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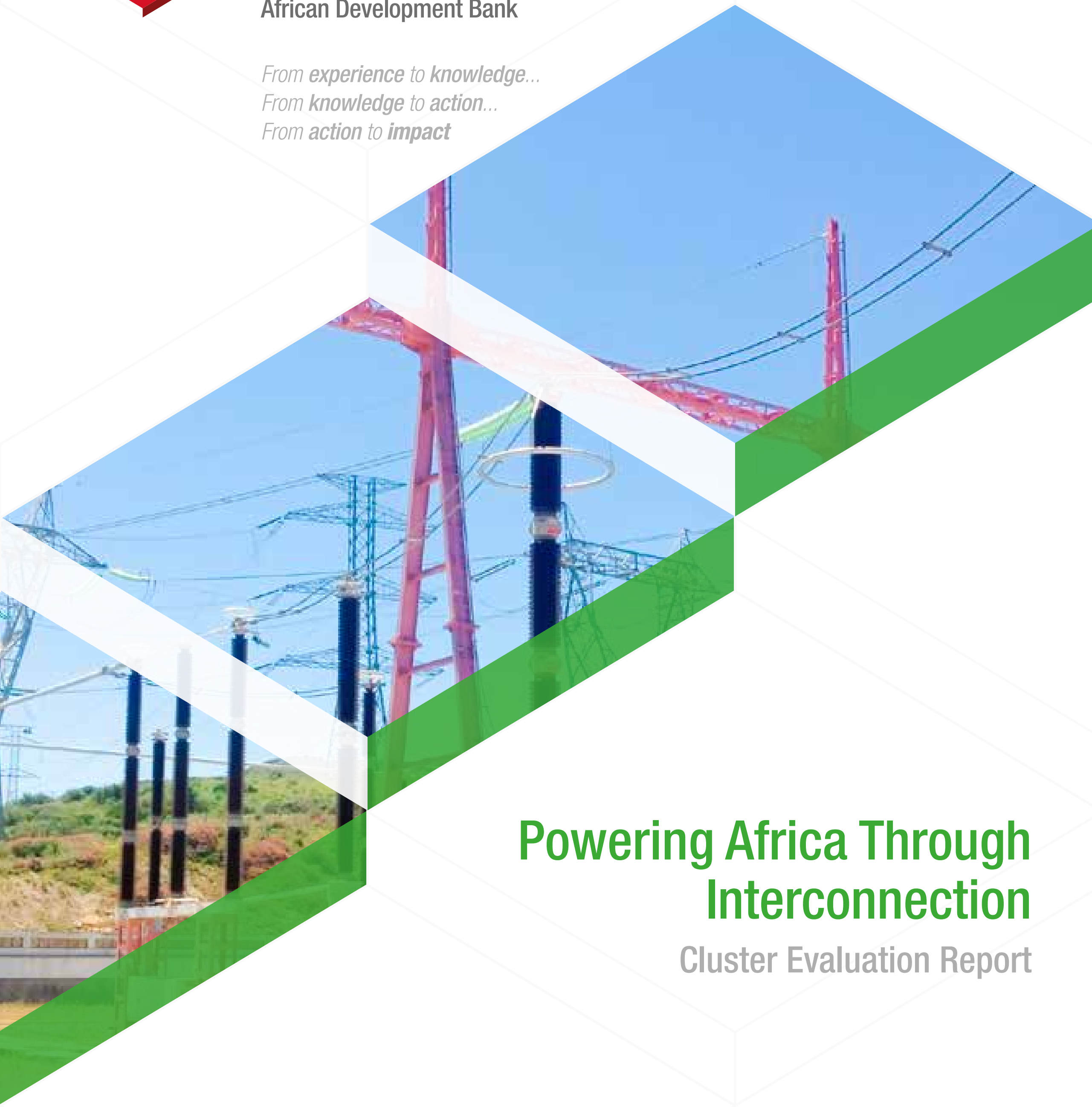

# Powering Africa Through Interconnection

## Cluster Evaluation Report

AFRICAN DEVELOPMENT BANK GROUP

March 2018

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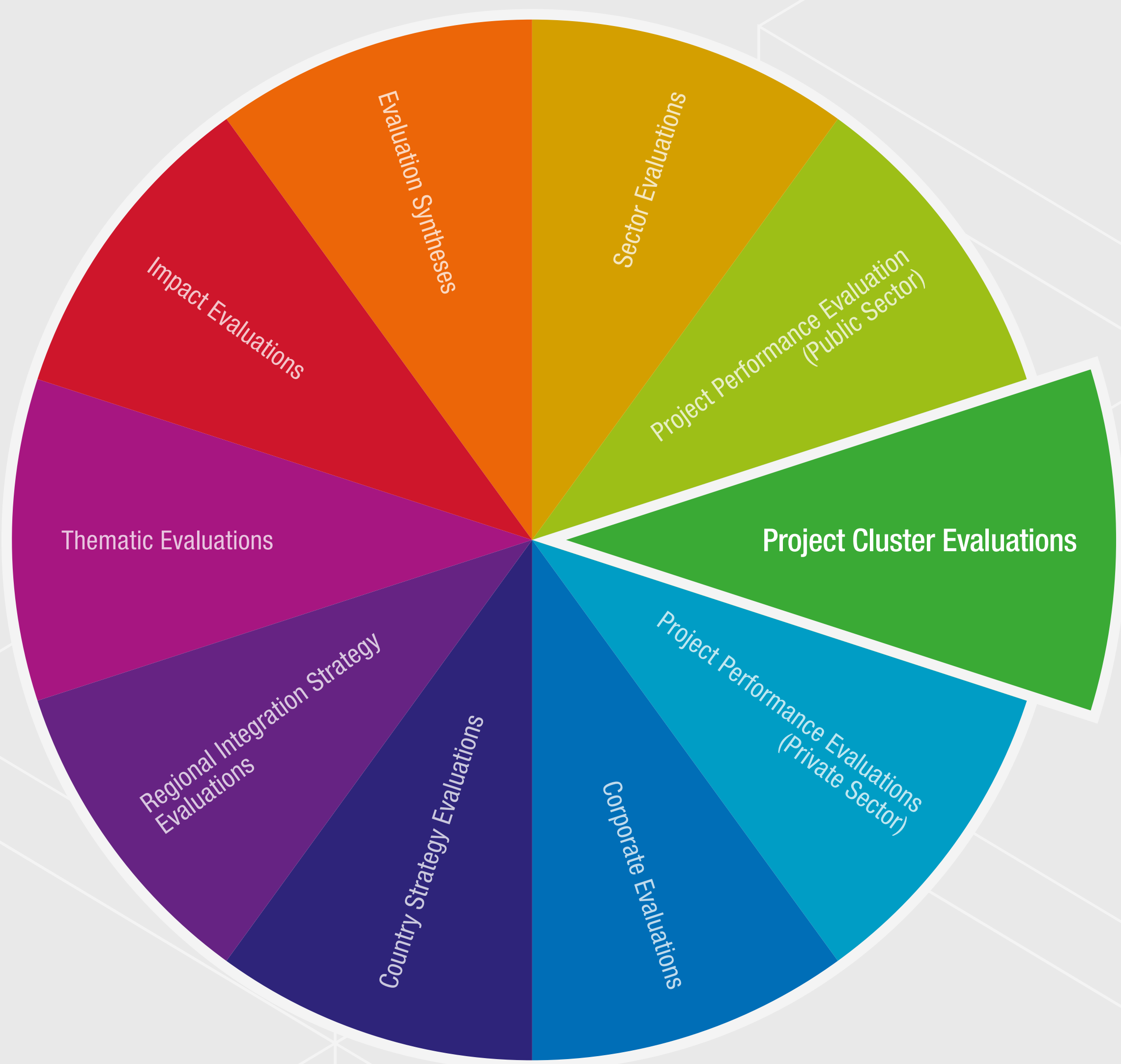

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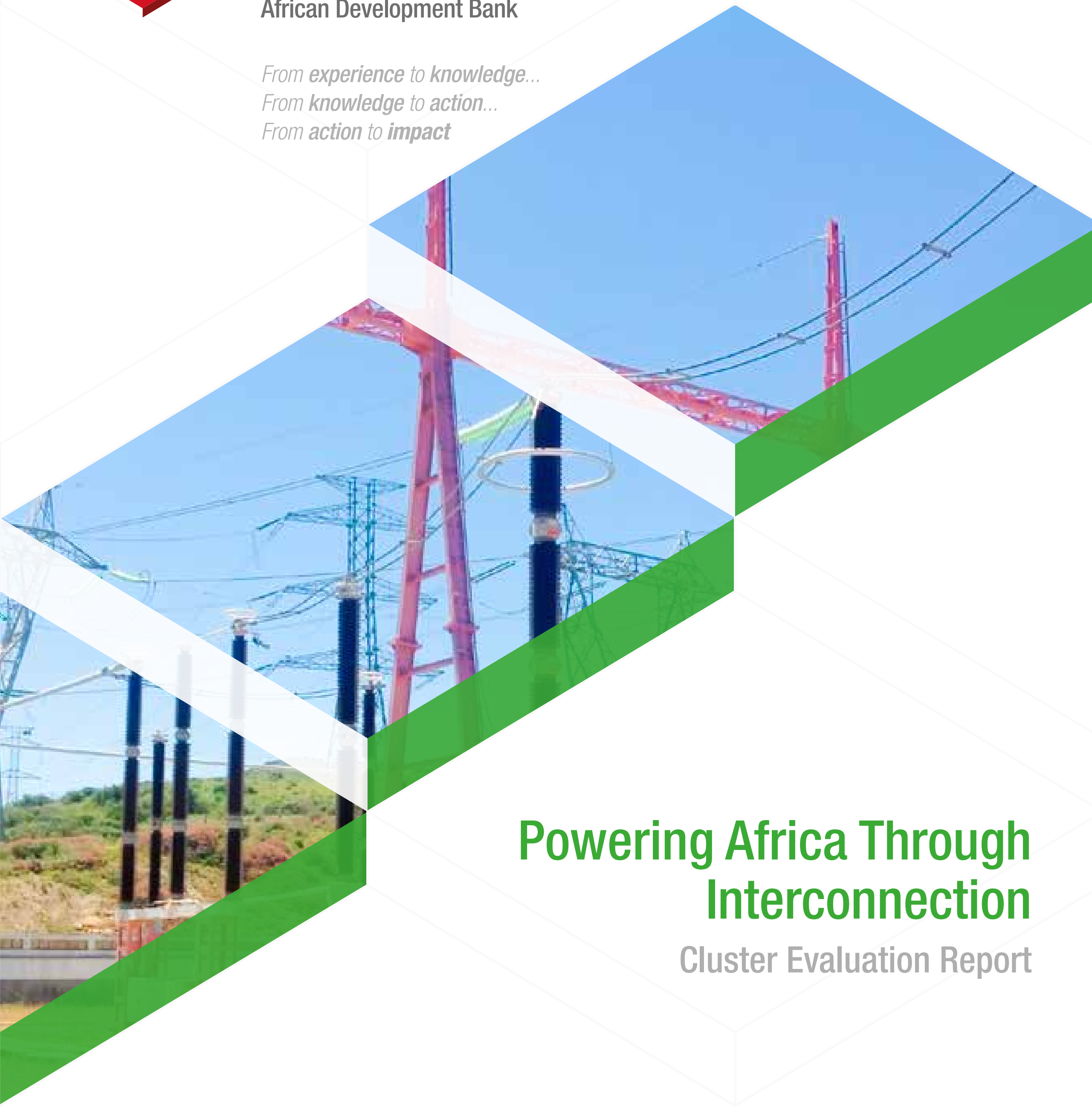

# Powering Africa Through Interconnection

## Cluster Evaluation Report

AFRICAN DEVELOPMENT BANK GROUP

March 2018

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**Powering Africa Through Interconnection: Cluster Evaluation Report**
IDEV Project Cluster Evaluation, March 2018




### About the AfDB

The overarching objective of the African Development Bank Group is to spur sustainable economic development and social progress in its regional member countries (RMCs), thus contributing to poverty reduction. The Bank Group achieves this objective by mobilizing and allocating resources for investment in RMCs and providing policy advice and technical assistance to support development efforts.

### About Independent Development Evaluation (IDEV)

The mission of Independent Development Evaluation at the AfDB is to enhance the development effectiveness of the institution in its regional member countries through independent and instrumental evaluations and partnerships for sharing knowledge.


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Design & layout: CRÉON – www.creondesign.net

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# Abbreviations and Acronyms

| | |
|---|---|
| ADF | African Development Fund |
| AfDB | African Development Bank |
| APVD | Approved (Recently) |
| CEB | Communauté Electrique du Bénin |
| COMP | Completed |
| EEPCo | Ethiopian Electric Power Corporation |
| EIRR | Economic Internal Rate of Return |
| FCFA | Franc de la Communauté/ Coopération financière en Afrique (African Financial Community Franc) |
| FIRR | Financial Internal Rate of Return |
| GWh | GigaWatt-hour |
| HVDC | High Voltage Direct Current |
| IDEV | Independent Development Evaluation |
| IPP | Independent Power Producer |
| Km | Kilomètre |
| Kv | Kilovolt |
| KWh | KiloWatt-hour |
| MVA | Mega-Volt Ampere |
| MW | MegaWatt |
| N/A | Not Applicable |
| NEPA | National Electric Power Authority |
| OMVS | Organisation pour la Mise en Valeur du fleuve Sénégal (The Organization for the Development of the Senegal River ) |
| ONEE | Office National de l'Électricité et de l'Eau Potable (National Electricity and Drinking Water Office) |
| PAD | Project Appraisal Document |
| PCR | Project Completion Report |
| PHCN | Power Holding Company of Nigeria |
| PPA | Power Purchase Agreement |
| PPER | Project Performance Evaluation Report |
| PPSA | Power Purchase and Supply Agreement |
| PRA | Project Results Assessment |
| SARI/Energy | South Asia Regional Initiative for Energy |
| TCN | Transmission Company of Nigeria |
| VRA | Volta River Authority |
| WAPP | West Africa Power Pool |
| ZESCO | Zambia Electricity Supply Corporation |

Photo: © AfDB

# Executive Summary

## Introduction and Evaluation purpose/scope

This report synthesizes the key findings of the evaluations of Power Interconnection (PI) projects, approved and implemented by the African Development Bank Group (AfDB or "the Bank") during 1999–2013.

The purpose of this cluster evaluation is: (i) to assess the relevance, effectiveness, efficiency, and sustainability of PI projects; and (ii) to identify key lessons on what worked and what did not work.

This evaluation can inform the design and implementation of future power interconnection interventions under the umbrella of the Bank's New Deal on Energy of Africa together with Regional Integration Policy and Strategy (RIPoS) for 2014–2023.

The AfDB approved 30 PI projects (representing 48 operations and amounting to UA 822 million in net loans and grants) in 1999–2013. These operations comprise 13 investments projects (UA 786 million) and 17 studies (UA 36 million). Six out of the 13 investment projects were purposively selected for this cluster evaluation.

With a total net approval amount of UA 196 million, the selected projects link the following countries: (1) Zambia and Namibia; (2) Morocco, Algeria and Spain; (3) Mali, Mauritania and Senegal; (4) Nigeria, Togo and Benin; (5) Ethiopia and Djibouti; and (6) Ghana, Togo and Benin.

## Project Cluster Performance

### Development outcomes

*Overall performance*

All six projects in the cluster (project cluster) were rated satisfactory on development outcomes. The project cluster was relevant, effective, and efficient with likely sustainable results. However, the project cluster was limited by substantial implementation delays, and inadequate risk assessment.

*Relevant project cluster objectives and design, but weak in some risks assessment*

The objectives of the project cluster are aligned with the developmental needs and priorities of the thirteen project countries involved. Importing countries faced growing demand for electricity but did not have sufficient generation capacity to respond. Thus, power interconnection projects served to fill this gap and accelerate the regional integration process.

The project cluster's objectives are aligned with the Bank's priorities and strategies. They also align with other donors' sectoral agenda including regional economic cooperation and integration, private sector development and environmental protection.

The project cluster designs have clear objectives with planned outputs that are relevant for PI. These objectives helped support regional integration process within involved countries.

While risks threatening achievement of sustainable outcomes were generally well identified in the planning stage, they were insufficiently analyzed and assumptions tended to be overly optimistic.

*Achievement of objectives*

The project cluster provided the physical outputs necessary for increasing availability of electric power to countries, either through power generation or through regional power exchange.

All completed projects achieved their outcomes in a satisfactory manner. The project cluster led to increased:

- Access to electricity-based services, due to the increased availability of electric power to countries. Cheaper imported electricity expands access for importing countries.

- Trading in electrical power on a cross border basis (except for the Morocco-Algeria, where the amount of energy carried by the interconnection is restricted).

  Yet, in two cases, the potential power exchange capacity reached their limits shortly after project completion. For instance, four years into the operation, Ethiopia and Djibouti have initiated action to construct a second line between the two countries. In the same vein, additional 700 MW of power interconnection with Spain is under development for Morocco project.

- Electric distribution through the expansion of sub-stations that received power from main transmission lines and delivered to consumers.

However, the project cluster failed to: (i) increase reliability, quality and affordability of electricity; and (ii) lower electricity tariffs and costs.

- Reliability and affordability proved to be a major challenge in project countries. Apart from Morocco and Namibia, reliability goals set for the majority of importing utilities remained unattainable.

  The achievement of this goal is dependent on several factors, including: (i) the reliability of both exporting and importing countries' national grids; (ii) sound operational and technical experience to execute and operate the state-of-the-art 400 kilovolt (kV) high voltage direct current (HVDC) used in PI projects; and (iii) the reliability of other generating facilities in the country.

- The goal of lowering electricity tariffs for the average consumer as a result of cheaper power imports over the interconnectors has yet to be achieved. This is attributed to: (i) the increasing demand for electricity services, that is widely covered by more expensive sources of thermal power from fossil fuels; (ii) the inefficiencies in utilities' domestic operations that are passed on to consumers; and (iii) lack of complementary national policies and programs (Morocco, Manantali Countries and Zambia) to lower electricity tariffs.

*Satisfactory project efficiency*

Although viable economically and financially (except for Morocco), the projects suffered from substantial implementation delays.

All six projects were characterized by substantial implementation delays leading to inefficiency and cost overruns. The key factors accounting for the project implementation delays include: (i) delays in loan effectiveness; (changes to project design; (iii) delays in counterpart funding; (iv) delays in procurement; and (v) inadequate management skills of project staff.

*Likely sustainability of PI project benefits*

The projects are rated sustainable on the following grounds: technical, economic, financial, environmental and social, and institutional. The Morocco/Algeria case was not sustainable on political ground.

The key exogenous factors influencing outcomes include: hydrology and demand risks.

