ethiopia . Occupying an area of 51,560 square kilometres. It has a semi-arid climate with in the eastern half which is drought-prone. South-eastern low lands to 800 1000 mm in the high lands. Average annual temperatures vary from 16 degrees Celsius in the central high lands to 27 degrees Celsius in the western low lands.

Centuries of uninterrupted cultivation have left the highlands of Tigray degraded from soil erosion and deforestation. Drought and famine recur once every few years especially in the eastern half which is drought-prone.

Amhara Region

The highlands of the Amhara Region are characterized by moisture stress, nutrient depletion and pervasive land degradation. In some parts of the region, particularly in the eastern and drought prone areas, environmental degradation and decline in agricultural productivity are becoming a serious concern. Agriculture, specifically crop production, is at a cross road as to whether it can continue as a business and means of livelihood or not - a hard choice for the rural people. One soil conservationist characterized and predicted this same situation thirty years ago and said as follows. "Ethiopia's past and present practice is dangerous to its standard of living, and there is very little hope for the future if the present trend continues… I see this beautiful and potentially productive country sliding - and I mean literally sliding rapidly towards early and complete environmental and consequently economic ruin." **(Leslie H. Brown, 1973).** This situation has now become a reality. The situation in some parts of the Amhara Region is no different from the general picture described above.

Available socio economic records today indicate that annual deforestation in the region is estimated at about 20,000 ha per year, and over the last ten years about 200,000 ha of forest was removed either for agricultural expansion, fuel wood and construction purposes, and the estimated forest cover today is less than 0.4% of the total area of the region. Wood shortage is acute and women use animal dung for fuel which otherwise could be used for soil to improve the fertility of the soil and improve productivity. The estimated total soil loss by erosion is about 1.1 billion tons (41% of the country) and most of it is from the highlands of the Amhara region closer to the Abay Basin.

About 66% of the total area of the Region is now affected by land degradation a substantial decrease of biological productivity of the land system. The most widespread cause of land degradation in the highlands is massive deforestation and expansion of agricultural activities which expose the land to soil erosion by water.

Recurrent droughts have affected the region quite severely, and today

of the total 10% Weredas in the region, about 52 Weredas (area with approximately 3 to 5 million people) are drought prone and in most years unable to produce sufficient food to meet the subsistence food need. Droughts coupled with land degradation have left the region with massive food deficit balance. For instance in 2000 and 2003 the estimated food deficit level of the region was reported as 183,983 and 3,958,500 MT, which is 33% and 28% of the national food deficit balance, respectively. As the figures indicated, the food deficit balance in the region is growing over years.

The Beshangule-Gumuze is one of the regions with less land degradation and deforestation problems in the Nile Basin part of Ethiopia. It has large untapped land and water resources and the potential for agricultural development (crop, livestock and fishery) is enormous. According to information gathered from river basin studies (Abay and Baro-Akobo River Basin Master Plan Studies), there is land is suitable soils, climate and abundant water resources.

However, poverty is a fundamental and compounded problem predominantly exhibited in the region. Approximately 93.4 percent of the population in the region earns their living from agriculture. Food production is a subsistence activity accomplished with family labour. In the rural areas, poverty has deepened into the life of the people. As a result the people of the region experience frequent food shortages, no proper shelter and clothing.

Records from the Regional Disaster Prevention and Preparedness Commission (DPPC) indicated that the population requiring food assistance over the last ten years (1992-2002) ranges between 4000 (1998) and 167,751 (1992) with food need each year recorded. Other unofficial reports on small sampled survey conducted on natives (particularly Gumuz) indicated that over 80% of the household's crop harvest lasts them less than six months, and in the remaining months of the year, the people resort to other activities for their livelihood such as hunting, fishing and collection of wild plants. These practices have already shown negative impacts on the environment depletion of forest and wild life resources, decline in fishery resources due to indiscriminate catching and the use of traditional methods to meet their basic needs, and also considered as a coping strategy by the local people during the hungry period.

The major causes for food shortage in the region are the continued use of traditional farming practices i.e. shifting cultivation.

The availability of large unutilized land encourages the people to practice shifting cultivation. Shifting cultivation is a traditional farming system evolved to meet the needs of the farmers. Cultivation is done manually using hand tools or hoe. Under this traditional farming system, farmers practice slash and burn and cultivate the land to produce crops for subsistence. This practice however has negative environmental implication as it accelerated deforestation on the remaining forest covered areas.

Gambella Region

Gambella Regional State is also endowed with enormous natural resources. There are two distinct seasons, dry and wet seasons. The annual temperature ranges between 25 and 380 C (maximum and minimum temperature range between 45 and 480C and between 15 and 200C, respectively).

Despite these huge resources, the region is food insecure. Almost all households experience a 3 to 5 months hunger period, and during this period, farmers are involved in fishing, hunting and food aid.

There is no agricultural wage labour since nearly all have similar economic status. Average land holding is less than 0.5 ha and it is not because of shortage of land, but the social development, and capacity of the household and stage of development of the agricultural practices/systems in the region is rudimentary to manage more land.

The performance of the agricultural sector in general is very poor, and agricultural practices are very primitive and largely include shifting cultivation. Deforestation is the main environmental threat of the region. The major causes for the alarmingly increasing deforestation in Gambella Region are Farm Land Expansion and the increasing population due to refugees and settlement programs..

Oromiya Region

Oromiya region is the largest region of Ethiopia. It occupies an area of 353,700 square kilometres, which is nearly 31% of the total area of Ethiopia. Oromiya's climate varies from semi-arid and arid in the south to humid in the west. Even though the region is a surplus producer of food crops, the rapid increase in population, coupled with land degradation due to erosion and cyclical drought poses great threat to its food security. Close to 35% of the population live below the absolute poverty line.

The natural resources potential of Oromiya, however, is relatively large with 7.2% of the region covered with high forest. About 75 % of this forest is found in the three zones of Bale, Illubabor and Jimma.

This forest contains indigenous tree species, including, Juniper procera, Podocarpus grasiler, Croton macrostachis, Pygem africana, Cyzygium guinens, Cordia africana, Olea africana, Aningeria adolphi frederike, Hagena abyssinica, Acacia abyssinica, Acacia spp. Except for acacia, which is used as fuel wood, all the above species of wood are of great economic importance as source of timber. In view of their economic importance, these trees continue to be exploited through legal and illegal means.

Forest protection has not been effective. Hence, forest resources are exposed to uncontrolled deforestation.

The main causes of deforestation are rapid growth of population, scarcity of agricultural land and prevalence of poverty. These causes of land degradation are being exercised in different parts of the region. Conversion of new land for cultivation, slash and burn methods are used in the western and south-western parts of the region thus compounding the problems associated with deforestation.

Sub River basins of Ethiopia

Three major sub basins in Ethiopia contribute to the flow of the Nile River. These three tributaries of the Nile River namely Blue Nile/Abbay, Tekeze/Atbara, and Baro-Akobo/ Sobat lie within the five regional states mentioned above and flow towards Sudan and then to Egypt; forming part of the system of Nile waters.

The highlands of Ethiopia include areas with altitudes above 1500 masl. The substantial portion of this area has slopes in excess of 20-30%. This has created favorable conditions for accelerated soil erosion especially the upper catchments of the Tekeze (Tigray region) and Abay (Ahara region).

The rate of deforestation in Ethiopia is alarming and the rate of afforestation is negligible in light of the very high rate of forest clearing for fuel, expanding agricultural land and construction purposes. Deforestation leaves the land surface barren and open to serious land degradation processes. In general, the high lands of Ethiopia where these sub basins are located is characterized by:

- High Population density
- Deforestation
- Depletion of grazing land/ forage resources
- Soil erosion
- Soil compaction

Leading to:

- Accelerated deterioration of natural resources
- Low agricultral productivity
- Food insecurity
- High dependency on food aid

Land degradation is seriously threatening the economic and social development of the country as a whole. Due to land degradation, an increasing number of Ethiopians has become vulnerable to the effects of drought.

