# MODULE 3

## Chapters 6 to 11

# 6 SUSTAINABILITY IN REGIONAL POWER PROJECTS

It is known that a country's energy development is closely linked to economic development. Even if energy development is often seen as a consequence of the level of development of a country, a new point of view is surfacing nowadays in the field of poverty reduction and socio-economic development. Power projects are now seen as major motive forces of socio-economic development. If socio-economic development is viewed through health, education and revenue improvement, it becomes clear that such socio-economic development is in key with efficient and clean forms of energy.

Moreover, to guarantee socio-economic development and poverty reduction, it is not sufficient to develop any kind of energy. The most efficient and clean types of energy are to be privileged because they render more possibilities for income generation and deteriorate less public health and the environment.

This chapter discusses the inter-linkages between environmental sustainability, poverty reduction strategies and socio-economic development activities within the context of regional power investment projects. It also suggests how these can be best implemented to benefit project host communities and environmental protection efforts in the Nile Basin countries.

## 6.1 Millennium Development Goals

In 2000, the United Nations Assembly established eight goals with their targets and indicators known as the "Millennium Development Goals (MDGs)" to reduce extreme poverty worldwide by 2015 using 1990 as the reference situation. The MDGs have made energy supply a major factor in sustainable development. Energy services destined to consumption (kitchen, lighting, heating, means of communication, etc.) are crucial to improve social welfare, and the energy services needed for production purposes, transportation and mobility, are indispensable for economic development. Power supply projects can contribute in different ways to all of the eight MDG.

In 2006, the Forum of Energy Ministers of Africa (FEMA) published a special report entitled "Energy and the Millennium Development Goals in Africa". Considering the role of modern forms of energy in achieving the MDGs in Africa, FEMA stated energy targets for African countries. These five targets are:

- “Doubling of the consumption of modern energy services including increased energy access for productive uses. The use of modern biomass technologies for industrial purposes to be explored.
- 50% of inhabitants in rural areas should use modern energy for cooking. Options should include improved cook stoves, which will result in both reduced air pollution and energy savings. Use of pressurized kerosene stoves and LPG stoves where the necessary support infrastructure is available can assist rural areas.
- 75% of the poor in urban and peri-urban should have access to modern energy services for basic needs.
- 75% of schools, clinics and community centres should have access to electricity as this would enhance their competitiveness.
- Motive power for productive uses should be made available in all rural areas”.

Linkages between energy and the eight MDGs have been established for Africa by FEMA. They are summarized in Table 6.1.

**Table 6.1 Matrix of Energy and the MDGs in Africa**

| | | |
|---|---|---|
| 1 | Eradicate extreme poverty and hunger | Increased modern energy is essential to generate jobs, industrial activities, transportation, and modernised agriculture in Africa. Most African staple foods need processing, conserved and cooked, and these require modern energy for reasonable quality of life. |
| 2 | Achieve universal primary education | Good educational facilities need electricity for teaching aids and for homes of students and teachers. Many children, especially girls, do not attend school in order to satisfy family subsistence needs. |
| 3 | Promote gender equality and empower women | Lack of access to modern fuels and electricity affects women and so lead to gender inequality. Household activities mostly done by women could be made easier with modern energy and save time. Time saved could be used for more productive activities. |
| 4 | Reduce child mortality | Diseases caused by poor quality water, and respiratory illness caused by the effects of indoor air pollution from traditional fuels and stoves, directly contribute to infant and child mortality |
| 5 | Improved maternal health | Women are disproportionately affected by indoor air pollution and water- and food-borne illnesses. Lack of electricity in health clinics, poor illumination in night deliveries, and daily household chores all contribute to poor maternal health, especially in rural areas. |
| 6 | Combat HIV/AIDS, malaria and other diseases | Electricity for communication (radio and television) is needed to spread important public health information to combat deadly diseases. Also, electricity is needed for illumination, refrigeration, sterilization, etc for effective health services. |

| | | |
|---|---|---|
| 7 | Ensure environmental sustainability | Energy production, distribution and consumption in Africa has many adverse effects on the local, regional and global environment including indoor, and air pollution, and land degradation. Cleaner energy systems are needed to address environmental sustainability. |
| 8 | Develop a global partnership for development | The World Summit for Sustainable Development called for partnerships between public entities, development agencies, civil society and the private sector to support sustainable development, including the delivery of affordable, reliable and environmentally sustainable energy services. |

Source: FEMA, 2006 (adapted from UNDP 2005)

The MDGs will be taken into account by the NBI EA framework for regional power investment projects. This aspect will be implemented in the Environmental Assessment procedure at different stages of the life cycle project. For instance, the scoping of a project will identify to what extent it contributes or not to the achievement of the MDGs in the host countries and communities.

### 6.2 Ecological aspects of power projects sustainability

The development of regional power projects such as an important hydroelectric project may have various sources of impact on natural ecosystems. These impacts include changes in annual flow and sedimentary regime downstream and upstream of the dam, modification to terrestrial ecosystems and losses of biodiversity, emission of greenhouse gas, interference with migration pattern of fish and reduction in flooding of riparian habitats downstream. Finally, new hydroelectric projects can generate cumulative impacts when they are planned within a basin including existing dams.

Hydroelectric projects require dams and reservoir which often flood large areas. The area of influence of the projects extend from the upper limits of the watershed zone for the reservoir to the downstream extremity, whether an estuary, a coast or an off-shore area.

The creation of a reservoir requires to flood valleys which are normally the habitat of a larger number of animal and vegetal species than other physiographic units of the catchment. Areas surrounding new reservoirs support habitats less attractive for wildlife than those lost in the reservoir and thus represent some limits for wildlife species displaced by the flood. Consequently, large impoundment can have dramatic effects for endangered species. Land used by human populations relocated upstream of the flooded areas can exhacerbate the degradation of habitats for wildlife and vegetation due to various activities like deforestation, irrigation and agriculture. In addition, the loss of vegetation in the upstream catchment can increase the volume of sediments trapped in the reservoir, and thus affect water quality. The sedimentary regime downstream of the reservoir can also be significantly modified by the presence of the dam. All these adverse effects are difficult to mitigate.

However, hydropower development can facilitate other uses than power generation, such as commercial or subsistence fisheries for riparian populations. Shallow reservoirs are generally more productive for aquatic wildlife. This increase in productivity, enhanced by flooding terrestrial ecosystems and the release of important quantities of nutrients, is significant in the first years following the filling of the reservoir. Thereafter, these effects gradually decrease. The fisheries potential of new reservoirs can significantly increase by implementing multi-functional techniques such as clearing the vegetation in productive areas of the reservoir.

Large reservoirs can contribute to greenhouse gas emissions due to the decomposition of flooded vegetation. These emissions can be mitigated by the deforestation of the reservoir before filling it, particularly areas where the vegetation is quite dense. By clearing the vegetation of the future reservoir, this can force the displacement of animal populations before the flooding, and thus minimise mortality by drowning during the filling of the reservoir. In addition, the period of filling shall be considered as a mitigation measure that could have positive effects on the rate of mortality of most vulnerable species.

The important changes in downstream hydrology of the river system have well known impacts on riparian and aquatic ecosystems. Fish population may decline downstream in consequence of change in flow regime (ex: lack of dissolved oxygen, sedimentation dynamic or riparian vegetation, blocking migration of aquatic organisms). One good way to mitigate the adverse effects of hydrological changes downstream of the dam is to maintain an environmental flow. The experience shows that to be efficient, this measure should be integrally part of the project planning. The environmental flow can vary in accordance with the life cycle of wildlife populations (ex: spawning period of fish species) living downstream of the dam or to ensure navigation for riparian human populations. Other measures, such as the establishment of sills or fish ladders, can contribute to minimise the effects of hydrological changes on the water level regime, bank erosion and fish migration.

Like any power plant, thermal power projects can change the biodiversity in the area of the proposed project. Emissions from thermal plants, in particular coal-fired plants, can act as precursors of acid rains. These will alter aquatic ecosystems and damage forest ecosystems. Taking big volumes of water from rivers and bays for plants cooling system can induce mortality of aquatic organisms encroached in the cooling system. This can reduce the populations of fishes and other aquatic organisms. Heated water discharges from the plants in the rivers can raise water temperatures thereby reducing plant and fishes in the natural water bodies. However, thermal power plants can also favour a significant rise in some fish species adapted to the new temperatures. These species may compensate for the decline and provide an important source of income. Anticipatory planning must identify these changes and opportunities in the natural water resources in order for the local populations to benefit from them.

Power transmission lines are typical linear projects. They have a long but narrow corridor of impacts. A transmission line is usually only 12 to 25 meters wide. The sources of impact that may affect the environment are development and clearing of the host sites and the clearing required for installation of the power transmission line. The clearing anticipated for the project will leave valuable firewood or lumber resources in its wake. These timber resources represent a benefit of the project, which should be redistributed to the persons affected by the project. Natural resources located under the line, substations and pylons may be lost temporarily or permanently.

In addition, construction of the power line right-of-way may result in the loss and fragmentation of habitat and vegetation along the line. These effects can be significant if fragile natural areas, such as wetlands or natural forests are affected. Appropriate planning and identification of the power transmission line route can allow to minimise the impacts on fragile and sensitive components of the environment.

The control of vegetation in the right-of-way is often necessary to protect the power line. Various techniques exist for controlling the growth of vegetation. From an environmental and social point of view, selective clearing using mechanical means by local workers is most preferable in NBI countries and should be evaluated in the framework of the project environmental assessment. Aerial spraying of herbicides should be absolutely avoided because it may result in contamination of surface waters and terrestrial food chains, as well as elimination of desirable species and direct poisoning of wildlife which would be very harmful for the environment, its resources and biodiversity.

**Box 6.1 Guiding principles for the ecological sustainability of power projects**

1. Through the preparation of an hydropower project, and especially during the EIA, plan for multi-functional techniques such as clearing the vegetation of the reservoir in order to enhance fisheries development in potential productive areas, minimise greenhouse gas emissions, water quality degradation and wildlife mortality, and facilitate navigation in the reservoir.
2. Plan for an environmental flow to minimise changes in downstream hydrology of the river system, in accordance with the life cycle of wildlife populations and to ensure navigation for riparian human populations.
3. Plan for other measures to minimise the effects of hydrological changes on the water level regime, bank erosion and fish migration, such as the establishment of sills or fish ladders.
4. Implement integrated watershed management in the catchment area of the reservoir in order to minimise soil erosion.
5. For thermal power projects, plan to minimise atmospheric emissions in compliance with emissions and ambient air international standards.
6. Minimise heated water discharge by favouring closed cooling system circuits.
7. Anticipate changes in the natural water resources in order for the local population to benefit from the new opportunities.
8. Plan and identify power transmission lines routes to minimise impacts on fragile, sensitive and protected areas.
9. Plan for local populations to benefit from the cleared forest resources.

## 6.3 Social aspects of power projects sustainability

Power projects may reduce poverty and benefit the population. Access to electricity promotes economic activities, eases domestic chores, improves health and education services, etc. However, they may also have negative impacts which will deepen poverty if those impacts are not identified and mitigated up front.

It is essential that the social benefits and impacts of power projects be considered in order to contribute to the MDGs and achieve sustainable development. Guidelines shall be followed for the integration of the socio-economic key issues in the unified standard EA framework for the regional power investment project. These guidelines will ensure an inter-linkage between environmental sustainability, poverty reduction and socio-economic development.

Several socio-economic key issues must be considered in the NBI EA framework in order to ensure that the social impacts of the projects to be screened will be examined in depth during the EA procedure. Key issues that must be considered are:

- Changes to the use of natural resources in the project area;
- Involuntary resettlement of population which may result in a worsening of poverty;

- Indigenous communities;
- Gender issues;
- Public health issues;
- Physical cultural resources or cultural heritage;
- Consultation of the stakeholders.

### 6.3.1 Changes to the use of natural resources in the project area

The use of natural resources refers to all uses by local populations of water, vegetation, wildlife and minerals which availability may be affected during the construction and operation of a power project. In rural areas such as the Nile Basin, most of the population livelihoods are land-based. Therefore, these people are very dependent on their biophysical environment. Any change in the forests and the aquatic ecosystem may entail reduction of the volume of available fishes, game, medicine plants, fruit-trees, etc. These are either used for self-consumption or income generation. Their reduction is likely to cause impoverishment of entire communities or the most vulnerable groups among them if programmes and measures are not planned to maximize the potential benefits of the projects.

Failure to identify these impacts at an early stage of the project preparation makes it difficult to find appropriate solutions afterwards. Therefore, changes in the access to natural resources shall be identified at the screening stage of the project.

One way of doing so is to take advantage of rural traditional knowledge. Indeed, rural populations in the NBI countries have been living over centuries in harmony with their surroundings, gained a deep understanding of the complex way in which the components of their environment are interconnected. Rural traditional knowledge has been and continues to be accumulated through time spent living on the land for many generations. It encompasses all aspects of the environment and sees humans as an intimate part of it. Traditional knowledge is part of the collective memory of the communities. The holistic view of the environment is generally based on fundamental values that support sustainability. In addition, traditional knowledge includes qualitative information on animals, plants and other natural phenomena. Traditional knowledge of local populations may help scientists recognize and evaluate species and spaces at risk and therefore, save time and money by guiding field work.

The changes produced by hydroelectric projects to the environment and resources used in the area, also offer important economic opportunities for the local communities. A major option is to incorporate affected people within irrigation schemes and develop reservoir fisheries. Dams and reservoirs offer chances to develop irrigation which can generate important increases in crop production and living standards of peasants in a sustainable environment. Well-planning, implementing and managing of the irrigation facilities and, giving priority to resettlers and downstream villagers in the irrigation schemes can produce very important benefices for local populations.

When soils present no important limitation to agricultural production, it is possible to promote local small irrigation projects around reservoirs. Manual or mechanical pumping from the reservoir can allow the growth of a large variety of products (vegetable, fruit, cereal, others). However, water availability (quantity, distance of transport) is subject to seasonal water level variations of the reservoir. In addition, a detailed market study is generally required to ensure that the increase in food production can be matched with a proper demand, on a local, national and/or international level. It could also be important to introduce small scale processing industries that could easily absorb the raw products, add value to these products and create more job opportunities for the local population.

Gravity irrigation can generally be achieved downstream in proximity of dams. Large gravity irrigated perimeters represent high investment cost but allow lower operational cost inj comparison with pumping irrigation. Proper water management organizations need to be created and technical support must be provided. Local small irrigation projects can also be achieved downstream of dams, with manual or mechanical pumping. In every case, appropriate enhancement measures such as improved seeds, fertilizers, tools and equipments must be planned in the project.

Large dams also offer important opportunities to develop reservoir fisheries for project affected people. In order to ensure that these people will become beneficiaries, it is essential to plan for instance training programs and technical assistance for them and to grant them a privileged access to the reservoir. In addition, it should be highlighted that hydroelectric projects offer important opportunities to expand fishing activities for local communities on the upstream of the dam and also downstream through the regulation of water levels. All these opportunities and appropriate enhancement measures must be investigated on a participatory basis and designed at an early stage of the project planning.

Besides, it should be noticed that the lessons learned from the past have resulted in improved hydroelectric projects. More and more, a sustainable development approach guides the planning and management of dams and reservoirs. They are designed to serve a wider range of development purposes.

Transmission lines can generally open up remote lands to human activities such as settlement, agriculture, hunting, fishing, recreation, etc. These activities will inevitably entail changes to the environment and resource use in the area. For instance, housing development may occur in uninhabited areas, unexploited lands may be used for crop production, hunting may reduce game in forests unexploited until then, etc. Therefore, transmission lines will have an impact on the environment and resource use in the area of the proposed project.

Indigenous peoples are distinct populations in that the land on which they live, and moreover the natural resources on which they depend, are part of their identities and cultures. They have very closed ties to forests, water, wildlife and natural resources. Therefore, if a transmission line project involves land acquisition or, commercial development of natural resources on land or territories that the indigenous peoples use or occupy, this project will have adverse impacts on the affected indigenous community. In this case, there will be a need for an Indigenous Peoples Plan.

**Box 6.2 Guiding principles for the social sustainability of changes in the access to natural resources**

1. Throughout the project planning and especially during the EIA, integrate the local communities' knowledge concerning the area's environment and its natural resources.
2. Consider potential losses in the access to natural resources as a social and economic risk for the population.
3. Perform an inventory and evaluate all the potential natural resources losses which will affect the income sources or means of livelihood of the population.
4. Consider the affected people as part of the displaced population even though they are not physically relocated.
5. Therefore, integrate these affected people in the resettlement plan in order to restore their livelihood and living standards.

### 6.3.2 Involuntary resettlement

Power projects require land acquisition and therefore, they entail displacement of population. In many African countries, involuntary resettlement is one of the major issues of hydroelectric projects. According to a former World Bank's senior advisor for social policy and sociology, “Forced population displacement caused by dam construction is the single most serious counter-developmental social consequence of water resource development” (cited in IUCN and the World Bank, 1997, p.42).

The risks of impoverishment that involuntary resettlement may cause, are well known. They include:

- The physical loss of homes and lands;
- The loss of productive assets;
- The loss of means of incomes and livelihood;
- The physical loss or access deprivation to basic community facilities and services (schools, clinics, wells, markets, etc.);
- Change in land use which affects the fertile and productive land for agriculture;
- The disruption of community networks and institutions, loss of cultural identity and loss of social fabric;
- The economic marginalization;
- Host-resettlers conflicts;
- Social exclusion;
- Impoverishment of the affected households;
- Marital conflict resulting to divorce and family instability.

Failure to identify these issues at an early stage of the project preparation makes it difficult to find appropriate solutions. Therefore, resettlement issues shall be identified from the screening and scoping stages of the project.

*Cairo*

At the same time, objectives and programmes shall be defined to take advantage of the economic opportunities generated by a power project, including for the local population. For instance, early planning of training and building capacity programs will favour the assignment of contracts to local enterprises and the recruitment of local manpower during construction of the power plant and the subsidiary structures. Assessment of the population training needs should be carried out on a participatory basis. This will enable the project to design the appropriate training and other requirements for the target population.

Early formulation of a resettlement plan elaborated to fit the particular context of the project is the recommended strategy to deal with displacement. The guiding principles figure in Box 6.3.

**Box 6.3 Guiding principles for the social sustainability of resettlement**

1. Minimize displacement through an investigation of all feasible project alternatives.
2. Plan carefully the resettlement plan ensuring that the resources will be sufficient to enable the displaced population to directly share the project benefits. The resettlement plan must represent a development opportunity for the resettlers.
3. Consult and involve the potentially displaced groups in the preparation and implementation of the resettlement plan. The technical design of the plan should integrate the options and solutions formulated by the affected persons. The involvement of project affected people (PAP) can be done by establishing working group with a representation from the affected communities and the respective authorities. The process should be transparent enough for all parties in order to avoid unnecessary confusions in due course.
4. Provide resettlers and host communities with sufficient compensation and assistance to guarantee that their livelihoods are improved or at least restored, to ensure that they are not put at a disadvantage. Special attention should be given to the vulnerable groups including women, orphans, elderly groups, etc.
5. Favour local businessess and local manpower in the resettlement process in order to induce economic development.
6. Develop an entitlement framework for the affected people and disseminate the information to the affected people. This will reduce the complaints about the eligibility and entitlements.
7. Put aside adequate provisions for compensation activities. There should be a reasonable and tolerable time from the time of decision to the time of effecting compensation to avoid loss of value due to inflation.
8. Put in place a practical institutional set up to administer the compensation process.
9. Allow for a close monitoring of the plan to identify any need to make changes during implementation. Even detailed plans will require adjustments to adapt to changing circumstances among the resettlers and the host communities.
10. Make provision for a monitoring of the resettlement operations until the livelihood and living standards of the displaced population and host communities are restored.
11. Develop the monitoring indicators to track socio-economic changes taking place during and after project implementation. Therefore, the basic information / profile of the affected households should be collected before any development intervention.

### 6.3.3 Indigenous communities

Identification of the project impacts on the potential changes in the environment and resources used by the population may highlight the existence of indigenous communities nearby the project area. Indigenous peoples are distinct populations in that the land on which they live, and moreover the natural resources on which they depend, are part of their identities and cultures. They have very close ties to forests, water, wildlife and natural resources. Ensuring that a development project respects the human rights, economies and culture of indigenous peoples contributes to poverty reduction and sustainable development.

In the NBI countries, indigenous peoples used to be nomadic. Most of them are still semi-nomadic, living in camps in the forests. Though they trade with specific groups of neighbouring farmers to get cultivated food, they are hunter-gatherers, living mostly on the wild products of their environment. Forest-dwellers, indigenous peoples are frequently among the most marginalized groups in their country. Their collective attachment to ancestral territories and usage of the resources of these territories may not be recognized by national or customary laws relative to ownership, occupancy and land use. However, their access to these territories is essential to the sustainability of their cultures and livelihoods.

*Batwa women*

If a project involves land acquisition or, commercial development of natural resources on land or territories that the indigenous peoples use or occupy, this project will have adverse impacts on the affected indigenous communities.

Involuntary resettlement of indigenous peoples or, involuntary restrictions on access to territories that these people traditionally use or occupy, must be identified at a very early stage of the project. Since physical relocation of indigenous peoples is very complex, alternatives to the project design must be explored to avoid such relocation.

At the screening stage, it is essential to identify whether or not, indigenous people live in, or have collective attachment, to the project area. For the purposes of planning the development of any area of land, it should be assumed a priori that any forest may be occupied or claimed by groups including indigenous communities. Even if there are no visible signs of occupation, the land may be occupied intermittently and exploited by communities whose lifestyles depend on frequent movements.

In exceptional circumstances when project designs may not be modified, the project proponents must prepare an Indigenous Peoples Plan. This process will be detailed in chapter 7.

**Box 6.4 Guiding principles of the social sustainability for indigenous communities**

1. At the screening stage of project preparation, identify whether or not, indigenous people live in, or have collective attachment, to the project area.
2. Based on the screening, undertake a social assessment to evaluate the projects potential impacts on the indigenous communities.
3. Examine project alternative designs to avoid any involuntary restrictions on access to territories that indigenous people traditionally used or occupied.
4. If alternatives can not totally avoid involuntary restrictions or resettlement, engage in free, prior and informed consultation with indigenous communities during social assessment.
5. If the project receives a broad support by the affected indigenous communities, develop with them an Indigenous Peoples Plan. This plan will set out the measures that will ensure that the affected people receive culturally appropriate benefits from the project and get compensations for the adverse impacts which can not be avoided.

### 6.3.4 Gender issues

The linkage between gender, energy, poverty reduction and sustainable development has been well demonstrated. The following document provides detailed information on the subject: UNDP, **Gender and Energy for a sustainable development: a toolkit and resource guide**, New York, 2004, 85 pages.

Access to affordable energy services is an essential condition to achieve poverty reduction and socioeconomic development. Approximately 2 billion people throughout the world have no access to electricity. About the same number depend on traditional fuels, mainly wood and wood coal, for cooking and heating.

Grid-based electrical power does not reach many rural areas in the Nile Basin Initiative countries, nor is there adequate distribution of gas or other efficient domestic fuels. Women are more affected than men by limited access to energy. Because of their traditional responsibilities for providing household energy by collecting fuel, women and girls would benefit the most from access of the households to improved energy services.

*African women*

Literacy rates and school enrolment levels are very different for men and women in the NBI countries. The time and physical effort spent by women and girls in gathering fuel (and carrying water) obviously limits their ability to enrol in school and engage in income-generating activities. Much of women's time is consumed by chores related to producing and cooking food without clean-burning fuels and energy efficient appliances.

In addition to the time and physical burdens involved in gathering wood or other traditional fuel, women endure long-term physical harm from tiring work without sufficient rest time. It has also been demonstrated that using biomass for cooking exposes women to health hazards due to cooking over poorly ventilated indoor fires.

Reduced chores for women and increased access to non-polluting power for household and productive activities can have remarkable effects on women's levels of health, empowerment, education, literacy, economic development, and involvement in community activities. These improvements in women's lives can have significant beneficial impacts to reduce poverty of these women, their families and communities.

Energy policies relating to fuel choices, electricity generating capacity, and energy delivery systems have impacts on development that are not generally analysed in their gender dimensions. Men and women may be affected differently by energy policies. For instance, the distribution of electricity without paying attention to the provision of modern cooking fuels or appliances may result in rural electrification that in fact increases the hardships of women: the working day is prolonged while traditional cooking fuel collecting and use remain unchanged. Attention to these kind of differing needs is required to achieve effective and equitable distribution of energy services.

Assessing the impacts of a power project on women involves an approach based on users' needs: "Energy planning is often focused on increasing supplies of fuel or electricity, especially for industrial and urban uses, with little attention to the energy demand characteristics of women, especially those in underserved rural areas. Rural energy needs for domestic, agricultural, and small-scale informal production activities, where women predominate, are given low priority. As a starting point for gender-sensitive energy planning, it is important to identify the energy services of primary importance to women and to consider options for providing those services. Approaches that favour demand-side considerations rather than supply-side energy targets are more likely to positively reflect women's actual needs. Overall, in order to reach the MDGs, energy should be considered within the context of community life, and energy policies and projects should be integrated in a holistic way with other programmes related to health, education, agriculture, and job creation" (UNDP, 2004, p.9-10).

Moreover, gender variations shall be a core concern in social analysis throughout the environmental impact assessment. Social analysis will focus on the fact that communities are composed of diverse groups and that gender is a variable likely to be environmentally significant. Since women and men have different social status and distinct needs, play different economic roles and, have diverse accesses and uses of resources, a given power project will have different impacts on men and women.

In accordance with the World Bank Social Analysis Sourcebook (2003), social diversity and gender issues will be incorporated in the environmental impact assessment's Terms of Reference. Gender analysis will focus on gathering gender-disaggregated information and data on men's and women's status, roles, activities, needs, constraints, opportunities and relationships.

**Box 6.5 Guiding principles to link gender equity and social sustainability**

1. Take into account demand-side considerations as well as supply-side energy targets while assessing a power project impact.
2. Incorporate social diversity and gender issues in the EIA Terms of references.
3. Analyse social dimensions of a project impact using gender-disaggregated information and data.

### 6.3.5 Public health issues

Section 6.1 has highlighted the links between a better access to electricity and the improvement of health conditions and the achievement of the MDGs through reduction of child mortality, improvement of maternal health, fight against HIV/AIDS, malaria and other diseases. Though power projects have the potential to reduce poverty, their operation may also present health hazards. The typical health impacts of power projects are reminded here:

- Hydroelectric projects: creation of a reservoir and associated water management structures may increase water-borne or water-related diseases as a result of standing water providing habitat for mosquitoes and other disease-carrying animals: malaria, schistosomiasis, onchocerciasis, encephalitis, etc.
- Thermal power projects: Large power plants can be noisy, inducing long term health problems to the population living in the vicinity of the plant.
- Electric power transmission systems: Low-slung lines near human activity raise the risk for electrocution. Electric power transmission lines generate electromagnetic fields (EMFs). The strength of EMF decreases with distance from transmission lines. Though there is no scientific consensus, the evidence suggests that health hazard may exist in the EMF of high-voltage transmission lines.

Besides those health impacts which might occur during the operation phase of the projects, expansion of VIH/AIDS during construction of the infrastructures is a major health concern. Power plant construction, especially dams, usually takes several years to build. It may extend from two to ten years, sometimes even longer. This involves the influx of several thousand workers for building the plant. Local workers tend to be only a small minority of the labour force since they seldom have the skills required to be hired. The desire to build the structures as fast as possible will often mean that cheap but well-trained workers will be hired from other regions or other countries. These workers are usually either single or living on the construction sites without their families. They generally receive cash wages on a regular basis and are often much wealthier than the local populations of the area. This situation is likely to promote the development of prostitution. This is a high potential for expansion of sexually transmitted diseases (STDs) including HIV/AIDS.

Moreover, most power projects include transmission lines. It is well known that transportation corridor projects in Africa are a predominant route for the spread of HIV/AIDS on the continent. The construction of a transmission system entails the use of a team of workers which moves with the progression of the construction, all along the corridor of the line for hundreds of kilometres. This situation represents an ideal pattern for the transmission of HIV/AIDS in the remote rural areas crossed by the transmission line.

Short and long term effects of a project on public health have an important impact on poverty and sustainable development. Considering the potential health hazards of power projects notably during the construction phase, this issue must be considered at the initial stage of preparation of the project. The scoping of the project will determine if a Health Impact Assessment (HIA) is required.

*Aquatic weeds in Nile River*

According to the World Health Organization (WHO), “When HIA is undertaken early in the development process of a proposal it can be used as a key tool for sustainable development. HIA allows the identification and prevention of possible health (and other) impacts right from the start in policy and decision-making. This enables health objectives to be considered at par with socio-economic and environmental objectives, bringing sustainable development closer. Another feature of HIA is its possible combination with other impact assessment methods. This integration allows proposals to be assessed from a sustainable development perspective including: health; education; employment; business success; safety and security; culture, leisure and recreation; and environment. Drawing on the wider determinants of health, and working across different sectors, HIA has the ability to link well with the sustainability agenda” (www.who.int/hia/about/why/en/index1.html).

**Box 6.6 Guiding principles to link health and social sustainability**

1. Consider potential health impact of a project at the initial stage of its preparation notably transmission of HIV/AIDS during construction of all type of power projects and, water-borne or water-related diseases associated with reservoirs of hydroelectric projects.
2. Transportation corridor projects being a predominant route for the spread of HIV/AIDS in Africa pay a special attention to the health risks entailed by the construction of power transmission lines.
3. At the scoping stage, establish if a Health Impact Assessment is required for the project as part of the EIA

### 6.3.6 Physical cultural resources

Physical cultural resources are important as sources of precious historical and scientific information and, as resources for economic and social development. They are also basic elements of people's cultural identity; they keep alive ties of the societies to their past and their cultural traditions. Therefore, their preservation for future generations is essential and as such, it is part of sustainable development.

The World Bank defines physical cultural resources (or cultural heritage) as follows: "movable or immovable objects, sites, structures, groups of structures, an natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. […] Their cultural interest may be at the local, provincial or national level, or within the international community" (World Bank, OP 4.11, p.1).

*Nile River in Egypt*

More and more physical cultural sites are being endangered by the need for development and by project activities. The loss of such resources is irreversible, but it is generally avoidable. Potential impacts of a project on physical cultural resources can be identified and, avoided or mitigated thru an environmental assessment process.

Power projects located in the vicinity of physical cultural sites may endanger similar sites. For instance, a reservoir may perhaps inundate sites of important cultural significance. Excavation and earth moving during construction of a power plant might destroy archaeological artefacts. Air emission sources (sulphur dioxide, oxides of nitrogen, carbon monoxide and particulates) from the combustion of fuels of thermal power projects may possibly have long term negative impacts on constructions of high historical value. Therefore, impacts of a power project on physical cultural resources shall be identified during the EA procedure (see chapter 7).

**Box 6.7 Guiding principles to link physical cultural resources and social sustainability**

1. Consider potential impacts of a project on physical cultural resources at the initial stage of its preparation.
2. Incorporate physical cultural resources issues in the EIA Terms of references.

### 6.3.7 Participation and consultation of the stakeholders

While planning and implementing projects, affected people have often been viewed as the target of poverty reduction efforts. Nowadays, a new approach called Community Driven Development (CDD) is adopted by major funding agencies. This approach treats poor people and their institutions as stakeholders in the search for sustainable solutions to development challenges. CDD is an approach that gives power to community groups and local governments for planning decisions and investing resources to reduce poverty. The principles of CDD include consultation and participation of the population in the planning, implementation and monitoring of projects.

Understanding the social implications of projects is critical in ensuring that the proposed project contributes to equitable and sustainable development. In the EIA, social analysis aims to identify the social dimensions of projects including the different stakeholder perspectives and priorities. Therefore, social analysis needs to establish participatory processes with the stakeholders, incorporate their views in the assessment and take into account their options in the design of the project.

Public consultation in the EA process is well documented. Since 1989, the World Bank requires that affected groups and NGOs be consulted as part of the environmental assessment of projects particularly those classified as Category A. This requirement is based on the important links existing between public consultation and project social sustainability in host communities. Consultation leads to a better understanding of public concerns and more acceptable decisions by projects proponents.

Consultations serve to give project information to the public and affected communities. They also serve to incorporate stakeholders' opinion and needs in the project design including their fears and expectations.

The benefits of public consultation are numerous. During EA process, the consultations serve, among other things, to identify:

- Socio-economic profile of the affected communities;
- major issues to be resolved;
- specific concerns notably about land acquisition and resettlement;
- adverse social impacts that may entail a decline in the living standards of the population;
- appropriate mitigation measures to protect the community's livelihoods;
- additional measures to maximize benefits to the project host communities;
- stakeholders' institutions and their potential responsibilities during project preparation and implementation.

Public consultation and participation are commonly accepted as important components of the decision making process regarding large dam projects. They are required to generate appropriate and sufficient information for impact assessment, but also, they provide insights on the means by which public support for a project can be mobilised.

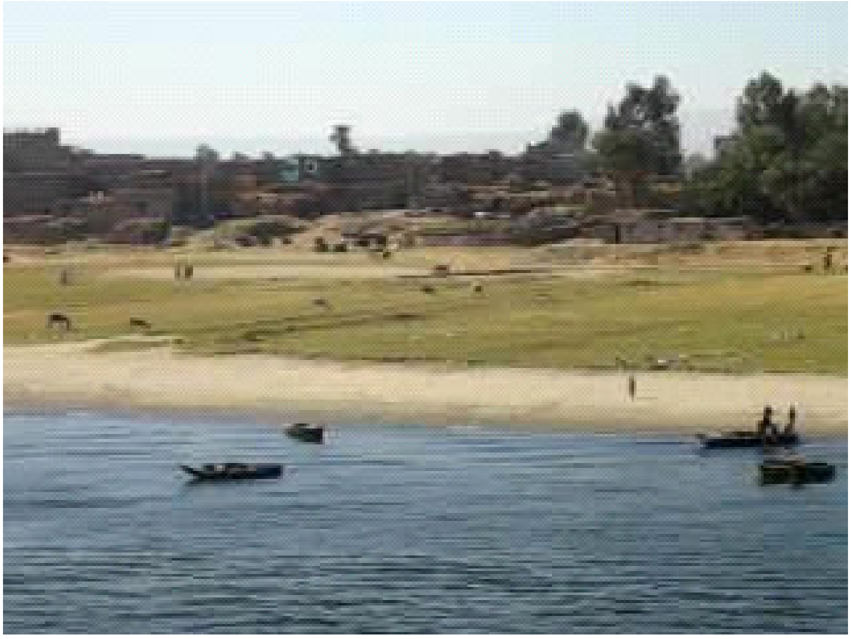
Yet, public consultation is essential for all types of power projects. For instance, the corridor selection process for an electric power transmission system can include key stages where the project proponent invites and encourages inputs from decision-making authorities, representative groups and from members of the community. Community workshops will provide a valuable opportunity to listen to community concerns and to incorporate suggestions into the project planning process. Furthermore, the participants may provide valuable local knowledge about significant sites located within the corridors. Features may include:

- areas of high agricultural/ horticultural value;
- sites of indigenous heritage significance;

- features of environmental significance;
- recreational areas;
- future development proposals.

The constraints and sites that attendees identify can be GIS mapped and presented in a second workshop. They are then analysed and the corridor options are refined in light of this feedback. Following the workshops, a series of meetings can be held with affected landowners or occupants in the transmission corridor.

*Cruise on mid-Nile River*



In any case, the results of the consultations shall be reflected in the design of the project. Box 6.8 gives the basic principles to ensure that public consultation is integrated to the EA process to ensure social sustainability of power projects. Appendix 3 provides details on the consultation objectives at each step of the EA process, the designing and implementation of a public consultation plan and, the techniques for public consultation.

**Box 6.8 Guiding principles to link public consultation and social sustainability**

1. Identify stakeholders groups
2. Provide effective and timely disclosure of project information to the stakeholders
3. Ensure their involvement starting from the scoping stage of the EA
4. Identify their concerns and include them in the Terms of Reference of the EIA
5. Ensure that expertise for an effective consultation is provided
6. During the EIA, identify mitigation and additional required measures with the stakeholders
7. Ensure that the concerns and proposals of the stakeholders are reflected in the project design
8. Disclose the results of the EIA to the stakeholders
9. During project implementation, inform the stakeholders about the Environmental Management Plan, ensure their involvement in the project's monitoring and, maintain a complaints and grievance procedure
10. Throughout the life cycle project, keep a record of all consultations including dates, names, topics of discussion and outcomes.

## 6.4 Economic aspects of power projects sustainability

As discussed in the previous sections, power projects can be closely linked to economic development if proper impact mitigation measures are elaborated, if comprehensive resettlement plans are established and if local development plans are included in the project. In such cases, power projects can have a positive economic influence by increasing labour productivity, creating jobs, creating more added value to local production, converting economic activities, converting land use, diversifying economic activities, increasing food production and increasing economic activity. Moreover, health improvement, better education, time saved, better living standards, better transportation, better access to natural resources, are also contributing factors to economic development.

*Ferry on Nile River*

In projects where no proper attention is paid to the economic impacts and their mitigation, negative impacts such as a decrease in food production, impoverishment, inflation, fluctuation in currency, decrease of economic activity, job losses and concentration of economic activity can be observed, thus, the importance of analysing the economic impact of a project up front.

Power projects entail various impact sources such as involuntary resettlement, changes in the environment, alterations in resource use in the area, disturbances to indigenous communities, modifications in gender issues and changes in public health. All of these impact sources can generate positive and/or negative economic impacts on the persons affected by the project (PAP).