### Project M&E performance

*Limited monitoring and evaluation (M&E) system.*

M&E systems were incorporated in project designs, but were not effectively operationalized and used. None of the six Project Completion Reports (PCR) was prepared on time. The PCR formats used did not provide comparable rating on effectiveness and development results.

## Key Issues & Lessons Learnt

### Timeframes

**Lesson #1:** Projects need to be designed and implemented with realistic timeframes, if they are to efficiently deliver their results.

- The project designs did not establish realistic timeframes based on solid analysis and assessment of potential risks.
- All the completed projects experienced completion delays, largely as a result of delays in loan effectiveness. This led to changes in the project environment and cost escalations.
- In the specific case of Ghana-Benin-Togo where Togo was under sanctions, lack of coordinated planning created a situation where portions of the assets were completed and remain idle.

### Mechanisms for upward adjustments

**Lesson #2:** An inbuilt tariff adjustment mechanism in Power Purchasing Agreements is an incentive for power export.

- The financial viability of Zambia/Namibia project is particularly sensitive to changes in the Power Purchase and Supply Agreements (PPSA) details (energy and tariff) as well as the bulk purchase tariff. In Zambia, the bulk purchase cost to Zesco is likely to triple or quadruple in the near future. This is due to: (i) the generation shortfall in Zambia; and (ii) the higher cost of generation from new capacity under development. This increase will erode some of the benefits of the project and hence the financial return unless recently agreed PPAs take into account expected increases in cost and build-in a mechanism for automatic tariff adjustments going forward.

  In the case of Ethiopia Djibouti project, a bilateral PPA was signed. However, in the long term power trade between the countries will be based on a competitive power market in the East African Power Pool (EAPP).

### Domestic end-user tariffs

**Lesson #3:** For power import to reduce meaningfully end-user tariffs in the importing countries, it must be of significant quantities relative to the available electricity.

In all importing countries, reducing domestic end-users tariffs has been a challenge. Prices for electricity supply services continue to be high in all participating countries.

- In Morocco, the government sought to lower electricity prices to be at par with its regional neighbors resulting in a decline in tariffs for all consumers. But from 2006, the tariffs started rising again until when they were stabilized in 2009. Thus, the goal of securing affordable power for the country was largely achieved. But increases in local generation costs as well as imports are likely to render such low tariffs unsustainable.
- As in the Moroccan case, all three OMVS member countries are increasingly resorting to thermal electricity generated from fossil fuels to meet increasing demand, a situation which has continued to put an upward pressure on end-user tariffs notwithstanding the use of the relatively cheap hydro power from the Manantali Power station.

  In Djibouti, despite the fall in power imports power cost, and average end-user tariffs, the latter remained high (36.05 US cents/kWh for MV customers and 28.08 US cents/kWh for LV customers). Of concern is the apparent absence of any mechanism for ensuring that the Borrower passes on the benefit of the project to consumers in the form of lower tariffs.

### Political commitment

**Lesson #4:** For multinational projects to achieve long-term results, they require sustained political commitment from the participating State-parties.

The viability and sustainability of regional cooperation require very strong political commitments of all the countries involved.

- The project cluster was successfully implemented largely due to the political commitment of the governments involved and the close cooperation between the utilities.
- Partner countries ought to find ways of resolving their differences to achieve the full benefits of projects investments and better cooperation (more specifically for Ethiopia and Djibouti).

  In contrast, for political reasons, despite the interconnection capacity to import over 10,000 GWh annually from Algeria, Moroccan power imports from Algeria have been limited to less than five percent of line capacity.

### Regional institutional frameworks

**Lesson #5:** Successful implementation of multinational operations needs effective and binding regional institutional frameworks.

An adherence by all parties to agreements underlying multinational operations is a major prerequisite for successful project operations. To ensure power interconnection project success and sustainability, participating governments and institutions need to commit to respecting such agreements. Therefore, a set of common development priorities is necessary for forging shared interests and sustainable project outcomes in countries participating in multinational operations.

- The successful conception, implementation and operation of the Manantali project has been attributed partly to a sound regional collaboration framework, well-grounded by international conventions and a clear distribution of costs and benefits among the participating countries.
- There is a need to build-in enforcement mechanisms in agreements underlying power interconnection operations in order to ensure that all stakeholders play by the rules. This task may be delegated to regional institutions, which can be empowered in future multinational power operations to play the role of an independent regional regulator and to enforce rules by applying sanctions. However, the actual situation shows that strong regional institutions are often lacking.

### Complementary government energy policies and programs

**Lesson #6:** Sustainable PI project benefits require proper alignment of complementary governments' policies and programs in the energy sector.

In two of the six projects (Morocco, and Ethiopia-Djibouti), the national governments and the public utilities, adopted complementary policies and programs. These policies and programs guarantee the equitable distribution and sustainability of project benefits with the timing of such programs aligned with the timing of project benefits delivery. This in turn, enhanced the likelihood of sustaining the project benefits.

In contrast, the rest of the four projects, lack of complementary policies and programs limits the sustainability the PI project's outcomes.

### Risk assessment

**Lesson #7:** PI projects need rigorous assessment of risk during the design phase, if they are to deliver sustained results.

The design of all PI projects requires thorough identification and analysis of risks. A lack of this analysis threatens the sustainability of project outcomes. All projects experienced shortcomings in assessing one or more of the six main risks identified within the group.

- Some of the critical exogenous factors such as hydrology and demand risks, gas supply risk and climate change conditions are well-known but under-estimated or not properly mitigated.

- The design was also silent on the inefficiencies and associated risks, due to the lack of proper and coordinated planning for multi-donor – funded projects. This can result in non-delivery of project assets, thus leading to no power transmission and no revenue generation – the case in Ghana, where assets have been idle since December 2014. ■


Photo: © AfDB

# Introduction

This report synthesizes the results of a cluster evaluation of six Power Interconnection (PI) projects. This cluster evaluation assesses the performance of the six African Development Bank (AfDB)-funded PI projects in order to draw pertinent lessons for policy and practice for designing and implementing PI projects. The performance assessment was based on the Development Assistance Committee of the Economic. Cooperation and Development OECD/DAC criteria of relevance, effectiveness, efficiency, and sustainability.

## AfDB-Funded Power Interconnection Projects

The energy sector has always been a high priority for the AfDB. It was identified as a priority in the: (i) 2007 High-Level Panel report on "Investing in Africa's Future"; (ii) AfDB's Ten-Year Strategy; and (iii) most recent AfDB five key priority areas (High 5s), which capture energy as "light up and power Africa".

Part of the AfDB's energy focus is on PI, which seeks to bridge the missing energy trade links and strengthen regional cooperation. The PI projects stimulate trade and economic growth, enhance energy security across the region, and promote regional integration. Regional power generation and interconnection projects are, therefore, earmarked to play a significant role in the AfDB's strategy to improve access to reliable and affordable energy for the economies and citizens of Africa. Consequently, the Bank Group encourages its regional member countries to share energy resource endowments, including natural gas and untapped hydropower potential, by connecting national gas and power grids, and developing sub-regional power pools (AfDB, 2007). In addition, the development of cross-border energy trading is one of the New Partnership for Africa's Development's (NEPAD) key goals with respect to the energy sector.

The AfDB approved 201 energy operations, amounting to UA 7 billion (in net loans and grants), over the period 1999–2013 (See Figure 1). This total amount represents 14% of the total net loans and grants approvals by the AfDB over the same period.

Forty-eight (48) of the 201 AfDB-funded energy operations in 1999-2013 were for PI. These operations, representing total net loans and grants of UA 822 million, comprise 13 investments projects (UA 786 million) and 17 studies (UA 36 million), and spread over the AfDB's six operational regions on the African continent; Central, East, West, North, South, and Multinational (Annex 2, Table 1). Five out of the 13 PI investment projects were completed while the rest (8) were at varying stages of implementation.

The five completed projects, together with one project nearing completion, are the basis of this cluster evaluation. These six PI projects were approved during 1999–2008, and completed (except one) in 2003–2016. With a total net approval amount of UA 196 million, these PI projects link the following group of countries: (1) Zambia and Namibia; (2) Morocco, Algeria and Spain; (3) Mali, Mauritania and Senegal; (4) Nigeria, Togo and Benin; (5) Ethiopia and Djibouti; and (6) Ghana, Togo and Benin. The six PI projects aim to improve access to and use of reliable, quality and sustainable electricity-based services for customers (populations and entities) in order to foster greater socio-economic development.

## Evaluation Purpose And Scope

This project cluster evaluation was conducted in order to: (i) provide AfDB Board and Senior Management with credible and actionable evidence on the extent of the development results and implementation performance of AfDB-funded PI projects; and (ii) provide AfDB operational management and staff, and other stakeholders with relevant lessons to inform the Bank's strategy, project design and implementation for PI.

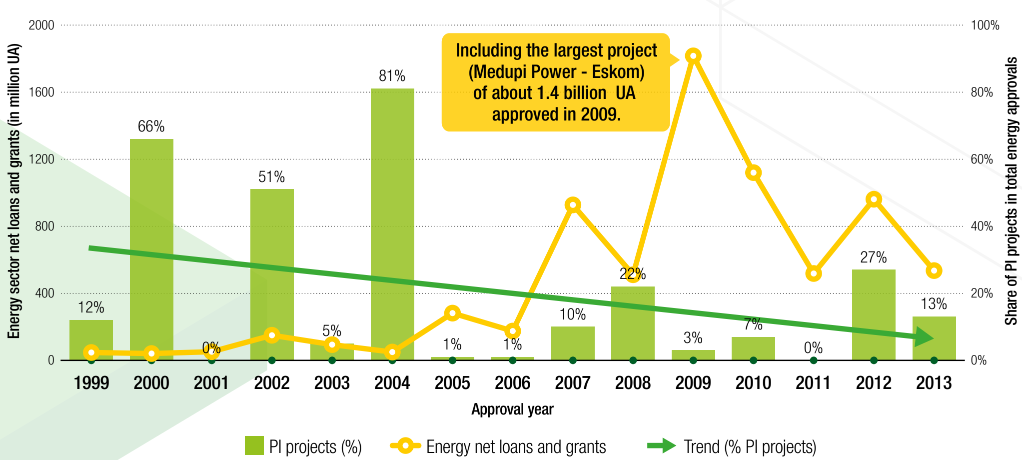
The evaluation covers a cluster of six of the 13 AfDB-funded PI investment projects adjoining 13 African countries (Algeria, Benin, Ethiopia, Djibouti, Ghana, Mali, Mauritania, Morocco, Namibia, Nigeria, Togo, Senegal and Zambia). The projects were approved in 1999–2008, and completed in 2003–2016, with one exception, which was near completion at the time of the review (see Annex 2, Table 2). The evaluation focuses on project relevance, effectiveness, efficiency, and sustainability. The key synthesis questions focused on the extent of the project results, and the factors, which facilitated or limited their achievement.

## Evaluation Approach, Methods And Limitations

The project-level evaluation used a theory-based approach. As the projects' theories of change were not explicit at appraisal and implementation, the evaluation team reconstructed a PI Project Logic Model (Annex 1). This provided the basis for assessing results both at individual project level, and at project cluster level.

The evaluation used a common data collection protocol to collect both quantitative and qualitative data on the performance of each of the six projects. The data was generated from multiple sources and collection methods including: (i) desk review of relevant AfDB

**Figure 1:** AfDB's increased focus on energy (since 2007), with decreasing trend in the share of PI projects



documents and literature; (ii) interviews with key stakeholders (both inside and outside the Bank); and (iii) field visits of purposively selected project sites. Each category of data was analyzed using mainly descriptive statistics. Comparative analysis was also done at indicator levels using baselines, targets and actual results. Evidence was triangulated from some of the data sources and methods.

The PI cluster evaluation is limited mainly by:

- The purposive nature of the sample of six projects. This limitation was mitigated, however, by the reasonable sample size (46% and 24% in terms of number and net amount, respectively) of the total AfDB project investment in PI in 1999–2013.

- The shortcomings associated with the field visits and stakeholder interviews especially in terms of insufficient coverage (of project sites and beneficiaries). The triangulation of evidence from other sources reduced the extent of the impact of these limitations.


Photo: © AfDB

# Project Cluster Performance

## Development Outcomes

**Overall performance:** The development outcomes of all the six projects were rated satisfactory (Annex 3, Table 4). As shown in Figure 2, the performance of the project cluster is satisfactory in terms of relevance, effectiveness, efficiency, and sustainability notwithstanding the substantial implementation delays.

### Relevance

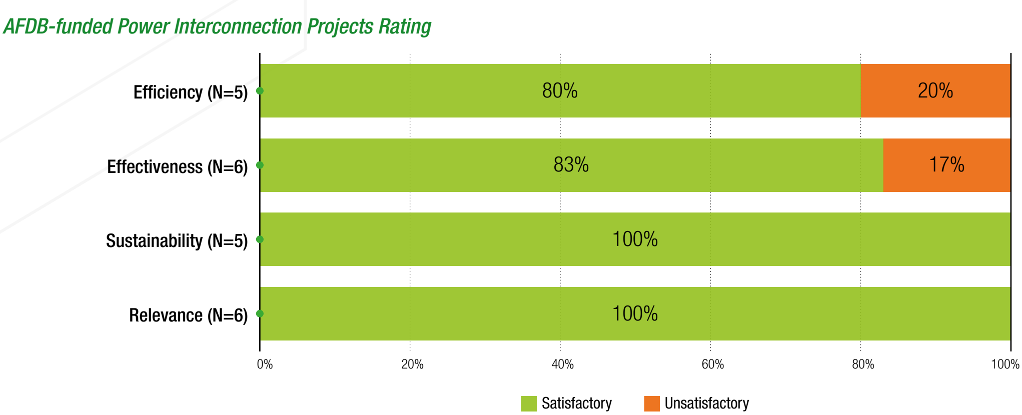
*Relevant project cluster objectives and design, but weak in risks assessment.*

**The objectives of the six PI projects (the project cluster) are aligned with the developmental needs and priorities of the thirteen project countries involved (Algeria, Benin, Ethiopia, Djibouti, Ghana, Mali, Mauritania, Morocco, Namibia, Nigeria, Togo, Senegal and Zambia).** The project countries seek different solutions to respond to their specific needs as stated in their project objectives. Mali, Mauritania and Senegal seek to generate and share hydropower. In the case of Morocco and Algeria, the focus was in strengthening the existing PI in order to increase the import of electricity from Spain. Benin and Togo aim at developing new interconnections in order to import power from Nigeria.

The electricity importing countries not only faced growing electricity demand but also inadequate generation capacity. From their appraisal reports, all the six evaluated projects focused on securing adequate, reliable and affordable electricity.

Specifically, Benin, Togo, and Ghana were facing significant challenges **in power supply during periods of drought.** For instance, in the case of the proposed Adjarala hydropower project (147 MW), where production will be shared between Togo and Benin, power supply will depend on annual rainfall and will be subject to seasonal variation. Another key issue faced by the project countries concerned power **transmission losses** (Togo, Benin, and Morocco).

**Figure 2:** Performance rating of PI project cluster




Source: IDEV's Project Results Assessment (PRA)

**Box 1:** Impact of hydrology in Ghana power generation

- In Ghana the current inadequate generation of electric power to meet domestic and export demand is largely due to low water levels in the country's three main hydro dams that account for nearly 50 percent of its electricity generation.
- By connecting Ghana's electricity grid to that of Nigeria through the project outputs, Ghana envisaged tapping into a potentially larger pool of relatively cheaper gas-fired electricity from Nigeria to augment its own generation and provide security of supplies, particularly during periods of drought.
- In contrast, since Ghana was a traditional source of power imports in addition to wheeling power from Côte d'Ivoire over its network to Togo/Benin, an increase in the transmission capacity of the interconnection between Ghana and these two countries was especially desirable during periods of favourable rainfall when Ghana is able to generate sufficient hydro power for its own use and for export.

Source: Ghana/Togo/Benin Interconnection PRAs

The Ghana-Togo-Benin Interconnection project, for instance, addressed the high transmission losses that result from the transfer of power over a long distance from Ghana and Côte d'Ivoire to Togo/Benin on the 161 kV transmission lines.

Other project countries experienced **environmental impacts and rising costs due to the utilization of oil-fired thermal plants** for power generation (Benin, Togo, Morocco, Djibouti, Mali, Mauritania and Senegal). The related interconnections between countries address these challenges by tapping into cheaper and cleaner sources of energy with limited greenhouse emissions.[1]

Finally, the **electricity demand has grown** in Ghana (10-12 percent), Togo (11 percent), Morocco (6.9 percent), Ethiopia (25 percent), and Zambia (7.5 percent as at 2007). Therefore, investments in generation are necessary. The lower cost of imported electric power (from Nigeria, Europe, Zambia) translated into more affordable and cleaner electricity for consumers (in Benin, Togo, Morocco and Namibia) compared to locally generated electricity from oil-fired thermal power plants. For exporting countries, the selected projects were relevant to their goals of deriving maximum value from the country's abundant oil and gas resources (Nigeria) as well as water resources (Ghana, Ethiopia and Zambia).[2]

**The project cluster's objectives are also aligned with the Bank's priorities and strategies and other donors' sectoral agenda including regional economic cooperation and integration, private sector development and environmental protection.** The project cluster's objectives are consistent with the Bank's vision of encouraging regional economic cooperation and integration (all projects), private sector development (Ghana, Togo, Benin, Morocco), and environmental protection (Nigeria, Ghana, Togo, Benin). The Bank's strategy papers highlight its vision to promote regional integration in West and East Africa including regional infrastructure development. In addition, the projects are aligned with the cluster country strategy papers which focus on enhancing the investment environment (Ghana), improving access to social services (Benin), providing support to infrastructure projects that lead to greater liberalization and improved competitiveness of the economy (Morocco), and producing energy and integrating markets (Senegal, Mauritania and Mali).

The projects are also in line with the socio-economic development strategies of ECOWAS, West Africa Power Pool (WAPP) and Southern African Power Pool (SAPP). A Regional Strategy Paper prepared in June 2006 by ECOWAS and the "*Union Économique et Monétaire Ouest Africaine* (UEMOA)" identified the development/interconnection of infrastructure, including projects in the WAPP program, to support regional economic integration and competitiveness gains as one of four axes for combating poverty in West Africa. New development in South African Power Pool is contributing to the relevance of the Zambia project in line with the SADC regional integrations agenda .[3]

**The project cluster designs have clear objectives with planned outputs that are relevant for PI. These objectives served the need of expediting the regional integration process among the participating countries.** The projects have clear objectives, as defined in the PAD's logical framework (Annex 2, Table 6). Each evaluated project constitutes a segment included in one the African Power Pools including the WAPP and the East African Power Pool (EAPP) (See Box 2).

