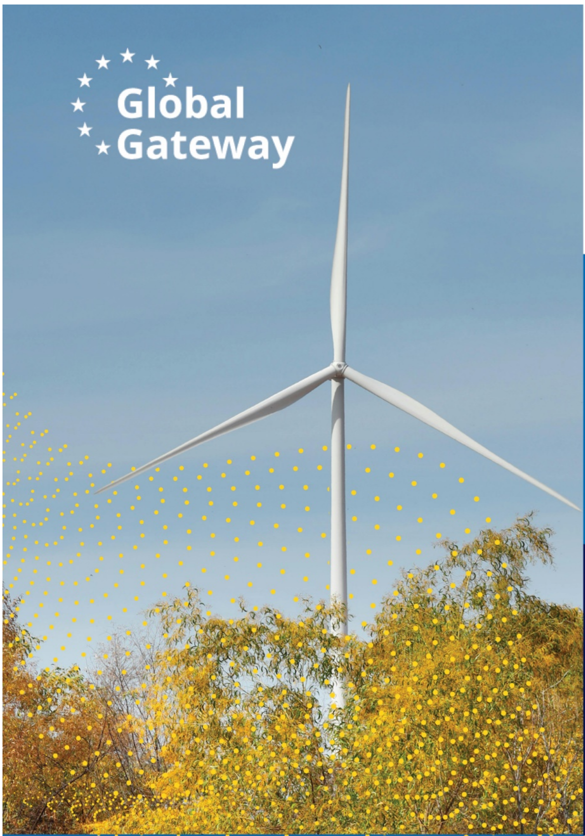

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Prefeasibility study on interconnection project:

Angola (Soyo)
- DR Congo (Inga)

Report Title	Prefeasibility study on interconnection project: Angola (Soyo) – DR Congo (Inga)
Version	V 2
Date	19/01/2026
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Executive Summary

Project context

The Pre-Feasibility Study for the Angola (Soyo) - D.R Congo (Inga) interconnector was conducted under the Continental Energy Programme for Africa (CEPA), an EU-funded technical assistance initiative (2025-2028) supporting the African Union (AU) energy programmes. CEPA's primary aim is to promote cross-border power cooperation, expand transmission networks at national, regional, and continental levels, and accelerate the adoption of renewable energy and energy efficiency, thereby contributing to the UN Sustainable Development Goal (SDG) 7, the AU Agenda 2063, and broader sustainable development objectives.

CEPA is supporting three flagship pan-African energy initiatives, which include the Africa Single Electricity Market (AfSEM), the Continental Power System Masterplan (CMP), and the African Energy Efficiency Strategy (AfEES), in collaboration with AU agencies involved in the energy sector and regional institutions such as the African Power Pools. The AfSEM and CMP were endorsed as flagship projects of the AU Agenda 2063 at the AU Assembly of Heads of State and Government in February 2024, in Addis Ababa, Ethiopia. Therefore, the CEPA is now focused on operationalising the CMP through two pillars: (I) supporting the update of continental and regional masterplans, and (II) preparing pre-feasibility studies for up to twenty (20) cross-border transmission projects. This Pre-Feasibility Study is being supported under Pillar II of the CMP programme.

Project description and rationale

The Angola (Soyo) - D.R. Congo (Inga) interconnector aims at sharing the generation capacities of both countries so that the resulting trade ends up in a lower cost of electricity for the consumers, which is a driving factors for two periods:

- Before the commissioning of the Inga 3 hydropower plant planned in D.R. Congo, the surplus generation capacity in Angola will be used to supply part of the growing demand in Kinshasa and surrounding areas, where present grid supply meets only a portion of effective demand and many consumers are unserved or rely on costly backup solutions.
- After the commissioning of Inga 3 (with an announced potential of up to 11,000 MW), DRC will have significant surplus low-cost hydropower. The interconnector will then act as a major evacuation corridor for Inga 3, complementing other planned routes such as the 400 kV "Boucle de l'Amitié" to the north-west and a high-capacity corridor towards the Katanga region and, further south, towards South Africa.

In the longer term, the Angola–DRC interconnector is envisaged as the first segment of a high-capacity north–south transmission backbone within the Southern African Power Pool (SAPP), reinforcing the interface between CAPP and SAPP and supporting the progressive development of the Africa Single Electricity Market.

Economic and financial aspects

A high-level Cost Benefit Analysis (CBA) compares two strategies for the interconnector (2.5 GW transfer capacity at 400 kV and 5 GW transfer capacity at 765 kV) against a "do nothing" approach. For the time being, Angola does not have the 765 kV voltage level among its standards for construction and operation: in this context, only the 400 kV option seems realistic in the short term while both options are studied in the rest of this document.

Both strategies show very high economic profitability. In terms of Economic Internal Rate of Return (EIRR), the 400 kV option achieves about 54% and the 765 kV option about 52% in the baseline case without Shadow Price of Carbon (SPC). When CO_2 externalities are valued using an SPC, the EIRR of Strategy

2 (765 kV) becomes higher than that of Strategy 1 (400 kV). The Benefit-Cost ratio is then 10.24 for the 400 kV strategy and increases to 14.16 for the 765 kV strategy.

- These high values are driven by three main factors: Before commissioning of Inga 3, the interconnector allows surplus Angolan generation (with costs around 11–12 EURc/kWh) to substitute for unserved demand and very high-cost "emergency" supply in western DRC (at around 18 EURc/kWh), where many consumers either lack access or rely on small diesel generators.
- After commissioning of Inga 3, low cost electricity is available and transferred from Inga 3 (5.9 EURct/kWh) to replace energy in Angola that is above 10 EURct/kWh. This difference is significant compared to other interconnection projects.
- Specific but well proven technologies like the 765 kV technology allow for massive transfers while using supports that are not very expensive (V guyed towers) compared to standard towers.

Sensitivity analysis has been carried out with respect to parameters that demonstrate the robustness of the profitability of the project: the discount rate (8%, 10%, 12%), the CAPEX (100%, 200%, 300% of reference values), and the year of Inga 3 commissioning (2035, 2040, 2045).

Given the above standardization limitation, the recommended strategy is Strategy 1 with 2.5 GW transfer capacity and at 400 kV.

The financial analysis could be done at a later stage considering that private investors can provide the main financing source supposing that guarantees are constituted, either at the state level or at the utility solvency level: the recommended financing model for the interconnector is blended financing comprising Independent Power Transmission (IPT) and sovereign loans and grants from international lenders, backed by government guarantees, with the transmission line assets owned by the IPT under a Build, Own, Operate, Transfer (BOOT) or Build, Operate, Transfer (BOT) scheme.

This is already in line with the existing legal framework of both countries. A financial analysis shows that even with electricity costs increased by 22% in DRC (to simulate the 22% export tax on electricity of DRC), the project remains largely profitable.

While the World Bank is presently committed to identify and gather the potential private investors for Inga 3, the same private investors could be approached for funding the Angola (Soyo) - DRC (Inga) interconnector. Moreover, this scheme would be fully aligned with their own participation to the Inga 3 investment.

Environmental Impact Scoping

In the area represented by the first 60 kilometers from Inga, the terrain consists of hills with an altitude ranging from 70 m to 500 m. Continuing westwards towards Soyo, the terrain becomes a plain. From the preliminary environmental scoping analysis carried out here, there is no key environmental impact identified that would hamper the feasibility of this interconnection project.

In fact, positive impacts are to be noted: once Inga 3 is commissioned, environmental benefits will include lower greenhouse-gas emissions through the displacement of thermal generation by hydro generation. Social benefits will encompass job creation during both construction and operation.

Primary objectives and Benefits

The technical design addresses several key strategic goals:

i) it seeks to boost regional transfer capacity between Angola and the DRC, enabling larger power exchanges, supporting bilateral energy trade, and providing access to least cost generation (the Inga site is unique because it benefits from the rainy seasons of both hemispheres, resulting in an almost constant river flow and consequently a minimized cost of generated kWh);

ii) it aims to improve grid reliability and redundancy, allowing mutual support during contingencies, therefore also reducing the risk and duration of electricity blackouts;

iii) it focuses on expanding energy access in rural and peri-urban border areas through downstream grid extensions and integrating distributed energy sources;

iv) it intends to foster industrial growth by providing stable electricity to emerging economic zones along the corridor, such as mining, manufacturing and logistics hubs, and also enables more in depth grid electrification both in Angola and DRC increasing energy access in both countries.

In the long term, the interconnector will become part of a regional transmission backbone linking CAPP and SAPP, paving the way for continental power-market integration aligned with the African Union's PIDA framework.

Recommendations and next steps

Approvals and Project Governance: Both governments should formally assess and endorse the pre-feasibility study results and commit to the project development. The utilities should lead the technical review and approval of the Pre-Feasibility Study, and the Ministries of Energy of both countries should affirm their support for advancing the project to the detailed Feasibility Study. Regarding project governance, a Joint Steering Committee is recommended to oversee the project's development. In parallel, a Project Management Unit, drawing staff from both countries, is required to handle the appointment of specialist services, such as consultants, owners' engineers and other advisors.

Feasibility Study: The next step is to conduct a detailed Feasibility Study, building on this pre-feasibility study's findings. The feasibility study will include a detailed market analysis, grid network simulations, detailed ESIA studies including Resettlement Action Plans (RAPs), comprehensive economic and financial analyses, and detailed project scope design. The feasibility study aims to present a bankable project with all required technical designs, environmental permits and agreements drafted, and funding structures in place to facilitate financing for construction.

Financing Strategy and Agreements: Concurrently, a resource mobilisation strategy should be implemented to fund both the detailed feasibility study and subsequent construction. The African Union Development Agency (AUDA-NEPAD) and SAPP can assist by promoting the project in continental fora and matching it with potential funders. It is recommended to prepare a Project Information Memorandum (PIM) emphasising the project's benefits, economic returns, and alignment with regional objectives, which will be presented at donor roundtables.

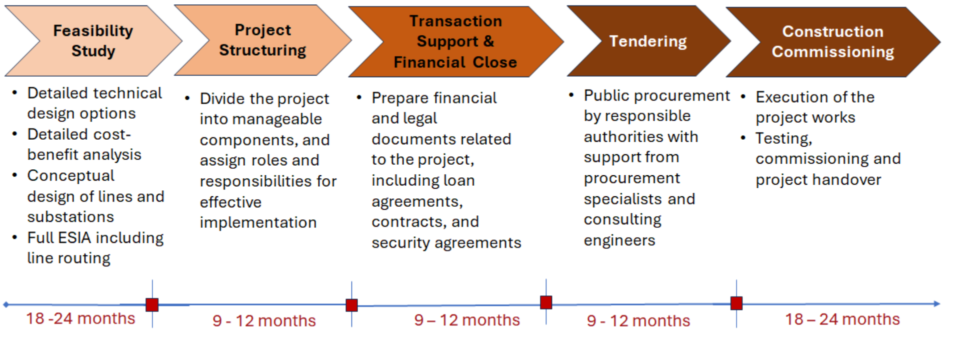
Legal and Regulatory Preparation: The project will require legal agreements covering institutional arrangements, cost allocation, and operational responsibilities. A power trading agreement specifying the tariffs will need to be drafted and approved by the regulatory bodies in both countries, i.e. ARE (DR. Congo) and IRSEA (Angola). Legal advisory support will be necessary to draft the required agreements.

Maximising Development Impact: Strategies should be put in place to ensure broader project benefits. A corridor development plan should be developed to leverage the transmission project to catalyse local community development. The corridor development plan should be accompanied by a job creation plan that encourages community participation and skills development, including vulnerable groups such as women and youth. This skills development concept is currently in preparation by the World Bank for the Inga 3 project itself: its extension to skills in the construction of transmission lines can be promoted.

Impact on Climate Change: This interconnection project between DRC and Angola is a first piece of a strategic regional corridor that would be a "West SAPP corridor", itself aiming at contributing to the decarbonization of the electricity generation of southern SAPP countries like South Africa and Botswana that rely heavily on coal and are large emitters of CO2.

Project Implementation Plan:

The proposed project implementation plan and timelines are provided below.



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Abbreviations list

ACE	Agence Congolaise de l'Environnement
ADPI	Agence de Développement du Projet Inga
AEGEI	Africa-EU Green Energy Initiative
AEIS	African Energy Information System
AfCFTA	African Continental Free Trade Area
AFD	French development agency
AfDB	African development Bank
AfEES	African Energy Efficiency Strategy
AFREC	African Energy Commission
AfSEM	African Single Electricity Market
APUA	African Power Utility Association
ARE	Autorité de Régulation du secteur de l'Electricité
ASR	African School of Regulation
AU	African Union
AUC	African Union Commission
AUC-DIE	African Union Commission Department of Infrastructure and Energy
AUDA-NEPAD	African Union's development agency
BESS	Battery Energy Storage Systems
C&SE	Communication & Stakeholder Engagement
CAPP	Central African Power Pool
CEPA	Continental Energy Programme in Africa
CEREEAC	Regional Centre for Renewable Energy and Energy Efficiency for Central Africa
CMP	Continental Power Systems Master Plan
CO2	Carbon Dioxide
COMELEC	Comité Maghrébin de l'Électricité
CORREAC	Commission Régionale de Régulation de l'Électricité de l'Afrique Centrale
CREEEs	Regional renewable energy and energy efficiency centres
DBSA	Development Bank of Southern Africa
DESIREE	DEmand-side management, Social Infrastructures, Renewables and Energy Efficiency
DFIs	Development finance institutions
EACREEE	East African Centre of Excellence for Renewable Energy and Energy Efficiency
EAPP	Eastern African Power Pool
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EE	Energy Efficiency
EIB	European Investment Bank
EPB	Energy Performance in Buildings
EREA	Energy Regulators Association of East Africa
ERERA	ECOWAS Regional Electricity Regulatory Authority

ESCOs	Energy service companies
ESIA	Environment and social impact assessment
ETSAP	Energy Transition Strategy and Action Plan
EU	European Union
EUD	European Union Delegation
eVs	E-vehicles
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
GIZ	German Cooperation Agency
GTAF	Global Technical Assistance Facility
HVDC	High Voltage Direct Current
IAEA	International Atomic Energy Association
IEA	International Energy Association
IFIs	International financial institutions
INGA	Instituto Nacional de Gestao Ambiental (Angola)
IPP	Independent power production
IPT	Independent power transmission
IRB	Independent Regulatory Board
IRENA	International Renewable Energy Agency
IRSEA	Instituto Regulador de Servicios de Electricade e Agua (Electricity and Water Regulatory Authority of Angola)
KfW	German state-owned investment and development bank
KS	Knowledge Sharing
kWh	Kilowatt-hour
LogFrame	Logical Framework
M&E	Monitoring & Evaluation
MDBs	Multilateral development banks
Med-TSO	Association of the Mediterranean Transmission System Operators
MEPS	Minimum energy performance standards
NEESAP	National energy efficiency strategies and action plans
NKE	Non-Key Expert
PACE	Property assessed clean energy
PAP	Project Affected People/Persons
PAP2	Second Priority Action Plan
PIDA	Programme for Infrastructure Development in Africa
PIM	Project Information Management
PPP	Public-Private Partnership
PSSE	Power system simulator for engineering (A Siemens product)
PtX	Power-to-X
PV	Photovoltaic
RAERESA	Regional Association of Energy Regulators for Eastern and Southern Africa
RCREEE	Regional Centre for Renewable Energy and Energy Efficiency
RE	Renewable Energy

RERA	Regional Energy Regulators Association of Southern Africa
RES	Renewable Energy Sources
RFNBO	Renewable fuels of non-biological origin
RNT	Rede Nacional de Transporte de Electricidade (TSO of Angola)
SACREEE	SADC Centre for Renewable Energy and Energy Efficiency
SADC	Southern African Development Community
SAF	Sustainable aviation fuel
SAPP	Southern African Power Pool
SARERA	SADC Regional Energy Regulators Authority
SC	Steering Committee
SCM	Steering Committee Meeting
SDG	Sustainable Development Goals
SHS	Solar home systems
SNEL	Société National d'Electricité (power utility of DRC)
SO	Specific Objective
SPC	Shadow Price of Carbon dioxide
SPCU	Strategic Planning and Coordination Unit
SPLAT	System Planning Test
T&D	Transmission & Distribution
TA	Technical Assistance
TAF	Technical Assistance Facility
TEI	Team Europe Initiative
TL	Team Leader
ToR	Terms of Reference
TSO	Transmission System Operators
vRE	Variable renewable energy
WAPP	West African Power Pool
WB	World Bank

1 Introduction

1.1. Objectives and expected outcomes

The **overall objective of the Continental Energy Programme in Africa (CEPA)** is to advance cross-border cooperation in power system and electricity market operation, support transmission network development at the national, regional and continental levels, and move forward Africa's renewable energy and energy efficiency agendas – thereby contributing to the achievement of SDG7 and other sustainable development goals.

Through the provision of high-level technical assistance (TA) and policy advice, CEPA will support the development and implementation of the three pan-African energy programmes:

- African Single Electricity Market of AfSEM,
- Continental Power System Master Plan (CMP) operationalisation,
- African Energy Efficiency Strategy or AfEES),

and thereby help create a conducive environment for attracting public and private investment in energy access, renewable energy and energy efficiency across the continent.

The CMP operationalisation consists of 2 pillars:

1. Pillar I: The update of the CMP
2. Pillar II: The preparation of up to 20 pre-feasibility studies for projects that are at the concept stage

The present report is a pre-feasibility study for Angola- D.R. Congo that is in the frame of Pillar II of the CMP. The two countries have signed a Memorandum of Understanding for preparing this interconnection, and several driving factors are expected to favour the project, notably:

- On the short term, the fact that present and future generation capacity of Angola could serve to supply part of the unserved demand of DRC, particularly in the Kinshasa area.
- On the medium term, the fact that in DRC, a key large power plant to be introduced is the hydro power plant Inga 3 (sized at 11,000 MW) that will need evacuation corridors, including towards countries at the south. Conversely, investing in that interconnection will favour an accelerated set-up of the Inga 3 project, which itself would secure access of SAPP countries to the low cost and clean energy of Inga 3.
- On the longer term, the Angola-DRC interconnection will be the first piece of a high capacity North-South power corridor of the SAPP, able to transfer power southwards to Zambia, Namibia and South Africa.

This project is further to another Angola-DRC interconnection project, the private initiative of Hydro-Link to build a transmission line from the South East of DRC (Katanga-Copperbelt region) to Lauca and soon Caculo Cabaça, which is 1,150 km long and designed for 1.2 GW power transfer[1] from Angola to DRC.

Given the many benefits of interconnections in general and the particular context of the projected interconnection (supply the unserved consumers of Kinshasa area, then evacuate the energy of a hydro power plant expected to provide electricity at low cost), the Cost Benefit Analysis presents very attractive outcomes for the Angola-DRC interconnection project.

[1] https://ippjournal.com/update/hydro-link-signs-pact-to-build-us15-billion-power-transmission-line-between-angola-and-drc expected to be commissioned in 2029

1.2. Purpose of the Study

The purpose of the study was to conduct a pre-feasibility assessment of the interconnector project and to recommend the next steps for further development. The pre-feasibility assessment comprised the following activities:

- Conduct a high-level assessment of the legal and regulatory frameworks in both countries and identify the key players and stakeholders in the electricity sectors of both countries,
- Evaluate the existing and future generation and transmission systems in both countries and determine the potential energy (GWh) and power (MW) flow exchanges across the planned interconnector,
- Conduct a high-level economic and financial evaluation of the project to determine its potential benefits to both countries, and
- Recommend the next steps for the project development.

During the early stages of the study, the CEPA team conducted a mission to DR Congo and Angola from July 21 to 25, 2025, for meetings with key project stakeholders in both countries.

The structure of the present report follows the steps outlined in the Programme for Infrastructure Development in Africa (PIDA) Prefeasibility Studies Implementation Guidelines v. 2.0, as discussed in detail and agreed upon with AUDA-NEPAD between April and May 2025. The remainder of the report is structured as provided in **¡Error! No se encuentra el origen de la referencia.**.

Table 1: Report Structure

Section in Report	Name	Description
2	Study Methodology	Present how the pre-feasibility study was conducted
3	Stakeholders and Communication	Evaluate the key stakeholders and identify their influence and roles in the project development.
4	Project Background	Presents the key project data in both countries
5	Analysis of countries' strategic objectives	Assess the alignment of the project with the countries' objectives
6	Technical and economic feasibility	Evaluation of the project's impacts, costs and benefits
7	Preliminary Environmental and Social Impact Assessment (ESIA)	Selection and assessment of the least impact line route
8	PPP Suitability and Affordability Screening	Assessing the project's potential to attract public and private investment
9	Project Screening	Screening the key elements of the project to determine the case for a full feasibility study
10	Project Management Plan and Project Governance	Develop the project implementation plan from full feasibility to execution.
11	Preparation and Next Steps	Recommend the next steps in developing the project

2 Study Methodology

The developed study methodology enabled the assessment of the project's key elements to establish its purpose, ensuring that the interconnector addresses a specific need and aligns with the strategic objectives of both Angola and D.R. Congo, as well as with regional and continental organisations such as the SAPP and AUDA-NEPAD. The methodology sought to illustrate how the project aligns with country and regional objectives and foster consensus among key stakeholders to secure strategic buy-in before making further investments. Figure 1 illustrates the applied study methodology.

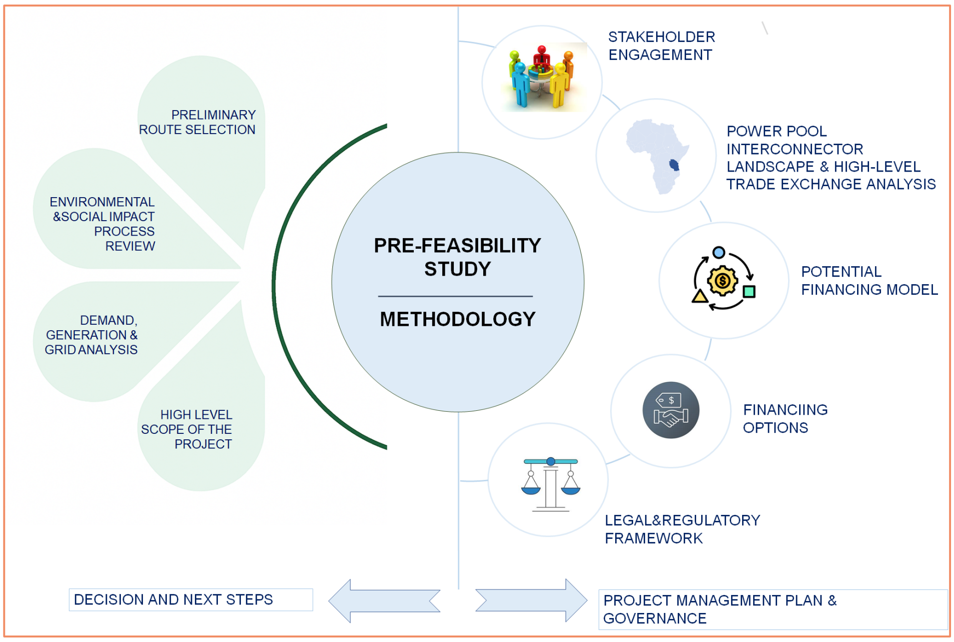


Figure 1: Study Methodology

The Pre-Feasibility study methodology entailed identifying the project's key stakeholders through a review of available documents, complemented by on-site missions to both Angola and D.R. Congo to ascertain the level of priority and support for the project in both countries. The D.R. Congo electricity market's potential to support the project's economics was investigated, considering existing and forecasted demand and supply in both countries and, to a limited extent, the region. The entire SAPP market was not analysed at this stage, as the project's first stage is focused on imports from Angola to D.R.C, and only in a second stage -once Inga 3 is commissioned- from D.R. Congo to Angola and other neighbouring countries (Zambia, Namibia). However, a detailed regional market analysis will be necessary at the Feasibility stage to quantify the project's influence on both country-to-country and regional electricity trade flows and economics.

A review of the legal and regulatory frameworks in both countries, complemented by data-gathering missions to Angola and D.R. Congo, was conducted to inform the effective implementation of the project in a legally compliant manner and to identify viable funding models. Furthermore, the review also informed the proposed project management plan and governance structure.

Moreover, the electricity transmission grids in both countries were assessed to confirm the interconnector's power transfer capacity. A high-level assessment of the project's environmental and social impacts (ESIA) was conducted to verify the ESIA process in both countries and to identify the least-impact transmission line route that avoids sensitive areas, such as forest reserves and heritage sites, and overall minimises social and environmental impacts.

The study concluded with a Cost-Benefit Analysis (CBA) to estimate the project's economic viability and outlined the next steps in project development, including estimated capital expenditure and financing requirements for various components from the Feasibility Study through implementation.

3 Stakeholders and Communication

3.1 Stakeholder Analysis

Angola Market Structure

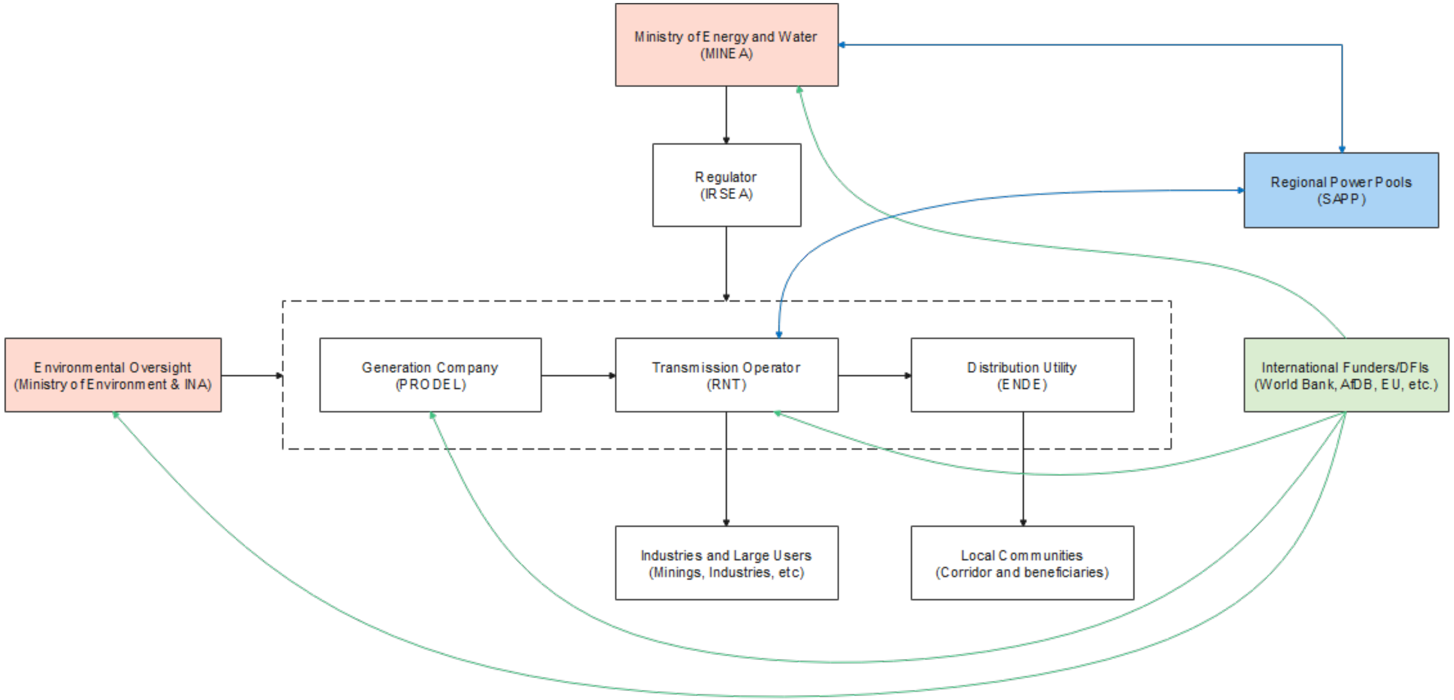


Figure 2: Market Structure for Angola

In Angola, the electricity sector is relatively stable and well-coordinated, but it relies on a network of internal stakeholders whose collaboration determines the success of the Soyo–Inga interconnection.

At the top is the Ministry of Energy and Water (MINEA), which sets the national energy strategy and in the frame of interconnections leads bilateral negotiations. MINEA works with the regulator IRSEA, responsible for licensing and tariff approval, and in the future will be controlling that exports do not hamper supply of electricity to national consumers.

Beneath them, the national transmission operator RNT manages the operation of G&T system and the future interconnectors, maintains system stability, and ensures the planning and the reliability of the supply to the distribution utility and to large consumers. In the frame of this interconnection project, RNT's relationship with PRODEL, the generation company, is vital, as PRODEL must allocate surplus power from Soyo and other power stations for export.

ENDE, the national distribution utility holds the revenue collection of the whole sector. Collectively, these institutions form a closely aligned chain: MINEA provides political leadership, IRSEA maintains regulatory power, and RNT, PRODEL, and ENDE implement operations.

In Angola, the transmission corridor of the interconnector slightly impacts local communities in Zaire and Lunda Norte provinces. The relationship of the related province administrations with MINEA and RNT is managed by the Ministry of Environment and its agency Instituto Nacional de Gestao Ambiental (INGA), which is responsible for reviewing and approving the environmental and social impact assessment (ESIA).

It is likely that communities anticipate tangible benefits such as compensation, jobs and electrification, and without these they might oppose or delay the project. The Ministry of Environment and INA link Angola's internal approvals with external stakeholders, particularly international funders, since no project of this scale advances without adhering to international safeguard standards.

Externally, Angola's partnerships are anchored in development finance institutions (DFIs) such as the World Bank, AfDB, EU, KfW, and DBSA[2]. These financiers engage directly with MINEA, RNT, and PRODEL, conditioning their support on governance, financial sustainability, and robust safeguards.

Angola also benefits from its membership in both the Central African Power Pool (CAPP) and the Southern African Power Pool (SAPP), which strengthens its position as a future regional exporter. Through these regional platforms, Angola hopes not only to supply DRC until Inga 3 is commissioned, but also to integrate more deeply into continental electricity markets.

The Angolan side thus combines strong institutional coordination with external financial and regional linkages, giving it both credibility and leverage in the interconnection project.

Below is a table providing a complete stakeholder analysis for the Angolan electricity market.

[2] Development Bank of Southern Africa

Table 2: Stakeholders analysis for Angola

#	Stakeholder	Role	Interests/Concerns	Goals	Importance	Current Support	Influence (How they could block project)
1	MINEA (Ministério da Energia e Águas – Ministry of Energy and Water)	Sets national energy policy, oversees utilities, and negotiates bilateral agreements with DRC	*Interests:* Monetise surplus generation, strengthen Angola's role in regional energy trade, and ensure national supply security. *Concerns:* Risk of over-committing exports at the expense of domestic needs; political risks in cross-border agreements	Position Angola as a regional power hub; leverage Soyo generation for exports; secure revenue	High	High	Could block by withholding political approval, delaying agreements, or reprioritising power for domestic use
2	IRSEA (Instituto Regulador dos Serviços de Electricidade e de Água)	Energy and water regulator; licenses, tariffs, compliance	*Interests:* Establish cost-reflective tariffs; ensure transparency in cross-border PPAs; protect Angolan consumers. *Concerns:* Political pressure to keep tariffs low (instead of cost-reflective); limited regulatory capacity for regional trade	Strengthen the credibility of Angola's regulatory framework; ensure balanced trade.	High	Medium	Could block by refusing tariff/licensing approvals, or weaken the project by misaligned tariff structures

#	Stakeholder	Role	Interests/Concerns	Goals	Importance	Current Support	Influence (How they could block project)
3	RNT (Rede Nacional de Transporte de Electricidade)	National transmission system operator	*Interests:* Ensure stable cross-border flows; protect system security; expand Angola's transmission backbone. *Concerns:* Technical and operational risks of large-scale exports; integration challenges	Guarantee reliable operation of the interconnector; strengthen the grid infrastructure.	High	High	Could block by not commissioning/maintaining required grid enhancements; system instability could compromise project viability.
4	PRODEL (Empresa Pública de Produção de Electricidade)	State-owned generation company	*Interests:* Increase utilisation of generation assets (Soyo CCGT and hydropower plants); expand export revenues. *Concerns:* Over-reliance on exports; delays in PPA signing; payment risks from SNEL	Optimise generation portfolio by diversifying domestic and export markets	Medium–High	Medium–High	Could block indirectly by withholding generation allocation or failing to dispatch supply as committed
5	ENDE (Empresa Nacional de Distribuição de Electricidade)	National distribution utility	*Interests:* Secure a stable supply for domestic consumers; reduce losses. *Concerns:* Fear of prioritisation of exports over domestic distribution	Ensure reliability of the domestic power supply while interested in benefiting from the revenues of interconnection	Medium	Medium	In a worst case scenario, could lobby politically against exports if domestic demand suffers. However this case is unlikely given the fact that a specific extension of Soyo would be dedicated to export to DRC.

#	Stakeholder	Role	Interests/Concerns	Goals	Importance	Current Support	Influence (How they could block project)
6	Local Communities (Zaire & Luanda Norte provinces, near corridor)	Host populations along the transmission line	*Interests:* Access to electricity, jobs, infrastructure improvements, and fair compensation *Concerns:* Land acquisition, resettlement disputes, exclusion from benefits	Gain employment, local electrification, and better infrastructure	Medium	Medium	Could block progress through protests, land disputes, or resistance to ROW acquisition
7	Ministério do Ambiente & INGA (Instituto Nacional de Gestao Ambiental)	Approve and monitor ESIA; enforce environmental laws	*Interests:* Compliance with Angola's environmental regulations, biodiversity, and social safeguards *Concerns:* Risk of inadequate ESIA; reputational damage if environmental harm occurs	Ensure environmentally sustainable implementation; safeguard communities	High	Medium	Could block by refusing ESIA approval or imposing stricter mitigation measures
8	International Funders / DFIs (World Bank, AfDB, EU, KfW, DBSA, etc.)	Provide finance, guarantee, and oversight	*Interests:* Bankability, governance, E&S safeguards, and regional integration success *Concerns:* Governance risks, weak enforcement, and payment risk from the DRC (SNEL or any other entity in charge)	Finance a viable project aligned with SDG7, climate goals, and regional integration.	High	Medium–High	Could block by withholding funding/guarantees, requiring extra studies, or delaying disbursements

#	Stakeholder	Role	Interests/Concerns	Goals	Importance	Current Support	Influence (How they could block project)
9	SAPP (Southern African Power Pool)	Regional pool linking DRC with southern Africa	*Interests:* Enhance regional trade, integration, and reliability. *Concerns:* Technical/market integration challenges, governance	Enable DRC's exports to Southern Africa in future	Medium–High	Medium	Could block by not supporting to secure funding for follow-up feasibility study

DR Congo Market Structure

The DRC electricity market structure is semi-liberalised but still dominated by SNEL as the main utility. The Ministry (MRHE) sets the policy direction, ARE regulates, and ANSER, along with small private operators, addresses rural and peri-urban electrification. Industrial demand drives much of the sector, especially in Katanga, and mainly for mining activities, while residential access remains very low. International funders and regional power pools play an essential role in shaping the sector's future.