In the case of involuntary resettlement, power projects can induce the loss of productive assets, the loss of means of income and the loss of livelihood. In order to minimize these impacts, projects must identify proper mitigation and development measures that can ensure local economic development. Proper resettlement plans accompanied by comprehensive development plans can become efficient tools in economic development in the resettlement areas. These plans must identify the pertinent development opportunities according to the PAP's socio-economic characteristics and economic development needs. A good comprehension of the PAP's development needs will become a solid base to economic development in their new environment.

When hydroelectric power projects and their reservoirs change the environment and modify the resources used in the area, they can cause significant losses in pasture and agricultural land in the reservoir area and cause a decrease in fish captures downstream. On the other hand, these projects offer great economic opportunities for the local communities. In fact, presence of regulated water levels downstream and the newly created reservoirs can develop new fishing opportunities as well as develop irrigation schemes. These new economic development opportunities cannot fully contribute to economic growth if they are not elaborated on the basis of socioeconomic baseline studies and if they are not accompanied by extensive training programs for the beneficiaries. The development programs must also take in consideration the indigenous communities that may have different development needs than the majority of the PAPs.

Regarding gender issues associated with power projects, it is well known that affordable energy supply is an essential factor in poverty reduction and socio-economic development.

Because of women's traditional responsibilities in their homes, improved access to energy services can alleviate women's workload usually dedicated to collecting fuel. This chore reduction, as well as the new access to non-polluting power for household and productive activities, can have beneficial effects on women's levels of health, empowerment, education and literacy. These opportunities can be transformed in sustainable economic development if the power projects identify appropriate gender oriented mitigation measures.

In terms of public health, power projects, through their resettlement and development plans, can improve the general public health level, through better health services, better disease prevention. Good health is directly correlated with better labour productivity, which in turn contributes to economic development.

Moreover, in order to maximise a project's influence on local economic development, the project's benefits must not only be shared with the project beneficiaries but also with the persons directly affected by the project. Therefore, power projects will need to pay particular attention to the persons they directly affect by financing local energy distribution to them through the project's economic rent[2] for example.

**Box 6.9 Guiding principles to take into account economic aspects of projects sustainability**

1. Analyze the economic impacts of a specific power project up front.
2. Mitigate the negative economic impacts in order to avoid situations such as decrease in food production, impoverishment, inflation, fluctuation in currency, decrease of economic activity, job losses and concentration of economic activity.
3. Enhance the positive economic impacts to attain increases in labour productivity, jobs creation, more added value to local production, conversion of economic activities, conversion of land use, diversification of economic activities, increases in food production and increases in economic activity.
4. Include local development plans as important parts of the project power.
5. Finance local energy distribution to the communities directly affected by the power project through the project's economic rent for instance.

[2] The economic rent is the revenue surplus related to a production factor in addition to what is required to induce this factor's participation in the production process. The value of the economic rent is measured by the difference in a product's sale price and its economic cost of production, including the normal return on capital. Economic rents exist in hydroelectric dam projects because these projects use natural resources and because there usually is a gap between world and cost prices for basic products such as electricity and petroleum for example.

## 6.5 Positive impacts of regional power projects on local communities

As demonstrated previously in this Chapter, power projects can have many positive impacts on local communities. These impacts include:

- Economic opportunities for peasants with the development of irrigation schemes and significant increases in crop production and living standards;
- Economic and health opportunities for rural populations with the development of reservoir fisheries which in addition to an increase of incomes, will allow an intake of proteins and a diversity of diet;
- Enhancement of living standards thru comprehensive resettlement and local development plans including social infrastructures, upgrading of housing, training, etc.;
- Economic development thru Increases in labour productivity, job creation, added value to local production, diversification of economic activities, rise of food production, etc.

Moreover, one of the most important positive impacts on local communities is rural electrification. Power projects offer important opportunities to bring affordable energy services to local communities. Access to these services is an essential condition to achieve poverty reduction and socioeconomic development of these communities. Therefore, affordable local energy services must be planned as part of the power project during its preparation. This can be done by taking into account demand-side considerations as well as supply-side energy targets while assessing a power project impact assessment. Demand-side considerations will involve the construction of transforming terminals and distribution lines which must be planned and budgeted in the project costs.

**Box 6.10 Guiding principles to improve positive impacts of power projects on local communities**

1. Develop irrigation schemes to increase crop production and living standards.
2. Develop fishing reservoirs which will increase incomes, allow an intake of proteins and a diversity of diet.
3. Develop comprehensive resettlement and local development plans to improve social infrastructures, upgrade of housing and, training of local communities' members.
4. Take into account demand-side considerations as well as supply-side energy targets while assessing a power project impact assessment.
5. Plan and budget in the project costs, construction of transforming terminals and distribution lines for the villages affected by the project.

# 7 ENVIRONMENTAL ASSESSMENT PROCESS FOR REGIONAL POWER PROJECTS

Chapter 6 has presented the guiding principles to achieve sustainable development through regional power projects. In order to integrate these guiding principles in the projects' cycle phases, this chapter defines the environmental assessment process.

This chapter comprises nine sections. The first three sections concern: 7.1 the justification of the EA framework; 7.2 the environmental assessment principles; 7.3 the general process for regional power projects. These sections are followed by five technical sections linked to the project cycle phases: 7.4 identification; 7.5 preparation; 7.6 appraisal and approval; 7.7 implementation and supervision and; 7.8 post evaluation. Sections 7.4 to 7.8 are the core of this chapter. They provide detailed information on the steps to follow, the activities to conduct and the administrative procedures to respect during EA process. Finally, section 7.9 identifies institutional responsibilities for EA process implementation.

## 7.1 Justification of the EA framework for regional power projects

As presented in the above section 4, the level of details of the environmental and social impact assessment procedures and frameworks of the NBI countries varies significantly from one to another. Some countries such as Egypt and Ethiopia do have comprehensive EIA regulations and guidelines, whereas in some other countries (Burundi and Rwanda for example), EIA is essentially based on general principles stated by the Law. Even DRC does not have yet an environmental framework law, even though it is currently in preparation. In addition, procedures of some countries provide for comprehensive EIAs in the case of major projects and simplified EIAs for small projects (such as maintenance of existing facilities).

Key social issues, such as resettlement, indigenous communities, gender and cultural heritage, are not always covered by EIA frameworks of each country. Considering the vision of the NBI Vision which is to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the Nile basin water resources, the key social issues shall be properly taken into account while evaluating specific regional power projects in the NBI countries.

No specific framework for power projects exists in the NBI countries. However, in Ethiopia and Egypt for example, there are some EIA guidelines for power projects that can be considered at the same level than international best practices.

In general, EA frameworks of funding agencies, especially World Bank and European Union, are much more detailed and restricting than frameworks of NBI countries. Apart from general EIA guidelines, the funding agencies do not have also specific EIA frameworks for regional power projects.

The International Hydropower Association (IHA) has a set of comprehensive sustainability guidelines for hydropower projects, for new and existing power facilities. These guidelines promote greater consideration of environment, social, and economic sustainability in the assessment of new energy supply options, new hydro projects and the management and operation of existing hydropower facilities. The guidelines provide guidance for aspects related to the evaluation of alternative energy options, alternative hydropower options, environmental assessment of hydropower projects, safety, management of existing hydropower schemes, legal and institutional arrangements and environmental management systems. The IHA guidelines provide useful information on the environmental, social and economic aspects of sustainability.

In addition, the Southern African Power Pool (SAPP, 2001) has developed EIA Guidelines for thermal power plants in the SAPP Region. The objective of these Guidelines is to provide procedures for the systematic performance of consistent, cost-effective, responsive, and approvable EIAs specific to thermal power projects in SAPP member countries.

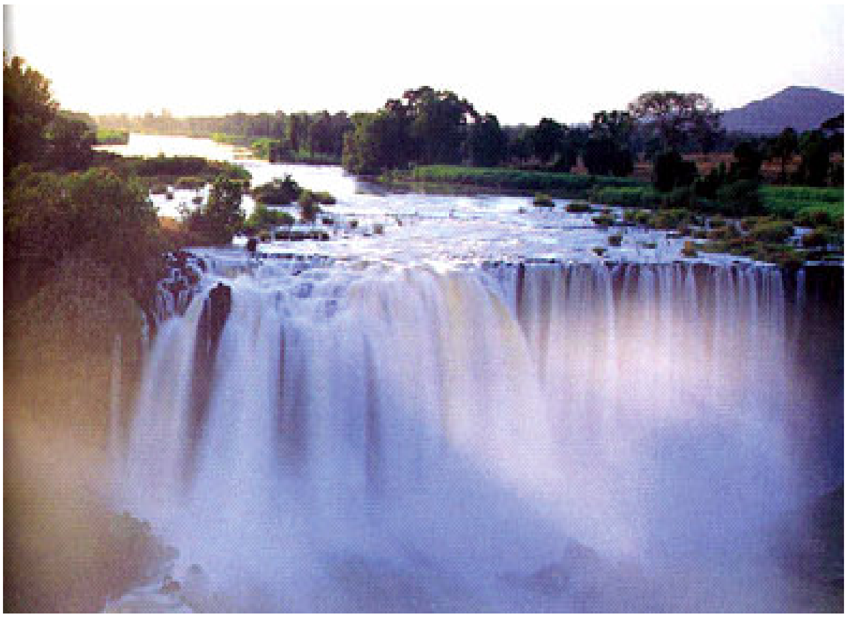
Moreover, numerous EIA guidelines exist for the EIA of power transmission lines, such as Hydro-Quebec's approach, tools and methods covering the whole project cycle of transmission lines and substations from feasibility to decommissioning, the EIA guidelines for transmission lines within the Southern African Power Pool Region (1999), etc.

As presented in the above Section 3, numerous power projects involving more than one country (transboundary projects) are planned for the near future in the NBI countries. Indeed, the mission of the NBI and the RPTP in particular is to develop regional power trade and markets among the NBOI countries. A harmonised EA framework will be required to assess the environmental and social impacts of these projects according to the international practices and to the NBI countries' policies and regulations.

Considering the diversity of EA procedures and frameworks of the NBI countries, funding agencies and international initiatives, as well as the potential transboundary power projects in the pipeline, it is therefore justified to develop a comprehensive standard framework of integrated environmental and social impact assessment applicable to all NBI countries in the frame of the NBI.

The main objective of the comprehensive EA framework which integrates environmental and social issues of power projects is to contribute to the vision of the NBI, which is to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the Nile basin water resources. Another key objective is to plan and implement the regional power projects according to best practices as far as sustainable development is concerned.

*Waterfalls on the Blue Nile*



## 7.2 Environmental assessment principles

Environmental assessment (EA) comprises a number of processes aiming to incorporate the environment into the planning of operations and development of projects, programs plans or policies. It is a systematic process for evaluating and documenting the possibilities, capacities and functions of resources and of natural and human systems in order to facilitate the planning of sustainable development and the decision process in general, as well as forecasting and managing negative impacts and the consequences of development proposals (André *et al.*, 2004).

According to World Bank's OP 4.01, the level, depth, and type of analysis of the EA process depend on the nature, scale, and potential environmental impact of the proposed project. EA consists:

- To evaluate a project's potential environmental risks and impacts in its area of influence;
- To examine project alternatives;
- To identify ways of improving project selection, location, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts;
- To mitigate and manage adverse environmental impacts throughout project implementation. Preventive measures rather than mitigation or compensatory measures are more favourable.

For OP 4.01, EA considers (i) the natural environment (air, water and land), (ii) human health and safety, (iii) social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources), and (iii) transboundary and global environmental aspects (climate change, ozone-depleting substances, pollution of international waters, and adverse impacts on biodiversity). EA considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions, the findings of country environmental studies, national environmental action plans, the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects, and obligations of the country under relevant international environmental treaties and agreements. The Bank does not finance project activities that would contravene such country obligations. EA is initiated as early as possible in project planning and integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project.

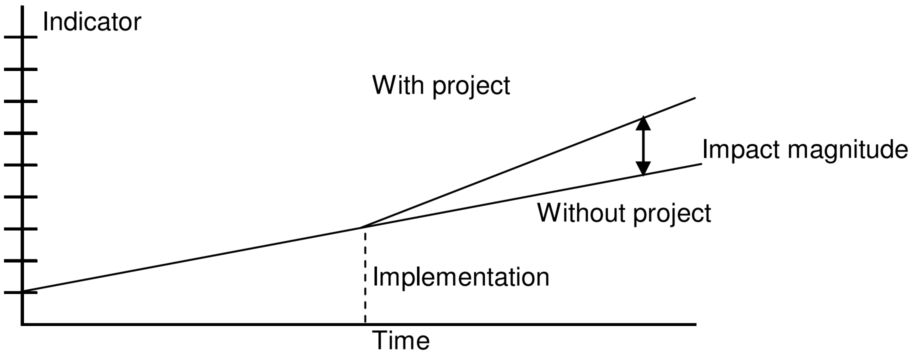
Environmental assessment processes or instruments include:

- Environmental studies and strategies, in the broad context of environmental action plans;
- Strategic environmental assessment, in the context of programs, plans and policies, sectoral and regional investments;
- Life cycle assessment, in order to consider the energy and materials used and discharged in the environment from a design to the disposal of a product;
- Environmental impact assessment, for projects and sometimes programs and activity plans;
- Environmental audit, in order to evaluate the compliance of operations with the rules, regulations, programs or policies of an organisation or a State.

An environmental impact assessment (EIA) is a "procedure to examine the environmental consequences, both beneficial and adverse, of a proposed development project and to ensure that these consequences are taken into account in project design" (André *et al.,* 2004). An EIA, as proposed in this framework, takes into account impacts on both the biophysical and human environment. It includes a whole range of specialised assessments dealing with environmental, social, economic and health impacts, and risk analysis. It studies the impacts of projects taken individually as well as the cumulative effects induced by the combination of several projects and activities in time and space.

An environmental impact can be defined as the effect, for a period of time and within a specific space, of a human activity on an environmental or human component, compared with the "without project" situation. Figure 7.1 illustrates the notion of magnitude of an environmental impact, which indicates the change in the value of a component of the environment within which a project is located.

**Figure 7.1 Illustration of an environmental impact**




Source: André *et al.*, 2004

The general EIA process that is applied by most funding agencies and national environmental agencies is illustrated on Figure 7.2. The EIA process begins when the project proponent decides to undertake a project by presenting a **project notice** describing the project to the authorities in charge of EIA. This first step is followed by the **preliminary screening** in order to determine the importance of the environmental impact assessment (EIA) study to conduct, i.e. simplified, detailed, management plan, etc. As previously mentioned, World Bank OP 4.01 provides project categories (A, B or C) for which the level of EIA is proportional to the anticipated importance of the project impacts.

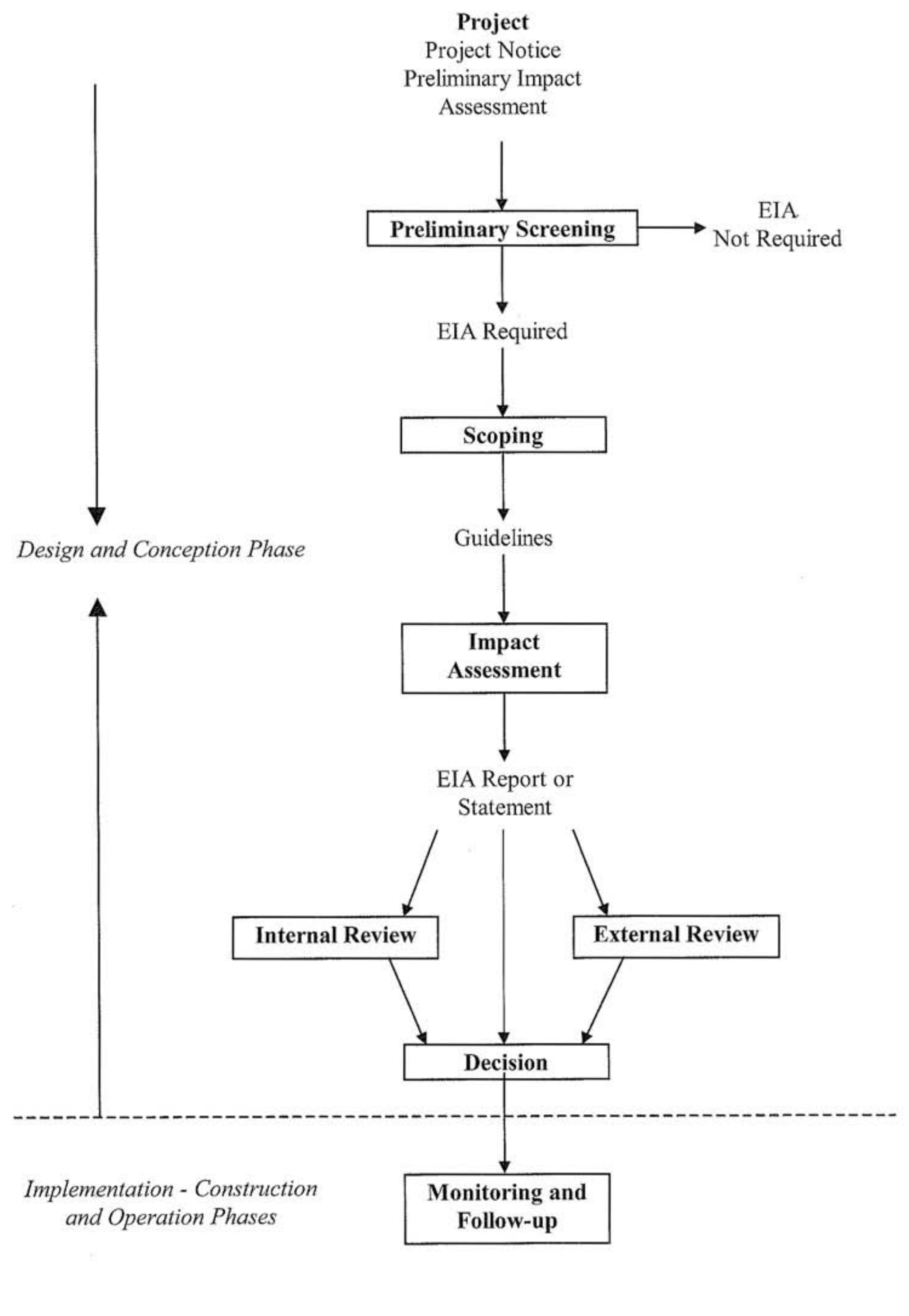
If the preliminary screening determines that an EIA is required, the **scoping** is the next step to undertake in order to define the scope of the EIA by preparing the terms of reference or guidelines of the study. Preliminary consultations of stakeholders can be required to conduct the scoping of the EIA. The results of the scoping will generally include the main environmental issues raised by the project, the timing and extent of analysis required, the sources of relevant expertise and suggestions for mitigation measures.

The **EIA studies** (impact assessment, resettlement plan, environmental and social management plan, etc.) are normally the responsibility of the project proponent who usually calls for expertise to carry out the study according to international standards and requirements of the funding agency. Additional public consultations shall be carried out during the study. To conduct the EIA studies, the expertise can often rely on general sectoral guidelines that must be adapted to the project background and environmental context.

Once the EIA studies are completed, the project proponent submits it to the relevant authorities and will then be subjected to internal and if necessary, external review. The **internal review** consists in checking the compliance between the terms of reference and the EIA studies reports. The preparation of a technical analysis report is generally the result of the internal review step. The **external review** is to get an impartial point of view of the particular interests of various parties involved in the project, such as the persons affected by the project (further public consultations).

The **decision** to go ahead with the proposed project is based on the internal and external review reports and the conclusions of the EIA report conclusions. Finally, **environmental monitoring and follow-up** measures normally recommended by the EIA study shall be carried out during the whole construction and operation phases of the project.

## Figure 7.2 General EIA Process




Source: André, P., Delisle, C. et Revéret, J.P., 2004

## 7.3 General EA process for regional power projects

The general process of the EA framework for regional power projects is illustrated on Figure 7.3. This process follows the general EIA process that is applied by most funding agencies and national environmental agencies explained in the previous section. In addition, it integrates additional aspects such as the implementation of social sustainability, life cycle assessment (LCA) and access to the Clean Development Mechanism (CDM). Additional diagrams are provided in chapters 9 and 10 dealing with LCA and CDM respectively. The implementation of this EA process will require a Regional EA Working Group (REAWG) coordinated by an existing institution of the NBI. The proposed composition and responsibilities of the REAWG are further discussed in Section 7.9 below dealing with the institutional responsibilities of the EA process implementation.

*Waterfalls on Nile River*

**Regional power projects include any hydropower, thermal, geothermal and transmission lines projects affecting or providing benefits to at least two NBI countries, including projects likely to cause significant adverse transboundary impacts, and/or significant adverse impacts on international heritage sites.**

According to the Convention on Environmental Impact Assessment in a Transboundary Context (called the Espoo EIA Convention of 1991 prepared under the auspices of the United Nations Economic Commission for Europe), transboundary impacts can be defined as any impact, not exclusively of a global nature (such as climate change, ozone depletion, biodiversity, etc.), within an area under the jurisdiction of a country caused by a proposed activity which the physical origin is situated wholly or in part within the area under the jurisdiction of another country.

For the application of the Espoo (EIA) Convention, a proposed activity is likely to cause significant adverse transboundary impacts by virtue of one or more of the following criteria:

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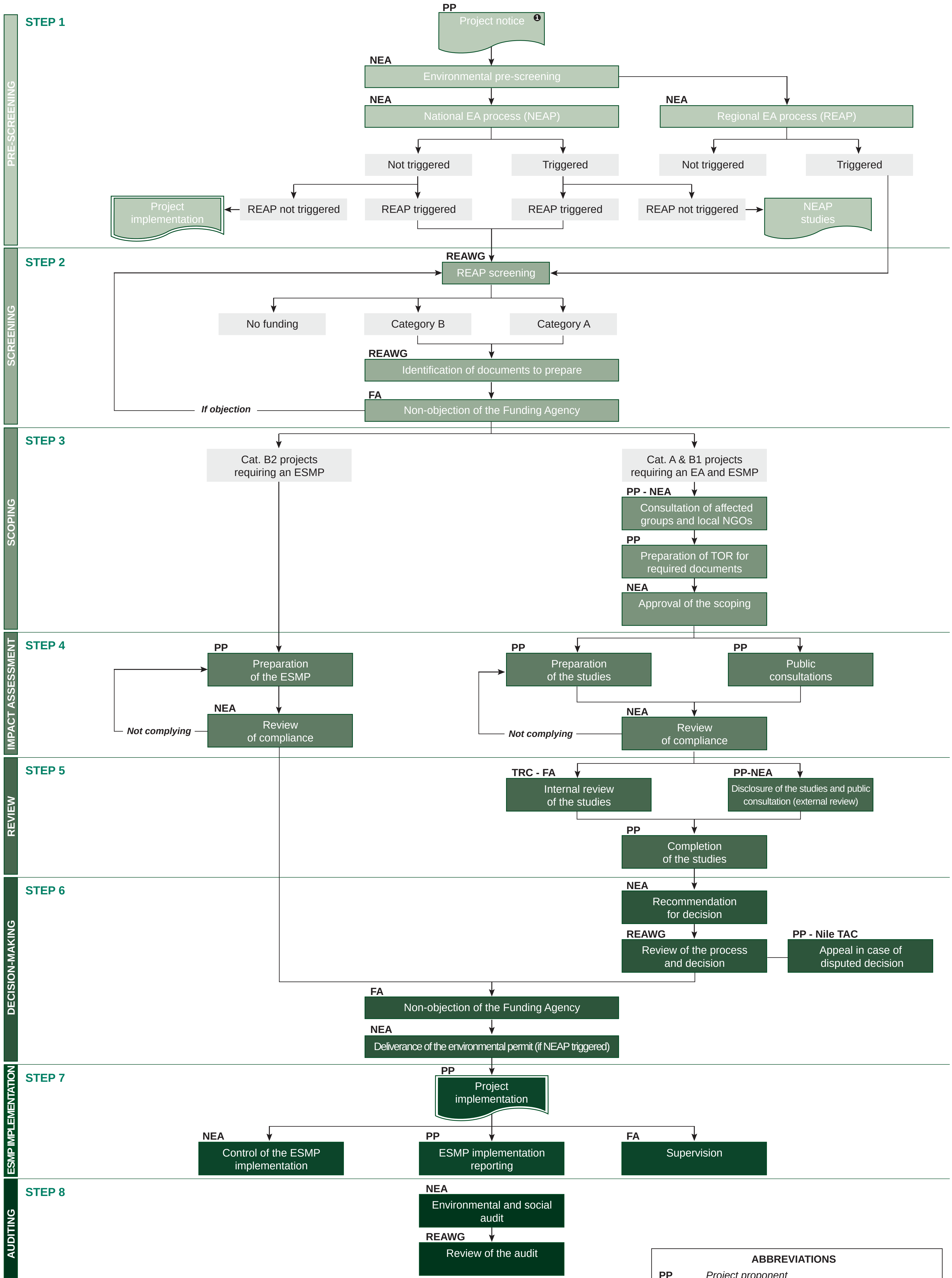
**Environmental Assessment Process for Regional Power Investment Projects** — **FIGURE 7.3**

Nile Basin Initiative




**ABBREVIATIONS**

| | |
|---|---|
| **PP** | *Project proponent* |
| **NEA** | *National environmental agency* |
| **REAWG** | *Regional EA Working Group* |
| **FA** | *Funding agency* |
| **TRC** | *Technical review committee* |
| **Nile TAC** | *Nile technical advisory committee* |
| **ESMP** | *Environmental and social management plan* |

❶ Any hydropower, thermal and geothermal power, and power transmission lines project in a NBI country.

05_16005_Fig 7-3_cm_pc.ai

(a) Size: proposed activities which are large for the type of the activity;

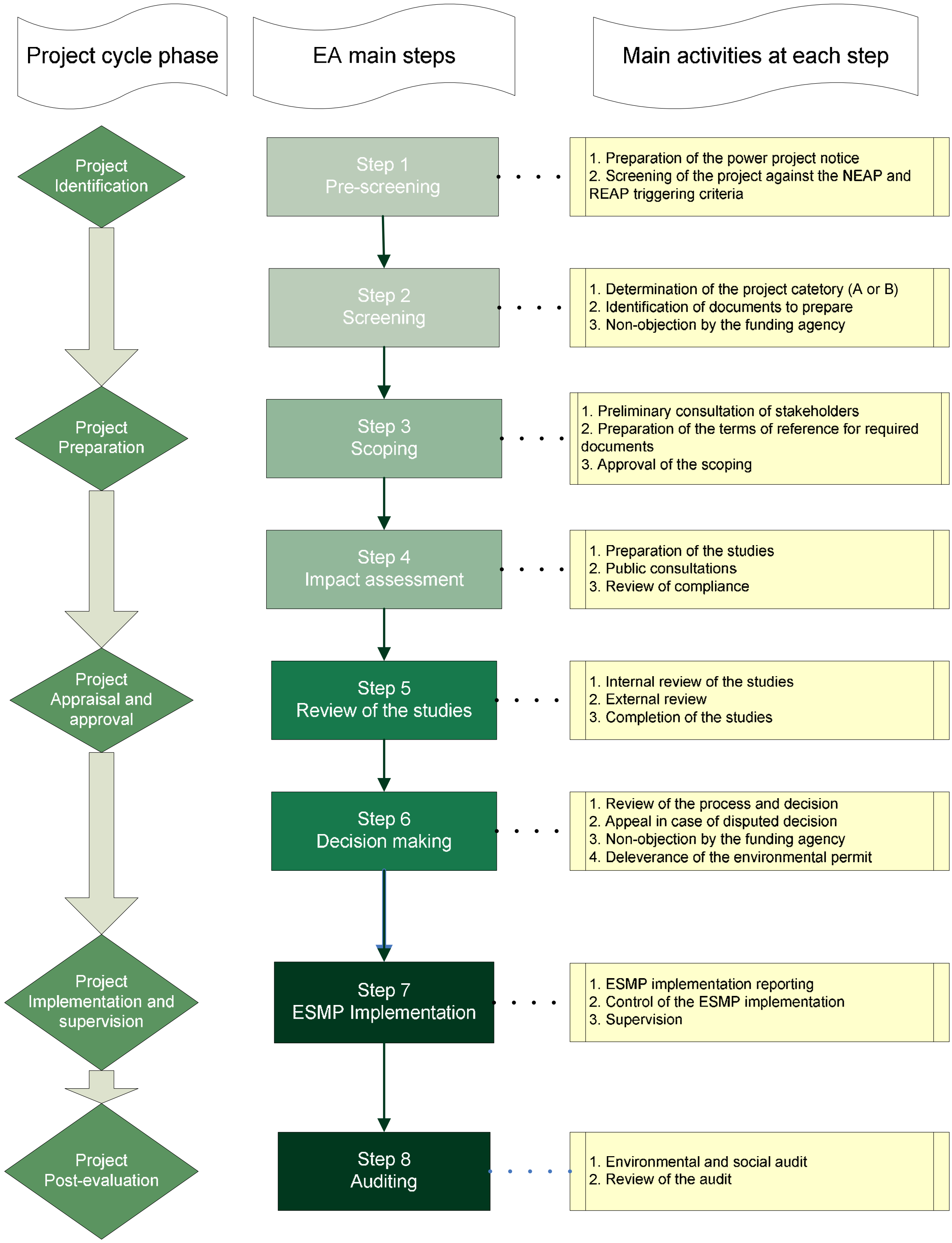
(b) Location: proposed activities which are located in or close to an area of special environmental sensitivity or importance (such as wetlands designated under the Ramsar Convention, national parks, natural reserves, sites of special scientific interest, or sites of archaeological, cultural or historical importance); also, proposed activities in locations where they would likely have significant effects on the population;

(c) Effects: proposed activities with particularly complex and potentially adverse effects, including those giving rise to serious effects on humans or on valued species or organisms, those which threaten the existing or potential use of an affected area and those causing additional loading which cannot be sustained by the carrying capacity of the environment.

International heritage sites are defined as any cultural, natural or mixed property that is on the World Heritage List of UNESCO.

Figure 7.4 summarises the eight main steps of the EA framework for regional power investment projects within the project cycle. The following sections (7.4 to 7.8 inclusively) describe in details the eight steps of the EA framework for regional power projects. For each step, activities to conduct and administrative procedures to follow are specified.

## Figure 7.4 Main steps of the EA process for regional power projects

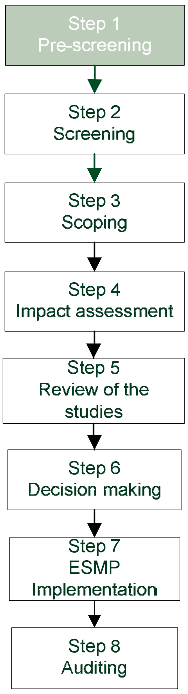


## 7.4 Project identification

At the project identification phase, the EA includes two steps:

Step 1: Preliminary screening

Step 2: Screening (or environmental screening)




### 7.4.1 Pre-screening (Step 1)

The pre-screening involves two main activities:

(1) the preparation of the project notice and;

(2) the analysis of the project notice.

#### 7.4.1.1 Preparation of the Project Notice

The proponent of any hydropower, thermal and geothermal power and transmission lines project in the NBI countries (Burundi, DRC, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda) has the responsibility to prepare a project notice which the content is presented in Box 7.1.

**Box 7.1 Contents of a Project Notice**

- Name and type of the project
- Identification of the proponent
- Nature and location of the project area;
- Area that may be beneficially or adversely affected by the project;
- Characteristics of the project design;
- Activities to be undertaken during the construction and operation of the project;
- Materials needed for construction and inputs required for operation;
- Potential products and by-products, including wastes generated by the project;
- Number of people that the project will employ and the economic and social benefits to the local community, the nation and neighbouring countries;
- Transboundary adverse environmental and social effects of the project, and how they will be eliminated or mitigated; and
- Any other matter, which may be required by the Environmental Agency of the country of origin.

The proponent shall submit five copies of the project notice to the National Environmental Authority (NEA) of the project country of origin.

#### 7.4.1.2 Analysis of the Project Notice

Upon reception of the project notice, the NEA has to analyse it to decide whether the power project is subjected to the National EA Process (NEAP) or to the Regional EA Process (REAP).

In all cases, whether the project involves only one or more than one country, the NEA shall transmit the project notice with the results of its analysis to the Regional EA Working Group (REAWG) in charge to coordinate the REAP, with copy of the project notice analysis to the project proponent.

The analysis of a project notice shall include the information listed in Box 7.2.

**Box 7.2 Contents of a Project Notice Analysis**

- Name and type of the project
- Identification of the proponent
- Project country of origin
- Other countries involved in the project
- Potential significant adverse transboundary impacts
- Potential significant adverse impacts on international heritage sites
- Project subjected or not to the national EIA process
- Project subjected or not to the regional EA process, with justification

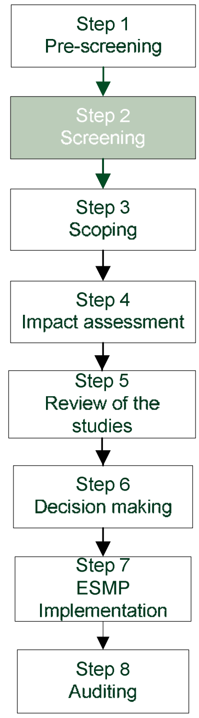
Hydropower, thermal, geothermal and transmission lines projects are subjected to the REAP if one of the following criteria is met:

- The project affects or provides benefits to at least two NBI countries;
- The project is likely to cause significant adverse transboundary impacts;
- The project is likely to cause significant adverse impacts on an international heritage site.

**In any case that the REAP is triggered, it is not necessary to duplicate the process by implementing the NEAP, because the REAP harmonizes the EA requirements of all NBI countries and funding agencies in general.**

### 7.4.2 Screening (Step 2)

In the case that the pre-screening determines that the project proposal is submitted to the REAP, the REAWG undertakes the proper screening of the project in order to determine the category of the project and therefore, the types of environmental and social studies that will need to be carried out before making the decision on the project.




The screening involves the following activities:

(1) Determination of the project category
(2) Identification of documents to prepare
(3) Non-objection by the funding agency
(4) CDM project screening (see Chapter 10)

***Determination of project categories***

The World Bank, African Development Bank and European Union categorize the project proposals according to various criteria, such as the type and scale of the project, location of the project, its environmental and social impacts and the importance of these impacts. The World Bank and AfDB use qualitative criteria, whereas the European Union has quantitative criteria (thresholds).

The proposed EA framework for regional power projects suggests the following categories of project:

- Category A if the project is likely to have significant adverse environmental impacts that are sensitive[3], diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works and may be transboundary. The EIA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing the EIA report and other related documents such as a resettlement plan, if required, and an environmental and social management plan (ESMP).

[3] A potential impact is considered "sensitive" if it may be irreversible (e.g., lead to loss of a major natural habitat) or raise issues covered by OP 4.10, Indigenous Peoples; OP 4.04, Natural Habitats; OP 4.11, Physical Cultural Resources; or OP 4.12, Involuntary Resettlement.

- Category B if the project potential adverse environmental impacts on human populations or environmentally important areas, including wetlands, forests, grasslands, and other natural habitats, are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than for Category A projects. The scope of environmental assessment (EA) for a Category B project may vary from project to project, but it is narrower than an EA for Category A. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. Depending on the type of project and the nature and magnitude of the impacts, the EA report of a Category B project may include a limited environmental impact assessment, or an environmental and social management plan (ESMP) if an environmental and social analysis is not required and that typical mitigation measures are sufficient.
- The "no funding" category applying to projects that funding agencies do not finance in accordance to their policies. For example, the World Bank does not support projects that involve the significant conversion or degradation of critical natural habitats in accordance with its OP 4.04 – Natural Habitats. Other similar situations may occur, depending of the characteristics of the project and the funding agency involved in its financing.

Clear criteria are required to assign the proper category to a given power project. This EA process defines such criteria only for category A projects (Table 7.1), meaning that if a given project does not meet any of the Category A criteria, then it is automatically assigned to category B, unless the "no funding" category applies for the reasons previously mentioned.

**Table 7.1 Criteria assigning Category A to power projects**

| Type and scale of the project | Location of the project | Impacts and issues | Nature of the impacts |
|---|---|---|---|
| Construction or expansion of:<br><br>• Large dams and reservoirs (more than 10 $Mm^3$ reservoir) Source: EU<br><br>• Power station (≥ 200 MW) Source: Canadian EA Act<br><br>• Transmission lines (≥ 220 kV and > 15 km) Source: EU | • Environmental sensitive areas, such as wetlands, habitats of threatened species, etc.<br>• Officially protected area<br>• In or near archaeological or historical sites<br>• In inhabited areas, where resettlement can be required or nuisances of the project can significantly affect the local populations<br>• In areas of conflicts for natural resources<br>• Along water body, in areas of groundwater recharge or drinking water supply<br>• On lands or in waters with precious resources (fisheries, minerals, medicinal plants, fertile soils, etc.) | • Significant pollution likely to affect the quality of air, water or soil<br>• Large scale physical disturbance of the site and surroundings<br>• Significant loss of forests or other natural resources<br>• Significant change in the hydrological regime<br>• Presence of hazardous products in significant quantity<br>• Involuntary resettlement and other significant social impacts (see Box 7.3)<br>• Loss or irreversible degradation of a natural habitat and loss of biodiversity or ecological functions<br>• Risks on human health<br>• Impacts on indigenous communities (see Box 7.4)<br>• No mitigation or compensation measures in the project design | • Irreversible environmental or social impact<br>• Neuralgic impact (triggering a safeguard policy of the World Bank – see Table 7.2 below)<br>• Local or regional impact, as apposed to site specific impact<br>• Adverse environmental or social impact of major importance |

**Box 7.3 Involuntary resettlement at the screening step**

The screening must identify if the project will require land acquisition or restriction of access to resources. Involuntary resettlement safeguard policy is triggered if a project causes people to lose land or other assets.