ENVIRONMENTAL ISSUE

Deforestation and land degradation are the major environmental threats depriving the top fertile soil and aggravating the food insecurity situation in the country. The negative externalities of the problem are not limited to Ethiopia. Rather it has transboundary implications. Hydropower, irrigation, water supply and flood control reservoirs in Sudan and Egypt are affected by siltation of eroded sediment from the Ethiopian highlands. This fact assured that land degradation problem in Ethiopia is major environmental threat with spill over effect to the downstream countries such as Sudan and Egypt.

Land degradation affects agricultural production in two major ways. First, erosion results in loss of soil depth, which in turn results in the decrease of the capacity of soils to hold water for plant growth. Second, the use of animal dung and crop residues for fuel wood purposes disturbs the soil nutrient cycle and reduces plant production. In addition to this, it accelerates surface runoff, imposing further losses on agricultural production. This renders the country vulnerable to recurrent food shortage problems.

Forest clearance and its resultant soil erosion have created chronic problems for dams and reservoirs constructed in the lower reaches of river basins. Deforestation and degradation which occurred for a very long time in the Ethiopian part of the Nile Basin has increased the on-site erodibility of soil, loosening it, and destroying its protective layer. When the eroded sediment enters into rivers and thence to dam reservoirs, it has serious negative consequences. The consequences can be in terms of reduction in water supplies and hydroelectric power production. Silted water brings greater wear and tear to hydroelectric turbines. Reservoir sedimentation leads to a reduction in the expected benefits such as irrigation, hydropower, navigation, flood control and other related purposes by shortening the life span of reservoirs. It also progressively impairs the drainage system downstream, reduces the carrying capacity of the irrigation canals and increases the probability of floods.

Topographic Condition

Cultivation of steep lands without applying conservation practices is one of the major causes of land degradation. According to the Ethiopian Highland Reclamation Study (EHRS, 1984), some 1.900 million tones of soil were annually eroded, equivalent to an average net soil loss of 100 tons/ha and an annual loss of 8 mm in soil depth.

The Nile Basin portion of Ethiopia areas such as the Amhara region, the source of Blue Nile, is generally characterized by steep slopes and erodible soil type. In addition to this, the area has got strong and short rain season from mid June to mid September. During these periods, the rivers are turbid and full of suspended solids which cause major land degradation and impact on water quality. For instance, the sediment inflow into Lake Tana is estimated to be $107m^3$/year. This leads to loss of its storage capacity of 6% /100years (JICA, 1997). This sediment inflow has got transboundary implication in the reduction of both the quality and quantity of the Nile Water. Figure 1 shows the problem of land degradation on uncultivated land.

Traditional Cultural Practices

Poor farming practices and continuous cropping without nutrient recycling, and improper land use practices are among the causes for accelerated soil erosion and ecological degradation. Most widely grown crops in the different farming systems include teff a tiny pinhead size grain with a production potential between 4 to 6 quintals per ha. Land preparation for teff production requires several repeated ploughings and the planting is done at a time of high rainfall amount and intensity in July, which contributes to accelerated soil erosion. This has contributed significantly to high soil loss rate and to the aggravated land degradation in the region.

Using crop residues and dung to meet rural household energy needs rather than for ameliorating soil fertility to increase agricultural

productivity and deforestation are causing severe loss of biodiversity, which in turn is negatively affecting water resources, infrastructure stability and ultimately the overall economy.

Lack of Awareness

Land degradation is a slow process. Farmers are not able to see the problem of land degradation as a result of their unwise cultivation in marginal areas. In some areas farmers are even unaware of the problem till their land is out of crop production. However, close observation of natural resources shows that the effects of land degradation such as sedimentation, flooding, deterioration of fresh water supply from springs, streams and lakes, and losses of other environmental benefits are becoming clearer and obvious in the country.

Over Grazing

Ethiopia is one of the African countries with the largest livestock population. Livestock are in most cases kept for prestige. This practice leads to having large numbers of livestock beyond the carrying capacity of the grazing land and consequently leads to massive land degradation. The country's livestock population is estimated to be 78 million by 1994 livestock census figures. From this 78 million livestock population, 75% (48.5 million) is located in the highland areas above 1500 m.a.s.l. Therefore, the pasture and rangelands in the highlands are severely overgrazed. Thus, overgrazing is much more critical in the highlands compared to the lowland areas and less degraded areas.

Rapid Population Growth rate

The rapid population growth rate of about 2.9% per year demands every year bringing new land for agricultural practice. This in turn leads to clearing of forest covers and converting of marginal lands to crop lands. Furthermore, forest resources are also demanded for construction of houses for the ever-growing population. This pressure over the land contributes to land degradation. The estimates of deforestation vary from 80,000 to 200,000 hectares per annum.

Figure 1 Illustration of land degradation on uncultivated land in highlands

Dependence on Fuel wood as source of energy

The existing dependence on firewood as a primary source of energy, coupled with the alarming rate of population growth and inefficiencies in use, bring about an ever-widening gap between the demand and the supply of fuel wood. The demand far outstripped the supply. In 1997, the deficit in fuel-wood consumption was 41.2 million m^3. In 2005, the gap grew to 58.1 million m^3. As a direct consequence, an aggressive deforestation process has caused the destruction of 200,000 ha of forest and the erosion of 2 billion m^3 of topsoil annually. Agricultural land is also deteriorating in quality every year.

A typical situation of the critical condition of the firewood demand in the country is shown in Figure 2. Firewood appears to be the dominant source of household energy needs in rural areas of the basin.

The most appropriate way of preventing the impact on the environment is to find ways to curtail the indiscriminate use of firewood by utilizing alternative and renewable energy resources. Adopting existing renewable technologies is not much of a challenge. The real challenge lies in developing the right methods and identifying entry points for such technology as the current energy policy in Ethiopia is not strongly supportive of renewable energy development.

Extent and Severity of deforestation and land degradation

Accelerated and indiscriminate deforestation leads to land degradation, soil erosion and the loss of soil fertility. It also upsets the agricultural production functions for farmers and leads, all things being equal, to reduced crop yields. It appears mandatory to provide the rural poor with modern energy technologies so that the labour wasted on inefficient energy sources could be redirected for other useful purposes. The appropriateness of replacing the firewood consumption by alternative renewable energy sources is indisputable. However, with the exception of large hydropower, Ethiopia has not specifically utilized its abundant alternative, renewable energy resources.

Macro and Sectoral Policies

Energy Policy

Efforts of soil and vegetation conservations appear to be unsuccessful in Ethiopia. Policy issues have not been supportive in reversing the situation (Feyera, 2006). For example, alternative energy provision is believed to be a solution to support the reversal of deforestation. But, the effort towards this objective is insignificant.

The current energy supply practice

in Ethiopia seems to treat large hydropower as the sole source of renewable energy in the country. In other words, the energy supply practice seems to be based on the premise that grid-based large hydropower generation is sufficient to cater for all energy needs in the country. This conclusion is unavoidable as long as the energy policy requires 'cost-effectiveness' as the criterion to set energy development priorities. As a result, other forms of renewable energy are not being accorded high priority. Therefore, the potential of renewable energy to abate the large scale environmental degradation in the basin cannot be tested at the moment. Even though not directly, the energy policy has somehow adversely impacted negatively on the Nile environment.

Figure 2 Photo At a firewood market; source Rami, UN-EUE

Macro economic policy

The macro economic policy of the country is a continuation of the policies started in 1994 by reorienting the budgetary resources towards poverty reduction strategy. The policy calls for strong revenue performance through tax reform programmes, and improvement of the monetary and financial sector performance. Subsidies are discouraged to bring about economic stability and economic performance. While it is necessary to restrict subsidies to direct production enterprises for the sake of economic efficiency, the renewable energy technology deserves to receive financial subsidization and tax rebate incentives as it can bring about huge intangible benefit in the form of environmental protection. The restriction is probably the cause for the mild and thus inconsequential growth of renewable energy technology in the country.