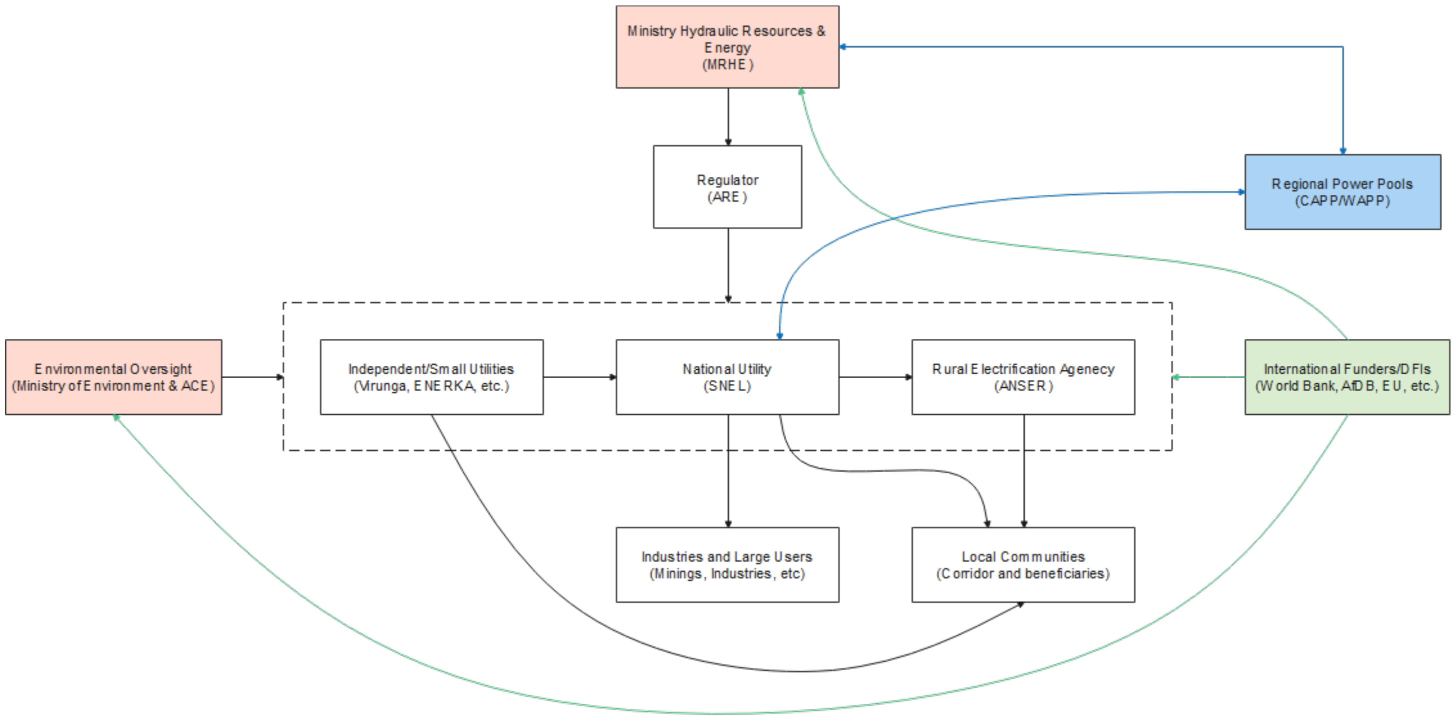


Figure 3: Market Structure for the DR Congo

In the DRC, the electricity sector remains fragmented and fragile, with internal stakeholders presenting both opportunities and risks.

At the centre, the Ministry of Hydraulic Resources and Energy (MRHE) sets national policy and has signed a bilateral agreement with Angola regarding the interconnections[3]. It collaborates with the Electricity Regulatory Authority (ARE), which establishes tariffs, issues licences, and enforces compliance. Together, MRHE and ARE form the foundation of the project's policy and regulation, although political considerations and capacity limitations heavily influence their decisions.

The state utility SNEL is the primary operational stakeholder. In the frame of the Inga-Soyo interconnection, it will be acting as the off-taker of Angolan power and managing the transmission grid. SNEL's role is vital; however, its weak financial health and history of payment arrears may pose significant risks to the project's sustainability in case the commissioning of Inga is delayed for many years. If SNEL cannot guarantee reliable payments, donor funding and investor confidence could be undermined.

Alongside these central actors, other institutions add additional layers. ANSER, the rural electrification agency, aims to ensure that large projects like Soyo–Inga also benefit rural and peri-urban communities, often aligning with donor priorities. Smaller utilities such as Virunga Energies and ENERKA operate independently in remote areas, away from the interconnection corridor, but highlight the growing importance of decentralised power solutions. Local communities along the DRC side of the interconnection corridor are crucial for the project's social licence, as they expect fair compensation, electrification, and employment. Their acceptance is closely linked to the oversight of the Ministry of Environment and ACE, which reviews the ESIA and guarantees compliance with environmental and social safeguards.

Externally, international funders such as the World Bank, AfDB, EU, KfW, and DBSA are influential. They engage directly with MRHE, ARE, and SNEL, providing funding while insisting on reforms and compliance with governance and safeguard standards. Like Angola, these financiers work closely with environmental authorities to address community concerns and biodiversity protection. At regional level, DRC's involvement in both CAPP and SAPP supports its ambitions to become a continental energy hub, anchored by the Inga complex. However, unlike Angola, DRC's credibility in regional frameworks is weakened by poor governance and institutional fragility, making donor support even more conditional.

Below is a table providing a complete stakeholder analysis for the D.R. Congo electricity market.

[3] Both for Inga-Cabinda-Pointe Noire (Boucle de l'Amitié) and for Inga-Soyo.

Table 3: Stakeholder analysis for the DR Congo

#	Stakeholder	Role	Interests and Concerns	Goals	Importance	Support	Influence (How could they block the project?)
1	MRHE (Ministry of Hydraulic Resources & Energy)	National policymaker, sector coordinator, bilateral agreements	*Interests:* Energy security, access, industrial competitiveness, and regional integration *Concerns:* SNEL's weakness, donor conditionalities, and political risks	Secure imports, strengthen grid, boost regional trade	High	High	Can block the project by refusing approvals or bilateral agreements
2	ARE (Electricity Regulator)	Licensing, tariff approval, compliance oversight	*Interests:* Transparent PPAs, fair tariffs, and regulatory credibility *Concerns:* Political pressure, weak institutional capacity	Create fair market rules, protect consumers, and attract investors	High	Medium	Can block the project by refusing tariffs, PPAs, or licenses
3	SNEL (National Utility)	Transmission operator, off-taker	*Interests:* Improved energy supply to the consumers, Reliable imports after interconnection, power supply to the industrial sector, improved reputation *Concerns:* Financial fragility, payment risk, and ageing network	Stabilise supply, reduce blackouts, satisfy mines/industry	High	Medium	Can block the project through non-payment of reimbursements to donors or block because of grid instabilities
4	ANSER (Rural Electrification Agency)	Expands rural/peri-urban access, manages subsidies	*Interests:* Inclusive electrification, donor alignment *Concerns:* Negligence/omission of rural areas, weak funding	Extend project benefits to communities	Medium	Medium–High	Can slow down the project indirectly by lobbying donors to insert a rural electrification component to the project
5	Small Utilities (Virunga, ENERKA, etc.)	Local generation/distribution in isolated areas	*Interests:* Recognition in national policy, grid integration *Concerns:* Marginalisation, lack of regulatory support	Expand operations, secure concessions	Low–Medium	Medium	Limited influence; can lobby donors for inclusivity

#	Stakeholder	Role	Interests and Concerns	Goals	Importance	Support	Influence (How could they block the project?)
6	Local Communities (Corridor)	Host communities along the ROW	*Interests:* Jobs, compensation, electrification *Concerns:* Land rights, displacement, exclusion from benefits	Gain livelihoods, infrastructure, and access	Medium	Medium	Can block the project via protests, land disputes, or resistance
7	Ministry of Environment & ACE	Approves ESIA, enforces safeguards	*Interests:* Compliance with E&S laws, protect biodiversity & livelihoods *Concerns:* Weak enforcement capacity, reputational risks	Guarantee sustainable project delivery	High	Medium	Can block by refusing ESIA approval or adding costly conditions
8	SINELAC (Regional Utility)	Multinational utility (Burundi, Rwanda, DRC)	*Interests:* Regional integration, cross-border credibility *Concerns:* Risk of being sidelined by bilateral mega-projects	Strengthen regional role, showcase shared utility model	Medium (Indirect)	Medium	Limited direct influence on the project; indirect influence through CEPGL/donors
9	Broader DRC Industry (Mining, IPPs, EPCs)	Consumers, contractors, developers	*Interests:* Reliable supply, fair tariffs, investment opportunities *Concerns:* Delays, governance risks, and high costs	Obtain secured power supply for operations, expand investments	High (Indirect)	Medium–High	Can block indirectly by bypassing SNEL or withholding support
10	International Funders / DFIs	Provide financing, oversight, and safeguards	*Interests:* Bankability, governance, regional trade, E&S compliance *Concerns:* Governance risks, SNEL solvency, safeguard failures	Finance a viable, sustainable, inclusive project	High	Medium–High	Can block by withholding finance or guarantees
11	CAPP (Central African Power Pool)	Regional power pool covering DRC and neighbours	*Interests:* Cross-border trade, regional integration *Concerns:* Weak interconnections, political fragmentation	Position DRC as a hub in Central Africa	Medium	Medium	Could block indirectly by withholding regional coordination support

#	Stakeholder	Role	Interests and Concerns	Goals	Importance	Support	Influence (How could they block the project?)
12	SAPP (Southern African Power Pool)	Regional pool linking DRC with southern Africa	*Interests:* Enhance regional trade, integration, and reliability. *Concerns:* Technical/market integration challenges, governance	Enable DRC's exports to Southern Africa in future	Medium–High	Medium	Could delay market integration, affecting export revenues

Partner Coordination & Other Stakeholders

Consultations between development partners and the DRC government are ongoing. Similarly, consultations are also taking place between the Angolan government and development partners.

On the DRC side, for example, ADPI (Agence de Développement du Projet Inga) is an energy sector working group discussing future options related to the evacuation of power from the upcoming Inga 3 project, and later the subsequent Inga projects. It maintains regular contact with development partners including the AfDB, World Bank (WB), IFC, French Development Agency (AFD), and the African Union. The World Bank has initiated a study on Demand Analysis and Forecast.

ADPI is also evaluating whether the Inga 3 project should be commissioned in a single phase or multiple phases. Regarding the Inga 3 project and its interconnection with Angola, the ADPI employs a participative approach that considers the requests of local communities, particularly in Kongo Central province, aimed at improving their living conditions and capacities.

On the Angolan side, the EU is involved through its GTAF in assessing the unbundling of the power sector, promoting energy access, and encouraging private sector participation. The World Bank is heavily involved in the interconnection project with Namibia ("ANNA" project), while AFD is launching projects aimed at reducing distribution losses and increasing access to electricity energy.

3.2 Communication Strategy

Objectives of the Communication Strategy

Recognising the centrality of effective and efficient communication and external relations in realising the project development objectives, the communication strategy aims to ensure all stakeholders, including the public in both countries, understand, recognise, and support the role of the project in the economic transformation of the two countries and the region.

Communicating impact for beneficiaries and delivering value for money for funders provides the best marketing tool for the project.

Strategy will aim to:

- Support stakeholder awareness and buy-in during feasibility and project preparation phases
- Promote transparency in planning, decision-making, and compliance
- Facilitate cross-border cooperation and alignment between national and regional actors
- Ensure local communities and Project Affected Persons (PAP's) are informed, consulted, and engaged in the process
- Build confidence among partners, regulators, DFIs/MDBs and the private sector about project readiness.

Target Stakeholders

Table 4: Target Stakeholders and Communication Focus

No	Category	Stakeholder	Tools/Channels	Purpose	Strategic Communication Focus
1	Internal – Government	The Government of Angola & the Government of the United Republic of DR. Congo - Ministries, Departments & Agencies (MDAs)	- Project Information Management (PIM), Feasibility Study Reports - Government Website - Stakeholder Workshops	- Formal communication to technical and financial stakeholders - Official Updates - Technical and strategic alignment	Policy alignment, institutional architecture, economic benefits, Value for Money and Public Private Partnerships for Infrastructure Development, implementation timelines
2	Internal - Utilities	Utilities (RNT, SNEL)	- Project Information Management (PIM), Feasibility Study Reports - Government Website - Stakeholder Workshops	- Formal communication to technical and financial stakeholders - Official Updates - Technical and strategic alignment	Scope, Quality, market design and system operations, human capital development, regional grid coordination & synchronization
3	Internal – Energy Regulators	Energy Regulators (IRSEA in Angola, ARE in DRC, Energy Regulators Association,	- PIM, Feasibility Study Reports - Government Website - Stakeholder Workshops	- Formal communication to technical and financial stakeholders - Official Updates	Operational, commercial & institutional readiness for regional power markets & trade; Tariff structure, grid

No	Category	Stakeholder	Tools/Channels	Purpose	Strategic Communication Focus
		Energy Regulation Centre of Excellence)		- Technical and strategic alignment	compliance & standards
4	External – DFIs/MDBs/IFIs	Development Partners, Banks, Financing Institutions	- PIM, Feasibility Study Reports - Government Website - Stakeholder Workshops	- Formal communication to technical and financial stakeholders - Official Updates - Technical and strategic alignment	Project milestones, Environmental & Social Safeguards (ESIA), transparent procurement strategy and selection methods; Social impacts
5	Internal – Host Communities /PAPs	Local Communities	- Public Participation - Government Website - Radio Announcements/Simplified Information Brochures	- Advocacy, Public Education, Awareness, ESIA Studies - Official Updates	Land use, social safeguards, compensation rights/FPIC, jobs, local supply
6	Internal – Environmental Regulators	Environmental Regulators: CEA (Congolese Environmental Agency), and in Angola the NIEM (National Institute for Environmental Management)	- PIM, Feasibility Study Reports - Government Website - Stakeholder Workshops	- Formal communication to technical and financial stakeholders - Official Updates - Technical and strategic alignment	Feasibility Studies, ESIA findings, mitigation strategies, alternative options, benefits
7	External – Local & International Media, NGOs, CSOs, PBOs	Media & Civil Society, Public Benefit & Non-Governmental Organizations	- Press Releases/Media Briefs - Government Website - Stakeholder Workshops	- Public and media engagement - Official Updates - Technical and strategic alignment	Project overview, public interest, environmental/ social impacts
8	External – Regional Organisations	Regional Entities (EAPP, EAC, NELSAP, SINELAC/ CEPGL)	- PIM, Feasibility Study Reports - Government Website - Stakeholder Workshops	- Formal communication to technical and financial stakeholders - Official Updates - Technical and strategic alignment	Power trade alignment, Asset Pricing/Tariffs, planning coordination; Capacity Building for efficient market & system operations for transmission system operators

Thematic Areas and Key Messaging

Table 5: Key Messages

No	Thematic Area	Strategic Communication Focus
1	Regional Integration	This project strengthens both Central Africa and Southern Africa energy security, economic integration, cohesion, and cross-border trade
2	Energy Access	Angola / DRC and are working together to deliver reliable, affordable electricity to their people.
3	Community Benefits	Local communities of both countries will benefit through jobs, infrastructure, and improved energy services.
4	Environmental & Social Responsibility	All necessary safeguards will be implemented to protect people, property, the environment, and interests.
5	Transparency	Commitment to open communication and stakeholder engagement throughout the project

Communication Timeline

Table 6: Communication Phases and Timing

Phase	Communication Focus	Duration
Pre-feasibility	Initial project disclosure, stakeholder mapping	3 Months
Feasibility Studies	ESIA/technical findings, community consultations, regional alignment	6 Months
Pre-construction	Land acquisition, compensation processes, updated technical scope	2 Months
Construction Preparation	Community engagement, grievance redress updates	t.b.d.

Feedback & Grievance Mechanism[4]: to be established

Monitoring & Evaluation

Table 7: Key Communication Performance Indicators

Indicator	Target
Stakeholder meetings held	≥ 10 across both countries
Media coverage (print/broadcast)	≥ 6 publications or features
Number of grievances addressed	100% of all submitted
Community satisfaction level	≥ 80% positive (via survey)
ESIA-related disclosures made	100% of required documents shared

Institutional Responsibilities

Table 8: Roles and Responsibilities in Communication

Stakeholder/Responsible	Role in Communication
Project Implementation Unit (PIU)	Lead coordination and execution of strategy

[4] This would typically include the following components: i) Local Grievance Committees (To be established in each affected region (Angola and DRC), ii) Public Engagement/Participation Fora. Iii) Toll-Free Phone Line: For community concerns (hosted by local government or project unit), iv) Feedback Boxes: Located at local government offices, v) Dedicated Project Email Address: For regional stakeholders and CSOs to send inquiries.

Ministries responsible for Energy (Angola, DRC)	Political engagement, media oversight
IRSEA/ ARE	Technical input, consumer information, and regulation
RNT / SNEL	POCs, Technical briefings
Partner Coordination Unit/ Communication Officers	Partner visibility, compliance reporting, and impact

4 Background for Soyo (Angola) – Inga (DR Congo)

4.1 Demand forecast in Angola

According to the *Plano Director do Sistema Eléctrico 2018–2040,* Angola's electricity system is set for rapid growth, with demand expected to rise from a peak of 5,195 MW in 2025 to 7,132 MW in 2030 and 9,180 MW in 2035, representing an average annual growth rate of around 6%. Energy demand follows the same trend, increasing from 30,275 GWh in 2025 to 53,316 GWh by 2035. The bulk of this load (+/-69%) is concentrated in the North network, which accounts for roughly two-thirds of total national demand. In contrast, the Central and Southern networks absorb most of the remainder, and the East remains relatively small.

4.2 Demand forecast in DR Congo

The Democratic Republic of Congo (DRC) does not have official, disaggregated demand projections from SNEL for the West and South networks, which are the main load centres. To fill this gap, forecasts have been prepared at SAPP level (2021), and result in the following figures.

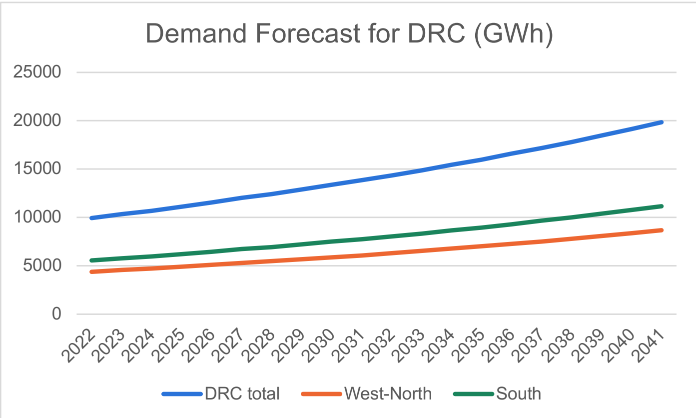


Figure 4: Demand Forecast for DR Congo

The measured peak for 2024 proved to be 2,010 MW for the whole country, which is a measurement showing a 61% load factor globally. As a result, the corresponding peak load forecast has a similar shape and shows the following values.

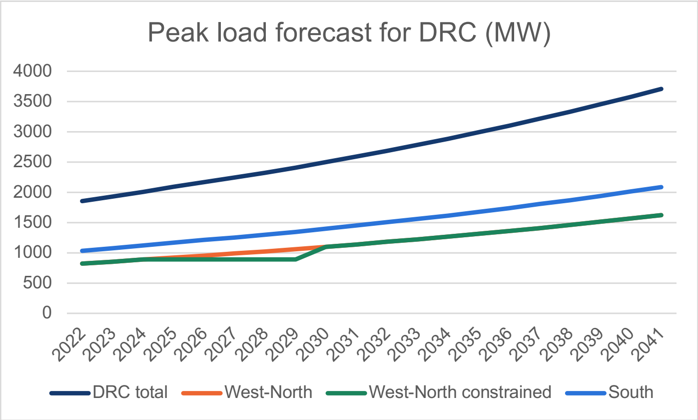


Figure 5: Peak Load Forecast for DR Congo

Since the supply to Kinshasa is presently constrained by the grid transfer capacity, the peak load in the West-North area will likely be capped because of two reasons: i) the limited available capacity from Inga 1 and 2 and ii) the limited transfer capacity of the transmission and distribution grid between Inga and Kinshasa. The present peak load of the West-North grid is estimated at 888 MW, and results in the green curve in the above figure. The ongoing rehabilitation of Inga 2 may however increase the available power supply with a specific step by step increase until 2030 or later.

Table 9: Medium Term Load forecasts for the West grid of DR Congo

in MW	2024	2025	2026	2027	2028	2029	2030
DRC total	2,010	2,088	2,165	2,243	2,321	2,408	2,498
West-North	888	922	955	988	1,022	1,059	1,098
West-North constrained	888	888	888	888	888	888	1098
South	1,122	1,166	1,210	1,255	1,299	1,348	1,399

The above figures show that the import of 600 MW to 750 MW from Soyo to DRC will provide two positive effects:

- It will unlock the supply to the West-North grid (mainly Kinshasa area) from 888 MW to at least 1,098 MW
- It will provide supply capacity to the HVDC line that supplies the south (Katanga and Copper belt) region

For the purposes of this pre-feasibility srudy, two demand scenarios are considered for DRC:

1. A ‘Reference’ scenario consistent with SAPP planning data and current investment commitments in generation and transmission; and
2. A ‘High growth’ scenario reflecting accelerated industrialisation (including the Special Economic Zones planned by the government) and higher electrification rates in Kinshasa and the Copperbelt region.

In the Reference case, peak demand in the West-North subsystem rises from 888 MW in 2024 to approximately 1,098 MW in 2030, assuming grid reinforcements keep pace with demand.

In the High growth scenario, peak demand could reach likely more than 3,000 MW in 2030, increasing the value of additional firm capacity delivered through the Angola interconnector. The Cost–Benefit Analysis uses the Reference scenario as the central case, knowing that a Least Cost Electrification Master Plan will address detailed demand forecasts and be developed in the coming months.

Higher growth trajectories would lead to chronic shortages, threatening industrial output in Katanga, constraining urban demand in Kinshasa, and undermining electrification targets nationwide, at least until Inga 3 is commissioned. In fact, the growth is dependent on both generation investments (Inga 3) and grid reinforcements that will be identified in the Electricity Sector Least Cost Master Plan for DRC presently launched by the Ministère des Ressources Hydrauliques et de l'Electrciité (Plan Directeur National D'Electrification à Moindre Coût (PDNEMC) de la République Démocratique du Congo (RDC), expected to be awarded in Jan. 2026).

As a result, it is here a "chicken and egg" problem where investments in generation and grids will enable the economic development and related demand for electricity. Any forecast presently available, from SAPP or other source, is by definition subject to the availability of generation and grids to supply the forecasted consumption. As a result, the present project is definitively an enabler of the Inga 3 project, which itself is an enabler of the future demand and related economic development: having all these investments properly coordinated will make the various Special Economic Zones planned and the electrification programmes become a reality. The above mentioned PFNEMC will clearly bring clarity and show strategies in this regard.

4.3 Generation and interconnection of Angola

To meet its demand, Angola's installed generation capacity will expand from about 8,416 MW in 2025 to over 13,524 MW by 2035. The North network is the clear hub, anchored by the large Kwanza River cascade Laúca (2,070 MW), Cambambe (960 MW), Capanda (520 MW), and the new Caculo Cabaça (2,172 MW) supplemented by Soyo CCGT (1,125 MW). By 2035, further additions such as Zenzo (950 MW) and Túmulo do Caçador (453 MW) will push northern capacity beyond 7,000 MW.

In Angola, Natural Gas is currently available only in Soyo, which is a place near the DRC border and less than 400 km from Kinshasa, a main consumption centre. The selection of Soyo as substation for this first Angola-DRC interconnector is therefore a key decision factor for transferring in the short term bulk electricity from Soyo CCGT to DRC and particularly Kinshasa.

Presently, the Angola power system consists in 5 power sub-systems[5]:

- Northern system
- Central System
- Southern system
- Eastern system
- Cabinda

The Central network gains projects like Lomaum, Genga (900 MW), Quilengue (210 MW), Lobito CCGT (1,125 MW), Quileva GTs, and new wind and solar farms, reaching over 3,400 MW.

The Southern system is strengthened by Baynes (300 MW), Namibe CCGT (720 MW), Tombwa wind (100 MW), and scattered solar projects, with around 1,200 MW installed by 2035.

The Eastern system remains modest, with Luachimo's 34 MW rehabilitation as its primary source.

This generation (see Table 10) trajectory ensures Angola maintains comfortable reserve margins of well above 20% over the forecast period. Crucially, the North network will consistently produce more than it consumes:

- in 2025 northern demand is about 3,570 MW against more than 5,800 MW of capacity, leaving a surplus of 2,200 MW;
- by 2030 the surplus is still about 2,000 MW; and by 2035 it exceeds 3,000 MW.

[5] https://angolaenergia2025.gestoenergy.com/en/conteudo/generation-0

This structural surplus underpins Angola's ability to not only supply its Central and Southern regions through reinforced 400 kV domestic corridors but also to become a net exporter to neighbouring countries.

Table 10: Existing and Planned generation capacity in Angola

Power Station	Type	Grid Region	2025	2030	2035	Notes
Baynes	Hydro	South (Namibe/Cunene)		300	300	Bi-national Angola–Namibia
Benguela Solar	Solar	Central (Benguela)	10	10	10	Pilot
Benjamin Wind	Wind	Central (Benguela)		52	52	Pilot
Cacombo / Calengue	Hydro	Central (Catumbela basin)		189	189	Identified in AO Energia 2025
Cacuaco GTs	GT	North (Luanda)	125	250	375	Peaking GTs
Caculo Cabaça	Hydro	North (Kwanza)	2,172	2,172	2,172	Major new hydro (will be in service in 2026)
Calenga Wind	Wind	Central (Huíla)		84	84	Early 2030s
Cambambe I & II	Hydro	North (Kwanza)	960	960	960	Existing
Capanda	Hydro	North (Kwanza)	520	520	520	Existing
Caraculo Solar	Solar	South (Namibe)	10	10	10	Pilot
Diesel/Biomass legacy	Diesel / Biomass		700	500	300	Progressive phase-down as hydro/CCGT expands
Genga	Hydro	Central (Huambo)			900	Starts 2035
Kiwaba Nzoji I & II	Hydro	North (Malanje)			104	Planned 2030s
Laúca	Hydro	North (Kwanza)	2,070	2,070	2,070	Completed ~2018
Lobito CCGT	CCGT	Central (Benguela)		750	1125	3 × 375 MW
Lomaum	Hydro	Central (Benguela)	65	65	65	Rehab/expansion
Luachimo	Hydro	East (Lunda Norte)	34	34	34	Small hydro
Lubango Solar	Solar	South (Huíla)		10	10	By 2032
Matala Solar	Solar	South (Huíla)			10	By 2034
Mussende I & II Wind	Wind	Central (Cuanza Sul)			80	By 2035
Namibe CCGT	CCGT	South (Namibe)		375	720	2 blocks staged
Nharea Wind	Wind	Central (Bié)			36	By 2035
Quilengue	Hydro	Central (Huíla)		210	210	Medium hydro
Quileva GTs	GT	Central (Benguela)	125	375	750	Staggered 2027–2033
Quipungo Solar	Solar	South (Huíla)			10	By 2035
Sambizanga GTs	GT	North (Luanda)	125	125	375	Staged GTs
Soyo CCGT 1	CCGT	North (Zaire)	1,125	1,125	1,125	Existing (phased 2017–18)
Soyo CCGT 2	CCGT	North (Zaire)	375	375	375	Planned for 2021
Tombwa Wind	Wind	South (Namibe)			100	Coastal
Túmulo do Caçador	Hydro	North (Cuanza Norte)			453	Planned 2035
Zenzo	Hydro	North (Cuanza Norte)			950	Early 2030s

Power Station	Type	Grid Region	2025	2030	2035	Notes
Total (MW)			**8,416**	**10,561**	**13,524**	
Additional Capacity (MW)				**2,145**	**2,963**	

In terms of energy generated, electricity in Angola is produced from the following sources: fossil fuels 25.04%, solar 0.12% and hydro 74.84% (data from 2022).

The installed capacity has increased fast during the last decade, as per the following graphic[6].

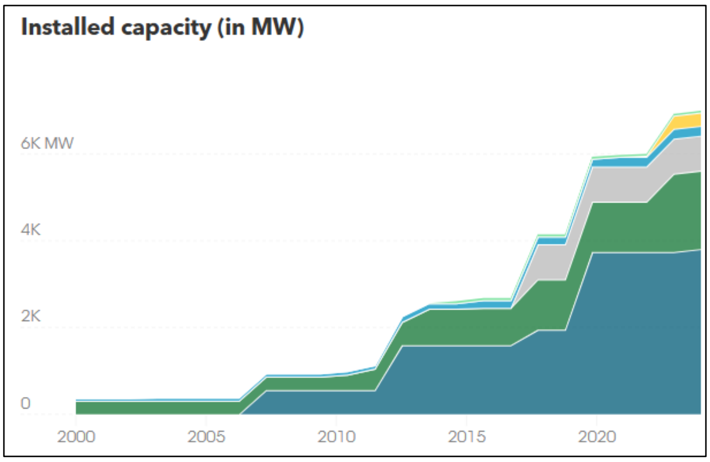


Figure 6: Installed Generation Capacity in Angola 2000 till 2025

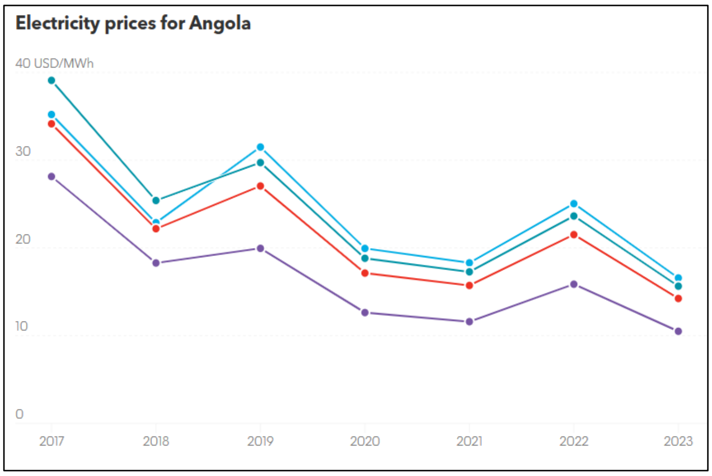


Figure 7: Electricity price in Angola 2007-2023

Since 2017 the price of electricity has been significantly decreasing, possibly linked to the large hydro power plants that have been commissioned since then.

[6] https://www.global-climatescope.org/markets/angola

As of 2025, Angola has no operational electricity interconnections with other countries. The Angolan grid remains outside the Southern African Power Pool (SAPP) synchronous grid until the commissioning of the interconnection with Namibia: integration efforts are ongoing and form part of Angola's long-term regional energy strategy. This means that, despite having significant surplus generation capacity in the North, Angola currently cannot export power across its borders.

Planned projects are, however, advancing. The most prominent is the Baynes Hydropower Project, a joint initiative between Angola and Namibia. Alongside the 600 MW bi-national plant of Baynes, new 400 kV transmission lines are proposed to connect Baynes HPP to Cahama in Angola and extend southward into Namibia, creating the first robust physical tie between the two countries. This Angola – Namibia (ANNA) development is expected to serve as the anchor point for Angola's eventual connection to the SAPP.

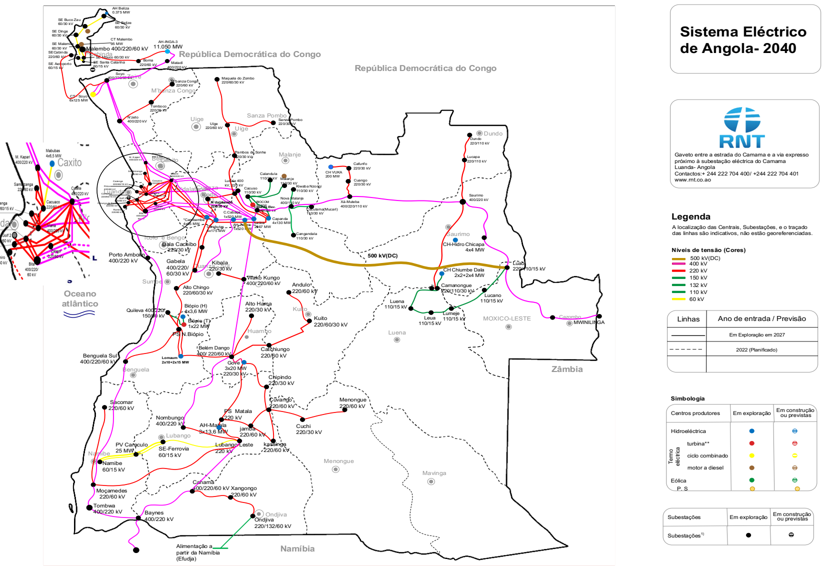


Figure 8: Planned Angolan electrical network in 2040

Another strategic project is the present Angola - DRC transmission corridor discussed here, designed to link Soyo on Angola's northwestern coast with Inga in the DRC. This corridor, still at the preparation stage, is studied firstly in this prefeasibility study, and more in depth in the feasibility study and ESIA that should follow. It is being promoted to enable Angola to supply hydropower and gas-based generation surplus into the DRC during a first period, and to export from DRC southwards in a next period (after commissioning of Inga 3). Since the internal DRC network is connected between the West (Inga) and the South (Kolwezi), the proposed interconnection could allow more power transfer to the mining heartland of Katanga.

4.4 Generation and interconnection of DR Congo

The Democratic Republic of Congo (DRC) possesses one of the world's largest untapped hydroelectric potentials, estimated at over 100,000 MW, much of which is concentrated at the Inga site on the Congo River. Despite this vast potential, the country's current generation capacity remains limited and is unevenly distributed across its extensive territory. As of 2025, the country's total available capacity is about 2,525 MW, with a substantial part not operational due to ageing equipment, inadequate maintenance, and operational restrictions.

The Western network, mainly consisting of Inga 1, Inga 2, and the Zongo plants, provides 2645 MW of installed capacity of which nearly 2,000 MW is available, which is just over 70% of the national total.

The Southern network, which supplies the Katanga mining hub, has just under 720 MW installed (25% of the national total). This imbalance is significant because most of the economic and industrial loads - particularly the energy-intensive copper and cobalt mines - are situated in the south, relying on relatively smaller stations such as Nseke, Nzilo, Koni, Mwadingusha, and the privately owned Busanga.

The Eastern, North-Eastern and North-Western regions remain supplied by a patchwork of small hydro plants (Ruzizi I and II, Tshopo, Mobayi, Bendera, Kilubi, etc.), of which the Ruzizi plants supply the Eastern grid. There is no integrated national transmission network capable of linking the country's major load centres: the west, south, east, north-east, and north-west all operate in isolation. The only significant internal link is the HVDC lines between Inga (West) and Kolwezi (South), consisting of two 500 MW circuits which allow bulk power transfer to the mining region. Still, this corridor is already saturated due to the demand growth in the South region (Katanga).

Table 11: List of existing and planned power stations and interconnections in the West and South networks

					2025			Generation Planning		
	Name	Units	Unit Rated Power (MW)	Rated Capacity (MW)	Available units	Available Capacity (MW)	Availability (%)	2025	2030	2035
W	INGA-1	6	58	348	3	174	50%	174	348	348
W	INGA-2	8	170	1360	3	510	38%	510	1,360	1,360
W	ZONGO-1A	3	13	39	1	13	33%	13	39	39
W	ZONGO-1B	2	15	30	1	15	50%	15	30	30
W	ZONGO-2	3	50	150	1	50	33%	50	150	150
	Total existing W					762		762	1,927	1,927
S	NSEKE	4	65	260	4	260	100%	260	260	260
S	NZILO	4	27	108	4	108	100%	108	108	108
S	Mwadingusha	3	10.8	32.4	4	43.2	133%	43.2	43.2	43.2
S	Mwadingusha	3	11.8	35.4	4	35.4	100%	35.4	35.4	35.4
S	Koni	3	14.04	42.12	4	56.16	133%	56.16	56.16	56.16
S	Busanga	4	60	240	4	240	100%	240	240	240
	Total existing S					**743**		743	743	743
W	Import - Congo							50		
W	Import - Angola								600	800
S	Import - Zambia							150	400	600
W	INGA 3									11,000
	TOTAL			2,644.92		1,516.56	57%	1,705	3,670	15,070

Source: SNEL

Externally, the DRC is connected to Zambia via multiple high-voltage lines, allowing both imports and exports within the Southern African Power Pool (SAPP). There is also a smaller link with the Republic of Congo (Brazzaville), though it operates at a much lower capacity. However, the lack of strong eastward and northward links has left large parts of the country reliant on small, isolated generation units with limited reliability.

At present, apart of the Inga 3 project led by the ADPI (Agence de Développement du Projet Inga), there is no comprehensive, publicly available information on new generation projects or firm import agreements beyond the limited assets already in service.

This absence of a clear pipeline for future generation capacity is one of the factors that cause the structural supply deficit across the country, where available generation barely meets half of the estimated demand. The lack of confirmed power generation projects and power import projects underscores the urgent need for a coordinated national generation and transmission development plan, without which the DRC risks prolonging its dependence on ageing hydropower plants, costly imports, and fragmented regional systems.

Envisaged power generation projects are:

- In the Eastern grid the Ruzizi III HPP (147 MW, construction from 2026-2030), and later on Ruzizi IV (287MW)
- In the Southern grid: Sombwe (132 MW) and Tembo project (about 117 MW) consisting in 4 plants (Kawa 17.5 MW, Dikolongo 18.6, Kambudji 31.9 MW and Tembo 50 MW)
- In the West grid, the Inga 3 project (11,000 MW), not sooner than 2032

4.5 Regulatory conditions and PPP suitability in Angola

Regulatory conditions in Angola for PPP can be summarized as follows.

Legal and Regulatory Context:

- Angola has strengthened its electricity law, particularly for transmission concessions, encouraging private sector involvement through PPPs and updated regulations.