**However, the project designs are weak in risks assessment. Although the risks threatening sustainable outcomes were reasonably well identified during project design, they were insufficiently analyzed**. They suffered from optimistic assumptions. Six main risks were identified by the appraisal teams: (i) utilities' ability to operate and maintain the project assets effectively; (ii) capacity of the exporting countries to generate enough electricity to meet national demand as well as contractual obligations to international customers; (iii) low tariffs regimes; (iv) political tensions between the trading countries; (v) limits on power purchasing agreements; and (vi) development of distribution networks. Three out of the six risks were to some extent common within the project cluster while the others were identified in one specific project (Annex 2, Table 3).

The first common risk is related to the **utility's ability to operate and maintain the project assets effectively** (five projects out of six). Indeed, the preservation of the system and ensuring sustainable results require significant efforts in servicing and maintenance of structures and facilities. In this regard, the project in Morocco is seen as a success story, while the other cases such as NEPA-CEB project and that of Zambia were unsuccessful[4].

**Box 2:** Power interconnection – An effective tool for regional integration

- The NEPA – CEB Power Interconnection Project connects the electricity grids of Nigeria to that of Togo and Benin, which is already connected with Ghana (on a 161 kV link), Cote D'Ivoire (on a 225 kV link), and Burkina Faso (on a 161 kV link). It therefore constitutes an important component in WAPP's vision of interconnecting the regional grids. The NEPA-CEB project also provides a platform for Nigeria to integrate into the regional Power Pool by linking the electricity grid of Nigeria to the already connected grids of Togo, Benin, Ghana, Cote d'Ivoire and Burkina Faso, thereby improving reliability of supply and optimizing production costs within the sub region.
- The Morocco project serves to enhance the cooperation in the energy sector between the Mediterranean countries of North Africa and Europe by reinforcing power interconnections between them. It complements, 225 kV interconnectors between Tunisia and Algeria (Since 1980), as well as between Tunisia and Libya (completed in 2001) and promotes power trade between these countries.
- The Ethiopia-Djibouti power interconnection was designed to serve as a springboard for the establishment of a regional power market in which Ethiopia's hydropower will play a significant role. Ethiopia's Power Sector Development Plan (2001–2006), aimed to develop other power interconnections with Kenya, Somalia and Eritrea as a means towards setting up an integrated Regional Energy Market. These interconnectors were to promote power trade between the countries initially based on bilateral contracts (PPA), but in the long term on a competitive power market in the East African Power Pool (EAPP). The existing 220 kV/200 MW Victoria Falls-Katima Mulilo interconnector has become a vital segment of the SAPPs ZiZaBoNa project which will support the regional linkages required to circumvent the current regional power flows via South Africa. Since 2012, ZESA has supplied 100 MW continuously to NamPower over the Victoria Falls-Katima Mulilo line. This is part of the ZiZaBoNa.

Source: Selected Power interconnection PRAs

The second common risk concerns **the capacity of the exporting country to generate enough electricity to meet its own national demand as well as its contractual obligations to its international customers** (three projects out of six). For the Ethiopia/Djibouti project, the Ethiopian Electric Power Corporation (EEPCo) drew up an elaborated generation expansion program that sought to optimize the generation mix and guarantee a firm capacity that was well above the country's peak demand. However, in the case of NEPA-CEB PI project this risk was not sufficiently mitigated (see Box 3).

The third common risk is the **low tariffs regime** (three projects out of six). In the case of the NEPA-CEB interconnection project, for instance, it was noted during the appraisal phase that, long term project outcomes could be affected if the tariffs were not reviewed. As a discussion with Power Holding Company of Nigeria (PHCN) indicated there was a flaw in the tariff structure used at the project appraisal stage. This miscalculated tariff was also the basis of the loan agreement. PHCN realized they were losing revenues and a review was necessary to adjust this discrepancy. In addition, the financial risk associated with Zambia Electricity Supply Corporation (ZESCO)'s weak financial position resulting from its historically low tariff regime, was the only risk identified at appraisal. All this threatened sustainability.

The fourth risk is related to **political tensions between the trading countries** and concerns mainly seen in the Morocco project, especially with political risk associated with Algerian imports. The project appraisal document (PAD) indicates that "it will be necessary for a spirit of cooperation to prevail between Morocco and Algeria on the one hand, and between Morocco and Spain on the other, despite some political tension in Morocco's relations with Algeria and Spain". Despite the identification of the risk, there was no analysis or mitigation measures suggested/taken.

The fifth risk concerned the **limits on Power Purchasing Agreements** within the Ethiopia-Djibouti project. It was mentioned in the PAD that "In view of the ongoing and planned acceleration of electrification in Ethiopia and the forecast doubling of generation requirements by 2010, the sustained availability of power supplies from Ethiopia to meet Djibouti's energy import demand may constitute a risk to the project". Again, there was no analysis or mitigation measures.

**Box 3:** Export Country Capacity Risk – The case of Nigeria

- Total installed capacity in the Nigerian power system in July 2002 was 6312 MW including some 317 MW procured from two IPP owned thermal generators but a mere 3200 MW of the total was available to meet a peak demand of 3083 MW. Moreover, demand was growing at a rate of 24.3 percent annually. Despite the bleak outlook the appraisal team placed store on the then ongoing rehabilitation of NEPA's power stations to resolve the countries' generation capacity constraints and increase electricity output significantly.
- As at March 2010, when the Bank's Project Completion Report (PCR) mission was launched, Nigeria's capacity to increase electricity generation and hence continue to provide cheap power for domestic consumption and for exports to CEB and Niger was seriously under threat due to severe power shortages. These were impacting negatively on socio-economic activities in the country. Although the sector reforms have been running for close to ten years significant challenges remain to be surmounted. By March 2015, when this evaluation mission visited Nigeria, the results of the reforms could be described at best as mixed, albeit they were progressing at a steady pace.
- Additionally, the ongoing sector reforms to introduce private participation into the sector were expected to harness the country's abundant gas reserves to boost power generation. It was also believed that the other members of the WAPP would have increased generation capacity hence enabling Nigeria to import cheap and cleaner hydro power. This has however not been the case so far and it is not envisaged any time soon. Thus Nigeria will be obliged to meet its contractual agreement irrespective of its inability to meet its own local demand.

Source: NEPA-CEB PI PRA

The final risk is the **deployment of distribution networks** (Manantali Energy Project). This risk was not taken into account during appraisal. Indeed, the evaluation funds that the stagnation in irrigated agriculture and limitations in rural electrification efforts in member countries have been attributed to the lack of adequate infrastructure in the member countries and their utilities, denying an equitable distribution of project benefits to the most vulnerable in the society.

### Effectiveness

***Substantial achievement of project objectives.*** *To a large extent, the five completed projects delivered their expected outcomes, notably supplying cheaper hydro-electric or gas-fired power to the national power utilities; improving importing countries' balance of payments through reduced dependence on imported petroleum products for electricity production; increased access to electricity for consumers in both urban and rural areas; and finally the creation and foundation for a sub-regional energy market that will promote broader regional integration goals. However, the following outcomes did not materialize: (i) increasing the reliability, quality and affordability of electrical-based power; and (ii) lowering electricity tariffs and costs.*

**The projects provided the main physical outputs necessary for increasing availability of power to countries either through power generation or through regional power exchange.** In all of the completed projects, the expected outputs were delivered, albeit in some cases (Morocco and Zambia), with minor modifications during the implementation period. Outputs delivered by the selected projects were principally related to the successful construction or expansion of hydro power stations; high voltage sub-stations to receive and deliver power for distribution; transmission lines with different levels of voltage and current (including the unique underwater link between Africa and Europe); and national dispatching centres (Annex 2, Table 4).

The ongoing Ghana/Togo/Benin project is an outlier where the construction of the Ghana segment (Volta-Tornu) has been completed, while that for Togo financed by another partner experienced substantial delays. During the evaluation time, Ghana was waiting for the CEB to complete the Davie substation in Lomé as well as the line segment from the Ghana-Togo border to the new Davie substation in Togo. The line assets in Ghana remain idle, and transmit no power and thus generate no revenues.

This situation is putting a strain on the borrower in meeting their loan servicing obligation. Furthermore, the transmission line in Ghana is subject to the risk of vandalism since it is not energized, posing a serious security risk to project assets.

**The five completed projects achieved their main outcomes in a satisfactory manner.** They led to inter-alia increased:

- **Access to electricity-based services**. By providing the relatively cheap electricity either through power generation[5] or through regional power exchange[6], the projects led to improved access of communities to electricity-based services (Box 4). For instance, Morocco achieved 100% and 98.6% of urban and rural community access respectively to electricity.

- **Cross-border electrical power trading.** The completed PI projects have significantly increased the cross-border electrical power exchange between the participating countries. In two of the projects (Ethiopia/ Djibouti and Morocco projects), potential exchange capacities reached their limits soon after the project completion. The increase in power exchange was partly because it was cheaper for some countries to use imported electricity than domestically generated electricity.

**Box 4:** Power interconnection – A tool of choice for improving access to electricity-based services

In Benin, the number of all consumer categories has increased significantly. Industrial customers have increased by 51 percent from 548 in 2007 to 826 in 2013 while commercial customers have increased by 67 percent from 69151 in 2007 to 115657 in 2013. Total consumption in Benin has increased from 580 GWh in 2007 when the line was commissioned to 865 GWh at the close of 2013, representing an overall increase of nearly 50 percent within seven years of operating the line. Almost all this consumption was imported by CEB and supplied to SBEE. 99.95 percent of Benin's local consumption in 2013 was imported power with only 0.41 percent of demand coming from local production. Similarly, the electricity access rate in Togo was just 15 percent with annual consumption of 509 GWh in 2001. Imported energy received from CEB has increased 108 percent from 525 GWh in 2007 to 1095 GWh thanks to cheap imports from Nigeria over the project interconnection. This high level of imports have replaced self-generation by Compagnie d'Energie Électrique du Togo (CEET). Nevertheless continued growth in demand necessitated the procurement of power from Contour Global, a new IPP that has been operating in Togo since 2010. With this limited domestic generation capacity, about 85 percent of Togo's power is imported, mostly from Nigeria and Ghana.

The main outcomes expected from the Ethiopian project was an increase in Electricity Access rate from 13 percent in 2003 to 20 percent by 2012. Electricity access rate in Ethiopia was 55 percent as at June 2015 thanks to the electrification of over 5000 towns and villages including the four border towns targeted under the project as part of the Government's UEAP. On the other hand, Djibouti was expected to increase its electricity access rate from 49.5 percent in 2003 to 60 percent in 2015. As at June 2015, electricity access in Djibouti was 58 percent. Furthermore, despite the marginal reduction in total losses in the last two years, losses in general and particularly losses of about 22.65 percent in 2011, when the line was first commissioned, are considered very high.

The increasing transfer capacities have enabled a rapid growth in net imports of power that has further spurred the growth in demand for electricity in these countries (Annex 2, Table 4). In all cases, exporting countries were able to meet their contractual obligations. They also increased their revenues. So far, Generation and Transmission utilities in Nigeria are estimated to have generated some US$ 456.73 million from power exports to CEB since the line became operational in 2007. In 2014 alone, NEPA's invoices to CEB for power sales topped US$ 102.00 million.

- **Electric distribution.** The project cluster increased electric distribution through the expansion of sub-stations that receive power from main transmission lines and delivered to consumers.

- **Efficiency in power supply** due to a reduction in transmission loss rate; expanded regional power trade; and reduced cost of power from the access to low-cost electricity import.

However, the PI projects sometimes failed to: (i) increase reliability, quality and affordability of electrical-based power; (ii) lower electricity tariffs and costs. More specifically:

- **The anticipated improvement in reliability and quality in electricity supply, hinging on imports of power, did not always materialize.** Power system reliability improved with adequate power imports across the interconnectors in Morocco and Namibia. However, this was not the case for the other importing countries, where electricity imports were unreliable. The success factors include:

  - The availability of relatively cheap power through imports, and the reliability of both exporting and importing countries' national grids.

    Morocco's project concentrated not only on the interconnection link, but also included transmission reinforcement components such as new HV and MV lines and new transformer stations[9]. However, the expected reliability gains were not achieved in Togo and Benin, mainly because the complimentary investments required for improving the local networks, and the reliability of other supply sources failed to materialize. The CEB system also failed in achieving reliability from of the interconnection to the Nigerian grid. This was due to the instability of the Nigerian network and challenges associated with synchronization of the two grids[10].

Other WAPP member countries' expectation that cheaper hydro sources of power could be generated and delivered over the interconnector to the CEB and Nigeria have failed to materialize. Nor is it envisaged that these objectives will be delivered soon.

- The managerial and technical capacities of exporting utilities to operate and maintain their national networks. NEPA-CEB and Morocco for instance demonstrated sound operational and technical experience to execute and operate a project of high voltage.
- The reliability of other generating facilities located in-country.

**Failure to lower electricity tariffs.** The goal of lowering electricity tariffs for the average consumer as a result of cheaper power imports over the interconnectors was not achieved in any of the evaluated projects. This was attributed not only to increased demand and the increasing use of thermal capacity to meet demand, but also due to inefficiencies in the utilities' domestic operations.

- Despite the fact that both importing and exporting countries tried to supplement their electricity supply by adding renewable energy from wind and solar, the proportion of renewable energy in the generation mix and their average cost advantages are still limited. The use of renewable energy did not make a significant impact on electricity tariffs.
- The failure to achieve cost reduction for the average consumer is also due to inefficiencies in the utilities' domestic operations that are passed on to consumers. The technical shortcomings, managerial and operational deficiencies increase the cost of utilities. As a result, these undermine the cost advantages provided by interconnectors. Consequently, the net effect is an increase in tariffs or at best a slowdown in tariff growth rate.

  Ineffective implementation of institutional reform components of projects aimed at addressing the above challenges to achieving the tariff reduction benefits. Often the reinforcement of the national grid by way of upgrading HV and MV transmission lines as well as transformer substations are necessary for the efficient distribution of the additional power made available on the interconnectors.
- Complementing interconnection projects with other critical components matters to lower electricity tariffs. Morocco's project provides a good example of complementing interconnector projects with the reinforcement of the national grid. This was not the case for other projects[11].

### Efficiency

***Satisfactory project efficiency.*** *All the six projects were economically viable, while five of six projects were financially viable. However, all projects suffered from substantial implementation delays. The key factors accounting for the project implementation delays including: (i) delays in loan effectiveness; (ii) project design modification; (iii) delays in providing the counterpart funds; (iv) delays in procurement of contractors; and (v) inadequate management skills for project staff.*

**Substantial project implementation delays:** The five completed projects neither adhered to the implementation schedule nor to the original cost plan. They suffered substantial time overruns. None of the six projects adhered to their original closing date or implementation period (See Annex 3 and Table 1). As table 1 shows, the average project implementation period (from start-up to completion) was 77 months (6 year and 5 months), which equates to an average delay of 55 months relative to the planned duration at appraisal. The implementation period range from a minimum of 51 months (4 years and 3 months) for Morocco Project to 126 months (10 years and 6 months) for NEPA-CEB Project This implies that the Bank and borrower factor in unrealistic implementation schedules without completely taking into account the multinational aspects of some of the PI projects. Six out of the 13 instruments used to finance the project cluster experience more than one year of delays from the date it became effective. Project delays were mainly attributable to: i) delays in meeting loan conditions, ii) project design modification, iii) delays in counterpart funding, and iv) problems related to the procurement of contractors. Delays were also caused by inadequate management and enforcement and shortage of project staff with relevant skills and experience.

**Cost overruns.** As the table shows, all five completed projects experienced cost overruns or underruns. Four of the five projects experienced cost overruns ranging from 16% to 69%. One project experienced a cost underrun of 5%.

It is also important to mention that for every UA invested by the African Development Bank in the project cluster, around 3.7 UA were leveraged from various stakeholders (Table 2).

**Viable economic performance:** All the completed project with re-estimated economic internal rate of return (EIRR) have EIRRs in excess of their respective opportunity costs of capital. No post-project EIRR was estimated for the ongoing project because of data limitations. Table 3 summarizes the economic returns from the projects in the cluster at various stages of the project from appraisal right through to the operational phase. Cost-benefit analysis results conducted at appraisal and completion phases differed to some extent from those of the post-evaluation for a variety of reasons, including the level of power exchange (NEPA-CEB, Morocco/Spain/Algeria), price administration (Ethiopia/Djibouti), a change in project scope (Ethiopia/Djibouti, Zambia/Namibia) and the cost of thermal generation (Manantali Energy). For instance, the Ethiopia/Djibouti project's economic internal rate of return (EIRR) was calculated at 62 percent, compared to the appraisal estimate of 25 percent and the PCR estimate of 28 percent. This high EIRR can be attributed to Djibouti's huge consumer surplus resulting from Electricité de Djibouti (EdD)'s failure to reduce domestic tariffs by 60 percent (as was projected at the appraisal stage).

**Table 1:** Project Time Performance

| Project's duration | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Signature to Completion | | | Start-up to Completion | | | Effective to First Disbursement [M] | First Disbursement to Last Disbursement [M] |
| | Planned [M] | Actual [M] | Variation | Planned [M] | Actual [M] | Variation | | |
| Average | 36 | 98 | +62 | 26 | 77 | +51 | 14 | 35 |
| Weighted average by net amount | 37 | 107 | +70 | 32 | 81 | +49 | 10 | 46 |

(*)Start-up Date: Date of awarding of the consulting services for supervision.

**Table 2:** Cost Variation [+/-] and %

| Country | Total Cost | | | | AfDB Amount | |
|---|---|---|---|---|---|---|
| | Planned UA mn | Actual UA mn | Variation UA mn | Variation % | Approved UA mn | % of total cost |
| 1. NEPA-CEB Power Interconnection | 35.02 | 33.40 | -1.62 | -5% | 10.50 | 31 |
| 2. Ghana-Togo-Benin Power Interconnection (*) | 71.5 | 71.5 | - | - | 32.26 | 45 |
| 3. Project for Strengthening Electric Power Grid Interconnections (Morocco/Spain) | 237.50 | 312.78 | 75.28 | 32% | 32.26 | 23 |
| 4. Ethiopia-Djibouti Power Interconnection Project | 42.76 | 72.21 | 29.45 | 69% | 72.85 | 34 |
| 5. Victoria Falls-Katima Mulilo Interconnection Project (Zambia/Namibia) | 11.98 | 15.27 | 3.29 | 27% | 24.82 | 31 |
| 6. Manantali Energy Project | 246.46 | 286.07 | 39.61 | 16% | 25.00 | 9 |
| **Total** | **645.27** | **791.18** | **145.91** | **23%** | **170.18** | |
| **Average** | **107.55** | **131.86** | **24.31** | **23%** | **28.60** | |

(*) ongoing project

**Viable economic performance:** All the completed project with re-estimated economic internal rate of return (EIRR) have EIRRs in excess of their respective opportunity costs of capital. No post-project EIRR was estimated for the ongoing project because of data limitations. Table 3 summarizes the economic returns from the projects in the cluster at various stages of the project from appraisal right through to the operational phase. Cost-benefit analysis results conducted at appraisal and completion phases differed to some extent from those of the post-evaluation for a variety of reasons, including the level of power exchange (NEPA-CEB, Morocco/Spain/Algeria), price administration (Ethiopia/Djibouti), a change in project scope (Ethiopia/Djibouti, Zambia/Namibia) and the cost of thermal generation (Manantali Energy). For instance, the Ethiopia/Djibouti project's economic internal rate of return (EIRR) was calculated at 62 percent, compared to the appraisal estimate of 25 percent and the PCR estimate of 28 percent. This high EIRR can be attributed to Djibouti's huge consumer surplus resulting from Electricité de Djibouti (EdD)'s failure to reduce domestic tariffs by 60 percent (as was projected at the appraisal stage).