The impacts covered include:
1. loss of housing or shelter;
2. loss of assets or access to assets;
3. loss of income sources or means of livelihood, whether or not the people will have to move to another location.

This includes people with formal property rights but also land held under customary rights and squatters residing on public lands.

Involuntary loss of common property resources or access to resources without losing possession of them is also considered involuntary resettlement.

Therefore, the project screening analysis should include a brief land acquisition assessment stating actual ownership, occupancy and use of the land identified for the purpose of the project. The land includes anything growing on or built on the land.

**Box 7.4 Indigenous peoples at the screening step**

The screening must identify whether indigenous peoples live in the project area or have collective attachment to the project area. In compliance with the World Bank policy (World Bank, OP 4.10 p.1-2)., the term "indigenous peoples" is used as a generic term to design distinct, vulnerable, social and cultural groups presenting the following characteristics in varying degrees:

a. "self-identification as members of a distinct indigenous cultural group and recognition of this identify by others;
b. collective attachment to geographically distinct habitats or ancestral territories and to the natural resources in these habitats and territories. "Collective attachment" means that for generations there has been a physical presence in and economic ties to lands and territories traditionally owned, or customary used or occupied, by the group concerned, including areas that hold special significance for it, such as sacred sites. "Collective attachment" also refers to the attachment of transhumant/nomadic groups to the territory they use on a seasonal or cyclical basis.
c. customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and
d. an indigenous language, often different from the official language of the country or region"

In conducting this screening, it might be necessary to get technical advice from social scientists and/or to consult indigenous communities representatives. If indigenous peoples do live in the project area or have collective attachment to the project area, the environmental assessment of the project shall include a specific indigenous peoples social assessment.

***Safeguard policies other than OP 4.01 triggered by the project and required actions***

In addition to determine the environmental category and the EA instrument to undertake, the environmental screening should allow to identify the safeguard policies of the World Bank other than OP 4.01 triggered by the project and therefore, the documents required by these policies (resettlement plan, indigenous communities plan, cultural property plan, etc.). As previously mentioned, the World Bank safeguard policies potentially applicable to power projects are the following:

OP 4.01: Environmental Assessment
OP 4.04: Natural Habitats
OP 4.10: Indigenous Peoples
OP 4.11: Cultural Property
OP 4.12: Involuntary Resettlement
OP 4.37: Safety of Dams
OP 7.50: International Waterways

On the basis of the description of these policies presented in the above Section 5, table 7.2 shows the situations that can trigger safeguard policies other than OP 4.01 and subsequent actions to undertake.

**Table 7.2 Situations triggering safeguard policies other than OP 4.01 and subsequent actions to undertake**

| Policy | Trigger | Actions |
|---|---|---|
| OP 4.04 | Impacts on natural habitat or on critical natural habitat | • Mitigation and/or compensation measures<br>• No funding for projects affecting critical natural habitat |
| OP 4.10 | Land acquisition, use of natural resources or restrictions on access to territories that indigenous people traditionally used or occupied | • Explore alternatives to the project design in order to avoid such territories<br>• Engage in free, prior and informed consultation with affected indigenous communities<br>• Elaborate an Indigenous Peoples Plan |
| OP 4.11 | Impacts on physical cultural resources that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance | • Mitigation measures as part of the environmental management plan<br>• Measures range from full site protection to selective mitigation |

| Policy | Trigger | Actions |
|---|---|---|
| OP 4.12 | Permanent or temporary land acquisition that entails either: 1) loss of housing or shelter; 2) loss of assets or access to assets; 3) loss of income sources or means of livelihood, whether or not the people will have to move to another location. | • Elaboration of a Resettlement Action Plan (or of an abbreviated resettlement plan in certain circumstances). |
| OP 4.37 | Construction of a new dam | • Design and construction supervision by experienced and competent professionals<br>• Dam safety measures |
| OP 7.50 | Hydroelectric project that involve the use of any water body that forms a boundary or flows through two or more states, and/or the use of a tributary of such water body | • Appropriate agreements or arrangements for the entire waterway or any part thereof between the riparian countries. |

***Environmental assessment instruments for regional power projects***

The types of EA to undertake for each project category are presented in Table 7.3:

**Table 7.3 EA instruments for regional power projects**

| Type of project | EA instrument |
|---|---|
| Category A project | EIA, including an ESMP, and Life Cycle Assessment (LCA) |
| Category B1: Category B project requiring an environmental and social analysis | Limited EIA, including an ESMP |
| Category B2: Category B project not requiring an environmental and social analysis and for which typical mitigation measures are sufficient: | ESMP |
| No funding category | No EA is required as the project is not retained |

### 7.4.3 Environmental screening administrative procedure

The administrative procedure to undertake the environmental screening of a regional power project is detailed in Table 7.4.

This procedure includes the preparation of an environmental screening form which content is presented in Appendix 4. This form allows to identify the project category and the safeguard policies triggered by the project, as well as the documents required according to these policies.

**Table 7.4 Administrative procedure of environmental screening (steps 1 & 2)**

| No | Action | Responsibility | Delay |
|---|---|---|---|
| 1 | Preparation of the project notice and transmission to the National Environmental Authority (NEA) of the project country of origin | Project proponent | N/A |
| 2 | Pre-screening of the project notice and notification to the project proponent | NEA of the project country of origin | According to national legislation. If none, maximum 2 weeks after reception of the project notice |
| 3 | Transmission of the project notice analysis to the Regional EA Working Group Agency (REAWG) | NEA of the project country of origin | 2 weeks after reception of the project notice |
| 4 | Validation of the project notice analysis and notification to the NEA(s) concerned by the project | REAWG | 2 weeks after reception of the project notice analysis |
| 5 | Preparation of the Environmental Screening Form and transmission to the Funding Agency | REAWG | 1 month after reception of the project notice analysis |
| 6 | Non-objection by the funding agency on the project category and safeguard policies triggered by the project | Funding agency | 2 weeks after reception of the Environmental Screening Form |
| 7 | Transmission of all relevant information to the NEA(s) concerned by the project | REAWG | 1 week after reception of the funding agency reply |

Following environmental screening, if the project is modified or if new information become available, the NEA and REAWG consider the relevance to change the category of the project and if this the case, review the Environmental Screening Form and submits it again to the funding agency for non-objection.

## 7.5 Project preparation

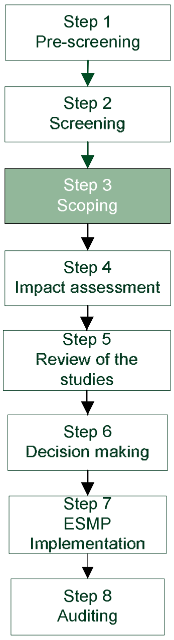
At the project preparation phase, step 3 and step 4 of the EA process are set in motion:

Step 3: Scoping (or environmental scoping)
Step 4: Impact assessment (or environmental assessment)

## 7.5.1 Scoping (Step 3)

This section presents: (I) the administrative procedure of environmental scoping and (II) special social issues to consider at the scoping step.

### 7.5.1.1 Environmental scoping main activities and administrative procedure




The objective of Environmental Scoping is to prepare the Terms of Reference (TOR) of the environmental and social studies identified during screening, according to the environmental and social issues highlighted in the Environmental Screening Form, so that these studies comply with applicable national legislation and policies of the funding agency.

This EA framework requires that scoping for the EA of a regional power project be conducted by the project proponent in consultation with the concerned NEA(s), and other interested stakeholders in the country of origin of the project as well as in the country of impact in case of significant adverse transboundary impact. The proponent has to prepare a scoping report which presents the results of scoping and also constitutes part of the Terms of Reference of the EA.

Environmental scoping involves the following activities:

(1) preliminary consultation of stakeholders
(2) the preparation of the TOR for the required documents
(3) approval of the scoping.
(4) step 1 of LCA (Goal and scope of the project – see Chapter 9)
(5) preparation of the project design document (PDD) for CDM application (Chapter 10)

At the scoping stage, preliminary consultation of stakeholders has the following objectives:

- To identify project stakeholders;
- To identify existing local information and traditional knowledge sources;
- To inform potential stakeholders of the ongoing EIA process and of the need for their inputs;
- To identify the local perceptions of the social and environmental key issues of the project.

Scoping involves visiting the project site and consultation with potentially affected groups, relevant governmental agencies, and representatives of other interested stakeholders including local non-governmental organizations (NGOs). This will include meetings to obtain their comments on what environmental and social issues the EA shall consider. The methodology for public consultations is provided in Appendix 3.

The project proponent shall prepare the TOR of the required studies and these shall be reviewed and approved by the NEA of the project country of origin. In case of significant adverse transboundary impacts, the NEA of the country of impact should also be consulted.

The contents of TOR for an EIA, a Resettlement Action Plan (RAP) and Abbreviated RAP of a category A project are presented in Appendix 5 and 6. For a Category B project requiring an EIA, the scope of the TOR can be reduced in accordance with the nature of the project, its potential impacts and the environment in which it is proposed.

The administrative procedure to undertake the environmental scoping (step 3 of the EA process) of a regional power project is detailed in Table 7.5.

**Table 7.5 Administrative procedure of environmental scoping (step 3)**

| No | Action | Responsibility | Delay |
|---|---|---|---|
| 1 | Notification to the project proponent to begin scoping | NEA of the project country of origin | 1 week after reception of all relevant information from the REAWG |
| 2 | Selection of the consultant to prepare the TOR of the studies | Project proponent | N/A |
| 3 | For category A projects, consultations of affected communities and local NGOs | Consultant and NEA | N/A |
| 4 | Preparation of the scoping report, including the TOR of the required documents according to screening results, and transmission to NEA of the project country of origin | Consultant | N/A |
| 5 | Transmission of the scoping report to the NEA of the country of impact in case of significant adverse transboundary impacts | NEA of the project country of origin | 1 week after reception of the TOR |
| 6 | Transmission of comments on the TOR to the NEA of the project country of origin | NEA of the country of impact | 2 weeks after reception of the TOR |

| No | Action | Responsibility | Delay |
|---|---|---|---|
| 7 | Approval of the TOR and notification to the project proponent | NEA(s) | 1 month following the reception of TOR from the Project proponent |
| 8 | Transmission of all documents to the REAWG | NEA of the project country of origin | 1 week after approval of the TOR |

#### 7.5.1.2 Special social issues to consider at the scoping step

The social issues triggered by power and interconnection projects are involuntary resettlement, poverty reduction and socio-economic development, public health, gender, vulnerable groups, indigenous communities and, historical and cultural sites. The objective of the scoping is to assess the extent of these issues in the project in order to identify the scope of studies that shall be carried out during project preparation. Most issues will be integrated in the terms of references of the Environmental Impact Assessment. However, involuntary resettlement and indigenous peoples issues will require special studies. The scoping shall determine the type and scale of these issues to establish the level of surveys and documentation required.

**I. Involuntary resettlement**

Generally, involuntary resettlement is one of the major social issues of power projects. Therefore, the screening will categorize the project to establish which type of study and planning instrument shall be used for the resettlement:

1. A Resettlement Action Plan (RAP) or;
2. An abbreviated resettlement plan.

A **Resettlement Action Plan** is required for any project that entails involuntary resettlement for 200 or more severely affected persons because of:

- Physical displacement due to loss of land;
- Permanent lost of more than 10% of the person's productive assets.

An **abbreviated resettlement plan** may be used if the project impacts are minor. The impacts are considered minor if one of the following conditions occurs:

- Less than 200 persons are physically displaced;
- The number of affected people is more than 200 but they are not physically displaced and they lose less than 10% of their productive assets.

In order to define exactly which type of resettlement instrument shall be used, the scoping needs an estimation of the number of people who will:

- loose their house or shelter;
- loose their productive assets or access to these assets;
- loose their income sources or means of livelihood.

It is likely that a RAP will be required for most NBI projects at the Environmental and social impact assessment stage. A RAP is the most detailed planning instrument for resettlement. Preparation of the RAP is a major task of the EIA.

Appendix 6 provides the Terms of Reference for a Resettlement Action Plan and for an Abbreviated resettlement plan. It also provides the overall objectives and the guidelines for preparing a resettlement instrument in accordance with the World Bank and the African Development Bank standards.

**II. Indigenous peoples**

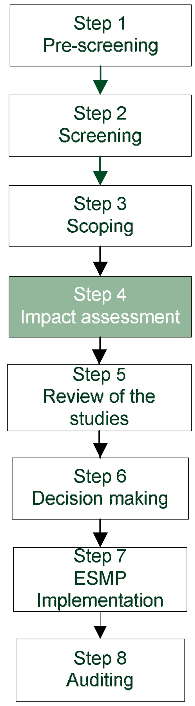
If indigenous peoples do live in the project area or have collective attachment to the project area, the environmental assessment of the project shall include a specific indigenous peoples social assessment to.

- Evaluate the project's potential impacts on the indigenous communities;
- Examine project's alternative to avoid significant adverse affects on these communities especially their physical relocation;
- If alternatives cannot totally avoid involuntary restrictions or resettlement, engage in free, prior and informed consultation with indigenous communities.

Appendix 7 gives details on the items that should be covered by an indigenous peoples social assessment.

The indigenous peoples social assessment must provide the project proponent all information to determine whether or not the affected indigenous communities give a broad support to the project. Such a support will be a condition to proceed with the project. If such a support is confirmed and the project planning is carried on, the project proponent will need to elaborate an Indigenous Peoples Plan (IPP). The IPP will specify the measures required to ensure that indigenous peoples receive social and economic benefits from the project. The proposed measures will be detailed and their cost will be budgeted for. The IPP will be integrated in the project design. Appendix 7 provides Terms of references to conduct an IPP.

### 7.5.2 Impact Assessment (Step 4)




This step comprises three main activities:

(1) Preparation of the studies, including steps 2 to 5 of LCA
(2) Public consultations
(3) Review of compliance

#### 7.5.2.1 EA Instruments

Based on the information from the scoping exercise as required in the Terms of Reference, the proponent or normally its consultant carries out the EA of the power project submitted to the Regional EA process. The above Table 7.3 presents the EA instruments to be used for each category of regional power projects.

*Manantali dam*

Category A projects require a full EIA, an ESMP, a LCA and social studies if required by this EA framework. The EA of a Category B project may include a limited environmental impact assessment, or only an environmental and social management plan (ESMP) in the case that an environmental and social analysis is not required. Guidelines to conduct a LCA are presented in Chapter 9 below.

*Environmental Impact Assessment*

First, it is important to underline that an EIA report for a Category A project shall focus on the significant environmental and social issues of the project. The scope and level of detail of the report shall be representative of the potential impacts of the project. The EIA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

**Box 7.5 Contents of an EIA Report**

- *Executive Summary*, presenting in a non-technical language a concise summary of the EIA Report with a particular attention on the methodology of the study, baseline conditions, alternatives considered, mitigation/enhancement/monitoring measures, public consultations, institutional aspects, and cost implications. This Executive Summary shall be written in English and in the local language of the project area, if necessary for public consultations.

- *Introduction*, presenting the purpose of the EIA, an overview of the proposed project to be assessed, including its purpose and needs, the project proponent and the consultant assigned to carry out the EIA, and mentioning the contents of the EIA Report and the methods used to carry out the study.

- *Policy, Legal, and Administrative Framework*, describing the relevant environmental and social policies of the funding agency and project country of origin, national legal requirements and relevant international environmental agreements ratified by the country.

- *Project Description and Justification* describing the project location, various project components, capacity, construction activities, facilities, staffing, working conditions, availability and source of raw materials, production methods, products, schedule of works, land tenure, land use system, potential beneficiaries, affected groups, including any offsite investments that may be required (i.e. access roads, water supply, housing for workers, and raw material and product storage facilities), and the need for any resettlement plan or indigenous peoples development plan.

- *Description of the Project Environment*, first fixing the limits of the study area that shall encompass all project direct and indirect impacts, then describing the relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project commencement, and by paying particular attention to rare, threatened, sensitive or valorised environmental and social components.

- *Public Consultations*, summarising the actions undertaken to consult the groups affected by the project, as well as other concerned key stakeholders including Civil Society Organisations. Detailed records of consultation meetings shall be presented in annex to the EIA Report. The records will include: location and day of the meeting, name of all participants, issues that have been raised.

- *Analysis of alternatives*, i.e. comparison of feasible alternatives to the proposed project site, technology, design, and operation, including the "without project" scenario, in terms of their potential environmental impacts incorporating life cycle and system approach, feasibility of mitigating these impacts, capital and recurrent costs, suitability under local conditions, and institutional, training, and monitoring requirements.

- *Potential Impacts and Mitigation/Enhancement Measures*, presenting the methodology of impact assessment, the detailed analysis of beneficial and adverse impacts of the selected project alternative on the physical, biological and human (social, cultural and economic) environments, indicating the importance and probability of the impacts. Irreversible impacts shall be clearly identified. Cumulative effects shall also be addressed taking into account other projects or actions planned in the study area. Appropriate mitigation measures shall be identified to prevent, minimise, mitigate or compensate for adverse environmental and/or social impacts. Moreover, enhancement measures shall be developed in order to improve project environmental and social performance.

- *Accident Risk Management Plan*, including safety measures and preliminary emergency plan for the construction and operation phases of the project including potential accident scenarios, major actions to properly react to accidents, responsibilities and means of communications. For projects that may cause major accidents whose consequences may exceed the project site (such as dam failure), the EIA shall include an analysis of the risk of accident including the identification of hazard and potential consequences, estimation of the consequences' magnitude and frequency, and risk evaluation (see Appendix 8 for more details).

- *Environmental and Social Management Plan* (ESMP), including mitigation and safety measures, monitoring, and institutional capacity building (see details hereafter).

- *Conclusion*, stating the environmental and social acceptability of the project, taking into account the impacts and measures identified during the assessment process. It shall also identify any other condition or external requirement for ensuring the success of the project.

- *Appendixes*, including the list of EA report preparers, consulted documents, record of interagency and consultation meetings, including consultations for obtaining the informed views of the affected people and local (NGOs).

*Environmental and Social Management Plan*

The environmental and social management plan (ESMP) consists in the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation of the project to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures. In summary, the EA team shall (i) identify the set of responses to potentially adverse impacts; (ii) determine requirements for ensuring that those responses are effectively implemented and in a timely manner; and (iii) describe the means for meeting those requirements.

**Box 7.6 Contents of an ESMP**

- *Impacts Mitigation*: summarizes all anticipated significant adverse environmental and social impacts; describes feasible and cost effective measures to address these impacts, in order to increase project benefits (enhancement measures) or to reduce potentially adverse environmental and social impacts to acceptable levels (mitigation measures). Each measure shall be described in detail, providing all technical information required for its implementation (design, equipment description and operating procedures, as appropriate).

- *Environmental and social monitoring*: provides specific description, and technical details, of monitoring measures, including the parameters to be measured, methods to be used, and definition of thresholds that will signal the need for corrective actions; also provides monitoring and reporting procedures to ensure early detection of conditions that necessitate particular mitigation or corrective measures, as well as information on the progress and results of mitigation.

- *Responsibilities and Institutional Arrangements*: identifies the responsibilities of the funding agency, project country of origin, implementing agencies and other stakeholders in applying the ESMP, particularly the mitigation and monitoring measures. In addition, the ESMP shall propose support to the organisations that may have insufficient capacities to fulfil their obligations. This support could be provided through various means including technical assistance, training and/or procurement.

- *ESMP Schedule and Costs Estimate*: Implementation schedule taking into account all activities related to the proposed mitigation and monitoring measures, as well as institutional arrangements. This schedule shall be coordinated with the overall project implementation plan.

- *Integration of the ESMP with Project*: integration of the ESMP into the project's overall planning, design, budget, and implementation, in order to be funded and supervised along with the project's other components.

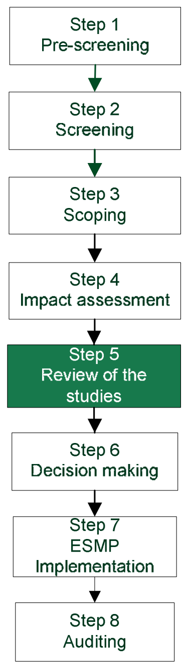
#### 7.5.2.2 Environmental Assessment Administrative Procedure

The administrative procedure to undertake the environmental assessment (step 4 of the EA process) of a regional power project is detailed in Table 7.6.

**Table 7.6 Administrative procedure of environmental assessment (step 4)**

| No | Action | Responsibility | Delay |
|---|---|---|---|
| 1 | Selection of the consultant(s) to carry out the studies | Project proponent | N/A |
| 2 | Preparation of the environmental and social studies | Consultant | According to TOR |
| 3 | For category A projects, consultations of affected communities and local NGOs | Consultant | According to TOR |
| 4 | Submission of the draft reports of the studies to the NEA of the project country of origin | Consultant | According to TOR |
| 5 | Review of compliance of the draft reports and emission of compliance or non-compliance notice to the consultant | NEA | 2 weeks after reception of the reports |
| 6 | In case of non-compliance, revision of the reports | Consultant | N/A |
| 7 | Transmission of the draft reports to the NEA of the country of impact in case of significant adverse transboundary impacts | NEA of the project country of origin | 1 week after emission of compliance notice to the project proponent |

## 7.6 Project appraisal and approval




At the project appraisal and approval phase, steps 5 and 6 of the EA process are set in motion:

Step 5: Review of the studies

Step 6: Decision making

### 7.6.1 Review of the studies (Step 5)

The review of the studies comprises three main activities:

(1) Internal review of the studies, including the national approval of a CDM project

(2) External review through disclosure and public consultation

(3) Completion of the studies

The review of the studies aims to establish whether the information provided is sufficient and complete and complies with the terms of reference. It judges the reliability of analysis and interpretation of data to find if it is consistent with the stated methodology and state of scientific knowledge. Further, it establishes the relevance of the findings in the studies for decision-making. In order to ensure objectivity in the review of EIA reports, a multidisciplinary review team shall be established. The objectives of the review process are the following:

- To determine whether the project EIA report constitutes a sufficient assessment of environmental and social impacts and to evaluate its relevance and quality for decision-making purposes;
- To gather a variety of opinions expressed by stakeholders concerning the acceptability of the project and the quality of the EIA process undertaken;
- To ensure that the EIA report and process comply with this EA framework;
- To establish whether the project complies with the policies of the project country of origin and the funding agency.

The review process shall include the analysis of the required studies and recommendations for the decision-maker. The following steps for EA review have been identified by the Regional EA Guidelines for Shared Ecosystems of the East African Community (EAC, 2006):

- Set the boundaries and scope of the review: the composition of the EA review team will depend on the significant environmental and social issues being addressed.
- Identify review criteria (examples are provided in Box 7.7): the TOR should be used as the main basis for identifying the review criteria (project objectives and description, baseline data, alternatives, environmental and social impacts, mitigation, monitoring, etc.). Special consideration should be given to significant adverse transboundary impacts and impacts on international heritage sites.
- Use input from public stakeholders: helps to check and determine the quality of descriptions in the EIA, including the description of the environment, the importance of the potential impacts and the acceptability of the possible alternatives; public review and hearings can provide significant stakeholder inputs.
- Carry out the review: by identifying the deficiencies in the EIA, focusing on crucial shortcomings observed in the report.
- Determine the required remedial measures: either the need for a supplement to the EIA (or a new EIA) in case of significant shortcomings; attaching conditions for implementation in case of easily rectifiable shortcomings; or need for clarification in case of minor shortcomings.

- Publish the review report: this is essential to ensure the objectivity and transparency of the whole process.

**Box 7.7 EIA review criteria**

- Compliance with the approved Terms of Reference
- Consistence/compliance with applicable laws, policies, and existing guidelines
- Sufficient quantitative information to make an informed decision about environmental and social components with a high degree of confidence
- Statement of confidence in findings
- Statements regarding gaps in information, uncertainties, risks
- Assessment of the project impacts on the environment, especially transboundary impacts
- Determination of the costs of mitigating and compensation measures
- Probability of significant indirect and/or cumulative effects
- Clear statement of likely irreversible or irreplaceable impacts
- Consistence with all environmental planning frameworks and policies
- Clear statement of any advantages for, or benefits to, the environment

Source: *Regional EA Guidelines for Shared Ecosystems of the East African Community* (EAC, 2006)

According to the above Table 7.3, the environmental and social studies of regional power projects in NBI countries include:

- An EIA, including an ESMP, for all projects of Category A and for most projects of Category B (Category B1);
- An ESMP for Category B projects which do not require an environmental and/or social analysis and for which typical mitigation measures are sufficient (Category B2);
- A Life Cycle Assessment for Category A projects;
- Social studies, such as resettlement plan and indigenous community plan, in accordance with the policies of the funding agency.

In order to comply with the environmental and social policies of funding agencies and regulations of NBI countries, the review of the studies shall include internal and external review processes.

However, the ESMP of Category B projects which do not require an environmental and/or social analysis can be approved directly by the NEA of the project country of origin, before the non-objection by the funding agency.

#### 7.6.1.1 Internal review

Following the emission of compliance to the consultant in charge of preparing the studies, the NEA of the project country of origin has the responsibility to establish an *ad hoc* technical review committee (TRC). Members of this committee may include representatives of the following organisations:

- NEA of the project country of origin;
- NEA of the country of impact, in case of significant adverse transboundary impacts;
- Environmental unit of the power utility of the project country of origin;
- Environmental unit of the Ministry responsible for Electricity.

Each member of the TRC participates in the technical evaluation of the studies, integrates relevant environmental, social and sectoral dimensions and prepares technical evaluation.

The NEA of the project country of origin is responsible of the evaluation process, ensures the coordination of the TRC activities and prepares the Internal Review Report. The NEA can consult other ministries or environmental organisations concerned by the project or request the services of other experts to accomplish the review of the EA studies.

The structure of the Internal Review Report may follow the contents of the scope of work included in the TOR of the studies, or the typical table of contents of an EIA report as indicated in this EA framework. For each item, comments shall indicate if the information is appropriate and complete, or not. If not, they should clearly state what is lacking and what should be done to comply with the TOR.

#### 7.6.1.2 External review (Disclosure of the studies and public consultation)

Involvement of, and inputs from stakeholders, interest groups and affected groups, form an integral part of the objectivity and transparency of the review process.

Public consultation is a very important cross-cutting issue for all World Bank safeguard policies. Public consultation is required by OP 4.01 as well as OP 4.10 and OP.4.12. The disclosure of project information to the population is requested by *The World Bank Policy on Disclosure of Information*. Therefore, proponents of all category A or B projects, are compelled to disclose relevant project documentation prior to the consultations. The documentation shall be written in a language understandable by the affected parties and it shall be properly disseminated.

For category A and B projects, the proponent must provide the parties with an appropriate abstract of the conclusions of the EIA preliminary reports. These preliminary reports must be made available to affected parties and local NGOs in an accessible public location.

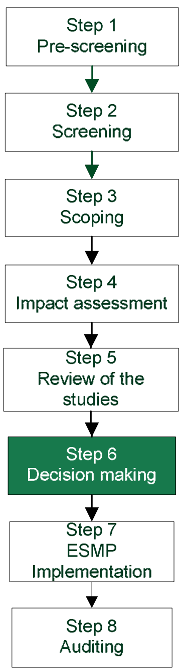
Afterwards, public consultation sessions must be held to receive the comments of the parties on the preliminary reports. These comments shall be taken into account in the final reports. Records of the sessions shall be held and put in appendix to the final reports.

#### 7.6.1.3 Completion of the studies

Following the internal and external review of the studies, the Consultant of the Project Proponent shall prepare the final version of the required studies, on the basis of the Internal Review Report, the Public Consultations records and the comments of the funding agency on the draft version of the studies transmitted by the NEA of the project country of origin.

Once completed, the project proponent submits to the NEA of the project country of origin the final version of the required studies.

### 7.6.2 Decision-making (Step 6)




At the end of the review of the studies, the NEA of the project country of origin submits all final documents to the Regional EA Working Group (REAWG) along with its recommendation on the regional power project.

In light of the NEA's recommendation, based on the report of the TRC, the minutes of the public consultations and the contents of the final report of the required studies, the REAWG makes the final decision concerning the project. This decision may be to authorize the project, with or without changes and under the conditions that the REAWG determines, or to turn down the project.

In case that the Project Proponent disputes the decision of the REAWG, then the case could be referred to a higher instance of the Nile Basin

Initiative, such as the Nile Technical Advisory Committee (Nile-TAC) or even the Council of Ministers of the Nile Basin Countries (Nile-COM).

Following the decision of the REAWG or the settlement of the dispute by the higher instance of the NBI, the case is submitted to the funding agency for non-objection on the decision.

Finally, in case that the National EIA Process was identified at the screening step as applicable to the project proposal, then the NEA of the project country of origin delivers the relevant environmental permit. As mentioned in the section on screening, in any case that the REAP is triggered, it is not necessary to duplicate the process by implementing the NEAP, because the REAP harmonizes the EIA requirements of all NBI countries and funding agencies in general.

### 7.6.3 Review and Decision-making Administrative Procedure

The administrative procedure to undertake the review and decision-making (steps 5 & 6 of the EA process) of a regional power project is detailed in Table 7.7.

This table describes all activities that lead to the decision on a proposed regional power project in the NBI countries. Following the approval, non-objection of the funding agency and deliverance of the environmental permit, an important step consists to ensure that the environmental and social measures recommended by the studies be integrated in the tender and contracting documents.

**Table 7.7 Administrative procedure of the review and decision-making (steps 5 & 6)[4]**

| No | Action | Responsibility | Delay |
|---|---|---|---|
| 1 | Emission of compliance notice to the consultant | NEA of the project country of origin | 2 weeks after reception of the reports |
| 2 | Transmission of the draft environmental and social studies to the funding agency | NEA of the project country of origin | 1 week after the emission of the compliance notice |
| 3 | Provision of the draft environmental and social studies at a public place accessible to project-affected groups and local NGOs | Project proponent and NEA | 1 week after the compliance notice emission |
| 4 | Establishment of the Technical Review Committee | NEA of the project country of origin | 2 weeks after the compliance notice emission |

[4] This process does not apply to Category B2 projects requiring only an ESMP.

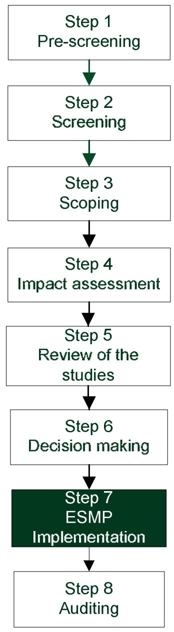
| No | Action | Responsibility | Delay |
|---|---|---|---|
| 5 | Analysis of the draft environmental and social studies and preparation of the Internal Review Report | Technical review Committee | 2 months after the compliance notice emission |
| 6 | Public consultations in the project area | Project proponent and NEA | 2 months after the compliance notice emission |
| 7 | Transmission of comments on the draft studies to the NEA of the project country of origin | Funding agency | 2 months after the compliance notice emission |
| 8 | Transmission of the Internal Review Report, Public Consultations Minutes and comments of the funding agency to the Project Proponent consultant | NEA of the project country of origin | 2 months after the compliance notice emission |
| 9 | Completion of the environmental and social studies and transmission to the NEA of the project country of origin | Consultant | N/A |
| 10 | Transmission of all final documents along with recommendation for decision to the REAWG | NEA | 2 weeks following the reception of final reports |
| 11 | Review of the EA process and decision on the project | REAWG | 2 weeks following the reception of final reports |
| 12 | Transmission of all final documents along with the decision to the funding agency and the NEA | REAWG | 2 weeks following the reception of final reports |
| 13 | Deliverance of the environmental permit, in case that the NEAP is triggered | NEA | After the non-objection of the funding agency |
| 14 | Integration of environmental and social measures recommended by the studies in the tender documents and contracting documents | Project proponent and NEA | After the deliverance of the environmental permit |

## 7.7 Project Implementation and Supervision

At the project implementation and supervision phase, the EA step 7 is set in motion. Step 7 consists basically in implementing the environmental and social management plan (ESMP).

### 7.7.1 ESMP implementation (Step 7)

This step includes the following activities:




(1) Implementation of the mitigation, monitoring and institutional measures by the project proponent
(2) Control of the ESMP implementation by the NEA
(3) Supervision by the funding agency
(4) Verification and certification of a CDM project

The project proponent shall ensure, during the whole life of the power project, that the measures identified to offset, mitigate or compensate the environmental and social adverse impacts are properly executed. This requires the involvement of at least one environmental and/or social officer on site in order to verify the implementation of the proposed measures. The supervisor(s) shall have the authority to modify the schedule or methods of work in order to reach the objectives of protecting the natural and human environments, if necessary.

The main objective of monitoring activities is to measure and evaluate the project impacts on affected environmental and social components and to implement remedial measures, if necessary. Monitoring activities allow to evaluate the accuracy of the potential environmental and social impact assessment, as well as the effectiveness of the recommended mitigation measures. Moreover, they allow to detect any unanticipated environmental or social impact which may occur during project implementation or operations and to adjust project activities accordingly.

The monitoring activities intent to quantitatively estimate the real impacts of a project on affected environmental and social components. They shall be overseen by a specialist with environmental or social expertise, according to the responsibilities and institutional arrangements defined in the ESMP.

Monitoring activities are based on indicators that measure changes over time of key environmental and social components affected by the project interventions. Therefore, for each major or undetermined environmental or social impact identified in the EIA and/or ESMP, an indicator shall be established to monitor the impact during project implementation and/or operations.

The selected indicators shall be easily measurable according to a pre-determined schedule, in order to adjust project implementation activities in case of unanticipated or non-mitigated adverse impacts. The proponent shall regularly report monitoring.

Adequate project funding shall be allocated to relevant agencies for efficient monitoring.

During project implementation, the project proponent shall periodically report to the NEA and the funding agency on:

- compliance with the measures agreed upon in the ESMP;
- the status of mitigation measures;
- the findings of monitoring programs.

The control of the ESMP implementation is the responsibility of the NEAs of the project country of origin and country of impact.

Finally, the funding agency bases the supervision of the project's environmental aspects on the findings and recommendations of the EA, including measures set out in the ESMP and other project documents.

*Power transmission line*

### 7.7.2 Administrative procedures for the ESMP implementation

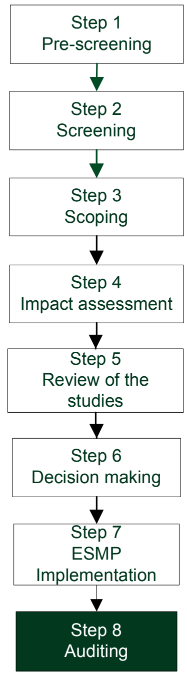
The administrative procedure to undertake the ESMP implementation of a regional power project is detailed in Table 7.8.

**Table 7.8 Administrative procedure of the ESMP implementation (step 7)**

| No | Action | Responsibility | Delay |
|---|---|---|---|
| 1 | Designation of an officer in charge to verify the implementation of the ESMP measures | Project proponent | As soon as possible following the project approval |
| 2 | Integration of environmental clauses in tender documents | Project proponent | As soon as possible following the project approval |
| 3 | Implementation of the mitigation measures | Contractors and operators | During project construction and operation |
| 4 | Verification of mitigation measures implementation | Environmental officer of the project proponent | During project construction and operation |
| 5 | Supervision | Funding agency | During project construction and operation |
| 6 | Reporting mitigation implementation to the NEA and funding agency | Environmental officer of the project proponent | In accordance with the ESMP |
| 7 | Environmental and social monitoring | Project proponent consultant | In accordance with the ESMP |
| 8 | Reporting monitoring results to the NEA and funding agency | Project proponent consultant | In accordance with the ESMP |

## 7.8 Project Post-Evaluation

### 7.8.1 Auditing (Step 8)




At the project post-evaluation phase, the EA step 8 is set in motion. Step 8 concerns auditing. It comprises two main activities:

(1) Environmental and social audit
(2) Review of the audit

Auditing consists basically in evaluating the effective environmental and social performance of the project, by noting notably if the environmental and social impacts caused by the project were anticipated in the EA report, and noting also the effectiveness of the mitigation measures taken.

Therefore, before the project decommissioning, the proponent shall undertake an environmental audit of the project to establish the resulting state of the natural and human environments once the project has been implemented.

Environmental auditing is an objective examination of whether or not practice complies with expected standard. Broadly, environmental auditing means to check the results of the environmental management during the project implementation and implies testing and verification. Auditing deals with the organization of monitoring data to establish the record of change associated with a project and the comparison of actual and predicted impacts for the purpose of assessing the accuracy of predictions and the effectiveness of impact management practices and procedures.

The environmental audit provides a systematic evaluation of environmental and social information on the extent to which a project complies with relevant policies and national regulations as well as with the project ESMP. In general, audits undertaken at the project completion phase shall help to better design future projects.

In general, Category A projects require a full audit, whereas Category B projects require a desk audit.

The full audit consists in a systematic, independent and documented process for obtaining evidence and evaluating objectively the extent to which audit criteria are fulfilled. The full audit requires a field mission. The desk audit is based on a desk review of environmental and social information provided during monitoring.

*Power substation*

The auditing process includes three phases: (i) audit preparation, (ii) auditing activities, and (iii) audit reporting.

The aim of the audit preparation is to plan the audit activities so that the audit can be conducted effectively and efficiently. It includes the preparation of the audit TOR, if necessary, audit plan and audit questionnaire. Other documents may be prepared such as registers, the audit checklist, and the template for the audit report. This phase also involves the identification of the audit team and associated tasks.

For a full audit, the on-site auditing activities involve an opening meeting with the proponent, document review, inspections, interviews, team meetings, preparation of audit findings and conclusions and a closing meeting with the project proponent.