Agriculture Sector Policy

The Ethiopian Government has put agriculture at the heart of its effort to generate economic growth and development, which is manifested in its Agriculture Development Led Industrialization Strategy (ADLI). Within the agricultural sector, the strategy focuses on the improvements in the productivity of peasant farms and pastoral activities, and the establishment of large-scale farms particularly in the lowlands. In the strategy, the development of agriculture is viewed in three sequential phases with improvement of traditional agricultural practices through the use of improved seeds at first; followed by expansion of small scale irrigation schemes, agricultural infrastructure and modern technological inputs (such as fertilizers, pesticides, etc.). At the second and third stage, it envisages to create non-agricultural employment generating schemes. Recognizing the fact that market forces alone cannot ensure the development of the agricultural sector. The strategy underlines the need for state support in terms of policy intervention and resource allocation.

Policy in Non-farm sector

Rural development has been largely associated with agricultural development in Ethiopia. As a result, attempts to achieve rural development have focused on improving agricultural productivity. The past rural development approaches such as the package approaches are focused on raising the productivity of the farmer by providing modern inputs or encouraging technological diffusion. These rural development packages, however, neglect the rural non-agricultural sectors as sources of employment and income. The fact that crop yields in Ethiopia remain low and farm sizes are small and fragmented suggests that rural households have to supplement their income from offfarm income sources. Thus agricultural strategies need to enhance and promote rural non-agricultural activities as a substantial part of rural development strategy in Ethiopia.

Leaving aside the production of crops and the tending of livestock, this view takes into account diverse range of activities, including the processing of agricultural products, manufacture of handicraft and other goods, commercial activities as well as the provision of other wide range of services. Surveys have identified various types of handicraft activities, food and drinks, and trade as well as small industries as the main categories of non-farm activities in rural Ethiopia.

The non-farm sector development needs its own policy that should complement the currently available policies particularly relating to

education, food security, and agriculture. Regional, zonal and woreda governments need to examine their policy towards the rural non-farm sector and design appropriate strategies. Similarly, the rural non-farm sector need not be considered as a residual sector and an institutional framework to support and facilitate the sector in place.

If sufficiently supported, the non-farm sector could make a difference in the drive to implement renewable energy solutions for rural communities. However, the non-farm sector is currently unable to do so because it is in a weak position. The main reason for this is the lack of appropriate policy and institutional support, lack of appropriate technology and other socio-cultural factors. A number of factors account for weak development of the non-farm sector. Most of these constraints are related to the limited purchasing power of the rural people, the nature of the non-farm sector, lack of appropriate policy and institutional support, lack of suitable technology, and other socio-cultural factors, (Tegene, 2006). Thus, the agricultural policy and related strategies and guidelines require amendments to make them more supportive of the intervention of the non-farm sector in promoting renewable energy technologies.

Economic Policy

Ethiopia's economic policy during the transitional period implied a radical change from the past. It involved and implied policies geared towards: (1) Macro-economic stabilization (euphemism for reduced spending on subsidies, public sector layoffs, devaluation, etc); (2) Restructuring of public expenditures in favour of "economic sectors"; and, (3) promotion of agricultural productivity, (Demessie, 2006). The overall development strategy was termed Agricultural Development Led Industrialization (ADLI) and it was subsequently augmented with strategic plans like the Poverty Alleviation and Sustainable Development (PASDEP). The aim of the PASDEP is to lay out the direction for accelerated, sustained and people-cantered development as well as to pave the groundwork for the attainment of the MDGs by 2015. During the PASDEP period, Ethiopia is expected to continue to pursue on the ADLI strategy, but with important enhancements to capture the private initiative of farmers and support the shifts to diversification and commercialization of agriculture. The policy documents advocate that in order to eradicate the daunting poverty challenges faced by the country and to improve people's livelihood, it is imperative to have an accelerated and sustained economic growth.

Among others, reduction in spending on subsidies is considered a necessary precondition for economic stability. Especially when it comes to direct production sectors, reduced subsidies are essential for economic efficiency and for competitiveness in the international market. However, when one considers environmental protection like afforestation and rehabilitation of degraded land, it becomes necessary to find ways to support such programmes through subsidies because such ventures are not expected to yield immediate benefits in the form of financial income. Related to this is the issue of renewable energy technology that in this study is taken as an important part of the environmental rehabilitation initiative. Renewable energy can ease the burden on indiscriminate usage of biomass as a source of energy and thus help reduce further environmental degradation. Thus the benefit remains to be largely intangible. Therefore, renewable energy initiatives should be supported through governmental subsidies, funds raised by the NBI- SVP, and international environmental funds like the Clean Development Mechanism, the Global Environmental Fund, Carbon Trading and the like. Therefore, the policy needs to make slight amendments by allowing subsidies as well as tax rebate/exemption from importation of renewable technologies. Otherwise the impact on the environment will worsen in the coming years.

The Environmental Policy

The Environmental Policy contains a number of very useful points regarding the promotion of renewable energy. However, implementation of the policy is hindered because of the restraining effect of the factors in the energy policy discussed above. Therefore, the environmental policy does not give sufficient support to bring about the necessary intervention.

The policies on the environment give alternative sources of energy their due places in the future of energy development in the country (EPA, 1997a; EPA 1997b). The need for the use of alternative energy sources such as solar power, wind, biogas, agricultural bio-fuel, liquid bio-fuel or small hydroelectric plants for towns and villages remote from the national grid has also been well recognized. The following are some of the policy guidelines set for the development and management of the country's energy resources in general and use of alternative sources of energy in particular:

- To adopt an inter-sectoral process of planning and development which integrates energy development with energy conservation, environmental protection and sustainable utilization of renewable resources;
- To promote the development of renewable energy sources and reduce the use of fossil energy sources both for ensuring sustainability and for protecting the environment, as well as their continuation into the future;
- To develop alternative energy sources for towns and villages remote from the national grid;
- To place an increasing reliance on energy efficient technologies, sustainable use of renewable resources, and the development of indigenous energy resources;
- To acquire, develop, test and disseminate appropriate and improved energy use technologies (e.g. improved stoves, charcoal kilns, solar powered cookers and heaters);
- To demonstrate and support the use of other energy sources (e.g. geothermal,

- Solar, etc.) in the various economic sectors where it is currently little used such as in transportation, irrigation, crop-drying, food processing, fish drying, and thermal heating;
- To promote and assist the private sector to assemble and manufacture energy development facilities and end-use appliances.

The policy statements are all well formulated and relevant. But, they seem to lack the necessary emphasis in proactively embracing the renewable energy option as an instrument of reversing environmental degradation. The policy lacks the necessary strong arm that could push renewable energy technology to the forefront. Therefore, it fails to impact the environment positively.

Although not highly cost-effective, renewable energy is an uncontested means of reversing the energy crisis as well as the environmental problem in the country and in the Nile Basin. Therefore, the environmental policy should have strongly favoured the promotion of renewable energy regardless of what it may cost in financial terms. The policy, as it stands today, is not adequately accompanied with relevant guidelines and strategies that could enable the achievement of the set out goals in practice on the ground.