**Table 3:** Economic Internal Rate of Return ex-ante and ex-post

| Project | | PAD EIRR (%) | PCR EIRR (%) | PRA EIRR (%) | Variation from PAD | Opportunity Cost of Capital (%) |
|---|---|---|---|---|---|---|
| Zambia (Namibia) | Victoria Falls-Katima Mulilo – 132 KV interconnection project | 15.1 | 25.3 | 28.1 | + | 12 |
| Morocco (Spain) | Electric Network Interconnection (Morocco-Spain) | 44.0 | 28.0 | 20.4 | - | 10 |
| Mali-Mauritania-Senegal | Manantali Energy Project | 16.0 | 15.0 | 17.0 | + | 10 |
| Nigeria-Togo-Benin | NEPA-CEB Power Interconnection Project | 24.9; 39.8 | 23.5; 40.8 | 81.3 | +++ | 12 |
| Ethiopia-Djibouti | Power Interconnection Project (Ethiopia-Djibouti) | 25.0 | 28.0 | 62.0 | ++ | 12 |
| Ghana-Togo-Benin | Ghana -Togo -Benin power interconnection (Ghana-Togo-Benin) | 25.0 | n/a | n/a | n/a | n/a |

**Strong financial performance:** With the exception of Morocco, all completed PI projects' financial performance are rated highly satisfactory. They registered returns higher than weighted average cost of capital, which was typically between 6 to 10 percent. Table 4 shows that the Financial Internal Rate of Return (FIRR) for the Ethiopia-Djibouti project, set at 13 percent, is a little lower than the appraisal estimate of 15.8 percent and the Project Completion Report (PCR) estimate of 11 percent. This reflects about 70 percent increase in investment costs as a result of the project re-design to cater for a double circuit transmission line, and together electricity consumption in the towns along the Ethiopian border[12].

The financial viability of the Moroccan project, however, suffered from the stagnation in local tariffs, increasing purchase price for imports, and the non-realization of anticipated revenues from wheeling charges. ONEE, the Moroccan electricity public utility, was expecting to receive from wheeling charges if the export of Algerian Power to Spain through Morocco had materialized. As a result of Morocco-Algeria political tensions, electric power exports from Algeria to Morocco was limited, but none from Algeria to Spain through Morocco. In sum, the Algeria-Morocco-Spain electric power link was grossly under exploited.

**Failure to establish cost-reflective tariffs can lead to substantial inefficiencies in the overall management of the sector.** This was explicit for the Morocco and Zambia projects:

- In Morocco, the practice of cross-subsidization of electricity has becoming a major problem. The current electricity tariff structure is set by a central governmental department and is designed with the dual objective of keeping the cost of energy low for a large spectrum of consumers (social tariffs), and ensuring financial targets to distributors regardless of their size, region or type of clients. The average tariffs in Morocco have been virtually stagnant at MAD 0.778 per kWh (around 8 USD cent per kWh) since the project was commissioned whilst the import price has been increasing. Failure to move to a cost reflective tariff in Morocco may jeopardize new private investments into the sector, since investors will be concerned about the financial viability of the Single Buyer the Office National de l'Électricité et de l'Eau Potable (ONEE).

- In Zambia, with regard to the project itself, the Bulk Sales Tariff (BST) negotiated between ZESCO and NamPower in the PPSA determines its financial viability and sustainability. The BST was to ensure export tariff was cost-reflective and did not subsidize the Namibian electricity consumer.

None of the project cluster proposed a tariff reform.

**Table 4:** Financial Internal Rate of Return ex-ante and ex-post

| Project | | PAD FIRR (%) | PCR FIRR (%) | PRA FIRR (%) | Variation From PAD |
|---|---|---|---|---|---|
| Zambia (Namibia) | Victoria Falls-Katima Mulilo – 132 KV interconnection project | 12.0 | 24.4 | 27.3 | + |
| Morocco/ Algerian & Spain | Electric Network Interconnection | 31.0 | 18.0 | 0.27 | --- |
| Mali-Mauritania-Senegal | Manantali Energy Project | - | 7.0 | 7.0 | |
| Nigeria-Togo-Benin | NEPA-CEB Power Interconnection Project | 19.9; 20.3 | 16.6; 21.3 | 62.4; 105.9 | +++ |
| Ethiopia-Djibouti | Power Interconnection Project (Ethiopia-Djibouti) | 15.8 | 11.0 | 13.0 | + |
| Ghana-Togo-Benin | Ghana-Togo-Benin power interconnection | 25.0 | n/a | n/a | n/a |

## Sustainability

**Likely sustainability of PI project benefits:** *Sustainability of project benefits is rated satisfactory. The project facilities are technically, economically and financially, environmentally and socially viable; with satisfactory institutional sustainability and strengthening of capacities, as well as satisfactory political and governance environment. However, the resilience to exogenous factors and risk management is rated unsatisfactory.*

**Satisfactory technical soundness.** Technical soundness of the evaluated PI projects is shown by the use of higher transmission voltage (for instance, 400 kV), which is considered technically appropriate because it reduces the magnitude of the transmitted current and thus losses associated with long transmission lines. Opting for higher voltage also allows for power transmission under water (Morocco/Spain) and asynchronous interconnection (for example, in the case of NEPA-CEB). The use of fiber optic technology on the transmission network for system communication and monitoring is deemed state-of-the-art in the energy industry (seen, for example, in the Manantali and Morocco/Spain projects). The only shortcoming that affected the technical sustainability was seen in the Manantali Energy project where operational challenges are associated with the absence of redundancies in the Western and Eastern transmission lines which are both radial in nature. Accordingly, any feeder failure results in a total loss of supply, and the associated consumers would not get any power.

**Viable economic and financial performance.** The selected PI projects are generating enough income for the exporting countries to ensure exports continue. The strong financial returns derived from the relatively cheap electricity received by importing countries compare well with the higher costs associated with alternative solutions, including self-generation[13]. For the NEPA-CEB project, apart from the fact that the project is generating enough income to ensure its continuation after completion, the project concept includes re-investment requirements to NEPA for the rehabilitation of the system every 20 years throughout the project's life. This ensures sustainable operations to produce continued benefits over the long term. In the case of the Ethiopia-Djibouti Interconnection, Djiboutian imports have been consistently above a figure of 300 GWh annually. This accounts for the US$ 85.25 million Ethiopia has generated from power exports to Djibouti in the last four years.

**Minimal adverse environment impacts.** Three of the six projects were categorized in the AfDB environmental and social category 2 (Ethiopia/Djibouti, Morocco and Zambia projects) as their impacts are easily mitigated. The other projects (Manantali, NEPA-CEB and Ghana/Togo/Benin) were rated as "environmental category 1". Regardless of their classification in category 1, the three projects were in compliance with the Bank's environmental policy requirement and also conformed to the concerned countries environmental protections laws. An environmental and social impact assessment was conducted for all the six projects and an Environmental and Social Mitigation Plan prepared and implemented. In the case of Manantali project, with regard to the project socio-environmental component (PASIE), the most remarkable achievement has been the approval of the Water Charter in 2002 that addresses the issue of efficient allocation of water for different purposes. However, the project's socio-environmental component delivered mixed and insufficiently documented results. Poor systematic monitoring and collection of national data by the OMVS make a sound assessment of the objectives achieved impossible. Although quantitative data on green-house gas (GHG) emissions were not available, the evaluation noted positive outcomes for the environment results in a significant reduction in GHC emissions due to the replacement of self-generation diesel-fired power plants by cheaper and greener hydro energy imports. Furthermore, in the case of the NEPA-CEB project, better utilization of Nigerian oil and gas resources, such as for power production, will help reduce the negative environmental impacts of gas flaring in the Nigerian hydrocarbon industry (oil and gas industry).

**Only two (Morocco and Manantali projects) of the six evaluated PI projects included capacity development components that aimed at strengthening government capacities to implement and manage the infrastructure constructed.** The PI projects included in this cluster bring up a high value of 400 kV, a state-of-the-art high voltage direct current (HVDC) for transmission. This requires operational and technical experience/expertise to execute and operate. Lack of such experience and expertise can negatively affect the success of the project and the achievement of targeted outcomes. Two projects (Morocco and Manantali) satisfied this condition. For Morocco, it was mainly because of several years of experience in operating the grid. In the same vain, most Manantali's staff benefited from training programs and technological transfer from Electricity Supply Commission, South Africa (ESKOM) expatriate personnel. This was not the case for the NEPA-CEB project.

**Sustained reforms-led institutional support.** Power sector reforms and power generation commitments in countries exporting electricity provide hope for a sustainable delivery of project outcomes. Institutional development outcomes in the Nigeria Electricity Supply Industry can be largely attributed to the Nigerian Power Sector Reforms over the last ten years. These reforms are rooted in the country's Electric Power Sector Reform Act of 2005, and in the follow up Nigerian Power Sector Reform Roadmap of 2010. These two initiatives laid out two key pillars for reform, namely: (1) the transitioning of Government Ownership/Management of electricity assets to private ownership/management of the Nigerian Electricity Supply Industry and (2) growth in the supply, availability and reliability of electricity in Nigeria. Meanwhile, the Ethiopia-Djibouti project had built-in institutional support components which were largely achieved.

**Good political support toward regional decision making.** All the PI projects were supported by a sound political and governance environment. The only exception was in Morocco project where the political situation between Algeria and Morocco threatened the sustainability of the project. All projects are driven by a regional vision of creating power pools to improve regional energy exchanges and reliability. The projects were well-aligned with regional policies and institutional frameworks and programs. The success of the OMVS Manantali Energy project, for example, is partly attributed to effective regional collaboration based on sound institutional arrangements. This was grounded on well thought out institutional conventions. Furthermore, the creation of regional institutions such as SOGEM and Société d'Exploitation de Manantali (SEM), the operating entity, helped to insulate the project from direct political interference while long-term political commitments were secured at the highest levels of government. This was achieved through various agreements that defined the rights and obligations of various state governments and institutions. None of the project cluster proposed a tariff reform.

**Low resilience to exogenous factors and insufficient risk management for the project cluster** Hydrology and demand risks along with risks to gas supply and climatic conditions are the salient exogenous factors that continue to threaten the sustainability of the interconnection projects. Projects' resilience to risk over time has been assessed to determine their sustainability. Among the key exogenous factors that continue to threaten the sustainability of these projects are:

- **Hydrology and demand risks.** Recurrent droughts, that periodically affect hydropower generation, limit the availability of cheap hydro power for exports in countries like Zambia, Ethiopia, Ghana and Côte d'Ivoire, Mali and the Senegal River Basin[14]. In terms of demand risk for the Zambia project, as average domestic tariffs rose rapidly, the incentive for exporting power diminished. It is important to note that despite these challenges Zesco not only fulfilled its contractual obligations to Nam Power but has signed an additional PPA that will increase Nam Power supply by another 247 GWh a year.

- **Growing demand for power in project cluster countries**. For instance, with an average annual demand growth rate of about 6.9%, the Moroccan government expects peak loads which had exceeded 4000 MW in 2008 after the commissioning of the project, to hit about 9000 MW by the year 2020. With an electricity demand growth rate of about 4.5% per annum in Djibouti, the country's demand is not going to reach a 100 MW any time soon and Ethiopian imports are likely to continue to cover more that 75% of Djiboutian demand. Moreover, the occurrence of peak demands at different periods for the two countries served to ensure Ethiopian Electric Power Corporation (EEPCo)'s capacity to meet EdD's peak demand.

- **Gas supply risks.** Gas supply challenges in countries such as Nigeria, Ghana, Algeria and Spain. This limits gas thermal power generation and hence export capacity. This inevitably impacts the sustainability of these projects[15].

  In addition, the Maghreb-Europe gas pipeline links the Hassi Rmel field in Algeria via Morocco and the Strait of Gibraltar with Spain, where it feeds into the European gas grid. However, the pipeline is reported to have been closed due to a recent escalation of political tension between the two countries; and

- **Climatic Conditions in Europe.** Extreme weather conditions that can impact power demand in Spain and the rest of Europe, which in turn limits Spanish exports to the Maghreb region[16].

## Project Monitoring and Evaluation

**Limited monitoring and evaluation (M&E) system**: M&E systems were incorporated in most project designs (Morocco, Zambia/Namibia, Manantali, Ethiopia/Djibouti project), but they were not effectively operationalized and used. For instance, in the Ethiopia/Djibouti project, the monitoring indicators and monitoring plan were agreed upon between the Bank and Borrowers/ Executing Agencies and clearly indicated in the Appraisal Report (logical framework) but progress was not monitored.

Four out the six projects have PCRs but none were prepared on time (Annex 3, Table 3).

Photo: © AfDB

# Key Issues and Lessons Learnt

## Timeframes Setting

**Lesson #1:** Projects need to be designed and implemented with realistic timeframes, if they are to efficiently deliver their results.

Realistic loan conditions ensure an effective project implementation and avoid delays and cost over-runs. The project cluster design did not set realistic timeframes that are based on solid analysis and assessment of potential risks, for borrowers to fulfill loan conditions so as not to create undue delays that could affect project schedules and cost. Moreover, no conditions were instituted to motivate borrowers to fulfill the loan conditions, particularly those relating to first disbursement so as not to create changes in the project environments that can throw cost estimates out of range. In fact, all the completed projects in the cluster, experienced completion delays, largely as a result of delays in effectiveness. Approving an upgrade of the Zambia Namibia line to a higher voltage and transfer capacity, only for the underlying PPA to be signed four years later, was for instance overly optimistic. Furthermore, both the Zambia – Namibia and the Ethiopia-Djibouti projects, had to be re-designed midway in the project implementation process. This also detracted from the performance of the Bank as well as the borrower. In the specific case of Ghana-Benin-Togo where Togo was under sanction, lack of synchronization of the funding timing, through proper coordinated planning, created a situation where portions of the assets were completed and remain idle.

The Bank has scope for improvement particularly with regards to realistic loan conditions that limit effectiveness time. More thorough due diligence is also required to avoid project re-design mid-stream with all its implications in terms of time and cost overruns.

## Mechanisms For Upward Adjustments

**Lesson #2:** An inbuilt tariff adjustment mechanism in Power Purchasing Agreements is an incentive for power export.

The financial viability of Zambia/Namibia project is particularly sensitive to changes in the Power Purchase and Supply Agreements (PPSA) details (energy and tariff) as well as the bulk purchase tariff. With the generation shortfall, Zambia is currently experiencing higher cost of generation from new capacity under development. The bulk purchase cost to Zesco is likely to triple or quadruple in the near distant future. This will increase the cost and erode some of the benefits of the project and hence the financial return unless recently agreed PPAs take into account expected increases in cost and builds in a mechanism for automatic tariff adjustments going forward.

In the Ethiopia Djibouti project, a bilateral contract (PPA) was signed. However, in the long term power trade between the countries will be based on a competitive power market in the East African Power Pool (EAPP). In this case, tariff will matter. PPA set different tariff in the wet season off-peak (6 US cents/KWh), and during dry season off-peak and wet season peak hours (7 US cents/KWh).

## Domestic End-User Tariffs

**Lesson #3:** An inbuilt tariff adjustment mechanism in Power Purchasing Agreements is an incentive for power export.

**Prices for electricity supply services continue to be high in the involved countries**. All three OMVS member countries are increasingly resorting to thermal electricity generated from fossil fuels to meet increasing demand. This continues to put upward pressure on end-user tariffs despite cheaper hydro power from the Manantali Power station. Given the variable costs of the different generation sources in Senegal (from 56 to 155 F/kWh against 21.7 F/kWh for Manantali and Felou, any reduction in contribution from Manantali and Felou, the only hydro sources of import in Senegal, will imply a heavy dependence of fuel-fired thermal plants at relatively high costs which impacts end-user tariffs negatively.

In Morocco, the increase in unit cost of imported power is attributed to global price spikes of primary energy, which affected production cost in the exporting utilities. Despite this increase, imports are relatively cheaper than local thermal production, even with the increased contribution of imported hard coal in Morocco's thermal generation. Prior to the project, the government sought to lower electricity prices to be at par with its regional neighbors resulting in a decline in tariffs for all consumers; but from 2006, they started rising again until 2009 when they again steadied. Thus, the goal of securing affordable power for the country was largely achieved. But increases in local generation costs as well as imports mean that these low prices are unsustainable.

In Djibouti, average tariffs were expected to drop 60 percent from 22 US cents/kWh in 2004 to around 8.8 US cents by 2011. This sharp fall in power costs to Djibouti, was part of the loan conditions for the Ethiopia-Djibouti project. Average end-user tariffs however increased between 32.0–37.5 US cents/kWh in 2010 prior to the commissioning of the line in 2011mainly due to higher fuel prices. Since 2011, however, when power imports begun, tariffs have generally stabilized, with prices reducing marginally by 3.7 percent to 36.05 US cents/kWh for MV customers and by 13.25 percent to 28.08 US cents/kWh for LV customers.

## Political Commitment

**Lesson #4:** For multinational projects to achieve long-term results, they require sustained political commitment from the participating State-parties.

The viability and sustainability of regional cooperation requires very strong political commitments from all the countries involved. Failure to attain and maintain strong political commitment can result in sub-optimal utilization of capital investments, thus limiting the achievement of the desired socio economic development outcomes.

The project cluster was successfully implemented largely due to the political commitment of the governments involved and the close cooperation between the utilities. Partner countries ought to find ways of resolving their differences to attain the full benefits of projects investments and better cooperation (more specifically for Ethiopia and Djibouti). In contrast, the political tensions between Morocco and Algeria and the Maghreb region's "non-integration" is reported to be causing the region around 2.2 percent of GDP growth, and as much as four–percent in lost growth outside the non-hydrocarbons sector[17]. Although previous political incidents had not impeded the maintenance and pursuit of energy cooperation between Morocco and Algeria, the interconnection capacity to import over 10,000 GWh annually from Algeria remained largely under-exploited by Morocco. Moroccan power imports from Algeria have been limited to less than five percent of the maximum line capacity.

## Regional Institutional Frameworks

**Lesson #5:** Successful implementation of multinational operations needs effective and binding regional institutional frameworks.