On the other hand, a desk audit involves the review of available project documentation, the audit questionnaire and other relevant documents collected for this purpose. Audit findings shall be communicated to the project proponent.

The final phase of an audit involves the production of the audit report presenting the findings, conclusions and recommendations.

### 7.8.2 Administrative procedures for the audit

The administrative procedure to undertake the environmental and social audit (step 8 of the EA process) of a regional power project is detailed in Table 7.9.

**Table 7.9 Administrative procedure of project auditing (step 8)**

| No | Action | Responsibility | Delay |
|---|---|---|---|
| 1 | Selection of the consultant to prepare the TOR of the environmental audit | Project proponent | N/A |
| 2 | Preparation of the TOR of the environmental audit and transmission to NEA of the project country of origin | Consultant | N/A |
| 3 | Transmission of the TOR to the NEA of the country of impact in case of significant adverse transboundary impacts | NEA of the project country of origin | 1 week after reception of the TOR |
| 4 | Transmission of comments on the TOR to the NEA of the project country of origin | NEA of the country of impact | 2 weeks after reception of the TOR |
| 5 | Approval of the TOR and notification to the project proponent | NEA(s) | 4 weeks following the reception of TOR from the Project proponent |
| 6 | Preparation of the audit and transmission of the draft to the NEA of project country of origin | Consultant | According to TOR |
| 7 | Transmission of the draft audit to the NEA of the country of impact in case of significant adverse transboundary impacts | NEA of the project country of origin | 1 week after reception of the audit |
| 8 | Transmission of the draft audit to the funding agency | NEA of the project country of origin | 1 week after reception of the audit |
| 9 | Transmission of comments on the draft audit to the NEA of the project country of origin | Funding agency and NEA of country of impact | 1 month after reception of the audit |
| 10 | Transmission of comments to the Project Proponent consultant | NEA of the project country of origin | 1 month after reception of the audit |
| 11 | Completion of the environmental audit and transmission to the NEA of the project country of origin | Consultant | N/A |
| 12 | Transmission of all final documents to the REAWG | NEA | 2 weeks following the reception of final reports |

## 7.9 Institutional Responsibilities in the EA Process Implementation

Various stakeholders will be involved in the implementation of the whole EA framework for regional power projects. Table 7.10 resumes the responsibilities of each responsible organisation. In addition, Figure 7.5 presents the organisational chart of the EA process implementation.

**Table 7.10 EA framework implementation responsibilities**

| Main steps | Activities | Responsible organisation |
|---|---|---|
| 1. Pre-screening | • Preparation of the power project notice | Project proponent (PP) |
| | • Screening of the project against NEAP and REAP triggering criteria | National environmental agency (NEA) |
| 2. Screening | • Determination of the project category (A or B) | Regional EA Working Group (REAWG) |
| | • Identification of the documents to prepare | REAWG |
| | • Non-objection | Funding agency (FA) |
| 3. Scoping | • Consultation of affected groups and local NGOs | PP and NEA |
| | • Preparation of the terms of reference for required documents | PP |
| | • Approval of the scoping | NEAs of countries of origin and impact |
| 4. Impact assessment | • Preparation of the studies | PP |
| | • Public consultations | PP |
| | • Review of compliance | NEA |
| 5. Review of the studies | • Internal review of the studies | Technical review committee (TRC) and FA |
| | • Disclosure of the studies and public consultation (external review) | PP and NEA |
| | • Completion of the studies | PP |
| 6. Decision-making | • Recommendation for decision | NEA |
| | • Review of the process and decision | REAWG |
| | • Appeal in case of disputed decision | PP – Nile technical advisory body (Nile TAC) |
| | • Non-objection | FA |
| | • Deliverance of the environmental permit | NEA |
| 7. ESMP implementation | • ESMP implementation reporting | PP |
| | • Control of the ESMP implementation | NEA |
| | • Supervision | FA |
| 8. Auditing | • Environmental and social audit | PP |
| | • Review of the audit | NEAs |

The implementation of this regional EA process will require the involvement of a Regional EA Working Group (REAWG) coordinated by an existing institution of the NBI to be identified during the operationalization phase of this EA framework (see Chapter 11 below), as agreed upon by all NBI countries.

The proposed composition of the REAWG is the following:

- One director, senior expert in environmental assessment of power projects;
- One social sciences expert specialised in social assessment of power projects;
- Support staff.

The main responsibilities of the REAWG would be the following:

- Coordination of the implementation of the EA framework for regional power projects;
- Determination of the category of projects subjected to the EA framework;
- Identification of the documents to prepare for each project subjected to the EA framework;
- Review of the EA process for each subjected project and decision-making regarding the project;
- Review of the EA framework when necessary.

## Figure 7.5 Organisational chart of the EA process

| | Project Proponent (PP) | National Environmental Agency (NEA) | Regional EA Working Group (REAWG) | Funding Agency (FA) | Technical Review Committee (TRC) | Nile Technical Advisory Committee (Nile TAC) |
|---|---|---|---|---|---|---|
| Step 1<br>Pre-screening | Preparation of the power project notice | Screening of the project against NEAP and REAP triggering criteria | | | | |
| ↓ | | | | | | |
| Step 2<br>Screening | | | Determination of the project category<br>Identification of the documents to prepare | Non-objection | | |
| ↓ | | | | | | |
| Step 3<br>Scoping | Consultation of affected groups and local NGOs<br>Preparation of the TOR for required documents | Consultation of affected groups and local NGOs<br>Approval of the scoping | | | | |
| ↓ | | | | | | |
| Step 4<br>Impact assessment | Preparation of the studies<br>Public consultations | Review of compliance | | | | |
| ↓ | | | | | | |
| Step 5<br>Review of the studies | External review<br>Completion of the studies | External review | | Internal review of the studies | Internal review of the studies | |
| ↓ | | | | | | |
| Step 6<br>Decision-making | Appeal in case of disputed decision | Recommendation for decision<br>Deliverance of the environmental permit | Review of the process and decision | Non-objection | | Appeal in case of disputed decision |
| ↓ | | | | | | |
| Step 7<br>ESMP Implementation | ESMP implementation reporting | Control of the ESMP implementation | | Supervision | | |
| ↓ | | | | | | |
| Step 8<br>Auditing | Preparation of the environmental and social audit | Review of the audit | | | | |

# 8 ISSUES TO CONSIDER IN THE PREPARATION OF EIA FOR REGIONAL POWER PROJECTS

This chapter provides general environmental and social impact assessment guidelines for hydropower, thermal and geothermal power, as well as for power transmission lines. The objective of these guidelines is to facilitate the identification and mitigation of the environmental and social impacts of regional power projects during the preparation of EIAs of such projects in the NBI countries.

However, it will be important that detailed EIA guidelines for power sector activities be prepared based on this EA Framework in the near future in order to harmonise the contents of the future studies. These guidelines shall focus on the major power projects planned in the NBI countries, i.e. hydropower projects, thermal power projects and transmission lines, and explain for each step of an EIA (i.e. description of the project, description of the environment, analysis of alternatives, environmental and social impacts, mitigation measures, risk management, monitoring, etc.) the aspects to consider in the frame of the studies. The guidelines shall also provide detailed information on the main issues related to each type of project.

The first section of this chapter identifies the typical potential environmental and social impacts which may be caused by the construction of a power facility in general. Common mitigation measures for the period of construction are also recommended.

In the four subsequent sections, specific guidelines related to each type of power projects, include the following information:

- General characteristics of the type of power project;
- Environmental issues related to the type of power project;
- Social issues related to the type of power project
- A check list of specific environmental and social impacts normally anticipated for the type of project;
- A check list of typical mitigation measures.

## 8.1 Construction of power facilities

The construction of a power facility, whichever is hydropower, thermal or geothermal power or even transmission lines, involves activities and sources of environmental impacts that are similar from one type of project to another. Therefore, Table 8.1 identifies the typical potential environmental and social impacts which may be generated by the construction of a power project in general, as well as the measures to prevent, offset, minimise or compensate these impacts related to construction.

*Manantali dam*

**Table 8.1 Potential impacts, mitigation and enhancement measures common to regional power projects – construction phase**

| Potential adverse and beneficial Impacts | Mitigation and enhancement measures |
|---|---|
| **Ambient air** | |
| • Degradation of ambient air quality<br>• Increase of ambient noise | • Near residential areas, avoid noisy works after regular working hours.<br>• Maintain the vehicles and machinery in good condition in order to minimise gas, noise and dust emissions.<br>• Use appropriate means to avoid dust dispersion during construction. |
| **Water** | |
| • Contamination of surface and underground water<br>• Disturbance of water runoff and drainage<br>• Change in surface water flow causing indirect impacts on water uses and fish habitat<br>• Increased sedimentation in waterways<br>• Wastewater discharge in the environment | • Maintain vehicles, machinery and equipment in good condition in order to avoid leaks and discharge of hazardous materials<br>• Take all precautions during the refuelling of vehicles, machinery and pumps, and forbid the refuelling near water bodies<br>• Ensure a safe management of hazardous materials<br>• Avoid crossing permanent waterways<br>• When it is necessary to cross a permanent waterway, locate the crossing where the banks are stable and the most narrow, use as much as possible existing infrastructures or install culverts with adequate supporting capacity, and at the end of works, take away all temporary installations used for crossing<br>• Do not hamper drainage of surface water and plan for restoration measures after construction<br>• Plan works in areas prone to flooding outside the rainy season<br>• Install appropriate sanitary facilities in workers' camps |
| **Soils** | |
| • Soil erosion<br>• Soil compaction<br>• Soil contamination<br>• Change in local topography | • Stabilise the soil in order to reduce potential erosion<br>• At the end of construction works, level off the soils and facilitate vegetation regeneration<br>• Limit the circulation of heavy machinery to minimal areas<br>• Use existing borrow pits rather than creating new ones.<br>• After the works, restore borrow pits by stabilising slopes and facilitating vegetation regeneration |
| **Ecosystems** | |
| • Encroachment in ecologically sensitive areas<br>• Reduction of the biodiversity | • Establish a protection perimeter around ecologically sensitive areas such as water bodies, wildlife habitat, drinking water sources, slopes prone to erosion and wetlands<br>• Minimise the length of works in sensitive areas |

| Potential adverse and beneficial Impacts | Mitigation and enhancement measures |
|---|---|
| **Vegetation** | |
| • Loss of vegetation and forest products<br>• Damages to trees | • Clearly mark the land clearing areas and optimize the structures location in order to minimize deforestation<br>• Protect the trees from machinery and carry out the operations in such a way as to prevent the trees to fall outside of the logging areas<br>• Immediately after the works, facilitate vegetation regeneration with adapted species to the project area<br>• Minimize vegetation destruction along water bodies. |
| **Wildlife** | |
| • Disturbance of wildlife<br>• Fragmentation and degradation of wildlife habitat | • Forbid workers to hunt and fish in the project area<br>• Plan works outside of the reproduction period of wildlife present in the project area<br>• Plan corridors for migrating domestic and wild animals |
| **Land use** | |
| • Loss of housing, assets or access to assets (productive lands and natural resources) and, income sources<br>• Change in land ownership rights and uses along access roads and rights-of-way, which can lead to social conflicts.<br>• Disturbance or loss of the territory for indigenous peoples<br>• Disturbance of other land users activities<br>• Development of agricultural and pastoral land due to an easier access.<br>• Access to new territory leading to an increased pressure on natural resources. | • Take into account the various land uses while designing the project in order to minimise the loss of land, particularly productive land.<br>• Explore all alternatives to avert or minimize resettlements<br>• Plan land use along access roads and rights-of-way in order to preserve agricultural and pastoral land<br>• Involve traditional authorities in the design of the project, particularly in defining the rights-of-way.<br>• Elaborate and implement a resettlement plan to improve or at least restore, affected people living conditions and standards<br>• Provide equivalent or better housing and accompanying facilities to involuntarily displaced people in accordance with consultation results.<br>• In accordance with priorities of displaced people, ensure appropriate funding for productive land compensation to people owning or occupying/cultivating the land and to people living from exploitation of natural resources<br>• Integrate the project infrastructures into land use and development plans.<br>• Elaborate an Indigenous Peoples Plan (IPP)<br>• Coordinate project works with the various land users |

<table>
<tr><th>Potential adverse and beneficial Impacts</th><th>Mitigation and enhancement measures</th></tr>
<tr><td colspan="2">Quality of life</td></tr>
<tr><td>• Poor living conditions for workers<br>• Reduction in the quality of life due to nuisances such as noise, dust and traffic<br>• Improvement in quality of life due to new economic opportunities<br>• Social conflicts due to the venue of new settlers<br>• Disruption of indigenous people's lifestyle and customs<br>• Disruption of social and cultural values and pattern for all project affected persons<br>• Constraints in adjusting to resettlement and changes in productive activities.<br>• Population pressure due to the arrival of migrants attracted by new economic opportunities.</td><td>• Provide workers with proper accommodations in sanitary conditions and plan accommodation for camp followers<br>• Establish a formal consultation mechanism with local authorities to discuss issues disturbing inhabitants and to find solutions satisfying all parties<br>• Train workers in the field of environmental protection<br>• Implement an adequate communication plan to inform primary stakeholders<br>• At the end of works, clean up and restore the construction area<br>• Compensate for important residual impacts<br>• Avoid building access roads across indigenous people tracks or pathways.<br>• Favour resettlement areas allowing indigenous people to preserve their lifestyle and customs.<br>• Ensure appropriate support from social services to facilitate the transition and to prevent conflicts within families or among groups.</td></tr>
<tr><td colspan="2">Health</td></tr>
<tr><td>• Increased risk of accidents on working sites and access roads<br>• Increase in communicable diseases prevalence rates, especially HIV</td><td>• Develop, communicate and implement safety and preventive measures for workers, primary stakeholders and the population (such as traffic calming devices)<br>• Control access to working sites<br>• Install and maintain appropriate signs<br>• Increase awareness on sexually transmitted diseases and provide condoms at low cost to men and women<br>• Provide malaria prophylaxis and impregnated bednets to workers and camp followers, in malaria-prone regions<br>• Whenever possible employ women rather than men, or married men with nearby families<br>• Favour labour camp sites that are not located too close to villages<br>• Provide adequate health services to respond to additional needs</td></tr>
</table>

| Potential adverse and beneficial Impacts | Mitigation and enhancement measures |
|---|---|
| **Economic activities** | |
| • Job opportunities<br>• Increased revenues for local shopkeepers and stallholders<br>• Loss of subsistence or income sources due to land acquisition and resettlement | • Give preference to local labour (men and women)<br>• Favour local purchases as much as possible (food, basic material)<br>• Offer compensation or alternative revenue opportunities to affected people as part of the resettlement plan<br>• Provide temporary food supplies to involuntarily displaced people, as needed.<br>• Provide complementary training /support to men and women to facilitate adjustment during the transition period. |
| **Infrastructures** | |
| • Development of new infrastructures or improvement to existing ones<br>• Degradation of existing infrastructures<br>• Insufficient infrastructures to respond to workers' needs | • Before construction, consult concerned ministries to verify the adequacy of the proposed infrastructures<br>• Involve the population (men and women) in the maintenance and management of the new infrastructures to assure their sustainability<br>• Protect existing infrastructures and ensure their repair in case of damages<br>• Provide domestic water supplies to satisfy all people's needs<br>• Ensure adequate energy supplies |
| **Cultural heritage** | |
| • Degradation or destruction of community cultural heritage | • Before construction, carry out an archaeological search in the potential areas containing artefacts and preserve any discovered artefact<br>• Negotiate with traditional authorities the preservation of important cultural, religious, historical and aesthetic sites and resources and agree on potential compensation for the communities<br>• During construction, ensure an archaeological surveillance in the potential areas containing artefacts and in case of a discovery, advise the concerned authorities<br>• Involve traditional authorities in monitoring cultural, religious, historical and aesthetic sites and resources during construction activities |

## 8.2 Hydropower projects

### 8.2.1 General characteristics of hydropower projects

Hydroelectric projects consist of dams, reservoirs, powerhouses and related structures such as switchyards for the generation of electricity. They require the construction of a transmission line to convey the power to its users. Electric power transmission lines are discussed further.

The dam and reservoir may be used for other purposes than electricity generation such as irrigation, flood control, water supply, recreation, fisheries, navigation and sediment control. However, these uses shall be well examined in order to ensure that the priority use (electricity) is optimised.

*Hydropower dam in concrete*

The construction and operation of dams and reservoirs include several activities or components that can potentially induce significant environmental and social impacts:

- River diversion, including the construction of a diversion canal.
- Land clearing and relocation/demolition of existing infrastructures in the future reservoir.
- Construction of secondary dykes.
- Population resettlement.
- Construction of access roads.

- Construction, maintenance and closure of labour camps and other temporary infrastructures.
- Construction of the dam: digging, blasting, construction of foundations, transportation and storage of material, operation of heavy machinery, etc.
- Exploitation of borrow pits (on-site and off-site).
- Activities associated with construction works such as the manipulation of fuel, waste and hazardous materials, production of wastewater, etc.
- Flooding and management of the reservoir.

Dams are built on a natural waterway in order to impound water. They can be made of concrete, rocks or earth. Dykes, generally in rocks or earth, intend to prevent water stocked in the reservoir to flow out of the reservoir through secondary valleys.

In general, a powerstation includes the following hydraulic and electric components:

- The water intake in the reservoir, which is normally equipped with grills to prevent debris entering into the system.
- The water conveyance canal that brings the water to the pressure pipeline.
- The pressure pipeline in which the water is directed to a turbine on a steep slope.
- The turbine consisting of a hydraulic wheel turning with the pressure of the water; the electricity is produced with an alternator, before being directed to electric transformers and a substation.
- Surging facilities to take care of overpressures as a result of sudden opening/closing of valves/gates.
- The water discharge canal that brings the water downstream into the waterway.

A hydroelectric complex is normally equipped with spillway, which are structures allowing the water to flow out of the reservoir when the maximum capacity is reached.

The design of hydropower projects varies according to local characteristics and energy needs. For example, to avoid problems related to the creation of a reservoir, the construction of a run-of-river powerstation might be preferred.

### 8.2.2 Environmental issues related to hydropower projects

**Changes in the river system**

Building a dam on a river and creating a reservoir can cause important impacts on the hydrology and limnology of the river system. The modification of the river water flow alters the quality, quantity and use of water, aquatic habitat, and sedimentation dynamics in the river basin. Major changes in the flow patterns downstream of the dam may occur because water storage and releases are managed for power demand rather than for downstream ecological balance.

The decomposition of organic matter on lands flooded by the presence of the dam creates an environment rich in nutrients. In addition to organic matter leaching from the watershed upstream of the reservoir, this organic input may enhance the growth of invasive aquatic weeds, such as water lettuce and water hyacinth, which can become real nuisances to the dam outflows, irrigation canals, fisheries, recreation, and navigation. Moreover, if the flooded land is heavily wooded, as it can be the case in the Nile Equatorial lakes countries, and not sufficiently cleared prior to flooding, decomposition will reduce oxygen levels in the water, thus affecting aquatic life (fisheries) and drinking water supplies, especially downstream of the dam, due to the production of hydrogen sulphide and methane, a greenhouse gas.

Suspended particles normally carried by the river settle in the reservoir, thus limiting its storage capacity and lifetime, and robbing downstream floodplains agricultural areas of silt rich in nutrients to sustain productivity. Moreover, the release of waters free of sediment can result in the scouring of downstream riverbeds and banks.

For hydroelectric projects in Tanzania and Kenya located on rivers flowing in the Indian Ocean, the habitat of aquatic wildlife in estuaries may be affected by the changes in water flow and quality due to variations in the salinity balance. Changes in nutrient levels and the degradation of water quality may also generate impacts on the productivity of an estuary.

Finally, hydroelectric projects in NBI countries may alter the levels of groundwater both above and below the reservoir.

**Fisheries and wildlife**

The changes in the river system may adversely affect fisheries, upstream and downstream of the dam, through the degradation of water quality, loss of spawning grounds and barriers to fish migration. However, the reservoir may sometimes enhance the development of fisheries.

The greatest impact on wildlife will come from loss of habitat resulting from reservoir filling and land-use changes in the watershed. Migratory patterns of wildlife may be disrupted by the reservoir and associated developments. Poaching and eradication of species considered to be agricultural pests have a more selective effect. Aquatic fauna, including waterfowl, reptiles, and amphibian populations are expected to increase in the reservoir.

### 8.2.3 Social issues related to hydropower projects

**Non-resident workers**

One major issue related to hydropower projects involves the arrival of hundred of workers for building the plant. This can have a significant adverse effect on the existing community infrastructure: school, police, fire protection, medical facilities, and so forth. Moreover, the influx of workers from other localities or regions may have a serious impact on the transmission of sexually transmitted infections such as HIV/AIDS and disrupt local social and cultural values, as well as the quality of life of the residents.

**Agriculture**

The selection of dam site must take into account the agricultural potential of the soils that will be lost under the flooded areas. Indeed, sites with the lowest soil potential shall be preferred in order to minimise the impacts for farmers. If the selected dam site has many good soil potential areas, the flooded surface should be minimized.

During its design, engineers must conceive a dam with a reservoir large enough to store sufficient water not only for electricity production but also for irrigation purposes, upstream and downstream of the dam. Whenever possible, design parameters should consider the exploitation of the marling zone for pasture and/or agricultural production. Marling zone is the portion of land flooded at the highest water level but not flooded at the lowest water level of the reservoir. Because of the growth period necessary between seeding and harvesting, only the upland portion of the marling zone can be profitably used.

Furthermore, electricity produced at the dam could also contribute to the sustainable development of the agricultural sector by improving agricultural product conservation (cold chain for vegetable, fruit, meat, fish, etc.) and transformation (juice manufacturing, cannery, dairy). Finally, hydroelectricity can also be used as an energy source for water pumps and this way reduce fuel consumption which contributes to air pollution (particle emission) and climatic changes (greenhouse effect).

**Resettlement**

Though the powerhouses and all related infrastructures involve land acquisition and involuntary resettlement, large dams and reservoirs often entail complex and difficult resettlement operations. If a dam is constructed and a large reservoir is produced, the reservoir may flood an entire river valley. Riverine fisheries and traditional floodplain agriculture are disrupted.

In NBI countries, river valleys and river banks are usually densely inhabited. The floodplains are vast areas of great importance for population. For instance, the population density in the area of the Nile Basin in DRC is approximately five times higher than in the rest of the country. In Kenya, 40% of the country's population live in the Nile basin though this area constitutes only 10% of the country.

In NBI countries, rural people depend on water resources for their living: agriculture, gardening, fishing, stockbreeding, drinking water, etc. The people have a land-base livelihood. River banks are generally fertile lands. They are often inhabited by farmers whose families have worked the land for generations.

Inundation of a valley will force people very attached to their land to move out. The relocation of the people affected is difficult since upland areas are generally already used by other farmers living next to the valley. Finding agricultural sites of vocational advantage or productive potential at least equivalent of those of the pre-displacement sites is very hard. The traditional means of livelihood of the affected people are difficult to restore. In addition, these rural people are often illiterate and their skills are likely to be location specific. The transition to alternative means of earning a livelihood thru training and job opportunities is not an easy process.

The reservoir will not only entail relocation. It will also disrupt the use of the river by people living outside the edge of the river banks. Access to common-property resources such as fishes in the downstream stretches of the river or forests in the surrounding area of the proposed reservoir will be compromised. The resettlement plan will need to compensate all these losses of incomes or means of livelihood whether or not the affected people must move to another location.

Resettlement issues related to dam construction and reservoir being very important, the selection of dams for construction must be based on a comprehensive analysis of alternatives. The severity of resettlement impacts will be a key criterion for screening these alternatives.

### 8.2.4 Potential impacts of hydropower projects and mitigation measures

Over all past experiences related to hydropower development, the environmental community has made substantial improvements to understand the environmental and social impacts of dams. The management of environmental issues arising from hydropower is undergoing rapid improvement. Targeted studies and monitoring programs have identified viable mitigation options and provided long-term assessments of their effectiveness. Changes in the approach to hydroelectric project planning and design have resulted in the optimisation of beneficial impacts and the reduction of adverse impacts.

Table 8.2 below summarises the environmental and social impacts specific to hydroelectric projects, and presents the common measures to offset, minimise, mitigate or compensate these impacts. General impacts and mitigation measures related to the construction of hydroelectric projects have been listed in Section 8.1 above.

**Table 8.2 Potential impacts, mitigation and enhancement measures specific to hydroelectric projects**

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
|---|---|
| **Water** | |
| • Alteration of water flow downstream impairing agricultural activities on floodplains.<br>• Flood control.<br>• Proliferation of aquatic weeds in reservoir and downstream impairing dam discharge, irrigation schemes, navigation and fisheries.<br>• Degradation of the reservoir water quality.<br>• Salt water intrusion in estuary and upstream. | • Clear the vegetation before flooding the reservoir.<br>• Apply appropriate weed control measures.<br>• Control land uses, wastewater discharge and agricultural chemical inputs in watershed.<br>• Limit retention time of water in reservoir.<br>• Maintain a minimum flow to prevent salt-water intrusion. |
| **Soils** | |
| • Loss of productive soils by flooding.<br>• Scouring of riverbed downstream of the dam due to the low content of sediments in water.<br>• Salinisation of floodplain soils. | • Avoid areas sensitive to erosion.<br>• Carry out the construction works in the dry season.<br>• Limit the circulation of heavy machinery to minimal areas.<br>• Avoid establishing access roads along steep slopes; instead, locate the access roads perpendicularly or diagonally to the slope.<br>• Use existing borrow pits rather than creating new ones; after the works, restore borrow pits by stabilising slopes and facilitating vegetation regeneration.<br>• Stabilise the soils in order to reduce potential erosion.<br>• At the end of construction works, level off the soils and facilitate vegetation re-generation.<br>• Implement integrated watershed management in order to control soil erosion.<br>• Prevent land clearing in watershed and facilitate the reforestation of cleared areas.<br>• Design the works in order to release sediments (hydraulic release).<br>• Dredge accumulated sediments.<br>• Regulate water flow to minimise soil salinisation. |

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
|---|---|
| **Biodiversity** | |
| • Destruction of ecosystems of particular interest.<br>• Degradation of ecologically sensitive areas.<br>• Loss of rare or threatened species. | • Design the project by taking into account ecosystems of particular interest and ecologically sensitive areas.<br>• Protect equal areas of ecosystems of particular interest to offset losses.<br>• Establish a perimeter of protection around sensitive ecosystems such as wetlands and unique habitats sheltering endangered species.<br>• Avoid flooding wetlands and protected areas. |
| **Vegetation** | |
| • Destruction of vegetation.<br>• Loss of forest products (fuelwood, timber, non-timber forest products). | • Minimise the land clearing areas around the reservoir.<br>• Recuperate the forest products extracted from land clearing and identify mechanisms to distribute the products to the local population. |
| **Wildlife** | |
| • Loss of wildlife and fish habitats.<br>• Disruption of wildlife migrations.<br>• Adverse impact on fishes due to changes in water flow and disruption of fish migrations.<br>• Creation of reservoir fisheries. | • Design the project by taking into account wildlife reproduction areas and migration corridors.<br>• Minimise sedimentation in spawning grounds downstream.<br>• Relocate animals before flooding the reservoir.<br>• Maintain a minimum water flow for fishes.<br>• Provide appropriate means of passage for fishes.<br>• Preserve spawning grounds.<br>• Facilitate the development of culture fisheries in reservoir as a mean of compensation. |
| **Health outcomes** | |
| • Changes in exposure to water borne diseases (diarrhoea and cholera associated with misuse of reservoir water for domestic purposes).<br>• Changes in exposure to water related diseases (malaria, onchocerciasis, filariasis associated with increases in vector breeding and contact).<br>• Improvement in health conditions due to better access to domestic water.<br>• Increased risk of drowning. | • Provide appropriate domestic water supply to address additional needs.<br>• Facilitate the implementation of appropriate latrines and other sanitation facilities.<br>• Information, education and communication about safe uses of reservoir water and occupational safety.<br>• Environmental management for vector control; contact avoidance via settlement location and design, use of bednets and repellents, construction of jetties; rapid diagnosis and treatment; focal insecticide and molluscicide application.<br>• Strengthen medical services to ensure rapid diagnosis and treatment and enhance diagnostic skills, taking into consideration the particular needs of men and women.<br>• Plan lifesaving equipment and measures.<br>• Ensure that downstream villages are informed in advance of water fluctuations. |

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
| --- | --- |
| **Socio-economic development** | |
| • Disruption of existing activities particularly floodplain agriculture and artisanal fisheries downstream.<br>• Disruption of activities in catchment areas, particularly if they represent potential sources of pollution for the reservoir.<br>• Induced development due to new opportunities such as in fisheries and irrigation. | • Offer appropriate compensations or alternative income opportunities to men and women having a reduced access to or loosing productive means.<br>• Whenever possible, give an opportunity to men and women who are directly loosing from the projects to benefit from new jobs or revenue-generating opportunities (e.g. induced development). |
| **Land use** | |
| • Loss of productive land and natural resources in flooded areas.<br>• Insufficient arable land to satisfy subsistence agricultural needs.<br>• Loss of territory for local populations.<br>• Rivalry associated with incompatible water uses upstream and downstream. | • Take into account the various land uses while designing the project in order to minimise loss of land, particularly productive land.<br>• Coordinate project works with the various land users.<br>• Involve traditional authorities in the design of the project.<br>• Wherever possible, compensate the loss of land by protecting an equivalent land area in the region.<br>• Prevent food insecurity by allocating land and credit to food cropping.<br>• Regulate dam releases to partially replicate natural flooding regime.<br>• Clearly define water rights and establish water user fees in consultation with concerned stakeholders. |
| **Infrastructures and services** | |
| • Destruction of existing infrastructures in the reservoir.<br>• Reliable water supply for irrigation, domestic and other uses.<br>• Contamination of domestic water supplies due to the mismanagement of the reservoir.<br>• Increased pressures on existing social services due to migration.<br>• Increased prices of services (water, electricity, etc.). | • Consult concerned administrations to verify the adequacy of proposed new infrastructures.<br>• Involve the local population in the maintenance and management of new infrastructures to ensure their sustainability.<br>• Ensure adequate social services, including drinking water supplies, for addressing the basic needs of the local populations and migrants.<br>• Assist social service administrations in coordinating their efforts to offer additional services and improve service delivery if required.<br>• Establish quality control for water supplies. |

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
|---|---|
| **Cultural heritage** | |
| • Loss of sites of cultural, archaeological or historical importance by flooding of very large areas. | • Before construction, carry out an archaeological search in the potential areas containing artefacts and preserve discovered artefacts.<br>• Negotiate with traditional authorities the preservation of important cultural, religious, historical and aesthetic sites and resources and agree on potential compensation for the communities.<br>• During construction, ensure an archaeological surveillance in the potential areas containing artefacts and in case of a discovery, advise the concerned authorities.<br>• Involve traditional authorities in monitoring cultural, religious, historical and aesthetic sites and resources during construction activities. |

## 8.3 Thermal power projects

### 8.3.1 General characteristics of thermal power projects

Thermal power projects may include gas, oil, coal or combined fuel-fired steam plants. The major components of these projects include the power system itself and many associated infrastructures: cooling system, stack gas cleaning equipment, fuel storage and handling areas, fuel delivery systems, solid waste storage areas, workers compounds and electrical substations. They also involve transmission lines and may require a pipeline in case of gas power systems.

*Thermal power station*

### 8.3.2 Environmental issues related to thermal power projects

**Atmospheric emissions**

Thermal power plants can constitute major air emission sources, including nitrogen oxides ($NO_x$), carbon monoxide (CO), sulphur dioxide ($SO_2$), carbon dioxide ($CO_2$) and particulates (which may contain trace metals). These emissions, caused by the combustion of fuels, can affect local and regional air quality and contribute to greenhouse gas emissions. The dispersion and ground level concentrations of these emissions are determined by the interaction of the characteristics of the plant stack, chemical characteristics of the emissions, and local meteorological and topographical conditions.

**Wastewater**

The bulk of wastewater from thermal power plants are typically clean cooling water and can be either recycled or discharged into a surface water body. However, the impact of waste heat on the water quality needs to be considered. Indeed, the increase in temperature can affect the aquatic habitat for vegetation and wildlife. Other liquid waste, particularly of coal-fired power plants, can also affect water quality.

### 8.3.3 Social issues related to thermal power projects

**Non-resident workers**

One of the major issues related to thermal power plants involves the arrival of hundred of workers for building and operating the plant. This can have a significant adverse effect on the existing community infrastructure: school, police, fire protection, medical facilities, and so forth. Moreover, the influx of workers from other localities or regions may have a serious impact on the transmission of sexually transmitted infections such as HIV/AIDS and disrupt local social and cultural values, as well as the quality of life of the residents.

**Agriculture**

The selection of a construction site for a thermal power plant must take into account soil potential (quality) of the land that will be lost for agriculture or pasture. For example, between two sites having good technical characteristics, the one with the lowest soil potential shall be selected. Thereby, it will be easier to compensate the losses with land having similar or higher potential. When ever possible, plant designers should pay attention in minimizing the surface area of the building in order to limit land lost.

Retrieving large volumes of water from rivers for industrial purposes can reduce significantly the volume of water use for agriculture (mainly for land irrigation and livestock watering purposes). For instance, water retrieved for a plant cooling system will be warmer when it will be pumped back to the stream. This raise of water temperature can decrease plant growth and disturb animals in the surrounding area. A planning phase must be done in order to carefully identify all changes and opportunities for the local population.

**Resettlement**

Gas pipelines do not entail much land acquisition. If the pipelines are underground, they involve restrictions on the use of the land inside their corridor. Therefore, they involve compensations for the restrictions imposed.

Depending on the type of facility, location and size of the thermal power projects, the resettlement impacts will vary significantly. The impacts are typical involuntary resettlements due to land acquisition for the plant site and the associated facilities. Thermal power projects have less severe resettlement impacts than those of dams. Security and safety considerations may require a large land area but resettlement can be minimized thru site selection. The plant may be installed in a vacant or scantily inhabited area. Like other projects, thermal power projects may cause indirect displacement. Scantily inhabited areas or isolated forests can shell resources used for instance by indigenous communities for their livelihood. Therefore, the resettlement planning will pay careful consideration to participatory assessment of social risks in the selection of the site process.

8.3.4 Impacts of thermal power projects and mitigation measures

Environmental impacts from thermal power plant operation are normally far more important than those of construction. Impacts that need to be analysed and reported include those on existing air, water, and soil quality, and the disposal of solid wastes. Impacts on the vegetation, wildlife, local populations, and the health and safety of workers must also be considered. According to the *Thermal Power Plant Projects Environmental Impact Assessment: Guidelines* of the Southern African Power Pool (SAPP, 2001), primary sources of environmental impacts of thermal power plant operation include:

- Fuel delivery, storage, and handling;
- Products of combustion;
- By-products of pollution control (ash, sludge, solid waste);
- Vehicular traffic;
- Fugitive emissions;
- Wastewater;
- Cooling water discharge, or salt drift in the case of the use of cooling towers; and
- Leaks and spills.

Table 8.3 below summarises the typical environmental and social impacts specific to thermal power projects, and presents the common measures to offset, minimise, mitigate or compensate these impacts. General impacts and mitigation measures related to the construction of a thermoelectric facility are listed in Section 8.1.

**Table 8.3 Potential impacts, mitigation and enhancement measures specific to thermal power projects**

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
|---|---|
| **Ambient air** | |
| • Deterioration of air quality due to stack gases emitted following fuel combustion.<br>• Greenhouse gas emissions.<br>• Odours due to onsite sewage or wastewater treatment or due to high sulphur content in fuel. | • Locate the facility away from sensitive air quality receptors.<br>• Design higher stacks to reduce ground level concentrations of pollutants.<br>• Use clean fuel, i.e. low sulphur coal.<br>• Install and maintain proper air pollution control equipment.<br>• Use equipment complying with restrictive standards. |
| **Water** | |
| • Degradation of surface water quality due to thermochemical plume impacts, generation of sanitary waste stream, and increased run-off due to removal of vegetation.<br>• Increase of the surface water temperature due to cooling waters discharge.<br>• Drawdown of the groundwater table in case of supply of process water from wells.<br>• Degradation of groundwater quality due to percolation from settling and sludge ponds, leakage of fuels, process chemicals, or other compounds used onsite. | • Undertake the collection and treatment of sewage and organic waste.<br>• Dilute wastewater at point of discharge<br>• Use biodegradable or otherwise readily treatable additives.<br>• Increase recycling and reuse of water.<br>• Use alternative heat dissipation design (ex. Closed cycle cooling).<br>• Dilute thermal condition by discharging water into larger receiving water body.<br>• Cool water on-site in holding pond prior to discharge.<br>• Install mechanical diffusers.<br>• Explore opportunities to use waste heat.<br>• Dewatering of sludge and appropriate disposal of solids.<br>• Use deep well injection below potable levels.<br>• Construct liners for ponds and solid waste disposal. |
| **Soils** | |
| • Soils contamination due to deposition of windblown fugitive dust and coal.<br>• Soils contamination due to deposition of sulphates, nitrates and metals from the stack plume.<br>• Soils contamination due to chemical discharges and spills. | • Implement above mitigation measures under the “ambient air” component.<br>• Develop spill prevention plans.<br>• Develop traps and containment systems and chemically treat discharges on site. |
| **Ecosystems and vegetation** | |
| • Vegetation removal and loss of habitat. | • Select alternative site to avoid loss of ecological resources.<br>• Compensate the loss of vegetation and/or habitat. |

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
|---|---|
| **Aquatic wildlife** | |
| • Thermal shock to aquatic wildlife.<br>• Entrainment and impingement of aquatic wildlife. | • Implement above mitigation measures under the “water” component.<br>• Locate the water intake in area that avoids significant impact on aquatic wildlife.<br>• Install screens on the water intake to avoid entrainment and impingement. |
| **Quality of life** | |
| • Increase of ambient noise due to the operation of heavy equipment, transfer and handling of fuel, turbines, steam relief, whistles and alarms, traffic (trucks and machinery). | • Control the timing of noise and vibration to least disruptive periods.<br>• Install noise barriers.<br>• Develop plan to educate workers on sensitive values and patterns. |
| **Health outcomes** | |
| • Worker exposure to dust from ash and coal.<br>• Worker exposure to toxic gases leaking from the broilers.<br>• Worker exposure to excessive noise.<br>• Potential for fire risk. | • Provide dust collector equipment.<br>• Maintain dust levels less than 10mg/m³.<br>• Monitor for free silica content.<br>• Provide dust masks when levels are exceeded.<br>• Maintain boilers properly.<br>• Monitor concentrations with levels not to exceed: $SO_2$ - 5ppm; CO - 50ppm; $NO_2$ - 5ppm.<br>• Maintain noise levels from below 90dBA.<br>• Provide ear protection if in excess.<br>• Ensure that fire prevention and fighting equipment is supplied to the project site. |
| **Infrastructures and services** | |
| • Increased demand on infrastructure due to induced secondary development. | • Provide infrastructure plan and financial support for increased demands.<br>• Construct facilities to reduce demands. |

## 8.4 Geothermal power projects

### 8.4.1 General characteristics of geothermal power projects

Depending on temperature, depth and quality of the water and steam in the project area, three different types of power plants are used to produce electricity from geothermal energy, i.e. dry steam, flash, and binary.