Energy and Hydropower Sector Policy

The energy policy, as stated by the Ministry of Mines and Energy (MME) 1994, outlines the need to rely mainly on hydropower to increase the electricity supply and to take advantage of geothermal, solar, wind and other renewable energy resources wherever appropriate. It also calls for the need to encourage energy conservation in industry, transport and other energy using sectors to ensure that energy development is environmentally friendly; and to provide appropriate incentives to the private sector. The energy policy accords the following order of priority for the development of various energy resources:

- Hydropower Development
- Oil and gas resources development
- Traditional energy development through reforestation programs

The policy gives priority to the planning and expansion of the energy supply required for economic development, particularly the implementation of the ADLI, while at the same time, taking measures to transform energy consumption in the country from traditional to modern sources. This will be carried out in an integrated manner through proper coordination with development planning and implementation and the strengthening of the linkages of the energy sector with other sectors of the economy. The policy also emphasizes the need to take energy utilization and efficiency increasing measures as well as the promotion, whenever feasible, of indigenous energy sources which are cost-effective and reliable. In line with the energy policy, the hydropower sector policy issued by the Ministry of Water Resources, MoWR 1999, also underscores the need to subject hydropower development schemes to strict environmental and stakeholder considerations as well as meeting economic criteria.

Thus, hydropower development has been accorded highest recognition and priority in both the water and energy sector development policies. Currently, more than 95% of electric energy generation in the country is from large hydropower. There is an existing total hydropower capacity of 814 MW in the country as shown in Table 1. Massive efforts in large hydropower construction are taking place which will increase the capacity by five times in a few years time when the construction of the plants is completed.

The growth in capacity is useful to meet the growing industrial demand in the country, the supply needs of rural towns to be connected under the Universal Energy Access Programme and the planned energy export to neighbouring countries in the framework of the regional power trade.

Both the energy and the hydropower policies underscore cost-effectiveness as basic criteria to develop the indigenous energy sources. Such requirement of cost-effectiveness is likely to exclude small hydropower and other forms of renewable energy sources from being potential candidates for development as their economic viability or cost-effectiveness is much less than large hydropower due to economies-of-scale. Thus, the criterion of cost-effectiveness, which is visibly embedded in the energy and hydropower sector policies, happens to be the major impediment to the promotion of indigenous renewable energy sources in Ethiopia. Conventionally, cost-effectiveness is evaluated without taking intangible benefits into account. As a result, the intangible benefits of the various forms of indigenous renewable energy sources such as the prevention of environmental degradation are not considered as advantages as they should have been. Therefore, renewable energy resources have been marginalized till now and they will remain so in the future unless the necessary policy intervention is taken.

The Ethiopian Electric Power Corporation (EEPCo) is the sole federal institution responsible for generating, transmitting, distributing and selling of electricity, whereas upstream activities of medium and large-scale hydropower project studies and design fall under the mandate of the water sector as per the current policy of the water management, (Michael, 2004). In accordance with the energy policy, the EEPCo generates and distributes electric energy from hydropower resources, which meet the criteria of cost-effectiveness. Naturally, this criterion favours large hydropower plants. Neither small hydropower plants nor any other form of decentralized renewable energy source get recognized because of economies-of-scale. Therefore, it is not surprising to find out that EEPCo's own policy discriminates decentralize/off-grid power supply in favour of centralized grid-based electrification. This brings to light the age old dilemma of the suitability of the grid to reach out to

widely scattered rural settlements. Many researchers contest the validity of solely utilizing large hydropower through the national grid system to solve the problem of energy supply to rural Ethiopia (Hailu et al, 1988; Zelalem,1992; Zelalem,2002).

Rural areas in Ethiopia are characterized by either low-density settlement with relatively large distances between households or villages with fewer inhabitants. This has hindered the use of modern sources of energy. Ignoring rural inhabitants by allowing them to continue the current use pattern of traditional energy sources is bound to have highly negative consequences for the rural economy at large, as well as the environment and the ecosystem balance. The enormity of the number of settlements casts doubt as to whether the grid system could be cost-effectively extended to reach out to rural settlements. As compared to large hydropower almost all of the common renewable energy sources including small hydropower may seem less cost-effective especially if the grid extension costs are not taken as part of the generation costs of large hydropower systems. If one compares only the specific costs ($/kw) of small hydropower with large hydropower, the specific cost of small hydropower may come out to be 1.5 to 3 times that of large hydropower. Solar energy specific costs are several times more costly. This fact gives EEPCo the justification to ignore all decentralized renewable energy sources and concentrate only on large hydropower development. This course of action taken by EEPCo remains to be in line with the energy sector policy, which stresses the need to maintain cost effectiveness of energy supply.

EEPCo has included in its strategic plan that it will extend the grid to cover the electricity needs of settlements within 100 km of any of its 33 kV substations. Based on this premise the off-grid Rural Electrification Master plan Study prepared a GIS buffer zone map to identify the future supply coverage area by EEPCo. The resulting map, in figure 4, shows that EEPCo's intended area of intervention covers nearly the whole of Ethiopia.

Figure 4 Buffer zones of 100 km radius from 33 kV Substations, source off-grid Master- plan one can see from the map that almost all of the Ethiopian Nile basin region falls under the radius of influence of EEPCo's planned intervention. This means that all of the settlements shown in figure 6 will be connected using the national interconnected grid system in the not distant future. The fulfilment of the extrapolated goals would be most welcome by all concerned citizens in general and by environmental advocates in particular. However, there is considerable doubt whether this target is achievable especially since EEPCo is also charged with the responsibility of catering for industrial energy demand which is growing at a very high rate in the country. Moreover, there is a need to export energy to neighbouring countries through the regional power trade programme.

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EEPCo's successful activities in achieving its mission of providing quality electricity services in Ethiopia are remarkable. However, there are certain issues which stand out as major concerns for environmental advocates who are interested in the promotion of renewable energy in Ethiopia. EEPCo simply fails to spell out that it cannot cover the energy needs of all rural settlements in the country. It does not make any effort to delineate those towns and settlements which it can cost-effectively supply from those which it cannot. This type of delineation is important because those settlements which do not fall under EEPCo's plan have to start as early as possible to search for a renewable energy solution to prevent dependence on firewood. Delay in doing so has its painful cost. Not only the concerned energy poor settlements but also downstream riparian countries are being penalized by the failure to take the right measures on time.

The ambiguity due to the lack of clear information imparts a sense of half-heartedness on the part of those who are engaged in rural electrification initiatives. For

Table 1 Hydropower Generation in Ethiopia

Plants	*Capacity (MW)*
Total Existing Capacity	814
Amerti Neshi Fincha	100
Tekeze	300
Tana Beles	460
Gilgel Gibe II	420
Gilgel Gibe III	1870
Total	3964

example, the off-grid rural electrification master plan study had to rely on assumptive algorithms to delineate the settlements to be served by EEPCo's grid system from those which need to be covered by decentralized/off-grid electrification. Therefore, recommended measures for off-grid electrification remain to be subject to the possible errors of the assumptions.

EEPCo's plan to cover the whole of Ethiopia by its grid system imposes a restraining effect on interested parties willing to invest on renewable energy development for rural off-grid electrification. Even the off-grid rural electrification master plan treats off-grid/renewable energy solutions as a transitory solution because EEPCo is expected to connect the rural settlements to its grid in the near future. Another concern regarding EEPCo's huge plan is the fear that EEPCo may not have the capacity to cover all the energy needs of rural settlements as planned. Thus off-grid renewable energy supply for rural settlements is seen as the most workable solution in the short and medium terms. Renewable energy technology, which should have been utilized in the rural settlements some decades ago, should not be delayed any more if one seriously desires to abate further degradation of the Nile basin environment.

The utilization of decentralized renewable energy resources is also necessary to sustain the development of large hydropower based grid system. All of the large hydropower plants in Ethiopia do have reservoir for water storage. The reservoirs store water, which is collected from watersheds that badly require proper management. It will, therefore, be self-defeating if more and more reservoirs are built without the accompanying watershed management measures. The major argument of this study is the fact that indigenous renewable energy utilization is one of the paramount watershed management interventions. This concept is schematically displayed in Figure 5, which reveals the vicious circle of energy poverty in the country. While serving the energy needs of rural settlements and also protecting the watershed from further degradation, the renewable energy sources could also help mitigate the problem of sedimentation in hydropower reservoirs and thereby break the vicious circle of energy poverty. This supplementary role should be counted as an important intangible benefit for renewable energy resources.