An adherence by all parties to agreements underlying multinational operations is a major prerequisite for successful project operations. To ensure power interconnection project success and sustainability, participating governments and institutions need to commit to respecting such agreements. Therefore, a set of common development priorities is necessary for forging shared interests and sustainable project outcomes in countries participating in multinational operations. The successful conception, implementation and operation of the Manantali project has been attributed partly to a sound regional collaboration framework, well-grounded by international conventions and a clear distribution of costs and benefits among the participating countries.

There is a need to build-in enforcement mechanisms in agreements underlying power interconnection operations to ensure that all stakeholders play by the rules. This task may be delegated to regional institutions, which can be empowered in future multinational power operations to play the role of an independent regional regulator and to enforce the rules by applying sanctions. However, the current situation shows that strong regional institutions are often lacking.

## Complementary Government Energy Policies And Programs

**Lesson #6:** Sustainable PI project benefits require proper alignment of complementary governments' policies and programs in the energy sector.

Lack of adoption, by national governments and the utilities involved in a regional energy project, of appropriate and complementary policies and programs, threatened the safeguarding of the sustainability of the outcomes of power interconnection projects (Manantali Energy project, NEPA-CEB project and Zambia-Namibia project). The following cases illustrate this situation:

- The stagnation in irrigated agriculture and limitations in rural electrification efforts in Mali, Senegal (Manantali project) and Western Zambia have all been attributed to the lack of adequate complementary national policies and programs to ensure the development of required infrastructure in the member countries and their utilities. This limits the equitable distribution of project benefits to the most vulnerable in the society.

- The change in project scope and design of the Zambia-Namibia project during Implementation was premised on the probable import of 150MW by NamPower from Zesco. This would be achieved by exploiting the project assets and the planned Caprivi Link intra-connector in Namibia. However, no definite commitments were made by NamPower to synchronize the completion of the Caprivi Link with the commissioning of the project interconnector before the project modifications were approved. As a result, the Caprivi Link was completed four years (2010) after the Interconnector project was commissioned. This resulted in significant underutilization of the line's capacity.

- Some projects (Nigeria, Ghana, Algeria, and Spain) provided generation or transmission infrastructure without adequate primary energy to power them. This resulted in underutilized and unsustainable assets[18].

- Finally, expectations of system reliability gains in Western Zambia, Togo and Benin, Senegal and Mali did not materialize due partly to the fact that the projects were not properly aligned with national transmission and distribution reinforcement programs and partly due to increasing demand in the various utilities[19].

## Risk Assessment

**Lesson #7:** PI projects need rigorous assessment of risk during the design phase, if they are to deliver sustained results.

The power interconnection projects design requires thorough identification and analysis of risks that threaten the sustainability of projects outcomes. Some of the critical exogenous factors such as hydrology and demand risks, gas supply risk and climate change conditions are well-known but under-estimated or not properly mitigated[20].

In contrast, the design was silent with the inefficiencies and risks associated with the lack of proper and coordinated planning for projects funded by different donors. This can result in project assets not being delivered, thus transmitting no power and generating no revenues. The Ghana-Togo-Benin project is a case in point where assets have been idle since December 2014. ■

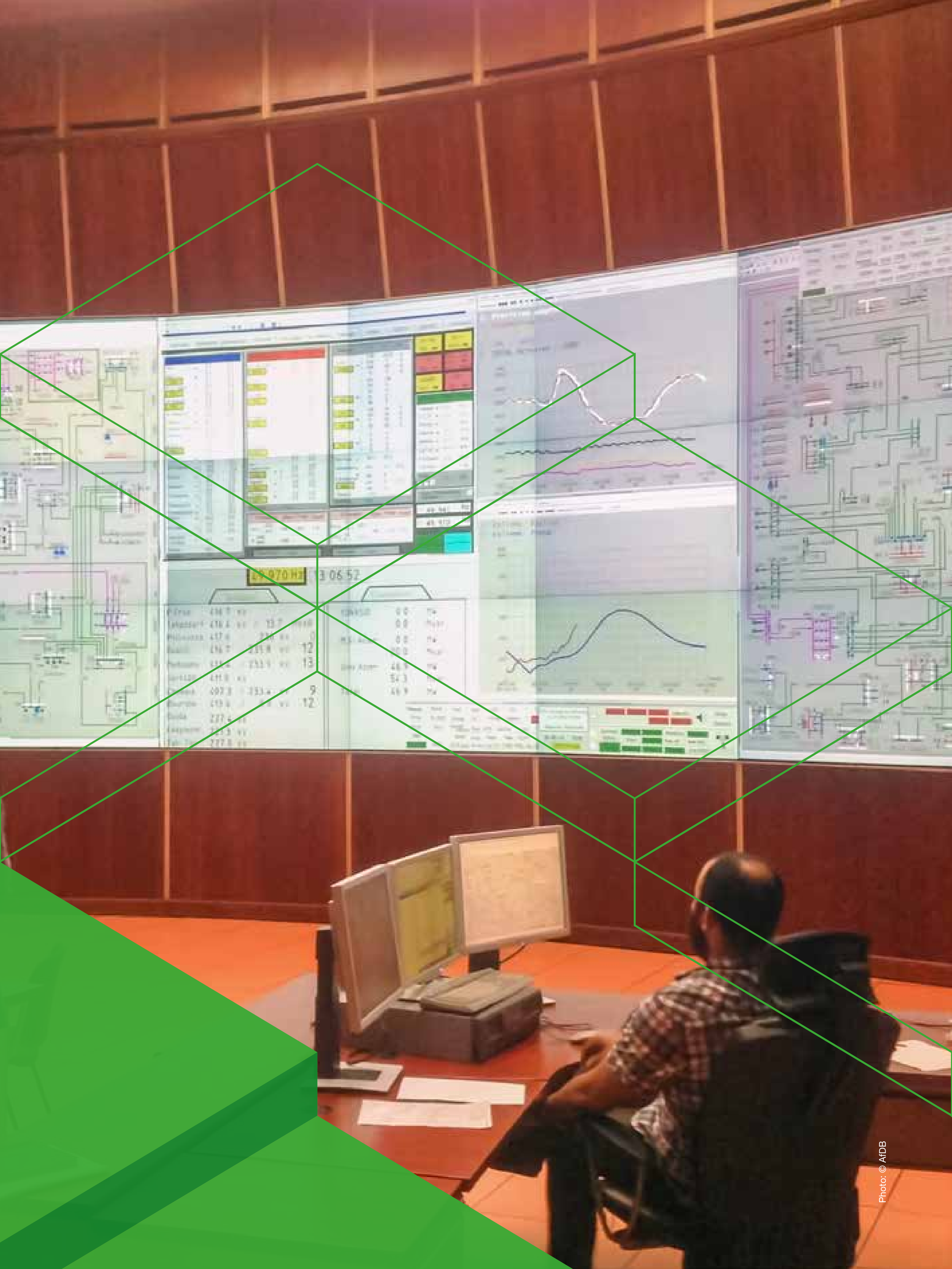
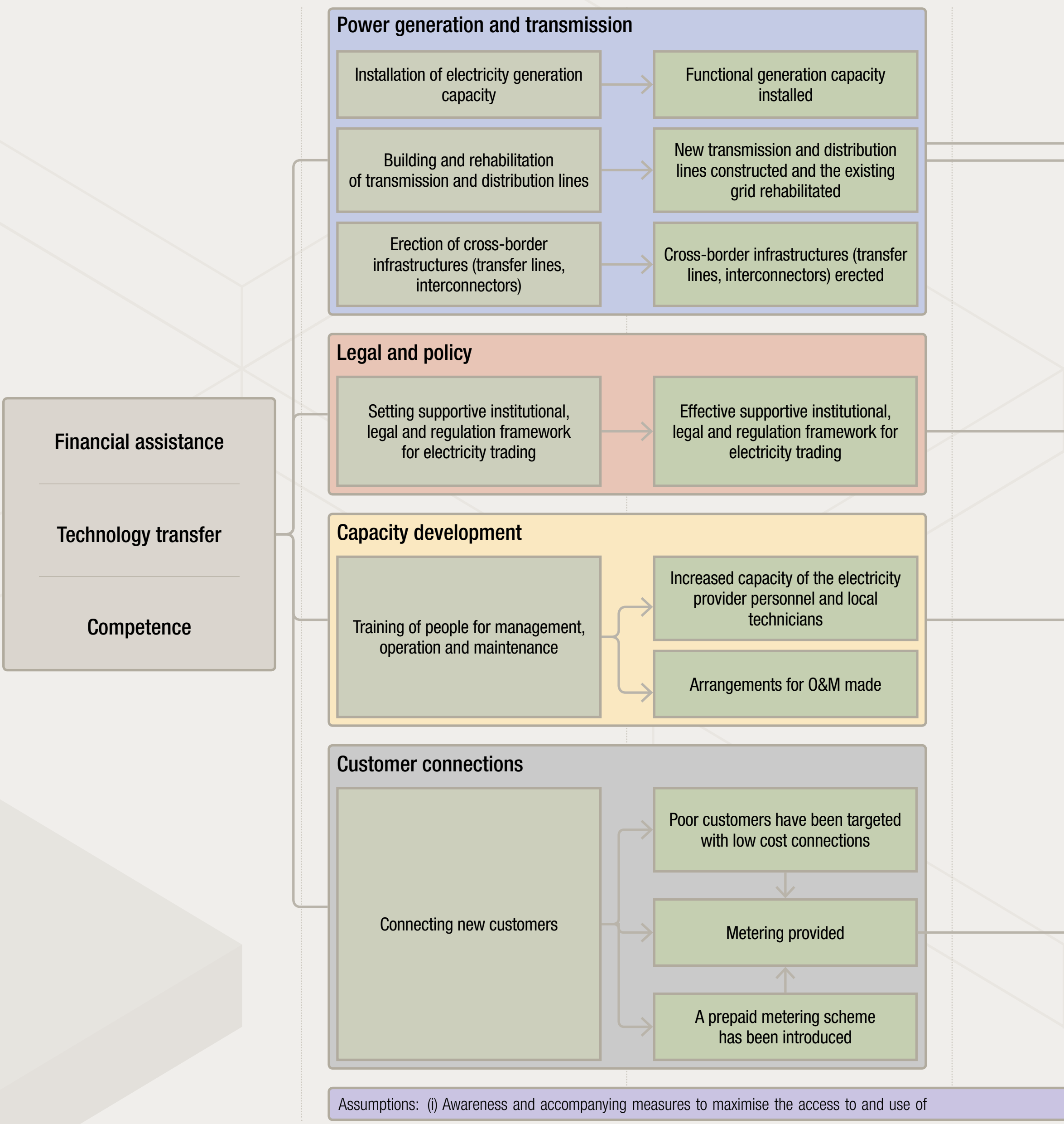
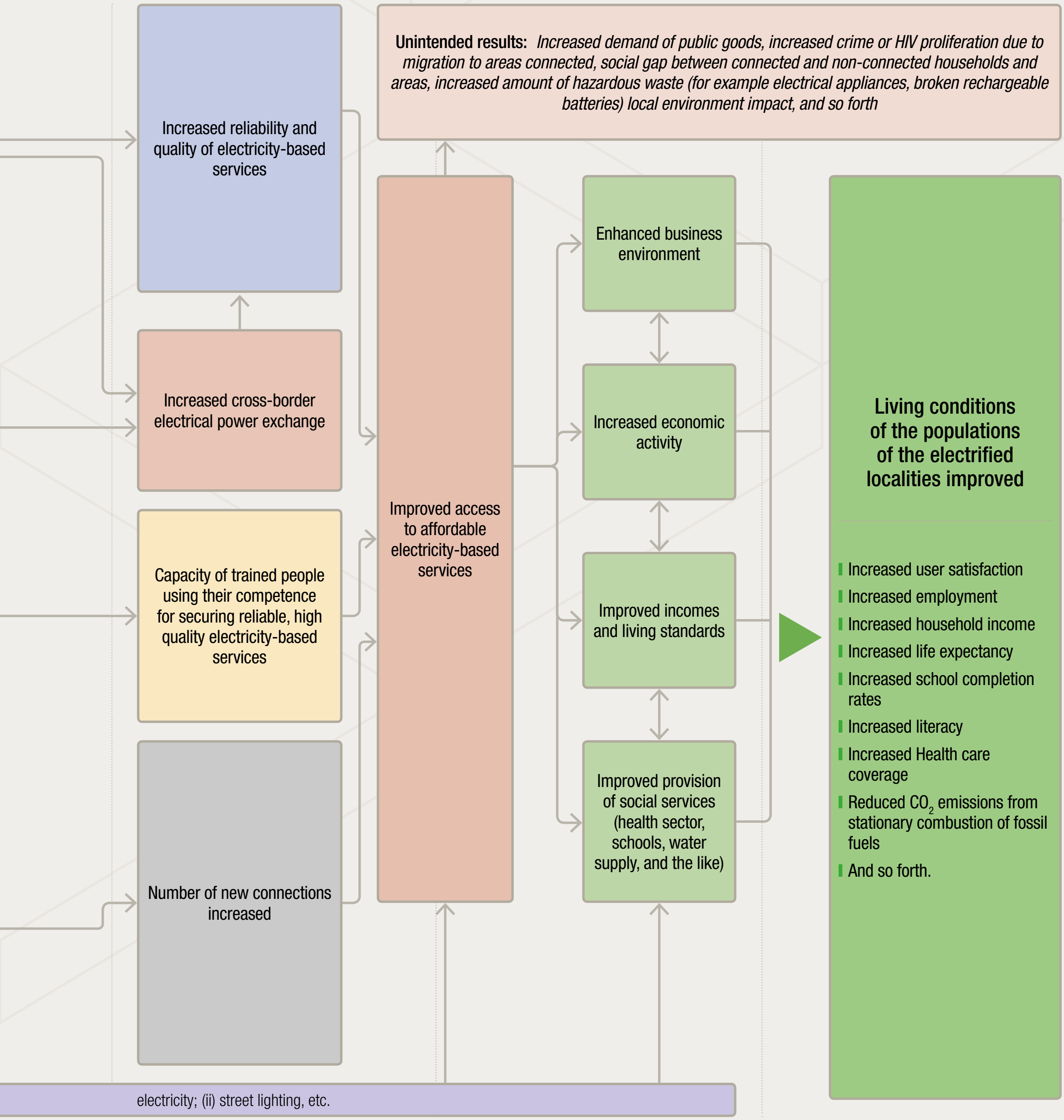


Photo: © AfDB

# Annexes

# Annex 1 — Power Interconnection Intervention Logical Model





**Unintended results:** *Increased demand of public goods, increased crime or HIV proliferation due to migration to areas connected, social gap between connected and non-connected households and areas, increased amount of hazardous waste (for example electrical appliances, broken rechargeable batteries) local environment impact, and so forth*
Increased reliability and quality of electricity-based services
Increased cross-border electrical power exchange
Capacity of trained people using their competence for securing reliable, high quality electricity-based services
Number of new connections increased
Improved access to affordable electricity-based services
Enhanced business environment
Increased economic activity
Improved incomes and living standards
Improved provision of social services (health sector, schools, water supply, and the like)
Living conditions of the populations of the electrified localities improved
Increased user satisfaction
Increased employment
Increased household income
Increased life expectancy
Increased school completion rates
Increased literacy
Increased Health care coverage
Reduced $CO_2$ emissions from stationary combustion of fossil fuels
And so forth.
electricity; (ii) street lighting, etc.

# Annex 2 — Main tables

**Table A2.1:** List of AfDB power interconnection projects and operations approved, 1999–2013

| Project # | Operation # | Project Name | Type | Project code |
|---|---|---|---|---|
| **Projects** | | | | |
| 1 | 1 | Victoria Falls-Katima Mulilo Transmission Project | | P-ZM-FA0-001 |
| 2 | 2 | Manantali Energy Project | Project | P-Z1-F00-023 |
| | 3 | Manantali Energy Project | Project | P-Z1-F00-023 |
| 3 | 4 | Electric Network Interconnection Project | Project | P-MA-FAC-011 |
| 4 | 5 | Nigeria-Togo-Benin Power System Interconnection Project. | Project | P-Z1-F00-013 |
| | 6 | Nigeria-Togo-Benin Power System Interconnection Project | Project | P-Z1-F00-013 |
| 5 | 7 | Ethiopia-Djibouti Power Interconnection Project | Project | P-Z1-FA0-008 |
| | 8 | Ethiopia-Djibouti Power Interconnection Project | Project | P-Z1-FA0-010 |
| | 9 | Ethiopia-Djibouti Power Interconnection Project Supplementary loan-Ethiopia | Project | P-Z1-FA0-023 |
| | 10 | Ethiopia-Djibouti Power Interconnection Project Supplementary loan-Djibouti | Project | P-Z1-FA0-025 |
| 6 | 11 | Ghana-Togo-Benin Power Interconnection Project | Project | P-Z1-F00-030 |
| | 12 | Ghana-Togo-Benin Power Interconnection Project | Project | P-Z1-F00-034 |
| 7 | 13 | Bujagali Interconnection Project | Project | P-UG-FA0-002 |
| 8 | 14 | Inga-PMEDE Hydroelectric Rehabilitation Project | Project | P-CD-FA0-001 |
| 9 | 15 | NELSAP Interconnection Project-DRC | Project | P-Z1-FA0-035 |
| | 16 | NELSAP Interconnection Project-Namibia | Project | P-Z1-FA0-030 |
| | 17 | NELSAP Interconnection Project-Rwanda | Project | P-Z1-FA0-031 |
| | 18 | NELSAP Interconnection Project-Uganda | Project | P-Z1-FA0-033 |
| | 19 | NELSAP Interconnection Project-Burundi | Project | P-Z1-FA0-034 |
| | 20 | NELSAP Interconnection Project-Uganda | Project | P-Z1-FA0-033 |
| | 21 | NELSAP Interconnection Project-Kenya | Project | P-Z1-FA0-032 |
| 10 | 22 | Mombasa-Nairobi transmission line | Project | P-KE-FA0-003 |
| 11 | 23 | Electric Interconnection CAR-DRC Phase 1 | Project | P-Z1-FA0-026 |
| | 24 | Electric Interconnection CAR-DRC Phase 1 | Project | P-Z1-FA0-047 |
| 12 | 25 | Ethiopia-Kenya electricity highway (Ethiopia) | Project | P-Z1-FA0-022 |
| | 26 | Ethiopia-Kenya electricity highway (Kenya) | Project | P-Z1-FA0-044 |
| 13 | 27 | Regional Rusumo Hydropower-Burundi | Project | P-Z1-FAD-007 |
| | 28 | Regional Rusumo Hydropower-Rwanda | Project | P-Z1-FAD-008 |
| | 29 | Regional Rusumo Hydropower-Tanzania | Project | P-Z1-FAD-009 |
| **TOTAL** | | | | |