Dry steam is extremely hot steam, typically above 235 °C. This steam is used for direct running of generators. This is the most simple and oldest principle and still in use because it is the far cheapest principle of generating electrical energy from geothermal resources.

Flash steam plants are the most common type of geothermal power generation plants in operation. Flash steam power plants use hot water above 182°C from geothermal reservoirs. As the water is pumped from the reservoir to the power plant, the drop in pressure causes the water to convert (flash) into steam to power the turbine. Any water not flashed into steam is injected back into the reservoir for reuse. Flash steam plants, like dry steam plants, emit small amounts of gases and steam.

*Geothermal power station*

Binary cycle power plants use water cooler than flash steam plants (i.e. from 107 to 182°C). The hot fluid from geothermal reservoirs is passed through a heat exchanger which transfers heat to a separate pipe containing Iso-butane or Iso-pentane, which are vaporized to power the turbine. The advantage of binary-cycle power plants is their lower cost and increased efficiency. These plants also do not emit any excess gas and, because they use fluids with a lower boiling point than water, are able to utilize lower temperature reservoirs, which are much more common.

In all cases the condensed steam and remaining geothermal fluid is injected back into the ground to pick up more heat.

### 8.4.2 Environmental issues related to geothermal power projects

On the environmental point-of-view, geothermal energy offers a number of advantages over fossil fuel used by thermal power plants. Indeed, geothermal energy is clean and safe for the surrounding environment. It is also sustainable because the hot water used in the geothermal process can be re-injected into the ground to produce more steam. Moreover, geothermal energy is competitive on the economic standpoint and reduces reliance on costly fossil fuels.

Geothermal power plants do not involve important environmental concerns, except for low levels of carbon dioxide, nitric oxide, and sulfur emissions. However, geothermal plants can be built with emissions-controlling systems that can inject these gases back into the earth, thereby reducing carbon emissions to non-significant levels.

### 8.4.3 Social issues related to geothermal power projects

**Land use**

The space requirements of geothermal installations (wells, pipelines and plant) are quite modest, so these facilities hardly interfere with agricultural utilization of the surrounding land and rarely require involuntary resettlement.

However, the selection of a construction site for a geothermal power plant must take into account soil potential (quality) of the land that will be lost for agriculture or pasture. For example, between two sites having good technical characteristics, the one with the lowest soil potential shall be selected. Thereby, it will be easier to compensate the losses with land having similar or higher potential. Whenever possible, plant designers should pay attention in minimizing the surface area of the facility in order to limit land lost.

### 8.4.4 Potential impacts of geothermal power projects and mitigation measures

General impacts and mitigation measures related to the construction of a geothermoelectric facility have been listed in Section 8.1. Specific environmental and social impacts are presented in Table 8.4.

**Table 8.4 Potential impacts, mitigation and enhancement measures specific to geothermal power projects**

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
|---|---|
| **Ambient air** | |
| • Low level greenhouse gas emissions.<br>• Odours due to onsite sewage or wastewater treatment. | • Install and maintain proper air pollution control equipment.<br>• Use equipment complying with restrictive standards. |
| **Water** | |
| • Degradation of surface water quality due to increased run-off following the removal of vegetation.<br>• Degradation of groundwater quality due to percolation from settling and sludge ponds, leakage of fuels, process chemicals, or other compounds used onsite.<br>• Potential for groundwater contamination from pipeline breakage. | • Undertake the collection and treatment of sewage and organic waste.<br>• Dilute wastewater at point of discharge<br>• Dewatering of sludge and appropriate disposal of solids.<br>• Construct liners for ponds and solid waste disposal.<br>• Inspect regularly (monthly) the pipeline route for possible pipeline damage. |
| **Soils** | |
| • Soils contamination due to chemical discharges and spills. | • Design the pipeline according to standard engineering practices and codes.<br>• Develop spill prevention plans.<br>• Develop traps and containment systems and chemically treat discharges on site. |
| **Ecosystems and vegetation** | |
| • Vegetation removal and loss of habitat. | • Select alternative site to avoid loss of ecological resources.<br>• Compensate the loss of vegetation and/or habitat. |
| **Quality of life** | |
| • Increase of ambient noise due to the operation of heavy equipment, turbines, whistles and alarms, traffic<br>• Disruption of social and cultural values and patterns. | • Control the timing of noise and vibration to least disruptive periods.<br>• Install noise barriers.<br>• Develop plan to educate workers on sensitive values and patterns.<br>• Provide behavioural and psychological readjustment programs and services. |

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
|---|---|
| **Health outcomes** | |
| • Worker exposure to toxic gases.<br>• Worker exposure to excessive noise.<br>• Potential for fire risk. | • Avoid exposure to hydrogen sulphide gas ($H_2S$) using monitoring and warning systems, and contingency plan for $H_2S$ release events.<br>• Maintain noise levels from below 90dBA.<br>• Provide ear protection if in excess.<br>• Ensure that fire prevention and fighting equipment is supplied to the project site. |
| **Infrastructures and services** | |
| • Increased demand on infrastructure due to induced secondary development. | • Provide infrastructure plan and financial support for increased demands.<br>• Construct facilities to reduce demands. |

## 8.5 Power transmission lines

### 8.5.1 General characteristics of power transmission lines

Power transmission and distribution lines aim to transport and distribute the power generated by a power station. The main structures of power lines include electric wires, conductors, towers, supports, transformers and substations. Access roads are also required for constructing and maintaining the line.

The size of the electrical structures depends on the voltage and the capacity of the power line. Wood poles are often used for low-voltage distribution lines in urban and rural areas. H-frame wood pole structures are used for intermediate voltage lines. High-voltage transmission lines of 161 kV and more are usually built on self-supporting and guyed-wired pylons.

*Power distribution line*

The length of power lines, which can vary from a few to hundreds of kilometres, depends on the purpose of the line. Low-voltage lines, used for power distribution, are usually much shorter than high-voltage lines, which are used to carry the energy from power plants located in remote areas.

The width of the power line right-of-way also ranges according to the voltage. The distribution line right-of-way in urban or rural areas is usually narrow (5 to 20 m), whereas the right-of-way of high-voltage power transmission lines can be hundreds of meters wide, particularly when there is more than one line in the right-of-way.

### 8.5.2 Environmental issues related to power transmission lines

**Biological aspects**

Transmission lines can open up more remote lands to human activities such as settlement, agriculture, hunting, recreation, etc. Construction of the power line right-of-way can result in the loss and fragmentation of habitat and vegetation along the line. These effects can be significant if natural areas, such as wetlands or natural forests are affected, or if the newly-accessible lands are the home of indigenous peoples.

The control of vegetation in the right-of-way is often necessary to protect the power line. Various techniques exist for controlling the growth of vegetation. From an environmental and social point of view, selective clearing using mechanical means by local workers is most preferable in NBI countries and should be evaluated in the framework of the project environmental assessment. Aerial spraying of herbicides should be absolutely avoided because it may result in contamination of surface waters and terrestrial food chains, as well as elimination of desirable species and direct poisoning of wildlife.

### 8.5.3 Social issues related to power transmission lines

**Agriculture**

The route of the power transmission lines must take into account soil potential of the land (agriculture, pasture) that will be lost under these infrastructures. For example, among routes sharing the same technical characteristics, the one covering the area with the lowest soil potential shall be selected. Whenever possible, designers should pay attention in minimizing the size of the line towers at the ground level in order to limit surface lost for pasture et agriculture.

In order to minimize fragmentation of agricultural plots (increasing the workload for farmers), it is recommended to layout the line towers parallel to other existing linear infrastructures such as highways, railways or roads.

**Resettlement**

Electric power transmission lines are typical linear projects. They have a long but narrow corridor of impacts. Therefore, land acquisition or restriction consists of a strip along property borders. Acquisition or restrictions imposed on this strip only affect a small part of one's property. Seldom, relocation of occupants will be required. In this case, the inhabitants can usually be resettled in the same area and often, on their own plot of land.

A transmission line is usually only 12 to 25 meters wide but it extends for hundreds of kilometres in rural areas. For instance, Ethiopia-Sudan transmission project, being implemented under the NBI, involves a corridor of approximately 450 km long.

Except if they cannot avoid densely populated areas, transmission lines do not require permanent land acquisition apart from the towers which impact will be very slight. However, construction of associated infrastructures such as power substations may entail land acquisition.

Construction of a transmission line will involve compensation for temporary losses such as crop damage. The resettlement plan will also provide compensations for restrictions imposed on land use under the transmission lines if such restrictions are applied. The land acquisition for the towers being of only a few square meters per tower, the residual of the asset being taken will remain economically viable. An easement fee will generally suffice to compensate this permanent loss.

While transmission lines have less severe impacts than those of large-area such as hydroelectric projects, they pose challenges in resettlement planning. By their linear nature, transmission lines involve many stakeholders spread out in numerous localities. Public information and consultation of the stakeholders including local authorities will be held over hundreds of kilometres. Because the geographically dispersed populations are likely to be culturally and linguistically heterogeneous, the information and consultation will entail case-by-case adjustments. The census of the population and valuation of the lost assets and, the organizational coordination and monitoring during implementation will face the same problems. In addition, the resettlement plan for a transmission line will pose an important institutional challenge since the line cuts through many administrative jurisdictions.

**Health and safety**

Even if it is not clearly demonstrated, several studies concluded that electromagnetism emanating from power transmission lines could affect the health of people living and/or working nearby. In order to avoid any problems, it is recommended that electric power lines should not be layout in irrigated perimeters as farmers spend numerous hours in their plots for soil preparation, seeding, weeding or harvesting.

Placement of low-slung lines or lines near human activity (e.g., highways, buildings) increases the risk for electrocutions. Technical guidelines for design ordinarily minimize this hazard. Towers and transmission lines can disrupt airplane flight paths in and near airports and endanger low-flying airplanes, especially those used in agricultural management activities.

### 8.5.4 Impacts of power transmission lines and mitigation measures

Table 8.5 below summarises the typical environmental and social impacts specific to power transmission, and presents the common measures to offset, minimise, mitigate or compensate these impacts. General impacts and mitigation measures of a power transmission line have been listed in Section 8.1.

**Table 8.5 Potential impacts, mitigation and enhancement measures specific to power transmission lines**

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
|---|---|
| **Ambient noise** | |
| • Increase in ambient noise near the substations. | • Locate substations in remote areas.<br>• Establish vegetation edges around substations, in order to minimise noise. |
| **Water** | |
| • Contamination of surface and groundwater by pesticides used for the maintenance of the transmission line right-of-way. | • Favour the use of vegetation mechanical maintenance by local workers rather than pesticides.<br>• If mechanical maintenance is not feasible (in areas difficult of access for example, select herbicides with minimal undesired effects.<br>• Do not apply herbicides by aerial spraying. |
| **Soils** | |
| • Soil erosion along the right-of-way.<br>• Risk of soil contamination from substations. | • If possible, locate the transmission line route in flat areas.<br>• Develop spill prevention plans.<br>• Develop traps and containment systems and chemically treat discharges on site. |
| **Biodiversity** | |
| • Encroachment into ecologically sensitive and protected areas.<br>• Increased access to ecosystems of particular interest. | • Design the right-of-way layout avoiding ecologically sensitive and protected areas.<br>• Establish a perimeter of protection around sensitive ecosystems such as wetlands and unique habitats sheltering endangered species.<br>• Minimise the length of work in ecologically sensitive areas.<br>• Minimise the right-of-way layout in wetland and natural forest. |
| **Wildlife** | |
| • Fragmentation of wildlife habitats.<br>• Birds hazards from transmission lines and pylons.<br>• Increase in poaching. | • Maintain wildlife habitat beneath transmission line.<br>• Avoid important bird habitat.<br>• Install deflectors on lines in areas with potential for bird collisions.<br>• Design the right-of-way layout by taking into account wildlife reproduction areas.<br>• Control illegal hunting. |
| **Quality of life** | |
| • Visual degradation of the landscape due to new infrastructures. | • Favour an architectural design integrating project infrastructures into the landscape. |

| Potential adverse and beneficial impacts | Mitigation and enhancement measures |
|---|---|
| **Health outcomes** | |
| • Effect of electromagnetic fields.<br>• Increased risk of accidents due to aircraft colliding with transmission lines and pylons.<br>• Increased risk of electrocution associated with illegal abstraction. | • Avoid irrigated perimeters.<br>• Locate the right-of-way to avoid airport flight paths.<br>• Install markers to minimise risks of low-flying aircraft.<br>• Control illegal abstraction. |
| **Socio-economic development** | |
| • Diversification of income generating activities due to a better access to energy.<br>• Disruption of some economic activities such as tourism. | • Encourage the pursuing of agricultural activities in rights-of-way after construction.<br>• Avoid tourist sites. |
| **Infrastructures and services** | |
| • Better access to energy. | • Include an access component in projects to favour a broader distribution of electricity to households. |

# 9 LIFE CYCLE AND SYSTEMS APPROACH IN THE EIA FRAMEWORK

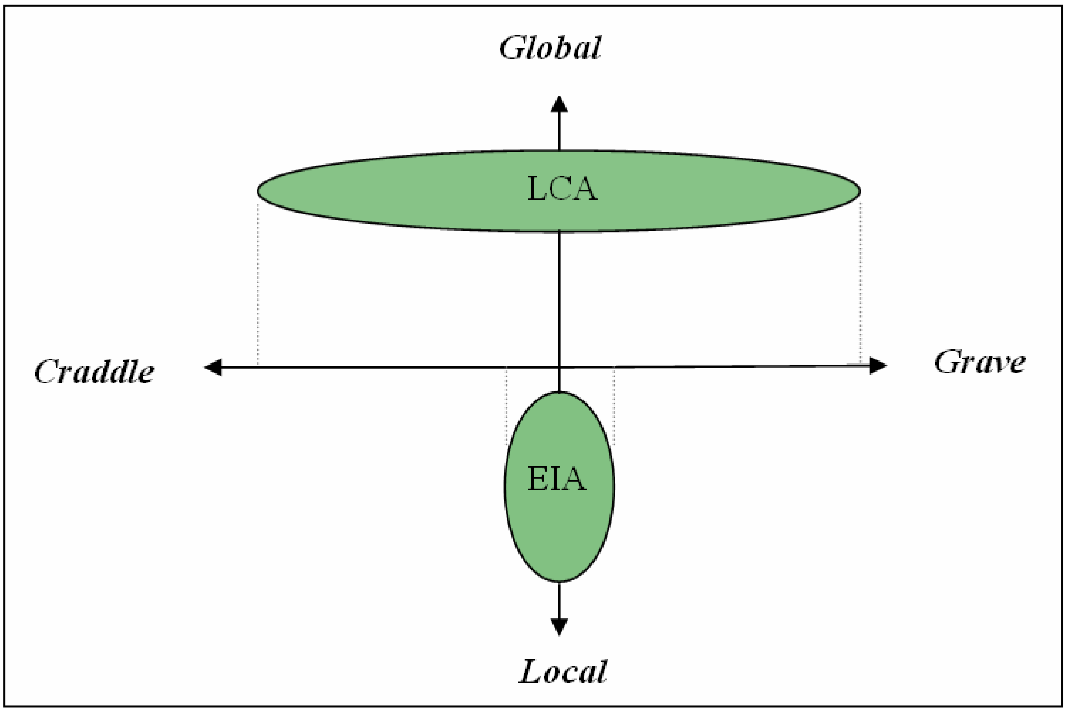
## 9.1 Life cycle assessment in EA

The integration of Life Cycle Assessment (LCA) in the environmental assessment (EA) of a power project is very innovative. Indeed, the LCA studies conducted so far were for general construction projects, especially after project implementation.

This EA framework considers three types of projects: hydropower, thermal and geothermal power plants. In addition, these projects require the construction of a power line to transport electricity to users.

The comparison of LCA and Environmental Impact Assessment (EIA) according to spatial (global versus local) and time (cradle versus local) scales is presented in Figure 9.1.

**Figure 9.1 Comparison of LCA and EIA**



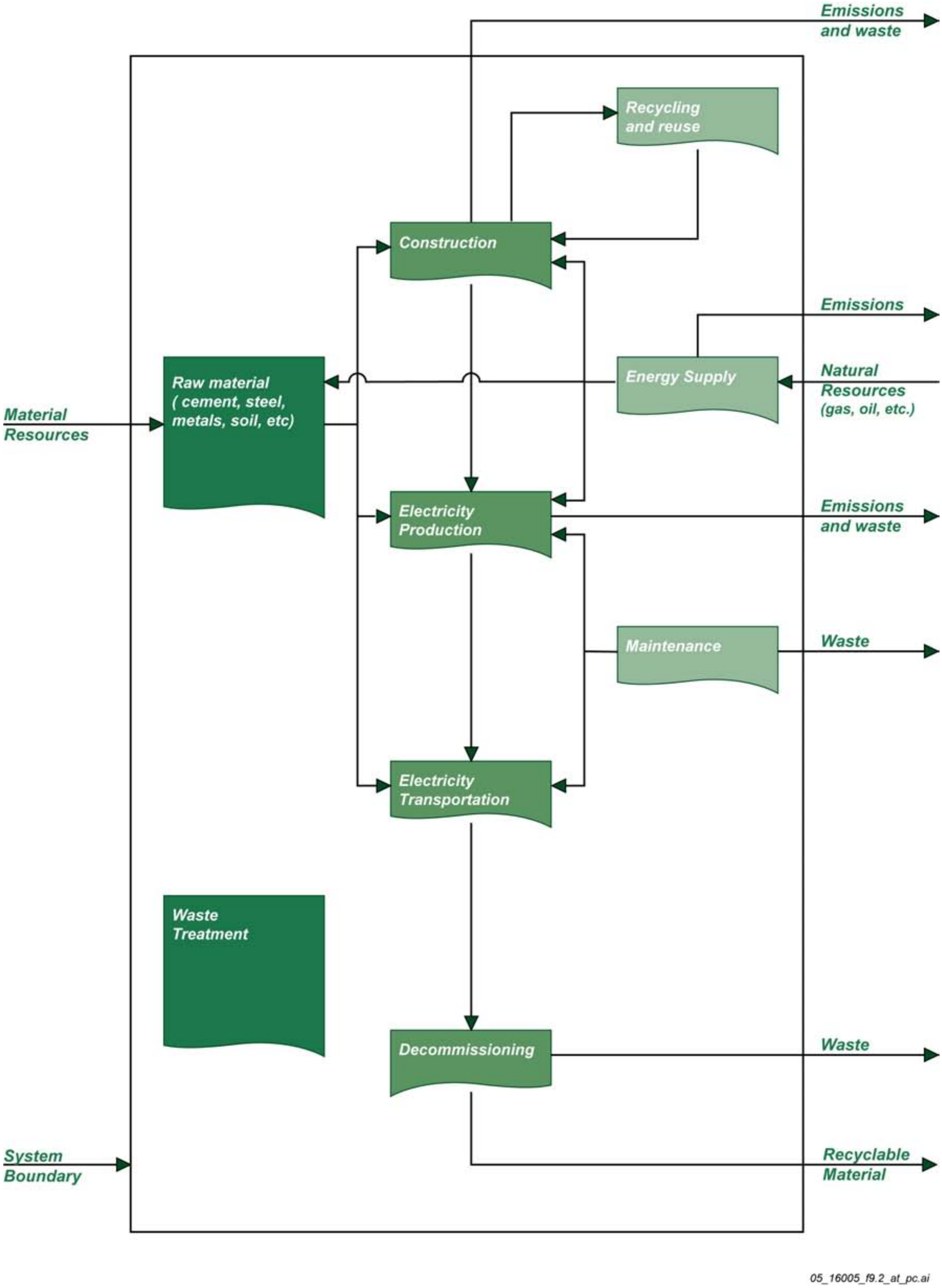

Contrary to EIA which is a specific site study, LCA is a method of evaluating the environmental impact systematically and quantitatively in the entire life cycle of a certain action by analysing all stages of the entire process “from craddle to grave”. LCA consists of three parts: identification and quantification of the flows of energy and materials; estimation of the consumption of energy and materials as well as emissions generation in every process; assessment of the total environmental impact of the entire life cycle and a proposal of solution to protect environment. However, LCA only assess the effects on ecology, health and the consumption of resources, and doesn't take into account economic or social effects.. That is the reason why, both LCA and EIA are complementary studies, especially for regional power projects in the NBI countries.

### 9.2 Definition of life cycle assessment

Life cycle assessment evaluates the global environmental impacts of a product (or a process) in relation of a functional unit, and this, for each step on its life cycle. According to ISO 14040, life cycle assessment shall include four different phases: definition of goal and scope, inventory analysis, impact assessment, and finally, interpretation of results. In other terms, LCA carries out an assessment quantified on all the project life cycle, thus covering a large number of different impacts. Moreover, it is the only assessment binding the environmental impacts and the principal function of the product or the project. For that reason, Life Cycle Assessment is a relevant holistic study, in complement to the Environmental Impact Assessment.

Applied to power projects, LCA must include the incidences of the raw material extraction, the treatment and the transport of fuels as well as the construction of the project, the activities of electricity production on the site and the decommissioning waste. Figure 9.2 shows the typical life cycle for an electrical power project.

**Figure 9.2 Typical Life Cycle (simplified model) for electrical power projects**



## 9.3 Life cycle assessment international standards

To make sure the LCA is recognized, it has to be conducted and based on international standards. The applicable international standard for LCA is the ISO 14040 series. The two most important standards of the ISO 14040 series are:

- ISO 14040 (2006): Environmental management – Life Cycle assessment – Principles and framework; and
- ISO 14044 (2006): Environmental management – Life Cycle assessment – Requirements and Guidelines.

They will be completed with:

- ISO 14047 (2003): Environmental management – Life Cycle assessment – Examples of application of ISO 14042;
- ISO 14048 (2002): Environmental management – Life Cycle assessment – Data documentation;
- ISO 14049 (2000): Environmental management – Life Cycle assessment – Examples of application of ISO 14041 to goal and scope definition and inventory analysis.

ISO 14040 defines the principles and the framework and ISO 14044 defines the requirements and the guidelines, all applicable to carry out a life cycle analysis. These two standards include: definition of the objectives and the scope of the life cycle analysis, the phase of life-cycle inventory and the evaluation of the impact of the life cycle. They also include the interpretation phase, the communication and critical review and the limitations of the life cycle assessment as well as the relationship between phases of the life-cycle assessment and the conditions for using choice of values and optional elements.

ISO 14047 is a technical report illustrating practices to conduct a life cycle impact assessment. They reflect the key elements of the life cycle impact assessment (LCIA) phases.

ISO 14048 provides the requirements and the structures for transparent and clear data documentation, so the exchange of Life cycle analysis and inventory cycle life data analysis will be facilitated.

The purpose of the Technical Report ISO 14049 is to provide examples of the method of realization of a life-cycle inventory. Those examples represent only a sample that would meet the provisions of the standard. They should not be regarded as the only way to put this standard into practice, but as a medium or resources.

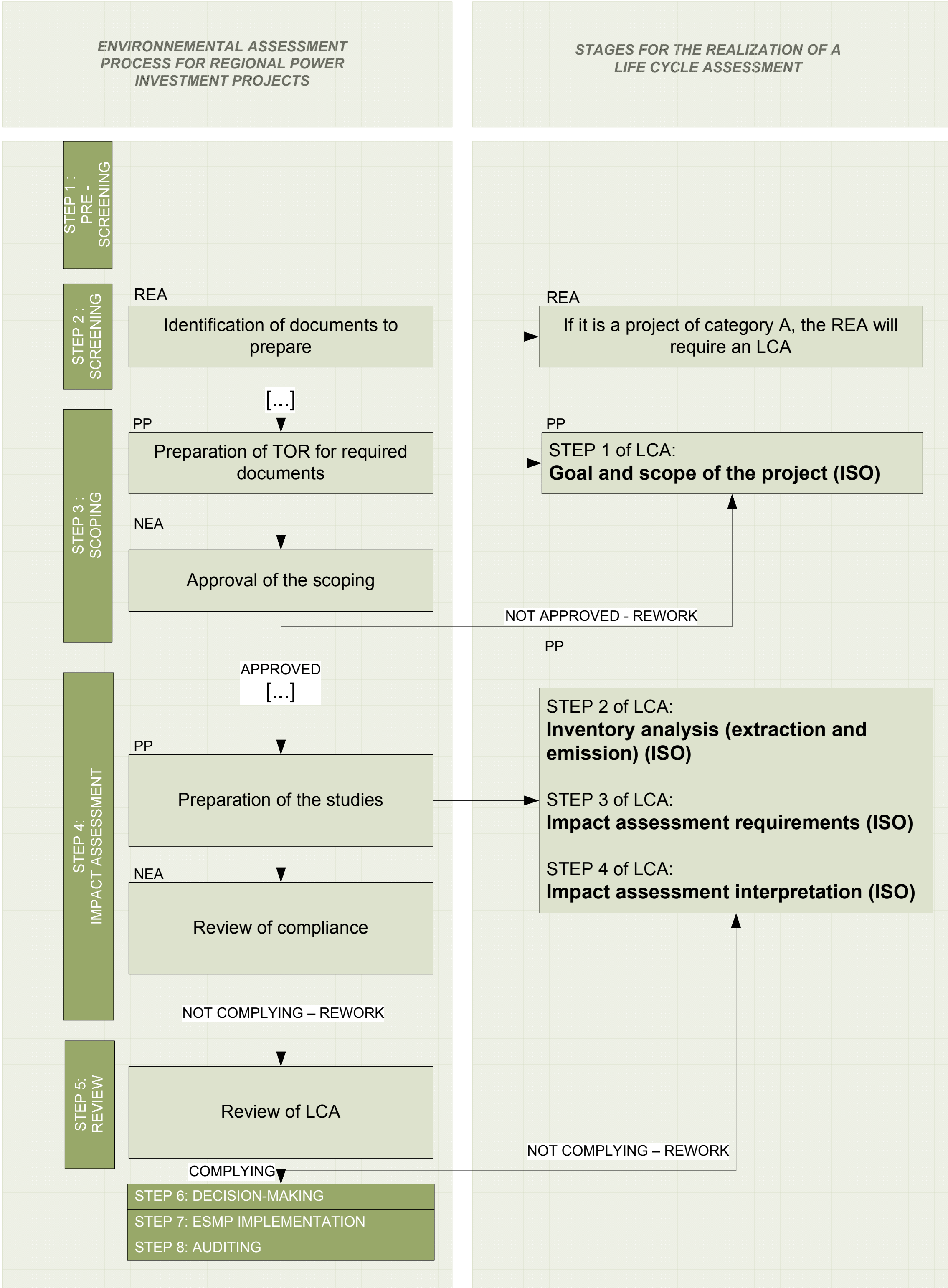
## 9.4 Life cycle assessment in the EA process for regional power projects in the NBI countries

The following points will help the proponent to understand what step of the Environmental Assessment Process it must undertake in the LCA study of the regional power project.

- Only Category A projects requires life cycle assessment.
- LCA is divided into 4 steps: 1) identification of the goal and scope, 2) inventory analysis, 3) impact assessment requirements, and 4) impact assessment interpretation. The first step is necessary in the scoping step of the EA Process. As for steps 2 to 4, they are carried out during the preparation of the studies during step 4 of the EA process (Impact assessment). In other terms, the LCA will be integrated in the EA process from the scoping stage up to the final decision.

Figure 9.3 shows the relation between LCA and the EA process for regional power projects.

## Figure 9.3 LCA in the EA process for regional power projects



## 9.5 Guidelines for conducting a life cycle assessment

### 9.5.1 Goal and scope of the project

According to ISO 14040, the goal of a LCA study shall unambiguously state the intended application, the reasons for carrying out the study and the intended audience, i.e. to whom the results of the study are intended to be communicated.

Moreover, the LCA study shall clearly describe the scope of the project. According to ISO 14040, the following items shall be considered:

- Goal and scope of the project;
- Function (ex: electricity production);
- Functional unit (ex: number of MWh generated);
- System boundary or main system components to be included in Electrical Power and transmission line project during construction, production, transportation, use and decommissioning phases;
- Sub-systems functions, functional units and boundaries among others related to the raw material production (ex: cement plant, steel plant, metal production plants, etc.), energy supply and land use;
- Data quality requirements;
- Critical review considerations based on international standard requirements.

Each of these items is developed in the following section.

**System function and functional unit**

The LCA study shall clearly specify the functions of the power investment project being studied. For example, the principal function should be "electricity generation".

When the function of the system is clearly defined, the LCA study shall identify the functional unit of the project. This functional unit indicates the unit being used to quantify the system function. Usually, the functional unit must be the same suggested in the others scenarios (generic scenarios). As an indication, the functional unit generally used in power projects is the MegaWatt hour (MWh).

**System Boundary**

The study shall determine which unit processes shall be included within his LCA. In order to establish the system boundary, the study needs to cover the various stages of the project life cycle:

- Extraction and preparation of the raw materials and energy;
- Construction of infrastructures, machines and inputs, as well as transportation;
- Main production phase (in this case: electricity production) and transportation;
- Waste processing (taking into consideration the possibilities of re-use, recycling and utilisation for energy purposes);
- Decommissioning of the plant.

**Data quality requirements**

The proponent shall define the data quality requirements to enable the goal and scope to be met by the LCA study. These data quality requirements specify the characteristics of data needed for the study. Data quality should be characterized by both quantitative and qualitative aspects and by the methods used to collect and integrate this data.

The data quality requirements include:

- Time-related coverage: the desired age of the data and the minimum length of time over which data should be collected;
- Geographical coverage: geographical area from which data for unit processes should be collected to satisfy the goal of the study (local, regional, national…);
- Technology coverage: technology mix (weighted average of the actual process mix, best available technology or worst operating unit).

The study shall also consider descriptors defining the nature of the data, such as the fact that they were collected from specific sites versus data from published sources, and whether the data should be measured, calculated or estimated.

The LCA study should use data from specific sites or representative averages for the unit processes contributing to the majority of the mass and energy flows in the systems being studied, as determined in the sensitivity analysis. The LCA should also use data from specific sites for unit processes that are considered to have environmentally relevant emissions.

The study must also consider the following additional data quality requirements in all studies, in a level of detail depending on the goal and the scope definition:

- Precision: measure of the variability of the data values for each data category used;
- Completeness: percentage of locations reporting primary data from the potential number existing for each data category in a unit process;
- Data representativeness: qualitative assessment of the degree to which the data set reflects the true population of interest (geographical coverage, time period and technological coverage);
- Consistency: qualitative assessment of how uniformly the study methodology is applied to the various components of the analysis;
- Reproducibility of the methods used throughout the LCA: qualitative assessment of the extend to which the methodology and data values allows an independent practitioner to reproduce the results reported in the study;
- Sources of the data and their representativeness;
- Uncertainty of the information.

**Critical review considerations**

The study shall consider conducting a critical review to verify if the LCA study has met the requirements of international standards related to methodology, data and reporting. This process gives more credibility to the study. The study shall define, in the scope of the study, whether and how to conduct the critical review and who is going to conduct the review. The scope and type of critical review desired shall be defined in this phase of the LCA (goal and scope definition).

The critical review will facilitate understanding of the LCA studies and enhance their credibility, by involving a third part (i. e. the interested parties). It should be mentioned in the scope of the study why the critical review is undertaken, what will be covered and what is the level of details desired. It is also important to specify who will be involved in the critical review process.

In the phase of LCA's scope definition, the study should consider the following information while defining the scope of the process of its critical review:

- The methods used to carry out the LCA are consistent with the International Standards ISO 14040 (2006);
- The method used to carry out the LCA are scientifically and technically valid;
- The data used is appropriate and reasonable in relation to the goal of the study;
- The interpretations reflect the limitations identified and the goal of the study;
- The study report is transparent and consistent.

It is important to know that ISO 14040 (2006) does not specify requirements on the goal or use of LCA, so the critical review can't neither verify nor validate the goals that are chosen for the LCA or the use of the LCA's results.

The critical review may be undertaken by three types of parties:

- An internal expert could be chosen in the case that an internal review is carried out. This expert needs to be familiar with ISO 14040 process and is scientifically and technically qualified. A review statement is prepared by the person conducting the LCA study and then reviewed by the internal, independent expert. This review statement may also be prepared by the internal, independent expert. It should be included in the study report;
- External expert could be chosen in the case that an external review is carried out. This expert needs to be familiar with ISO 14040 process and is qualified (scientifically and technically). A review statement is prepared by the person conducting the LCA study and then reviewed by the external, independent expert. This review statement may also be prepared by the external, independent expert. It should be included in the study report;
- An external independent expert is selected to act as the chairperson and, considering the goal, scope and budget available for the review, he will select another independent qualified reviewer.

### 9.5.2 Inventory analysis (extraction and emission)

The LCA study shall conduct an inventory analysis, which includes a data collection and calculation procedures to quantify relevant inputs and outputs of the system. These inputs and outputs may include the use of resources (energy, raw material, transport consumptions…) and releases to air, water and land associated with the system. The study must draw interpretations from these data, depending on the goals and scope of the LCA. The data also constitute the input to the life cycle impact assessment.

The study shall collect, for each unit process that is included within the system boundaries, the qualitative and quantitative data for inclusion in the inventory. The procedure used for data collection may vary depending on the scope, unit process or intended application of the study. Data collection can be a resource-intensive process. The study should consider in the scope the practical constraints on data collection and document it in the study report.

The LCA should pay attention to the significant calculation considerations outlined in the following.

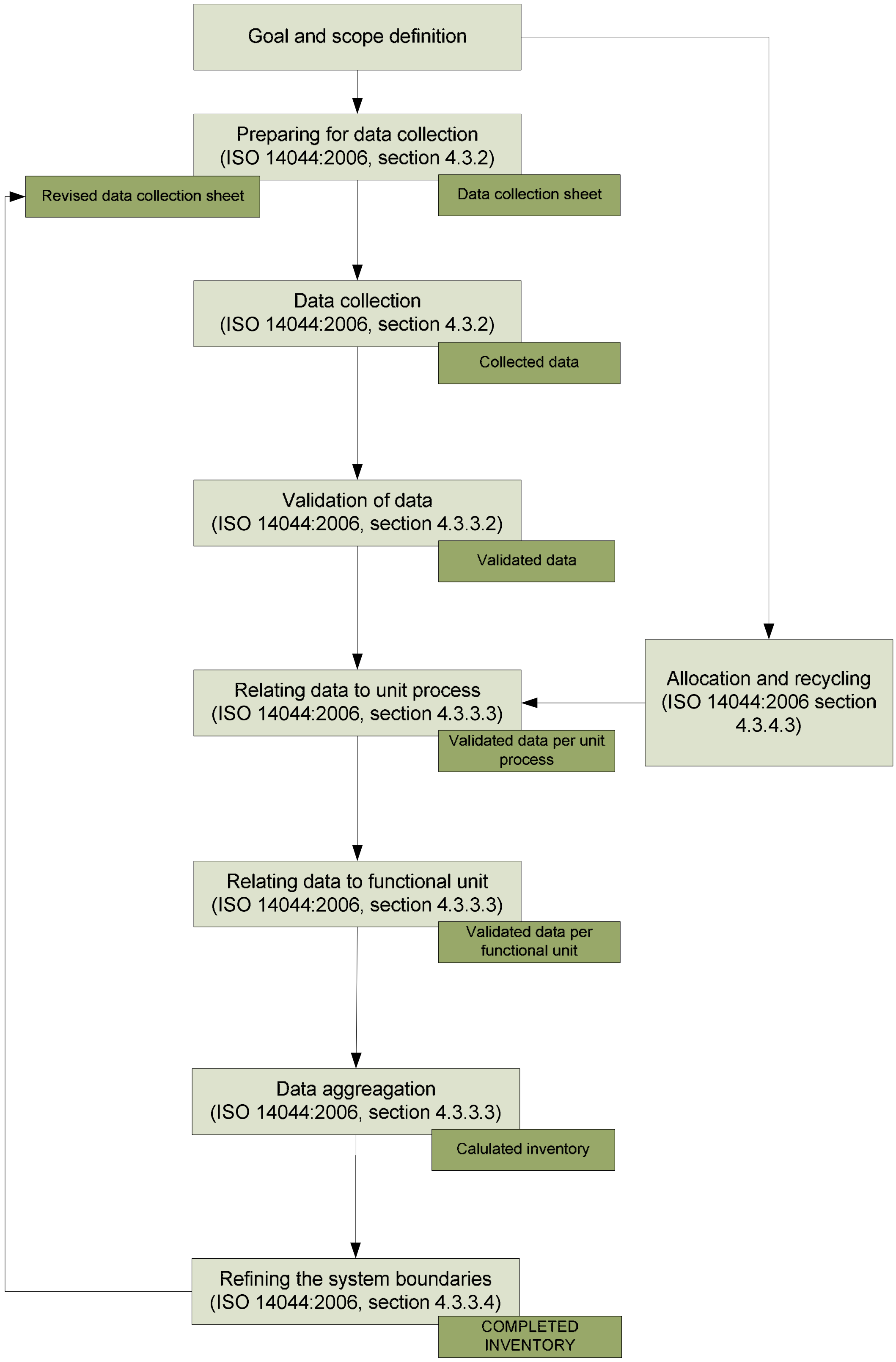
- Allocation procedures are needed when dealing with systems involving multiple products (e.g. multiple products from petroleum refining). The material and energy flows as well as associated environmental releases shall be allocated to the different products according to clearly stated procedures, which shall be documented and justified.
- The calculation of energy flow should take in consideration the different fuels and electricity sources used, the efficiency of conversion and distribution of energy flows as well as the inputs and outputs associated with the generation and use of that energy flow.