Figure 3 Rural Settlements in Nile basin, source Master plan of off-grid rural electrification

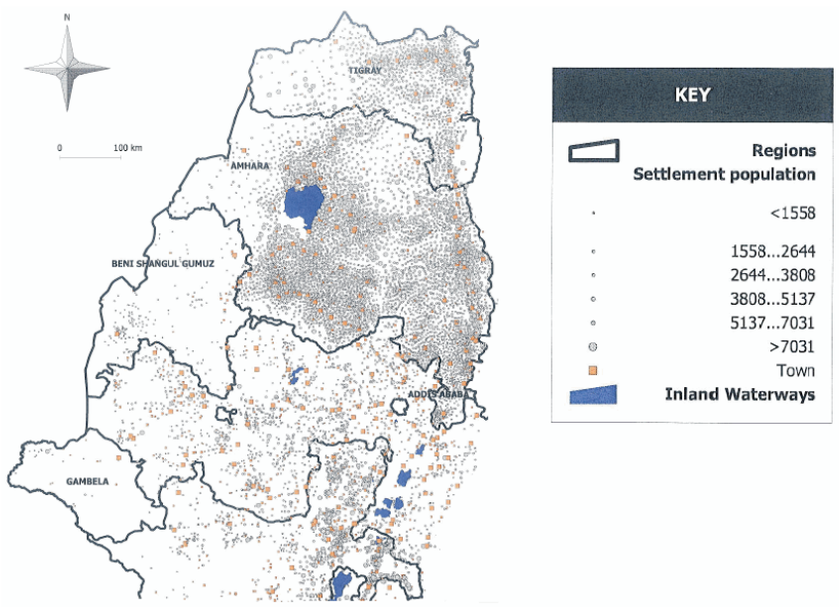
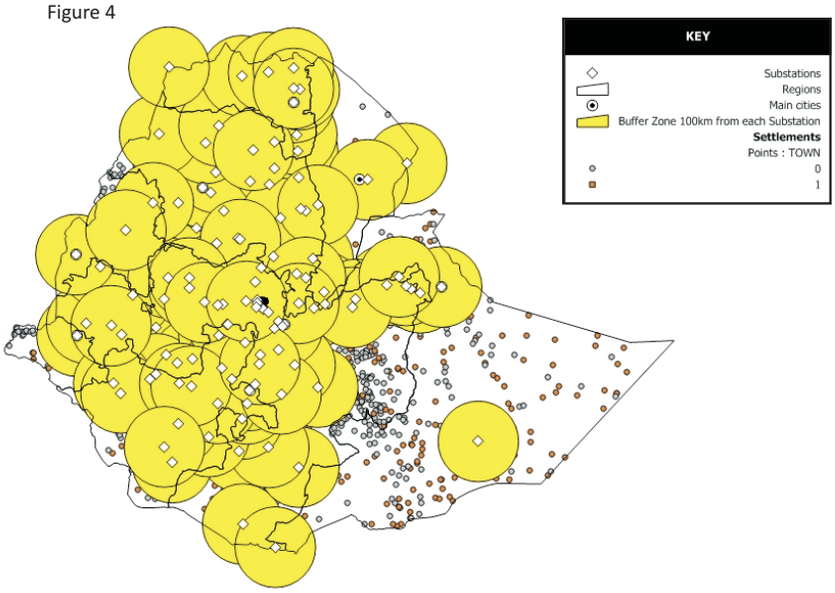


Figure 4



The Ethiopian Water Resources management policy (EWRMP) is a recent Policy issued in June 2000. The main goal of the policy is "to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available water resources of Ethiopia for significant socio-economic development on sustainable basis". In order to carry out its goal, the policy objectives include:

- Equitable and sustainable development of the Water Resources of the country for socio-economic benefits of the people;
- Allocation and appointment of water for efficient, equitable and sustainable use, according to

integrated plans;

- Managing and combating droughts and related disasters through efficient allocation, distribution, storage and other means;
- Flood control and mitigation through various means; and
- Conserving, protecting and developing water resources and aquatic environment on sustainable basis.

The basic principles on which the above policy, goal and objectives are founded are:

- Water, as a natural resource, is commonly owned by the people of Ethiopia.
- As far as conditions permit, every Ethiopian has a right to access to water of sufficient quality and quantity to satisfy basic needs.
- Water need to be recognized both as economic and social good.
- Water resources development shall be rural-centred, decentralized, participatory and integrated approach.
- Management of water resource shall be according to the norms of social equity, systems reliability, economic efficiency and sustainability.
- Water resources management need to promote the participation of stakeholders, especially women and other user communities.

The EWRMP is a comprehensive document covering every aspect. It provides guidelines to inland water transport, aquatic resources, water for tourism and recreation, water allocation, environment, technology, water pricing, stakeholders, gender issues, water quality and enabling environment.

RECOMMENDATIONS

Policy framework

The macro and sectoral polices in Ethiopia are not direct causes for land degradation and deforestation. Almost all policies are supportive of environmental protection and poverty alleviation. However, all of them lack proper instruments to enforce the policies. Therefore, there is need to have a regular review of the various policies to reflect new developments in the country and to have strong enforcement arms to control the massive land degradation and deforestation problems. Table 2 provides a summary of the recommended interventions

Renewable Energy Solutions

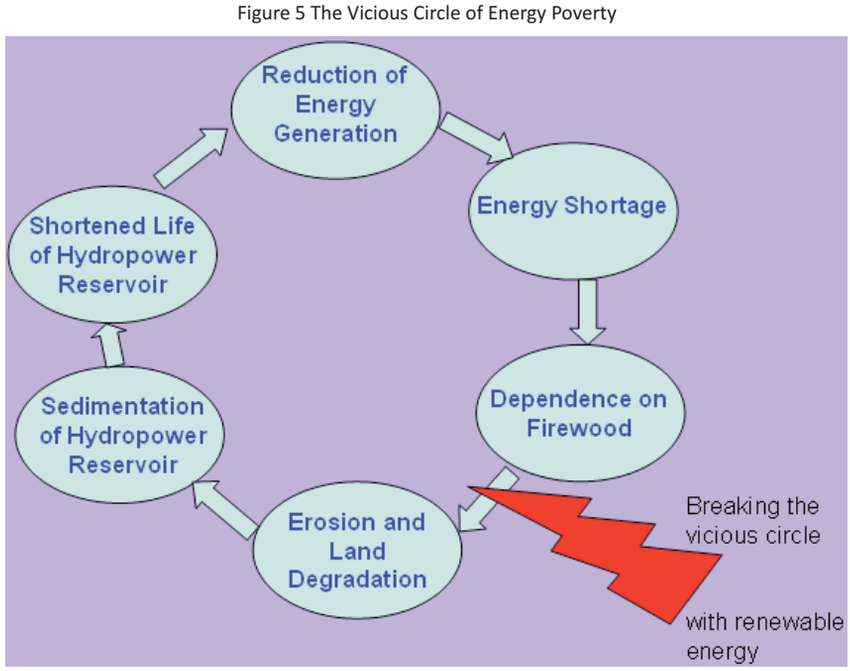
The reduction of soil erosion in the upper reaches of the Nile River will decrease siltation and lessen the potential for natural disasters throughout the entire river. Ongoing land degradation in Ethiopia requires urgent action, and has to be addressed at different levels of society, including widespread soil and water conservation activities, and the introduction of renewable energy technologies which integrate local knowledge and farmer's initiatives.

If coupled with best practice environmental protection measures, the renewable energy promotion in Ethiopia will play a crucial role in preventing further degradation. There is a huge energy resource potential in Ethiopia, which if utilized, could minimize the present energy crisis prevailing in the country and enhance the process of rural electrification. Renewable energy resources need to be promoted and disseminated to provide energy services for income-generating activities and poverty alleviation. This will require harnessing of all proven and available renewable energy resources using imported and locally assembled technologies.