| Country | Status | Approval Date | Net Loan Amt (UA M) | Disbursement Rate |
|---|---|---|---|---|
| Zambia | Completed | 01/12/1999 | 5.80 | 100.00 |
| Multinational | Completed | 22/03/2000 | 24.42 | 100.00 |
| Multinational | Completed | 22/03/2000 | 0.81 | 100.00 |
| Morocco | Completed | 13/11/2002 | 65.02 | 100.00 |
| Multinational-Nigeria | Completed | 27/11/2002 | 10.34 | 100.00 |
| Multinational | Ongoing | 27/11/2002 | 0.69 | 94.72 |
| Multinational-Ethiopia | Completed | 13/12/2004 | 20.26 | 100.00 |
| Multinational-Djibouti | Completed | 13/12/2004 | 17.19 | 100.00 |
| Ethiopia | Completed | 08/10/2008 | 4.56 | 100.00 |
| Multinational | Completed | 08/10/2008 | 15.59 | 100.00 |
| Multinational-Ghana | Ongoing | 04/04/2007 | 14.87 | 74.93 |
| Multinational-Benin | Ongoing | 04/04/2007 | 17.39 | 16.31 |
| Uganda | Ongoing | 30/10/2007 | 22.15 | 0.00 |
| Dem Rep Congo | Ongoing | 18/12/2007 | 35.70 | 44.75 |
| Dem Rep Congo | Ongoing | 27/11/2008 | 27.62 | 5.32 |
| Multinational | Ongoing | 27/11/2008 | 1.21 | 78.19 |
| Multinational | Ongoing | 27/11/2008 | 30.47 | 13.11 |
| Uganda | Ongoing | 27/11/2008 | 7.59 | 23.60 |
| Multinational | Ongoing | 27/11/2008 | 15.15 | 5.29 |
| Multinational | Ongoing | 26/03/2010 | 34.37 | 0.00 |
| Kenya | Ongoing | 16/06/2010 | 39.77 | 16.53 |
| Kenya | Ongoing | 06/05/2009 | 50.00 | 48.55 |
| Multinational | Approved | 19/09/2012 | 29.73 | 0.00 |
| Multinational | Approved | 19/09/2012 | 5.55 | 0.00 |
| Ethiopia | Ongoing | 19/09/2012 | 150.00 | 0.67 |
| Kenya | Ongoing | 19/09/2012 | 75.00 | 1.49 |
| Multinational | Approved | 27/11/2013 | 16.70 | 0.00 |
| Rwanda | Approved | 27/11/2013 | 25.38 | 0.00 |
| Tanzania | Approved | 27/11/2013 | 22.41 | 0.00 |
| | | | **785.74** | |

| Project # | Operation # | Project Name | Type | Project code | |
|---|---|---|---|---|---|
| **Studies** | | | | | |
| 1 | 30 | ELC. OMVG Production and Transport energy Study | Study | P-Z1-FA0-003 | |
| 2 | 31 | CEEAC Electric Interconnection Country Study | Study | P-Z1-FA0-004 | |
| 3 | 32 | Equat Nile Interconnection Country Study | Study | P-Z1-FA0-005 | |
| | 33 | Equat Nile Interconnection Country Study | Study | P-Z1-FA0-005 | |
| 4 | 34 | Eastern Nile Power Trade Program Study | Study | P-Z1-FA0-006 | |
| 5 | 35 | ELEC OMVG Production & Transport Study | Study | P-Z1-FA0-009 | |
| 6 | 36 | RUSUMO Transport Energy Line Study | Study | P-Z1-FAB-006 | |
| 7 | 37 | Inga Study and Associated Interconnections | Study | P-Z1-FA0-014 | |
| 8 | 38 | Ethiopia-Kenya Elect. Intercon. Phase II | Study | P-Z1-FAD-003 | |
| 9 | 39 | Guinea-Mali Line Study (FOMI) | Study | P-Z1-FA0-029 | |
| | 40 | Guinea-Mali Line Study (FOMI) | Study | P-Z1-FA0-029 | |
| 10 | 41 | Cross-border electrification at CEEAC | Study | P-Z1-FA0-040 | |
| 11 | 42 | Zizabona Power Interconnection Project | Study | P-Z1-F00-043 | |
| 12 | 43 | Creation of the agency for the Inga Site | Study | P-CD-FA0-005 | |
| 13 | 44 | Support For INGA-3 Development | Study | P-Z1-FA0-054 | |
| 14 | 45 | Development Project INGA3-INGA/PATCD | Study | P-CD-FA0-009 | |
| 15 | 46 | North Kivu 220KV Transmission Line | Study | P-Z1-FAD-005 | |
| 16 | 47 | OMVG Energy Project complementary Studies | Study | P-Z1-FAB-021 | |
| 17 | 48 | CAMEROUN-TCHAD Interconnection Study | Study | P-Z1-FA0-048 | |
| **TOTAL** | | | | | |

| Country | Status | Approval Date | Net Loan Amt (UA M) | Disbursement Rate |
|---|---|---|---|---|
| | | | | |
| Multinational | Completed | 07/07/2000 | 1.62 | 100.00 |
| Multinational | Completed | 21/07/2003 | 2.48 | 100.00 |
| Multinational | Completed | 05/11/2003 | 1.98 | 100.00 |
| Multinational | Completed | 05/11/2003 | 0.11 | 0.00 |
| Multinational | Completed | 31/03/2004 | 2.63 | 100.00 |
| Multinational | Completed | 26/01/2005 | 3.41 | 100.00 |
| Multinational | Completed | 27/10/2006 | 2.08 | 100.00 |
| Multinational | Completed | 30/04/2008 | 9.51 | 92.78 |
| Multinational | Completed | 15/07/2010 | 0.65 | 99.00 |
| Mali | Ongoing | 12/01/2011 | 0.83 | 25.26 |
| Guinea | Ongoing | 12/01/2011 | 1.67 | 27.00 |
| Multinational | Approved | 29/02/2012 | 0.46 | 0.00 |
| Multinational | Approved | 18/12/2012 | 1.30 | 0.00 |
| Dem Rep Congo | Ongoing | 17/04/2013 | 2.00 | 0.00 |
| Multinational | Approved | 23/08/2013 | 1.31 | 0.00 |
| Dem Rep Congo | Ongoing | 13/05/2013 | 1.50 | 70.96 |
| Multinational | Approved | 07/06/2013 | 0.00 | 0.00 |
| Multinational | Approved | 19/08/2013 | 1.31 | 0.00 |
| Multinational | Approved | 07/10/2013 | 1.25 | 0.00 |
| | | | **36.10** | |

**Table A2.2:** List of projects evaluated *

| # | Country | Project name | Period (App.–Comp.) | Net amount (Million UA) | Total cost * (Million UA) | Region |
|---|---|---|---|---|---|---|
| 1 | Zambia (Namibia) | Victoria Falls-Katima Mulilo-132 KV interconnection project | 1999–2008 | 5.85 | | South |
| 2 | Morocco (Spain) | Electric Network Interconnection (Morocco) | 2002–2007 | 65.02 | 321.78 | Maghreb-Europe |
| 3 | Mali/ Mauritania/ Senegal | Manantali Energy Project | 2000–2003 | 25.23 | 286.07 | West |
| 4 | Nigeria/Togo/ Benin | NEPA-CEB Power Interconnection Project. | 2002–2007 | 11.03 | 33.41 | West |
| 5 | Ethiopia/ Djibouti | Power Interconnection Project (Ethiopia) | 2004–2010 | 20.26 | 72.11 | East |
| | | Power Interconnection Project (Djibouti) | 2004–2010 | 17.19 | | East |
| | | Power Interconnection Project (Djibouti)–Supplementary Loan–(Ethiopia) | 2008–2011 | 4.56 | | East |
| | | Power Interconnection Project (Djibouti)–Supplementary Loan–(Djibouti) | 2008–2011 | 15.59 | | East |
| 6 | Ghana/Togo/ Benin | Ghana-Togo-Benin power interconnection (Ghana) | 2007–2010 | 14.87 | 71.55 | West |
| | | Ghana-Togo-Benin power interconnection (Benin) | 2007–ongoing | 17.39 | | West |
| **TOTAL** | | | | **197.17** | | |

* at Completion

**Table A2.3:** Main risks identified during the evaluated power interconnection projects' appraisal

| Main Risk Identified | Project 1 | Project 2 | Project 3 | Project 4 | Project 5 | Project 6 |
|---|---|---|---|---|---|---|
| 1. Capacity of exporting countries to generate enough electricity to meet its own national demand as well as it contractual obligations to its international customers | ● | ● | | ● | | |
| 2. Low tariffs regime | ● | | | ● | ● | |
| 3. Utility capacity to operate and maintain the project assets effectively | ● | ● | ● | | ● | ● |
| 4. Political tension between involved countries | | | ● | | | |
| 5. Limits on Power Purchasing Agreements | | | | ● | | |
| 6. Development of distribution networks | | | | | | ● |

**Project 1: NEPA-CEB Interconnection Project (Nigeria/Benin/Togo); Project 2: Ghana-Togo-Benin Interconnection Project**
**Projec 3: Project to Strengthening Electric Power grid Interconnection Project of Morocco (Morocco/Spain/Algeria)**
**Project 4: Ethiopia – Djibouti Interconnection Project; Project 5: Victoria Falls-Katima Mulilo Interconnection Project (Zambia/Namibia)**
**Project 6: Manantali Energy Project (Mali/Mauritania/Senegal)**

**Table A2.4:** Main outputs of the evaluated power interconnection projects as at July 2015

| | Quantity |
|---|---|
| Capacity of Hydropower Station installed (MW) | 200 |
| Number of Substations constructed or extended | 34 |
| Length of High Voltage Transmission Line constructed (km) | 3128.8 |
| Length of submarine cable (km) | 28 |
| Length of Fibre optic network on the long VHT and HT lines (km) | 2460 |

**Table A2.5:** Additional annual cross-border electrical exchange enabled by the project

| Project | Power Exchange | | | |
|---|---|---|---|---|
| | Planned and Commis-sioned | As at completion | As at post-evaluation | Comments |
| 1. NEPA-CEB Interconnection Project | 570 GWh (75 MW) | 100 MW | 1.489 GWh (200 MW) | CEB is negotiated with TCN to increase this to 300 MW |
| 2. Project to Strengthening Electric Power grid Interconnection Project of Morocco) – With Spain | 700 MVA | 700 MVA | 700MVA | Discussions are ongoing for additional 700 MVA |
| – With Algeria | 596 GWh | 596 GWh | 143 GWh | Renew political tension |
| 3. Ethiopia – Djibouti Interconnection Project | | | 350 GWh | |
| 4. Zambia Victoria Falls-Katima Mulilo Interconnection Project | | | 350 GWh | |
| 5. Manantali Energy Project | | | 700 GWh | |

**Table A2.6:** Sector goals and OVIs by project

| Countries | Project name | Sector goals | Project objectives | Objectively Verifiable Indicators (OVI) |
|---|---|---|---|---|
| Nigeria, Togo and Benin | NEPA-CEB Interconnection Project | Improve the quality and reduce cost of power supply in the ECOWAS region | (i) Provide an alternate source of power supply to Togo and Benin in order to meet their shortfall in electricity imports from Ghana and Côte d'Ivoire and improve voltage on the CEB transmission network; (ii) Reduce power outages in Togo and Benin during drought years and thus limit economic and social hardships on the population of the two countries; and (iii) Link the electricity grid of Nigeria to the already connected grids of Benin, Togo, Ghana, Côte d'Ivoire and Burkina Faso, thereby improving reliability of supply and optimising production cost within the sub region. | **After December 2004** (i) Power imported from Nigeria represents 20% of electricity consumption in Togo and Benin. (ii) Continuous power supply to industries, hospitals and schools during drought years. (iii) Reliability of supply in Togo and Benin improved by 10%. **(iv) Production cost in Togo and Benin reduced by 5%.** |

| Countries | Project name | Sector goals | Project objectives | Objectively Verifiable Indicators (OVI) |
|---|---|---|---|---|
| Morocco, Algeria and Spain | Project to Strengthening Electric Power grid Interconnection | Enhance the security of electric power supply, improve Morocco's balance of payments and the competitiveness of Moroccan enterprises. | (i) Increase interconnection capacity and imports of electric power.<br>(ii) Least cost supply of electric power market.<br>(iii) Enhancement of the security and reliability of the transmission grid | **By 2006:**<br>(i) Increase in capacity from 700 to 1,400 MW between Morocco and Spain and 500 to 1,700 MW between Morocco and Algeria.<br>(ii) Imports of over 3,000 GWh.<br>(iii) Fall in the average purchasing price of electric power by ONE to below MAD 0.40/KWh.<br>(iv) Improved stability of frequency and fall in total outage time from 34 minutes in 2000 to less than 15 minutes in 2006. the cost of energy. |
| Ethiopia and Djibouti | Power Interconnection Project | To increase access to electricity in Ethiopia and Djibouti through regional cooperation in the energy sector | To establish power trade between Ethiopia and Djibouti and increase electricity access at affordable prices | **By 2010**<br>**Ethiopia**<br>(i) Electricity trade is increased from zero in 2004 to about-300 GWh of electricity<br>(ii) Foreign exchange revenue for EEPCo is increased from nil to at least US$ 1.9 Million.<br>(iii) 8,571 consumers are connected to grid in four border towns of Ethiopia- [Adigala (4,464), Ayasha (2144), Dewelle (1354) & Harewa (609)]<br>**Djibouti**<br>(i) Average tariff in Djibouti is reduced at least by 10%.<br>(ii) About 33,000 existing consumers benefit from cheaper electricity |

| Countries | Project name | Sector goals | Project objectives | Objectively Verifiable Indicators (OVI) |
|---|---|---|---|---|
| Zambia and Namibia | Victoria Falls-Katima Mulilo Interconnection Project | Make available adequate and least cost energy to the various economic sectors to promote economic growth and improve quality of life. | (i) Strengthen the network capacity of ZESCO and NamPower in order to increase the export of Zambian surplus hydroelectricity to Caprivi Region of Namibia with a view to augmenting the foreign exchange earning to ZESCO.<br>(ii) Strengthen the electricity network in Western Region of Zambia to make possible the extension of the national grid to new supply centres within Zambia | (i) Increased network capacity from 10 MW to 30 MW through replacing the existing 66 kV line by 132 KV.<br>(ii) Average increase in electricity consumption by 2.4% per annum; and<br>(iii) Increased electrification level by 10% per annum. |
| Mauritania, Senegal and Mali | Manantali Energy Project | (i) Regional enhancement of the hydroelectric potential of the Bafing River (tributary of the Senegal River) at the Manantali dam, through the construction of a hydroelectric power station and the interconnection of the electricity networks of the OMVS member countries in order to their supply of electrical energy at lower cost and the reduction of their oil bill.<br>(ii) Energy integration of OMVS member countries through the creation of energy trading conditions and the sharing of benefits related to economies of scale | Establishment of a subregional hydroelectric generating capacity and an electrical interconnection network of OMVS member countries | (i) Increasing the number of subscribers in urban and rural areas, improving the quality of service (reducing unintentional power cuts and improving energy quality) and increasing energy supply<br>(ii) Lower average cost per kWh of electricity delivered by the national production parks of the three countries<br>(iii) Reduction of the consumption of petroleum products for the production of electricity in proportion to the hydroelectric energy delivered to each of the three countries |
| Ghana, Togo and Benin | Power Interconnection Project | Reduce poverty in the ECOWAS region through increased access to modern energy services. | Increase transmission capacity between Nigeria, Benin, Togo, and Ghana for trading of electricity which will improve reliability of supply, reduce production costs and, during drought periods, meet shortfall in output of hydropower stations. | (i) Reliability of power supply in the interconnected countries is improved.<br>(ii) Cost of power supply in the interconnected countries is reduced.<br>(iii) Continuity of supply is maintained during drought years. |

Source: Project Appraisal Documents

**Table A2.7:** Project ratings

| Evaluation Criteria | Rating (1–4) | | | | | |
|---|---|---|---|---|---|---|
| | Zambia/ Namibia | Morocco/ Spain | Manantali | NEPA-CEB | Ethiopia/ Djibouti | Ghana/ Togo/ Benin |
| **Relevance** | | | | | | |
| 1. Relevance of projects' objectives | 4 | 4 | 4 | 4 | 4 | 3 |
| 2. Relevance of projects' design | 2 | 4 | 3 | 3 | 4 | 4 |
| **Overall Relevance** | **3** | **4** | **3** | **3** | **4** | **3** |
| **Effectiveness** | | | | | | |
| 1. Projects' outputs achievement | 4 | 4 | 3 | 4 | 3 | 2 |
| 2. Projects' outcomes achievement | 3 | 3 | 3 | 3 | 3 | |
| **Overall Effectiveness** | **3** | **4** | **3** | **3** | **3** | **2** |
| **Efficiency** | | | | | | |
| 1. EIRR | 4 | 4 | 4 | 4 | 4 | |
| 2. FIRR | 3 | 2 | 3 | 3 | 3 | |
| 3. Timeline | 2 | 2 | 3 | 2 | 1 | |
| **Overall Efficiency** | **3** | **2** | **3** | **3** | **3** | |
| **Sustainability** | | | | | | |
| 1. Technical Soundness | 3 | 3 | 3 | 3 | 3 | |
| 2. Economic and Financial Viability | 3 | 3 | 3 | 3 | 3 | |
| 3. Institutional sustainability and strengthening of capacities | 3 | 3 | 3 | 3 | 3 | |
| 4. Political and governance environment | 3 | 3 | 3 | 3 | 3 | |
| 5. Environment and Social Viability | 3 | 4 | 3 | 3 | 3 | |
| 6. Resilience to exogenous factors | 2 | 3 | 2 | 2 | 2 | 2 |
| **Overall Sustainability** | **3** | **3** | **3** | **3** | **3** | |

Source: Project Evaluation Reports (IDEV)