As shown on Figure 9.4, the approach to conduct a life cycle inventory analysis is the following:

- From reference flow defined in relation to the functional unit, the tree of the process for all basic unit modules of the system is established;
- For each unit basic process, its inputs and direct emissions are determined in a production inventory;
- The data regarding emissions and extractions of these inputs are sought in a database or throughout direct contact with the manufacturer of the product. These data could also be obtained *in situ*. Regarding indirect emissions and extractions, they are calculated by multiplying the quantity of input used by functional unit with factors of emissions per unit of inputs;
- Total emissions and extractions are calculated by summing direct elementary flows and emissions and extractions indirectly linked to inputs.

As data are collected and more is learned about the system, the study could identify new data requirements or limitations. These may require a change in the data collection procedures so that the goals of the study will still be met. In another hand, the study may identify issues that require revisions of the goal and scope of the study.

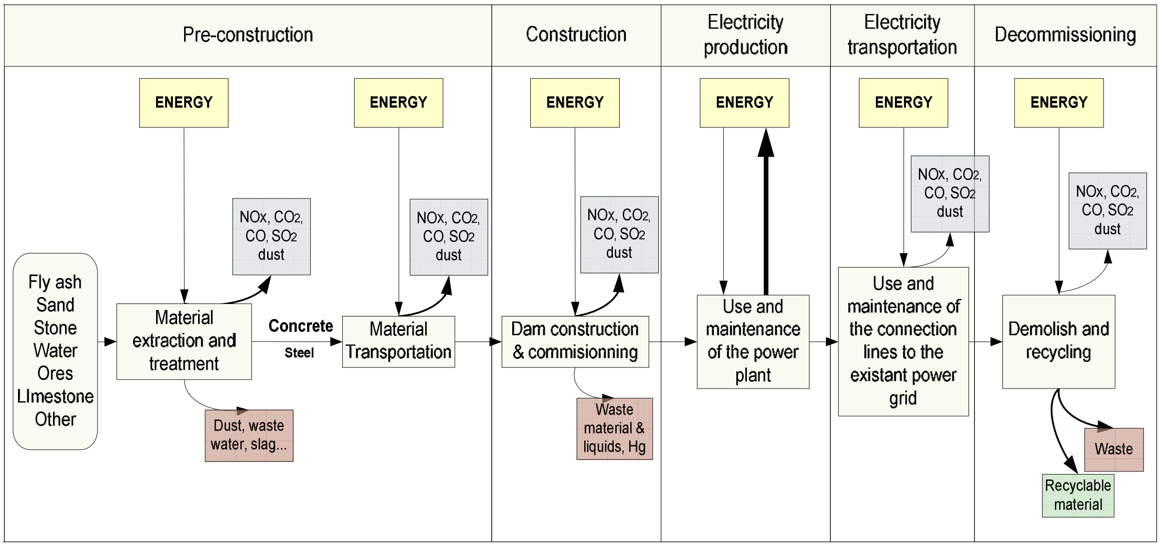
## Figure 9.4 Simplified procedures for inventory analysis



As shown on Figure 9.2 above, the LCA of the three types of power plant project have to take in consideration the following aspects during life cycle inventory:

1. Raw material
2. Construction phase
3. Electricity production
4. Electricity transportation
5. Decommissioning

### 9.5.2.1 Guidelines specific to hydropower projects




For hydro-power projects the LCA inventory shall quantify material and energy flows considering the following inputs and outputs:

Inputs, including:

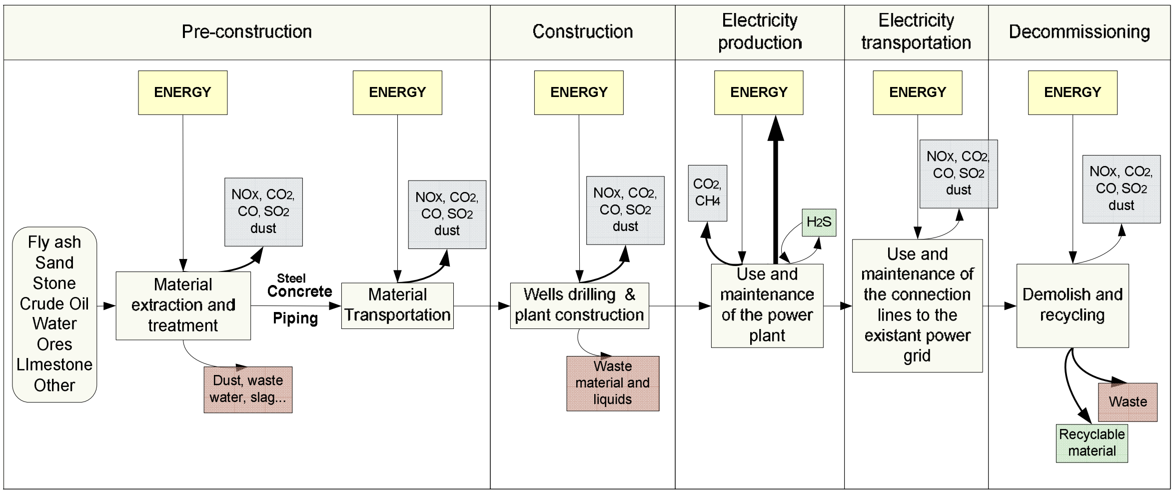
- material extracted to produce concrete: fly ashes, sand, stone, water, limestone...
- material extracted to produce steel: ores, limestone, coal (used to produce coke, a sub-product of steel)…
- energy consumed at each phase of the LCA in MWh

Outputs, including:

- energy produced during the operational phase (Electricity Production) in MWh
- emissions to air: mainly nitrogen oxides ($NO_x$), carbon dioxide ($CO_2$),sulphur dioxide ($SO_2$), methane ($CH_4$), and dust

- emissions to water: mercury pollution during commissioning phase
- waste for treatment: mainly waste water during the pre-construction phase, waste liquids during the construction, and waste material from decommissioning
- recyclable material from the decommissioning

### 9.5.2.2 Guidelines specific to geothermal power plants




For geothermal power projects the LCA inventory shall quantify material and energy flows considering the following inputs and outputs:

Inputs, including:

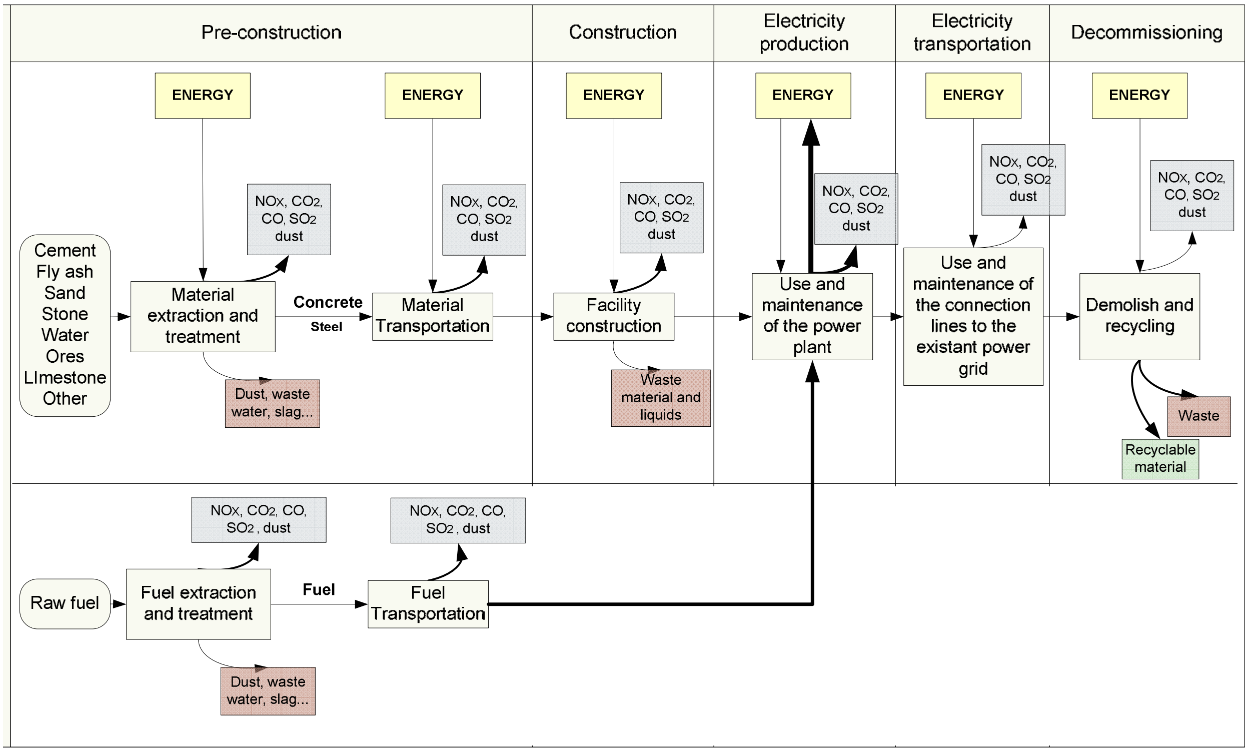
- material extracted to produce concrete: fly ashes, sand, stone,water, limestone...
- material extracted to produce steel: ores, limestone, coal (used to produce coke, a sub-product of steel)…
- material extracted to produce plastic pipes: mainly crude oil
- energy consumed at each phase of the LCA in MWh
- hydrogen sulfide coming with the hot ground water which is re-injected in the pipes into the ground

Outputs, including:

- energy produced during the operational phase (Electricity Production) in MWh
- emissions to air: mainly nitrogen oxides ($NO_x$), carbon dioxide ($CO_2$),sulphur dioxide ($SO_2$), methane ($CH_4$), polycyclic aromatic hydrocarbons (PAH), VOCs and dust
- emissions to water: hydrogen sulfide if not totally re-injected into the ground

- waste for treatment: mainly waste water during the pre-construction phase, waste liquids during the construction, and waste material from decommissioning
- recyclable material from the decommissioning

#### 9.5.2.3 Guidelines specific to thermal power plants




For thermal projects the LCA inventory shall quantify material and energy flows considering the following inputs and outputs:

Inputs, including:

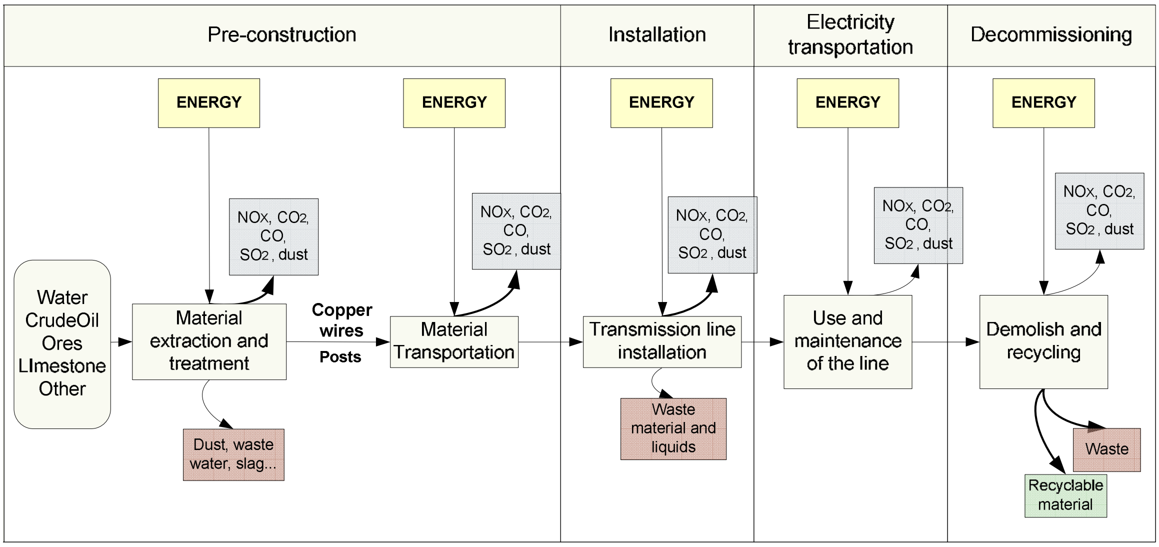
- material extracted to produce concrete: fly ashes, sand, stone, water, limestone...
- material extracted to produce steel: ores, limestone, coal (used to produce coke, a sub-product of steel)…
- energy consumed at each phase of the LCA in MWh
- raw fuel extracted to feed the thermal power plant: lignite, oil or gas

Outputs, including:

- energy produced during the operational phase (Electricity Production) in MWh

- emissions to air: mainly nitrogen oxides ($NO_x$), carbon dioxide ($CO_2$),sulphur dioxide ($SO_2$), methane ($CH_4$), PAH and VOCs
- emissions to water: acid rains
- waste for treatment: mainly waste water during the pre-construction phase, waste liquids during the construction, and waste material from decommissioning
- recyclable material from the decommissioning

### 9.5.2.4 Guidelines specific to transmission lines




For transmission projects the LCA inventory shall quantify material and energy flows considering the following inputs and outputs:

Inputs, including:

- material extracted to produce posts (steel or wood)
- material extracted to produce copper wires: ores, crude oil…
- energy consumed at each phase of the LCA in MWh

Outputs, including:

- emissions to air: mainly nitrogen oxides ($NO_x$), carbon dioxide ($CO_2$),sulphur dioxide ($SO_2$),methane ($CH_4$), PAH, VOCs and dust
- emissions to water: mainly waste liquids used for equipment maintenance during the installation phase
- waste for treatment: mainly waste material from decommissioning
- recyclable material from the decommissioning

### 9.5.3 Impact assessment requirements

This phase is the third step of the LCA. With the inventory analysis, the study has allowed to determine the quantities of material and energy extracted, and the emissions in water, air and ground. It is now time to link the information to their impact on the environment. This process involves associating inventory data with specific environmental impacts and attempting to understand those impacts. The level of detail, choice of impacts evaluated and methodology used depends on the goal and scope of the study.

The assessment may include the iterative process of reviewing the goal and scope of the LCA study to determine when the objectives of the study have been met, or to modify the goal and scope if the assessment indicates that they cannot be achieved.

The impact assessment phase includes elements such as the following:

- Selection of the impact categories, environmental indicators and characterization models; Tables 9.1 and 9.2 present examples of environmental indicators;
- Assignment of the inventory results to the impact categories;
- Determination of the category indicator results;
- Comparison to the environmental indicators.

## Table 9.1 Atmospheric and liquid rejects indicators - World Bank maximum values

| Industry | Atmospheric Emissions | | | Liquid Effluents | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Particulate matter ($mg/Nm^3$) | Sulfur oxides ($mg/Nm^3$) | Nitrogen oxides ($mg/Nm^3$) | pH | COD (mg/l) | TSS (mg/l) | Oil and grease (mg/l) | Phenol (mg/l) | Temp. increase | Metals and other (mg/l) |
| Cement manufacturing | 50 | 400 | 600 | 6-9 | | 50 | | | ≤ 3°C | |
| Coal mining and production | 50 | | | 6-9 | | 50 | 10 | | ≤ 3°C | Mercury: 3.5 |
| Steel manufacturing | 50 | 500 | 750 | 6-9 | 250 | 50 | 10 | 0.5 | ≤ 3°C | Cadnium: 0.1<br>Chronium: 0.5<br>Mercury: 0.01<br>Plomb: 0.2<br>Zinc: 2<br><br>$CN^-$ free: 0.1<br>total: 1 |
| Thermal power, new plants | 50 | 0.2 tpd/MWe (to 500 MWe)<br><br>0.1 tpd/MWe (incr. over 500 MWe)<br><br>Not to exceed 2000 $mg/Nm^3$ in flue gases<br><br>Not to exceed 500 tpd | 750 | 6-9 | | 50 | 10 | | ≤ 3°C | Chronium: 0.5<br>Copper: 0.5<br>Iron: 1<br>Zinc: 1<br><br>Chlorine shoking: max. value is 2 mg/l for up to 2 hrs, not to be repeated more frequently than once in 24 hrs, with a 24-hrs average of 0.2mg/l. |

Source: World Bank, Pollution Prevention and Abatement Handbook, Summary of air emission and effluent discharge requirements presented in the industry Guidelines Section.

Abbreviations:
N in $mg/Nm^3$ stands for “normal” that is to say a temperature of 0°C and an atmospheric pressure of 1 atmosphere.
tpd/MWe: metric tons per day per megawatt of electricity
COD: Chemical oxygen demand
TSS: Total suspended solids
CN: cyanide

## Table 9.2 Ambient air quality indicators of different world standing institutions

| Institution | Parameter | Criterion | |
|---|---|---|---|
| | | Type | Value ($\mu g/m^3$) |
| World Bank [1] | Sulfur dioxide | Daily | 125 |
| | | Yearly | 50 |
| | Nitrogen dioxide | Daily | 150 |
| | Particulate matter | Daily | 70 |
| | | Yearly | 50 |
| World Health Organization [2] | Sulfur dioxide | Daily | 125 |
| | | Yearly | 50 |
| | Nitrogen dioxide | Yearly | 40 |
| | Carbon monoxide | Hourly | 30 000 |
| | | 8 hours | 10 000 |
| European Union | Sulfur dioxide [3] | Daily | 250 |
| | | Yearly | 80 |
| | Nitrogen dioxide [4] | Hourly | 200 |
| | Particulate matter [3] | Daily | 250 |
| | | Yearly | 80 |
| USEPA – United-States [5] | Sulfur dioxide | Daily | 365 |
| | | Yearly | 80 |
| | Nitrogen dioxide | Yearly | 100 |
| | Carbon monoide | Hourly | 40 000 |
| | | 8 hours | 10 000 |
| | Particulate matter | Daily | 150 |
| | | Yearly | 50 |

(1) Source: World Bank, Pollution Prevention and Abatement Handbook, General Environmental Guidelines Section.
(2) Source: Air Quality Guidelines, WHO, Genève, 2000.
(3) Source: Council of European Communities, 1980, Council Directive of 15 July 1980 on air quality limit values and guide values for sulphur dioxide and suspended particulates.
(4) Source: Council of European Communities, 1985, Council Directive 85/203/EEC of 7 March 1985 on air quality standards for nitrogen dioxide ($98^{th}$ percentile of the distribution of hourly values throughout the year).
(5) Source: USEPA, National Ambient Air Quality Standards.

The proponent needs to understand that because there is subjectivity in the life cycle impact assessment phase such as the choice, modelling and evaluation of impact categories, and in order to ensure that assumptions are clearly described and reported, transparency is critical in impact assessment.

### 9.5.4 Impact assessment interpretation

The goal of this life cycle assessment stage is to identify the steps of the project on which the proponent shall take actions to reduce the environmental impacts of the system.

The study must combine the findings from the inventory analysis and the impact assessment in the interpretation phase of LCA, or, in a case of life cycle inventory studies, the findings of the inventory analysis only. The interpretation has to be consistent with the defined goal and scope, in order to reach conclusions and recommendations.

The interpretation findings may take the form of conclusions and recommendations to decision-makers, consistent with the goal and scope of the study. The interpretation phase may involve the iterative process of reviewing and revising the scope of the LCA, as well as the nature and quality of the data collected consistently with the defined goal.

The findings of the interpretation phase should reflect the results of any sensitivity analysis that is performed. Though subsequent decisions and actions may incorporate environmental implications identified in the findings of the interpretation, they lie beyond the scope of the LCA study, since other factors such as technical performance, economic and social aspects are also considered.

To facilitate the interpretation, the study must interpret each phase of the LCA which are the definition of goal and scope, the life cycle inventory analysis (emission and extraction) and the impact assessment. The study could also compare each LCA step contribution (for example, material preparation, transportation and energy), consider each component of the system contribution and for each pollutant and substances extracted, consider their contribution for each type of impact (what are the emissions and extractions which generate the major part of the impact.

# 10 ACCESS TO THE CLEAN DEVELOPMENT MECHANISM FUND

## 10.1 Overview of the Clean Development Mechanism

### 10.1.1 Origins of the Clean Development Mechanism

The global climate is changing and it is now demonstrated that it is due to human activities. The complex climate models developed these last years enabled the population to understand the potential irreversible and catastrophic consequences of this change. Although the exact extent of the impacts and the speed at which this will occur remain unknown, it is certain that industrialized countries, with their high levels of greenhouse gas emissions, carry the major part of responsibility. It is equally obvious that developing countries will assume the major burden of the negative impacts, due to their particular vulnerability in geographic location, as well as economic, political, social and environmental conditions.

#### 10.1.1.1 Climate Change Convention

In this context, in 1992 after the Earth Summit of Rio de Janeiro, 154 countries signed the United Nations Framework Convention on Climate Change (UNFCCC), an environmental treaty that provides the outline of a global action plan to reduce emissions of greenhouse gas and combat global warming.

The treaty as originally framed set no mandatory limits on greenhouse gas emissions for individual nations and contained no enforcement provisions; it is therefore considered legally non-binding.

Rather, the treaty included provisions for updates (called "protocols") that would set mandatory emission limits. The principal update is the Kyoto Protocol, which has become much better known than the UNFCCC itself.

Signatories to the UNFCCC are split into two groups:

- Annex I countries (industrialized countries).
- Developing countries.

Annex I countries agree to reduce their emissions (particularly carbon dioxide) to target levels below their 1990 emissions levels. If they cannot do so, they must buy emission credits or invest in conservation. Developing countries have no immediate restrictions under the UNFCCC.

#### 10.1.1.2 Kyoto Protocol

The Kyoto Protocol was designed to further strengthen the provisions of the UNFCCC and introduced flexible mechanisms that would allow a reduction of greenhouse gas emissions in the most cost-effective, efficient and sustainable manner.

It was agreed on 11 December 1997 at the 3rd Conference of the Parties to the treaty when they met in Kyoto, and entered into force on 16 February 2005.

As stated in the treaty itself, the objective of the Kyoto Protocol is to achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"[5].

As of June 2007, 172 parties have ratified the protocol. Of these, 36 countries (plus the EU as a party in its own right) are required to reduce greenhouse gas emissions to the levels specified for each of them in the treaty (representing over 61.6% of emissions from Annex I countries)[6], with three more countries intending to participate. Notable exceptions include the United States and Australia. One hundred thirty seven (137) countries have ratified the protocol, but have no obligation beyond monitoring and reporting emissions.

#### 10.1.1.3 Convention of Parties 7 (COP-7) in Marrakech

Of these instruments, the Clean Development Mechanism (CDM) is of greatest interest to the developing world. It allows channeling foreign investment to these countries to promote sustainable development and abate greenhouse gas emissions while generating certified emission reduction units (CERs) that industrialized nations can apply towards meeting their own emission reduction targets.

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5 *The United Nations Framework Convention on Climate Change*. Retrieved on November 15, 2005. http://unfccc.int/essential_background/convention/background/items/1353.php

6 Kyoto Protocol: Status of Ratification, 10 July 2006 (PDF). UNFCC. Retrieved on October 30, 2006. http://unfccc.int/files/essential_background/kyoto_protocol/application/pdf/kpstats.pdf

At the COP-7 meeting in Marrakech, Morocco October 29-November 10, 2001, negotiators in effect completed the work of the Buenos Aires Plan of Action, finalizing most of the operational details and setting the stage for nations to ratify the Protocol[7]. The completed package of decisions is known as the Marrakech Accords. The United States delegation continued to act as observers, declining to participate in active negotiations. The main decisions at COP-7 included operational rules for international emissions trading among parties to the Protocol and for the CDM and joint implementation.

In fact, the CDM was an important feature of the negotiations leading up to the Kyoto Protocol. Some governments desired flexibility in the way that emission reductions could be achieved and proposed international emissions trading as a way of achieving cost-effective emission reductions. At the time it was considered a controversial element and was opposed by environmental NGOs and, initially, by developing countries that feared the environmental integrity of the mechanism would be too hard to guarantee. Eventually, and largely on US insistence, the CDM and two other flexible mechanisms were written into the Kyoto Protocol.

The purpose of the CDM was defined under Article 12 of the Kyoto Protocol. Apart from helping Annex I countries comply with their emission reduction commitments, it must assist developing countries in achieving sustainable development, while also contributing to stabilization of greenhouse gas concentrations in the atmosphere.

The CDM gained momentum in 2005 after the entry into force of the Kyoto Protocol.

### 10.1.2 International Standards on GHG

International standards were also developed to facilitate the implementation of CDM. In this project, the applicable standards are:

- ISO 14064-1: *Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals* includes requirements for the design, development, management, reporting and verification of the GHG inventory of an organization.
- ISO 14064-2: *Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements* details requirements for planning a GHG project, the identification and selection of sources, sinks and reservoirs of greenhouse gases relevant to the project and the baseline for monitoring, measurement, documentation and report of the project GHG, and the management of data quality.

[7] See http://www.climnet.org/COP7/cop7.htm

- ISO 14064-3: *Specification with guidance for the validation and verification of greenhouse gas assertions* enounces requirements for selecting GHG validators/verifiers, establishing the level of assurance, objectives, criteria and scope, determining the validation/verification approach, assessing GHG data, information, information systems and controls, evaluating GHG assertions and preparing validation/verification statements.

Finally the use of the *Guidelines for National Greenhouse Gas Inventories* (*2006 Guidelines*) issued by the International Panel on Climate Change (IPCC) upon invitation of the United Nations Framework Convention on Climate Change (UNFCCC) shall be necessary to develop successful CDM projects. The 2006 Guidelines are divided into five volumes and provide methodologies for estimating national inventories of anthropogenic emissions by sources and removals by sinks of greenhouse gases. The recent revision of the Guidelines provides good practices guidance based on internationally agreed methodologies to help countries to estimate their greenhouse gas (GHG) emissions. These guidelines shall be excessively useful to report GHG inventories to the UNFCCC.

Regarding regional power projects in the NBI countries, the applicable section of the IPCC guidelines is included in Volume 2: Energy.

### 10.1.3 Advantages for the host country

The prime objective of the CDM is to contribute to the sustainable development objectives of the non-Annex I countries.

Taking into account the fact that investments provided for the CDM will be made in developing countries and that they will generally be financed by countries ("Parties", or authorized legal entities, within the meaning of the Protocol) or companies from these later. This innovative mechanism can be considered as a new source of funding for projects.

The role of the CDM is to support project that can:

a. Contribute to the local environment;
b. Contribute to the economy in parallel, and generate positive social impacts;
c. Encourage Foreign Direct Investment in new low emission technology transfer;
d. Provide an additional financial contribution to render a project financially viable by lowering the cost of its implementation and operation.

Accordingly, the appeal of this new system for host countries is that it can set up structures, in an increasing number of developing countries, for the promotion, support and validation of these projects.

## 10.2 Requirements and issues related to CDM projects

### 10.2.1 Basic CDM Project Requirements

*Real and Measurable GHG Emissions Reductions*

CDM projects must lead to real, measurable reductions in greenhouse gas emissions, or lead to the measurable absorption (or "sequestration") of GHGs in the Nile basin countries. The "project boundary" defines the area within which emissions reductions occurs. Emissions reductions must occur on the project site or "upstream" from the project. For example, in projects that reduce electricity use through efficiency or fuel substitution in a region where power is produced from fossil fuels, the emissions reductions occur upstream at the power plant.

*Additional GHG Emissions Reductions*

GHG emissions from a CDM project activity must be reduced below those that would have occurred in the absence of the project. In fact, it must be shown that the project would not have been implemented without the CDM. Without this "additionality" requirement, there is no guarantee that CDM projects will create incremental GHG emissions reductions equivalent to those that would have been made in Annex I countries, or play a role in the ultimate objective of stabilizing atmospheric GHG concentrations.

There are six eligible GHGs: carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbone (HFC), perfluorocarbon (PFC) and sulphur hexafluoride ($SF_6$). A project can only be eligible if emissions of one or more of these GHGs are reduced.

All CDM projects, therefore, require the estimation or measurement of "baseline" emissions — those that would have occurred without the project — and actual emissions that occur after a project has been implemented. For example, a wind power generation project might displace emissions from an existing fossil fuel power plant in a region or delay the construction of a new plant. The emissions reductions from improved fuel efficiency in an industrial process would be measured against existing plant emissions. Section 10.4

provides more details about how to select the boundaries of a project and establish its baseline.

*Sustainable Development*

All CDM projects must contribute towards sustainable development in the host country and must also be implemented without any negative environmental impacts. To ensure that these conditions are met, host countries determine whether the CDM project activity meets the sustainable development objectives in their country, and also decide whether an environmental assessment of the project is required. More details and guidance on defining Sustainable Development priorities are given in Section 10.3.4.

### 10.2.2 Project Participants

In general, the following represent the participants involved in CDM projects. In some cases, the project proponent may also include the CER purchaser, should the company choose to play an active role in the development of the project, in addition to receiving the CERs.

***Project Proponent:*** An entity, such as a company or local NGO, that develops and implements a CDM project.

***CER Purchaser:*** A company that invests in the project or purchases CERs generated by the project.

***Host Country:*** The developing country in which the CDM project takes place.

***Executive Board:*** The supervisory body of the CDM, accountable to the Conference of the Parties, that oversees the global negotiations on climate change until the Kyoto Protocol is ratified. The Executive Board was elected at COP 7 and comprises 10 members of the Parties of the Protocol, representing various economic blocs. For more information on the Executive board, visit the UNFCCC CDM Web Site at www.unfccc.int/cdm.

***Designated Operational Entity:*** An independent legal entity designated to validate CDM activities and emissions reductions. The Designated Operational Entity is accredited by and accountable to the Executive Board. Project Proponents may designate the Designated Operational Entity of their choice from a list maintained by the Executive Board.

### 10.2.3 Eligibility to participate in the CDM

All projects that satisfy the additionality and sustainable development criteria are acceptable under the CDM. However, CDM credits will only be granted to national governments and companies in Annex I countries that have ratified the Kyoto Protocol and agreed to meet their obligations under the Protocol regarding compliance and reporting of emissions. There is no legal limit or ceiling on the number of CDM credits that an Annex I country can use to meet its Kyoto reduction target; however, individual countries may enforce internal limits or targets.

The Executive Board has decided that a project can have more than one host country. This former aspect is thus very relevant for interconnection transmission lines, or hydro projects on the Nile River running along borders.

### 10.2.4 CDM Project Costs

The costs of a CDM project include those of the project itself and the additional “transaction” costs associated with using the CDM.

#### 10.2.4.1 Project Costs

Considering power generation investments, project costs shall include the following categories:

- Project design costs, including engineering studies and financial analysis.
- Capital costs or, if the project upgrades an existing system, the incremental capital costs of a low-emissions option over a baseline technology.
- Fuel and operating costs, or the net increase or decrease in fuel or operating costs over baseline technology.

#### 10.2.4.2 Transaction Costs

It is important, for a project developer, to evaluate the costs due to the CDM process, known as “transaction costs”. These additional CDM project costs are detailed in Box 10.1.

CDM projects will also incur costs related to contractual, or legal, arrangements that are not normally encountered in other development projects. For example, a broker, or intermediary, may be required to facilitate the project transaction or a CER purchase agreement (see

Section 10.2.5). Other related legal fees may also apply (see Section 10.2.6 for more details).

In general, CDM project transaction costs can run as high as $200,000 for a large project[8].

**Box 10.1 Transaction costs**

Project preparation phase

- Selection of baseline methodology and estimation of emissions reductions
- Preparation of a CDM CER purchase agreement
- Host country approval, stakeholder input, and environmental assessment
- Preparation of the Project Design Document (PDD)
- Project validation by a Designated Operational Entity
- Registration fee

Project operational phase

- Emissions reduction measurement
- Validation by a Designated Operational Entity
- 2% adaptation fee

(Emissions reduction measurement and Validation by a Designated Operational Entity: About 10% of transaction costs)

*Source: adapted from Pembina 2003*

10.2.4.3 Small-scale projects

The baseline setting and approval processes for small-scale CDM projects will be simplified or eliminated, significantly reducing the transaction costs for these projects. Regarding power generation investments, small-scale project are defined as renewable energy project activities with a maximum output capacity equivalent of up to 15 megawatts. As regional power projects in NBI countries are not likely to include such small initiatives, this case will not be detailed in this report. More details on simplified procedures for small-scale projects can be found in CDM - Information and Guidebook, Second Edition UNEP[9] (Sections 4.1.3 and 5.3).

8 See Table 2, page 24, Guide to the Kyoto Protocol project mechanism, 2nd edition, Clean Development Mechanism (CDM), 2004, for more details on transaction costs http://carbonfinance.org/docs/b_en_cdm_guide_ld.pdf

9 See CDM - Information and Guidebook, Second Edition, UNEP , 2003 http://cd4cdm.org/Publications/cdm%20guideline%202nd%20edition.pdf

### 10.2.5 Financing Options in a CDM Project

In most cases, selling CERs through the CDM will provide only part of the financing necessary for the project. A project developer wanting to use this source of "carbon financing" to make a project feasible will still need conventional financing. Nevertheless, the sale of the CERs from the project will provide the additional revenue or start-capital to make the project feasible, or remove other barriers that favour the baseline technology.

An Annex I country or company participating in the CDM may choose from a variety of financial options to gain CERs from a CDM project:

- **Full or Partial Equity:** A company finances all of a CDM project, or co-finances part of a CDM project, in return for full or shared financial returns and CERs;
- **Financial Contribution:** A company financially contributes towards the cost of a CDM project an amount equal to some portion of the incremental cost of the project over and above the baseline technology, or finances the removal of market barriers, in return for CERs;
- **Loan:** A company provides loan or lease financing at concessional rates in return for CERs; or,
- **Certified Emissions Reduction Purchase Agreement:** A company agrees to buy CERs as they are produced by the project.

#### 10.2.5.1 Full or Partial Equity

An investing company may finance all or part of the capital cost of the CDM project in return for both financial and CER returns. The level of financing will depend on the type of project. For example, projects with relatively large capital costs, such as building hydropower dam facilities, may benefit from co-financing from the investor. As in any foreign investment, the level of involvement of an investor will represent a balance between the amount of equity required to implement the project and the risk involved, as well as the expected rate of return based on the value of the CERs.

The particulars of the financial arrangement are determined on a project-by-project basis by the local project proponents and the potential investing company. The ownership of CERs becomes the subject of an annex to the conventional financing agreement. The agreement should stipulate the nature of the returns of the investing company; for example, an investor may request either full or shared financial returns, as well as CERs.

If a company is using the CDM solely to obtain credit for emissions reductions, a financial contribution or CER purchase agreement is a better option (see below).

10.2.5.2 Financial Contribution

For power investment projects, a financial contribution is used when a company finances part of the incremental cost of the low-emission technology over the baseline technology.

In most cases, the company makes the financial contribution at the beginning of the project, and receives the rights to the CERs as they are produced. This should be clearly stipulated in a contractual arrangement between the project proponents.

Risk assessment and due diligence are still important parts of project development, but in this case it is the risk associated with the emissions reduction that must be assessed. Questions regarding the reliability of the technology and the certainty of the reductions, for example, should be considered.

Financial contributions can be used to obtain credits on any project where an incremental can be easily identified including renewable energy power plants. Although the level of contribution may vary from project to project, the contribution would normally amount to no more than 10% of the total project cost.

Emissions reduction projects financed by the World Bank Prototype Carbon Fund (PCF) are good examples of projects where a financial contribution is used to secure a stream of CERs with up-front co-financing. The financial contributions for selected PCF projects are provided in Table 10.1 In general, the PCF limits its funding to 2% to 10% of the total project cost, or limits its contribution to a maximum of US$5/tonne of $CO_2$ [10].

[10] See http://carbonfinance.org/Router.cfm?Page=PCF&ItemID=9707&FID=9707 for more information on Prototype Carbon Fund

**Table 10.1 Summary of PCF Financial Contributions to Selected CDM Projects**

| Project | Total Project Cost (US$) | PCF Contribution (US$) | Basis of PCF Contribution | Schedule of PCF Contribution |
|---|---|---|---|---|
| Wind power facility, Honduras | $58,000,000 | $4,048,275 | Sale of carbon credits (at US$3.50/tonne $CO_2$) | Contributions to be paid on an annual basis for 10 years |
| Two wind farms, Morocco | $200,000,000 | By competitive bidding | PCF funding to supplement electricity sales in order to capture commercial rate of return to investors | Payment schedule to coincide with payment schedule under power purchase agreement |
| Three micro-hydro facilities, Guatemala | $320,000 | $15,000 | Up-front value of 4,755 tonnes $CO_2$ over 10-year period | PCF to provide up-front financing |
| Geothermal facility, Guatemala | $30,000,000 | Not specified | Sale of carbon credits | Yearly contributions starting when $CO_2$ displacement begins |
| Run-of-river hydro plant, Chile | $34,000,000 | $3,400,000 | 10% of total cost | Initial payment followed by balance payments as emissions reductions are generated |

*Source: based on Pembina 2003.*

10.2.5.3 Loan

Another option is to provide partial financing for a CDM project in the form of a loan to the local proponents, to allow them to implement the emissions reduction project. In such cases, the loan principal would be repaid over an agreed upon period, with a return in the form of CERs rather than a financial return.

