SRESA of a Regional Transmission development in Mozambique

Adriana Lafleur; Stephen Lindley
Environment & Water, SNC-Lavalin Inc., Toronto, Ontario, Canada

Electricidade de Moçambique (EDM), the national electrical utility responsible for the generation, transmission, distribution and sale of electricity in Mozambique, under the Ministry of Energy, received financing from the European Investment Bank (EIB) to perform the Strategic Regional Environmental and Social Assessment for the Transmission power line project (CESUL). SNC-Lavalin Inc. was mandated to perform the study.

The objective of the Strategic Regional Environmental and Social Assessment (SRESA) is to inform decision makers of potential environmental and social impacts of policies, plans and programs at the earliest stages of the decision making process, comparing valid options at a strategic level to design investment strategies that are environmentally sustainable for a region as a whole.

Mozambique possesses abundant natural energy resources. The Zambezi River has an estimated generation capacity of 20,000 MW**.** Coal and natural gas resources add approximately 10,000 MW. These resources together generate approximately 30,000 MW**.** To transmit power from these sources to markets in Mozambique and the South African Power Pool (SAPP), the Government of Mozambique plans to develop an Extra High Voltage (EHV) transmission line system from Tete to Maputo, the CESUL (Center – South) project. The CESUL system involves a combination of a 500 kV high voltage direct current (HVDC) overhead electrical transmission line and a 400 kV high voltage alternating current (HVAC) and the related facilities.

Several major project developments are proposed to be implemented as components of the CESUL system. The projects considered in the SRESA are presented inTable 1:

Table 1 – Projects considered in the SRESA

Project name	Capacity	Status
CESUL Transmission system project		Proposed
Cahora Bassa hydroelectric generation project	2075 MW	Existing
Cahora Bassa North hydroelectric generation project	850-1245 MW	Proposed
Mphanda Nkuwa hydroelectric generation project	1,300 MW	Proposed
Boroma hydroelectric generation project	210 MW	Proposed
Lupata hydroelectric generation project	600 MW	Proposed
Benga coal mine and coal-fire generation project	2000 MW	Development
Moatize mine and coal-fired power generation project first and second phase	1200 MW each	Development
Other projects		
Energy Development and Access Projects (EDAP)		
Beira - Sena Railway		
Transportation of coal on the Zambezi River coal export route		

Methodology

The study was performed considering the following aspects cited and explained below:

- Legal framework,
- Socio-economic Environmental and Baseline,
- Alternative sources of power generation for the region,
- Modeling The Zambezi River Basin Hydrology,
- Community Impacts and Mitigation,
- Community engagement,

- Project benefits,
- SEA for Sustainable land use planning,
- Sustainable Development Action Plan.

Legal framework

SRESA complies with Mozambican regulations and various international environmental and social principles and standards including those of the European Investment Bank (EIB), the International Finance Corporation (IFC) and the World Bank, SAPP policies and the Equator Principles. Guidance framework was identified and included in the study.

Socio-economic and Environmental Baseline

The study area covers an area approximately 1,400 km by 350 km between the Cataxa substation and the Maputo substation which form the most northern and southern connection points for the CESUL transmission system.

The environmental baseline has been reviewed. The analysis of the physical, biological and socio-economic conditions of the study area provide an understanding of the major role that the Zambezi River plays in Mozambique's overall economic performance, and identifies the environmentally vulnerable areas within the study areas of the projects.

Alternative sources of power generation for the region

The comparative plans for the electrical sub–sector of the region were analyzed for the period 2013 to 2030 considering:

Plan 1 – No CESUL project
Plan 2 – Existing Hydro system plus new Mphanda Nkuwa and Cahora Bassa North hydro.
Plan 3 – Plan 2 plus coal thermal projects added for export to South Africa.

Total cost effectiveness was measured in terms of the net present value of total system capital and operating costs for each plan. Environmental and Social aspects were integrated into the costs analysis.

Without CESUL project (Plan 1), only 10% of the Mozambique population will have grid-based electricity services and electricity supply will not meet demand for 2030. This implies that public health and other public services will not have a chance to improve in the future.

SRESA confirmed previous studies which concluded that the best CESUL option is the development of the Mphanda Nkuwa and Cahora Bassa North hydroelectric projects with the addition of coal-fired plants at Moatize and Benga and high voltage transmission to transmit the power domestically and internationally.

It was shown that development of Plan 3 with the proposed hydro and thermal plants would reduce power supply costs by 4 % over Plan 2 for the region.