# Annex 3 — Performance tables

**Table A3.1:** Time variations in months and % overrun [+/-]

| Commitment date (signature date) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project/Instrument | Approval Date<br>a | Original Signature Date<br>b | Actual Signature Date<br>c | Estimated time [M]<br>d=b-a | Actual time [M]<br>e=c-a | Delay [M]<br>f=e-d | Variation [+/-] in %<br>h=f/d*100 |
| 1.1 Victoria Falls-Katima Mulilo [ADF] (Zambia) | 01/12/1999 | 30/09/1999 | 17/02/2000 | | 2 | | |
| 1.2 Victoria Falls-Katima Mulilo [Multi Debt Relief Initiat] Zambia | 01/12/1999 | 30/09/1999 | 17/02/2000 | | 2 | | |
| 2.1 Electric Network Interconnection (Morocco) | 13/11/2002 | 01/04/2002 | 06/05/2003 | | 5 | | |
| 3.1 Manantali Energy Project Multinational | 22/03/2000 | Unspecified | 02/05/2000 | | 1 | | |
| 3.2 Manantali Energy Project Multinational | 22/03/2000 | Unspecified | 02/05/2000 | | 1 | | |
| 4.1 NEPA-CEB Power Interconnection Project. Multinational | 27/11/2002 | 31/01/2003 | 29/09/2003 | 2 | 10 | 8 | 400 |
| 4.2 NEPA-CEB Power Interconnection Project. (Nigeria) | 27/11/2002 | 31/01/2003 | 25/03/2003 | 2 | 3 | 1 | 50 |
| 5.1 Power Interconnection Project (Ethiopia) | 13/12/2004 | 31/03/2005 | 16/05/2005 | 3 | 5 | 2 | 67 |
| 5.2 Power Interconnection Project (Djibouti) | 13/12/2004 | 31/03/2005 | 22/07/2005 | 3 | 7 | 4 | 133 |
| 5.3 Power Interconnection Project-Supplementary Loan (Grant to Djibouti) | 08/10/2008 | 01/11/2009 | 13/11/2008 | 12 | 1 | -11 | -92 |
| 5.4 Power Interconnection Project-Supplementary Loan (Loan to Ethiopia) | 08/10/2008 | 01/11/2009 | 13/11/2008 | 12 | 1 | -11 | -92 |
| 6.1 Ghana-Togo-Benin power interconnection (Ghana) | 04/04/2007 | 30/04/2007 | 17/05/2007 | 0 | 1 | 1 | |
| 6.2 Ghana-Togo-Benin power interconnection (Benin) | 04/04/2007 | 30/04/2007 | 02/06/2008 | 0 | 13 | 13 | |
| **Effective date (entry into force date)** | | | | | | | |
| Project/Instrument | Approval Date<br>a | Original Effective Date<br>b | Actual Effective Date<br>c | Estimated time [M]<br>d=b-a | Actual time [M]<br>e=c-a | Delay [M]<br>f=e-d | Variation [+/-] in %<br>h=f/d*100 |
| 1.1 Victoria Falls-Katima Mulilo [ADF] (Zambia) | 01/12/1999 | 30/11/1999 | 28/12/2001 | | 24 | | |
| 1.2 Victoria Falls-Katima Mulilo [Multi Debt Relief Initiat] (Zambia) | 01/12/1999 | 30/11/1999 | 28/12/2001 | | 24 | | |
| 2.1 Electric Network Interconnection (Morocco) | 13/11/2002 | Unspecified | 04/10/2003 | | 10 | | |
| 3.1 Manantali Energy Project Multinational | 22/03/2000 | Unspecified | 30/10/2000 | | 7 | | |
| 3.2 Manantali Energy Project Multinational | 22/03/2000 | Unspecified | 07/11/2000 | | 7 | | |
| 4.1 NEPA-CEB Power Interconnection Project. Multinational | 27/11/2002 | 30/04/2003 | 01/11/2004 | 5 | 23 | 18 | 360 |
| 4.2 NEPA-CEB Power Interconnection Project. (Nigeria) | 27/11/2002 | 30/04/2003 | 08/12/2003 | 5 | 12 | 7 | 140 |
| 5.1 Power Interconnection Project (Ethiopia) | 13/12/2004 | 01/01/2005 | 08/08/2006 | 0 | 19 | 19 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5.2 Power Interconnection Project (Djibouti) | 13/12/2004 | 01/01/2005 | 08/08/2006 | 0 | 19 | 19 | |
| 5.3 Power Interconnection Project-Supplementary Loan (Grant to Djibouti) | 08/10/2008 | Unspecified | 13/11/2008 | | 1 | | |
| 5.4 Power Interconnection Project-Supplementary Loan (Loan to Ethiopia) | 08/10/2008 | Unspecified | 06/07/2009 | | 8 | | |
| 6.1 Ghana-Togo-Benin power interconnection (Ghana) | 04/04/2007 | 31/08/2007 | 28/11/2007 | 4 | 7 | 3 | 75 |
| 6.2 Ghana-Togo-Benin power interconnection (Benin) | 04/04/2007 | 31/08/2007 | 12/07/2010 | 4 | 39 | 35 | 875 |

**Completion date**

| Project/Instrument | Approval Date a | Original Comple-tion Date b | Actual Comple-tion Date c | Estimated time [M] d=b-a | Actual time [M] e=c-a | Delay [M] f=e-d | Variation [+/-] in % h=f/d*100 |
|---|---|---|---|---|---|---|---|
| 1.1 Victoria Falls-Katima Mulilo [ADF] (Zambia) | 01/12/1999 | 31/12/2002 | 31/12/2006 | 36 | 84 | 48 | 133 |
| 1.2 Victoria Falls-Katima Mulilo [Multi Debt Relief Initiat] (Zambia) | 01/12/1999 | 31/12/2002 | 31/12/2006 | 36 | 84 | 48 | 133 |
| 2.1 Electric Network Interconnection (Morocco) | 13/11/2002 | 30/11/2006 | 30/06/2009 | 48 | 79 | 31 | 65 |
| 3.1 Manantali Energy Project Multinational | 22/03/2000 | 30/06/2002 | 30/11/2003 | 27 | 44 | 17 | 63 |
| 3.2 Manantali Energy Project Multinational | 22/03/2000 | 30/06/2002 | 30/12/2003 | 27 | 45 | 18 | 67 |
| 4.1 NEPA-CEB Power Interconnection Project. Multinational | 27/11/2002 | 31/10/2004 | 03/02/2007 | 23 | 50 | 27 | 117 |
| 4.2 NEPA-CEB Power Interconnection Project. (Nigeria) | 27/11/2002 | 31/10/2004 | 03/02/2007 | 23 | 50 | 27 | 117 |
| 5.1 Power Interconnection Project (Ethiopia) | 13/12/2004 | 30/06/2009 | 31/12/2010 | 54 | 72 | 18 | 33 |
| 5.2 Power Interconnection Project (Djibouti) | 13/12/2004 | 30/06/2009 | 30/09/2011 | 54 | 81 | 27 | 50 |
| 5.3 Power Interconnection Project-Supplementary Loan (Grant to Djibouti) | 08/10/2008 | 30/06/2009 | 30/12/2011 | 8 | 38 | 30 | 375 |
| 5.4 Power Interconnection Project-Supplementary Loan (Loan to Ethiopia) | 08/10/2008 | 31/12/2010 | 31/12/2010 | 26 | 26 | 0 | 0 |
| 6.1 Ghana-Togo-Benin power interconnection (Ghana) | 04/04/2007 | 30/06/2010 | 31/12/2014 | 38 | 92 | 54 | 142 |
| 6.2 Ghana-Togo-Benin power interconnection (Benin) | 04/04/2007 | 30/06/2010 | 31/12/2015 | 38 | 104 | 66 | 174 |

**Table A3.2:** Timeline

**Actual project timelines (in months)**

| Project | Net amount | Approval to signature [M] | Signature to effective [M] | Effective to first disbursement [M] | First disbursement to completion [M] |
|---|---|---|---|---|---|
| 1.1 Victoria Falls-Katima Mulilo [ADF] (Zambia) | 4.75 | 2 | 22 | 14 | 45 |
| 1.2 Victoria Falls-Katima Mulilo [Multi Debt Relief Initiat] (Zambia) | 1.1 | 2 | 22 | 36 | 24 |
| 2.1 Electric Network Interconnection (Morocco) | 65.2 | 5 | 4 | 3 | 65 |
| 3.1 Manantali Energy Project Multinational | 24.42 | 1 | 5 | 0 | 36 |

| | | | | | |
|---|---|---|---|---|---|
| 3.2 Manantali Energy Project Multinational | 0.81 | 1 | 6 | 6 | 31 |
| 4.1 NEPA-CEB Power Interconnection Project. Multinational | 10.34 | 10 | 13 | 8 | 18 |
| 4.2 NEPA-CEB Power Interconnection Project. (Nigeria) | 0.69 | 3 | 8 | 13 | 24 |
| 5.1 Power Interconnection Project (Ethiopia) | 20.26 | 5 | 14 | 4 | 48 |
| 5.2 Power Interconnection Project (Djibouti) | 17.19 | 7 | 12 | 5 | 56 |
| 5.3 Power Interconnection Project-Supplementary Loan (Grant to Djibouti) | 15.59 | 1 | 0 | 5 | 32 |
| 5.4 Power Interconnection Project-Supplementary Loan (Loan to Ethiopia) | 4.56 | 1 | 7 | 3 | 14 |
| 6.1 Ghana-Togo-Benin power interconnection (Ghana) | 14.87 | 1 | 6 | 45 | 40 |
| 6.2 Ghana-Togo-Benin power interconnection (Benin) | 17.39 | 13 | 25 | 38 | 27 |
| TOTAL | 197.17 | | | | |
| Average Time (M) | | 4 | 11 | 14 | 35 |
| **Average Time weighted by net amount (M)** | | **5** | **9** | **10** | **46** |

**Planned time to completion (in months)**

| Project | Net amount | Planned time to completion | | | |
|---|---|---|---|---|---|
| | | Approval to completion [M] | Signature to com-pletion [M] | Effective to completion [M] | Start-up to completion [M] |
| 1.1 Victoria Falls-Katima Mulilo [ADF] (Zambia) | 4.75 | 36 | 39 | 37 | 37 |
| 1.2 Victoria Falls-Katima Mulilo [Multi Debt Relief Initiat] (Zambia) | 1.1 | 36 | 39 | 37 | 37 |
| 2.1 Electric Network Interconnection (Morocco) | 65.2 | 48 | 55 | | 48 |
| 3.1 Manantali Energy Project Multinational | 24.42 | 27 | | | 11 |
| 3.2 Manantali Energy Project Multinational | 0.81 | 27 | | | 11 |
| 4.1 NEPA-CEB Power Interconnection Project. Multinational | 10.34 | 23 | 21 | 18 | 18 |
| 4.2 NEPA-CEB Power Interconnection Project. Nigeria | 0.69 | 23 | 21 | 18 | 18 |
| 5.1 Power Interconnection Project (Ethiopia) | 20.26 | 54 | 50 | 53 | 31 |
| 5.2 Power Interconnection Project (Djibouti) | 17.19 | 54 | 50 | 53 | 31 |
| 5.3 Power Interconnection Project-Supplementary Loan (Grant to Djibouti) | 15.59 | 8 | | | 13 |
| 5.4 Power Interconnection Project-Supplementary Loan (Loan to Ethiopia) | 4.56 | 26 | 13 | | 31 |
| 6.1 Ghana-Togo-Benin power interconnection (Ghana) | 14.87 | 38 | 38 | 33 | 29 |
| 6.2 Ghana-Togo-Benin power interconnection (Benin) | 17.39 | 38 | 38 | 33 | 29 |
| TOTAL | 197.17 | | | | |
| Average time (M) | | 34 | 36 | 35 | 26 |
| **Average time weighted by net amount (M)** | | **39** | **37** | **18** | **32** |

**Actual time to completion (in months)**

| Project | Net amount | Actual time to completion | | | |
|---|---|---|---|---|---|
| | | Approval to completion [M] | Signature to com-pletion [M] | Effective to completion [M] | Start-up to completion [M] |
| 1.1 Victoria Falls-Katima Mulilo [ADF] Zambia | 4,75 | 76 | 75 | 62 | 55 |
| 1.2 Victoria Falls-Katima Mulilo [Multi Debt Relief Initiat] Zambia | 1,1 | 110 | 107 | 96 | 84 |
| 2.1 Electric Network Interconnection (Morocco) | 65,2 | 90 | 87 | 78 | 51 |
| 3.1 Manantali Energy Project Multinational | 24,42 | 120 | 119 | 109 | 100 |
| 3.2 Manantali Energy Project Multinational | 0,81 | 84 | 83 | 75 | 51 |
| 4.1 NEPA-CEB Power Interconnection Project. Multinational | 10,34 | 142 | 140 | 136 | 126 |

| | | | | | |
|---|---|---|---|---|---|
| 4.2 NEPA-CEB Power Interconnection Project. Nigeria | 0,69 | 76 | 75 | 62 | 55 |
| 5.1 Power Interconnection Project (Ethiopia) | 20,26 | 110 | 107 | 96 | 84 |
| 5.2 Power Interconnection Project (Djibouti) | 17,19 | 90 | 87 | 78 | 51 |
| 5.3 Power Interconnection Project-Supplementary Loan (Grant to Djibouti) | 15,59 | 120 | 119 | 109 | 100 |
| 5.4 Power Interconnection Project-Supplementary Loan (Loan to Ethiopia) | 4,56 | 84 | 83 | 75 | 51 |
| 6.1 Ghana-Togo-Benin power interconnection (Ghana) | 14,87 | 142 | 140 | 136 | 126 |
| 6.2 Ghana-Togo-Benin power interconnection (Benin) | 17,39 | 142 | 140 | 136 | 126 |
| TOTAL | 197.17 | | | | |
| Average time (M) | | 99 | 98 | 89 | 77 |
| **Average time weighted by net amount (M)** | | **109** | **107** | **98** | **81** |

**Delays to completion (in months)**

| Project | Net amount | Delays to completion | | | |
|---|---|---|---|---|---|
| | | Approval to completion [M] | Signature to completion [M] | Effective to completion [M] | Start-up to completion [M] |
| 1.1 Victoria Falls-Katima Mulilo [ADF] (Zambia) | 4.75 | 40 | 36 | 25 | 18 |
| 1.2 Victoria Falls-Katima Mulilo [Multi Debt Relief Initiat] (Zambia) | 1.1 | 74 | 68 | 59 | 47 |
| 2.1 Electric Network Interconnection (Morocco) | 65.2 | 42 | 32 | 78 | 3 |
| 3.1 Manantali Energy Project Multinational | 24.42 | 93 | 119 | 109 | 89 |
| 3.2 Manantali Energy Project Multinational | 0.81 | 57 | 83 | 75 | 40 |
| 4.1 NEPA-CEB Power Interconnection Project. Multinational | 10.34 | 119 | 119 | 118 | 108 |
| 4.2 NEPA-CEB Power Interconnection Project. (Nigeria) | 0.69 | 53 | 54 | 44 | 37 |
| 5.1 Power Interconnection Project (Ethiopia) | 20.26 | 56 | 57 | 43 | 53 |
| 5.2 Power Interconnection Project (Djibouti) | 17.19 | 36 | 37 | 25 | 20 |
| 5.3 Power Interconnection Project-Supplementary Loan (Grant to Djibouti) | 15.59 | 112 | 119 | 109 | 87 |
| 5.4 Power Interconnection Project-Supplementary Loan (Loan to Ethiopia) | 4.56 | 58 | 70 | 75 | 20 |
| 6.1 Ghana-Togo-Benin power interconnection (Ghana) | 14.87 | 104 | 102 | 103 | 97 |
| 6.2 Ghana-Togo-Benin power interconnection (Benin) | 17.39 | 104 | 102 | 103 | 97 |
| TOTAL | 197.17 | | | | |
| Average time (M) | | 73 | 77 | 74 | 55 |
| **Average time weighted by net amount (M)** | | **70** | **70** | **81** | **49** |

## Table A3.3: Delays in the preparation of PCRs

| Project | PCR due date | Actual PCR date | Time [M] |
|---|---|---|---|
| 1. NEPA-CEB Power Interconnection | 03/08/2007 | 25/10/2010 | 38 |
| 2. Ghana-Togo-Benin Power Interconnection | - | - | - |
| 3. Project for Strengthening Electric Power Grid Interconnections Morocco/Spain | 17/11/2009 | 25/10/2010 | 11 |
| 4. Ethiopia-Djibouti Power Interconnection Project | 31/10/2010 | 15/06/2011 | 7 |
| 5. Victoria Falls-Katima Mulilo Interconnection Project (Zambia/Namibia) | 22/06/2007 | 13/03/2009 | 20 |
| 6. Manantali Energy Project | | | |

**Table A3.4:** Power Interconnection Project cluster ratings

| | Rating | | | | | |
|---|---|---|---|---|---|---|
| | Victoria Falls-Katima Mulilo 132 KV | Morocco Electric Network | Manantali Energy | NEPA-CEB | Ethiopia & Djibouti | Ghana, Togo & Benin |
| Relevance (N=6) | 3 | 4 | 3 | 3 | 4 | 3 |
| Effectiveness (N=5) | 3 | 4 | 3 | 3 | 3 | |
| Efficiency (N=5) | 2 | 2 | 3 | 2 | 2 | |
| Sustainability (N=5) | 3 | 3 | 3 | 3 | 3 | |
| Development outcome (average of the 4 main criteria) | 2.75 | 3.3 | 3.0 | 2.7 | 3.0 | |
| | S | S | S | S | S | |

## Table A3.5: Disbursement profiles

| Disbursement ratio (compared to open undisbursed balance) - by project and year | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | **Net approval** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** |
| Victoria Falls-Katima Mulilo [ADF] Zambia | 4.75 | | | | | 2% | 21% |
| Electric Network Interconnection (Morocco) | 65.2 | | | | | | 68% |
| Manantali Energy Project Multinational loan | 24.42 | | | 55% | 56% | 31% | 13% |
| Manantali Energy Project Multinational grant | 0.81 | | | 9% | 34% | 0% | 0% |
| NEPA-CEB Power Interconnection Project. Multi Region | 0.69 | | | | | | |
| NEPA-CEB Power Interconnection Project. Nigeria | 10.34 | | | | | | |
| Power Interconnection Project (Ethiopia) | 20.26 | | | | | | |
| Power Interconnection Project (Djibouti) | 17.19 | | | | | | |
| Power Interconnection Project - Supplementary Loan (Grant to Djibouti) | 15.59 | | | | | | |
| Power Interconnection Project - Supplementary Loan (Loan to Ethiopia) | 4.56 | | | | | | |
| Ghana - Togo - Benin power interconnection (Ghana) | 14.87 | | | | | | |
| Ghana - Togo - Benin power interconnection (Benin) | 17.39 | | | | | | |
| **Total** | **196.07** | | | | | | |
| **Average (*)** | | | | **23%** | **44%** | **19%** | **37%** |
| **Weighted Average by net amount** | | | | **53%** | **55%** | **25%** | **50%** |

(*) Geometric average

| Cumulative Disbursement ratio (compared to open undisbursed balance) – By project and year | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | **Net approval** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** |
| Victoria Falls-Katima Mulilo [ADF] Zambia | 4.75 | | | | | 2% | 23% |
| Electric Network Interconnection (Morocco) | 65.2 | | | | | | 74% |
| Manantali Energy Project Multinational loan | 24.42 | | | 55% | 81% | 87% | 88% |
| Manantali Energy Project Multinational grant | 0.81 | | | 9% | 40% | 40% | 40% |
| NEPA-CEB Power Interconnection Project. Multi Region | 0.69 | | | | | | |
| NEPA-CEB Power Interconnection Project. Nigeria | 10.34 | | | | | | |
| Power Interconnection Project (Ethiopia) | 20.26 | | | | | | |
| Power Interconnection Project (Djibouti) | 17.17 | | | | | | |
| Power Interconnection Project - Supplementary Loan (Grant to Djibouti) | 15.59 | | | | | | |
| Power Interconnection Project - Supplementary Loan (Loan to Ethiopia) | 4.56 | | | | | | |
| Ghana - Togo - Benin power interconnection (Ghana) | 14.87 | | | | | | |
| Ghana - Togo - Benin power interconnection (Benin) | 17.39 | | | | | | |
| **Total** | **196.07** | | | | | | |
| **Average (*)** | | | | **23%** | **57%** | **19%** | **50%** |
| **Weighted Average by net amount** | | | | **53%** | **78%** | **72%** | **75%** |