10.2.5.4 CER Purchase Agreement

As an alternative arrangement to the up-front financing of a CDM project, a company may wish to buy emissions reductions as they are produced. In this case, payment for the CERs becomes an additional revenue stream for the project host. For example, in a small hydro or wind power generation project, payment for CERs provides an annual income, along with payment for electricity produced.

This option reduces the risk to the buyer of the CERs as all of the risk associated with generating the emissions reductions remains with the project developer. It also makes the transaction of purchasing credits as simple as purchasing a product. The project developer, however, must ensure that the sale price of the credits reflects all of the costs and risks associated with registering the CDM project and verifying the emissions reductions. A CER purchase agreement formalizes the agreement to purchase the credits from the CDM project as they are produced. In many ways it is similar to a power purchase agreement, used by independent power producers. The CER purchase agreement should be finalized before the project is implemented, and can be used by a project developer to obtain conventional project financing and to steer the project through the CDM approval process.

#### 10.2.6 Risk, Ownership, and Legal Aspects

Besides the normal financial and other risks associated with any new project, there is also a risk with CDM project that the emission reduction may not occur.

Assessment of the risk of emission reductions not occurring becomes an important part of the due diligence assessment of the project for companies taking an active investment role in a CDM project or making an up-front contribution towards the cost of the project in return for future CERs. Conservative selection of baselines and clear emissions monitoring protocols will help to reduce the risk of overestimating emissions reductions. (Section 10.4 provides the necessary details to ensure these elements are considered.)

Political risks and natural hazards that could reduce the ability to generate CERs need to be considered. Although this type of event is beyond the control of both the buyer and seller, both parties must come to an agreement regarding the ultimate responsibility for CER production should such an event occur. Financial tools such as hedging, guaranties and insurance products can be used to minimize the risk.

Investment agreements must clearly state how risks will be mitigated and shared. If a CER purchase agreement is being used, all of the risk is borne by the project developer or host, and this must be reflected in a higher price per tonne of emissions. The investment arrangement — which should be negotiated prior to project implementation — may be influenced by two factors:

- The financial arrangement that has been negotiated: For example, a company that prefers to simply purchase CERs as they are produced will most likely not be a direct participant in the project; in this case, the seller assumes all the risk and may, as a result, sell the CERs at a premium.
- The ability of the project proponents to fulfill certain project approval requirements: For example, a company may have acquired knowledge in baseline determination

and thus be well suited to carry out the emissions reduction calculation (i.e., to be more directly involved than simply acting as a buyer). Doing so may help reduce the risks associated with the verification of CERs. As a result, the investing company may be able to negotiate a lower price.

It may be prudent to hire a qualified independent verifier to ensure the validity of the CERs. However, the buyer and seller will have to work out between themselves which entity will pay this cost. In cases in which the seller is simply purchasing CERs, this cost will be borne solely by the seller.

## 10.3 Establishing a National Authority

A CDM Project must be validated by the Designated National Authority (DNA). This DNA has the responsibility of validating the project based on the sustainable development priorities defined by the host country.

This section which is mainly based on the document Establishing National Authorities for the CDM - A Guide for Developing Countries of Christiana Figueres (2002)[11], details the steps to undertake in order to properly set the DNA which will play a critical role in the CDM project.

### 10.3.1 Definition

The DNA is the National Entity with authority (both legal and technical) for CDM project assessment, in other words responsible for:

- Evaluation and approval (written);
- Confirming compliance with national and international criteria;
- Confirming support to Sustainable Development and national development priorities.

This entity is required by the Annex Decision 17/CP7 of the Conference of Parties 7 which stipulates: "To participate in CDM, parties must designate a NA".

### 10.3.2 DNA functions

The DNA has two main functions: a regulatory function and a promotional function.

[11] Electronic document available at http://www.cckn.net/pdf/cdm_national_authorities.pdf

#### 10.3.2.1 The Regulatory Function

The regulatory function is mandatory according to the international agreement. It constitutes a prerequisite for project validation and certification.

Indeed the DNA will have to ensure the evaluation and approval of projects.

Evaluation and approval of the project will consist in assessing if the CDM project contributes to Sustainable Development (SD) in the host country and if it complies with national and international criteria in order to:

- Increase probability of success;
- Create incentive for specific projects and/or priorities; and
- Reduce perceptive and real risks for national and foreign investors.

The four steps to set up an evaluation and approval process are the following:

- Adopt international criteria;
- Develop national criteria;
- Establish national procedures for evaluation; and
- Establish guidelines for project presentation.

*International criteria*

The DNA will have to become familiar with the adopted international eligibility criteria in order to secure the benefits. This acknowledgement will enable it to verify that the CDM projects:

- Assist Non Annex I parties in achieving both SD and the ultimate objective of the UNFCCC;
- Result in real, measurable and long-term benefits related to mitigation of climate change;
- Result in reduction of emissions that are additional.

Box 10.2 outlines some of the key international elements that should be assessed as part of the national evaluation process.

**Box 10.2 Key international criteria**

**Eligibility of project type:**
- Consistency with UNFCCC decisions.

**Additionality:**
- Preparation of a quantitative baseline assessment.
- Inclusion of a qualitative description and justification of baseline scenario.

**Measurability:**
- Quantification of impacts of project interventions on carbon stocks and flows (difference between baseline and project scenario).
- Projections of and accounting principles for emissions reductions projections and the carbon offsets generated and accumulated over the project's lifetime.
- Accounting provisions for dealing with permanence and reversibility of project interventions.

**Externalities:**
- Provisions for management of leakage.
- Provisions for management of other risks related to carbon stocks and flows.

**Securing carbon benefits:**
- Monitoring plan assessment.
- Suitable provisions in the monitoring plan for preparing and facilitating periodic verification and final certification of emission reductions.

*Source: Figueres C., 2002*

*National criteria*

In the same way, the national evaluation and approval process aims at confirming the projects' contribution to sustainable development based on the framework of the CDM national climate policy and/or carbon offset strategy. Therefore, the DNA has to develop national criteria which should be based on those listed in Box 10.3. In choosing the criteria that are relevant for the host country, the DNA should take into account that the more criteria it will select, the more expansive will result the preparation and then the transaction costs.

**Box 10.3 Key national elements which should be evaluated**

**1. Compliance with relevant policy and regulatory regimes**

*National scope:*

- Compatibility with national sustainable development objectives.
- Congruence with the national climate policy and/or carbon offset strategy.
- Eligibility of the project proposal according to a positive or negative list of eligible CDM activities, technologies and/or sectors, eventually adopted by the host country.

*Sectoral scope:*

- Compliance with related political and legal framework.
- EIA in accordance with procedures as required by the relevant sector.

*Local scope:*

- Compatibility with local priorities, as stated in local development agendas.
- Comments by local stakeholders directly and indirectly involved with the project.

**2. Financial Review**

- Review if project is dealing with a negative cost mitigation option and, if so, describing barriers that have impeded the project from being implemented.
- Excluding the use of official development aid for project funding.
- Overview of financing structure.

**3. Technical and institutional feasibility**

*Management capacity*

- Description of the institutional arrangements and participation of each institution's in the implementation of the project.
- Previous experience and performance in the field.

*Infrastructure and technical capacity*

- Local availability of qualified human resources.
- Local availability of adequate institutional resources.

*Transfer of technology and know-how*

- Description of the implications for local institutional enhancement.
- Description of the implications for national capacity building.
- Description of technology transfer.

**4. Special consideration of other environmental and developmental impacts**

Additional environmental, socio-economic, technical and institutional benefits (and costs) that are considered relevant.

*Source: Figueres C., 2002*

*Guidelines for project presentation*

The project proponent has to describe the project features in the Project Design Document (PDD) form established by the UNFCCC. This document will assess the international criteria.

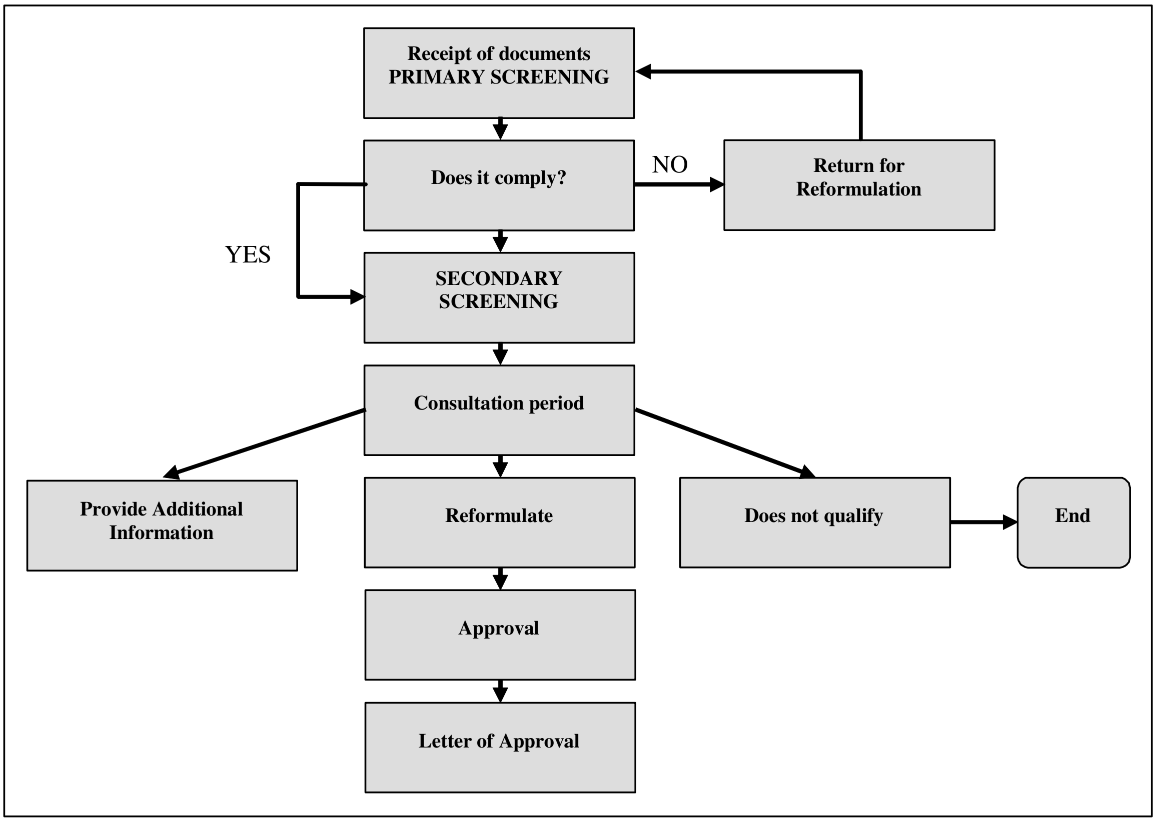
However, to be able to evaluate the national criteria, the DNA may add sections to the existing PDD form or require an additional document to collect the information. In all cases, the DNA has to supply transparent and consistent guidelines to the project proponent on the way to present the project.

*National procedures*

To attract project investors in the host country, the DNA shall standardize a transparent and quick process to screen, evaluate and approve CDM projects.

Figure 10.1 illustrate a possible evaluation procedure.

**Figure 10.1 Evaluation procedure**




*Source: Figureres C., 2002*

*Tracking and reporting to the UNFCCC Secretariat*

Regulatory functions also include tracking and annual reporting to the UNFCCC secretariat. For this purpose, the DNA must design a system for registering and tracking the holding and transfer of CERs of the project. This tracking system, preferably electronic, should facilitate the drafting of the annual report.

#### 10.3.2.2 The Promotional Function

The promotional function is voluntary for the host country and it is not regulated internationally. Its adoption should suit the specific necessities of the host country from the point of view of capacity building and marketing development.

*Capacity building*

The capacity building offered by the DNA shall support the project proponent in the implementation of the CDM project in several areas, listed in Box 10.4.

**Box 10.4 Capacity building opportunities areas**

1. **Project Identification and Formulation**

DNA can hold training sessions for project developers during which they are shown how to identify carbon mitigation projects, and they start to familiarize themselves with UNFCCC, carbon market, and the PDD form.

2. **Baselines Definition**

DNA should also train project developers on the different approaches to baseline definition and on the corresponding consequences on the transaction cost and in meeting emission reduction verification requirements. They should also know how to properly document the establishment of baselines. Moreover, in order to lower project preparation costs, the DNA may establish national baseline parameters for each of the main project sectors.

3. **Quantification of Emissions Reductions**

Due to the critical role that estimated emissions reduction potential can play in financing decisions for CDM projects, it is important that project developers are knowledgeable about the procedures for estimating the emissions reduction potential of CDM projects.

4. **Project Monitoring**

A monitoring plan should be established that is transparent and in accordance with international standards in order for independent third party agents to verify the results. To enhance the capacity and knowledge on monitoring requirements for CDM projects, the DNA should provide training for project proponents on efficient and accepted methods of collecting the required project indicators.

*Source: based on Figueres C., 2002*

*Marketing*

Marketing is another important task to be performed by the DNA. As the CDM market is highly competitive for host countries and quite restrictive (partly because of the exit of the United States from the Kyoto Protocol) only high quality CDM projects will be able to prevail. Therefore, a host country interested in being actively engaged in the carbon market needs an aggressive marketing strategy. It should take full advantage of international experiences, internal and external consultants that provide inputs for identification, formulation and development of proposals for potential CDM project activities, as well as multilateral banks acting as intermediaries for buyers in addition to brokers that bring potential buyers and CERs suppliers together.

### 10.3.3 Initial assessment

Prior to creating a Designated National Authority, it is advisable to undertake a quick assessment of the political and institutional feasibility of setting up an effective entity. This first evaluation should mainly consider the political environment and the technical expertise. The items to be assessed are listed in Box 10.5.

**Box 10.5 Political and technical prerequisites to create a DNA**

**1. Political Elements**

***Kyoto Protocol ratifying***

Developing countries wiling to participate in the CDM must have ratified the Kyoto Protocol.

***Political stability***

These long-term effect projects need a frank commitment to the CDM concept. It may be necessary to work with the opponent groups (climate change sceptics, environmentalists, activists…) in order to identify with them how national needs can be met through the CDM.

***Institutional rivalries***

The institution which drafts the National Communication (NC) for the UNFCCC is usually a scientific one and may become involved in the DNA, but it is not necessarily the ideal institution to head it up. Given the various functions of the DNA (see section 3.2 & 3.6) it is advisable for it to have participation from various sectors. Thus, there may be competition between institutions, which desire control over the new program. Relevant institutions should be brought together to discuss common interests in the CDM.

***Level of inter-institutional and intersectoral communications***

The variety of CDM projects types gives a crucial importance to the efficiency of the intersectoral and inter-institutional channels of communications.

**2. Technical expertise**

***General level of Interest and Understanding***

It consists in evaluating how much general awareness rising is needed to build the institutional capacity.

***Level of technical/scientific expertise for project development and evaluation***

It determines the level of external capacity building needed for developing, appraising and approving CDM projects.

***Availability of Resources***

Availability of resources can be assessed through the identification of the stakeholders and an institutional analysis (whether there is a critical mass of support to establish a DNA).

*Source: based on Figueres C., 2002*

As shown on Table 10.2, all the countries of the Nile Basin have ratified and put in force the Kyoto Protocol since 2005.

However it is noticeable that all the CDM potential of these countries remains underexploited since only five large scale and four small scale projects are currently registered for the 9 countries.

In addition, this table stresses that the NC author is sometimes the same entity as the DNA officially registered at the UNFCCC. As mentioned earlier this solution is not always the most efficient considering that day-to-day tasks involved in preparing and processing CDM project activities could be carried outside of a state administration, to ensure greater and more rapid scope for action.

## Table 10.2 NBI countries and climate change

| Country | Kyoto Protocol ratification | Registered CDM projects | NC | NAPA | Registered DNA | NC author |
|---|---|---|---|---|---|---|
| Burundi | 2001/10/18 | N/A | Yes | Yes | None | Ministère de l`Aménagement du Territoire, et de l`Environnement |
| Democratic Republic of Congo | 2005/03/23 | N/A | Yes | Yes | Ministère de l'Environnement | Ministère des affaires, foncières, environnement et développement touristique |
| Egypt | 2005/01/12 | 4 large scale projects | Yes | No | Egyptian Environmental Affairs Agency (EEAA) | Egyptian Environmental Affairs Agency (EEAA) |
| Ethiopia | 2005/04/14 | N/A | Yes | No | Environmental Protection Authority (EPA) | Tadege, Abebe |
| Kenya | 2005/02/25 | N/A | Yes | No | National Environment Management Authority (NEMA) | Ministry of Environment and Natural Resources |
| Rwanda | 2004/07/22 | N/A | Yes | Yes | Environment Unit in Ministry of Lands, Environment, Forestry, Water and Mines | Ministry of Lands, Environment, Forestry, Water and Mines |
| Sudan | 2004/11/02 | N/A | Yes | Yes | High Council of Environment and Natural Resources (HCENR) | Ministry of Environment and Physical Development |
| Tanzania | 2002/08/26 | 1 small-scale project<br>1 large scale project | Yes | Yes | Division of Environment, Vice-President's Office | Ministry of Environment Centre for Energy Environment, Science and Technology |
| Uganda | 2002/03/25 | 1small-scale multi-location project | Yes | No | National Climate Change Steering Committee (NCCSC)<br>Ministry of Water and Environment, | Ministry of Water, Lands and Environment |

*Source: UNFCC website*

Abbreviations used in the table: NC: National Communications NAPA: National Adaptation Program of Action
Both are national reporting documents submitted to the UNFCCC.

### 10.3.4 Sustainable Development Criteria

The analysis of current policies and regulations in the Nile basin countries has revealed a diversity of environmental and social policies and regulations within the Nile basin countries and, in general, the absence of clear sustainable development policy. Consequently, the relevant governmental authorities should define sustainable development policies and priorities and/or reinforcing social and environmental legislations allowing the development of criteria and requirements which will be necessary for the project validation by the DNA.

While many countries will take different approaches to setting Sustainable Development (SD) criteria for CDM projects, it is useful to define a basic set of sustainability principles. In general, any project should contribute to three types of sustainability:

Ecological Sustainability

- Maintain productive capacity and renewability of species and of biologically productive land and water surfaces;
- Maintain Earth's life support systems, including living ecological processes and functions, and global physical systems;
- Preserve biological diversity.

Economic Sustainability

- Provide all with meaningful employment and a place to make a contribution;
- Create sufficient wealth to allow all to meet their needs, and attain a high quality of life;
- Drive innovation and technology improvement, meeting human needs with fewer resources and less ecological damage;
- Maintain physical and social infrastructure and knowledge assets for future generations.

Social Justice and Equity

- Maintain cultural identity and respect;
- Empower and support the participation of individuals, while protecting the strength and viability of community;
- Equitably share natural resources and the benefits of development;

- Provide equal access to nutrition, health, education, self confidence, and opportunity;
- Foster peace and security.

Amongst the Nile basin countries Kenya have already begun to identify criteria for CDM projects. Others countries like Egypt or Tanzania have also formalized Sustainable Development priorities.

The lists presented in Box 10.6 have been compiled from different country's CDM criteria.

Appendix 9 provides extracts of Tanzania SD strategy as well as CDM project guidelines developed by Kenya as illustrations of what can be expected from host countries.

**Box 10.6 Criteria that can be used for CDM project screening**

Social Criteria

- Improves quality of life, especially for the very poor
- Alleviates poverty (e.g., by providing regular income)
- Improves equity (e.g., by improving the income of poor women)

Economic Criteria

- Provides financial returns to local entities
- Results in a positive impact on balance of payments (e.g., through new investment)
- Transfers new technology

Environmental Criteria

- Reduces GHGs and the use of fossil fuels
- Conserves local resources
- Reduces pressure on local environments
- Provides heath and other environmental benefits
- Meets local renewable energy portfolio standards and other environmental policies

*Source: Pembina, 2003*

Once the criteria defined, the next step in the assessment process is to define SD indicators that will reflect them in order to be able to measure the performance of the project regarding these specific points.

First of all, an SD indicator as to be comprehensive (i.e., reflecting the environmental, economic and social dimensions of SD) and measurable (unambiguous and obtainable with no excessive effort) in order to be useful to the decision maker.

Regarding CDM projects, the host country shall select a set of SD indicators that are:

a. Complete to verify that the overall objective of sustainability has been met (local and global, three dimensions of SD);
b. Operational: balance coverage of the area, unambiguous, policy-relevant;
c. Decomposable: the set of indicators should be breakable into different section to facilitate the decision making;
d. Non-redundant in order to avoid double counting;
e. Minimal: as small as possible in order to reduce the dimensionality of decision problem and reduce the costs of measuring process and assessment process.

More detailed information and examples of potential SD indicators are presented in the CDM - Information and Guidebook from the UNEP, Section 3[12].

### 10.3.5 Steps in Creating a DNA

Once the initial assessment is accomplished indicating favourable conditions for the DNA, the steps provided below present a general framework for establishing a DNA.

1. Define the DNA's mission and objectives

It must at a global level contribute to the ultimate objective of the Convention, and at the domestic level it should help meet national sustainable development goals.

2. Obtain official status

Seek support of political entities such as Ministries of Environment, Energy, National Resources, etc; and establish a legal framework via Presidential or Ministerial Decree or any other legal instrument. This legal instrument shall contain justifications, authorities, objectives and organisational structure, financing functions and procedures that will be the platform for the development and sustainability of the DNA. Furthermore, the DNA should have the authority to grant export of emissions right (CERs).

[12] **3.1.2 How to select SD indicators** (page 19) and **3.1.3 Examples of potential SD indicators that can be applied to CDM project evaluation** (page 20), available at http://cd4cdm.org/Publications/cdm%20guideline%202nd%20edition.pdf

3. Review and establish national legal framework

A review of the national legislation is crucial. The legal framework of a host country will directly affect the success of the national authority. Depending upon the development priorities of the host country, some legislation might be compatible with CDM. As such with trade and investment in general, those host countries with most transparent rules and most streamlined procedures, will be in the best positions to compete for CDM resources.

At this level, the Nile basin countries will be able to refer to the review of national legislation made under this study and presented.

4. Align program strategies with national sustainable development priorities

National strategies for CDM should be based on local sustainable development objectives. It is important to identify national policies already established for social and economical development in areas related with climate change such as energy, land use change and forestry, industry, etc. These policies will ultimately have the greatest impact on national resources and the environment at the local level and on climate change at the global level. CDM is a real opportunity to channel resources towards projects that are most likely to further national development priorities.

5. Attain broad stakeholder participation

This is one of the most challenging steps. Some countries have centralised programs within the central government institutional framework. Others have achieved active participation from all sectors of the society and different sectors of the economy. Including participation of the private sector encourages a less bureaucratic, more result-oriented and business-like approach. Private and public developers together or by themselves are the real actors and the driving force for the implementation of cost-effective mitigation options.

6. Obtain financial and non-financial resources

Funds will be crucial and the source of funds will depend on stakeholders' involvement. DNAs based on public funding may face funding constraints and one way to deal with is to broaden the sources of in-kind support from stakeholders for items such as the physical facilities for offices as well as logistic assistance such as financial and accounting management support from private or NGO entities. This will allow for more flexibility to the NDA. Operational costs for running a NA might also be financed via a small commission fee on CER trading.

7. Staff the NA

The staff for the DNA will typically be donated from government agencies in part or full-time regime. This team shall benefit from the assistance from NGO's and/or private companies (consulting hours).

8. Establish relationships with the national focal point for climate change and other ministries

The DNA needs to have open communications with the government agencies of the sectors relevant to the CDM for technical review and national approval activities. The DNA staff members shall also represent their country at the climate change negotiations.

### 10.3.6 Tasks assigned to the DNA

To sum up, according to Paulo Manso[13], from the OECD, the DNA would carry out the following tasks:

- Carrying out secretariat duties for the CDM Board;
- Serving as a focal point and provide support for investors/buyers;
- Promoting the CDM project approach;
- Providing potential projects for investors;
- Processing framework agreements with investors/buyers;
- Assessing statements made on environmental impact;
- Providing legal advice for investors/buyers;
- Coordinating with other official entities and authorities;
- Drawing up standardised baselines;
- Monitoring ongoing CDM projects;
- Conducting public relations work, updating the web, etc.

[13] Establishing a National Authority (NA) for the Clean Development Mechanism (CDM): The Costa Rican Experience
By Paulo Manso, 2003, http://www.oecd.org/dataoecd/11/32/2957712.pdf

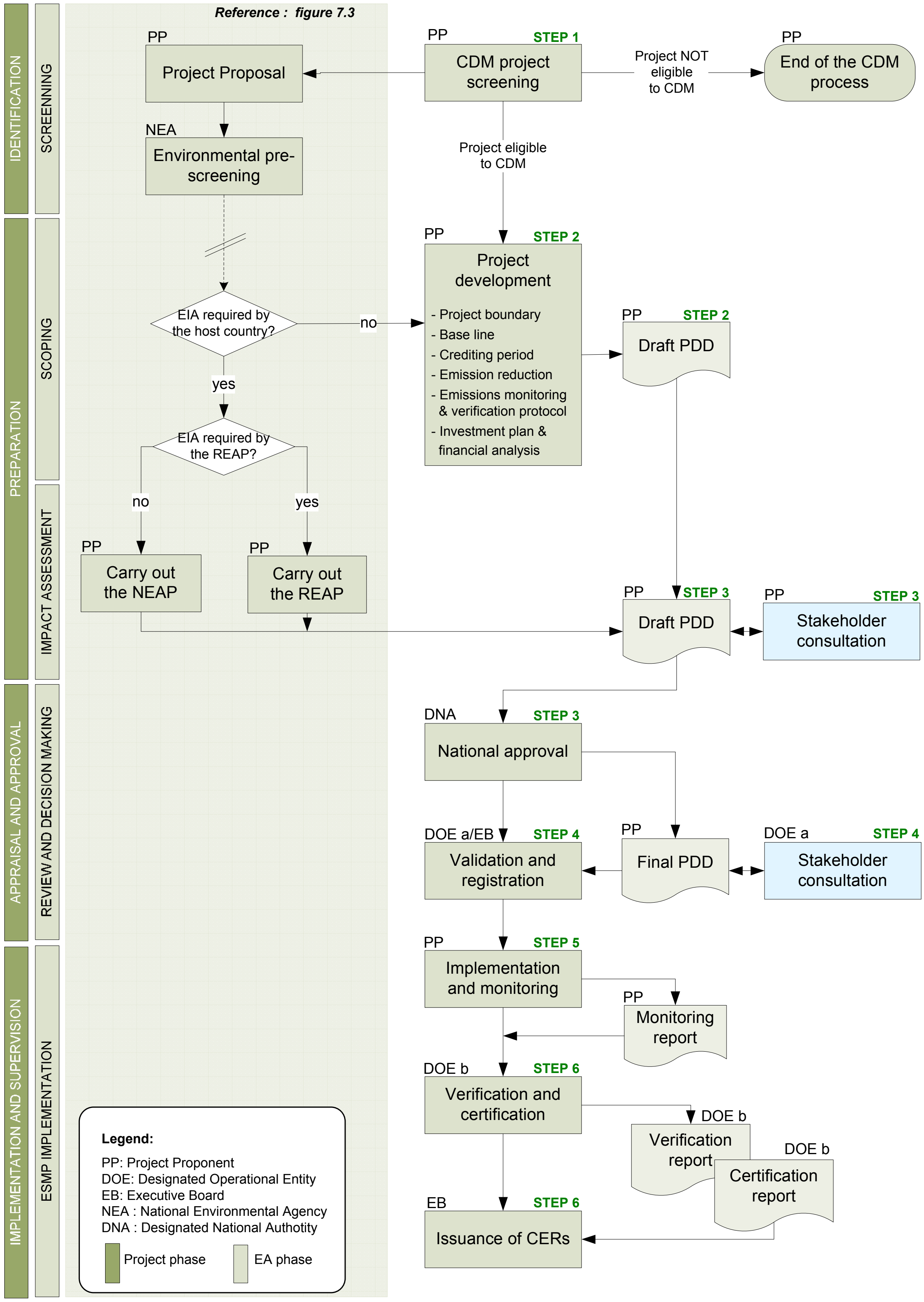
## 10.4 Frameworks and directives for developing and implementing a CDM for power project

This section shows how the CDM is integrated in the EA Process and details the steps that should be followed when implementing a CDM project.

### 10.4.1 Integration of CDM in the EA Process for Regional Power Projects

Figure 10.2 shows an overview of the integration of CDM in the EA process for regional power projects. The six step process are detailed in the following section.

## Figure 10.2 CDM into the EA process for regional power projects



### 10.4.2 General CDM Process for power projects

The project cycle can be divided into six steps, as shown in Table 10.3. Also provided in the table are the parties responsible and the official time requirements for certain tasks. If the DNA role seems to be limited in this representation, it is important to remember that CDM process frameworks and other preparation activities have to be handled beforehand. This necessary preparation shall help to attract project proponents and to convince investors.

**Table 10.3 Overview of Project Cycle, showing official timelines and responsibilities**

| Step | Task | Timeline | Responsible Party |
|---|---|---|---|
| 1 | **Project Screening** | | **Project proponent** |
| 2 | **Project Development** | | |
| | • Estimate real emissions reductions | | **Project proponent** |
| | • Develop emissions monitoring and verification protocol | | **Project proponent** |
| | • Prepare investment plan, undertake financial analysis | | **Project proponent** |
| | • Draft Project Design Document | | **Project proponent** |
| 3 | **National Approval** | | |
| | • Carry out an EIA if necessary | | **Project proponent** |
| | • Invite stakeholders' comments | | **Project proponent** |
| | • Approve the project | | **DNA** |
| 4 | **Validation and Registration** | | |
| | • Finalize Project Design Document | | **Project proponent** |
| | • Invitation of stakeholder comments | 30 days | **DOE a** |
| | • Validation | 8 weeks | **DOE a** |
| | • Registration | | **EB** |
| 5 | **Implementation and Monitoring** | | |
| | • Implement project | | **Project proponent** |
| | • Monitor and record emissions | | **Project proponent** |
| 6 | **Verification and Certification** | | |
| | • Verify emissions reduction | | **DOE b** |
| | • Certify emissions reduction | 15 days | **EB** |
| | • CER issuance | | **EB** |

*Source: adapted from Pembina, 2003*

**Abbreviations**
DOE: Designated Operational Entity EB: Executive Board DNA: Designated National Authority

### 10.4.3 Step 1: Project screening

The purpose of this step is to determine whether the proposed project is eligible to earn CDM credits. Screening should also be used to ensure that the project meets the project developer's and investing company's own criteria, and to generally assess risks associated with the project.

This step shall occur at the very beginning of the EA Process for Regional Power Projects, even before the project proposal is submitted to the National Environmental Agency (NEA) of the host country.

Table 10.4 summarizes a basic procedure that can be used to screen a CDM project.

**Table 10.4 Project screening criteria**

| Question | | Answer | |
|---|---|---|---|
| | | Yes | No |
| 1 | Is the project consistent with sustainable development priorities in the host country? | Proceed to next question. | The project is not eligible as this is a crucial element for the CDM. |
| 2 | Does the project result in real, measurable and long-term emissions reductions below those that would have happened without the project? | Proceed to next question. | The project is not eligible as this is a crucial element for the CDM. |
| 3 | Is the project activity mandated, directly or indirectly, by laws or regulations that are enforced in the host country? | The project is not eligible since the host country would have required the activity anyway in the absence of the CDM. | Proceed to next question. |
| 4 | Could the project have been undertaken as a result of normal business investment practice prevailing in the host country without the CDM? | The project is not eligible since it could have occurred in the absence of the CDM. | Proceed to next question. |
| 5 | Does the project lead to the transfer of new, environmentally efficient technologies or management practices to the host country? | Proceed to next question. | Technology transferred under the CDM must be the best commercially available in terms of GHG emissions per unit of production. |
| 6 | Is the project financed by a pre-existing official development assistance (ODA) program? | The project is not eligible. | Proceed to next question. |
| 7 | Does the project meet local country development priorities and have local support? | Proceed to next question. | It will be more difficult to obtain host country and stakeholder approval. |
| 8 | Does the project have negative environmental or social impacts? | An EIA may be required and there could be negative international publicity. | Proceed to next question. |
| 9 | Is there general stakeholder support for the project? | Proceed with project development. | It is unlikely that the CDM project will be approved by the host country. |

*Source: Pembina, 2003*

To answer the first question on SD, the project proponent will need to consult the host country SD priorities and/or policy.

### 10.4.4 Step 2: Project Development

Once the decision has been made to proceed with submitting a project to the CDM, the project will need to be analyzed and developed in more detail. The following activities are involved:

1. Estimate emissions reductions
    - Choose project boundary — the physical area within which emissions reductions occur and the actual types of GHG emissions to be reduced.
    - Select project baseline — the "business as usual case" against which emissions reductions are measured.
    - Set crediting period — the period over which emissions reductions will be claimed.
    - Calculate emissions reductions against baseline.
2. Preparation of the emissions monitoring plan
3. Preparation of the investment plan and initiation of the financial analysis
4. Preparation of the draft Project Design Document

The Project Design Document (PDD) is the official document required by the host country, Designated Operational Entity (DOE), and Executive Board (EB) for project approval. It contains information about the project boundary, baseline, expected emissions reductions, and monitoring plan. The financial analysis provides a measure of how valuable the CDM is to the project at different carbon prices. The following sections describe in detail the essential aspects of each of the above steps.

#### 10.4.4.1 Choose Project Boundary

The project boundary clearly identifies the sources and sinks of all six GHGs that will be reduced by the project, and sets the physical area within which the emissions will be reduced. All GHG emissions that are "significant and reasonably attributable" to the project activity must be included.

Generally speaking, there are two types of emissions related to CDM project activities within the project boundary: on-site and off-site. GHG reductions (or increases) that result from the project outside of the project boundary are called “leakage”.

- ***On-site emissions*** are those that arise immediately from the project activity itself. For example, when a biomass gasifier is installed in place of a diesel burner at a small manufacturing business, GHG emissions reductions will occur on-site because diesel fuel is being replaced.
- ***Off-site emissions*** are those that occur upstream or downstream from the project. The same gasifier project will also reduce emissions in the supply system of the displaced diesel fuel. This would include reduced emissions in oil exploration, the refining process, and fuel transportation.

Where electricity is saved or generated on-site, all of the emissions reductions occur upstream. For example, a hydropower project will result in a decrease in the demand for grid electricity. If this electricity is derived from a power grid that uses fossil fuel–based power plants, there will be a decrease in emissions at these plants. Upstream emissions reductions from grid electricity savings are usually characterized by an emissions factor that is either the weighted average of emissions reductions for all plants in the power grid, or the next new fossil fuel power plant that will be added to the grid (see also Select Project Baseline and Calculate Emissions Reductions below).

10.4.4.2 Select project baseline

The baseline of a project is a measure of the emissions that would have occurred in the absence of the proposed project activity, and is used to estimate the emissions reductions from the project. Baselines for CDM projects are normally **determined on a project-by-project basis** and are based on previously accepted methodologies (outlined below).

There are three acceptable methodologies that can be used to measure the baseline of a CDM project. The choice of which to apply will depend mainly on the type of project, but will also be affected by the availability of data.

1. **Status quo emissions:** This approach assumes that without the CDM project future emissions would have been the same as current or historic emissions. Reductions from the proposed project are measured against this future projection, using an emissions factor based on current information. Although relatively easy to measure, and useful in projects that affect grid electricity, this methodology fails to take into account technological developments that lead to more efficient processes, as well as regulatory revisions and significant market restructuring that may affect the intensity of future emissions.

2. **Market conditions:** This approach assumes that the technology normally used under current market conditions is the baseline and allows market barriers, such as lack of financing and product distribution channels, to be taken into account when selecting the baseline. This is particularly important where these barriers discourage adoption of otherwise cost-effective high efficiency technologies.
3. **Best available technology:** This approach is most useful in rapidly changing markets where historic emissions are not relevant, and the "best commercially available technology" is used as the baseline. It takes the average emissions of similar project activities undertaken in the previous five years (in similar social, economic, environmental, and technological circumstances), whose performance is among the top 20% of their category.

Sometimes, a combination of the above methodologies is required to reveal a complete picture of what would have happened in the absence of the project activity. If none of these methodologies is applicable to the project activity, a new methodology may be proposed. However, newly proposed methodologies must be approved by the Executive Board before the project can commence, so this approach may delay implementation. Regardless of the chosen methodology, a baseline must meet the following criteria:

- It must be established in a transparent and conservative manner, regarding the choice of approaches, assumptions, methodologies, parameters, data sources, and key factors.
- It must take into account relevant national and/or sectoral policies and circumstances (e.g., sectoral reform initiatives, local fuel availability, and the economic situation in the project sector). Equally important are any proposed or anticipated future policies that may affect the project or baseline scenario, as these may change the overall situation and, therefore, the allowable credits (which, in turn, will have an impact on the financial gain of the project). It is advisable to obtain, in writing, any relevant government or business documents whose content is anticipated to have an impact on the project scenario.
- It must provide a justification of the appropriateness of the baseline choice.