Addressing gaps in the existing energy policy is a key success factor for the promotion of renewable energy. It is stressed that except for photovoltaic components and systems, there is ample technical capability with facilities and human resources to partially or wholly manufacture or assemble a variety of renewable energy technologies. A clear-cut and progressive energy policy that purposely encourages productive energy end use in rural areas using alternative sources is urgently needed.

Basically, policies are selected options to be used as instruments for achieving intended goals and objectives and as such policies will serve only as a general directive principle in a wider scope and therefore do not consist of an elaborated action plan. Consequently it is essential to immediately adapt development strategies, policy implementation methodologies and pertinent action plans to translate the policies into practice. This type of exercise is particularly necessary for the environmental policy which contains important elements but lacks the necessary policy

Figure 5 The Vicious Circle of Energy Poverty



instrument to implement them.

The recommendation to overcome deforestation problem, fuel wood shortage and to have sustainable environment and natural resource management would, therefore, be to couple environmental rehabilitation programmes such as integrated watershed management, afforestation, and soil and water conservation with the development of alternative renewable energy sources. Supportive intervention should be in place that could initiate the unreserved promotion of renewable energy technology together with the enhancement of best practice biophysical environmental rehabilitation.

The success of intervention measures could be tested at small scale level in the form of pilot projects. For example, successful biophysical measures in Ethiopia are cited as case study of best practice activity being undertaken by GTZ in the Nile Basin Region of the country.

Most intervention activities are focused on the mechanical conservation of soil, soil and stone bunds, ridging, and contour ploughing. In the past there was lack of involvement of people in the planning and implementation of the schemes. The policy response to land degradation in Ethiopia has focused on the technical aspects, promoting adoption of particular conservation technologies, particularly physical structures such as terraces and bunds. Although this has helped reduce erosion rates, some economic evaluations of these technologies have shown these technologies to yield low returns to farmers, in some cases actually reducing yields by reducing cultivable area (Fitsum, 1999). This has led to poor execution and maintenance of the conservation schemes. The positive experience of GTZ in biophysical measures and gully rehabilitation activities in parts of the Nile basin is a clear example of the need for participatory approach. Through popular participation, it is possible to identify the peculiarities and the specific features of an area and thus be able to recommend appropriate solutions. For example, there is a clear advantage of grass strips over soil bunds because of their extremely low labour costs for construction and maintenance and because they take up less area. The initial investment and the payback period for grass strips are significantly less than soil or stone bunds.

The search for the right solution

Table 2: Summary of Specific remedial Measures

POLICIES	INTERVENTION	ACTORS
ADLI	The pro-agriculture development strategy requires the sufficient provision of renewable off grid energy supply to promote sustainable agriculture. The current agricultural practice is essentially subsistence agriculture supported by human and animal power. The ADLI policy could be successful if a suitable and alternative source of energy is provided as a pre-requisite.	FDRE
PASDEP	The development plan to lay out the directions for accelerated, sustained, and people-centered economic development should target the participation of the local communities in active watershed management and in the provision of alternative energy sources to contribute to the accelerated growth. Accelerated growth with out provisions to protect the environment will lead to further degradation of the environment.	FDRE
Food Security Strategy, Productive Safety Net Program (PSNP)	The strategy has a clear focus on environmental rehabilitation as a measure to reverse the level of degradation and also as a source of income generation for food insecure households through focus on biological measures. It needs also to have a clear focus on the provision of alternative and renewable energy sources to ease the burden on the natural environment.	FDRE
Macroeconomic Policy	Macroeconomic policy should be reformed to remove restriction on subsidies to alternative energy development for the effectiveness of watershed rehabilitation efforts.	MoFED
Environmental Policy	Environmental policy on promotion of renewable energy should be reinforced with an appropriate legal instrument to promote the policy proactively. Wide spread advocacy for public awareness of the environmental issues should be carried out.	EPA
Energy Policy	The constraint on renewable energy sources should be removed. Cost effectiveness as a criterion for prioritizing the energy supply options should not be applied any further when it comes to rural energy supply. Rural energy supply should be recognized as a basic necessity for the successful prevention of environmental degradation. The policy should be shaped to support off-grid rural energization initiatives regardless of whether they are cost effective or not.	MME
Agricultural Policy	Proper non-farm sector policies should be implemented in order to couple the drive for rural development with environmental protection initiatives. Through it, it is possible that the non-farm sector could support renewable energy and thereby enhance environmental protection initiatives.	MoA
Rural Land Administration and Land Use Proclamation	The proclamation has got highly positive elements in it. But, it lacks instruments for its enforcement.	Federal Ministry of Agriculture and Rural Development and the Regions. (MoRAD)
Water Resources Management Policy	Although the policy is supportive of cross-cutting integrated water resources and watershed management in Ethiopia, the level of accomplishment of the integrated water resources development is at very low level. To be effective, watershed management should be carried out in a holistic manner with involvement of all concerned stakeholders. The water policy should emphasize this issue and should put appropriate mechanisms in place to ascertain integrated approaches. The integration of energy supply with watershed management is one of the main recommendations of the paper.	MoWR

could come through a series of similar demonstration projects based on small watersheds, as well as a comprehensive program of conservation, management, enforcement, monitoring, and training. Projects that seek to alleviate poverty, to improve agricultural production and to restore the ecological balance of the region by providing appropriate and sustainable energy supply are very much necessary.

The total exploitable renewable energy that can be derived annually from primary solar radiation, wind, forest biomass, hydropower, animal waste, crop residue and human waste is about 1,959x103 Tcal per year (EEA, 2002). Out of this, the share of primary solar radiation is about 73.08 percent, while the share of biomass resources is about 12.8 percent (Table 3).

It is well known that direct energy source in the world is solar energy. All other energy sources including hydropower are derivatives or indirect sources of energy. Studies indicate that for Ethiopia as a whole, the yearly average daily radiation reaching the ground is 5.26 KWh/m^2. This varies significantly during the year, ranging from a minimum of 4.55 KWh/m^2 in July to a maximum of 5.55 KWh/m^2 in February and March. The abundance of solar energy in the Ethiopian portion of the Nile basin is shown in Figure 9. Unless properly tapped and used to prevent further degradation, this vast amount of solar energy would continue to burn the exposed land surface and thereby contribute to further degradation.

Small Hydropower (SHP)

Around 300 million people across 760 counties are supplied by electricity from SHP but in Ethiopia focuses on large hydropower as the main source of energy. The developments of mini- and micro-hydropower, which are more suited to rural electrification, are not practiced yet. At present, there are only about a handful of small-scale hydroelectric plants (0.25-1MW capacity) in the entire country. The average annual potential (exploitable with small slope plants without reservoir) is estimated to be about 20 TWh/year. The electric energy generated from small slope plants, being smaller in capacity and geographically dispersed, is of great importance for rural electrification.

The master plan for off-grid rural electrification has revealed the presence of many small hydropower sites in Ethiopia. Figure 6 shows some of the identified small hydropower sites in the Ethiopian portion of the Nile basin.

An important lesson about small hydropower development can be learned from China's experience. China has many large hydropower plants. One of the largest hydropower plants in the world i.e. the three gorges project with 17 GW capacities is built in China. However, China has not neglected small hydropower potential. For over three to four decades, China has witnessed remarkable development in the expansion of small hydropower. By the end of 2001 more than 40,000 small hydropower stations had been built in China, with a total installed capacity exceeding 26 GW and an annual output of 87.1 billion kWh. The Chinese leaders have shown deep commitment to rural electrification, and SHP is considered as one of the most important ways of achieving this.