(*) Geometric average

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 49% | 95% | | | | | | | | | | |
| | 57% | 106% | | | | | | | | | | |
| | 46% | 57% | 15% | | | | | | | | | |
| | 23% | | | | | | | | | | | |
| | 18% | 68% | 29% | 71% | | | | | | | | |
| | 13% | 35% | 47% | 41% | 26% | | | | | | | |
| | | 2% | 12% | 27% | 58% | 53% | 76% | | | | | |
| | | | 4% | 24% | 75% | 80% | 36% | | | | | |
| | | | | | 31% | 41% | 46% | 96% | | | | |
| | | | | | 28% | 52% | 64% | | | | | |
| | | | | | | | 7% | 29% | 43% | 42% | 75% | |
| | | | | | | | | | 6% | 14% | 14% | 16% |
| | | | | | | | | | | | | |
| | **30%** | **38%** | **16%** | **37%** | **40%** | **55%** | **35%** | **53%** | **16%** | **25%** | **32%** | **16%** |
| | **49%** | **72%** | **21%** | **30%** | **49%** | **58%** | **46%** | **64%** | **23%** | **27%** | **42%** | **16%** |

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 62% | 100% | | | | | | | | | | |
| | 94% | 108% | | | | | | | | | | |
| | 94% | 97% | 98% | | | | | | | | | |
| | 54% | | | | | | | | | | | |
| | 18% | 74% | 82% | 95% | | | | | | | | |
| | 13% | 43% | 70% | 83% | 87% | | | | | | | |
| | | 2% | 14% | 37% | 74% | 88% | 97% | | | | | |
| | | | 4% | 27% | 82% | 96% | 98% | | | | | |
| | | | | | 31% | 59% | 78% | 99% | | | | |
| | | | | | 28% | 66% | 88% | | | | | |
| | | | | | | | 7% | 34% | 62% | 78% | 95% | |
| | | | | | | | | | 6% | 19% | 31% | 42% |
| | | | | | | | | | | | | |
| | **44%** | **45%** | **31%** | **53%** | **54%** | **76%** | **54%** | **58%** | **19%** | **39%** | **54%** | **42%** |
| | **82%** | **82%** | **62%** | **45%** | **65%** | **81%** | **74%** | **67%** | **32%** | **46%** | **60%** | **42%** |

**Cumulative disbursement ratio (compared to approval amount) – by project and year**

| Project | Net approval | Year 1 | Year 2 | Year 3 | |
|---|---|---|---|---|---|
| Victoria Falls-Katima Mulilo [ADF] Zambia | 4.75 | 0% | 0% | 0% | |
| Electric Network Interconnection (Morocco) | 65.2 | 0% | 74% | 94% | |
| Manantali Energy Project Multinational loan | 24.42 | 0% | 55% | 81% | |
| Manantali Energy Project Multinational grant | 0.81 | 0% | 9% | 40% | |
| NEPA-CEB Power Interconnection Project. Multi Region | 0.69 | 0% | 0% | 18% | |
| NEPA-CEB Power Interconnection Project. Nigeria | 10.34 | 0% | 0% | 13% | |
| Power Interconnection Project (Ethiopia) | 20.26 | 0% | 2% | 14% | |
| Power Interconnection Project (Djibouti) | 17.19 | 4% | 27% | 82% | |
| Power Interconnection Project - Supplementary Loan (Grant to Djibouti) | 15.59 | 0% | 31% | 59% | |
| Power Interconnection Project - Supplementary Loan (Loan to Ethiopia) | 4.56 | 0% | 0% | 28% | |
| Ghana - Togo - Benin power interconnection (Ghana) | 14.87 | 0% | 0% | 0% | |
| Ghana - Togo - Benin power interconnection (Benin) | 17.39 | 0% | 0% | 0% | |
| **Total** | **196.07** | | | | |
| **Geometric average of percentages** | | **4%** | **21%** | **37%** | |
| **Weighted Average by net amount** | | **4%** | **49%** | **68%** | |

| | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 |
|---|---|---|---|---|---|---|
| | 2% | 23% | 62% | 100% | | – |
| | 108% | | | | | |
| | 87% | 88% | 94% | 97% | 98% | |
| | 40% | 40% | 54% | | | |
| | 74% | 82% | 95% | | | |
| | 43% | 70% | 83% | 87% | | |
| | 37% | 74% | 88% | 97% | | |
| | 96% | 98% | | | | |
| | 78% | 99% | | | | |
| | 66% | 88% | | | | |
| | 0% | 7% | 34% | 62% | 78% | 95% |
| | 0% | 0% | 6% | 19% | 31% | 42% |
| | | | | | | |
| | **46%** | **54%** | **51%** | **68%** | **62%** | **63%** |
| | **82%** | **73%** | **64%** | **76%** | **72%** | **66%** |

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# Endnotes

1. At the time that the Manantali project was conceived, the power sectors of the three countries (Mali, Mauritania and Senegal) were faced with the serious need for reliable, low-cost power supply and increased electricity access in urban and rural areas. The three countries had low supply and high cost of electricity coupled with low electrification rate. The main problems identified in the project appraisal reports remain valid today and have even worsened. While Mali and Mauritania have periodic generation deficits, blackouts are chronic in Senegal. Given the increasing cost of petroleum fuels, the electricity generated at Manantali has been providing a substantially lower-cost alternative to thermal-based power generation and also respond to the need to develop more clean sources of energy with limited greenhouse emissions.
2. The availability of electricity markets beyond the borders of Nigeria was relevant to the Federal Government of Nigeria's (FGN) stated goal of deriving maximum benefit from the country's abundant oil and gas resources. This was achieved by encouraging private investment in gas-fired thermal power generation for both domestic as well as export markets. Additionally, the evaluated project provided a platform for the countries involved to integrate into the regional Power Pool by linking their electricity grid and improving reliability of supply and optimising production cost within the sub region. The Victoria Falls – Katima Mulilo Interconnection Project (Zambia) - also served to enhance Zambia's capacity to derive greater export revenues from its abundant hydro power resources, particularly during off-peak periods, while providing cheaper hydropower to offset expensive thermal generation in Namibia. By strengthening the power interconnection between Zambia and Namibia, the project served to deepen the regional Integration and cooperation goals of SADC
3. The ongoing Zimbabwe-Zambia-Botswana-Namibia (ZiZaBoNa) power transmission corridor will support regional linkages that circumvent the current regional flows via South Africa by channelling power between Zimbabwe, Zambia, Botswana and Namibia. The existing 220kV/200MW Victoria Falls-Katima Mulilo interconnector has become a vital segment of the ZiZaBoNa project although not envisioned originally. In the first phase of ZiZaBoNa, 100MW will be transferred from ZESA (Zimbabwe) to NamPower (under a 15-year contract, that commenced in 2012), wheeled over the Victoria Falls-Katima Mulilo line.
4. In the case of NEPA-CEB Project, it was well known at inception report in 2002 that NEPA's weak financial situation affected its capacity to maintain and operate its installations efficiently. Project staff in both PHCN (NEPA) and CEB had limited capacity to effectively operate the substations. However, this issue was not properly addressed. Accordingly, project staff did not receive adequate training to operate effectively the substations. Without adequate training there was a risk to sustained achievement of project outcomes because project staff were using previous experience this sometimes did not necessarily apply to the project's proposed technology. For Victoria Falls-Katima Mulilo power, a weak financial position threatened the utility's capacity to operate and maintain the project asset effectively.
5. For example, the Manantali Energy project
6. Importing countries, such as Morocco, Benin and Togo, Namibia and Djibouti
7. In the case of the NEPA - CEBs interconnection project, power trade between Nigeria's TCN and CEB of Togo/Benin increased gradually from 570 GWH, representing a power flow of 75 MW in 2007 when the line was commissioned, to 1.489 GWH at the close of 2014, representing a power flow of 200 MW and a cumulative growth of 160 percent over the period. Similarly, power trade between Nam Power of Namibia and ZESCO of Zambia have been consistent at around the 50 MW firm power stipulated under the Power Purchase and Supply Agreement of 2010. Nonetheless, there was a four year delay in completing the Caprivi-HVDC link that connects the Namibian grid to that of Zambia through the project interconnector. Today, ZESCO's supply to Namibia over the interconnector constituted ten percent of total energy consumption in that country and 14.6 percent of Namibia's total imported power. In the case of the Ethiopia-Djibouti Power Interconnection Project, Djiboutian imports of hydropower from Ethiopia seem to have stabilized at around 350 GWh over the last three years.
8. In Morocco where the objective was to double the transit capacity of Morocco's interconnection with Spain from 700 mw to 1400 MW, the evaluation noted that while the 1400 MW was in services, additional 700 MW were underdevelopment. In the case of Ethiopia/Djibouti Interconnection project, four years into the operation of the line, Ethiopia and Djibouti have initiated action to construct a second line between the two countries.
9. The main result of the project was a more robust electricity grid that was capable of bringing available power from both local sources as well as imports to the targeted project beneficiaries in a reliable manner. Overall outage duration in 2007 was 20.4 minutes and in 2008, 22.9 minutes compared to 34 minutes in 2000. Transmission loss rate has dropped from 5.8 percent in 2002 to 4.7 percent in 2008 and 4.3 percent in 2014
10. Owing to insufficient generation in the Nigerian grid, which was struggling to meet a largely suppressed national demand load, coupled with frequent failures of obsolete generation and/or overloaded transmission infrastructure, frequencies tended to swing wildly beyond the acceptable range. This led to frequent partial or total collapses in the Nigerian grid. Inevitably, such interruptions are transferred to any interconnected system if they are electrically synchronized. To avoid importing these disturbances, CEB has had to separate its interconnected grid with VRA and CIE from its interconnection with TCN in Nigeria. In turn, this has compromised the reliability gains that could have been derived from synchronizing the two system. Consequently a segment of CEB load is supplied by the Nigerian grid, while the other segment is supplied by the CEB interconnect grid with VRA and CIE which is more stable. The assumption of reliability gains resulting from the interconnections should have been taken into account so as to strengthen and stabilize the national grids
11. For instance, the challenge of supplying reliable electricity to consumers persists in Senegal (Manantali project) due to weaknesses in the grid. In the case NEPA-CEB interconnection project, stakeholders assumed that reforms in the Nigerian power sector would automatically attract private sector participation to utilize Nigeria's abundant gas resources. This would improve generation capacity in Nigeria without ensuring the existence of concrete government policies and programs that guarantee adequate gas production and transmission to gas-fired power plants where they are required
12. Indeed, at appraisal, consumer surplus was calculated to total 22 US cents/kWh, which reflected prevailing tariffs. This was set against the "with project" import price of six US cents/kWh. Yet by the time the project was commissioned in 2011, average prevailing tariffs were 35 US cents/kWh.

Accordingly, the import price set at seven US cents per kWh resulted in a far larger consumer surplus. Even allowing for the fact that the prevailing tariff is set to reduce gradually over time to about 20 US cents/kWh, Djibouti will continue to derive huge consumer surpluses at the prevailing import price. This accounts for the extraordinary economic returns the project is currently enjoying. The Moroccan project on the other hand saw financial returns fall from the 31 percent estimated at appraisal to 18 percent at the PCR stage and down to a mere 0.27 percent at this evaluation. This reflects the fact that the average price of power imported from Spain has increased rather than decreased, as was originally projected. This is due to increases in the prices of primary fuels used for power generation in Spain and a provision for inflation in the exporting country. Almost all the projects are generating returns that are far in excess of what was forecast at the appraisal stage.

13. The external peer reviewer questioned some methodologic aspect of the project economic and financial analysis. This mean that results should be taken with caution.

14. Both Ethiopia and Zambia are drought prone countries. They export cheap hydro power to their neighbors, for example, Djibouti and Namibia. But these cross border power supply contracts rely heavily on good rainfall. Meanwhile, in West Africa the NEPA-CEB interconnector was a means for Togo and Benin, through their joint utility - CEB - to diversify their electricity supply sources through connecting their electricity grids to Nigeria, a country with an abundant supply of petroleum and natural gas resources. In the event of drought in Ghana this option would provide an economically viable source of power. However, during periods of poor rainfall in Ghana, VRA's ability to meet its contractual obligations to CEB was greatly compromised because nearly 68 percent of electricity generated in Ghana is from just two hydro power stations, both located in Akosombo and Kpong. Severe droughts in Mali in 2006 and 2007 severely diminished the output from the Manantali power station. In 2007, the plant generated 552.5 GWh, the lowest annual figure in nearly 15 years of the plant's operation and a total significantly below the annual goal of 804 GWh. This resulted in lower power sales to the OMVS member countries and forced many countries to resort to expensive emergency power supply arrangements to fill their supply deficit. This in turn had negative effects on utilities' balance sheets. For instance, between 2005 and 2008, Senelec was obliged to resort to Aggreko Power Rental Units for between 40 – 100 MW of diesel-fired thermal power at a cost of around FCFA 105/kWh, compared to FCFA 21/kWh for Manantali power

15. For instance, Nigeria's capacity to generate adequate electricity from its mostly gas-fired thermal plants to meet both domestic and export markets remain a critical risk that threatens the sustainability of the NEPA-CEB project. When all the NIPP plants have been commissioned by the end of 2015, the hydro to thermal mix in Nigeria's installed capacity will be a balance equivalent of nearly 15 percent to 85 percent. In spite of this outcome, the development of gas production, processing and transportation infrastructure has not kept pace with the roll out of gas fired thermal power plants. In fact, even though Nigeria has the ninth largest reserves of gas in the world, gas supply has always been a challenge due to poor gas infrastructure, low gas prices and continued vandalism on gas pipelines. Looking ahead, the ability of gas supply companies to confront the age old challenge of oil and gas pipelines vandalism will prove critical for addressing gas supply. It has been erratic in the past and local gas production from the Jubilee Oil and Gas Fields in western Ghana has limited capacity.

16. The increasing importance of the European energy market to Morocco and the whole of the Maghreb region means that extreme climatic conditions in Europe may limit the availability of surplus power for exports. This clearly presents a sustainability challenge to the Maghreb. Extreme climatic conditions in Europe tend to raise electricity demand and reduce the available power for Africa. Although Morocco's interconnections with the other Maghreb countries was strengthened under the project, it was expected that any reduction in Spanish imports would be substituted by increased imports from the Maghreb region

17. Indeed, the Morocco project increased power transfer capacity between the Morocco and Spain from 700MVA to 1400MVA enabling the rapid growth in net power imports that has spurred the growth in demand for electricity in Morocco. Total imports increased from 1533.4 GWh in 2002 to 6138.3 GWh in 2014, with imports from Spain accounting for almost all the electricity imported into the country. From 2006, when the IME2 started operation, imports from Spain have grown from 2030 GWh to 5835.5 GWh, representing an increase of 187.5 percent. The Algerian imports also saw an increase from 160.8 GWh in 2006 to 756.4 GWh in 2012, but dropped to 177.2 GWh in 2013, picking up slightly to 302.8 GWh in 2014. However, even if previous incidents had not impeded the maintenance and pursuit of energy cooperation between Morocco and Algeria, the evaluation finds that despite the interconnection capacity to import over 10,000 GWh annually from Algeria, Moroccan power imports from Algeria have been limited to less than five percent of line capacity

18. For instance, gas supply challenges in countries like Nigeria, Ghana, Algeria and Spain have the tendency to limit gas-fired thermal power generation and hence export capacity, and also impact the sustainability of the concerned interconnectors. In Nigeria and Ghana, the development of gas production, processing and transportation infrastructure, has not kept pace with the roll out of gas fired thermal power plants. The new GENCOs and IPP plants in both countries have suffered from insufficient gas supplies that continue to hamper their smooth operation. As a result, despite the nearly 10.109 MW of available generation capacity, the actual maximum ever achieved was 7492.6 MW in April 2014 due to gas supply constraints. This means that, nearly 2.600 MW of available capacity could not be dispatched as a result of gas unavailability.

19. This was in contrast to the Moroccan project which incorporated grid strengthening programs. Expectations of system reliability gains in Togo and Benin did not materialize due to the instability of the Nigerian grid. This has hampered synchronization of the grids. Assumptions about reliability gains in project areas resulting from interconnection projects should take into account the necessary requirements for attaining these gains/benefits and incorporate them as policy positions that should be adopted by the borrower as part of the loan conditions

20. For instance, the assumption that the deregulation of the power sector in Nigeria in itself was going to ensure adequate responses from the private sector to address Nigeria's generation shortfall was not entirely realistic. This was underlined by the fact that the FGN needed to make temporary interventions with respect to NIPP power plants, gas infrastructure development as well as transmission and distribution reinforcement projects. The Government did so to bolster the sector and to make it more attractive as an investment opportunity to the private sector. In addition, the sweeping assumption of reliability gains resulting from the interconnection should have taken into account the necessary requirements for stabilizing the Nigerian grid.

IDEV

Independent Development Evaluation
African Development Bank

An IDEV **Project Cluster Evaluation**

## About this Evaluation

This report synthesizes the results of a cluster evaluation of six power interconnection projects implemented during the period 1999-2013 and funded by the African Development Bank Group. These projects amounted to UA 196 million and linked the following countries: (1) Zambia and Namibia; (2) Morocco, Algeria and Spain; (3) Mali, Mauritania and Senegal; (4) Nigeria, Togo and Benin; (5) Ethiopia and Djibouti; and (6) Ghana, Togo and Benin. The objective of this cluster evaluation is: (i) to assess the relevance, effectiveness, efficiency, and sustainability of completed PI projects; and (ii) to identify key lessons on what worked and what did not work.

The evaluation used a theory-based approach that not only examined which results were achieved, but also how and why the results were achieved or not.

The evaluation used a common data collection protocol to collect both quantitative and qualitative data on the performance of each of the six projects. The data was generated from multiple data sources and collection methods including: (i) desk review of relevant AfDB documents and literature; (ii) interviews with key stakeholders (both inside and outside the Bank); and (iii) field visits of purposively selected project sites. Descriptive and comparative analysis were undertaken as well as data triangulation.

This project cluster evaluation is a learning product, focusing on findings and lessons. As such, it does not contain recommendations. Rather than AfDB Management preparing a formal Management Response, a knowledge sharing and capitalization workshop was held with the relevant operations departments of the Bank.

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