Modeling the Zambezi River Basin Hydrology

The hydrology model of the Zambezi river basin showed that there are two distinct hydrologic systems which are currently operated independently: The Upstream Kariba/Kafue system and the Downstream Cahora Bassa system (South bank) and its associated reservoir. The proposed Mphanda Nkuwa and Cahora Bassa North bank hydroelectric developments will be added to the Downstream system.

Flood management for the Lower Zambezi basin consists of two conflicting objectives:

- Flood control to lower risk to the communities downstream: this is compatible with hydroelectric power generation. Coordinated operation of the two systems enhances flow regulation and flood control.
- Flood restoration to minimize seasonal flooding and benefit the environment and agriculture sector.

Cumulative impacts and mitigation

An analysis of the cumulative impacts of Plan 3 project was performed based on data provided by the individual EIAs for each project considered in the SRESA. The conclusion of the analysis is that impacts to the natural environment from the preferred CESUL system can be mitigated to acceptable levels through technology and appropriate corridor selection.

Impacts resulting from resettlement and relocation are expected to be offset by a properly executed Resettlement Action Plan, plus the indirect benefits of economic development and increase to community well-being that are expected to result from electrification of rural and peri-urban areas resulting from the 400 kV transmission line and EADP projects.

Although coal plants may increase the level of emissions, the Hydroelectric projects are expected to contribute an overall reduction in the carbon footprint. To ensure this, it is necessary to conduct on-going monitoring of air quality impacts at each thermal plant through the life of each project.

The cumulative effects to the natural, social and economic environment are expected to be net positive once a Zambezi River Watershed Management Plan is in place, supported by all riparian countries within the Basin.

Community Engagement

Two phases of Public consultations were performed during the SRESA, to ensure that the assessment considered priority issues, concerns and perceptions of affected communities and interested parties:

- Participants focused on a particular project ESIA rather than the SRESA as it is a new concept for participants.
- Participants were in agreement with CESUL project once explanation and clarification on various aspects of the study was provided.

An Institutional Capacity Assessment and Capacity Building Programme was carried out to identify all the key public sector institutions that will be involved in implementing, assessing and monitoring the environmental and social aspects and plans discussed in the SEA.

Project benefits

Economy: The new developments would generate electricity in excess of that required for domestic use resulting in an increase in export GDP. Agriculture will benefit from the coordinated operation of hydropower facilities providing more reliable irrigation and a reduction in drought conditions. This will in tur, stimulate employment growth.

International relations: Coordinated operation of hydropower and irrigation facilities will require regional agreements and trans-boundary cooperation in the Zambezi River Basin.

Environmental and social: Development of CESUL will provide an opportunity for regulation, control and restoration of historic Zambezi River flows, through coordinated operation of the existing and new hydropower facilities, resulting in benefits to subsistence agriculture in the lower basin and restoration of riverine and delta habitats.

The socioeconomic analysis outlines benefits such as job creation that is both a direct and indirect result of improved irrigation and the development of power projects, however policies must be created to ensure equitable sharing of benefits with vulnerable groups, and proper processes must be followed for resettlement if needed. The SRESA highlights that while the “no development” scenario will not negatively affect the environment or communities, it presents no opportunity for development and improvement in quality of life.

SRESF for Sustainable Land Use Planning

A Strategic Regional Environmental and Social Framework (SRESF) was prepared to help development planners design investment strategies, programs and projects that are environmentally sustainable for the region as a whole including environmental considerations in policies, plans, and programs at the earliest stages of decision-making.

A Sustainable Development Action plan (SRDAP)

The Spatial Development Initiative (SDI) programme in Mozambique, seeks to identify the sustainable economic potential of a geographic area "Growth pole" or zone "Development Corridor". SDIs tend to have an "anchor" project (or group of anchors) which provide the project revenue for the infrastructure. "Growth poles" were identified within the CESUL study area taking into account the following criteria: Geopolitical aspects, Environmental aspects and Socio-economic environment.

Steps to elaborate a Sustainable Development Action Plan (SRDAP) include:

1. Conduct a Situation Analysis currently affecting the SDI's. Mapping of key environmental and social issues.
2. Conduct a stakeholders analysis
3. Select Environmental and Social priorities
4. Conduct an Institutional capacity, political, economic and risk assessment
5. Address institutional weaknesses, capacity gaps and economic constraints
6. Institutional coordination (policies, plans, etc.)
7. Institutional arrangements (key staff, required skills and equipment).

The Preliminary Situation Analysis for Tete province includes:

- the Growth pole in Tete city,
- the Beira agricultural Growth corridor,
- the Zambezi River area and
- the Nacala corridor,

Figure 1, shows the Preliminary Situation Analysis for the CESUL RoW and Southern Mozambique.