Risk Assessment:

- Key risks for private investors include macroeconomic instability, limited sovereign guarantees due to high public debt, and a lack of established PPA templates.
- The government is urged to provide credible payment guarantees and improve transparency.

Affordability:

- Angola faces challenges in affordability, with a significant long-term investment need and heavy reliance on sovereign guarantees, leading to unsustainable debt levels. There is heavy reliance on sovereign guarantees risks debt levels reaching 100% of GDP which is deemed unsustainable.
- Electricity tariffs are low relative to costs, and revenue collection is low, undermining cost recovery.

Innovative Structures & PPPs:

- The Angola Power Development Master Plan suggests using PPP models, diversifying financing, restructuring tariffs, and exploring project-specific structures.
- Transmission concessions under the updated law will allow private entities to design, build, and operate projects under long-term contracts.
- Hydropower and gas-fired projects are suitable for PPPs, as are renewable energy projects with proper grid absorption and tariff mechanisms.
- Transmission projects are now formally suitable for PPPs.

Traditional Procurement:

- Smaller distribution/transmission projects are less attractive to private investors and remain under public procurement or are better suited for donor financing.
- On the opposite, large transmission projects like interconnections may attract private investors, particularly when transfers are secured either by low cost available generation, like it is the case for Inga power plants in DRC or by highly valued demand for consumption like Kinshasa deficit of electric energy.

4.6 Regulatory conditions and PPP suitability in DRC

Regulatory conditions in DRC for PPP can be summarized as follows.

Legal and Regulatory Context:

- The DRC has a PPP framework (Law No.18/016 of 2018 and Electricity law), but there's room for improvement, especially concerning state companies.

Risk Assessment:

- The DRC's size presents opportunities, but lack of governance (corruption) tend to increase the cost of services and materials.
- Governance: Political challenges and the lack of a dedicated PPP institution can hinder oversight.
- Infrastructure: while the country needs significant infrastructure rehabilitation and proper sectoral planning, the Angola-DRC interconnection would likely require reinforcements of the distribution of Kinshasa for the electricity to reach all the consumers.
- Access to Land: Land ownership is a risk due to the complexity of government layers.
- Construction Delays & Financial Risk: Security issues, delays in surveys/permits, and access problems can lead to increased costs.

Affordability:

- The financial state of SNEL makes it impossible for it to make the necessary capital investment to develop the grid as well as provide grid power for mining operations. Without these, diesel gensets are used but make power supply very expensive. One solution would be to leverage the strong investment focus on the mining sector and tie it to grid expansion through financing for this.

Innovative Structures & PPPs

- The DRC has built a strong experience in the East and North-East were private distribution companies (Discos) have built MV networks and are supplying entire regions, some the size of a small African nations. This is also the area with the biggest mining activities including the vast copper belt which extends to Zambia.
- The DRC seems ready to consider private investments or PPPs in transmission lines and interconnection lines.
- Based on the above, the regulatory framework can adapt to allow for the following:
    - SNEL can receive debt for specific components of the network expansion to members and pay it back through special rates if needed.
    - Regional TSOs with strong private sector equity component could be among the shareholders.

Procurement:

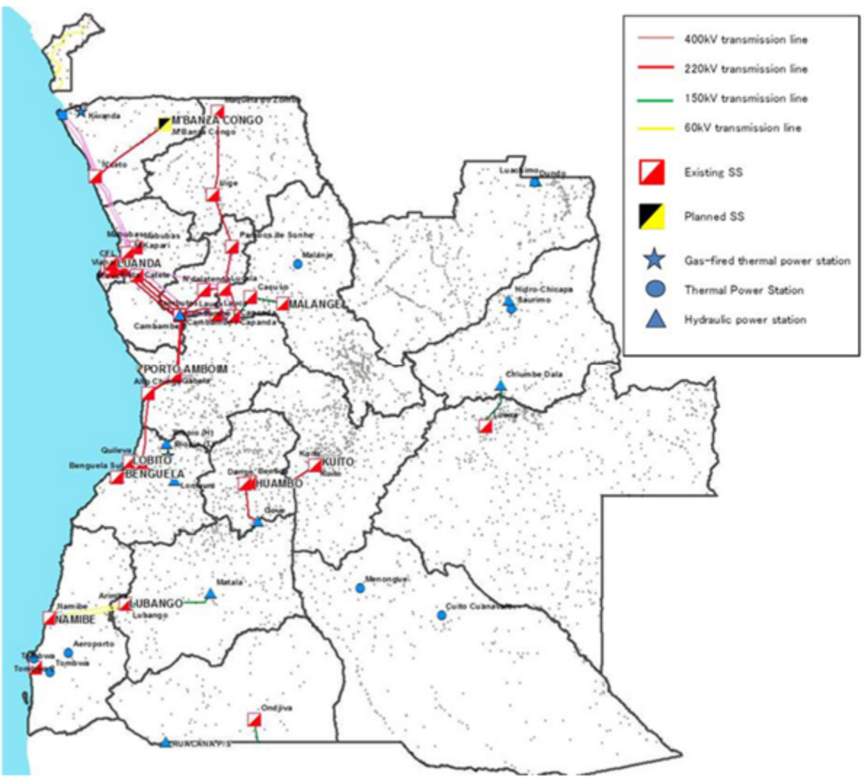
- The PPP Law (Chapter 3, Articles 33) outlines procurement processes, including pre-qualification and advertisement (Article 34, with a 45-day waiting period).
- The traditional procurement can be described from the DRC's experience in the licensing Discos and small hydro by provincial authorities. It shows that there is interest in the energy sector. However, the country risk should be taken into consideration and the low number of PPP in the energy sector reflects that risk.
- There is, however, a strong private interest in building small vertical utilities supplying towns and cities. This opens up a new procurement pathway where SNEL can focus on transmitting cheap hydro to these Discos.

4.7 Transmission grid model of Angola and D.R. Congo

Angola and D.R. Congo are both members of SAPP and are also both members of CAPP.

The Angola Transmission Grid

The grid of Angola has significantly extended during the recent past. Here is the map of the grid as of 2017.



(Source: RNT)

Figure 9: Angola transmission Grid as in 2017

The map of the existing Angola grid of 2025 is presented on next page. It includes now 400 kV extensions southwards to Belem substation.

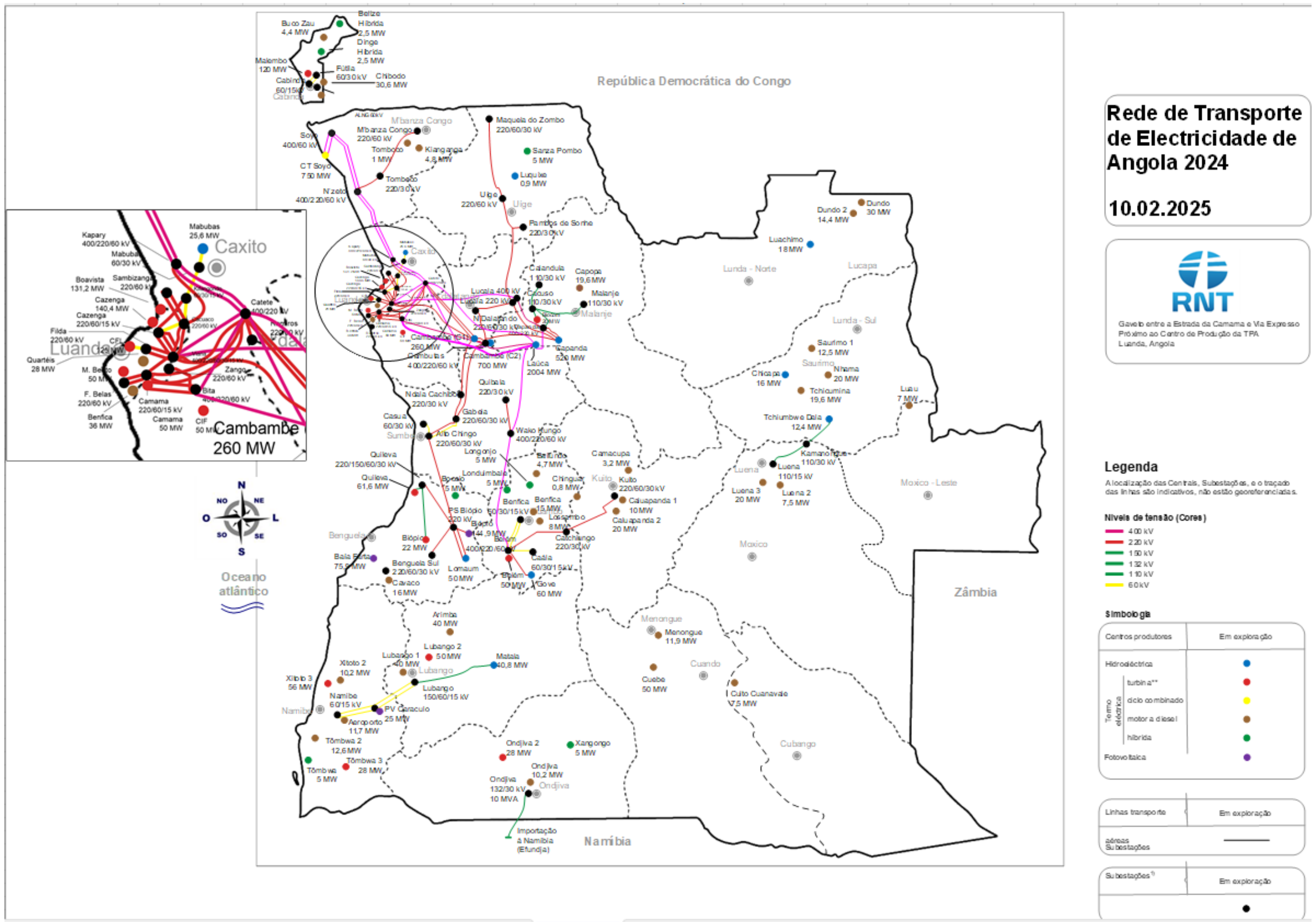


Figure 10: Angola transmission Grid as in 2025

For the long term, the planned corridors are the following (cf. Angola Energy 2025).

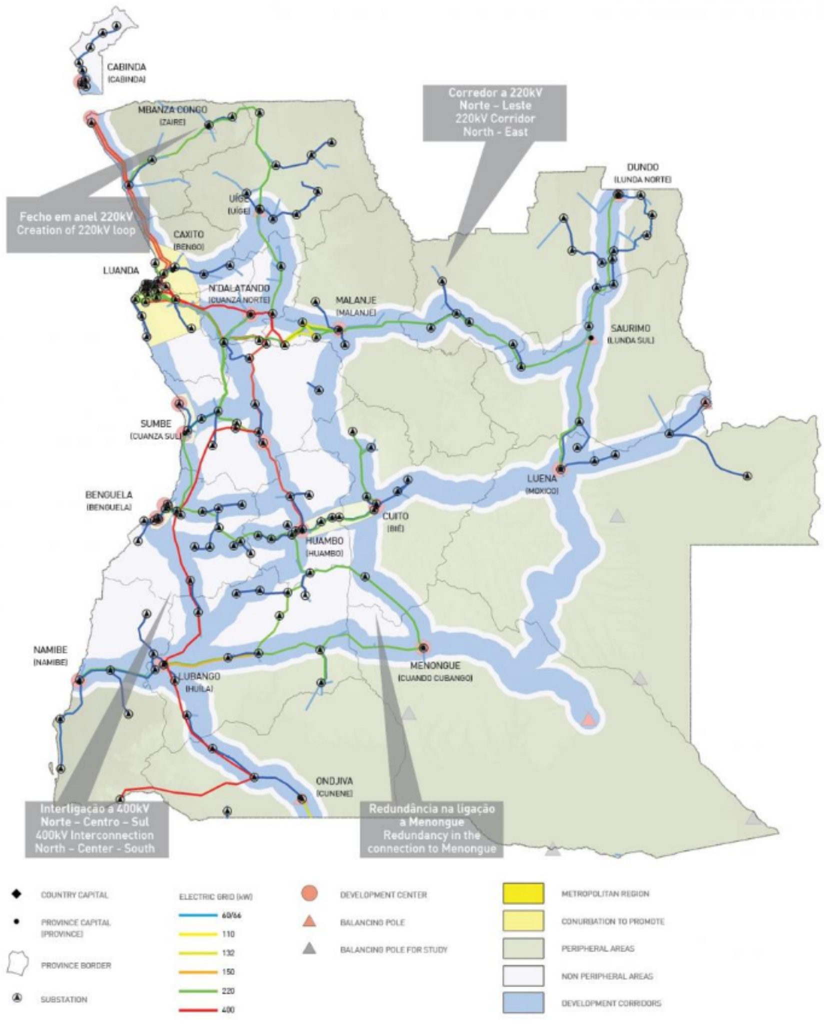


Figure 11: Angola planned development corridors

Source: *https://angolaenergia2025.gestoenergy.com/en/conteudo/transport*

Four 400 kV lines are under construction:

1. Cambutas – Catete Line (123 km)
2. Catete – Viana Line (36 km)
3. Chipindo – Capelongo Line (109 km)
4. Genga – Benga Line (30 km)

Beside the interconnection project with Namibia (ANNA project, to be completed in 2029), there is a private project for a 1,500 MW capacity line to the DRC Copper belt connecting the Angola Lauca plant, led by Hydro-Link/Symbion (US) and Mitrelli Group (Swiss)[7].

In addition to the above private interconnection project, the RNT interconnection projects are summarized in the following table:

Table 12: Interconnections foreseen for Angola Grid (RNT) and interconnections analysed in this study

Voltage Level	Project Name	Circuit specification	Transmission (MW) Import/Export	Observation
765 kV	Soyo (Angola) – Inga (DRC) *Strategy 2*		5,000 MW	Angola initially plans to export 600 to 750 MW to the DRC. Angola's proposal to import 5 GW, linked to the construction of the Inga 3 Hydroelectric Power Plant.
400 kV	Soyo (Angola) – Inga (DRC) *Strategy 1*	Double circuit, each consisting of 3 X AAAC Sorbus 659.4 mm² conductors	2,500 MW	Angola initially plans to export 600 to 750 MW to the DRC. Angola's proposal to import 2.5 GW, linked to the construction of the Inga 3 Hydroelectric Power Plant.
400 kV	Cazombo (Angola) – Mwinilunga (Zambia)	Single circuit, consisting of 3 X AAAC Sorbus 659.4 mm² conductors	The line aims at exporting 600 MW to Zambia.	The link will have a transmission capacity of up to 2000 MW
400 kV	Cahama (Angola) – Kunene (Namibia)	Singel circuit, consisting of 3 X AAAC Sorbus 659.4 mm² conductors	The line aims at exporting at least 600 MW to Namibia	According to feasibility studies, a maximum of 600 MW should be exported to Namibia in the first phase.
220 kV	Ondjiva (Angola) – Efundja (Namibia)	Single circuit consisting of one ACSR 250 mm² conductor	According to the capacity of the 132 kV transmission line, a value not exceeding 90 MW is estimated.	The Angolan government is interested in exporting energy to Namibia via the planned Ondjiva 220/132/60 kV SE.

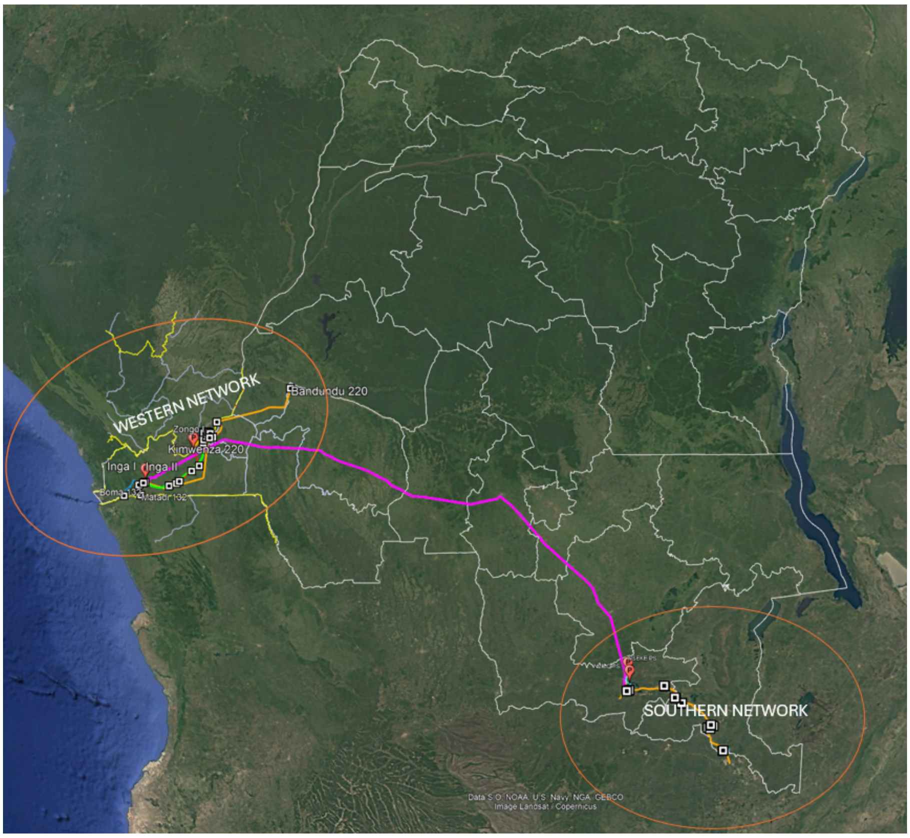
The DRC transmission grid

The SNEL grid is composed of three independent sub-grids:

- The Western grid
- The Southern grid
- The Eastern grid

[7] (https://african.business/2025/07/energy-resources/us-firm-to-build-1-5bn-angola-to-drc-power-line)

The two main grids are presented on the following map.



OVERALL DRC NETWORK (WEST AND SOUTH): 500kVDC, 400kV, 220kV, 132kV or 120kV, 70kV

Figure 12: DRC existing transmission grid

Currently, there is no official plan for future grid in DRC, but a Least Cost National Electrification Plan is to be launched in January 2026 through World Bank financing.

However, some former plans are available as per the following map:

- in orange colour, a first phase for transmission lines is shown
- in violet colour, a second phase for the planned lines.

(the borders are shown in yellow).

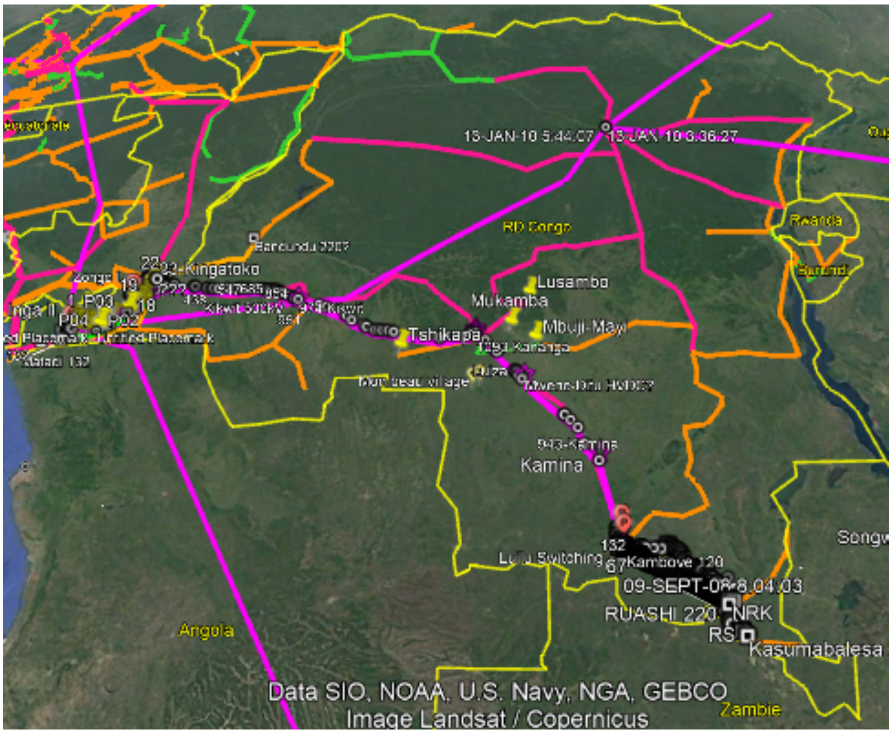


Figure 13: DRC planned transmission Grid for the long term

The three independent grids are in evolution:

- The Western grid, including a 400 kV link Inga – Kinshasa, an interconnection with Republic of Congo (interconnection Kinshasa-Brazzaville of about 100 MW transfer capacity). This grid is to be extended in the coming years by the “Boucle de l’Amitié” (Friendship Loop), a 400 kV double circuit line Inga-Cabinda-Pointe Noire – Brazzaville- Kinshasa.
- The Eastern grid (Kivu area), presently concentrated in Bukavu for south Kivu and Goma for North Kivu, will be interconnected by 220 kV lines in the coming years around the Kivu lake (Kamanyola-Buhandahanda-Goma on DRC side, Goma-Gisenyi-Kibuye-Cyangugu- on the Rwandan side), all supplied by the Ruzizi I, Ruzizi II and soon the Ruzizi III power plants. These will be extended by the Beni-Bunia-Butembo 220 kV line towards lake Albert.
- The Southern gid (Katanga area), connecting Kolwezi and Lumumbashi to the mining centres and several local hydro power plants (power lines of 120 and 50 kV connected the mining towns Likasi, Kolwezi, Lubumbashi and even Kipushi, supplied notably by the recently refurbished Mwadingusha HPP of 78 MW). This grid is connected to Inga (in the Western grid) with two HVDC circuits rated each 1,000 MW.

Regarding a potential integration of these 3 grids within a national transmission grid, it seems that neither the SNEL, the Ministry of Energy and Hydraulic Resources nor the CAPP are planning the interconnection of these three grids in the 2025-2030 the time horizon.

4.8 Cross-Border Cost Allocation and Wholesale Tariff for the interconnection project

This sub-section aims at setting basic principles for computing the recommended tariff for the transfers on the line.

The tariff for the transfers on the interconnection should be set in a way that the operation on the agreed economic lifetime (usually 25 years) is profitable with a Financial Internal Return Rate (FIRR) of at least the agreed value (a figure between 15% and 18% is likely).

The tariff should be set based on the following:

- The forecast of the transfers on a conservative basis so that even in case the transfers are lower than expected, the line investment can be paid off.
- The tariff should be computed based on the above conservative energy transfer (in the two directions), proposed as being constant and for all actors, and in a way such that the revenues allow a profitable operation for the interconnector along its economic lifetime.

Considering that the compensations for environmental and social impacts are out of the frame for the interconnection line cost, the revenue from operating the interconnector should be allocated among the two countries using the same fraction as the cost distribution among the two countries.

For computing the revenue allocation as per analysis on Google Earth, the proposed routing of the line is 59% in Angola and 41% in D.R. Congo. With an assumed total length of 190 km, this represents 111.2 km in Angola and 78.8 km in D.R. Congo.

4.8.1 Angola

In Angola, the regulation of electricity activities- covering generation, transmission, distribution, and commercialisation- is established by Presidential Decree No. 76/21, issued on March 17, 2021. This decree sets the legal framework for licensing and network operations. Additionally, the Tariff Regulation (Presidential Decree No. 4/11, dated January 6, 2011) defines the principles and structure of tariffs, including charges for Use of System and the Transmission Network, forming the basis for cost-reflective pricing mechanisms[8].

The national regulator IRSEA (Instituto Regulador dos Serviços de Electricidade e de Águas) publishes tariff schedules periodically, such as Despacho No. 3133/25, which covers the 2025–2028 tariff cycle. These schedules classify tariffs into High Voltage (HV), Medium Voltage (MV), and Low Voltage (LV), specifying charges for energy (kWh) and capacity[9] (kW/kVA). Although these tariffs are applicable to domestic network usage, no fixed tariffs for export/import wheeling have been publicly disclosed so far.

Consequently, bilateral cross-border transfers depend on negotiated, cost-reflective agreements aligned with SAPP standards, considering capacity, energy, and losses to ensure sufficient revenue to achieve the targeted Financial Internal Rate of Return (FIRR) over the interconnector's lifespan.

In the absence of an official cross-border tariff, one approach is to estimate the interconnector tariff based on Angola's internal Use-of-System costs, which include capacity and energy expenses, and then compare this to regional wheeling tariffs. An approximate range from these calculations is between USD 5 and USD 15 per MWh, aligning with findings from World Bank transmission pricing studies[10]. Additional benchmarks can be derived from the Transmission Use of System (TUoS) tariffs of Namibia’s Nampower and South Africa’s Eskom/Nersa, while the Eswatini Energy Regulatory Authority (ESERA) framework provides a

8 Government of Angola, *Presidential Decree No. 4/11 of 6 January 2011 Tariff Regulation for the Electricity Sector*, Luanda: Ministério da Energia e Águas, 2011. [Online]. Available: https://faolex.fao.org/docs/pdf/ang205084.pdf
9 Instituto Regulador dos Serviços de Electricidade e de Águas (IRSEA), *Despacho No. 3133/25 Tabelas de Tarifas de Energia Eléctrica (2025–2028 Cycle)*, Luanda: IRSEA, 2025. [Online]. Available: https://www.irsea.gov.ao
10 World Bank, *Transmission Pricing Methodology and Regional Integration: Case Studies and Best Practices*, Washington DC: World Bank Group, 2024. [Online]. Available: https://documents1.worldbank.org/curated/en/099072124082035121/pdf/P1745041896f3b0261ba5c134ea628f9140.pdf

model compatible with the SAPP methodology, utilising Modern Equivalent Asset (MEA) valuation and MW-km allocation principles[11].

4.8.2 DRC

The Electricity Law of 2014 allows for Import and Export of electricity under a Licensing regime. The Regulations on Importation and Exports are published in December 2018 under Decree No 18/053. It reinforces some of the provisions under the Electricity Law of 2014 such as priority to national demands and giving the Minister the powers to suspend import and export activities during force majeure events.

The principle of open access to the national transmission system in terms of export and import of power is guaranteed under Article 11 of the Regulations and any refusal should be explained within 5 days to the applicant, the regulator and the Ministry of Electricity and Hydraulic Resources (Ministère des Ressources Hydraulique et de l'Electricité).

The tax exemption and financial incentives for Import and export of electricity are confined in Regulation (Decree) No 18/054 of 2018.

The Regulation allows exemptions from VAT and related import duties for import of electricity to meet local demand and of materials needed for that purpose. However, under Article 2, exports are subject to 1% duty. Incentives for import and export are valid for 5 years under this Regulation.

However, whilst these regulations prohibit the resale of tax exempted energy service, it is silent on how re-export of energy or transit power will be treated.

Interconnection with neighbouring countries although allowed is also subject to a regulated transmission charge of USD 0.22 / KWh as published by an Inter-Ministerial Order[12]. The policy rationale for such a prohibitive transmission tariff could be to curb exports.

4.9 Regional Transmission Grid Connections

Angola and D.R. Congo are both members of the Southern African Power Pool (SAPP) and. Central African Power Pool (CAPP).

The SAPP region is endowed with rich resources for electricity generation, with hydropower being the dominant source in most countries, except Botswana, South Africa and Zimbabwe, where coal is the primary source. Nuclear power is also present with the Koeberg 1,920 MW nuclear power plant in South Africa, the only large existing nuclear power facility in Africa.

[11] Eswatini Energy Regulatory Authority (ESERA), *Wheeling Framework for the Electricity Supply Industry of Eswatini*, Mbabane: ESERA, 2022. [Online]. Available: https://www.esera.org.sz

[12] Arrêté Interministériel 009 econat et 013 enrh du 15 mars 2018 portant détermination des règles, des procédures et des modalités de fixation et de révision des tarifs d'achat de l'électricité aux producteurs d'électricité, des tarifs d'accès aux réseaux de transport et de distribution d'électricité ainsi que des tarifs de vente de l'électricité au consommateur final.

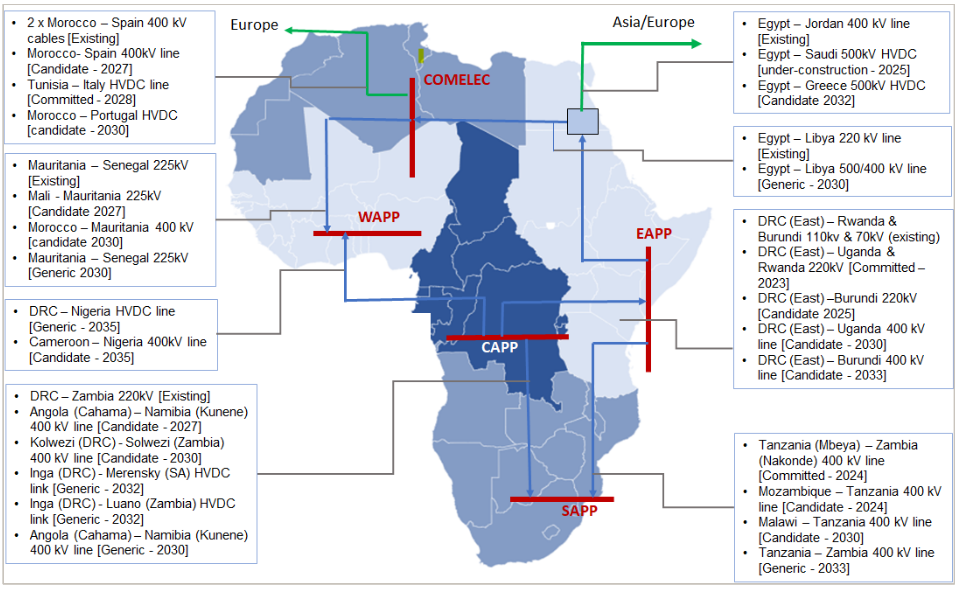


Figure 14: Existing and planned interconnections between African regions and with Europe and the Middle East, from CMP Synthesis Report (2023)

5 Analysis of Country Strategic Objectives and Potential Technical Alternatives

5.1 Alignment with Strategic Goals

The strategic goal for SNEL is to secure the Inga 3 generation project by providing to investors in generation credible evidence that transmission interconnection assets are built and will be ready for the evacuation of the Inga 3 power. Before that period, the objective of SNEL is to supply Kinshasa and surroundings with reliable power, possibly imported from Angola (Soyo CCGT plants).

The strategic goal for RNT is to capture a large share of the Inga 3 capacity by being one of the firsts transmission interconnectors to evacuate the Inga 3 power, knowing that other interconnector projects are Inga-Cabinda-Pointe Noire (transfer capacity of 1,000 MW to 2,000 MW) and Inga-Kolwezi-Limpopo (South Africa, Gauteng province, with a transfer capacity reaching 5,000 MW).

As detailed in the next paragraph, for the project of Angola (Soyo) – DRC (Inga) interconnection studied here, two targets and related sizing are envisaged:

- 2.5 GW transfer capacity, leading likely to a 400 kV double circuit line configuration
- 5 GW transfer capacity leading likely to a 765 kV line configuration, most probably with two single circuit lines

As per the meetings held, the strategic goal of both the DRC main stakeholder SNEL (represented through the ADPI (Agence de Developpement du Projet Inga)) and the Angola main stakeholder RNT, is the 5 GW transfer capacity target because it maximizes the confidence that investors can have in evacuating capacity from Inga 3. This is also in line with:

- The future interconnections of Angola (to Namibia and to Zambia)
- The future economic zones of Angola (need to industrialize Angola, including projects for smelters for steel, silicon, etc.)

However, the 400 kV present voltage limitation in Angola would not allow for a 5 GW firm transfer capacity, but 2.5 GW.

5.2 Stakeholder Feedback and CAPEX of the project

The paragraphs below reflect the positions expressed by the stakeholders during the Data Collection mission that has been held in July 2025.

5.2.1 Feedback from Angolan stakeholders

From the Angolan side, the transmission system operator RNT is in charge of planning and operating interconnections. Based on the current standards in Angola, RNT considers only the 400 kV scenario.

RNT is in charge of planning and operating the transmission grid, but also in charge of planning and managing the interconnections.

The Government of Angola, through the National Directorate of Electric Energy (DNEE) and with technical support from RNT-EP, is preparing an update of the Master Plan for the Expansion of the Electric System (PDESE) for the period 2027–2057. The plan will be revised based on the following elements:

1) New demand projection by province and type of customer;
2) Integration of variable renewable sources (solar and wind) to reinforce system resilience;
3) Inclusion of regional interconnection projects and export lines;
4) Expansion of the transmission system at 400 kV and 220 kV;

5) Modular generation planning (hydroelectric, renewable, thermal);
6) Cost and investment analysis with feasibility criteria.

The new PDESE is expected to be finalized and approved by the end of 2026, with support from international technical assistance.

5.2.2 Feedback from DRC stakeholders

From DRC, two main stakeholders expressed their positions: the national power utility SNEL and the agency for the Inga project development (ADPI: Agence pour le Développement du Projet Inga).

Both ADPI and SNEL indicated that several evacuation corridors are considered for Inga 3:

- the west-north corridor “Boucle de l’Amitié” (Inga-Cabinda-Pointe noire and Inga-Kinshasa-Brazzaville totalling a transfer capacity of 4 GW)
- GW for South Africa; 1.5 GW for the DRC main industrial companies (mines of Katanga)
- Up to 5 GW for Angola

SNEL and ADPI did not specify an imposed voltage level: voltages of 400 kV and above can be envisaged, including the potential 765 kV level. SNEL indicated that there is 220 kV line project in the Kongo Central region (Ozombo-Makela-Kwilu) that will ensure rural electrification and local economic development. Therefore, the interconnection with Angola does not need to serve rural electrification and does not need to include a substation at Matadi. A recent reference cost for 400 kV could be available from the Inga-Kinshasa 400 kV line that has been commissioned in 2015 (400 million USD for 263.7 km).

The inputs from the stakeholders have mainly consisted of information on the transmission grid, generation plans and desired cross-border transfer levels. More detailed information will be needed for the feasibility study to be launched after this pre-feasibility study.

5.3 Potential Technical Alternatives

The technical contents of the two strategies are described hereafter with an estimate of the CAPEX costs. These estimates will need to be later refined during Feasibility study based on detailed line routing and review of the current conditions of the existing assets, namely the Soyo and Inga substations.