Wind and other renewable energy sources

Ethiopia has also exploitable reserve of 10,000 MW wind energy with an average speed of 3.5 5.5m/s, 6 hours/day. Small towns, villages, farms and other scattered loads in remote areas provide ideal situation in which electricity generation from wind is convenient compared to conventional diesel generation or grid connection. Other renewable energy such as geothermal energy resources are available in the country to a moderate degree. Geothermal energy resources suitable for power production total about 700 MW.

Some successful experiences of Biogas energy in Ethiopia by some agro-based firms for their partial consumption from the waste they produce is elaborated in case study by Alemayehu (2005). The results are very much encouraging if conducted on a large scale.

Innovative Combination of Renewable Energy

The best option to utilize the renewable energy resources is through innovative combination of the sources in a hybrid system. One source of renewable energy may be suitable for one location but not so for another. Therefore, off-grid electrification should be thoroughly planned and executed as an integrated effort of modern energy supply and environmental conservation.

It is time that the existing energy policy be amended in such a way that it strongly supports the promotion of tapping the abundantly available renewable energy resources in the country to help reverse the rampant environmental degradation in the country in general and in the Nile basin in particular.

Renewable Energy offers substantial social and environmental benefits in solving rural electricity shortages, integrated development of mountain areas, water, forest and road networks, protection of the rural environment, alleviation of poverty, and promotion of the local social sustainability and economic development. These benefits cannot be achieved by other, solely commercial, power supply practice. As the immense social and environmental benefits of renewable energy could not be paid back in financial terms, the nature of renewable energy enterprises needs to be recognized as a special, non-profit entity in the power market through legislation.

The fact that special support is given to renewable energy developments in other countries has been underscored in the off-grid Rural Electrification Master plan Study of 2006. "The importance of subsidies is also one of the important recommendations of the off-grid electrification master plan, (REES, 2006). "In other countries with similar programs investment costs are heavily subsidized in order to make tariffs more affordable. The consultant strongly suggests that the Government of Ethiopia gives favourable consideration to that possibility. It can be expected that donors would initially provide most of the subsidies as they do in other

countries. In the medium and long term, the subsidies could be financed by a levy paid by customers who are supplied by EEPCO's interconnected system."

Validation of proposal

The most highly recommended way of validating the suggested proposal is through well thought out and planned pilot projects. A successful example of pilot land rehabilitation project in the Nile basin was presented in the previous section. It was indicated that the adaptability of the measure to the local condition of the site was one of the key success factors. It is necessary to carryout pilot projects in other areas of the basin as well to identify differences and similarities for the implementation of such measures. The pilot presented in the case study section was limited to biophysical treatment. However, for effective rehabilitation of the environment, the biophysical measures should be a component of an integrated and holistic watershed management and protection approach that takes appropriate energy provision as an additional component. Such multi-purpose approach is suitable to find standard solutions for the common problem of the basin. Joint actions can thus be made possible to share the benefits as well as the higher financial requirements of the integrated developments. The joint efforts can also create convenient situation to pool resources from various sources such as the Clean Development Mechanism, Global Environmental Fund, Carbon Trading opportunities and so on. Moreover, records of intervention measures and their outcome should be properly kept and managed. Properly organized detailed reports should be prepared in a presentable way to be able to convince major stakeholders and decision makers about the importance of the policy interventions.

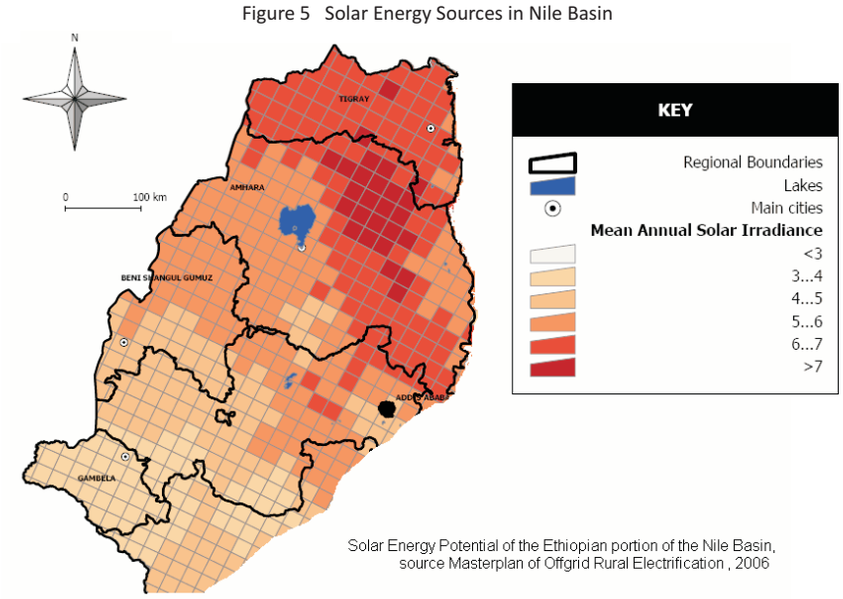
Careful planning and handling of pilot projects is crucial to validating the suggested policy reform. In general, in conducting the integrated pilot projects it is important to gauge the positive impacts in the basin in the form of firewood consumption reduction, forest area cover increase and so on. This type of monitoring is very important as it helps to scale up and roughly estimate the effect of the intervention at a broader level. In this regard, carefully selected indicators and their respective baseline situations represent two important elements on the basis of which the level and quality of progress of the policy reform interventions could be assessed.

Table 3: Renewable Energy Resources in Ethiopia,

No	Energy Resources	Energy in 10^3 Tcal per year			
		Potential	% share	Exploitable	% share
1	Primary solar radiation	1,953,550	99.7	1,954	73.08
2	Wind	4,779	0.24	239	8.94
3	Forest Biomass	800	0.005	240	8.97
4	Hydropower	552.1	0.03	138.00	5.16
5	Animal Waste	111.28	0.01	33.73	1.26
6	Crop Residue	81.36	0.004	40.63	1.52
7	Human Waste	28.18	0.0014	28.18	1.05
Total		1,959,901.93	100.00	2,673.54	100

Source: CESEN, EEA 2002

Figure 5 Solar Energy Sources in Nile Basin



Solar Energy Potential of the Ethiopian portion of the Nile Basin, source Masterplan of Offgrid Rural Electrification , 2006

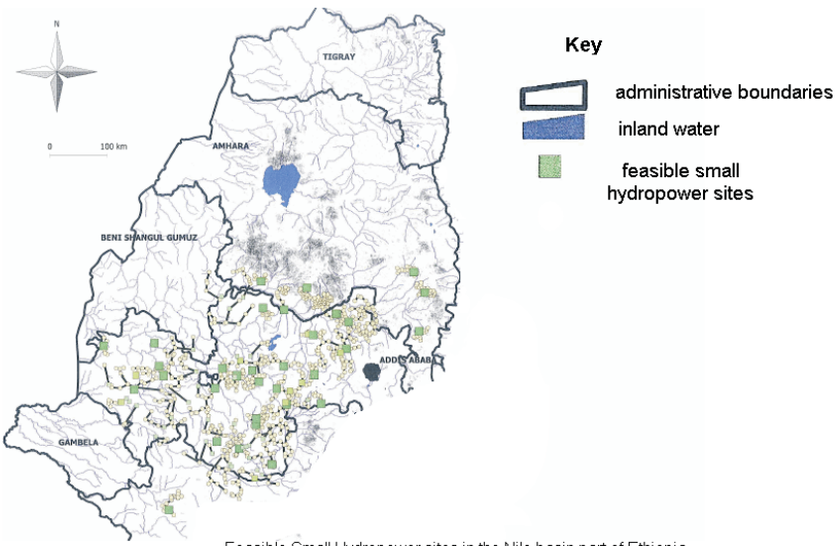
Formalization of Proposal

Adoption of a new policy or the amendment of an existing policy is often a multi-stage process. Stakeholder groups usually discuss a prospective policy extensively at different levels before adopting it. Such discussions among stakeholder groups provide an understanding of where a specific policy proposal is headed and the chances of its adoption within a given time frame.