- the Potential Growth Poles of Maputo,
- Chimoio in Manica province and
- Beira in Sofala province,
- the Maputo corridor,
- the Beira corridor and
- the proposed Limpopo corridor

Conclusions and recommendations

Because the South African system is large, the economic differences between the plans for power generation were relatively small, however the proposed plan including hydro and coal-thermal plants and the HVDC and HVAC systems would reduce power supply costs for the region while maximizing the potential for power export.

To maximize financing potential of the entire CESUL system, the private financed coal-fired thermal generation power plants may be the first projects to be developed, followed by the supporting transmission infrastructure. However, the railroad to Beira port and/or to Nacala port would have to be upgraded. Upgrades would also be necessary at the Beira and/or Nacala ports in order to transport the coal for export. Using the Zambezi River for barging the coal to the coast is possible but not desirable when comparing this option to the lower impacts of upgrading the existing Beira railroad.

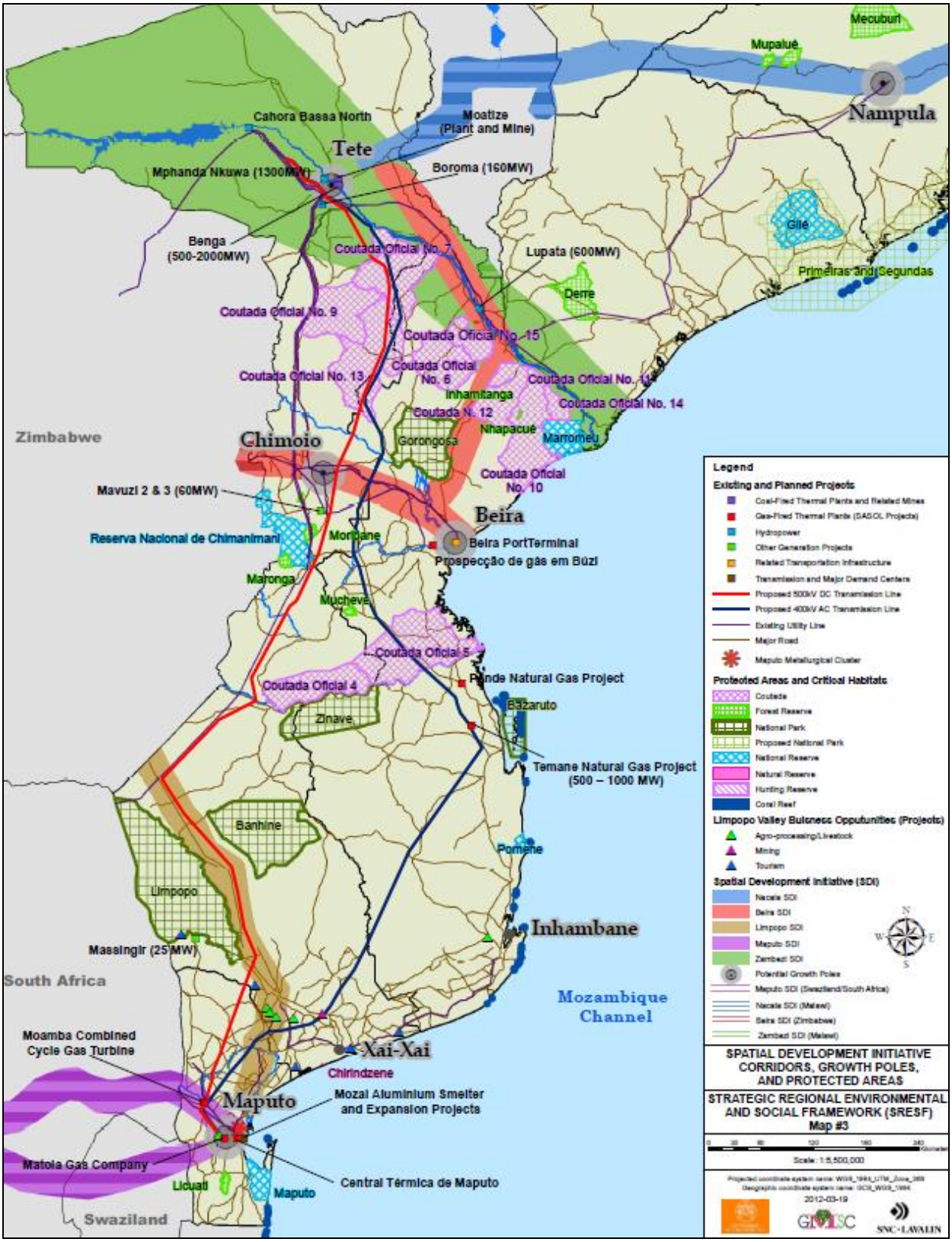
Hydropower projects will develop depending on the availability of financing and the availability of transmission lines. The CESUL transmission project will be developed if the hydroelectric and/or thermal power projects are developed to sufficient capacity.