When emission reduction occur upstream from a project within an electricity grid and there is no obvious baseline power plant that can be used as a baseline, then a weighted average regional grid emissions coefficient should be used. This approach allows the use of published or commonly used standard emission coefficients for the local or regional power grid based on current common characteristics of the grid. These include annual power production and efficiencies for each power plant (hydro, coal, geothermal) in each year that CERs will be claimed. These coefficients will be the same for all CDM projects operating in the region, unless the project specifically addresses one aspect of the load curve — e.g., it reduces peak demand. In the RPIP perspective, countries of the NBI shall refer to Volume 2 of the IPCC Guidelines for National Greenhouse Inventories[14] to access the coefficients usually used for power generation projects.

Appendix 10 provides more details and an example of how weighted average emissions factors can be derived, and shows when and how a baseline should allow for transmission and distribution losses.

Examples of baseline choices for several projects financed under AIJ or by the World Bank PCF are provided in Table 10.5 below.

**Table 10.5 Baseline methodologies for CDM Power Projects**

| Type of project | Baseline Approach | Type of CDM Baseline |
|---|---|---|
| Wind power facility, Honduras | Current power is generated by hydropower, with thermal plant back-up. The wind farm would displace the need for the thermal plant, and, therefore, the emissions from this plant were used as the basis for the emissions reduction calculation. | *Best available technology. The average emissions of typical thermal plants in the previous five years (in similar social, economic, environmental, and technological circumstances), whose performance is among the top 20% of their category.* |
| Two wind farms, Morocco | Emissions are compared to current fossil fuel–derived electricity (from coal, oil, and gas), measured by carbon intensity. Since future additions of similar oil-based plants were expected, current emissions could be used as the baseline. | *Status quo (current) emissions.* |
| Three micro-hydro facilities, Guatemala | The three communities did not have access to electricity, so the analysis was based on the displacement of kerosene lamps for lighting. | *Market conditions. Kerosene normally used under current market conditions (market barriers prevent use of more effective technologies).* |

*Source: based on Pembina, 2003*

### 10.4.4.3 Set crediting period

The time period during which credits arising from the project can be claimed is not necessarily equal to the operational lifetime of the project activity. It is assumed that, without the project, the baseline technology will gradually improve over time and “catch up” with the CDM project technology. There are two options for the crediting period of CDM projects:

[14] See 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2 Energy http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.htm
**Chapter 2: Stationary combustion** will be used to estimate for coal combustion emissions for power generation GHG inventory.
**Chapter 4: Fugitive Emissions** will apply to coal extraction and transport fugitive emissions, as well as all greenhouse gas emissions from oil and gas systems except contributions from fuel combustion.

- an initial period of seven years, which may be renewed a maximum of two times, for a total of 21 years (renewals are contingent on re-validation of the original project baseline, and, in some cases, the baseline may need to be updated with newly available data); or,
- a maximum of 10 years with no option of renewal.

10.4.4.4 Calculate Emission reductions

After determining the project boundary and the baseline emissions, the net emissions reductions can be estimated. For each year in the project period, the on-site and off-site emissions of both the baseline and the project must be tallied. To estimate emissions, it will be necessary to use an emissions factor specific to the fuel displaced and project and baseline technologies.

Emissions factors for on-site emissions will be dependent on the following:

- the chemical composition of the fuel used (e.g., carbon content);
- the efficiency of fuel conversion (e.g., fuel combustion efficiency affecting $CO_2$, CO, and unburned fuel emissions); and,
- other characteristics of the technology that affect the production of GHGs (e.g., $NO_x$ production related to combustion temperature).

Emissions factors for upstream emissions will depend on the characteristics of the electricity grid or fuel supply chain. In electricity projects, upstream emissions factors are expressed in tonnes per kWh and based on either the weighted average emissions from all power plants used in the grid or the “marginal” or next plant that would added to the grid if the CDM project were not built. Appendix 10 provides an example of how weighted average emissions factors are estimated. These factors will depend on the location of the CDM project, but it is expected that standard emissions factors that can be used by all projects in a given area will be developed to simplify this process.

In fuel efficiency or substitution projects, the upstream emissions factors will depend on the energy used to produce and refine the fuel, and the energy used to transport the fuel to the site. In many projects these emissions are small compared with those on-site, and, therefore, the supply chain is not included within the project boundary. These emissions, therefore, become “leakage.”

The following provides an overview of the steps involved in determining net emissions reductions. Each step must be completed for each GHG associated with the project. A template for these calculations is provided in Appendix 10.

**Table 10.6 Overview of Emissions Reductions Calculation**

| | | | | | |
|---|---|---|---|---|---|
| 1 | Estimate Total Baseline Emissions | = | Baseline On-Site | + | Baseline Off-Site |
| 2 | Estimate Total Project Emissions | = | Project On-Site | + | Project Off-Site |
| 3 | Calculate Net Emissions Reductions | = | Total Baseline | - | Total Project |
| 4 | Estimate the $CO_2$ Equivalent Reduction | = | Net Emissions | x | Global Warming Potential[15] |
| 5 | Calculate Total Emission Reductions | = | Sum of $CO_2$ Equivalent Reductions | | |

Most of the power generation projects eligible to CDM lead to a reduction of upstream or "off-site" emissions.

10.4.4.5 Develop Emissions Monitoring and Verification Protocol

All GHG emissions related to the project must be measured and recorded throughout the crediting period. The monitoring of emissions essentially re-tests whether the project is actually reducing GHG emissions and meeting the condition of real emissions reductions. A monitoring plan is required for project validation and must be provided in the Project Design Document (see Section 10.4.4.7 below).

In general, a monitoring plan collects and archives all data relevant for determining all GHG emissions related to the project activity. These include the following:

- project sources within the boundary area;
- baseline sources within the boundary area; and,
- any sources outside the project boundary that are significant and reasonably attributable to the project.

Most monitoring and verification (M&V) protocols will use a similar approach to that used to estimate GHG reductions described above. In an M&V protocol, emissions factors are used to convert actual measured fuel or electricity production or savings into GHG reductions. Weighted average grid emissions factors are used when a project results in upstream

15 See Appendix 10 for more details on Global Warming Potentials

emissions reductions and the mix of power plants in the grid may change from year to year (see Appendix 10).

#### 10.4.4.6 Prepare Investment Plan and Undertake Financial Analysis

Before undertaking a financial analysis of how the value of carbon credits from the CDM will benefit the project, an investment plan outlining the role of each party (local debt and equity financing, CER purchaser, etc.) should be prepared. The investment plan should identify the expected returns (i.e., financial returns and emissions reductions) that each party expects from the project. See Section 10.2.5 for more details on carbon financing options.

Next, identify the expected conventional financing requirements and arrangements for cost recovery that would be expected in the project. For example, in a renewable energy–based power project, conventional financing will be required for the base cost of the technology, and the sale of the power produced will contribute to cost recovery.

Most companies seeking credits for emissions reductions through a CDM project will be interested only in contributing to the part of the project that actually reduces the emissions. In some types of projects, such as small hydro or wind power, the CDM would help finance the incremental cost of the renewable energy project over the baseline technology (e.g., a gas-fired turbine or coal plant). In others, such as a landfill gas recovery project, the CDM might finance the whole project. More details on the types of financial positions that companies can take to earn CERs in CDM projects are provided in Section 10.2.5.

Once the expected emissions have been estimated, and the financial and investment arrangements agreed to, a financial analysis should be performed for each investor in the project, at several CER prices (per tonne). The analysis should include all costs and revenue streams associated with projects, such as an estimate of capital and operating costs, and any costs to remove barriers (such as marketing, financing, etc.). It should also include an assessment of sensitivity and risk. The results will provide an estimate of the financial returns to each investor, and the impact of the CDM on the viability of the project.

Completing the financial analysis and answering the following questions will help determine whether the project should be pursued from a financial point of view, and answer the questions on the project's "additionality" included in the CDM approval process:

- Is the project financially viable without the sale of CERs?
- Does the CDM financing or sale of CERs have a sufficient impact on the financial returns from the project or the removal of market barriers to make the project more easily implemented?
- Can financial returns and CERs be recovered effectively and at a reasonable risk?
- Is the investor's entitled share of CERs satisfactory?
- Are the emissions reduction costs (cost per tonne) satisfactory?

10.4.4.7 Prepare Draft Project Design Document (PDD)

The draft Project Design Document (PDD) sets the basis for the final PDD which will be submitted to the Executive Board (EB).

The following provides an overview of the major components required in a PDD[16], while the UNFCCC website is resourceful regarding guidelines[17] and real registered CDM project's PDDs[18].

**Description of the project.** A general description of the project should identify:

- the name of the project;
- a listing of all project proponents, including their coordinates;
- the project location, including the host country and regions, as well as a discussion of the physical location of the project activity;
- the project type — for example, reduction projects may be fuel substitution, renewable energy, or energy efficiency projects;
- a description of the technology to be employed, and, if the technology will be transferred (e.g., to local stakeholders), a discussion of how this will be accomplished;
- a brief explanation of the GHG emissions reductions that will occur as a result of the project, including a discussion of why these reductions would not occur in the absence of the project, and a discussion of any relevant national circumstances; and
- a description of the public funding of the project, if relevant.

**Baseline methodology.** The name of the chosen baseline methodology must be included (see Section 10.4.2.2 above), along with a discussion of the following:

16 An electronic version of the CDM PDD can be accessed through the UNFCCC Website at http://cdm.unfccc.int/Reference/PDDs_Forms/PDDs/index.html
17 See http://cdm.unfccc.int/Reference/Guidclarif/index.html
18 See http://cdm.unfccc.int/Projects/registered.html

- why it was selected;
- how it will be applied in the context of the project;
- how it was established in a transparent and conservative manner; and
- why the project is additional to the baseline scenario.

Duration of the project/crediting period. The starting date of the project must be provided, and the chosen crediting period must be clearly stated (i.e., 10 years, or 21 years with baseline renewal every seven years). The expected operational lifetime (which is not necessarily the same as the crediting period) of the project should also be stated.

**Monitoring methodology and plan.** As with the baseline, the monitoring methodology should be chosen from an approved list to be made available on the UNFCCC CDM Web site. In addition, a justification of the choice must be provided. The monitoring plan should identify the data used to calculate the emissions reductions, and discuss why this data is accurate, comparable (i.e., to similar projects), complete, and valid. In other words, it must show that quality assurance for data monitoring, collecting, and reporting has been implemented. If a new monitoring methodology is to be used, a detailed discussion must be presented, including the methodology's strengths and weaknesses, and whether it has been applied successfully elsewhere (Annex 4 of the PDD provides a template for this discussion).

Calculation of how GHG emissions are reduced. The net reductions in GHG emissions must be clearly identified and compared to emissions reductions that would have occurred without the project activity.

**Environmental impacts.** A description of the identified environmental impacts, as well as a discussion of the EIA, if applicable, must be included.

**Stakeholder comments.** Stakeholders must be consulted prior to the implementation of a project. Their comments, as well as the ways these comments were taken into account, must be documented.

**Annex 1.** Information on participants in the project activities.

**Annex 2.** Information regarding public funding. Since official development assistance from Annex 1 countries cannot be used directly in the implementation of a CDM project (purchase of CERs), it must be clearly shown that funding support for any part of a project — for technology transfer, for example — is exclusive of official development assistance.

**Annex 3.** Baseline information

**Annex 4.** Monitoring plan

The draft PDD can be prepared by, or on behalf of, the project proponent (e.g., the local company, community, or NGO in the host developing country) or the company providing the CDM financing. The information provided at this stage is normally sufficient for a preliminary investment or CER purchase agreement to be prepared between the project proponent and the contributing company.

### 10.4.5 Step 3: National Approval

At this stage, the project process must start to follow the procedures and schedule set out in the Marrakech Accords. An Environmental Impact Assessment must be performed if negative impacts are suspected. All CDM projects incorporate stakeholder input and host country approval prior to implementation. The steps during this stage are as follows:

1. Undertake environmental impact assessment (if required).
2. Obtain stakeholders' comments.
3. Obtain host country approvals.

The host country shall refer to **Figure 10.1 Evaluation procedure** to customize the procedure in this domain.

#### 10.4.5.1 Undertake Environmental Impact Assessment

If either the project proponent(s) or the host country believes that negative environmental or social impacts from the project activity will be significant, then an environmental impact assessment (EIA) must be carried out. This EIA will be undertaken in the Environmental Assessment Process defined in Chapter 7 above either at a national scale or at the regional scale if it concerns a regional power project (see figure 7.3).

The results of the environmental assessment must be attached to the final Project Design Document. Section 10.3.1 provides more details on sustainable development criteria that may serve as a basis for the EIA.

10.4.5.2 Obtain Stakeholders' Comments

Local stakeholders and the international community have two opportunities to provide comments on the CDM project activity. The first is the responsibility of the project proponent, who must consult with stakeholders to garner input and support for the project. A summary of this consultation process, as well as the comments received and the ways the comments were taken into consideration, must be included in the final Project Design Document.

The second opportunity for input occurs when the Designated Operational Entity makes the Project Design Document public (see Section 10.4.4.7). In this stage, stakeholders and others have 30 days to provide their comments. The DOE then evaluates the comments and determines whether the project should go forward.

10.4.5.3 Obtain Host Country Approvals

The project proponent must obtain written approval of the voluntary participation of each party involved — that is, the country of the project proponent and the host country. Written confirmation from the host country that the project will achieve sustainable development is also required. This will be determined either on a project-by-project basis or by assessment against national sustainable development criteria (see Section 10.3.4).

Host country confirmation must also be attached to the final Project Design Document by the Designated Operational Entity (see below).

10.4.5.4 Case of multilateral projects

If the project has impacts on several countries of the Nile basin, "multilateral funds do not necessarily require written approval from each participant's DNA. However those not providing a written approval may be giving up some of their rights and privileges in terms of being a Party involved in the project. A written approval from a Party may cover more than one project provided that all projects are clearly listed in the letter."(CDM Glossary of Terms, UNFCCC)[19]

### 10.4.6 Step 4: Validation and Registration

The validation process is based on the UNFCCC requirements and on the standards ISO 14064-3 (*Specification with guidance for the validation and verification of greenhouse gas assertions*) and ISO 14065 (*Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition*).

Additional stakeholder comments, as well as national approval, constitute the final requirements for project approval. Once these elements are incorporated into the draft PDD produced earlier, the PDD may be finalized and submitted to the Designated Operational Entity (DOE). The DOE evaluates a project against the requirements of the CDM, and then approves (i.e., validates) the project and refers it to the CDM Executive Board for registration. Registration is the formal acceptance of a validated project, and must be obtained prior to project implementation. In its validation of the project activity, the DOE will ensure the following:

- voluntary participation by all parties (who must be Parties to the Kyoto Protocol) was invited;
- stakeholders' comments were received and taken into account;
- an analysis of the environmental impacts – and, if necessary, an EIA – was conducted;
- a real emissions reduction will ensue as a result of the project;
- baseline and monitoring methodologies comply with Executive Board guidelines; and
- written confirmation by the host country that the project meets sustainable development criteria has been received.

When the DOE is satisfied that these conditions have been met, it will make the PDD public for further stakeholder input and receive comments for 30 days. After this time, any comments are taken into consideration, and the DOE will make a decision on whether to validate the project.

[19] See http://cdm.unfccc.int/Reference/Guidclarif/glossary_of_CDM_terms.pdf

Once validated, the PDD and any supporting materials are forwarded to the Executive Board for approval. Approval by the Executive Board results in registration of the project. Registration is final eight weeks after the Executive Board receives the validated document, unless further review is warranted. After a project is registered, the CDM registration fee is paid (see Section 10.2) and the project developer may proceed with implementation.

### 10.4.7 Step 5: Implementation and Monitoring

Once a project is implemented, emissions must be monitored. It is important to ensure that the measurement of project-related GHG emissions is done in accordance with the protocol prescribed in the PDD. Monitoring reports must be forwarded to the DOE (DOEb on Figure 10.2 and in Table 10.3) so that emissions reductions can be verified and CERs issued.

Simplified monitoring protocols for small-scale projects may not involve actual measurement of emissions, but all the necessary information set out in the simplified protocol must be collected by the project operator to enable verification by the DOE.

### 10.4.8 Step 6: Verification and Certification

The verification process is based on the UNFCCC requirements and on the standards ISO 14064-3 (*Specification with guidance for the validation and verification of greenhouse gas assertions*) and ISO 14065 (*Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition*).

#### 10.4.8.1 Verify and Certify Emissions Reductions (CERs)

The project developer must select a new OE (DOE b on Figure 10.2 and in Table 10.3) which must make sure that the certified emissions reductions have resulted according to the conditions agreed upon in the initial validation of the project.

The DOE will periodically review the monitoring reports associated with the project and will ensure that GHG measurement is being performed in a prudent manner. In its analysis, the DOE may conduct on-site inspections, speak with project participants and local stakeholders, and collect its own data. If necessary, the DOE may insist on additional data, which it will source. It may also require changes to the monitoring methodology for future reporting periods.

Once the DOE is assured that the requirements for verification are met, it will issue a written confirmation of verification for the project activity. The verification report will be forwarded to the Executive Board and project participants, and will also be made public. The DOE then issues a certification report to the public and the Executive Board.

10.4.8.2 Issuance of Certified Emissions Reduction

The certification report serves as the official request for the issuance of CERs by the Executive Board. Unless a review is required (for example, in cases of fraud or incompetence attributed to the DOE), the issuance will be deemed final 15 days after the Executive Board receives the certification report.

The CERs are dispersed by the Executive Board as follows: a 2% adaptation levy (see Section 10.2.7) will be deposited into the appropriate accounts of the CDM registry; the remainder will be deposited into the registry accounts of the parties and the project participants.

## 10.5 Potential baselines and CDM eligible projects

Table 10.7 identifies the potential baseline scenarios in the NBI countries and therefore, the eligible projects based on the strategic power investment plans.

### Table 10.7 Identification of potential baseline scenarios and eligible projects based on the strategic power investment plans

| Countries | Current energetic picture (capacity of power production) | Strategic energetic investment plans (capacity of power production) | Typical baseline scenario | Potential energy power generation project |
|---|---|---|---|---|
| Burundi[1] | 100% hydroelectric | 100% hydroelectric | Hydroelectric power plant | Renewable energies (wind power, solar power, biomass…) |
| Democratic Republic of Congo[1] | 84.3% hydroelectric<br>15.7% thermal | 52.3% methane (Kivu Lake)<br>47.7% hydroelectric | Methane gas power plant | Renewable energies (wind power, solar power, biomass…)<br>Hydroelectric<br>Geothermal |
| Kenya[1] | 58.3% hydroelectric<br>17.9% diesel<br>11.3% geothermal<br>10.1% gas<br>2.3% steam | 45.6% coal<br>42.4% geothermal<br>6% natural gas<br>6% wind | Coal fired power plant | Renewable energies (wind power, solar power, biomass…)<br>Hydroelectric<br>Geothermal<br>Natural gas |
| Rwanda[1] | 75.6% hydroelectric<br>24.4% diesel | 57.8% hydroelectric<br>42.2% methane (Kivu Lake) | Methane gas power plant | Renewable energies (wind power, solar power, biomass…)<br>Hydroelectric<br>Geothermal |
| Tanzania[1] | 70.7% hydroelectric<br>29.3% thermal | 31.1% natural gas<br>1% diesel<br>67.9% hydroelectric | Natural gas power plant | Renewable energies (wind power, solar power, biomass…)<br>Hydroelectric<br>Geothermal |
| Uganda[1] | 97.5% hydroelectric<br>2.5% thermal | 100% hydroelectric | Hydroelectric power plant | Renewable energies (wind power, solar power, biomass…) |
| Egypt[2] | 86% thermal<br>13% hydroelectric<br>1% wind | 69.3% natural gas<br>21.5% wind<br>8.2% nuclear<br>1% hydroelectric | Natural gas power plant | Renewable energies (wind power, solar power, biomass…)<br>Hydroelectric<br>Geothermal |
| Ethiopia[2] | 87.4% hydroelectric<br>11.6% thermal<br>1% geothermal | 97.4% hydroelectric<br>2.6% coal | Coal fired power plant | Renewable energies (wind power, solar power, biomass…)<br>Hydroelectric<br>Geothermal<br>Natural gas |
| Sudan[2] | 59% thermal<br>41% hydroelectric | 45.5% hydroelectric<br>36.8% gas oil<br>17.2% HFO[3]<br>0.5% diesel | HFO[3] or gas oil fired plant | Renewable energies (wind power, solar power, biomass…)<br>Hydroelectric<br>Geothermal<br>Natural gas |

(1) Source: Strategic/Sectoral, Social and Environmental Assessment of Power Development Options in the Nile Equatorial Lakes Region, SNC Lavalin International, February 2007
(2) Source: Eastern Nile Power Trade Program Study, EDF – Generation and Engineering Division, March 2007
(3) HFO: heavy fuel oil

As summarized here in the second column of table 10.7, the power profile of the Nile Basin Countries varies a lot (see chapter 3 for more details).

The third column shows the portfolios of the additional power investments illustrating the strategic power development that have been chosen by the Nile Basin Countries following the studies handled in the Nile Equatorial Lakes Region and in the Eastern Nile Region in 2007.

The typical baseline scenario is indicated in the table 10.7 as a guideline only as it will have to be re-evaluated to consider the local parameters of the project (see section 10.4.4.2). In the same way, the DNA shall take into account the specificity of the project to select and accept CDM projects among the potential acceptable projects listed here.

This table also takes into account the fact that this study focuses on hydroelectric, geothermal and natural gas power stations for future development of electricity generation systems. However, considering the potential baseline scenarios listed for the nine concerned countries, wind power as well as solar power could be added as eligible scenarios for each country.

As far as transmission lines are concerned, the same potential baseline scenario has been identified for the whole Nile basin: a lack of power transmission lines can be identified in every site where the electricity is provided by local diesel power stations which require the transportation of fuel by trucks to be fed. This transportation, highly polluting, is the baseline scenario.

In Burundi, the electricity originates from hydroelectric dams and the country has decided to continue developing this hydroelectric potential in the future. This means that the production of electricity in Burundi is not a source of GHG and can hardly be “cleaner”. As a consequence, to elect projects to access to CDM funds, the Burundi will have to consider renewable energy projects with less impact on the environment such as wind farms and solar power stations.

In the case of the DRC, the power development portfolio shows that the new investments will be made in two directions: around 50% of hydroelectric power and the other 50 % in methane power. Although the extraction of methane from the Kivu Lake represents many environmental advantages (Unité de Promotion et d'Exploitation du Gaz du Lac Kivu in

Rwanda) the production of electricity from methane is not totally neutral for the environment (escaping of $H_2S$, $CO_2$...). This explains why the hydroelectricity, geothermal and renewable energy projects are cleaner than the methane fired stations. Moreover a methane power station is easier and shorter to build and to commission than an hydroelectric dam so that the methane power station represents a potential baseline more relevant than the hydroelectric power plant for this country. It is thus easy to understand that any hydroelectric, geothermal and renewable energy projects will be eligible to the CDM program if the additionality criterion is demonstrated.

Considering Kenya, the worst scenario regarding the environment for future power investments would be the construction of a new coal-fired power station. As a consequence, the list of eligible projects goes from natural gas power stations (GHG emissions are less important than for coal fuel) to hydroelectric dams (no GHG emissions), including geothermal power station which would be situated in between on an environmental friendly scale.

As Rwanda has the same strategic investment plan as DRC, the baseline and potential eligible projects are the same as mentioned above in the DRC section.

As far as Tanzania is concerned, the power development portfolio designed for this country indicates that the less environmental friendly scenario would consist in investing in a natural gas power station. Therefore, the only options that have to be taken into account to access to CDM credits are the geothermal, hydroelectric and renewable energy power plants.

In the same way as Burundi that plans to develop only hydroelectricity, the projects that would be potentially interesting for the CDM program in Uganda are less harmful renewable power projects including wind power and solar power.

Egypt forecasts a strong development of its natural gas power generation facilities in the next years. Thus, like Tanzania, the projects to be considered by the Egyptian government for the CDM projects are the geothermal, hydroelectric and renewable energy solutions, emitting less GHG than natural gas power stations.

In Ethiopia, the energy plan for future investments shows that coal fired plants will be the more polluting power generation systems among the new installations. As a consequence, it could be the baseline of a CDM project if it is proven that it would have been the retained solution if no additional financing is available. In such a scenario, the eligible projects would be, from the less harmful for the environment to the worst: hydroelectric power generation, geothermal projects, natural gas fired stations, renewable energy projects.

According to its energy investment portfolio, the worst power development option for the environment in Sudan is the construction of heavy fuel oil power stations. It would be the baseline in most cases for Sudan. As this fuel is more harmful than diesel and natural gas, the eligible projects to access to CDM funding would be, among the solutions this project focus on: hydroelectric power generation, geothermal power projects, natural gas fired stations and renewable energy projects.

# 11 OPERATIONALIZATION OF THE EA FRAMEWORK

This Chapter provides the information required to enforce and implement (operationalize) the proposed EA framework for regional power projects. First, a mechanism tying the NBI countries is proposed to operationalize the framework. Secondly, recommendations for capacity building in environmental management are provided and finally, a preliminary budget is presented to operationalize the EA framework.

## 11.1 Proposed enforcement mechanism

The process to enforce the EA framework for regional power projects is illustrated on Figure 11.1.

Following its approval by the RPTP, it is proposed that the final version of the EA framework be transmitted to the NBI Secretariat (NBI-SEC), which will have the task to prepare, with technical assistance, a draft Protocol allowing the NBI countries to approve and adopt the EA framework.

The Nile-SEC will submit for approval the draft Protocol to the NBI Technical Advisory Committee (Nile-TAC). On the basis of the comments of the Nile-TAC, the Nile-SEC will prepare the final Protocol enforcing the implementation of the EA framework in the NBI countries. After final approval by the Nile-TAC, the Protocol shall be signed by the NBI Council of Ministers (Nile-COM).

The Protocol allowing the NBI countries to approve and adopt the EA framework shall be ratified by each NBI country, through regulations signed by the Minister in charge of Environment. Following ratification, the resulting regulations and the Protocol shall be largely publicised in each NBI country

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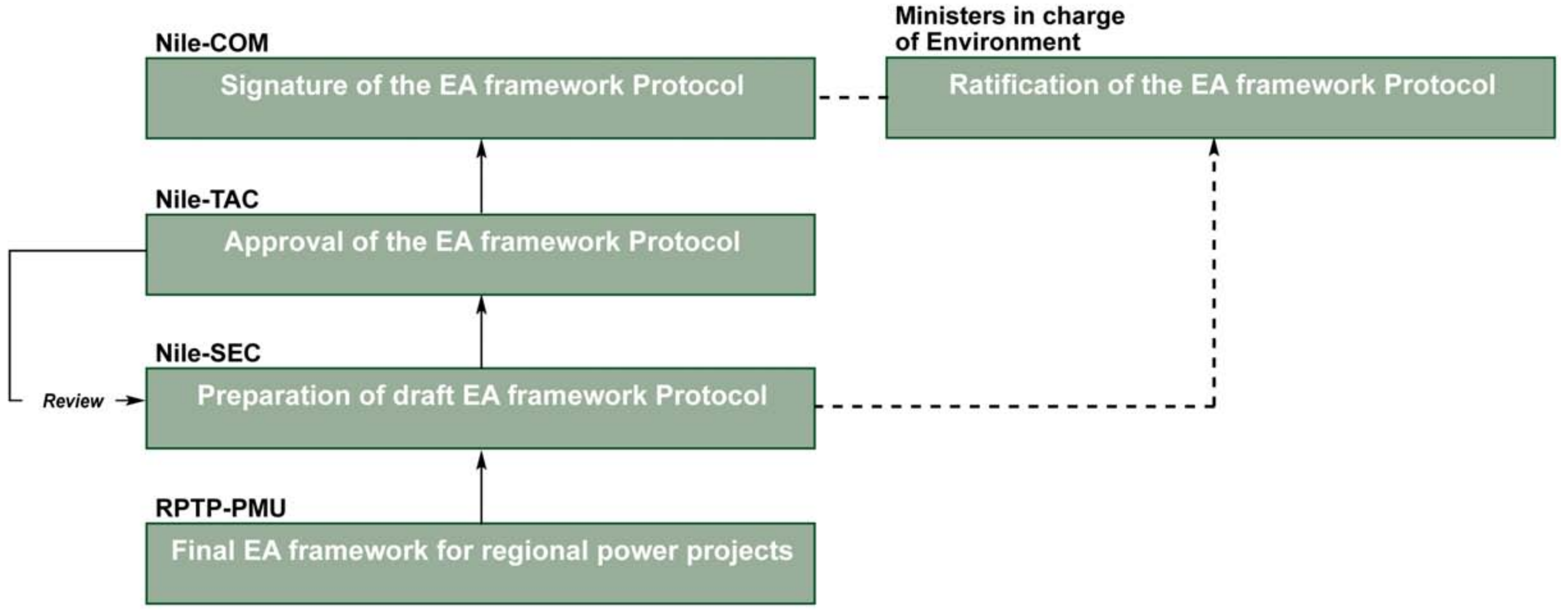
**Figure 11.1 Enforcement of the EA framework for regional power projects**



The national environmental agencies shall be responsible to implement the resulting regulations enforcing the implementation of the EA framework for regional power projects in the NBI countries.

## 11.2 Capacity building in environmental management

In order to ensure the implementation of the EA framework and on the basis of a comprehensive institutional analysis, it is essential that the concerned staff of the institutional organisations involved in the process be trained and become familiar with the components of the EA framework. The institutions involved are those identified in the above Chapter 7.

Three activities are proposed and detailed in the following sections:

- Four-day capacity building workshops on the EA framework;
- Technical assistance along the EIA review process;
- A two-day annual participative review of the projects studied during the period.

### 11.2.1 Workshops

The four-day workshops shall deal with the EA framework and its different components (applicable policies and regulations, safeguard policies of the World Bank, evaluation of regional power investment projects). These workshops shall be directed by two international experts (one environmentalist and one sociologist), assisted by local consultants as needed. Various training methods and tools shall be used, such as formal presentations, group discussions, case studies, application exercises and field visit.

These workshops shall be offered at the regional (Regional EA Working Group) and national levels (nine NBI countries). Around twenty participants, separated in three groups shall be trained.

The proposed topics of the workshops shall be as follows:

- Existing Power Master Plans in the NBI countries.
- Short review of the existing environmental and social framework and procedures in the NBI countries:

  *Environmental topics*
  - NBI environmental policy
  - EIA procedures and regulations

- Water resources management policy
- Greenhouse gas emissions policies and regulations
- International environmental treaties and conventions

*Social topics*
- Land issues and resettlement policy
- Poverty reduction and socio-economic development
- Public health policy
- Vulnerable groups including women policy
- Historical and cultural sites policy and regulation
- Indigenous community policy
- Institutional framework in the NBI countries

- Issues related to environmental assessment considered by four funding agencies: World Bank, African Development Bank, Canadian International Development Agency and European Union. The issues to be discussed include the environmental policies and environmental and social assessment procedures, natural resources management policy, resettlement policy, poverty reduction, public health, vulnerable groups, historical and cultural sites policy, indigenous communities policy, public participation and consultation, dams policy and international waterways policy.
- Guiding principles to achieve sustainable development through regional power projects: achievement of the Millennium development goals and important issues, such as biodiversity, involuntary resettlement, changes to the environment and resource use in the area, indigenous communities, gender issues, public health issues, economic development, physical cultural resources and, participation and consultation of the stakeholders.
- Environmental assessment process for regional power projects. The steps to follow at each phase of the project cycle shall be explained in details: 1) pre screening; 2) screening; 3) scoping: 4) impact assessment; 5) review; 6) decision-making; 7) ESMP implementation and; 8) auditing.
- Environmental and social impact assessment guidelines. Case studies shall be presented and discussed for the four types of projects considered in this EA framework (hydropower, thermal power, geothermal power and transmission lines). Specific environmental and social issues shall be identified, potential impacts specified and mitigation measures provided. Different topics could be studied in more details such as: Public consultation in the environmental assessment process; Involuntary resettlement; Indigenous peoples; Accident Risk Management.
- Integration of the Life Cycle Approach (LCA) in the EA process. The international standards shall be presented and life cycle assessment in the EA process for regional power projects in the NBI shall be discussed. Guidelines for conducting a life cycle assessment could also be studied.
- Various requirements to access to the benefits of the Clean Development Mechanism (CDM). After an overview of the CDM, requirements and issues related to CDM projects shall be presented. Frameworks and directives for developing and implementing a CDM for power projects shall also be detailed and examples given, such as baseline emissions calculations for power grids and net emissions reductions calculations.
- A one-day field visit could be programmed to a power plant and/or transmission station and lines site. Among others, participants could be invited to fill an

environmental and social impact grid and discuss the different issues raised by the operation of the infrastructures.

#### 11.2.2 Technical assistance

Customized assistance could be offered to the Technical Review Committees during the first EIA's review processes, especially for projects showing significant transboundary adverse impacts.

#### 11.2.3 Annual participative review

A two-day participative review meeting could be hold annually regarding the environmental reviews of power projects in the pipeline. This annual meeting would gather together regional and national participants.

A month before the seminar, participants would have to present a short document describing the different projects submitted to them through the year and the difficulties they encountered dealing with them. The problematic situations would then be discussed during the seminar conducted by two international experts (environmentalist and sociologist), who would be assisted by local experts as needed. Solutions would be presented, studied and discussed in order to ease the application of the environmental assessment framework and its components in the following year.

### 11.3 Preliminary budget to operationalize the EA framework

Table 11.1 presents a preliminary budget in current US dollars required to operationalize the EA framework for regional power projects during the 10 years following its acceptance by NBI authorities. This budget plans for funds required to:

- develop and get approved the binding mechanism (Protocol) by the NBI countries;
- develop detailed environmental and social impact assessment (ESIA) guidelines for hydropower, thermal power and transmission lines projects;
- undertake an institutional analysis of the environmental agencies of the NBI countries (as described in Section 4.13 above);
- build the capacity in environmental management of stakeholders identified to implement the EA framework;
- coordinate the implementation of the EA framework (Regional EA Working Group);
- implement the EA framework at the national level (National Environmental Agencies);

- annual participative review to identify the problems encountered in the EA process implementation and propose corrective actions.

Considering the projects mentioned in the different power master plans and power trade studies (see Chapter 3 above), this preliminary budget is based on the assumption that 30 regional power projects (3 per year), identified as such in accordance with this EA framework, will be evaluated in the next 10 years in the NBI countries.

*Waterfalls on the Blue Nile*

**Table 11.1 Preliminary budget to operationalize the EA framework (in current US $)***

| Activities | Years | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
| **Technical assistance** | | | | | | | | | | | |
| Development of the EIA protocol | 75 000 | | | | | | | | | | **75 000** |
| Detailed ESIA guidelines (3) | 95 000 | 97 850 | 100 786 | | | | | | | | **293 636** |
| **Capacity building** | | | | | | | | | | | |
| Institutional study | 95 000 | | | | | | | | | | **95 000** |
| Workshops (3) | | 70 000 | | | | | | | | | **70 000** |
| Technical assistance for review of EIA (desk work) | | 25 000 | | | | | | | | | **25 000** |
| Annual review | | 30 000 | 30 900 | 31 827 | 32 782 | 33 765 | 34 778 | 35 822 | 36 896 | 38 003 | **304 773** |
| **EA process implementation** | | | | | | | | | | | |
| Regional EA Working Group (part-time) | | 25 000 | 25 750 | 26 523 | 27 318 | 28 138 | 28 982 | 29 851 | 30 747 | 31 669 | **253 978** |
| National Environmental Agencies (part time) | | 50 000 | 51 500 | 53 045 | 54 636 | 56 275 | 57 964 | 59 703 | 61 494 | 63 339 | **507 955** |
| **Total** | **265 000** | **297 850** | **208 936** | **111 395** | **114 736** | **118 178** | **121 724** | **125 375** | **129 137** | **133 011** | **1 625 342** |

* See detailed breakdown on next page

**Detailed breakdown of Figure 11.1**

| | | | |
|---|---|---|---|
| Development of the EIA protocol | Professional fees: | 60 000 $ | |
| | Expenses: | 15 000 $ | |
| | **Total:** | **75 000 $** | |
| Detailed ESIA guidelines (first year) | Professional fees: | 75 000 $ | |
| | Expenses: | 20 000 $ | |
| | **Total:** | **95 000 $** | annual inflation of 3% during years 2 & 3 |
| Institutional study | Professional fees: | 70 000 $ | |
| | Expenses: | 25 000 $ | |
| | **Total:** | **95 000 $** | |
| Capacity building workshops: | Professional fees – preparation: | 5 000 $ | |
| | Profesional fees – workshops (3): | 38 400 $ | |
| | Participants (20) – workshops: 9 600$ | 9 600 $ | |
| | Expenses: | 17 000 $ | |
| | **Total :** | **70 000 $** | |
| Technical assistance for review of EIA (desk work) | Professional fees : | 24 000 $ | |
| | Expenses: | 1 000 $ | |
| | **Total:** | **25 000 $** | |
| Participation at the annual review | Professional fees : | 25 000 $ | |
| | Expenses: | 5 000 $ | |
| | **Total:** | **30 000 $** | |
| Regional EA Working Group (part-time / first year) | Salaries: | 23 000 $ | |
| | Expenses: | 2 000 $ | |
| | **Total:** | **25 000 $** | annual inflation of 3% from years 3 to 10 |
| National Env. Agencies (part-time / first year) | Salaries: | 45 000 $ | |
| | Expenses: | 5 000 $ | |
| | **Total:** | **50 000 $** | annual inflation of 3% from years 3 to 10 |

# MODULE 4

## Appendices