Strategy 1: 400 kV double circuit for 2.5 GW firm transfer capacity

Table 13: CAPEX for Strategy 1

#	Activity Description	Un	Amount	Unit Price MUSD	Unit Price MEUR
1	Angola: Expansion of the Soyo 400/220/60 kV substation with a 400 kV bay and panel		1	3	**2,53**[13]
2	DRC: Construction of the Camp Kin S/S 400 kV incl. 2 400/220 kV 3x350 MVA S/S		1	120	**101.17**
3	DRC: two 400 kV/220 kV transformers of 350 MVA at Kinshasa (Kimwenza)		1	12	**10.12**

#	Activity Description	Un	Amount	Unit Price	Line Cost (MUSD)	Line Cost (MEUR)	Line Cost (MEUR) Angola	Line Cost (MEUR) DR. Congo	Cost/km (MEUR/km)	Ampacity (A) per circuit	Th. Cap MVA per circuit	Corridor Cap. MVA	Th. Firm Cap. MVA	EUR/MVA of Firm cap.
4.1	Constr. 400 kV Soyo - Matadi - Inga, **SC**, 3 cond./ph.(3 X AAAC Sorbus)	km	190	3 X 500,000.00	285	240,28	140,63	99,65	1,26	3,555	2,463	2,463	0	
4.1'	Constr. 400 kV Soyo - Matadi - Inga, **SC**, 4 cond./ph.(4 X AAAC Sorbus)	km	190	4 X 550,000.00	313,5	264,31	154,70	109,61	1,39	4,740	3,284	3,284	0	
4.2	Constr. 400 kV Soyo - Matadi - Inga, **DC**, 3 cond./ph.(3 X AAAC Sorbus)	km	190	3 X 800,000.00	456	384,45	225,02	159,43	2,02	3,555	2,463	4,926	2,463	0,156
4.2'	Constr. 400 kV Soyo - Matadi - Inga, **DC**, 4 cond./ph.(4 X AAAC Sorbus)	km	190	3 X 880,000.00	501,6	422,89	247,52	175,38	2,23	4,740	3,284	6,568	3,284	0,129
4.2'	Constr. 400 kV Soyo - Matadi - Inga, **TC**, 3 cond./ph.(3 X AAAC Sorbus)	km	190	3 X 1,100,000.00	570	480,56	281,27	199,29	2,53	3,555	2,463	7,389	4,926	0,098

Strategy 2: two 765 kV single circuit lines totalling 5 GW firm transfer capacity

[13] RNT, Angola, 2025

Table 14: CAPEX for Strategy 2

#	Activity Description	Un	Amount	Unit Price MUSD, 2010	Unit Price MEUR, 2010	Unit Price MEUR, 2025
	765KV Line Ter. Bay with Shunt Reactor			3,77	3,18	12,71
	765 kV C&P Panels			0,29	0,24	0,96
	765 kV Equipment Erection, Testing & Commissioning			0,17	0,14	0,57
	765 kV busbar (Bus bar & Hard ware materials for 765 kV Switchyard)			0,75	0,63	2,53
	765KV Shunt Reactor			2,07	1,75	6,99
	765KV Bus Reactor Bay			3,16	2,66	10,66
	400 kV transformer bay			0,68	0,57	0,68
	765/400KV Transformer and 765 kV Bay			9,26	7,81	31,23
1	Exp. of the Soyo 400/220/60 kV S/S with 765 kV busbar, tfo, two 765 kV bays and panel		1	20,15	16,99	30,64
2	Construction of the Camp Kin S/S 400 kV (Bcle de l'Amitié) incl. two 400/220 kV 3x350 MVA		1			101,17
3	Introduction of two 400 kV/220 kV transformers of 350 MVA at Kinshasa (Kimwenza) (tbd)		1			10,12
4	Extension of Camp Kin substation with 765 kV busbar, two 765 kV bays, tfo and panel		1	20,15	16,99	30,64
Total						**240,52**

Source: CERCind.gov.in, India, 2010, with price escalation estimate for 2025

#	Activity Description	Un	Amount	Unit Price in South Africa (MEUR/km)	Unit Price assumption for DRC or Angola (MEUR/km)	Line Cost (USD)	Line Cost (MEUR)	Line Cost (MEUR) Angola	Line Cost (MEUR) DR. Congo	Cost/km (MEUR/km)	Ampacity (A) per circuit	Th. Cap MVA per circuit	Corridor Cap. MVA	Th. Firm Cap. MVA	EUR/MVA of Firm cap.
4.3	Constr. 765kV Soyo - Matadi - Inga, S**C**, (6xAAAC 400mm² guyed V tower)	km	190	1	1,25	282	237,50	139,01	98,49	1,25	4560	6042	6042	0	
4.3'	Constr. 765kV Soyo - Matadi - Inga, S**C**, (3 X AAAC 400mm², other countries)	km	190	2	2,5	563	475,00	278,01	196,99	2,50	4560	6042	6042	0	
4.4	Constr. 765kV Soyo - Matadi - Inga, two S**C**,.(3xAAAC 400mm² guyed V tower)	km	190	**2**	2,5	**563**	**475,00**	**278,01**	**196,99**	**2,50**	**4560**	**6042**	**12084**	**6042**	**0,079**
4.4'	Constr. 765kV Soyo - Matadi - Inga, two S**C**,.(6xAAAC 400mm² other countries)	km	190	4	5	1127	950,00	556,03	393,97	5,00	4560	6042	12084	6042	0,157

Source : ESKOM, South Africa, 2025

6 Technical – Economic Feasibility

6.1 Project Impacts

6.1.1 Typical exchange levels between countries

Based on the feedback from stakeholders, two sizing options are considered in this study since proposed by the power utilities: 2.5 GW (strategy 1) and 5 GW (strategy 2).

The projected energy exchanges are derived from assumptions on the load factor:

- for the first period (defined next), from a 70% load factor (for Soyo to Inga transfer): 4,553 GWh/yr
- for the second period (defined next) from a 66 % load factor (Inga to Soyo transfer): 14,454 GWh/y in strategy 1 (2.5 GW firm capacity) and 28,908 GWh/yr in strategy 2 (5 GW firm capacity)

The first period is expected mainly to serve consumers that presently are not consuming because of scarcity of energy: it does not modify the generation dispatch of DRC.

The second period is expected to provide to Angola (and surrounding systems) an energy that is less costly (hydro energy from Inga 3, with estimated cost at about 59 EUR/MWh), which would be used instead of energy generated in Angola (estimated above 108 EUR/MWh).

6.1.2 Gains on generation costs due to the interconnection

This sub-section aims at estimating the gains on generation costs. Therefore, generation costs have to be estimated for both sides of the interconnection.

Recent forecasts available for electricity generation costs are those from the CMP released in 2023. These are here extrapolated on a 40-year period that represents the operation of the interconnector, starting from the expected commissioning year of 2030 (see Annex 1).

In Angola, the cost of generation is expected to slightly decrease until 2040, then to increase[14].

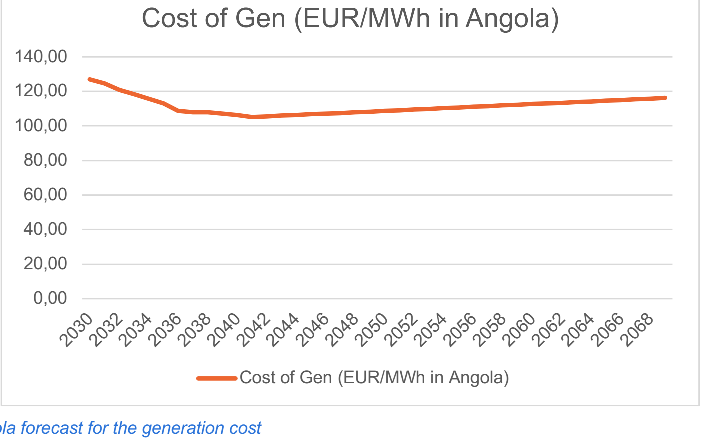


Figure 15: Angola forecast for the generation cost

[14] Values derived from Energia 2025, RNT Angola and completed for the longer term with the forecasts from CMP released in 2023.

In DRC, the costs of generation in the western grid are related to the hydro generation at Inga, and is also available from the CMP released in 2023 as per the following chart.

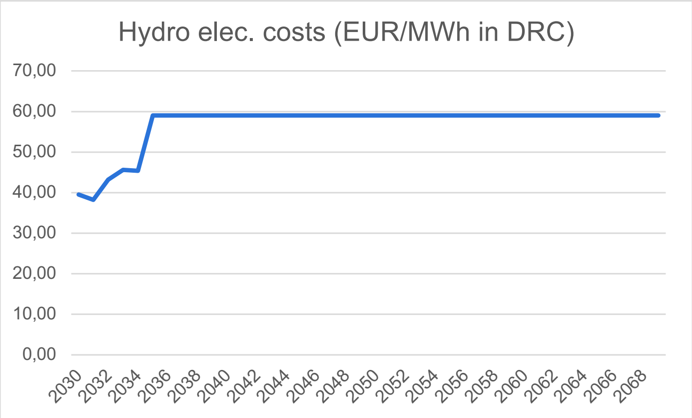


Figure 16: DRC forecast for the generation cost (with Inga 3 supposed to be commissioned in 2035)

<u>Before commissioning of Inga 3</u>

Presently, and until commissioning of Inga 3, a large part of the demand is not served in the western grid of DRC. From the meetings held with SNEL, the main figures, although approximate, are the following.

The generation level in the western grid consists in Inga 1, Inga 2 and the Zongo HPP, totalling about 1,655 MW.

Table 15: Present dispatch of the generated power in the western grid of DRC during peak load

Station	MW
Inga I	348
Inga II	1,088
Zongo-1A	39
Zongo-1B	30
Zongo-2	150
Total Available Gen capacity	**1,655**

Dispatch	(MW)
Katanga[15]	610
Kinshasa	916
Boma et Matadi	60
Other towns	19
Transmission losses	50
Total	**1,655**

The demand of Kinshasa is presently estimated as being around 1,660 MW, where the 55% is delivered to the consumers (916 MW) and 45% not delivered (750 MW).

This situation, the gap of about 750 MW not delivered may last in the future since the demand of Kinshasa is growing, while the ongoing rehabilitation of Inga 2, also progressing, will compensate partly this growth (presently, Inga 2 can generate 80 % of its rated capacity).

[15] The transfer from Inga to the South East (Katanga region) through the existing HVDC line varies from 500 MW to 720 MW, hence an estimated average of 610 MW.

As a result, since the existing generation system of DRC is operated at full available capacity, the future imports from Angola will not replace DRC power generation but be added to the DRC generation: the imports from Angola to DRC will serve customers that are presently undersupplied or presently using unformal private supply systems" small gensets or, in very rare cases, PV panels with batteries: these private generators can also be called "emergency generators".

For that transfer of 750 MW from Angola to the western grid of DRC, the value of the generation cost in DRC is the cost of that "emergency generation", with a conservative assumption, it is here supposed to be 18 EURct/kWh (or 180 EUR/MWh), representing some 21.3 USct/kWh. This is a conservative value, since it may be much higher, knowing that the electricity sold in Eastern DRC (Goma…) by private operators is around 40 to 50 USct/kWh.

During the period *before* commissioning of Inga 3, the forecast of generation costs in Angola between 2030 and 2035 evolves from 126 to 115 EUR/MWh, i.e. a 120 EU/MWh average, the gain on generation would then be around 180- 120 = 60 EUR/ MWh (or 6 EURct/kWh) is which 7.1 USct/kWh, as provided by ADPI (Agence de Développement du Projet Inga).

After the commissioning of Inga 3, the generation cost at Inga 3 is expected to be 7 USct/kWh as per the values provided by the ADPI.

The cost of generation in Angola is expected to be at that time at 11 USDct/kWh.

During the period <u>after</u> commissioning of Inga 3, the gain on generation would then be around 4 USct/kWh.

6.1.3 Gain on grid losses due to the interconnection

<u>Losses on the interconnector</u>

The length of the interconnector lines is rather small (190 km). Consequently, the loss level is assumed to be 1% of the power injected in the interconnector.

<u>Grid Loss Reduction</u>

Grid losses are usually low in transmission (about 1% to 4%) compared to distribution losses (often much larger than 5%). Grid losses depend on the shape of the grid, the load curve and the amount of reactive energy flow. There is no universal target for transmission losses because the optimal level of losses is the level reached when there is no more profitable project that can reduce the loss level.

From the above considerations, two main facts have to be considered:

- In case the interconnection injects a power transfer that will be superimposed to the power flow prevailing before the interconnection, then losses are significantly increased (because linked to the square of the current)
- In case the interconnection injects a power transfer that will be opposite to the power flow prevailing before the interconnection, then losses are significantly decreased

In the case of the Angola-DRC interconnection, the two following periods are distinguished:

Before commissioning of Inga 3:

- The losses on the DRC grid are increased because the transfer from Inga to Kinshasa is increased by the transfer from Soyo to Inga
- The losses on the Angola grid remain unaffected since the power exported by Angola to Inga originates from the Soyo power plant(s), hence not affecting the rest of the Angolan grid.

After commissioning of Inga 3:

- The losses on the DRC grid are increased because the transfer from Inga to Kinshasa is increased, although this is not due to the interconnection in itself but to the commissioning of Inga 3.
- The losses on the Angola grid are much likely increased because the transfer aims at supplying several Angolan consumption centres from the north (like in the case when the Soyo power plant was supplying the Angolan grid) and supplying systems that will be interconnected to Angola, like Namibia and Zambia. The related increase in transmission losses may show profitability for some

grid reinforcement projects (that were not profitable before the commissioning of Inga 3). However, even if this is the case, the low cost of Inga 3 energy may also lead these projects to be financed.

Loss variations due to the interconnection are rarely a determining factor for justifying an interconnection project. Some specific estimates are presented in Annex 6 on grid modelling.

6.1.4 Gains on reliability and spinning reserve

Reliability Improvement due to the interconnector

During the period before the commissioning of Inga 3, the interconnection will provide power to several DRC consumption centres including the capital Kinshasa. Given the present shortage of power in the supply of Kinshasa, the interconnection clearly provides a huge gain in terms of reliability. SNEL, the power utility of DRC, considers that they can presently supply only 50% of the energy demand of Kinshasa.

During the period after the commissioning of Inga 3, the interconnection will contribute to supply systems that are regularly in deficit, like Zambia that is often subject to drought and related shortage of power, hence the planned additional interconnection between Zambia-Angola.

Reduction of Spinning Reserve requirements due to the interconnector

As per SAPP spinning reserves sharing requirements, DRC (SNEL) is already scheduled to provide spinning reserve (23.2 MW) and Angola (RNT) will be scheduled to provide about 42 MW of reserve once Angola will be interconnected to other SAPP countries though Namibia (ANNA project, which is expected to be commissioned before Soyo - Inga).

From that point, any other new interconnection to be commissioned for linking countries that are already interconnected with other SAPP countries will not, per se, allow a reduction of spinning reserve (except if the transmission reliability margins are not high enough on the interconnections existing at that time). This will also be the case of the Angola (Soyo) - DRC (Inga) interconnection: it will not, per se, reduce the requirements for spinning reserve, because at the time of its commissioning (2030) both DRC and Angola will be interconnected to the rest of SAPP.

6.1.5 Increase of potential for hosting vRE and evolution of the generation energy mix

The evolution of the energy mix in Angola is dictated by the Electricity Master plan, which includes hydro power plants, thermal power plants and variable renewable energy (vRE) power plants (e.g. solar PV).

The evolution of the energy mix in DRC is oriented by projects that have been identified, which are mainly hydro power projects.

The integration of variable renewable energy plants in a grid can be maximised when integrated in a system that satisfies two criteria:

- The generation system to be interconnected can easily absorb variations of the power injected by renewable energy plants and variations of the load, without being limited by a technical minimum dispatch level: this is the case of hydro power plants but not thermal power plants.
- The cost of kWh of the generation system to be interconnected will not be increased by integrating vRE: this is the case of Hydro Power Plants (HPP) with reservoirs but not for Thermal Power plants.

The Angola - DRC interconnection partly matches the above conditions since the Angola system is fitted with several hydro plants with reservoirs. The DRC system is mainly based on hydro plants that are of the run of river type.

As a result:

- DRC system can better integrate vRE plants since it has access to the flexibility provided by Angolan hydro power plants with reservoirs

- Angolan system is not really affected in terms of integrability of vRE after the interconnection with DRC, except if DRC hydro plants with reservoirs are also commissioned (which is not presently planned)

As a whole, the Angola-DRC interconnection favours the integration of vRE.

6.1.6 Shadow price of the CO2 emissions

In case the project decreases or increases CO2 emissions, the related impacts are accounted for in the economic analysis.

For thermal generation, the Carbon factor is considered as being 0.7 ton of CO2 per MWh.

Two contexts are envisaged for the shadow price of CO2 emissions forecasts, proposed[16] as follows:

- "Low" from 40 in 2025 to 120 EUR/tCO2 in 2065
- "High" from 80 in 2025 to 200 EUR/tCO2 in 2065

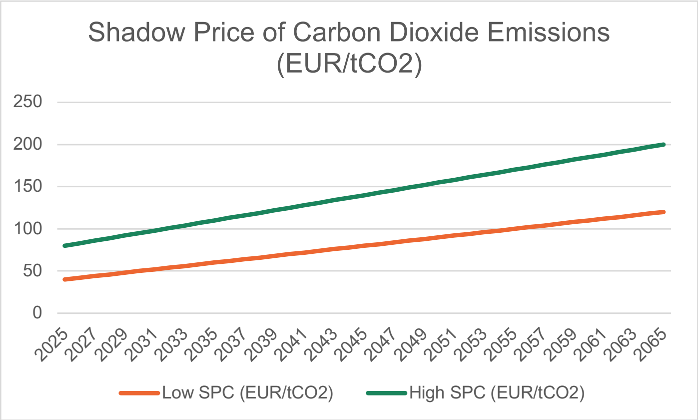


Figure 17: forecast for the Shadow Price of Carbon Dioxide

These will be used in the Cost Benefit Analysis for a sensitivity analysis of the economic results.

The two periods for operation of the interconnection are modelled in the following way:

- Before commissioning of Inga 3: the interconnection will serve at transferring power from Soyo thermal power plant (CCGT) to DRC, therefore with CO2 emission contents in the transferred energy: the shadow price of CO2 will be considered as a societal cost for that period, using the above forecasts.
- After commissioning of Inga 3: the interconnection will serve at transferring power from Inga 3 HPP (DRC) to Soyo (and further), therefore without CO2 emission contents in the transferred energy: there is then no shadow price of CO2 to be considered for that period.

6.1.7 Total transfer capacity and role of the project in the regional strategy

The SAPP has strong objective for providing abundant power supply at reasonable costs to its members. It has planned large energy corridors:

[16] Source: Guidebook for Economic and Financial Analysis of Regional Electricity projects, by PPIAF, The World Bank, 2020

- A central corridor with the Inga-Kolwezi-Lompopo link
- A western corridor with the Inga-Angola (Soyo)–Namibia link

Therefore, being part of the western corridor, the present project has a crucial role to play.

The present project is backed by a long term driving factor which is the combination of three facts:

- The acknowledged large and low cost potential of the electricity generation from Inga 3 and following projects that form Grand Inga
- The steadily rising demand of electricity in South Africa and also its neighbours including Zambia, Zimbabwe and Botswana
- The high reduction of CO2 emissions that the project enables, at least once the western corridor is completed: the energy from Inga would then replace a significant share of the power from the ageing coal fired power plants of South Africa.

Interconnection across SAPP via strategic transmission corridors can save the SADC region an estimated USD 37-42 billion in Net Present Value (NPV) by 2040. The eight high-priority regional transmission projects are expected to bring economic benefits of USD 4.3 billion in NPV[17].

The present project, the Angola (Soyo) – DRC (Inga) interconnector is the first piece of the western corridor, and its large power delivery potential (5 GW if Strategy 2 is favoured) is consistent with the large corridor vision where clean and low cost bulk power would be transferred to south of SAPP where old and polluting power plants burning coal are still used and present high outages rates.

6.1.8 Impact on access to electricity

Considering the huge generation capacity of Inga 3 that this interconnection project will provide to SAPP countries, the project will definitively enable increasing access in several SAPP countries. Furthermore, the electricity generated for this increased access is without CO2 emissions[18] and available all along the year due to the constant flow of the Congo river.

The impact on access to electricity is fundamental for the economic development of the SAPP members as reminded in the CMP Baselines Demand Forecast released in 2022 (GT072 of GTAF):

The demand drivers are shown the following table.

Table 16: Demand drivers for countries within SAPP

Country	Demand drivers
Angola	• Population growth, electricity access • Unserved demand
Botswana	• Urbanisation, population growth, electricity access • GDP growth due to mining sector activities
Eswatini	• Electricity access, step loads • Organic growth at household level
Lesotho	• Urbanisation, electricity access • GDP growth due to mining
Malawi	• Electricity access • GDP growth due to residential and agriculture sector activities
Mozambique	• Electricity access • GDP growth across all sectors

[17] As per Stephen Dihwa, Director of Coordination Centre of SAPP
[18] Apart of the CO2 emitted during the fabrication of the cement

Namibia	• Electricity access • GDP growth due to organic growth and step loads
South Africa	• Urbanisation, GDP growth, mining sector growth • New energy intensive innovations (data centres, electric vehicles, etc)
Zambia	• Urbanisation, electricity access • GDP growth due to mining sector activities
Zimbabwe	• Urbanisation, population growth, electricity access • GDP growth due to industrial and commercial activities

The main parameters that are expected to drive demand growth within the region include electricity access rates, population growth, urbanisation, GDP growth due to industrialisation, mining and agriculture, and the introduction of energy intensive new technologies.

6.1.9 Sensitivity on the sizing of the project interconnection

Two sizing strategies are envisaged, differing by the voltage level, type of towers, and firm transfer capacity:

- 2.5 GW for Strategy “1”: 400 kV double circuit line (classical towers holding two circuits)
- 5 GW for Strategy “2”: two single circuit lines at 765 kV, each based on guided “V” towers.

Regarding the 765 kV solution:

- The “guided V” designs are known to be very cost effective because they require relatively less metal than classical (4 feet) tower designs. If classical towers are used for 765 kV instead of “guided V”, then the cost would be about 2.5 the cost of the 400 kV solution.
- Typically, six conductor bundles are used for 765 kV, at 27mm diameter with about 400mm² of aluminium section per conductor (Tern ACSR).
- The 765 kV is not proposed as double circuit line but rather two separate single circuit lines because the double circuit case would imply a high power loss in case of N-1 tower outage.

As a result of the above, the 765 kV solution presents a lower cost per MVA transferred, including estimates of the cost for studies for the Environmental and Social Impact Mitigation and for Project Management.

Table 17: Budget Estimates and CAPEX per MVA of firm capacity

Activity	Cost Estimate (EUR m) Strategy 1 (400 kV)	Cost Estimate (EUR m) Strategy 2 (765 kV)
Project Preparation and Feasibility Studies – includes Feasibility study, ESIA study, Engineering design and technical advisory (5% of CAPEX)	26,84	35,78
Transmission Lines and Substations construction (materials for towers, conductors, insulators, tower erection, transformers, switchgear, control and protection systems) and labour	**536,71**	**715,52**
Environmental and Social Impacts Mitigation - Implementation of the Environmental and Social Management Plan (ESMP) and Resettlement Action Plan (RAP) (5% of CAPEX)	26,84	35,78
Project Management and Contingencies – Project Management Unit costs, Owner’s Engineer, engineering supervision) (10% of CAPEX)	53,67	71,55
Total Project Cost (EUR m)	**644,05**	**858,63**

Activity	Cost Estimate (EUR m) Strategy 1 (400 kV)	Cost Estimate (EUR m) Strategy 2 (765 kV)
Corridor Firm Transfer Capacity (MVA)	3284	6042
CAPEX per MVA of Firm Transfer Capacity (MEUR/MVA)	0,196	0,142

6.2 Economic Analysis and New Business Opportunities

6.2.1 Government policy

In both the Democratic Republic of the Congo (DRC) and Angola, there is not fully institutionalised, cross-sector "one-size-fits-all" project evaluation framework mandated by law. Instead, each country relies on overarching development plans and sectoral strategies that guide the evaluation practice.

In the DRC, the 2024–2028 National Strategic Development Plan (PNSD) integrates economic diversification, sustainable development, and energy access as foundational pillars, thereby creating de facto evaluation benchmarks for large infrastructure projects[19]. Likewise, the National Energy Policy (2022) defines appraisal expectations for energy sector investments, emphasising reliability, access, and sustainability[20]. Rather than prescribing a single rigid model, DRC ministries and financiers expect project proponents to present analyses such as Cost–Benefit Analysis (CBA), Economic Net Present Value (ENPV), and Economic Internal Rate of Return (EIRR), often complemented by multi-criteria assessments consistent with donor norms and sector best practices[21].

Angola operates under a similar policy-driven appraisal system. The National Development Plan (PDN) 2023–2027 and related energy sector strategies provide the primary evaluation reference points. These frameworks define priority sectors, performance metrics, and investment focus, indirectly shaping what counts as a viable project. In the power sector, project proposals are routinely evaluated using CBA/EIRR analyses, system-expansion least-cost modelling, and risk assessments in line with the country's ongoing Electricity Law reforms[22]. Thus, while neither country mandates a universal evaluation method, both have converged on evidence-based, cost-oriented appraisal frameworks aligned with international practice.

For the DRC–Angola Interconnector, this implies that project documentation should adopt a rigorous cost–benefit and least-cost comparative framework, augmented by multi-criteria evaluation of resilience, economic impact, and strategic fit to ensure alignment with ministerial and financing institution expectations.

6.2.2 Public sector strategies

Aligning project with national development plans and sector-specific strategies

Democratic Republic of the Congo

The DRC's PNSD 2024–2028 elevates economic diversification and balanced territorial development as national priorities. Within this framework, the DRC–Angola Interconnector supports industrialisation of border provinces such as Kongo Central and mitigates energy bottlenecks that constrain manufacturing and service expansion. The National Energy Policy (2022) further mandates the improvement of energy access, reliability, and integration of renewables objectives that a cross-border interconnector directly advances by enhancing firm capacity and operational flexibility.

Institutionally, the project aligns with ongoing programs led by SNEL, ANSER, and ARE, which pursue electrification and sector reform. A stable cross-border supply will reinforce provincial electrification plans and contribute to regional power-pool integration, positioning the DRC as a future energy exporter within

[19] *Ministère du Plan et Suivi de la Mise en Œuvre de la Révolution de la Modernité, Plan National Stratégique de Développement (PNSD) 2024–2028, Kinshasa, RDC, 2024.*
[20] *Ministère des Ressources Hydrauliques et Électricité (MRHE) & UNDP, Politique Nationale de l'Énergie de la République Démocratique du Congo – Version révisée de mai 2022, Kinshasa: Gouvernement de la RDC / PNUD, 2022.*
[21] *International Energy Agency, Democratic Republic of the Congo Energy Policy Review 2024, Paris: IEA, 2024.*
[22] *Trade.gov, Angola – Energy Sector Overview, U.S. Department of Commerce, International Trade Administration, 2024. [Online]. Available: https://www.trade.gov/country-commercial-guides/angola-energy*

CAPP and SAPP frameworks[23] . There are presently plans for 220 kV lines to supply the whole region around Matadi: considering there is no future generation plants planned in the DRC West grid before Inga 3, these 220 kV lines can only be supplied if the power from Soyo is made available.

Angola

Angola's PDN 2023–2027 highlights infrastructure, industrialisation, and faster SDG implementation as crucial drivers of national transformation. The energy sector, especially transmission and interconnection, is designated as a strategic "accelerator." Reforms under Energia 2025 and related regulations aim to attract private investments and enhance sector efficiency[24] .

Angola targets generating 73 % of its electricity from renewable sources by 2027, requiring improved interconnection and system flexibility. The interconnector aligns with PDN's goals of expanding the transmission network, boosting supply reliability, and incorporating renewable energy. The Ministry of Energy and Water plans to extend Angola's transmission grid from around 3,354 km to 16,350 km by 2025. Additionally, a link to DRC supports this vision by providing supply redundancy, fostering regional trade, and lowering overall system costs.

Ensuring the project addresses identified gaps in infrastructure or services

Democratic Republic of the Congo

Electricity access remains a major infrastructure challenge in the DRC, with rural electrification below 20% and frequent outages in urban areas[25]. The interconnector will enhance the main network, enabling the import and export of large-scale power to manage seasonal and hydrological changes. It will also bolster ANSER's provincial electrification efforts by offering a reliable high-voltage supply for mini-grids and local distribution systems. Beyond energy security, the interconnector supports the country's water-energy-ecosystem strategy by enabling flexible hydropower dispatch and advancing commitments within national climate and sustainable development frameworks[26].

Angola

Angola faces similar challenges: increasing demand, limited transmission capacity, and unequal regional access[27]. Projections indicate that the national grid needs significant expansion to satisfy industrial and residential demands[28]. The Inga-Soyo interconnector acts as a flexible buffer, allowing power imports during generation shortfalls and exports when surplus energy is available. According to the PDN 2023–2027, Angola aims to achieve approximately 250,000 new electricity connections each year, contingent on strengthening transmission corridors[29] . Additionally, the interconnector enhances the integration of variable renewable energy sources by boosting grid stability and balancing capabilities[30] .

6.2.3 Cost-Benefit Analysis

This sub-section aims at undertaking a Cost-Benefit Analysis (CBA) to ensure that societal benefits exceed costs.

Periods of specific operation modes:

For the period before commissioning of Inga 3

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[23] *African Development Bank, Angola Country Strategy Paper 2023–2027, Abidjan: AfDB, 2023*

[24] *Ministério da Energia e Águas (MINEA), Energia 2025: Plano de Desenvolvimento do Sector Eléctrico, Luanda: Governo de Angola, 2022*

[25] *World Bank, Democratic Republic of the Congo Country Diagnostic 2023: Power and Connectivity Challenges, Washington, DC: World Bank Group, 2023*

[26] *UN SDGWE Initiative (DRC Water–Energy–Ecosystems Nexus Project), Synthesis Report on Integrated Resource Planning, Kinshasa, RDC, 2024.*

[28] *Trade.gov, Angola – Energy Sector Overview, U.S. Department of Commerce, International Trade Administration, 2024. [Online]. Available: https://www.trade.gov/country-commercial-guides/angola-energy*

[29] *Ministério do Planeamento e do Desenvolvimento Territorial, Plano de Desenvolvimento Nacional (PDN) 2023–2027, Luanda: Governo de Angola, 2023*

[30] *United Nations Development Programme (UNDP), Angola Sustainable Development Goals Acceleration Report 2024: Infrastructure and Industrialisation, New York: UNDP, 2024*

As per the power utility of DRC, SNEL, the power supply of Kinshasa only reaches about 55% of the real demand for electricity, leaving 45% of the demand unserved.

The interconnection project therefore enables the survival of existing enterprises of western DRC, including the capital Kinshasa, and the creation of new enterprises.

While the duration of the period after commissioning of the proposed interconnection and before the commissioning of Inga 3 is not certain (from 2 years to potentially more than 10 years), the above-mentioned positive impact is prolonged in fact after the commissioning of Inga 3, as follows.

For the period after commissioning of Inga 3

After commissioning of Inga 3, the interconnection is operated for exporting the energy of Inga 3 to Angola and southern SAPP systems that will be interconnected to Angola.

In Angola, the increased available supply due the interconnection will serve industrial projects such as:

- projects for smelters for steel production, silicon production, etc.
- projects for rural electrification and large economic development projects (Lobito corridor, projects launched within the EU–Angola Dialogue Programme[31] etc.)
- Angola-DRC (Katanga - Copperbelt) interconnection expected to be commissioned in 2029 (signed MoU): since this project is backed by a private company showing a high probability of completion, the energy from Inga could be transferred to Soyo and then to central Angola, to be wheeled eastwards towards the Katanga province

Comparing project alternatives to select the most cost-effective option

Given the two sizing options (2.5 GW and 5 GW transfer capacities), the voltage levels of 400 kV and 765 kV respectively are expected for the interconnection line.

The following table shows three classical indicators for economic analysis: Economic Net Present Value, Economic Internal Return Rate, Economic Cost/Benefit Ratio.

These are proposed for three cases of valuing the Shadow Price of Carbon (SPC): zero SPC, low SPC, and high SPC.

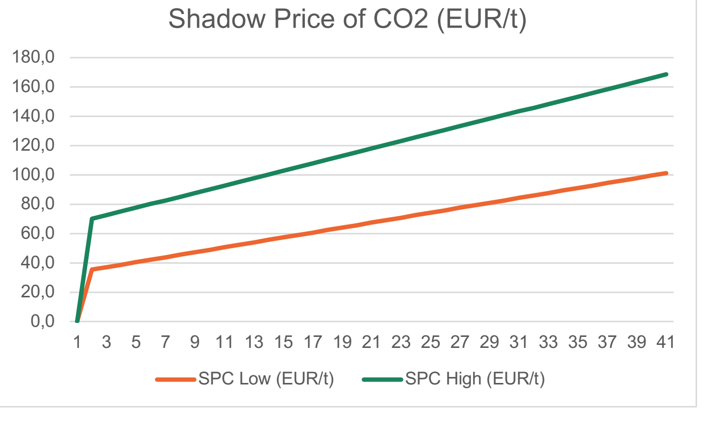

Figure 18: Forecast of the Shadow Price of CO2

The Cost–Benefit Analysis compares the ‘with-project’ strategies to a clearly defined ‘without-project’ counterfactual. In the Reference case without the Angola–DRC interconnector, it is assumed that:

[31] https://360mozambique.com/world/africa/eu-funds-new-angola-projects-to-boost-lobito-corridor-and-economic-growth/

- Western DRC continues to rely on Inga 1, Inga 2 and Zongo hydropower, supplemented by small-scale emergency diesel generation and load-shedding to meet part of the suppressed demand in Kinshasa;
- Angola focuses on domestic transmission reinforcements and does not invest in a dedicated Inga evacuation corridor; and
- regional exchanges between SAPP and CAPP are limited to existing and already committed interconnections.

Alternative counterfactuals, such as large-scale diesel or PV–battery schemes dedicated to Kinshasa, are considered for sensitivity purposes in Annex 1. In all such cases, the interconnector remains the least-cost option for delivering reliable capacity and energy to the main load centres.

Table 18: Economic Analysis of strategies 1 and 2 for various discount rates, base case

	Strategy 1: 400 kV – TTC of 2.5 GW			Strategy 2: 765 kV – TTC of 5 GW		
Discount Rate (from Inputs)	8%	10%	12%	8%	10%	12%
ENPV (No SPC) MEUR	5,581	4,175	3,206	10,609	7,846	5,954
ENPV (Low SPC) MEUR	5,037	3,669	2,734	10,065	7,340	5,482
ENPV (High SPC) MEUR	4,493	3,178	2,283	9,486	6,832	5,024
EIRR (No SPC)	54%	54%	54%	52%	52%	52%
EIRR (Low SPC)	39%	39%	39%	43%	43%	43%
EIRR (High SPC)	30%	30%	30%	37%	37%	37%
BCR (No SPC)	10,24	8,24	6,78	14,16	11,20	9,04
BCR (Low SPC)	5,39	4,39	3,66	8,46	6,75	5,52
BCR (High SPC)	3,73	3,05	2,56	6,14	4,92	4,04

From the above table, the following conclusions can be drawn:

- Both strategies are very profitable, showing return rates much beyond 30%, even when SPCs are high.
- Strategy 2 (based on 5 GW firm capacity and 765 kV level) has a much higher Net Present value, about two times the NPV of the Strategy 1, and also a much higher Benefit Cost ratio (about 1.5 time the B/C ratio of strategy 1).
- The Internal Return Rate is very high, and pretty similar for both strategies, and above 50% if no carbon cost is taken into account.
- Both strategies are worth to be further investigated, both at national level and at SAPP level, knowing that Inga hydro complex is potentially a huge generation centre (estimated at more than 40,000 MW total potential) which could supply several countries of SAPP. It is however noted that Angola does not yet have the 765 kV voltage level among its standards for construction and operation.

These results are obtained while considering conservative options (see above CAPEX values) and using the following parameters.

Table 19: Parameters for the Economic Analysis

Power of the export from Soyo to Inga (then to Kinshasa) (MW)	750
Commissioning year for the interconnection	2030
Commissioning year for the Inga 3 power plant	2035
Value of Lost Load, or Emergency Energy in DRC (EUR/MWh)	180

Value of Lost Load, or Emergency Energy in Angola (EUR/MWh)	500
Load Factor for Angola (Soyo) to DRC (Inga)	70%
Load Factor for DRC (Inga) to Angola (Soyo)	66%
Losses on Interconnector (%)	1%
Base Year for Prices	2025

The value of Emergency Energy refers to the cost of the energy that is used by people that are presently not served by the grid. In some contexts, like Kinshasa in DRC, it is assumed that these "unserved by the grid" consumers have their own private installation (gensets and/or PV with batteries).

Assessing risks and incorporating sensitivity analysis to account for uncertainties

Sensitivity on CAPEX

Using a 10% discount rate, the following table shows the economic performance in case the CAPEX is double or triple the one identified earlier. It is noted that the CAPEX is estimated at 536 million EUR for the 400 kV strategy and 715 million EUR for the 765 kV strategy, which is therefore 33% more costly than the 400 kV.

Table 20: Economic Analysis of strategies 1 and 2 for various CAPEX escalation cases, with discount rate 10%

	Strategy 1: 400 kV - TTC of 2.5 GW			Strategy 2: 765 kV - TTC of 5 GW		
CAPEX Sensitivity	100%	200%	300%	100%	200%	300%
ENPV (No SPC) MEUR	4175	3672	3170	7846	9107	8437
ENPV (Low SPC) MEUR	3669	3166	2664	7340	8601	7931
ENPV (High SPC) MEUR	3178	2675	2172	6832	8093	7423
EIRR (No SPC)	54%	32%	24%	52%	59%	41%
EIRR (Low SPC)	39%	26%	20%	43%	52%	37%
EIRR (High SPC)	30%	22%	18%	37%	45%	33%
BCR (No SPC)	8,24	4,40	3,00	11,20	7,33	5,00
BCR (Low SPC)	4,39	3,00	2,28	6,75	5,42	4,03
BCR (High SPC)	3,05	2,31	1,85	4,92	4,36	3,41

The project remains very profitable, even when the CAPEX is 300% the base estimate. These favorable results are not surprising since the investment is relatively low (only 190 km of transmission line) and the difference of electricity value on both sides of the line is high. Focusing on the period after commissioning of Inga 3, the "CAPEX question" could be turned in another way: are all assets well represented for transferring the power to the various areas where the selling price is the one assumed here (Angola)? A first answer would be the one presented in Annex 5 where the project is not limited to Soyo but extended southwards (towards Namibia border) and eastwards (towards Zambia border). Results of Annex 5 show that a CAPEX that would be 5 times the CAPEX estimated here would still lead to profitability: it could then finance transmission corridors in Angola towards the East and or the South, up to the related 5 times CAPEX level.