SRESA implementation: Since SRESA is a tool to help the decision making process, it would be most effective to include it at the early stage of planning, and continue updating the SRESA according to the evolution of the projects under consideration. The SRESA should be a process along with strategic planning.

How to implement the SRESA for project planning:

- Identification of projects for implementation
- Need completed EIA of the projects.
- Stakeholders participation (two or more Public Consultations)
- Regional planning (existing and proposed)
- Consideration of Projects Financing (sources, availability, timing)
- Establish Projects priorities (needs, financing).
- Capacity building and Institutional Strengthening to help project implementation.

Figure 1 - Preliminary Situation Analysis for CESUL right of way and Southern Mozambique



REFERENCES

1. Strategic Regional Environmental and Social Assessment (SRESA) - Mozambique Regional Transmission Development Project (CESUL), SNC-Lavalin International, GMSC, December 2012.
2. Strategic Regional Environmental and Social Framework (SRESF) - Mozambique Regional Transmission Development Project (CESUL), SNC-Lavalin International, GMSC, December 2012.
3. Mozambique Regional Transmission Backbone project, Environmental and Social Impact Assessment, Mott MacDonald, SCDS, May 2011.
4. Hidroelectrica de Mphanda Nkuwa – Tete – Mozambique, Estudo de Impacto Ambiental – COBA, Impacto, ERM, Julho, 2011.
5. Projecto Hidroelectrico de Boroma, no rio Zambeze, Provincia de Tete- Relatorio do Estuo de Pre-viabilidade Ambiental e Definição de Ámbito (EDPA), November 2011. Impacto.
6. Riversdale Zambezi River Coal Barging project – Specialist study on the potential effects on estuary and marine ecology. ERM, Lwandle Technologies (PTY) Ltd. 25/05/2011.
7. Energy Development and Access Project, EDAP, Environmental and Social Management Framework, Ministerio da Energia, April 2009.
8. Energy Development and Access Project, EDAP, Resettlement policy Framework, Ministerio da Energia, October 2009.
9. Beira Rail Concession Project, Environmental Audit and Management Plan, Impacto, Maputo, 2004.
10. Projecto da Mina de Carvão do Zambeze – Riversdale, Relatorio de EPDA, Impacto, ERM, Julho 2011.
11. Projecto Hidroelectrico de Lupata no Rio Zambeze, Estudo de Pre-viabilidade Ambiental e Definicao de Ambito, Impacto, ATP Engenharia e Consultoria, Lda, Mozambique, Novembro, 2011.
12. Technical & Economic Feasibility Study for Mozambique Regional Transmission Backbone Project (CESUL), Norconsult, Vattenfall, presentation, November 25, 2011.
13. The Zambezi River Basin: A Multi-Sector Investment Opportunities Analysis, Summary Report Vol.1; The World Bank, Water Resources Management; Africa Region; June 2010.
14. Investing Across Borders, 2010. Investment Climate Advisory Services and World Bank Group. 2010.
15. Republic of Mozambique: Poverty Reduction Strategy Paper. IMF Country Report No. 11/132. International Monetary Fund. June 2011.
16. The Millennium Development Goals (MDG) of Mozambique.
17. Prospects for growth poles in Mozambique, World Bank, August, 2010
18. Vision, Objectives and Values, Southern African Power Pool,
19. Abstract, Spatial Development Planning Technical Assistance Project for Mozambique, World Bank Group, 2010.
20. Pobreza e o Ambiente, MICOA, Direcção Nacional de Planificação, Maputo, 2006.
21. Handbook for Preparing a Resettlement Action Plan, International Finance Corporation, 2002.
22. Prospects for Growth Poles in Mozambique, The World Bank, August 2010.
23. Republic of Mozambique: Poverty Reduction Strategy Paper – Economic and Social Plan for 2005, International Monetary Fund, Washington D.C., August, 2005
24. Preliminary Global Terms of Reference for the Umbrella and Individual SDI Strategic Environmental and Social Assessments for the Spatial Development Planning Technical Assistance project, The World Bank, August 2010, paper No. E2532.
25. National Adaptation Program of Action (NAPA), Ministry for the Coordination of Environmental Affaires, MICOA, Maputo, December 2007.
26. Energy Development and Access Project, Environmental and Social Management Framework, Ministry of Energy Mozambique, 30 April, 2009.