The recommended process for the adoption of the suggested policy reform in this study involves, among others, the following milestones:

- Formation of advocacy groups to discuss the nature and severity of the problem (in this case deforestation, land degradation and so on) which is to be overcome through the suggested policy reform
- Conducting a formal assessment of the policy reform and identification of the concerned stakeholders, the beneficiaries and affected groups
- Investigation of other options to achieve the set out goals without the need to adopt the policy reform. Investigation of the pros and cons of the different options.
- Extensive consultation with key stakeholders on the basic problem and possible solutions, and the proposed policy reform

Figure 7 Small Hydropower Sites in the Nile Basin



Feasible Small Hydropower sites in the Nile basin part of Ethiopia , source Offgrid Rural Electrification Masterplan , 2006

and its impact on the environment
- Refinement of policy reform proposal and development of specific proposals to address the problem
- Carrying out public debate on the proposed policy between opponents and proponents of the policy reform
- Presentation of the policy proposal to representatives of the relevant government body (legislature or executive branch ministry or office)
- Discussion of the policy proposal among governmental bodies, advocates of the policy reform, and other key stakeholder groups including the private sector
- Drafting and introduction of legislation or executive order supporting the policy reform
- Adoption of the policy through legislation, regulation, decree, or executive order.

Evaluation Process

It is essential to create mechanisms for the evaluation of the success of the proposed renewable energy policy reform. For this purpose one needs to investigate what a well-designed evaluation system looks like. An evaluation and control monitoring system that adequately tracks, and thus effectively supports the policy reform process usually includes many of, if not all of, the following characteristics:

- Provides a user-friendly means of understanding the current status of the relevant policy
- Includes policy reform stakeholders as partners in reviewing the process of adoption and implementation and in setting future performance targets. Partners like the Ministry of Mines and Energy, the Ministry of Water Resources, the Ministry of Agriculture, Environmental Protection Authority, MoFED and other interested stake holders could be the major actors. Conducting a participatory evaluation process means sharing the functions which in turn makes shared learning from the evaluation possible. Participatory monitoring and evaluation is the best way of learning and improving sustainability and ownership. This is so because it allows for early consultations and involvement of all stakeholders in identifying problems to be tackled through the policy reform, the course of action needed to implement the reform, and available resources for the purpose. Participatory researches are important to compile, analyze and scrutinize the background information that led to the appeal for policy reform.
- Follows the reform process through completion of policy implementation. In this context, systematic monitoring and follow-up should be viewed as a management tool that allows for continuous and timely adjustment. It is a process that permits reassessing different assumptions and provides opportunities for adoption of more effective implementation strategies.
- Describes in detail the stages or events used for rating progress. For example, if a good number of the pilot projects are registering success thus giving green light to scale up the pilot activities to actual rollout in a basin-wide implementation.
- Describes in detail the methodology or process used for rating the different stages of the reform. Common approaches to monitor policy reform are discussed below.

Approaches to Monitoring Policy Reform

This section outlines the common approaches to monitoring policy reform. The approaches can be categorized as follows:
- Quantitative approaches,
- Composite approaches (using some combination of qualitative and quantitative methods), and
- Descriptive approaches

Monitoring teams should carefully consider cost and practicality when reviewing these approaches. There are some particularly challenging issues for monitoring the performance of policy reform efforts.

One of the challenges is the monitoring and reporting of milestone events. In most cases, important events occur en route to actual policy implementation. These critical milestones do not easily lend themselves to quantitative monitoring and reporting without loss of information about noteworthy achievements and their significance. Milestones such as completion of pilot projects, the observation of positive watershed impacts should be well thought through from the start.

The other challenge is the setting of

targets. Organizational capacity is a key factor in determining the time needed to carry out a reform, yet this factor is difficult to predict. This presents challenges when monitoring teams try to set targets such as when and to what extent a reform will be implemented.

As these issues indicate, the monitoring team must balance a number of considerations, both when they develop their policy monitoring systems and when they define performance targets.

Conclusions and Recommendations

In Ethiopia, land degradation and deforestation are the major environmental problems affecting the natural resources and biodiversity. These are the basis for achieving accelerated agricultural development and for meeting food security and other basic necessities. The severity of land degradation could be seen in a number of gullies and huge amount of sediment deposition in downstream water structures.

The national and sectoral policies of the country are, however, not directly impacting the environment. In fact, most of the policies are supportive of environmental preservation. Especially the environmental policy is well formulated with regard to protecting the environment. What is lacking is proper policy instruments to enforce these policies. For example, the environmental policy advocates the importance of renewable energy implementation. However, nothing is happening with regard to promoting renewable energy in the country. Failure to promote renewable energy leads to the aggravation of the condition of the environment. Thus, it is the failure to enforce the policy rather than the policy itself, which is impacting the environment negatively.

The water resources management policy document underlies the importance of an integrated approach to water resources development for optimal utilization of the country's water resource. Integrated water resources management promotes the coordinated development and management of water, land and related resources to maximize economic and social welfare in an equitable and sustainable manner. This is an excellent policy but the implementation of the integrated approach is not becoming a reality due to lack of clear strategies to execute the policies.

The population policy has a major goal of harmonization of the rate of population growth with the capacity of the country for the development and rational utilization of natural resources to the end that the level of welfare of the population is maximized over time. This is a very clear and important policy for environmental protection. Nevertheless, public awareness of the magnitude of the population problem trickles down very slowly.

There are also cases where the policy is misinterpreted to the disadvantage of the environment. For example, the energy policy requires cost-effectiveness for the implementation of the indigenous energy sources. The company in Ethiopia with the monopoly for power generation sticks to this criterion and thereby rates only large hydropower as a cost-effective source of energy. As a result, all other sources of renewable energy such as solar, small hydropower, wind, biogas and similar decentralized energy sources are rendered out of the picture, which leads to the increased shortage of energy in rural areas and thus the continued dependence on firewood resulting in negative implication to the environment. The energy policy should therefore be rectified to include the need to support rural energy supply initiatives in spite of not being cost-effective. The macro economic policy should also be tailored to allow subsidies and tax-exemption for such energy solutions, which could bring about environmental rehabilitation.

Acronyms

Acronyms and Abbreviation

ADLI Agricultural Development Led Industrialization

CDM Clean Development Mechanism

DPPC Disaster Prevention and Preparedness Commission

EEA Electric Energy Agency

EEPCo Ethiopian Electric Light and Power Corporation

EFAP Ethiopian Forestry Action Program

EGS Employment Generation Scheme

ENTRO Eastern Nile Technical Regional Office

EPA Environmental Protection Authority

ETB Ethiopian Birr

FAO - Food and Agricultural Organization

FDRE Federal Democratic Republic of Ethiopia

FFW Food for Work

GDP Gross Domestic Product

GEF - Global Environmental Fund

GTZ - German Technical Cooperation

GW Giga Watts

kV Kilo Volts

kWh Kilowatt hours

LE - Notation for the Egyptian Pound

MDGs Millennium Development Goals

MME Ministry of Mines and Energy

MoFED Ministry of Finance and Economic Development

MoWR Ministry of Water Resources

MT - Metric Tonne

MW Mega Watts

NBI-SVP Nile Basin Initiative Shared Vision Program

PASDEP Plan for Accelerated and Sustained Development to Eradicate Poverty

PSIR Political Science and International Relations

PSNP - Productive Safety Net Program REES Rural Electrification Secretariat

REES Rural Electrification Secretariat

RET Renewable Energy Technology

SFCDD State Forest Conservation and Development Department

SHP Small Hydropower

SNV Netherlands Technical Cooperation

UNESCO United Nations Education and Science Commission

UN-EUE United Nations Emergency Unit for Ethiopia

USD United States Dollar

VAT Value Added Tax

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