Sensitivity on the commissioning date of Inga 3

Until Inga 3 is commissioned, the city of Kinshasa will lack of energy until the commissioning of the interconnection line (expected to take place in 2030). From the commissioning year of the projected line, the city of Kinshasa and surroundings, together with the city of Matadi and rural areas to be served by the planned 220 kV lines, will be supplied by the Soyo CCGT thermal power plant through this line. This situation will last until the commissioning of Inga 3, whose date (year) is still very uncertain. Given this uncertainty, a sensitivity analysis is proposed with commissioning years of 2035 (reference), 2040 and 2045. The comparison of the economic results is provided in the following table.

Table 21: Economic analysis of strategies 1 and 2 for various Inga 3 commissioning years, with discount rate 10%

Inga 3 Commissioning year Sensitivity	Strategy 1: 400 kV - TTC of 2.5 GW			Strategy 2: 765 kV - TTC of 5 GW		
	2035	2040	2045	2035	2040	2045
ENPV (No SPC) MEUR	4,175	3,311	2,860	7,846	5,443	4,101
ENPV (Low SPC) MEUR	3,669	2,422	1,690	7,340	4,553	2,931
ENPV (High SPC) MEUR	3,178	1,601	644	6,832	3,716	1,868
EIRR (No SPC)	54%	47%	46%	52%	39%	36%
EIRR (Low SPC)	39%	28%	24%	43%	28%	23%
EIRR (High SPC)	30%	18%	13%	37%	22%	16%
BCR (No SPC)	8,24	6,75	5,97	11,20	8,08	6,34
BCR (Low SPC)	4,39	2,65	1,97	6,75	3,75	2,51
BCR (High SPC)	3,05	1,71	1,24	4,92	2,52	1,64

As it can be seen in the table, except for strategy 1 with high Shadow Price of Carbon, the economic performance of the project remains very good even in the case of a long delay in the Inga 3 works (commissioning in 2045 instead of 2035).

Recommendation for one of the strategies

At this pre-feasibility study stage, three factors are favouring Strategy 2:

- The better economic performance, both in terms of Internal Return Rate and in terms of Benefit/Cost ratio
- The potential for long term bulk transfers towards other SAPP member states, particularly Zambia where the variability of the yearly rainfalls asks for energy imports and Namibia, which is bordering the largest energy consumer of the SAPP, i.e. South Africa
- Strategy 2 can be implemented in two steps, with a first operation period in 400 kV as it is usually the practice, and operating at 765 kV when Inga 3 is commissioned (depending on the power level that is agreed to be transferred to Soyo). It is however noted that Angola does not yet have the 765 kV voltage level among its standards for construction and operation.

6.2.4 Estimate direct benefits

Approach and Comparators

Estimating the direct economic benefits of the DRC–Angola Interconnection requires using verified market data and lessons from similar regional power projects. Since both Angola and the DRC are members of the Southern African Power Pool (SAPP) although Angola[32] is not yet connected with the other SAPP countries, benchmark data from SAPP offers a strong basis for assessing financial and operational advantages. Comparative analysis of recent cross-border projects, such as ZIZABONA (Zimbabwe–Zambia–Botswana–Namibia) and Ethiopia–Kenya, provides relevant insights into the value of energy trading, reliability improvements, and systemic efficiency. These projects share similar technical features

[32] *African Development Bank, "Angola Country Strategy Paper 2023–2027," Abidjan, 2023.*

(220–400 kV AC or 500–800 kV HVDC systems), institutional frameworks, and cost structures, making them suitable analogues for the Soyo–Inga interconnector[33], [34], [35] .

Market Benchmarks (Price and Capacity Anchors)

According to the Southern African Power Pool (SAPP) Market Performance Reports, average Day-Ahead Market (DAM) clearing prices in 2024 ranged between 9.4 USct/kWh and 12.6 USct/kWh, depending on season and system congestion (in EUR/kWh 7.9 to 10.6). These prices reflect the marginal cost of traded energy within Southern Africa and serve as a realistic proxy for valuing bilateral exchanges between Angola and the DRC. The SAPP market structure also provides insight into expected trading volumes and liquidity trends, as it captures over 6 TWh of traded electricity per year, with steadily growing participation from regional utilities.

Comparable projects further strengthen this valuation basis. For example, the Cahora Bassa project and related evacuation lines has demonstrated the viability of interconnectors within the SAPP perimeter[36],[37] . Similarly, in the EAPP, the Ethiopia–Kenya 2,000 MW HVDC link has shown the broader macroeconomic benefits of regional integration by unlocking surplus hydropower and lowering national generation costs[38] . These examples[39],[40] help establish practical assumptions for trade capacity, power flow patterns, and benefit magnitudes where large hydro plants also serve regional consumption centres.

Direct Benefit Categories

The primary direct benefits of the DRC–Angola interconnector are similar to those seen in other African power trade projects. These include energy trade value, wheeling revenue, improved system reliability, fuel displacement, reserve sharing, and environmental benefits.

The energy trade benefit is calculated by multiplying the net electricity exchanged by the market price. Using the SAPP DAM benchmark for a 200–400 MW transfer at 60 % capacity factor, it results in 1.05 to 2.2.1 TWh traded annually, worth approximately USD 99–265 million before losses and charges (in EUR m 83 to 223).

Wheeling revenue comes from third-party use of the line for energy transit, based on capacity or energy.

Reliability benefits are measured by the avoided unserved energy (EENS) and can be valued using each country' s Value of Lost Load (VOLL). African benchmarks typically range from EUR 1.6 to 8 per kWh (USD 2–10 per kWh); thus, small reductions in outages can lead to significant economic benefits.

Fuel displacement benefits stem from replacing expensive local diesel or heavy-fuel generation, usually costing EUR 0.2 – 0.3 per kWh (USD 0.25–0.40 per kWh), with cheaper imported hydropower or other low-cost sources traded through the interconnector.

Finally, reserve sharing and environmental benefits come from coordinated grid management: shared spinning reserves lower the costs of maintaining reliability, while displaced thermal power reduces CO_2 emissions. The value of these benefits can be assessed using avoided reserve capacity costs and national carbon prices or similar shadow prices.

Illustrative Benefit Envelope

Based on conservative estimates from comparable projects, the interconnector could facilitate annual energy trade worth between USD 100 million - USD 260 million, along with additional system benefits such

[33] *Southern African Power Pool, “Market Performance Report – April 2024,” Harare, 2024. [Online]. Available: https://sapp.co.zw*
[34] *Southern African Power Pool, “Market Performance Report – May 2024,” Harare, 2024. [Online]. Available: https://sapp.co.zw*
[35] *Southern African Power Pool, “Monthly and Day-Ahead Market Information Portal,” 2025. [Online]. Available: https://www.sappmarket.com*
[36] *PIDA / AUDA-NEPAD, “ZIZABONA Interconnector Project,” 2023. [Online]. Available: https://www.au-pida.org/project/zimbabwe-zambia-botswana-namibia-zizabona-interconnector-project/*
[37] *AllAfrica / Global Energy Network Institute, “US$ 225 million ZIZABONA Power Interconnector to be Officially Unveiled,” 2012*
[38] *African Development Bank, “Ethiopia–Kenya Electricity Highway – Impact Snapshot,” Abidjan, 2024*
[39] *Energize Magazine, “SAPP Grid Expansion to Connect Malawi (2025), Tanzania and Angola (by 2028),” Johannesburg, 2025*
[40] *Japan International Cooperation Agency (JICA), “Data Collection Survey on SAPP Interconnector Options Including Angola via Baynes,” Tokyo, 2018*

as enhanced reliability and reduced need for reserves. Using average SAPP market prices 7.9 – 10.6 EURct/kWh (9.4–12.6 USct/kWh), this results in the stated trade value range, not including revenues from wheeling and ancillary services[41] . The Ethiopia–Kenya project further demonstrates that integrating large hydropower resources across borders (like with this project) can cut total generation costs by 5–10 % at the system level, while also improving voltage stability and reserve capacity.

6.2.5 Quantify benefits through cost savings analysis

Areas where technological innovations lead to cost reductions

The known economic benefits obtained from transmission interconnections are the following:

1. **Non-simultaneity of the peak load:** Difference of the time of occurrence of the peak load, leading to a low total generation capacity requirement after interconnection, compared to before interconnection
2. **Complementarity of the two generation systems:** the optimal generation dispatch of an extended system (i.e. extended by the interconnection) leads to low operation costs than for the initial separated systems. This can lead to replace power originating from thermal power plants by power originating from less costly energy sources or less polluting energy sources.
3. **Hosting capacity for variable Renewable Energy plants:** the interconnected system provides a higher hosting capacity because of more inertia, more short circuit power, more frequency control power and more plants to compensate for unexpected deviations from power injection forecasts
4. **Reduced total requirements for Frequency Containment Reserves (FCR)**, most often in the form of spinning reserve (primary reserve)
5. **Reduction of Unserved Energy:** in several cases, interconnections can provide supply at times where no generation was available in one of the two systems

The fundamental cost reductions that will arise from the Inga – Soyo interconnection come from five components that differ significantly:

Table 22: Cost reductions due to the interconnection

	Potential sources of benefits	Angola-DRC interconnection BEFORE commissioning of Inga 3	Angola-DRC interconnection AFTER commissioning of Inga 3
1	**Non-simultaneity of the peak load**	No (because same time zone)	No (because same time zone)
2	**Complementarity of the two generation systems**	Yes, providing energy from Soyo TPP to DRC	Yes, providing low cost hydro energy to Angola/SAPP
3	**Hosting capacity for variable Renewable Energy plants**	Yes	Yes
4	**Reduced total requirements for Frequency Containment Reserves (FCR)**	Yes	Yes
5	**Reduction of Unserved Energy**	Yes, huge (*)	Yes, but limited

(*) since Kinshasa presently has a distribution grid able to supply only about 50% of the true demand for electricity

Project Description and Context

The DRC–Angola Interconnection Project seeks to establish a high-voltage transmission line connecting Soyo in northern Angola to Inga in the Kongo Central province of the Democratic Republic of the Congo (DRC). This project is a key part of the Southern African Power Pool (SAPP) initiative and supports both countries' efforts to strengthen regional energy cooperation and electricity trading. The interconnector will

[41] *World Bank, "East Africa Power Integration – Ethiopia–Kenya Interconnector," Washington DC, 2024*

improve the stability and reliability of both grids, boost power exchange capacity, and pave the way for integration between CAPP and the Southern African Power Pool (SAPP)[42], [43].

On the Angolan side, the line starts in Soyo, a strategic area rich in gas and energy assets, including the Angola LNG plant and the Soyo combined-cycle power station. On the DRC side, the line ends at the Camp Kin substation near Inga, close to the Inga I–III hydroelectric complex, which when fully developed will have the potential to generate over 40 GW of power[44]. This corridor will link a growing coastal generation hub to one of Africa's most significant hydropower resources, establishing a foundation for future cross-border energy trade.

Technical Characteristics and System Configuration

The proposed interconnection has two configuration options: a strategy "S1" based on a 400 kV AC double-circuit transmission line intended for a firm transfer capacity of 2,500 MW, and a strategy "S2" based on two 765 kV single circuit lines, providing 5,000 MW firm transfer capacity. It will extend on approximately 190 km, with about 110-140 km in Angola and 50-80 km in the DRC depending on the selected route. The plan includes new step-up substations, switching yards, and protection and control systems that adhere to IEC 61850 and regional standards for interoperability[45] . Due to the extensive span across the Congo River, the alignment will follow the river's eastern bank within Angola, then turn north to cross near the Inga Gorge, where the terrain is suitable for tower anchoring and causes minimal environmental impact.

Both nations will use steel-lattice, self-supporting towers averaging 45–60 m in height, engineered to handle heavy mechanical loads and withstand the extreme wind and humidity typical of the Lower Congo region. The type of tower differs between the 400 kV double circuit line (standard or "danube" towers) and the twin 765 kV single circuit lines (guyed towers), with higher towers for the crossing of the Congo river. Conductor choices will focus on low-loss aluminium-conductor steel-reinforced (ACSR) types with anti-corrosion coatings. Shield wires will incorporate optical-fibre ground wires (OPGW) for communication and SCADA system integration. To maintain voltage stability, especially during light-load conditions, reactive-power compensation devices such as shunt line reactors will be installed to enable the energizing of the line.

Primary Objectives

The technical design addresses several key strategic goals. Firstly, it seeks to boost regional transfer capacity between Angola and the DRC, enabling larger power exchanges, supporting bilateral energy trade, and proving access to least cost generation (the Inga site is unique because is benefits from the rainy seasons of both hemispheres, resulting in an almost constant river flow and consequently a minimized cost of generated kWh). Secondly, it aims to improve grid reliability and redundancy, allowing mutual support during contingencies, therefore also reducing risk and duration of blackouts. Thirdly, it focuses on expanding energy access in rural and peri-urban border areas through downstream grid extensions and integrating distributed energy sources. Fourthly, it intends to foster industrial growth by providing stable electricity to emerging economic zones along the corridor, such as mining, manufacturing, and logistics hubs[46] .

In the long term, the interconnector will become part of a regional transmission backbone linking CAPP and SAPP, paving the way for continental power-market integration aligned with the African Union's PIDA framework[47].

Expected Outcomes

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[42] Southern African Power Pool, *Annual Report 2024: Regional Interconnection Status*, Harare, 2024. [Online]. Available: https://sapp.co.zw

[43] African Union Development Agency (AUDA-NEPAD), *PIDA Energy Outlook 2023: Priority Regional Projects*, Johannesburg, 2023.

[44] Ministère des Ressources Hydrauliques et Électricité (MRHE), *Politique Nationale de l'Énergie de la RDC (2022)*, Kinshasa, 2022

[45] International Electrotechnical Commission (IEC), *IEC 61850 – Communication Networks and Systems for Power Utility Automation*, Geneva, 2013.

[46] African Development Bank (AfDB), *Angola Country Strategy Paper 2023–2027*, Abidjan, 2023.

[47] Programme for Infrastructure Development in Africa (PIDA), *Continental Power System Master Plan 2023*, Addis Ababa, 2023

Once completed and integrated with internal grid reinforcements, the Angola–DRC interconnector is expected to deliver several measurable outcomes:

- *Reliability and security of supply:* Synchronous operation and shared reserves between Angola and DRC will reduce the frequency and duration of supply interruptions, particularly in the Kinshasa and Soyo areas, and lower the economic cost of unserved energy.
- *Energy trade and optimisation of generation:* The interconnector will facilitate energy exchanges of up to 4.5 TWh per year in the initial phase and, depending on the selected strategy and the development of Inga 3, around 15 TWh or 30 TWh per year in the second phase. Both countries will be able to monetise surplus generation and import during shortages, reducing overall generation costs.
- *Improved access to electricity:* By relieving supply constraints and supporting downstream grid extensions, the project will help expand electrification in border regions and urban centres in both countries, complementing national access programmes.
- *Climate and environmental benefits:* By displacing thermal generation with low-carbon hydropower and efficient gas generation, the interconnector will contribute to lower greenhouse-gas emissions. Environmental and social impacts along the 190 km corridor will be managed through a dedicated Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) in line with national legislation and international standards.
- *Jobs, industrialisation and regional integration:* Construction and operation will create employment and skills opportunities, while improved power supply will support industrial development in mining, manufacturing and logistics hubs along the corridor. At regional level, the project will strengthen the interface between CAPP and SAPP, support implementation of AfSEM and the African Continental Free Trade Area (AfCFTA), and contribute to the AU's Programme for Infrastructure Development in Africa (PIDA).

7 Preliminary Environmental Scoping Analysis

7.1 Site specifications

The 190 km 400 kV transmission line will connect the future Inga 3 hydropower complex in Kongo Central province of D.R. Congo to Soyo substation in North-West Angola.

Figure 19: Location of the interconnection line on the DRC map

On the DRC side, the proposed connection is to a substation to be created, Inga 3 “400 kV substation” or Inga 3 “400/765 kV substation”. The existing substation, Inga 2, is fitted with 220 kV busbars and the line Inga-Kinshasa, although built in 400 kV technology, is operated at 220 kV. The 400 kV double circuit line to Kinshasa will also be connected to the interconnection line Inga-Boma-Moanda-Cabinda-Pointe Noire, which is a main section of the future 400 kV “Boucle de l’Amitié” loop linking Brazzaville and Kinshasa both at west and east.

On the Angolan side, the Soyo 400 kV substation is already existing and connects to the whole Angolan 400 kV transmission grid, and to the large combined cycle power plant of Soyo (750 MW).

Comentado [BM1]: TODO: Combine both maps in QGIS

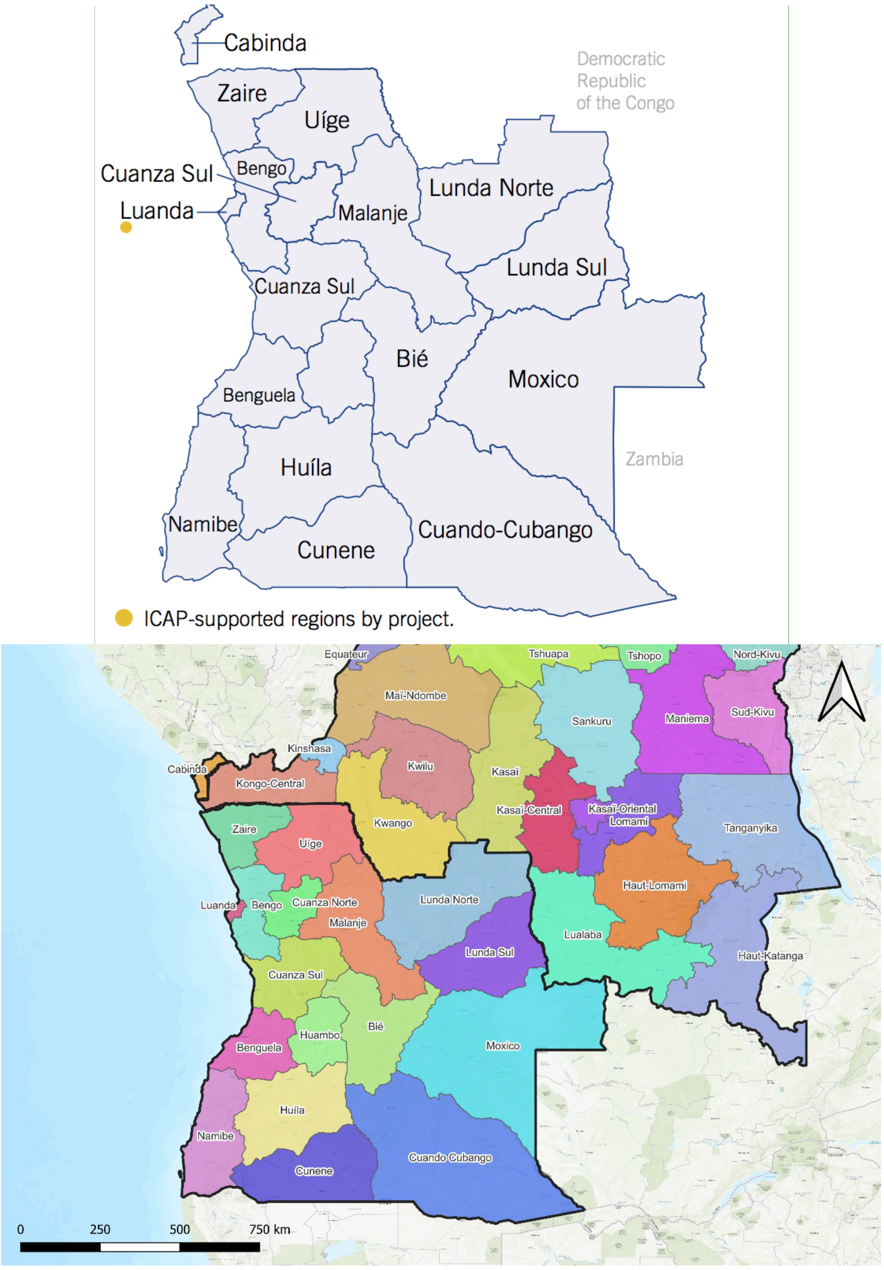

Figure 20: Combined map of border region between Angola and DR Congo

Key infrastructure associated with the interconnector include the transmission lines and towers, access roads and the terminal substations.

Figure 21: Approximate routing of the proposed transmission corridor

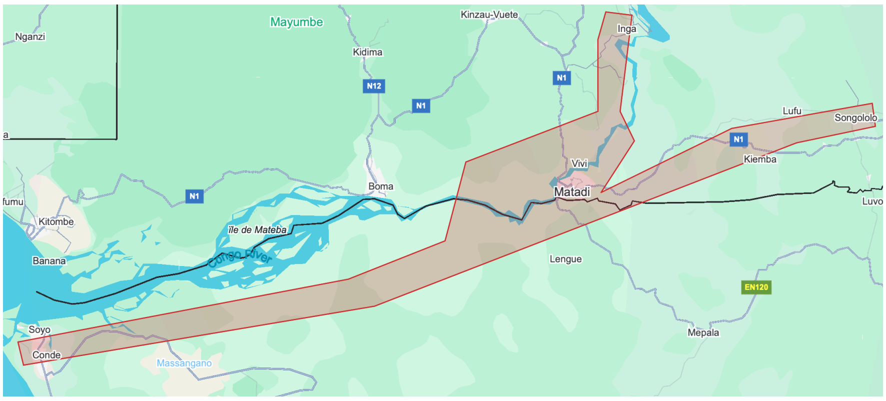

Figure 22: Zone for potential favourable corridor

The province of Kongo Central has a population of 430,000 according to the 2016 census, with a population density of 140 inhabitants per km² at that time.

7.2 Topography

In the area represented by the first 60 kilometers from Inga, the terrain consists of hills with an altitude ranging from 70 m to 500 m. Continuing westwards towards Soyo, the terrain becomes a plain, as shown in the elevation chart available on Google Earth.

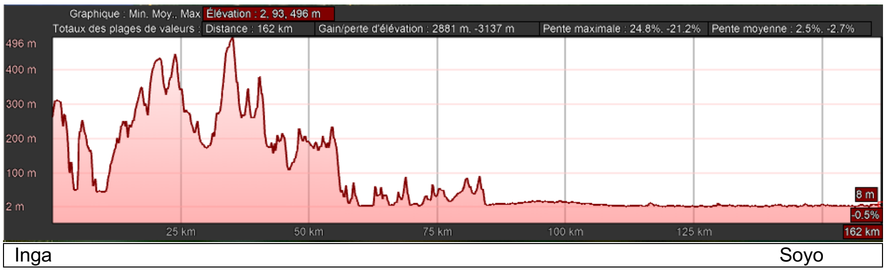

Figure 23: Elevation in meters from Inga to Soyo

The vegetation can be observed to some extent on satellite pictures and proves to consist in forests of trees that are of low height.

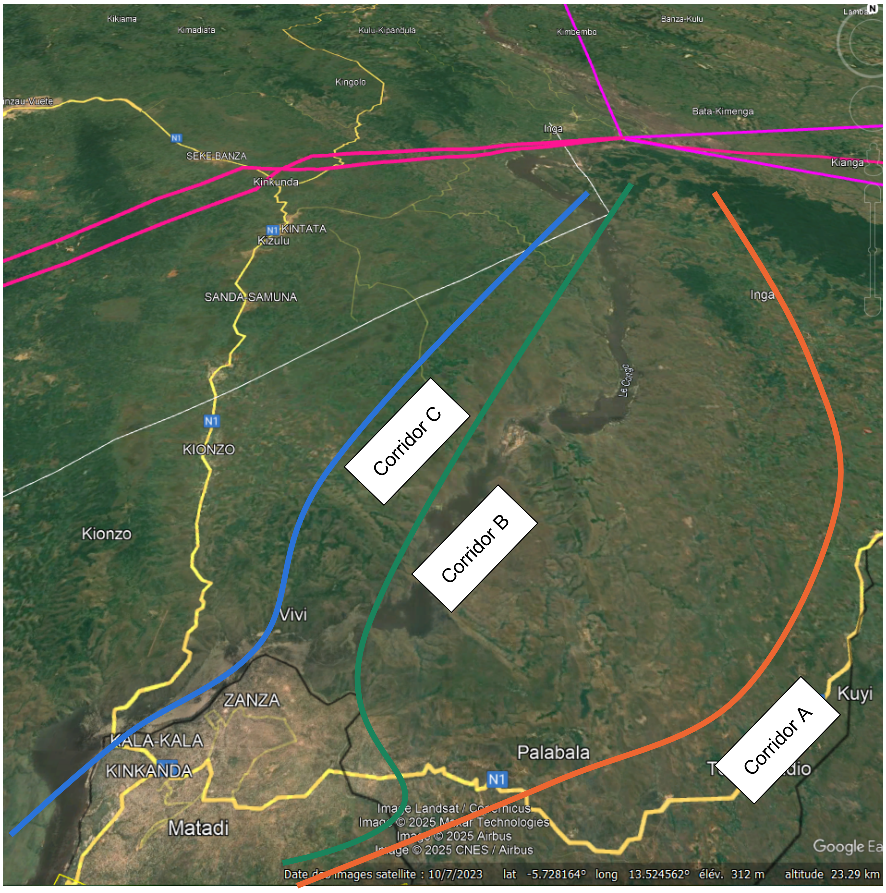

Figure 24: Comparison of the three potential favourable corridors

Between Inga and Matadi, at least 3 corridors can be envisaged and compared (A, B, C) on the above picture.

7.3 Angolan Environment

The following paragraphs are based on information from the Instituto Geográfico e Cadastral de Angola (IGCA) and the Instituto Nacional de Biodiversidade e Áreas de Conservação (INBAC), complemented by national development and environmental frameworks such as Energia 2025 and the Plano de Desenvolvimento Nacional (PDN) 2023–2027[48],[49] ,[50].

7.3.1 Parks and Reserves[51]

In the Zaire Province, the coastal and forest ecosystems are part of the Mayombe transboundary forest complex, which spans borders with Angola, the Democratic Republic of Congo, and the Republic of Congo. Angola's Mayombe, managed by the Mayombe National Park, is a vital conservation area aimed at preserving tropical moist forest biodiversity and safeguarding endangered species[52].

The park and its buffer zones, overseen by INBAC, include parts of Tomboco, Nóqui, and Cuimba municipalities. The region around Soyo and Nzeto also features smaller mangrove and coasta, wetland ecosystems, critical for fish breeding and shoreline protection[53]. However, increasing deforestation due to local fuelwood collection, charcoal production, and agricultural expansion poses significant threats. Similar to the DRC's Luki Biosphere, the Angolan Mayombe experiences degradation from unsustainable wood harvesting and shifting cultivation[54]. The proposed interconnector corridor starts near Soyo, south of the Mayombe forest area, and follows zones with secondary vegetation and disturbed landscapes caused by oil and gas infrastructure development[55].

7.3.2 Climate

Zaire Province has a humid tropical climate shaped by the Benguela Current, which cools coastal temperatures and lowers rainfall near the coast compared to the interior[56]. The area experiences two main seasons: a lengthy rainy period from October to May, with a brief dry spell in January–February, and a dry season from June to September. Average annual rainfall ranges from 900 mm close to the coast to

[48] Instituto Geográfico e Cadastral de Angola (IGCA), *Atlas Geográfico Nacional de Angola*, Luanda, 2023. Available: [https://www.igca.gov.ao/documentos/atlas-geografico-nacional.pdf] (https://www.igca.gov.ao/documentos/atlas-geografico-nacional.pdf). Accessed: Oct. 2025

[49] IGCA, *Cartografia Física da Província do Zaire*, Luanda, 2023. Available: [https://www.igca.gov.ao/publicacoes/cartografia-zaire.pdf] (https://www.igca.gov.ao/publicacoes/cartografia-zaire.pdf). Accessed: Oct. 2025

[50] Instituto Nacional de Biodiversidade e Áreas de Conservação (INBAC), *Relatório sobre a Rede Nacional de Áreas de Conservação*, Luanda, 2023. Available: [https://www.inbac.gov.ao/relatorios/areas-de-conservacao-2023.pdf] (https://www.inbac.gov.ao/relatorios/areas-de-conservacao-2023.pdf). Accessed: Oct. 2025.

[51] INBAC, *Plano de Gestão do Parque Nacional do Mayombe 2023–2030*, Luanda, 2023. Available: [https://www.inbac.gov.ao/parques/mayombe/plano-de-gestao.pdf] (https://www.inbac.gov.ao/parques/mayombe/plano-de-gestao.pdf). Accessed: Oct. 2025.

[52] Ministério da Energia e Águas (MINEA), *Energia 2025 – Estratégia de Desenvolvimento do Sector Eléctrico*, Luanda, 2020. Available: [https://www.minea.gov.ao/publicacoes/Energia2025.pdf] (https://www.minea.gov.ao/publicacoes/Energia2025.pdf). Accessed: Oct. 2025.

[53] Ministério da Economia e Planeamento (MEP), *Plano de Desenvolvimento Nacional 2023–2027*, Luanda, 2023. Available: [https://www.mep.gov.ao/documentos/pdn-2023-2027.pdf] (https://www.mep.gov.ao/documentos/pdn-2023-2027.pdf). Accessed: Oct. 2025

[54] Government of Angola, *Plano Director Nacional de Energia 2025*, Luanda, 2020. Available: [https://www.minea.gov.ao/publicacoes/pdn-energia-2025.pdf] (https://www.minea.gov.ao/publicacoes/pdn-energia-2025.pdf). Accessed: Oct. 2025.

[55] Ministério da Energia e Águas (MINEA), *Relatório de Infraestruturas de Transmissão 2024*, Luanda, 2024. Available: [https://www.minea.gov.ao/publicacoes/relatorio-transmissao-2024.pdf] (https://www.minea.gov.ao/publicacoes/relatorio-transmissao-2024.pdf). Accessed: Oct. 2025.

[56] Ministério do Ambiente (MINAMB), *Relatório Nacional do Estado do Ambiente 2023*, Luanda, 2024. Available: [https://www.minamb.gov.ao/documentos/estado-do-ambiente-2023.pdf] (https://www.minamb.gov.ao/documentos/estado-do-ambiente-2023.pdf). Accessed: Oct. 2025.

approximately 1,200–1,400 mm further inland, with typical monthly temperatures from 22 °C to 30 °C [57],[58]. Humidity levels are high along the coastal plain but decrease toward the interior plateau. The Benguela Current sometimes causes fog and mild coastal droughts, particularly around Soyo and Nzeto. These climatic variations result in a gradient from humid inland forests to semi-humid coastal ecosystems.

7.3.3 Relief and Soil

The province's relief mainly consists of low-lying coastal plains and gently undulating plateaus stretching eastward toward the Congo Basin escarpment, with elevations generally ranging from 50 m to 800 m[59]. The coastal plain around Soyo features sandy and alluvial soils, while inland areas have ferralsols and red lateritic soils with moderate fertility[60].

7.3.4 Hydrography

The Angolan part of the project lies within the Congo River basin, mainly around the lower Congo River, which flows westward into the Atlantic near Soyo. The Congo Delta features extensive wetlands and mangroves, serving as crucial ecological areas for fish breeding and migrating birds[61].

Besides the Congo, several smaller rivers drain Zaire Province, including the Lufico, Luala, Mpozo, and Luango rivers. These rivers experience significant seasonal changes, with high flows during the rainy season and low flows in dry periods[62].

Groundwater resources are plentiful but mostly found in fractured rock aquifers and coastal sand deposits. The hydrology of the region is shaped by the interaction between inland rainfall and the adjacent Benguela oceanic system, similar to the coastal basin of the neighbouring DRC[63].

7.3.5 Land Use

Land use in the Zaire corridor is mainly rural, featuring small-scale farming, grazing, and fishing near the coast[64]. Oil and gas facilities, especially around Soyo, exist alongside subsistence farming, forming a diverse landscape of industrial and community areas. Farming primarily involves cassava, maize, and groundnuts, with low mechanization and reliance on rainfall. Vegetation along the transmission route mostly consists of secondary forest or shrubland that has been cleared for agriculture or infrastructure.

[57] Instituto Nacional de Estatística de Angola (INE), *Anuário Estatístico Provincial 2023 – Zaire*, Luanda, 2024. Available: [https://www.ine.gov.ao] (https://www.ine.gov.ao). Accessed: Oct. 2025
[5858] Instituto Nacional de Meteorologia e Geofísica (INAMET), *Boletim Climatológico 2023*, Luanda, 2024. Available: [https://www.inamet.gov.ao/publicacoes/boletim-climatologico-2023.pdf] (https://www.inamet.gov.ao/publicacoes/boletim-climatologico-2023.pdf). Accessed: Oct. 2025.
[59] INAMET, *Estudo Hidroclimático da Faixa Litoral Norte*, Luanda, 2023. Available: [https://www.inamet.gov.ao/publicacoes/estudo-hidroclimatico-2023.pdf] (https://www.inamet.gov.ao/publicacoes/estudo-hidroclimatico-2023.pdf).
[60] World Meteorological Organization (WMO), *Regional Climate Profile for Central Africa*, Geneva, 2022. Available: [https://library.wmo.int/doc_num.php?explnum_id=11370] (https://library.wmo.int/doc_num.php?explnum_id=11370). Accessed: Oct. 2025.
[61] World Wide Fund for Nature (WWF), *Mayombe Transboundary Forest Biodiversity Assessment*, Gland, 2020. Available: [https://d2ouvy59p0dg6k.cloudfront.net/downloads/mayombe_biodiversity_report.pdf] (https://d2ouvy59p0dg6k.cloudfront.net/downloads/mayombe_biodiversity_report.pdf). Accessed: Oct. 2025
[62] Food and Agriculture Organization (FAO), *Soil and Agro-Ecological Zoning for Angola*, Rome, 2022. Available: [https://www.fao.org/3/cc2830en/cc2830en.pdf] (https://www.fao.org/3/cc2830en/cc2830en.pdf). Accessed: Oct. 2025
[63] African Development Bank (AfDB), *Angola Power Sector Diagnostic Report*, Abidjan, 2021. Available: [https://www.afdb.org/en/documents/angola-power-sector-diagnostic-report] (https://www.afdb.org/en/documents/angola-power-sector-diagnostic-report). Accessed: Oct. 2025.
[64] AfDB, *Environmental and Social Appraisal Report – Power Interconnectors Phase III*, Abidjan, 2022. Available: [https://www.afdb.org/en/documents/environmental-and-social-appraisal-report-power-interconnectors-phase-iii] (https://www.afdb.org/en/documents/environmental-and-social-appraisal-report-power-interconnectors-phase-iii). Accessed: Oct. 2025

The Plano Director Nacional de Energia 2025 designates Soyo and Nzeto as key industrial-energy zones, supporting the development of the interconnector in line with national corridor priorities[65].

7.3.6 Environmental and Social Considerations

Under the Environmental Framework Law (Law No. 5/98) and Decree No. 51/04, the Soyo–Inga transmission line requires a comprehensive Environmental Impact Assessment (EIA)[66]. The Ministério do Ambiente (MINAMB) is responsible for granting environmental approval, while the Instituto Nacional de Biodiversidade e Áreas de Conservação (INBAC) oversees biodiversity concerns within protected areas[67]. Activities in the Mayombe Forest or mangrove wetlands demand special permits from INBAC and local authorities, including mitigation strategies like buffer zones and reforestation efforts. Coordination with the Instituto Geográfico e Cadastral de Angola (IGCA) is necessary for land demarcation and mapping.

7.4 DRC Environment

This sub-section is based on information from the AZES (Agence pour les Zones Economiques Spéciales).

7.4.1 Parks and Reserves

In the Kongo Central province, the Mayombe forest (also spelled Mayumbe) was famous for its wood and trees were cut until recently to be brought to the two nearest ports (Moanda and Matadi). The area includes a reserve called "Biosphere of Luki" and the vegetation around this reserve is nowadays much less dense than in the past, as a consequence of the human activity[68], mainly the cutting of trees for getting wood for cooking, most often transforming the wood into charcoal. This activity with high impact on the environment is a consequence of the lack of available alternatives for cooking, in short a consequence of bad economic conditions that the populations have faced during the last 50 years.

The corridor A shown on the above picture stretches south of the Moyambe forest, while corridors B and C pass through the Moyambe forest.

7.4.2 Climate

Kongo Central is characterized by a short dry season from May to September and a long rainy season from October to May, interspersed with a short dry season between January and February. The uniqueness of Kongo Central's climate lies in the rainfall pattern and the length of the dry season. Indeed, at the same latitude, it rains less, especially in the coastal region, than in the east. The number of rainy days is lower, but the dry season is longer, and the short dry season is more pronounced. Because of this, the Congo river maingly carries water that came for in the East.

In fact, Kongo Central is the least rainy province in the country, with the greatest interannual variation in precipitation. This explains the frequency of droughts.

The Benguela Current plays a major role, and drought is a periodic and disruptive phenomenon in Kongo Central. This is due to two factors:

- Low rainfall: Kongo Central records the lowest rainfall rates in the country. Rainfall decreases from east to west (1,500 mm in Kwango and 900 mm on the Atlantic coast);

[65] African Development Bank (AfDB), *Integrated Safeguards System – Operational Safeguards (OS1–OS5)*, Abidjan, 2013. Available: [https://www.afdb.org/en/documents/integrated-safeguards-system] (https://www.afdb.org/en/documents/integrated-safeguards-system). Accessed: Oct. 2025.

[66] African Union Development Agency (AUDA-NEPAD), *Programme for Infrastructure Development in Africa (PIDA) Progress Report*, Midrand, 2022. Available: [https://www.nepad.org/publications] (https://www.nepad.org/publications). Accessed: Oct. 2025.

[67] Japan International Cooperation Agency (JICA), *Hydrological Mapping of the Lower Congo Basin*, Tokyo, 2020. Available: [https://openjicareport.jica.go.jp/pdf/12345678.pdf] (https://openjicareport.jica.go.jp/pdf/12345678.pdf). Accessed: Oct. 2025.

[68] https://www.wwfdrc.org/?32628/Un-autre-recit-pour-la-foret-du-Mayombe

- Interannual irregularities: there is a succession of dry and rainy years.

There are sensitive regional climatic variations in Kongo Central. They can be summarized as follows:

- Coastal region: high temperatures, very pronounced drought;
- Mayombe: less pronounced drought, highly irregular rainfall, cooler temperatures;
- Manyanga and Songololo territories: a fairly dry region overall, except for the higher areas (massifs, mountains, ridges) where rainfall is abundant and temperatures cool;
- South of the Cataracts (from Mbanza-Ngungu to Kinshasa): a fairly humid transition zone with heavy rainfall; lower temperatures on the summits (Bangu, Mbanza-Ngungu) and warmer and less rainy in the depression.

7.4.3 Relief and Soil

Kongo Central has a very varied relief in detail; but it is essentially a province of plateaus that are more or less sharply dissected and never very high. Altitudes rarely exceed 750 m.

Four regions within Kongo Central can be distinguished: the coastal region, the Mayombe region, the Cataractes region, and the borders of Kongo Central (around the Kwango River).

Kongo Central province has four soil types, namely:

- Sandy soils of the arenoferral type: this is a poor soil type that is not suitable for agriculture, but can be suitable for livestock farming (north of Mateba Island);
- Sandy clay and clayey soils: these are located in Lukula and Tshela, north and northwest of Seke-Banza (Bas-Fleuve District); These soils belong to the ferrasol group on basic rock, except for the western part, which is of the Cretaceous sublittoral sandstone type. Generally, fertility is average, except for the western part (sandy);
- Sandy-clay soils: are located south of Seke-Banza (Lower River District), southwest of Luozi (Cataractes District), in Mbanza-Ngungu except in the northwest (Cataractes District), and in Madimba, Inkisi Valley (Lukaya District). From west to east, the Mayombe system, the Upper Shiloango system, the tillite system, and the schist-limestone system are distinguished. The texture is clayey-silty to sandy-clayey; it is a fertile soil, except south of Mbanza-Ngungu (Cataractes District), where the texture is composed of fine sand;
- Sandy-clay soils with sandy-clay patches are found north and east of Luozi (Cataractes District), northwest of Mbanza-Ngungu (Cataractes District), and in Lukaya District; these soils are fragile and of low fertility.

7.4.4 Hydrography

Kongo Central is part of the greater Congo River basin, with the exception of the Mayombe, which is drained by the Shiloango River. However, the contribution of Kongo Central tributaries to the Congo river's flow is minimal (1.5% maximum). Similarly, while the Congo River is a major transport route for the Democratic Republic of Congo, the navigable portion of Kongo Central is only 168 km between Matadi and Banana. Thus, of the 400 km between Kinshasa and Banana, 232 km (Kinshasa-Matadi) are not navigable due to waterfalls and rapids.

Furthermore, the Congo River boasts tremendous hydroelectric potential, estimated at 100,000 megawatts, including 58,000 megawatts between Kinshasa and Matadi in the Kongo Central region. In addition to the Congo River, the Kongo Central hydrographic network is made up of numerous smaller rivers, the most important of which are: Inkisi, Nsele, Mfidi, Lubishi, Lumene, Bombo, Lufimi, Luidi, Lukunga, Ngufu, Mosi, Mobi, Lugunga, Kwilu, Lufu, Mfumu, Yambi, Luala, Tombe, Lunionzo, Madiadia, Luima, Sanzikua, Lukasu, Ngudi, Luozi, Luenda, Lukula, Lubuzi, Mbavu, Lemba, Luangu, Mbulu, Nkiela, and Ndudi, as well as the Shiloango River in the Bas-Fleuve region.

7.4.5 Land Use

The land use in the area of the projected line is predominantly rural agriculture and communal grazing.

The Environmental Permits are required by ACE (Agence Congolaise de l'Environnement for DRC) and Ministerio de Ambiente (for Angola).

The Social Safeguards are tocomply with WB/AFDB standards, FPIC (Free, Priori and Informed Consent) for vulnerable groups.

7.5 Least Impact Line Route

The preliminary least-impact line route for the transmission line between Inga (DRC) and Soyo (Angola) is based on minimizing environmental/social risk and takes into account the logistics and construction constraints. Regarding logistics, the ports that are recommended for minimizing adverse impacts are the following:

- Matadi port for DRC side
- Soyo port for Angola side

The advantage of basing the logistics from these two ports are:

- An existing infrastructure artery (partly along the Congo river and the road) to reduce new access roads, spoil, and temporary camps.
- Skirts sensitive habitats by keeping south/east of Moyambe Forest Nature Reserve, limiting biodiversity offsets and steep-slope towers.
- Avoids dense settlements: the works are outside cities and stay in lower-density agricultural, fewer PAPs and simpler compensation.
- Strong grid endpoint at Soyo already existing as a transmission hub, with existing substation

Route Considerations

- Parallel existing linear assets (paved roads/ROWs) where safe clearances allow; target ≤1–2 km offsets to bypass towns/schools.
- Keep ≥5 km from national parks/reserves (project-specific buffers per ESIA scoping).
- Avoid critical habitats (riparian corridors, wetlands) and cross rivers orthogonally at narrowest points.
- Cap slopes at ~20–25% for tower pads; prefer ridge-top alignments over side-hill cuts.
- Limit angle points (≥800–1,000 m spans where feasible); favour straight segments across agricultural mosaics.
- Use a 1 km ESIA corridor for assessment/consents; finalize a 40–60 m RoW centerline inside that band after RAP mapping.
- Micro-site around schools, clinics, graves, and cultural sites with ≥200–500 m buffers
- Select structure types (tangent vs. suspension) to reduce foundation footprint in soft soils/wet zones.
- Time works to dry season near wetlands; implement bird-diverters on waterways/flight lines.

Regarding the construction of the line, the lack of roads in the northern part of Angola (from Soyo to the proposed crossing point into the DRC) will impose a specific logistic frame for the works to be carried out.

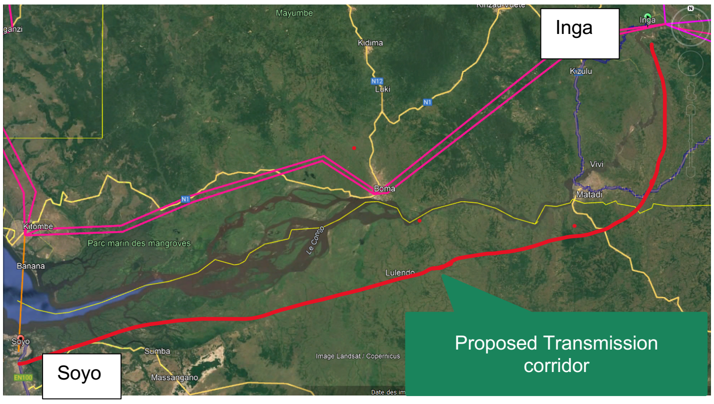

Figure 25: Least Impact line route for the 400 kV interconnector from the Inga substation "Camp Kin" in DRC to Soyo in Angola

7.6 Geographical Area

7.6.1 Administrative Coverage

Angola

Zaire Province, including Soyo, Nzeto, and Tomboco Districts, is located in northwestern Angola, covering around 40,000 km² with an estimated population of about 700,000 people. The provincial capital is M'Banza Kongo, a UNESCO World Heritage Site . The province borders the Democratic Republic of Congo (Kongo Central Province) to the north and northeast, the Atlantic Ocean to the west, and Uíge and Bengo provinces to the east and south, respectively.

The town of Soyo, situated at the Congo River's mouth, serves as Angola's main oil and gas hub and the western endpoint of the planned interconnection. The terrain varies from low coastal plains to plateaus reaching approximately 800 meters in elevation, with vegetation including coastal mangroves and inland semi-deciduous forests.

Democratic Republic of Congo

Kongo Central Province (Muanda, Tshela, Songololo, Luozi Territories): Kongo Central spans approximately 53,000 km² and has a population of over 6 million . Its capital, Matadi, is the main Atlantic port of the DRC, while Muanda is a key coastal town facing Soyo.

The province shares borders with Angola's Zaire Province to the southwest, the Republic of Congo to the north, and Kinshasa Province to the east. It features notable geographical landmarks such as the Mayombe Forest, Luki Biosphere Reserve, and Bas-Congo Plateau, ranging in elevation from 300 to 700 meters. The Congo River acts as a natural boundary across much of the region.

7.6.2 Temporal Boundaries

Project timeframes include the mobilisation, construction, commissioning, and demobilisation phases, estimated at 36–48 months.

7.6.3 Institutional Boundaries

The project is under the jurisdiction of Angola's Ministry of Energy and Water (MINEA) and the Ministry of Hydraulic Resources and Electricity (MRHE) of the DRC. The agencies responsible for implementing it are RNT and SNEL, which handle transmission development and maintenance.

7.6.4 Climatic Conditions

The corridor is situated in a humid tropical climate. The rainy season occurs from October to May, with a brief dry period in January and February. The dry season lasts from June to September. Annual rainfall ranges from 1,000 to 1,400 mm, and average daily temperatures range between 22 °C and 30 °C.

7.6.5 Primary and Secondary Impact Zones

Table 23: Impact Zones

Category	Description
Primary Impact Zone	Transmission Line Right-of-Way (RoW), tower foundations, substations at Soyo and Inga
Secondary Impact Zone	Access roads, logistics areas, worker camps, and service corridors.
Road Access	Combination of paved and laterite roads. In Angola: EN100 and some secondary roads connect Soyo to M'Banza Kongo; in DRC: RN1 Muanda to Matadi.
Remote Sections	Riverine and forested zones near the Congo River require temporary roads, pontoons, or barges for equipment.
Transport Hubs	Soyo Port (Angola) and Matadi Port (DRC) serve as primary logistics gateways.
Ecological	Sensitive areas include Luki Biosphere Reserve (DRC) and Soyo mangrove wetlands (Angola).
Social	Dispersed settlements, farming villages, schools, and places of worship along corridors.
Cultural	Archaeological and sacred sites near M'Banza Kongo warrant protection.
Terrain	Rolling plains and erosion-prone slopes near the Congo escarpment.
Hydrological	Major crossings: Congo, Lufico, Luala, Mpozo rivers.

7.6.6 Land Availability

Land Acquisition Needs:

- Transmission RoW: ~800 ha (40 m × 200 km).
- Substations & Ancillary Facilities: 10–20 ha.
- Temporary Uses: camps, laydown areas, access roads.

Land Ownership and Legal Frameworks:

- Angola: State-owned land under the Land Law No. 9/04; concessions issued as DUAT; expropriation[69] for public utility with compensation.
- DRC: State property under Loi n° 73-021 of 20 July 1973; Loi n° 77-001 on expropriation; customary tenure dominant in rural zones.

Availability and Constraints:

- Rural land is generally available but occupied.
- Challenges: informal tenure, overlapping claims, compensation disputes[70].

[69] Republic of Angola, *Lei de Expropriação por Utilidade Pública No. 1/21*, Luanda, 2021. Available: [https://www.minfin.gov.ao/legislacao/lei-expropriacao-1-21.pdf] (https://www.minfin.gov.ao/legislacao/lei-expropriacao-1-21.pdf). Accessed: Oct. 2025

[70] Republic of Angola, *Lei de Terras No. 9/04*, Luanda, 2004. Available: [https://www.minfin.gov.ao/legislacao/lei-de-terras.pdf] (https://www.minfin.gov.ao/legislacao/lei-de-terras.pdf). Accessed: Oct. 2025

- Approach: develop Resettlement Action Plan (RAP) and grievance mechanisms consistent with IFC PS5 and AfDB ISS[71].

7.6.7 Summary of Key Environmental Impacts

Table 24: Key Environmental Impact

Impact Category	Description
Biodiversity	Vegetation clearing; possible disturbance in Mayombe and Luki zones[72] .
Soil & Erosion	High risk on slopes and tower foundations.
Water Resources	Sediment/pollution risks at river crossings.
Air & Noise	Temporary increase from construction equipment.
Waste	Metal scraps and oil residues require regulated disposal[73] .
Visual & Aesthetic	Towers may affect coastal and forest vistas.
Social	Temporary relocation and community safety risks.

7.6.8 National Environmental Legislation Overview

Angola:

- Law No. 5/98 – Environmental Framework Law.
- Decree No. 51/04 – EIA procedure regulation.
- Law No. 6/17 – Forestry and Wildlife Law.
- Law No. 7/15 – Labour and Occupational Safety requirements.

Democratic Republic of Congo:

- Loi n° 11/009 du 9 juillet 2011 – Environnemental Protection Law.
- Décret n° 14/019 du 2 août 2014 – EIA/ESIA regulation.
- Forest Code (2002) – forest use and protection.
- Labour Code (2016) – worker health and safety.

Preliminary Sustainability Measures

- Route optimization to avoid sensitive zones and dense settlements[74].
- Erosion control and reforestation programs.
- Comprehensive Environmental and Social Management Plan (ESMP).
- Stakeholder engagement and community liaison offices.
- Compliance with IFC Performance Standards (PS1, PS2, PS5) and AfDB policies[75].

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[71] Republic of Angola, *Decreto No. 51/04 sobre Estudos de Impacte Ambiental*, Luanda, 2004. Available: [https://www.minamb.gov.ao/legislacao/decreto-51-04.pdf] (https://www.minamb.gov.ao/legislacao/decreto-51-04.pdf). Accessed: Oct. 2025

[72] Republic of Angola, *Lei de Terras No. 9/04*, Luanda, 2004. Available: [https://www.minfin.gov.ao/legislacao/lei-de-terras.pdf] (https://www.minfin.gov.ao/legislacao/lei-de-terras.pdf). Accessed: Oct. 2025

[73] Porto de Soyo Authority, *Relatório Anual de Actividades Portuárias 2023*, Soyo, 2024. Available: [https://www.portosdeangola.co.ao/soyo/relatorio-2023.pdf] (https://www.portosdeangola.co.ao/soyo/relatorio-2023.pdf). Accessed: Oct. 2025

[74] International Finance Corporation (IFC), *Performance Standards on Environmental and Social Sustainability*, Washington, D.C., 2012. Available: [https://www.ifc.org/performance-standards] (https://www.ifc.org/performance-standards). Accessed: Oct. 2

[75] African Development Bank (AfDB), *Environmental Procedures for Regional Infrastructure Projects*, Abidjan, 2020. Available: [https://www.afdb.org/en/documents/environmental-procedures-regional-projects] (https://www.afdb.org/en/documents/environmental-procedures-regional-projects). Accessed: Oct. 2025

- Periodic environmental audits and rehabilitation of construction sites.

7.7 Procedures and Process for Environmental and Social Impact Assessments

7.7.1 Angola

7.7.1.1 Legal and institutional framework

The Environmental Impact Assessment (EIA) in Angola is required for activities with potential environmental or social impacts. It ensures environmental considerations are included in project planning before implementation. Governed mainly by Law No. 5/98 (Basic Environmental Law) and Presidential Decree No. 117/20, the process is managed by the Ministry of Environment[76,77] through its National Directorate, supported by provincial and sectoral departments.

The process starts with screening, where the project proponent submits a description to the Ministry of Environment, which reviews it to determine if a full Environmental Impact Study (EIS), a simplified assessment, or exemption is needed. Projects are categorised under Decree No. 117/20: Category A with significant impacts requiring a full EIS; Category B with moderate impacts needing a simplified study; and Category C with minimal or no impacts, possibly exempt. The Ministry issues a screening decision on requirements.

7.7.1.2 Summary of EIA/ESIA process in Angola

The EIA/ESIA process in Angola follows nine sequential stages summarised in the following table.

Table 25: ESIA process in Angola

Stage	Name	Responsible Entity	Description	Key Output
1	**Screening**	Ministry of Environment	The project proponent submits a brief project description. The Ministry of Environment determines whether a full, simplified, or no EIA is required, classifying the project under Category A, B, or C according to potential environmental impacts.	Screening decision letter outlining category and EIA requirement
2	**Scoping and ToR**	Proponent & Ministry	Defines key environmental and social issues, study area, and methodology. The proponent prepares a Scoping Report, which is reviewed and approved by the Ministry to produce official Terms of Reference.	Approved Terms of Reference for the EIS
3	**Environmental Impact Study (EIS)**	Accredited Consultant	Comprehensive assessment of project impacts, alternatives, and mitigation measures. Includes baseline studies, Environmental and Social Management Plan (ESMP), and non-technical summary.	Final EIS and ESMP submitted for review

[76] Government of Angola, Presidential Decree No. 117/20 of 22 April 2020 – Environmental Impact Assessment and Licensing Regulation, Luanda, 2020. [Online]. Available: https://legalmca.com/wp-content/uploads/2020/05/07052020-Angola-New-Environmental-Regulation-for-Assessment-and-Licensing_.pdf
[77] Republic of Angola, *Law No. 5/98 of 19 June 1998 – Basic Environmental Law*, Luanda, 1998. [Online]. Available: https://www.ecolex.org/details/legislation/basic-environmental-law-no-598-lex-faoc018069

Stage	Name	Responsible Entity	Description	Key Output
4	**Public Consultation**	Proponent	Public hearings and disclosure of EIS findings to affected communities. Stakeholder feedback is incorporated into the final study.	Consultation report with record of stakeholder input
5	**Review and Licensing**	Ministry of Environment	The Ministry reviews the EIS for adequacy and compliance with environmental standards. Upon approval, it issues an Environmental Licence for construction, operation, or decommissioning.	Environmental Licence with conditions
6	**Monitoring and Compliance**	Proponent & Ministry	Implementation of the ESMP, periodic monitoring, and submission of compliance reports. The Ministry performs inspections and audits to ensure adherence.	Monitoring and audit reports; inspection records
7	**Environmental Audit and Closure**	Ministry of Environment	Final audit verifies rehabilitation, closure activities, and post-project environmental condition. The Ministry certifies successful completion.	Final Audit Report and Closure Certificate
8	**Strategic Environmental Assessment (SEA)**	Public Authority	Conducted for sector policies, plans, or programmes likely to have cumulative impacts, ensuring sustainability principles are integrated at higher planning levels.	SEA Report

7.7.2 DR Congo

The Democratic Republic of the Congo (DRC) has put in place a regulatory system that requires Environmental Impact Assessments (EIA) or Environmental and Social Impact Assessments (ESIA) for all significant development projects, such as power transmission lines and substations. These requirements are mainly outlined in Law No. 11/009 of July 9, 2011, concerning the Fundamental Principles of Environmental Protection, and in Decree No. 14/019 from August 2014, which specify the procedures for obtaining environmental approvals and conducting compliance checks.

7.7.2.1 Legal and Institutional Framework

The Ministry of Environment and Sustainable Development (MEDD) is the main authority responsible for environmental assessments, while the Agence Congolaise de l'Environnement (ACE) handles technical and administrative tasks such as project screening, reviews, and issuing environmental compliance certificates. Provincial Environmental Directorates support field verifications and engage with local communities.

7.7.2.2 Overall requirements and EIA/ESIA process

The EIA/ESIA process in DRC follows nine sequential stages summarised in the following table.

Table 26: ESIA process in DRC

Stage	Stage Name	Responsible	Description of activities
1	**Registration/ Screening**	Project developer and ACE	The project developer submits a *Notice of Intent* to ACE, which determines whether a full or simplified ESIA is required. Power infrastructure projects such as substations and transmission lines are automatically categorised as high impact (Category A), requiring full ESIA.
2	**Scoping**	Project developer and ACE	Preparation and submission of Terms of Reference (ToR) defining study boundaries, key issues, methodology, and consultation plans.
3	**Baseline Studies**	Accredited Consultants	Multidisciplinary collection of environmental, ecological, and socio-economic data along the line corridor and substation sites.
4	**Impact Assessment**	Consultant and Project developer	Identification and evaluation of potential impacts during construction, operation, and decommissioning, including cumulative and transboundary effects.
5	**Mitigation and ESMP**	ACE + Project developer/ Consultant	Formulation of an Environmental and Social Management Plan (ESMP) outlining mitigation actions, monitoring indicators, responsibilities, and budgets.
6	**Public Consultation**	ACE / MEDD	Mandatory stakeholder engagement and disclosure of draft reports in accessible languages, culminating in a public hearing (*audition publique*) .
7	**Review and Approval**	Project developer	ACE conducts a technical review and, upon satisfaction, issues an Environmental Compliance Certificate.
8	**Implementation and Monitoring**	ACE + Project developer	The developer implements the ESMP and submits regular compliance reports.

7.7.2.3 Specific Requirements

In the Democratic Republic of the Congo (DRC), Environmental and Social Impact Assessments (ESIAs) for transmission lines and substations follow a comprehensive framework that integrates national laws with international best practices. A transmission line of this size is categorised as a Category A development under Law No. 11/009 of 9 July 2011 and Decree No. 14/019 of 2 August 2014, designating it as a high-impact project that requires a full Environmental and Social Impact Assessment (EIES complète) before initiation[78],[79].

The assessment must specifically consider establishing rights-of-way (ROW) and compensating affected individuals, vegetation clearing efforts, and biodiversity offset programmes - especially in ecologically sensitive areas like the Mayombe Forest - and address the impacts of construction and maintenance tracks, which can cause unplanned deforestation and settlement. It should also evaluate community safety

[78] Democratic Republic of the Congo, *Law No. 11/009 of 9 July 2011 on Fundamental Principles Relating to the Protection of the Environment*

[79] Democratic Republic of the Congo, *Decree No. 14/019 of 2 August 2014 establishing procedures for environmental compliance and audit*

and electromagnetic-field (EMF) exposure, ensuring clear communication with local communities about potential health and operational risks. Additionally, project proponents must demonstrate alignment with SNEL's national transmission master plan and provincial land-use policies, ensuring infrastructure development supports broader environmental management goals. This comprehensive approach guarantees that energy projects in the DRC meet both national regulations and international environmental safeguard standards set by organisations such as the African Development Bank, World Bank, and IFC.

7.7.2.4 Alignment with International Standards

Given limited regulatory capacity, international best practices, such as the IFC Performance Standards, the World Bank Environmental and Social Framework, and the African Development Bank Integrated Safeguards System, are typically applied to supplement national requirements, ensuring consistency with global sustainability benchmarks.

8 PPP Suitability and Affordability Screening

8.1 Private Sector Participation

8.1.1 Private sector participation in Angola

Private sector involvement is being encouraged in the energy sector. The legal reforms included in the PND and associated legislation are intended to open production (and other segments) to private players, moving away from a system in which the state has been the principal producer, buyer and seller of electricity.

Following recent amendments to the electricity laws in Angola in July 2025, transmission has also been opened to the private sector, which is expected to influence the participation of the private sector in transmission role.

Currently, the major private activities in Angola are engineering, procurement and construction (EPC). Following are several examples:

i. Cambambe HPP：Odebrecht, Alstom, Voith, Semence
ii. Lauca HPP：Odebrecht
iii. Laúca-Huambo transmission line：CMEC
iv. Soyo：CMEC, GE
v. Soyo 2 lotto：AE energy, GE

As a Japanese participant, Sumitomo Corporation has signed an MOU with the Angolan government to build a diesel power plant utilizing diesel generators in off-grid set ups.

There is increasing actual project activity (solar projects, interconnectors) involving private or mixed-private consortia for example:

i. Biopio Solar Power Station (188.8 MW, Benguela, commissioned ~2022).
ii. Baía Farta Solar Power Station (96.7 MW, commissioned ~2022).
iii. Caraculo Solar Power Station (25 MW first phase, ~2023).
iv. MoU in 2024 between Angola Government, ProMarks & Trafigura for a 2,000 MW transmission interconnector (HVDC) to carry surplus hydropower to DRC & Zambia.

PPPs in generation (especially solar PV and hydropower) are emerging, supported by multilateral financing (World Bank, AfDB). Notwithstanding reforms and recent developments pointing to new commitments from independent power producers (IPPs), to date Angola has seen little private participation in any segment of the electricity sector value chain, and structural challenges persist in the electricity market. Major barriers include insufficient grid infrastructure, high distribution losses, and a slower pace of development of solar and wind energy resources compared to the country's potential. Electrification currently stands at 47 percent, and while universal electricity access remains a priority, reaching this goal requires effective participation of private investment across the value chain.

There are U.S. based power product and solutions companies active in Angola such as GE, Cummins, Caterpillar and Westing House Turbines, among others. In addition, European companies (Germany, Portugal) supply equipment to the energy sector. Portuguese, Brazilian, and Chinese construction companies generally lead in project construction.

Angola Power EPC Industry Overview

The Angola power EPC market is moderately fragmented. Some of the key players (in no particular order) include Isolux Corsan SA, Gesto-Energia SA, Anglo Belgian Corporation, AEE Power Corporation, and Siemens AG. Some of the European companies in the electricity sector in Angola are listed here:

1. *Isolux Corsan, S.A.*

Isolux Corsan, founded in 1928 and based in Madrid, Spain, is an EPC services provider operating primarily in the energy and infrastructure sectors. The company manages over 6,811 kilometers of lines in Brazil, India and Peru, and develops both private and public car parks in Spain. Isolux Corsan has a diverse portfolio that includes more than 750 MW of photovoltaic power projects and over 879 MW of wind power projects, with operations spanning 4 continents and 9 countries.

2. *Gesto-Energia S.A.*

Gestro – Energia S.A is based in Portugal and has an overall experience of more than 50,000 MW of renewable energy projects in Africa, America, Asia and Europe and more than 50,000 km of electrification infra-structure planned. Gesto develops projects that contribute to sustainable energy access and to the development of a better world.

3. *Anglo Belgian Corporation*

Anglo Belgian Corporation (ABC) is an "open source" manufacturer of medium speed engines with various energy outputs, operating a state-of-the-art production facility in Gent, Belgium since 1912.

4. *AEE Power Corporation*

AEE Power EPC is based in Madrid, Spain and is a Pan-African EPC Contractor and Power Developer specialized in power infrastructures of Sub-Saharan Africa.

5. *Siemens AG*

Siemens is a German energy technology company. Siemens Energy in Angola has historically worked closely with the oil and gas sector, and has also played a pivotal role in addressing challenges in electrification and skill development, which are particularly vital in Southern Africa's energy transition journey.

Other EPC include Dominion (Spain), AEEpower (Portugal-Spain), and EKN (Sweden).

Basic Screening of a Private Independent Transmission Line (IPT) funding under a PPP is assessed below.

Table 27: Basic screening of PPP suitability of the Interconnection project with respect to Angola regulatory framework

Question	Pass	Fail	Answer	Suitability
Is there a legal Framework for PPP allow for private sector participation in Transmission Lines	X		• Electricity law reform (2025) Law No. 6/25, 23 July 2025 explicitly liberalise transmission, amendment to Law No. 14-A/96, of 31 May 1996 • PPP Law o Law No. 11/19 of 14 May 2019 • Public procurement laws o Law No. 41/20 of 23 December 2020 o Law No. 9/16 (June 2016)	Yes
Strategic Significance/ Political Interest	X		• Enable participation in regional power markets (SAPP) • Power exports will enhance Angola's regional influence and economic diplomacy • Attracting private capital • Improving governance and regulation • Cost reductions create political space for gradual tariff reforms	Yes

Question	Pass	Fail	Answer	Suitability
			• National Grid Integration & State Cohesion	
Consistency with Angola national development plan, sectoral polices ?	X		• Consistent with plans to Integrate the Northern, Central and Southern electricity systems • Enabling reliable power supply to underserved regions • Supporting equitable socio-economic development	Yes
Technical feasibility /Complexity	X		• Likely issues that may arise include Commercial frameworks may take longer to finalise than the technical design.	Yes
Project's Size and scope significant to justly investment costs	X		• The size of the line Expandable 300–600 MW (220 kV double-circuit or 400 kV single circuit) matches Angola's low cost hydro surplus potential, is material for Zambia's system growing demand and deficit periods and supports both firm power exports and seasonal trade	
Any Significant Risks association with the Project			• Macroeconomic instability & foreign exchange shortages. • Fuel/commodity price fluctuations. • Limited sovereign guarantees since Angola's public debt already high. • Lack of established PPA templates and regulatory predictability.	Partial
Is there appetite for PPPs in the Energy Sector ? If so how many ?	X		• Several private sector participation in Hydro and PV solar generation	Yes
Commercial Viability	X		The transfer Capacity is large enough to generate meaningful economic and financial benefits. The capacity matches Angola's hydro surplus potential and Zambia's system demand and deficit periods	Partial

8.1.2 Private sector participation in DRC

The DRC has developed a distinct PPP framework with both the legal requirements and the institutions under the law No.18/016 of 2018. The Electricity law also makes clear provisions for private sector participation through concessions with long term licensing.

In addition, the Public Procurement Authority plays a role in the PPP frameworks. However, there is still a lot of room for improvement, especially regarding the role of state companies. Nonetheless, the sheer size of the DRC implies there are opportunities still there, especially due to the high cost of energy from private providers.

The following list shows examples of a private companies, mostly from European or funded through European development or climate finance, active in the DRC's energy sector. Most of the investment is small scale with the view of leverage on climate finance or lower environmental impact. Due to the fact of the immense hydro potential of the DRC, a lot of the private operators are given concessions to rehabilitate or build small scale hydro power systems and operate their own grids. Strictly speaking these could be classified as PPP and include:

- *VIRUNGA ENERGIES SAU* is a private utility operating under a Public Private Partnership (PPP) model in distribution of electricity. It is owned by Virunga foundation and the public conservation body, the Institut Congolais pour la Conservation de la Nature (ICCN). It operates a small hydro facility (<2MW) and the aim is to use profits for conservation efforts and also localised access to modern energy. This project highlights how innovation in energy investment can be linked to long term environmental conservation.
- *ENERKAC (Kasaï Central Energy)* is a small PPP project that uses both solar and thermal power plants operating as a small IPP. The provincial government owns 5% share in ENERKAC.
- *Energie du Nord Kivu (ENK)* is another small PPP modelled on a BOO framework for a small hydro power system to serve two cities in the north-east of the DRC. It is also owned 5% by the provincial government and the reminder by the private firm STS.
- *NURU* is a private solar mini-grid operator in the DRC operating in the town of Goma where it has a distribution concession. It launched a 1.3 MW hybrid solar system in 2020 and three smaller mini-grids in three towns Beni (55kW), Faradje (217 kW) and Tadu (125 kW) in 2021. NURU is currently developing phase II of the project to expand capacity to 13.7MW after securing additional financing. It is backed by private equity and clean energy facilities like the EU's EDFI and ElectriFI, AFD, investment funds of developing partners (WB/IFC) as well as climate funds.

The private sector participation in the DRC energy sector is very strong and diversified reflecting the low electrification rates and the huge opportunities it presents both financially and for innovative solutions. It can be classified, based on data published by the World Bank and ARE, into three categories:

- *Independent Power Producers (IPPs):* These are mostly private operators or PPP in cases of hydropower (often rehabilitated units) where energy is sold to a concessionaire or SNEL. These include companies like ENERKAC, Katanga Energy, Hydroforce, Kibali Gold etc.
- *Distribution Concessions (DisCos):* These include a legal arrange between the government (provincial or national) for a specific period in which they have exclusivity to provide electricity services for a designated area (city, town etc). They include companies like Virunga SARL, Electricité Du Congo (EDC), Electricité du Nord Kivu (ENK) and SOCODEE.
- *Solar Home Systems (SHS):* These are vendors of energy systems (PV) for homes that are not connected as a network (utility). However, the service can be on different financial models with monthly fees collected to repay the initial capital deployment or for energy consumed. These include companies like Altech, Orange Energie, BBOXX and Weast Energy.

Basic Screening of a Private Independent Transmission Line (IPT) funding under a PPP is assessed below.

Table 28: Basic screening of PPP suitability of the Interconnection project with respect to DRC regulatory framework

Question	Pass	Fail	Answer	Suitability

Is there a legal Framework for PPP allow for private sector participation in Transmission Lines	X		• Electricity Laws
			  ○ Loi n°2011/022
			• PPP Law
			  ○ Law No. 18/016 of 2018,
			  ○ Decree No. 21/04 of 2021
			• Public procurement laws
			  ○ Décret n° 2008/035
			• Procurement Authority, electricity regulatory, PPP Unit etc
			• L'Autorité de Régulation des Marchés Public
				Yes

Question	Pass	Fail	Answer	Suitability
Strategic Significance/ Political Interest	X		• Regional Energy Policy • CAPP.SAPP/EAPP Interconnection • The Interconnection projects will likely receive high interest due to the potential to export and import. Regarding the DRC, the likelihood of private companies showing strong interest and linking the projects to some large mining project is also high, hence the political support due to jobs that can be created. • Interconnections Projects will also likely receive support	Yes
Consistency with DRC national development plan, sectoral polices?	X		• Yes, concessions on hydro power and exports are embedded national development goals	
Technical feasibility /Complexity	X		• Transmission lines are low technology infrastructure and likely issues will be environmental such as Resettlement Action Plans (RAPs)	Yes
Project's Size and scope significant to justly investment costs	X		• There is a huge demand from the mining sector as well as domestic efforts to improve access, and a present strong potential for PPPs. Import and exports potential are high due to the size of the DRC	
Any Significant Risks association with the Project			• No Tariff related issues leading to interconnection as regulation is set in US $. • Land rights and access to right of way • Multiple countries involved	Partial
Is there appetite for PPPs in the Energy Sector? If so how many?	X		• Yes • Several private sector participation in generation and PV solar	
Commercial Viability	X		The energy supply is available and demand is also present. The prevalence of public sector Off-taker and their financial reliability • Sector experience • Investor appetite • Project economic competitiveness and financial sustainability	Partial

EPC companies in DRC include AEE Power (Spain, Portugal), EPC Africa (Rwanda) and ABC Contracting (Belgium).

8.2 Testing PPP Suitability

Here below the main criteria for a country frame to attract PPP are reviewed.

8.2.1 Angola

Table 29: PPP suitability screening in Angola

Investment Indicators		High-Level Assessment
Policy and Regulatory	**Ease of market entry**	The energy sector in Angola has laws allowing the private sector to engage in all electricity sectors investments through PPP, potentially easing market entry. However, the country low Ease of Doing Business ranking (Angola is out of 190) suggests bureaucratic hurdles. Proper collaboration with established stakeholders, both private sector developers and government entities, can create opportunities for new investors to enter the market.
	Clarity of investment priorities	In Angola, the Energia 2025 outlines clear investment priorities for the energy sector, emphasising the development of renewable energy resources including large hydro but also gas fired power plants and the expansion of electricity access. However, the delays and uncertainties faced by private sector developers in executing PPAs and obtaining necessary licenses suggest potential challenges in aligning investor priorities with government objectives.
	Certainty of cash flow	In Angola, ENDE, the distribution public utility, struggles to collect unpaid bills, leading to cash flow uncertainties. In 2023, the recapitalization of banks has led to an increase in the solvency ratio, which was at 22.8 percent in 2020, exceeding the regulatory limit of 10 percent. This demonstrates that Angola's banks have become more resilient. With numerous large power plants investments, the government's commitment to energy sector development is evident. But cash flow uncertainties exist, although limited by the Ministry of Finance which guarantees the full payment of any liabilities, debt (including to suppliers such ENDE, etc.). Currently, approximately 80% of residences in Angola are not metered, which has resulted in a large loss of funds and a need for state subsidies. The Energy Sector Efficiency and Expansion Program includes the installation of 860,000 prepaid metres and a custom database to keep track of consumers. Improving payment mechanisms and addressing non-technical losses issues and commercial losses issues are crucial to mitigate risks and enhance investor confidence.
Power Sector Context	**Sectoral track record**	The national grid has been rapidly developed in the last few years, with investments made on the Laúca and Caculo Cabaça hydroelectric power stations and the 400-kV Laúca-Cambambe and Laúca-Capanda transmission and distribution systems. Several projects are on the way, including Sun Africa, a mini-grid project that combines solar PV with extending power lines and constructing substations and water supply systems, as well as other governmental projects hybrid solar power generation systems to expand the electricity grid to 60 communities. On 14 May 2019, Angola enacted Law No. 11/19, the Public-Private Partnership (PPP) Act. This law modernizes PPP processes by simplifying approvals, its purpose is to define the general terms applicable to the involvement of the State in the various stages of a public-private partnership.
	Sectoral growth	Annual electricity production in Angola increased by 9.3% between 2020 and 2024, rising from 12460.4 GWh to 13 625 GWh, with an installed capacity having increased from 2972 MW to 3647 MW. The present access rate should be around 60% and the National Development Plan 2023–2027 of Angola an on-grid electrification rate increasing to 72% in 2050, Before commissioning of Inga 3, the projected interconnection will have no impact on access rate. After commissioning of Inga 3, the interconnection with boost electricity availability and call for extensions of the distribution grids.

Country Context	**Governance and political**	The Regulatory Institute of Electricity and Water Services (IRSEA) is the regulatory authority for renewable energies and enforcing powers of the electricity regulatory authority. Revised energy-sector licensing regulations have improved legal protection for investors to attract more private investment in electrical infrastructure, such as dams and hydro distribution stations In september 2024, the Ministry of Energy has decided to set up a new institution, which will be autonomous and independent different from the current situation of IRSEA, and which will exercise powers in terms of **setting prices**, and the Minister also pointed out that a **public-private partnership (PPP) solution** is being planned for Luanda province, where resolutions will be adopted with a view to introducing improvements in the public service. Also, MINEA wants to bring the private sector into the power sector activities and recognises the need to raise collection rates.
	Business environment	Angola's bank industry has flourished in recent decades. From 2012 to 2020, banking assets increased by over 185 percent, a rapid growth boosted by the country driven by the oil sector's recovery and diamond extraction, along with strong expansion in commerce and fishing. There are currently economic reforms being implemented by the government and which will unlock the country's potential. Access to financing from international financial institutions (IFI) may be limited, affecting the availability of funding support for investment projects in the electricity sector. The IFC is actively involved in strengthening the country's financial sector by providing loans and risk-sharing facilities to local banks to help them increase lending to small and medium-sized enterprises (SMEs). Also PPP are possible in Angola and protected by law, but attracting private investment for distribution, 'mainly implies a tariff reform', as Angolan distribution tariffs are low and subsidised. That stifles earnings, with the fixed tariff of Angolan Kwanza AOA14 /kWh ($0.015 cents/kWh). As an example, a 25 MW solar PV plant which was launched in 2023 in Namibia, south-west Angola, by a consortium, Solenova, that includes the UK's BP and state-owned Sonangol. In 2025, a new private 45 MW solar plant, Qilemba, will be in place thanks to France's Total Energies, Sonangol and Angolan company Greentech. Also a green hydrogen project with Sonangol, CWP, Gauff and Conjuncta is to be equipped with 600 MW of electrolizers, proving that the PPP frame works in Angola.
	Macro-economic framework	Angola recorded the highest economic expansion since 2014, with real Gross Domestic Product (GDP) growth reaching 4.4% in 2024. Consumer price inflation in Angola averaged 20.1% in the ten years to 2024, nearly twice the Sub-Saharan Africa regional average of 10.8%. Recently, it fell to 17.43% in October 2025. Real GDP growth is projected at an average of 2.9% from 2025 to 2027, and this will not be enough to improve significantly living standards. Given the global uncertainty and decreasing oil prices, one of the challenges is to reduce the dependence of the economy on the oil sector.
	Banking and capital markets	Of the 26 commercial banks registered to operate in Angola, five of this control over 80 percent of total banking assets, deposits, and loans. Private capital is essential for infrastructure and energy project development since Angola is close to reach its limit for borrowing foreign capital.

8.2.2 DRC

Table 30: PPP suitability screening in DRC

Investment Indicators		High-Level Assessment
Policy and Regulatory	Ease of market entry	The energy sector in DRC has laws allowing the private sector to engage in all electricity sectors investments through PPP, potentially easing market entry. However, the country low Ease of Doing Business ranking (DRC is 180 out of 190) suggests bureaucratic hurdles. Collaboration with established stakeholders, both private sector developers and government entities, can create opportunities for new investors to enter the market.
	Clarity of investment priorities	There is not Electricity Sector Master Plan in DRC so far but two large initiatives clearly show the path decided by the government: (i) the creation of the Agence de Développement du Projet Inga (ADPI) which works in close relation with SNEL and financing institutions like the World Bank, and (ii) the set up of the Least Cost Electricity National Master Plan, itself using the results of the ongoing Electrification Master Plan.
	Certainty of cash flow	In DRC, SNEL, the public utility, struggles to collect unpaid bills, leading to cash flow uncertainties. The government's commitment to energy sector development is evident, but cash flow uncertainties persist, exemplified by delays in payments to private sector developers. Improving payment mechanisms and addressing governance issues are crucial to mitigate risks and enhance investor confidence in the sector.
Power Sector Context	Sectoral track record	In DRC, The 2015 Electricity Act (Decree-law No. 15/009 of April 25, 2015) aims to increase private sector participation in generation. It established tax and customs relief measures for electricity production, import, and export. Sector has seen significant progress, with ongoing efforts to address corruption and improve international relations. Challenges persist, such as low consumer purchasing power and limited grid access. An interim PPP has been signed for a private distribution company (Virunga Power) to take over rural distribution (up to 70% of the North Kivu county). Off-grid solutions are also being explored.
	Sectoral growth	Annual electricity production in the Democratic Republic of Congo (DRC) increased by 9.3% between 2020 and 2024, rising from 12460.4 GWh to 13 625 GWh, with an installed capacity having increased from 2972 MW to 3647 MW. The number of LV consumers has increased by 38% on that period and the sector is expected to grow a lot, given its large population. However, structural reforms intended to accelerate progress in the sector are lagging behind. Many observers point to the lack of a coherent governance framework, insufficient coordination between institutions, and the absence of a national energy master plan as major obstacles to significant progress. The projected interconnection will boost electricity availability and call for extensions of the distribution grids.
Country Context	Governance and political	The ARE is an independent public institution is responsible for ensuring access to the electrical grid, protecting consumers, and regulating the country's electricity sector. However, challenges such as corruption may compromise its effectiveness.
	Business environment	Access to financing from international financial institutions (IFI) may be limited, affecting the availability of funding support for investment projects in the electricity sector. The IFC is actively involved in strengthening the country's financial sector by providing loans and risk-sharing facilities to local banks to help them increase lending to small and medium-sized enterprises (SMEs). Also PPP are possible in DRC and protected by law. The DRC is reforming its legal and institutional framework for public-private partnerships (PPPs) to attract more investment. An IMF technical assistance mission has helped to develop a roadmap for reform and establish an inter-institutional commission of experts. A report of July 2025 with support from African Legal Support Facility (ALSF) indicates that the law will be updated for inserting explicit references to GHG effects of projects and related climate

Investment Indicators		High-Level Assessment
		impact analyses. As an example, Sun Africa announces a project of 4000 MW combining hydro, solar PV and storage together with reinforcements of HV and MV lines to modernize the grid.
	Macro-economic framework	Consumer price inflation in DR Congo averaged 12.9% in the ten years to 2024, in line with the Sub-Saharan Africa regional average of 10.8%. While inflation reached 17.65 % in 2024, it fell to 13.5% in 2025. The tax-to-GDP ratio in the Democratic Republic of the Congo increased by 3.6 percentage points from 8.9% in 2021 to. 12.5% in 2022. The administration has emphasized attracting international investors, for instance by creating a dedicated Business Climate Cell (Cellule du Climat des Affaires, or CCA). In 2024, the DRC's economy demonstrated resilience, achieving a real GDP growth rate of 7.9 percent, driven by a 12.8% expansion in the extractive sector, particularly copper and cobalt production. Real GDP growth is expected to growth at 6% until 2028, boosted by investment in capital projects and export earnings from mining. The DRC maintains in 2025 a managed floating exchange rate regime, wherein the rate of the Congolese franc is determined by supply and demand in the market. Mining sector and petroleum sector have a specific foreign exchange regime.
	Banking and capital markets	The DRC's banking system is comprised of the BCC and 18 commercial banks as well as savings/credit cooperatives, microfinance institutions, financial transfer. Foreign aid remains essential for infrastructure and energy project development.

8.2.3 Risk Assessment for Angola

Table 31: Risk assessment for Angola

Legal Framework	Legal framework is appropriate for PPP[80] and therefore for a Special Purpose Vehicle that would manage the interconnector
Project Size and Market Fit	The project size is limited considering the 190 km of line between Soyo and Inga Hub future substation.
Investor Market Appetite	Private investors market appetite will likely be high since a large demand of electricity in Angola and beyond will be served after Inga 3 commissioning, but also because generation in Soyo, Angola is organized in a framework that proved its adaptability.
Building Considerations	Project structuring should not face major difficulties since Angolan stakeholders already have managed much larger projects
Output requirements	Output requirements can be discussed among stakeholders, possibly inside SAPP, having to select between the 2.5 GW and the 5 GW version.

8.2.4 Risk Assessment for DRC

[80] Government of Angola, Decreto Presidencial n.º 316/19 de 28 de Outubro de 2019 (Regulamento da Lei das PPP), Luanda, 2019. Available: https://faolex.fao.org/docs/pdf/ang190926.pdf

Table 32: Risk assessment for DRC

Legal Framework	Legal framework is appropriate for PPP and therefore for a Special Purpose Vehicle that would manage the interconnector
Project Size and Market Fit	The project size is limited considering the 190 km of line between Soyo and Inga Hub future substation.
Investor Market Appetite	Private investors market appetite will likely be high since a large demand of electricity will be served both before and after commissioning of Inga 3.
Building Considerations	Project structuring should not face major difficulties since DRC stakeholders already have managed much larger projects
Output requirements	Output requirements can be discussed among stakeholders, possibly inside SAPP, having to select between the 2.5 GW and the 5 GW version.

8.3 Affordability Considerations

The feasibility of the Angola–DR Congo interconnector project hinges on effectively blending public and private resources to achieve fiscal sustainability and long-term operational efficiency. Due to the limited fiscal capacity of both governments, full funding from public budgets without concessional support and private investment is unlikely[81]. A realistic strategy involves combining sovereign contributions, concessional loans, and private-sector equity[82].

In practice, the public sector would finance enabling activities like land acquisition, permitting, and environmental and social assessments, while development finance institutions would provide concessional debt or grants for part of the construction costs, while the private partner would invest in equity and commercial loans, supported by steady revenues from transmission or wheeling charges between ENDE and SNEL. This blended approach reduces the immediate fiscal load on both countries and incentivises the private operator to maintain efficiency and service quality.

For full bankability, predictable revenue mechanisms are vital, including long-term transmission use-of-system (TUoS) agreements, sovereign guarantees, and credit-enhancement options such as partial-risk guarantees or escrow accounts[83].

8.4 Innovative Financing Structures

Due to its cross-border nature and strategic significance, the project can benefit from various innovative financing options that enhance its bankability and attract investors. A hybrid PPP model could enable both governments to participate directly in construction funding while delegating long-term operations and maintenance to a private partner, which could recover part of its investment through regulated tariffs, both for Angola[84] and DR Congo[85].

[81] International Monetary Fund, Public Investment Management Assessment (PIMA): Democratic Republic of the Congo, Washington DC, 2021. Available: https://infrastructuregovern.imf.org/content/dam/PIMA/Countries/DRC/documents/DRC%20PIMA%20-%20English%20version.pdf
[82] African Development Bank, Public–Private Partnerships in Africa: Building Sustainable Infrastructure for Regional Integration, Abidjan, Côte d'Ivoire: AfDB, 2023
[83] World Bank, Benchmarking Infrastructure Procurement 2023: Congo (Democratic Republic), Washington DC, 2023. Available: https://bpp.worldbank.org/content/dam/sites/data/bpp/cntrypdf/BI-2023-Congo-Dem-Rep-PPP.pdf
[84] Government of Angola, Lei n.º 11/19 de 14 de Maio de 2019 sobre as Parcerias Público-Privadas (PPP Law), Luanda: Ministério das Finanças, 2019. Available: https://www.ucm.minfin.gov.ao/cs/groups/public/documents/document/zmlu/mjiy/~edisp/minfin222667.pdf
[85] Government of the Democratic Republic of Congo, Loi n° 18/016 du 9 juillet 2018 relative aux Partenariats Public-Privé (PPP Law), Kinshasa, 2018. Available: https://www.vda.pt/en/media/news-and-media/drc-legal-framework-on-public-private-partnership-contracts/20495/

Another effective approach is viability-gap funding, where grants or soft loans cover the non-recoverable part of capital costs, lowering perceived risks for private investors. The creation of a regional pooled-finance or guarantee facility, managed through SAPP or CAPP, could further improve credit security and mitigate cross-border payment and currency risks[86].

Innovative green-finance tools are also pertinent. Issuing green or climate infrastructure bonds, aligned with African Green Infrastructure Fund guidelines, could attract impact-driven investors focused on sustainable energy connectivity[87]. Additionally, a sovereign-backed special-purpose vehicle jointly owned by RNT and SNEL, with private investor participation, would allow both nations to maintain strategic control while benefiting from private sector efficiency and financial discipline.

8.5 Short-Term Fiscal and Institutional Constraints

In the near term, various fiscal and institutional challenges may influence affordability and project timelines. Both Angola and the DRC have limited fiscal space, with their national budgets strained by social and infrastructure needs. This restricts their capacity to provide significant upfront funding or guarantees without external support. Additionally, institutional capacity remains an obstacle. Although both countries have implemented PPP legal frameworks, Law No. 11/19 in Angola and Law No. 18/016 in the DRC, their PPP agencies are still developing the technical and financial expertise necessary to handle complex cross-border projects.

Regulatory differences between the two systems exacerbate these challenges. Variations in tariff-setting methods, currency policies, and procurement processes may lead to approval delays and uncertainty for investors. Additionally, the financial health of off-takers SNEL and ENDE is fragile, as both utilities struggle with low cost recovery and revenue-collection issues. To mitigate these problems, solutions such as partial-risk guarantees, escrow accounts, or donor-supported payment-security mechanisms are likely necessary.

Despite short-term challenges, the medium-term prospects look promising. The interconnector supports regional integration objectives and has the potential to receive concessional funding from the AfDB, Africa50, the EU, bilateral donors and the World Bank Through a combination of financial innovation and institutional backing, these obstacles can be addressed, leading to financial closure within a sustainable and cost-effective PPP framework.

8.6 Outcome of PPP Suitability Test

8.6.1 Angola

Proceed with PPP

The legal framework in Angola allows for private investments in the transmission sector, hence the recommended design is *concession/PPA framework* before tendering to improve investor confidence

Traditional Procurement

Transmission projects are now formally suitable for PPP under the 2025 legal changes. Private or legal entities (public or private) may get transmission concessions.[88]

[86] Clifford Chance LLP, Public–Private Partnerships in Angola, London, UK, 2011. Available: https://www.cliffordchance.com/content/dam/cliffordchance/briefings/2011/04/publicprivate-partnerships-in-angola.pdf
[87] Miranda Law Firm, Approved the new legal framework applicable to Public–Private Partnerships (PPPs) in Angola, Lisbon, 2019. Available: https://mirandalawfirm.com/en/insights-knowledge/publications/alerts/approved-the-new-legal-framework-applicable-to-public-private-partnerships-ppps
[88] Government of Angola. (2025). *Law No. 6/25, of 23 July 2025: Amendment to the General Electricity Law* (Law No. 14-A/96). Diário da República. Retrieved from Amendment to the General Electricity Law - Angola | Law No. 6/25, of 23 July

Solar IPPs with defined PPAs are being commissioned, proving feasibility. These act as "proof points" for moving more capacity via PPP / IPP models. Also, projects with high social objectives like transmission, rural electrification, loss-reduction are better suited for *donor/ODA financing* or public funding.[89]

Further Analysis Required

Further analysis is required to check the solvency of Angola State to finance the envisaged public share of the PPP and appear as solvable in front of IFI's.

8.6.2 DRC

Proceed with PPP

All transboundary transmission projects seem to be suitable for PPP projects due to the fact that, ironically, it might be more feasible and perhaps the least cost than overcoming the challenges of internal administration and environment to build long distance transmission line. The strong mining sector is inclined to be a leading avenue for private sector participation. Regional cooperation is also most likely to be strongly supportive of the project due to the role DRC can play in CAPP, SAPP and EAPP.

Political Support:

Coupling with investment in the mining sector will receive strong political support due to the associated socio-economic benefits. It will lead to regional stability and cooperation

Environmental & Social Impacts:

Likely impacts can be mitigated with RAPs and stakeholder support magnified with integration of electrification of local communities.

Procurement Method

Improving investment climate suggests investors will have to build, own, and operate any transmission facilities. Based on the existing law, procurement should be tendered and evaluated by the PPP unit. However, the most recent projects have been unsolicited and private sector driven.

This shows that there is either lack of capacity in driving the procurement process or that policy restrictions might prevent further sectoral reforms needed to attract the private sector.

Currently there is a strong private sector present in the energy sector in the DRC in the form of IPP's but not as PPPs. Several solar and mini-grids as well as private captive generations exists for industrial operators. With the right policy framework investment could be increased through PPP for increased access to electricity or for new interconnectors.

Traditional Procurement

The DRC's experience in the licensing Discos and small hydro by provincial authorities shows that there is interest in the energy sector. However, the country risk should be taken into consideration and the low number of PPP in the energy sector reflects that.

There is, however, a strong private interest in building small vertical utilities supplying towns and cities. This opens up a new procurement pathway where SNEL can focus on transmitting cheap hydro to these Discos

Further Analysis Required

Further analysis is required in the field of the solvency of D.R. Congo State to finance the envisaged public share of the PPP and appear as solvable in front of IFI's.

Based on the above, at least three financing and implementation models appear viable for the Angola–DRC interconnector:

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[89] Angola – The Project for Power Development Master Plan in the Republic of Angola, Final Report, December 2018, JICA/TEPSCO
Angola_The Project for Power Development Master Plan in the Republic of Angola_2018.pdf

1. A predominantly public model, in which RNT and SNEL own the assets and raise long-term debt from DFIs (EIB, AfDB, WB, DBSA, bilateral agencies), possibly complemented by climate finance facilities, with cost recovery through regulated tariffs and power-trade revenues;
2. A regulated asset concession model, in which a private transmission concessionaire designs, builds, finances and operates the line under a long-term contract, remunerated through availability-based payments by the TSOs, backed by partial risk guarantees; and
3. A hybrid model, in which the main cross-border line is developed by a special-purpose vehicle (SPV) with public and private shareholders, while internal reinforcements remain in the public sector.

Stage 2 of project preparation should include a comparative assessment of these options, focusing on affordability, risk allocation, bankability and consistency with the two countries' PPP frameworks.

8.7 Preparation of Next Stage

The following activities will be required to facilitate full Project Feasibility Studies:

Drafting Terms of Reference (ToRs) for the next stage, which entails conducting a detailed Feasibility Study, including:

- Environmental and Social Impact Assessment (ESIA) studies;
- Resettlement Action Plan (RAP); and
- Comprehensive economic and financial analyses.

9 Project Screening

9.1 Summary

The Angola-DRC interconnection is a 190 km high-voltage transmission line connecting Soyo in northern Angola to Inga in the Kongo Central province of the DRC. The direct benefits from this interconnection include boosting the regional transfer capacity between Angola and the DRC, improving grid reliability and redundancy, expanding energy access in the border areas, and fostering industrial growth.

The recently improved legal framework in Angola fully allows for private investments in the transmission sector, rendering the suitability of a concessions / PPA framework which improves investor confidence. There is also a strong private sector presence and interest in the power sector of the DRC. However, both Angola and the DRC currently face various fiscal challenges which influence affordability. Consumer affordability is also a challenge in both countries.

The legal and regulatory framework for Angola's power sector is relatively advanced in the unbundling design, independent regulation, licensing rules and tariff model reform, but enforcement and transparency are weak. Whilst there is still no dynamic and liberalised electricity market in the DRC, it is clear that the electricity market is diverse and evolving.

The CBA results from this pre-feasibility study indicate that the 765 kV double-SC line option for the Angola (Soyo) – DRC (Inga) interconnection is better than the 400 kV or do-nothing options.

However, the 765 kV is not among the voltage standards in Angola and therefore the 400 kV option is recommended in the present context.

The Economic Internal Rate of Return (EIRR) in this case is 54%, which is reduced to up to 30% when considering high shadow carbon pricing, leading to a Benefit-to-Cost Ratio (BCR) of 10.24. The estimated capital cost for the Angola-DRC 400 kV interconnection is around EUR 644 million.

Any 765 kV option would rather have to be harmonized at SAPP level, which is not yet the case.

9.2 Project Description

The Angola-DRC interconnection is a 190 km high-voltage transmission line connecting Soyo in northern Angola to Inga in the Kongo Central province of the DRC. This project supports both countries' efforts to strengthen regional energy cooperation and electricity trading, aiming at sharing their generation capacities to result in a lower cost of electricity for the consumers. The interconnector will improve the stability and reliability of both grids, boost power exchange capacity, and pave the way for integration between CAPP and SAPP.

On the Angolan side the line starts in Soyo, a strategic area rich in gas and energy assets. On the DRC side the line ends at the Camp Kin substation, close to the Inga 1–3 hydroelectric complex. The line will link a growing coastal generation hub to one of Africa's most significant hydropower resources, establishing the foundation for future cross-border energy trade.

9.3 Project Benefits

The Angola-DRC transmission interconnection is expected to result in the following direct benefits:

- boosts regional transfer capacity between Angola and the DRC, enabling larger power exchanges, supporting bilateral energy trade, and providing access to cheaper generation;
- improves grid reliability and redundancy allowing mutual support during contingencies, therefore also reducing the risk and duration of blackouts;
- expands energy access in rural and peri-urban border areas through downstream grid extensions and integrating distributed energy sources;

- fosters industrial growth by providing stable electricity to emerging economic zones, also enabling more dense grid electrification and increasing energy access in both countries.

9.4 PPP Suitability

The recently improved legal framework in Angola fully allows for private investments in the transmission sector, rendering the suitability of a concessions / PPA framework which improves investor confidence, especially since there are still delays and uncertainties faced by private sector developers in executing PPAs in the country. There is also a strong private sector presence and interest in the power sector of the DRC, which could further support PPAs through policy framework improvements which would improve the country's Ease of Doing Business ranking.

9.5 Affordability Analysis

The feasibility of the Angola–DRC transmission interconnector project hinges on effectively blending public and private resources to achieve fiscal sustainability and long-term operational efficiency. However, Angola and the DRC currently face various fiscal challenges which influence affordability. Both countries have limited fiscal space, with their national budgets strained by social and infrastructure needs, restricting their capacity to provide significant upfront funding or guarantees without external support. Additionally, the financial health of both off-takers (ENDE and SNEL) is fragile, as they struggle with low cost recovery and revenue collection issues.

Consumer tariffs in Angola are low and subsidised. Consumer tariffs are also very low in the DRC, due to the abundant hydro resources, but are still however further subsidised. Consumer affordability is a challenge in both countries, with limited purchasing power affecting the sustainability of user-pay models.

9.6 Legal and Regulatory Issues

The legal and regulatory framework for Angola's power sector is relatively advanced in the unbundling design, independent regulation, licensing rules and tariff model reform, but enforcement and transparency are weak. Whilst there is still no dynamic and liberalised electricity market in the DRC, it is clear that the electricity market is diverse and evolving.

9.7 Project Readiness and Status

Following this pre-feasibility study, which also includes initial elements of a more detailed feasibility study, the Angola-DRC interconnection is now in the Feasibility Study (S2B) maturity stage.

The CBA results from this pre-feasibility study indicate that :

- the 765 kV double-SC line option for the Angola (Soyo) – DRC (Inga) interconnection is better than the 400 kV or do-nothing options. The Economic Internal Rate of Return (EIRR) in this case is 52%, which is reduced to up to 37% when considering shadow carbon pricing, leading to a Benefit-to-Cost Ratio (BCR) of 14.16. The estimated capital cost for the Angola-DRC 765 kV interconnection is around EUR 859 million.
- the 400 kV double-circuit option for the Angola (Soyo) – DRC (Inga) interconnection is a profitable option. The Economic Internal Rate of Return (EIRR) in this case is 54%, which is reduced down to 30% when considering shadow carbon pricing, leading to a Benefit-to-Cost Ratio (BCR) of 10.24. The estimated capital cost for the Angola-DRC 400 kV interconnection is around EUR 644 million.

Considering that the 765 kV is not among voltage standards in Angola, the 400 kV option is the best positioned for a fast implementation.

9.8 Information Availability

Further to the consolidated information provided in the present pre-feasibility study, a number of sources with more detailed information on the Angola (Soyo) – DRC (Inga) interconnection are referenced throughout this report.

9.9 Outline of Project Management Plan

The two governments are expected to sign a bilateral Memorandum of Understanding (MoU) and/or a Joint Implementation Agreement, which will define roles, cost-sharing arrangements and responsibilities. Effective governance is critical in a binational infrastructure project. It is proposed that Angola and the DRC establish a Joint Project Steering Committee, with high-level representatives from each country's energy ministry and utility. This committee will provide strategic oversight, facilitate cooperation, and make key decisions.

A dedicated Project Management Unit (PMU) will be necessary to ensure a stable and well-managed implementation environment, as well as strategic oversight. The PMU will coordinate all activities across the two jurisdictions, manage consultants and contractors, and report progress to the Project Steering Committee and financiers.

10 Project Management Plan and Project Governance

10.1 General Organization

There will be a need to sign agreements to underpin the project governance. The two governments are expected to sign a bilateral Memorandum of Understanding (MoU) and/or a Joint Implementation Agreement, which will define roles, cost-sharing arrangements, and responsibilities. Each country's energy regulator will need to approve the interconnection and any tariff or wheeling arrangements for the power trade. The project's viability in terms of its economic benefits to both countries should be clearly quantified for the project to obtain the necessary support from national stakeholders and from private investors entering in a PPP scheme on each side of the interconnection.

Effective governance is critical in a binational infrastructure project. It is proposed that Angola and DRC establish a Joint Project Steering Committee, with high-level representatives from each country's energy ministry and utility. This committee will provide strategic oversight, facilitate cooperation, and make key decisions. Additionally, the utilities will serve as implementing agencies, coordinating closely to ensure that technical standards and schedules are aligned.

A dedicated Project Management Unit (PMU) will be necessary to ensure a stable and well-managed implementation environment, as well as strategic oversight. The PMU unit will be staffed with experts and personnel as outlined in the Staffing Plan. It will coordinate all activities across the two jurisdictions, manage consultants and contractors, and report progress to the Project Steering Committee and financiers.

Figure 26 depicts the proposed Project Governance Organogram.

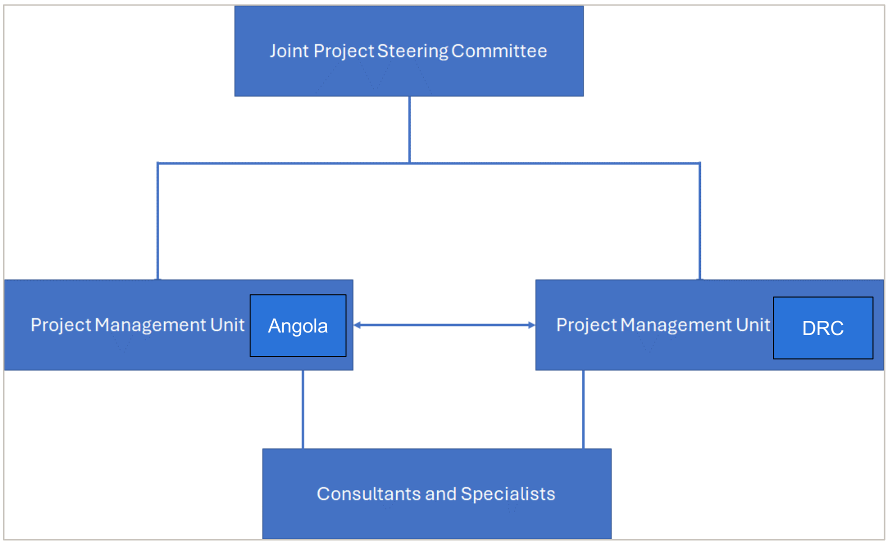


Figure 26: Proposed Project Governance Organogram

10.2 Staffing plan

The staffing plan, as outlined in the **¡Error! No se encuentra el origen de la referencia.** below is proposed for the project's development. The staffing plan may be split into two coordinated PMUs (one in each country) or a single unified PMU with clear and defined reporting lines. Creating a strong PMU is crucial for project success; thus, the team will likely include seconded experienced personnel from utilities and experts financed by the project's budget.

Table 33: Staffing plan for Angola-DRC Interconnector

Position	Responsibility
Project Director	Overall project leader, likely to be appointed by the lead ministry or utility. Provides strategic direction and liaises with the High-Level Steering Committee to ensure the project is developed on schedule and within budget.
Project Managers (Country Leads)	One project manager, based in Angola, and another in DR Congo, coordinate activities within their respective countries. They will report to the Project Director and synchronise cross-border tasks, and each will oversee the local permitting, utility coordination and national stakeholder engagement.
Technical Team	A group of engineers and specialists, working with the Project Director and Country Managers, will be responsible for the project engineering and design. The core group will comprise Transmission Line Designers, Substation Designers, and Civil Engineers. The other specialist roles are provided below.
Environmental and Social Specialists	These could be utility staff dedicated to managing the ESIA and ensuring compliance. They will oversee the independent consultants appointed to conduct the ESIA. During construction, they will coordinate with national environmental authorities to ensure that contractors follow all mitigations outlined in the Environmental and Social Management Plan (ESMP) and the Resettlement Action Plan (RAP).
Procurement Specialists	Responsible for managing the procurement processes in line with the country's legal fragment and standard World Bank/AfDB guidelines. The specialists will be responsible for preparing the bidding documents, running the tendering, ensuring transparency in bid evaluations, and handling contract awards. This function can be outsourced to an experienced Consultant who will be managed by the entities responsible for public procurement in both countries.
Financial Management Specialists	Will handle the project's financial disbursements and financial reporting. In a donor-funded scenario, they establish the project's financial management system in accordance with World Bank/AfDB or donor requirements, manage loan/grant withdrawals, and ensure that all expenditures are accurately tracked. They will also produce regular financial reports and facilitate any audits. In a PPP scenario, this role would oversee the disbursement of viability gap funding (if any) and monitor the concessionaire's financial compliance.
Legal and Contract Advisor	Provides legal support on contracts, agreements, and regulatory compliance. This function is vital when negotiating loan agreements and PPP contracts, and to ensure that cross-border agreements (power purchase and transmission service agreements between Angola and DRC) are legally valid.
Administration and Support Staff	The Country managers will work with local administrative staff responsible for handling logistics, documentation, and communication.

10.3 Budget estimates and funding plan

The project budget estimates, from feasibility studies to execution, are provided in **¡Error! No se encuentra el origen de la referencia.**.

Table 34: Budget Estimates

Activity	(EUR m) Strategy 1 (400 kV)	(EUR m) Strategy 2 (765 kV)
Project Preparation and Feasibility Studies	26,84	35,78
Transmission Lines and Substations construction and labour	536,71	715,52
Environmental and Social Impacts Mitigation - Implementation of the ESMP and RAP	26,84	35,78
Project Management and Contingencies	53,67	71,55
Total Project Cost (EUR m)	**644,05**	**858,63**

A robust commercial and financial structure is necessary to allocate risks fairly, mobilise financing and ensure long-term sustainability. Several funding modalities differ in terms of recourse to utility balance sheets, equity requirements and risk-sharing among governments, utilities, and private companies. **¡Error! No se encuentra el origen de la referencia.** presents the available funding options, along with their advantages and disadvantages.

Table 35: Funding options analysis

Funding option	Description	Advantages	Disadvantages	Applicability to the Interconnector Projects
Corporate Finance (Utility-led)	RNT (Angola) and SNEL (DR Congo) fund and own the project, relying on sovereign-backed loans.	Simplicity – direct control by national utilities	Heavy burden on the utility balance sheets and exposure to sovereign risk	Unlikely, utilities may lack sufficient borrowing capacity
Public Financing Model	Governments borrow from institutions such as the AfDB and World Bank and lend to utilities	Access to concessional finance and strong government support	Increases sovereign debt	Classic model (concessional funding) but Angola and DRC have already reached their borrowing limits
Independent Power Transmission (IPT) Model	Private developer finance, builds and operates the lines under a 25–40-year concession	Mobilises private capital and transfers construction, operation, and maintenance risk to a private developer	Needs strong credit enhancements and has higher long-term costs if the risk premium is factored in	Appropriate for interconnectors that are backed by direct private sector demand. This will be a first in Africa.
Joint Venture Special Purpose Vehicle (SPV)	RNT and SNEL form a joint company to own and operate the line	Shared risk and governance, and facilitate regional cooperation	Complex to negotiate and potential governance disputes	Likely for a cross-border between Angola and Tanzania.
Merchant Model	Private company builds and operates revenues from wheeling charges	Off-balance sheet for governments and utilities	Very high risk for the private companies without long-term guarantees of utilisation and long-term PPA	The model has not been used for interconnectors in the region.

The funding options most likely to be applicable for the Angola- DRC Interconnector are the public financing model, the Joint Venture SPV and the Independent Power Transmission Model (IPT).

10.4 Work program and timetable

The envisaged development programme for the project, following approval of the Pre-Feasibility Study, will start with the next stage, which is the Feasibility Study. This will be followed by project structuring, transaction support, and financial close, culminating in tendering and the appointment of a contractor to execute the works. The timelines for each activity are provided below, based on experience from previous similar projects. Opportunities to expedite the project will be further explored at the Feasibility Study stage. Also, the Tendering phase will address the cases of private investors entering in a PPP scheme, along with the setting of a revenue stream and guarantees to secure the attractiveness of the project to private investors.

¡Error! No se encuentra el origen de la referencia. presents the proposed project implementation program.

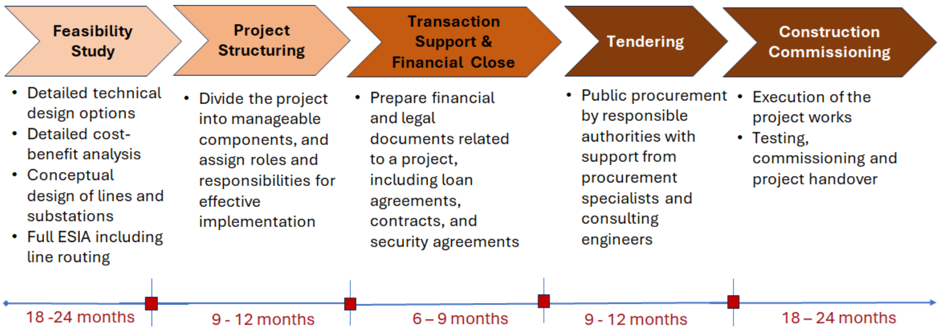


Figure 27: Program implementation program

11 Preparation and Next Requirements

After completing the Pre-Feasibility Study, the project moves into the preparatory phase for full feasibility and implementation planning. This phase emphasises obtaining approvals, mobilising resources, and outlining the technical, institutional, and financial preparations needed for the next development stage.

11.1 Approval of Pre-Feasibility Study Outputs and Quality Certification

Approval of the Pre-Feasibility Study for the Angola-DRC interconnector requires a coordinated process that aligns with the approval processes of both countries. Both countries should endorse the Pre-Feasibility study to pave the way for a full Feasibility Study.

The proposed approval process is depicted in **¡Error! No se encuentra el origen de la referencia.**.

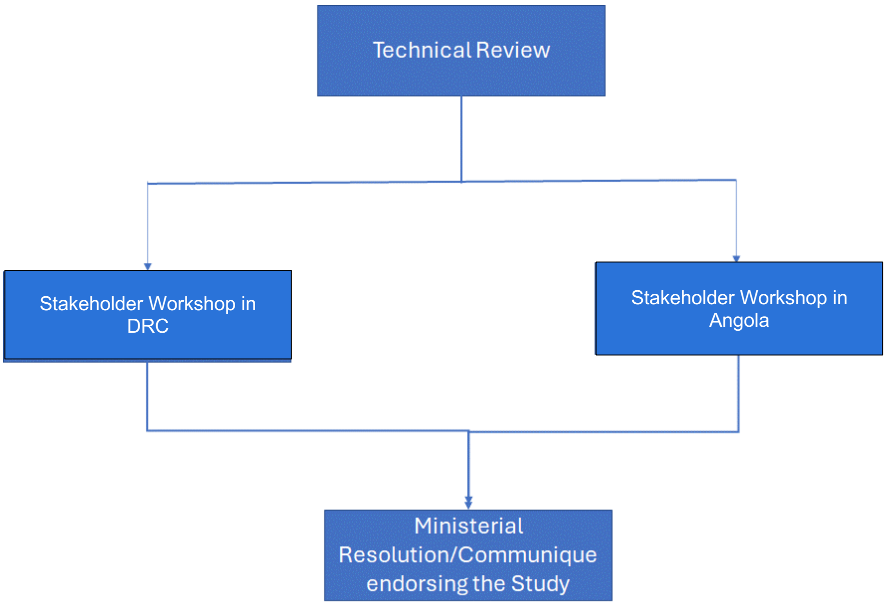


Figure 28: Pre-Feasibility Study Approval Process

The steps in the above figure are described in detail below, including the parties responsible.

11.1.1 Technical Review

RNT (Angola) and SNEL (DRC), the power utilities of the two countries, should conduct a technical review of the Pre-Feasibility Study to ensure that the technical assumptions and the preliminary project design are sound and meet the project's objectives. Other parties to provide input into the technical review include the African Union Development Agency (AUDA-NEPAD) and the SAPP.

11.1.2 Approval and Certification

Since the project is a cross-border initiative, joint approval is required from representatives of both Angola and DRC.

In this regard, following the technical review and approval by the utilities RNT and SNEL, two workshops are planned, one in each country, to present the results of the Pre-Feasibility Study. Each workshop is expected to be attended by representatives from the ministries of energy, the regulator, and the power utilities (RNT and SNEL).

In Angola, this review and validation will involve the Ministry of Energy and Water (MINEA), which manages power policy and investment planning[90], the Regulatory Institute for Electricity and Water Services (IRSEA), responsible for tariffs and licensing, and the RNT, the transmission system operator. Further consultation will also be needed with the Ministry of Finance (MINFIN) and the Ministry of Environment (MINAMB) to verify financial commitments and environmental safeguards, ensuring alignment with the National Renewable Energy Strategy[91] .

On the DRC side, the process will involve the Ministry of Hydraulic Resources and Electricity (MRHE), which oversees the country's energy policy and grid development[92] , along with the National Electricity Regulatory Authority (ARE), the National Electrification Agency (ANSER), and the public utility SNEL (Société Nationale d'Électricité). Additionally, the Ministry of Environment and Sustainable Development (MEDD) and the Ministry of Finance will evaluate the study's adherence to environmental and fiscal regulations[93] .

A resolution supporting the project from each of the countries' ministries of energy should be issued to certify that both governments support the Pre-Feasibility Study and are committed to proceeding to the next stage, which entails a Full Feasibility Study. This process is crucial for building stakeholder trust and meets the requirements of financiers (e.g., development banks often require evidence of government approval of project studies before funding the next phase).

11.2 Preliminary Job Creation, Resource Mobilisation and Corridor Development Strategy

Developing the Angola – DRC Interconnector presents an opportunity not only to improve infrastructure but also to spur economic development in the corridor region. A preliminary strategy should address how to maximise job creation, plan for resource mobilising, and promote corridor development both during the construction phase and in the long term.

The next step involves developing a Corridor Development Strategy that aligns infrastructure investments with socio-economic growth priorities in both countries. This will include frameworks for local job creation, skills development, and community participation during detailed feasibility and construction phases.
In Angola, implementation coordination will include the provincial governments of Zaire and Uíge, municipal administrations, and local development agencies, ensuring consistency with the National Programme for Rural Electrification (PNER)[94] .

[90] Ministry of Energy and Water of Angola (MINEA), *About the Ministry of Energy and Water of Angola*. Available: https://www.minea.gov.ao/
[91] Ministry of Energy and Water of Angola (MINEA), *National Strategy for the New Renewable Energies: Angola*. Available: https://www.minea.gov.ao/index.php/component/content/article/19-destaque/137-national-strategy-for-renewable-energies
[92] Ministry of Hydraulic Resources and Electricity of the Democratic Republic of the Congo (MRHE), *Country Profile: DRC Energy Sector*, SACREEE database. Available: https://www.sacreee.org/index.php/member-state/democratic-republic-congo
[93] U.S. International Trade Administration, *Democratic Republic of the Congo Energy Sector Guide*, Washington DC, 2024. Available: https://www.trade.gov/country-commercial-guides/democratic-republic-congo-energy
[94] International Energy Agency (IEA), *National Programme for Rural Electrification of Rural Areas (PNER) Angola*, Paris, 2018. Available: https://www.iea.org/policies/5843-national-programme-for-rural-electrification-of-rural-areas-pner

In the DRC, engagement will extend to the Provincial Government of Kongo Central, territorial administrations, and local customary authorities along the proposed corridor.

11.2.1 Job Creation

Job opportunities will mainly arise during the project construction. The three pillars that could underpin a job creation strategy are depicted in **¡Error! No se encuentra el origen de la referencia.**.

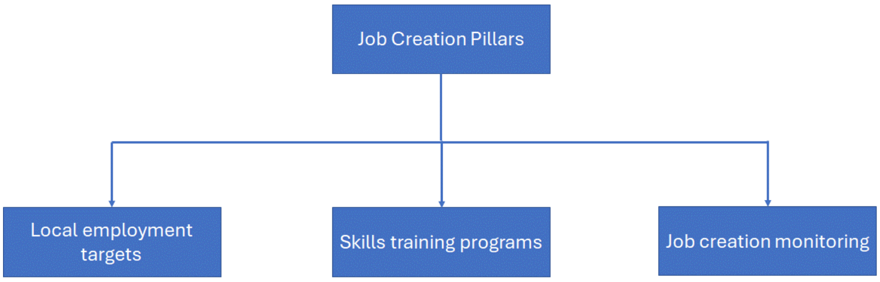


Figure 29: Job creation strategy pillars

11.2.1.1 Local Employment Targets

Local employment targets could be set for hiring local workers in both countries. Contractors can be incentivised to use local labour for unskilled and semi-skilled jobs and to subcontract to local firms where possible. Activities such as bush clearing, digging tower foundations, and providing security for construction equipment can be undertaken by local labour. Hiring of local labour should first target communities along the line route to facilitate community ownership and support for the project. Additionally, contractors could be incentivised to source materials such as cement, steel, and aggregates locally when available. For day-to-day feeding requirements at construction camps, local suppliers could meet these needs.

11.2.1.2 Skills Training Programs

Contractors could be incentivised to implement training/apprenticeship programs ahead of and during construction. This will help build the capacity of local workers to take on skilled positions, such as technicians and machine operators, and ensure a qualified workforce for the project. Collaboration with vocational training schools could be a key part of this strategy, with a focus on relevant trades such as electrical work, civil work and heavy equipment operation. This could leave a legacy of a more skilled workforce that can provide a base for future projects like this.

11.2.1.3 Job Creation Monitoring

As part of the project management, a mechanism for monitoring job creation numbers and the share of local jobs should be established. Contractors should be required to report on such numbers regularly, and adjustments should be made if set employment targets are not met. The employment targets could be set based on precedent from similar projects.

11.2.1.4 First Estimate

A first estimate is available using the CMP "Job Creation Transmission measurements" for the generic Angola-DRC interconnector, based on the work undertaken during development of the CMP 2023 – 2040. For estimates of job creation for generation and transmission projects, the methodology presented in the publication Ram et al. (2019)[95] on “Job creation during the global energy transition towards 100% renewable power system by 2050” was used. The methodology utilises the Employment Factor (EF) approach initially proposed by Rutovitz et al. (2015) and follows the steps presented in the following figure:

Figure 30: Estimation of total jobs per project (Source: Ram et al. (2019))

The tool provides then the following estimates, in Job Years.

Table 36: Funding options analysis

	Tot. Transfer capacity	CAPEX (MEUR)	Nb Job Years estimate
S1 (400 kV Double Circuit)	2.5 GW	536	30,812
S2 (765 kV Two Single Circuits lines)	5 GW	715	41,002

[95] Ram, M., Aghahosseini, A., Breyer, C. (July 2019). Job creation during the global energy transition towards 100% renewable power system by 2050. Published in Technological Forecasting and Social Change 151(3). Retrieved from https://www.researchgate.net/publication/334359425_Job_creation_during_the_global_energy_transition_towards_100_renewable_power_system_by_2050

11.2.2 Resource Mobilisation Strategy

Resource mobilisation efforts will involve the AfDB, World Bank, Agence Française de Développement (AFD), Development Bank of Southern Africa (DBSA), and EU funding mechanisms. Regional coordination under AUDA-NEPAD with SAPP and CAPP will ensure alignment with cross-border power-market integration objectives[96] .

The resource mobilisation strategy should target the following key areas, as depicted in **¡Error! No se encuentra el origen de la referencia.**.

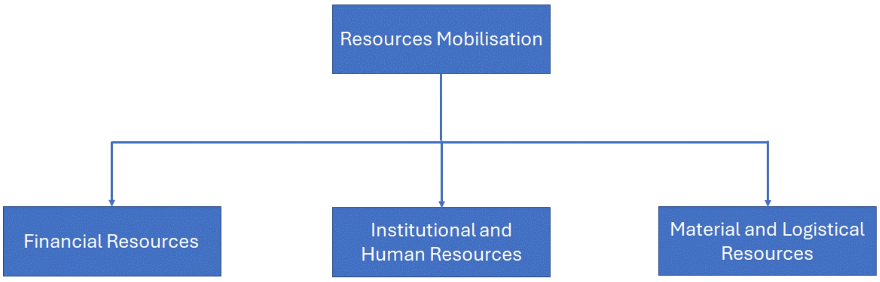


Figure 31: Resources mobilisation strategy pillars

The resource mobilisation strategy should be phased in alignment with the project development program to ensure that funding and resources are available from the Feasibility Study Stage through to construction.

11.2.2.1 Financial Resources

It is essential to identify the mix of funding sources early in the project development process. Given the scale of the interconnector projects, funding is likely to come from multiple sources. To show ownership, both governments should commit some funding, though limited, but the bulk of the budget will likely come from international development partners such as the African Development Bank and the World Bank. The strategy will involve preparing a robust case for grant or concessional loan support, presenting the project at infrastructure financing summits organised by key African institutions such as AUDA-NEPAD. Governments in Angola and DR Congo can request that AUDA-NEPAD and the SAPP spearhead project development activities, review, and support project funding models proposed for the project.

11.2.2.2 Institutional and Human Resources

Following the staffing plan described above, a Project Management Unit with staff drawn from both countries should be assigned to the project. The Project Management Unit will manage the day-to-day activities and coordinate with consultants, contractors and stakeholders. In cases of capacity gaps, the resource plan should include technical assistance or consulting firms to assist the governments of Angola and DR Congo. Donor-funded technical assistance can be sought with the aid of AUDA-NEPAD and the SAPP to fulfil sourcing requirements for owners' engineers, legal advisors for cross-border agreements, and financial advisors.

11.2.2.3 Material and Logistical Resources

The strategy should outline the required supply chains for construction materials and equipment, leveraging experiences from recently completed 400 kV in Angola and DR Congo and 765 kV line projects in other countries like South Africa and India. Where capacities have been developed locally through previous projects, these capacities should be maximised to ensure a sustainable local industry. To the

[96] African Development Bank (AfDB), *Programme for Infrastructure Development in Africa (PIDA): Regional Infrastructure Development Framework*, Abidjan, 2023.

extent possible, existing transport/logistics companies should be engaged and prioritised. Efficient customs and border logistics between Angola and DRC will be crucial for the smooth movement of construction materials. Cross-border agreements should facilitate this process by offering incentives, such as reduced or waived import duties and taxes.

11.2.3 Corridor Development Strategy

The strategy should leverage the interconnector to drive economic growth along its route. The aim is to ensure local communities tangibly benefit (through access to power, markets, or transport) rather than just having the interconnector pass through. The corridor approach can be used as an incentive during resource mobilisation.

The strategy will be predicated upon the three areas as per **¡Error! No se encuentra el origen de la referencia.**.

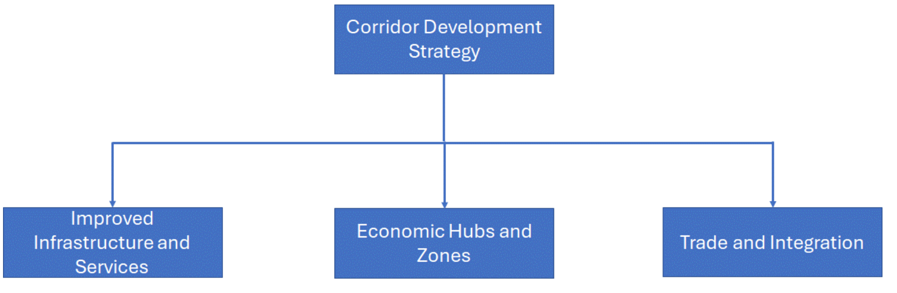


Figure 32: Corridor development strategy

11.2.3.1 Improved Infrastructure and Services

The interconnector is expected to expand electricity access in the regions of Angola and D.R. Congo along its route. The interconnector should be accompanied by distribution lines from terminal substations that feed communities along the interconnector. The interconnector connection to the Soyo substation (Angola), to Camp Kin (near Inga, DR. Congo), will help achieve this objective. The strategy could include plans for rural electrification or industrial power connections in communities near the line, turning the corridor into a zone of improved energy access.

11.2.3.2 Economic Hubs and Zones

The Project Management Unit for the project should work with local utilities to identify potential economic hubs along the corridor. The governments of Angola and DRC should task the PMU with identifying the potential economic hubs along the corridor. New or expanded markets, agro-processing centres, mining operations, or special economic zones are already planned by ministries of both countries and additional ones could be planned around corridor nodes (such as near new substations created by the project, mainly Soyo and Inga). Where possible, the line route should align with other infrastructure projects, such as rail and road, along the same corridor.

11.2.3.3 Trade and Integration

In addition to the electricity trade enabled by the interconnector, economic hubs along the interconnector corridor can create markets for trade in both countries. The strategy should include ensuring that the nearest border post processes are streamlined and that trade barriers are reduced. In the long run, new markets can be created through complementary industries for both countries, thereby increasing trade between them. Metrics should be established to track the corridor's economic impact over time, including local business numbers, traffic volumes along the corridor, new investments in the region, and employment trends. This approach could yield evidence-based results useful for motivating similar projects in the future.

11.3 Capability Needs Assessment for Next Phase

A capacity needs assessment is essential before initiating a full Feasibility Study. The Feasibility Study will be an in-depth analysis covering the technical, environmental, legal, economic and financial aspects of the interconnector project. The purpose of the capacity needs assessment is to ensure that Angola and DR Congo have the requisite skills, knowledge, and institutional strength to manage and contribute effectively to the next project phase.

In both countries, this process should be led jointly:

- in DRC by RNT and SNEL, under the oversight of the regulator (ARE), and Ministry of Energy and Water (MRHE), and Ministry of Environment (MEDD)
- in Angola with technical input from the Ministry of Energy and Water (MINEA), the regulator (IRSEA), the Ministry of Environment (MINAMB).

The assessment will define core competencies in system planning, environmental and social management, financial modelling, and legal frameworks for regional power trade. It will also guide institutional strengthening, training, and capacity-building programmes potentially implemented through regional centres of excellence such as AFSEC (African Electrotechnical Standardization Commission) or ECREEE (ECOWAS Centre for Renewable Energy and Energy Efficiency)

Overall, these preparatory actions will lay the groundwork for a well-coordinated transition into the Full Feasibility Study Phase, ensuring that the project remains technically sound, financially viable, environmentally sustainable, and institutionally harmonised between both jurisdictions.

11.3.1 Technical Expertise

The local government utilities, RNT (Angola) and SNEL (DRC), have part of the necessary skills and expertise to conduct the technical studies required for the feasibility study. Historically, the two countries have relied on technical assistance from development partners to undertake such studies. Therefore, hiring engineering consulting firms to conduct technical studies for the feasibility study is recommended. Where possible, the engineering firms should be incentivised to partner with local or regional consulting firms to ensure skills transfer.

11.3.2 Environmental and Social Impact Assessment

Both countries have the institutional capacity to oversee and approve the ESIA process as part of the Feasibility Study. The institutions responsible for the ESIA process in Angola and DRC are the Ministry of Environment of Angola with its agency Instituto Nacional de Gestao Ambiental (INGA), and Agence Congolaise de l'Environnement (ACE) of the DR. Congo. They will verify that the ESIA consultants are sufficiently qualified. For such a project, the ESIA consultants will require support from the national utilities, RNT (Angola) and SNEL (DRC), to engage local communities in public engagement and participation meetings, where they will introduce the project and its expected impacts. The ESIA must follow due process to avoid court challenges and public protests during the construction phase. As such, the ESIA consultant team should comprise the necessary expertise, which, among others, includes public engagement specialists, as well as specialists in biodiversity, ecology, and wildlife.

11.3.3 Legal and Regulatory Capacity

A cross-border project entails complex legal work, from understanding the land acquisition laws in each country to drafting agreements between Angola and DRC on project cost allocation, operation, and revenues, and ensuring compliance with energy regulators, IRSEA (Angola) and ARE (DRC). Both governments will need legal advisors with experience in international and cross-border agreements. The Angola-DRC interconnector can leverage on the ongoing cross-border projects, e.g. the Angola-Namibia 400 kV line and the Boucle de l'Amitié 400 kV line (Kinshasa-Inga-Cabinda-Pointe Noire-Brazzaville-Kinshasa), for experience in drafting the necessary contracts. In this regard, legal advisors will be required to collaborate with government ministries, utilities, and regulatory bodies. The legal advisors should ensure that approaches are harmonised across the two jurisdictions and outline a phased plan to ensure that the necessary agreements, permits and licenses are obtained.

11.3.4 Economic and Financial Analysis

The Feasibility Study should include a detailed cost-benefit analysis, financial modelling and funding strategy for the project. This function should ideally be conducted by consultants with the necessary financial and economic expertise to work with credible data assumptions. The analysis should include long-term benefits of the project and the financial viability, considering tariff setting for the sale and wheeling of electricity between the two countries. In addition to trade between Angola and DRC, the interconnector is also expected to facilitate the wheeling of power from DRC to Zambia and Namibia through Angola after the commissioning of Inga 3. The analysis should consider sensitivities to various demand scenarios in both countries. Working with the hired consulting firms, utilities in both countries should build the necessary capacity to evaluate the results of the Feasibility Study. The Feasibility Study should propose a funding plan that governments can critically review and negotiate with prospective funders.

11.3.5 Overall Project Management Needs

The Project Management Unit (PMU) team, comprising representatives from both countries, should be established to handle project management duties, including scheduling, procurement of consultants, contract management, progress monitoring, and reporting. The team should be drawn mainly from the utilities and ministries of both countries. The PMU will work closely with appointed legal and financial advisors, as well as the owners' engineers, for the project. The team should have the capacity to address morning cross-cutting issues such as gender inclusion and community engagement to ensure that women and youth are included in jobs and training.

In line with the PIDA project cycle, the next steps can be structured as follows:

- Stage 2A (Feasibility): complete detailed load-flow and dynamic studies, refine demand and generation scenarios, finalise route selection and ESIA scoping, and develop a full CBA with alternative counterfactuals,
- Stage 2B (Project structuring): select the preferred financing and PPP model, design the cross-border cost-allocation and tariff framework, prepare term sheets for power-trade and wheeling agreements, and launch early market sounding with potential investors and DFIs, and
- Stage 3 (Financial structuring and close): prepare tender documents or financing proposals, negotiate financing packages, and reach financial close.

Each stage will require dedicated technical, legal, environmental and financial advisory support, and should be overseen by a joint Project Management Unit representing both countries and regional institutions (SAPP, CAPP, AUDA-NEPAD).

ANNEX 1: Cost Benefit Analysis

CBA Formulas

Trade & System > Benefits

Supposing Country A is importing from Country B *(and Country B has capacity for export, i.e. overcapacity)*:

o **Production Cost Savings** in Country A = Net Imports x (CostkWh_Country A-CostkWh_Country B) / 1000

o **Loss Reduction** = - Losses (GWh) x Loss Energy Price / 1000 (EUR M)

o **Reliability improvement** VOLL = Unserved Energy Avoided x VoLL / 1,000,000 (EUR M)

o **VRE Integration improvement** = VRE Curtailment Reduced x VRE Value / 1,000,000 (EUR M)

Costs

o Incremental Loss Cost = Losses (GWh) x Loss Energy Price / 1000 (EUR M)

Externalities

o CO: Low/High = Net Emissions x SPC / 1,000,000 (EUR M) (SPC table on Inputs)

Economic Cash Flows

o Net Benefits for No/Low/High SPC, plus ENPV & EIRR (also ENPV at low/high test discount rates)

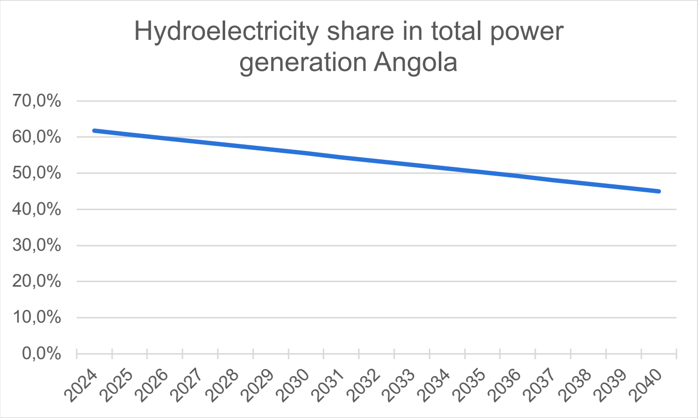
Inputs added

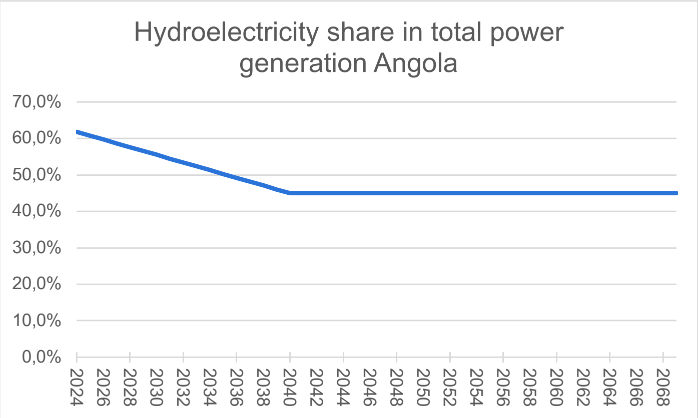
o Avoided Capacity Cost (EUR/kW-y), Reserve Sharing Value (EUR/kW-yjj, VRE Value (EUR/MWh), Loss jEnergy Price (EUR/MWh), VoLL, discount rates, SPC table, commissioning year (drives calendar years).

1) Production cost savings

Production cost estimates for Angola

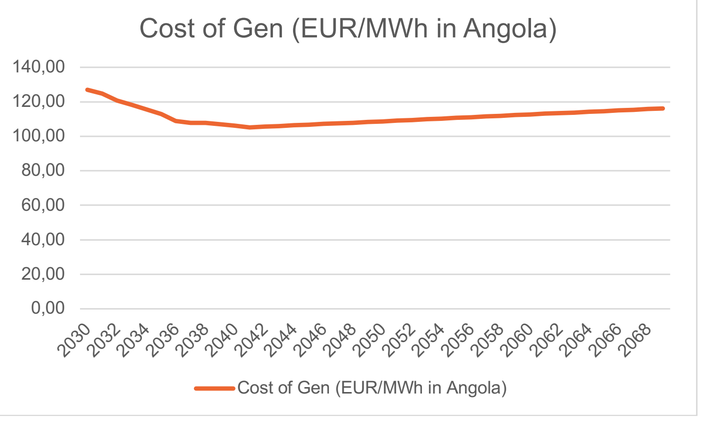
The generation mix in Angola will roughly follow a share evolving from 62% of hydro presently[97], which is expected to last until 2030 before decreasing to 45% in 2040 as per the Master Plan.





The generation cost in Angola is then estimated as per the following evolution.

[97] https://www.trade.gov/country-commercial-guides/angola-energy



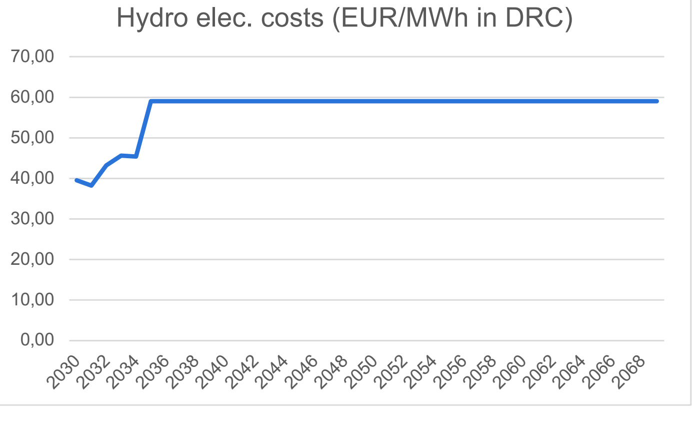
This average cost of generation in Angola has been estimated using:

- Until 2035, the cost of kWh available from the IRENA SPLAT model developed during the CMP 2023 - 2040
- From 2035 on, the shares of hydro and thermal energy, and
    - The average cost of hydro energy, reaching 0.566 EUR/kWh
    - An estimate of the cost of thermal energy (Soyo CCGT), estimated at 0.14 EUR/MWh, with and escalation of costs of fuels

<u>Production cost estimates for DRC:</u>

This average cost of generation in DRC has been estimated using:

- Until 2035, the cost of kWh available from the SPLAT model (between 0.04 and 0.07 USD/kWh)
- From 2035 on, for Inga 3, the cost of kWh announced as being a target is 0.07 USD/kWh as per ADPI, which is equivalent to 0.059 EUR/kWh.



Note: since the cost of kWh in both countries include a CAPEX and an OPEX component, there is no Capacity Deferal cost to take into account (the capacity costs are included in the cost of kWh).

2) Losses on the interconnector and Grid Loss Reduction

Losses on the interconnector

The length of the interconnector lines is rather small (190 km). Consequently, the loss level is assumed to be 1% of the power injected in the interconnector.

Grid Loss reduction

During the first period (Soyo to DRC transfers, expected to take place from 2030 until the commissioning of Inga 3), the operation of the interconnection will not affect the losses on the Angolan grid because Soyo (the generation point) is at the extremity of the Angolan grid.

During the second period (Inga to Angola transfers), the situation can be analysed as follows.

The transmission grid of Angola shows significant hydro generation in the South and the East of Luanda, resulting in significant power flows from the South to Luanda, which is rather in the North. As a result, any flow from the DRC towards the South of Angola will reduce the South -> North flows and reducing the related grid losses in Angola.

Particularly, this can take place once wheeling of power is planned from DRC through Angola to Zambia and Namibia.

Since this wheeling option is not yet confirmed, a conservative assumption will be considered, i.e. it is assumed that there are no savings on grid losses due to the projected interconnection, neither in the first period, nor in the second period.

3) Reliability Improvement and reduction in Spinning reserve requirements

Reliability Improvement due to the interconnector

All power systems have components that show a certain probability of failure, and as a result, an expected amount of Energy Not Served. In case the demand is above the generation capacity during a given period, and particularly if this is the case during normal operation, the Energy Not Served is positive during that period. Creating an interconnection provides an additional path that can contribute reducing this Energy Not Served, thereby improving the reliability and the related reliability indices (SAIDI, SAIFI, CADI, CAIFI etc.).

As per SNEL, the present level of demand in Kinshasa is about 2000 MW, and presently only half of it can be served because of the combination of the limited available generation capacity and the needs of the industrial sector, mainly the mines in the Katanga region.

As a result, until the commissioning of Inga 3, there is an extremely high level of unserved energy, estimated at least at 750 MW and possibly in the order of 1000 MW that lasts almost every day and every hour of the year.

Therefore, any energy flow from Soyo to Inga would be transferred to Kinshasa and supply almost 750 MW of unserved demand in Kinshasa. This unserved demand present consist in the demand of consumers having probably small diesel sets, consumer using candle or gas instead of electricity, and consumers having access to no energy at all except some small devices based on batteries, and some are supplied by small PV systems. The assumption proposed here is conservative, meaning that the cost of unserved energy is approximated by the cost of the emergency energy, i.e. the cost of operating here is 180 Euro/MWh.

Reduction of Spinning Reserve requirements due to the interconnector

All system operators try to have reserves enough to cope with single mode failures of generation units, so that a tripping of a generation unit, even the largest generation unit or importing line does not let the frequency drop reach the automatic load shedding level.

Systems that are independent, i.e. not connected, have each their spinning reserve capacity, itself based on the size of the largest generation unit. Once two such systems are interconnected, like here Angola and DRC, the total spinning reserve can be sized based on the largest generation unit, i.e. less than the sum of the capacities of the two formerly identified generation units.

Here, since both DRC and Angola are part of the SAPP, they should contribute to the SAPP primary frequency reserve once interconnected to the existing SAPP grid. As per the SAPP website, although the SNEL is connected through an HVDC line likely not able to transfer synchronizing power, SNEL should contribute to the SAPP spinning reserve (www.sapp.co.zw/technical-information). The gain on official reserves requirements would then come from connecting the Angolan grid operated by RNT to the rest of the SAPP grid. It can be estimated using published values:

Before the Interconnection of Angola to other SAPP systems (sapp.co.zw/technical-information)

Utility Name	Largest Generator (MW)	Maximum Demand (MW)	Spinning Reserve (MW) e	Quick Reserve (MW) f	Operating Reserve (MW) g = e + f	Spinning Reserve (as % of Max Demand)
BPC	150	610	27	27	54	4,43%
CEC	10	765	9,7	9,7	19,4	1,27%
EDM	38	830	14,2	14,2	28,4	1,71%
ESKOM	930	34913	507,3	507,3	1014,6	1,45%
LEC	24	150	4,9	4,9	9,8	3,27%
NamPower	92	629	19,3	19,3	38,6	3,07%
SEC	10	227	3,8	3,8	7,6	1,67%
SNEL	**65**	**1317**	**23,2**	**23,2**	**46,4**	1,76%
ZESA	220	1589	47,1	47,1	94,2	2,96%
ZESCO	180	1522	41	41	82	2,69%
TOTAL	**1719**	**42552**	**697,5**	**697,5**	**1395**	1,64%
RNT- Angola	**334**	**5195**	**334**			

After the projected Angola - DRC Interconnection or the Angola- Namibia interconnection

A conservative assumption is to consider that Angola will provide some 42 MW of reserve after interconnection, compared to the present 334 MW reserve requirement related to the N-1 generation criteria applied on the existing system (the largest generation units are those of Lauca, each sized at 334 MW rating).

Utility Name	Largest Generator (MW)	Maximum Demand (MW)	Spinning Reserve (MW) e	Quick Reserve (MW) f	Operating Reserve (MW) g = e + f
BPC	**150**	**610**	**25,38**	**27**	**54**
CEC	**10**	**765**	**9,1**	**9,7**	**19,4**
EDM	**38**	**830**	**13,3**	**14,2**	**28,4**
ESKOM	**930**	**34913**	**476,9**	**507,3**	**1014,6**
LEC	**24**	**150**	**4,6**	**4,9**	**9,8**
NamPower	**92**	**629**	**18,1**	**19,3**	**38,6**
SEC	**10**	**227**	**3,6**	**3,8**	**7,6**

Utility Name	Largest Generator (MW)	Maximum Demand (MW)	Spinning Reserve (MW) e	Quick Reserve (MW) f	Operating Reserve (MW) g = e + f
SNEL	65	1317	21,8	23,2	46,4
ZESA	220	1589	44,3	47,1	94,2
ZESCO	180	1522	38,5	41	82
RNT (assumption)			*42*		
TOTAL	1719	42552	697,7	697,5	1395

The savings of spinning reserve of Angola would be 334-42 MW = 292 MW and the savings for other members of SAPP would be 42 MW. These reserves reductions can be valued at the generation capacity cost of countries involved in reserve contributions.

However, it is likely that the ANNA (Angola-Namibia) interconnection will be commissioned before the present Angola – DRC interconnection. In that context, there are no savings on the spinning reserve due to Angola-DRC interconnection.

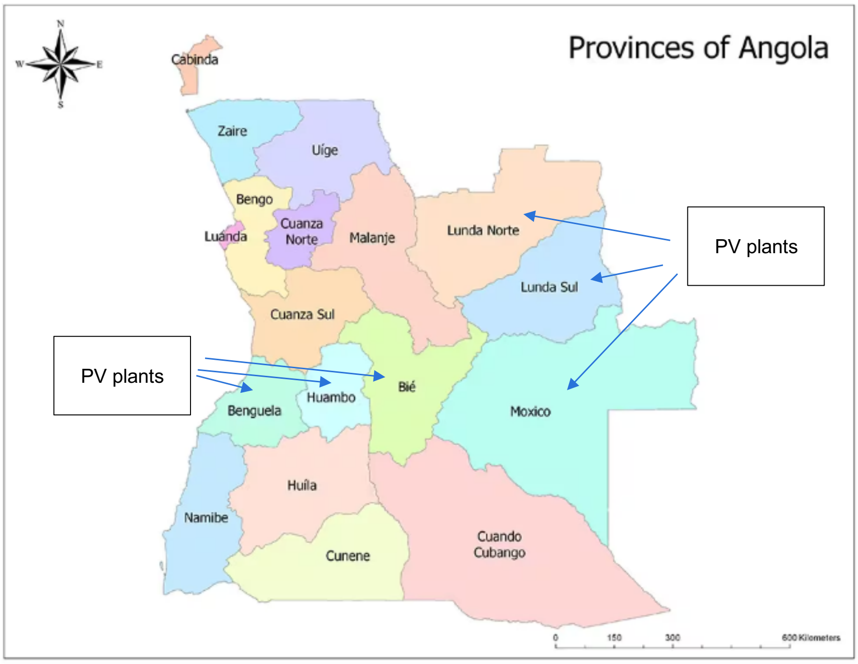
4) VRE Integration improvement

There is presently only a few IPP, these provide PV energy and are situated in the south of Angola.

The vRE plants in operation in Angola are the following (commissioned between July 2022 and September 2025 by MCA Group in consortium with Sun Africa):

1. Biopio (188MWp)
2. Baía Farta (96MWp)
3. Saurimo (~26.1MWp)
4. Luena (~26.9MWp)
5. Lucapa (~7.2MWp)
6. Cuito (~14.65MWp)
7. Bailundo (370 MWp)

All these are concentrated in 6 provinces, in the south of the country: Benguela, Huambo, Bié, Lunda Norte, Lunda Sul and Moxico provinces. The line loadings in the neighbourhood of the installed vRE plants are not affected by the projected Angola (Soyo)- DRC (Inga) interconnection.



So far, as per RNT, there is no vRE curtailed. As a result there is no reduction of vRE curtailement to take into account in the Cost-Benefit Analysis. Therefore, there is no economic revenue from this term.

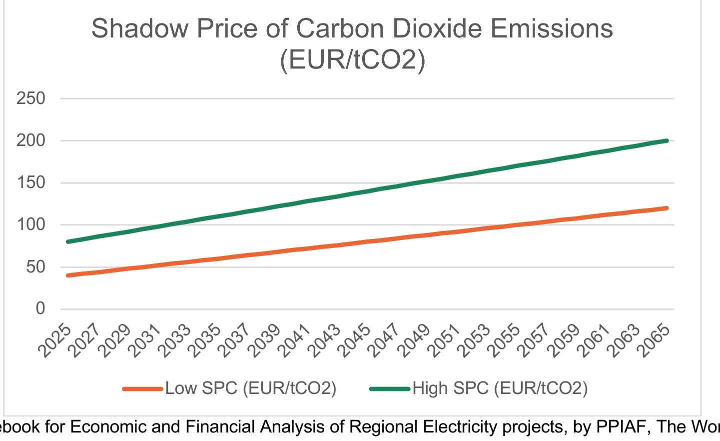
5) Externalities: Impact of CO2 Emissions

In case the project decreases or increases CO2 emissions, the related impacts or are to be accounted for in the economic analysis.

For the thermal generation, the Carbon factor is considered as being 0.7 ton of CO2 per MWh.

Two contexts are envisaged for the shadow price of CO2 emissions forecasts, with forecasts :

- "Low" from 40 in 2025 to 120 in 2065
- "High" from 80 in 2025 to 200 in 2065



Source: Guidebook for Economic and Financial Analysis of Regional Electricity projects, by PPIAF, The World Bank, 2020

6) CAPEX and OPEX of Project Alternatives

Using the CAPEX described at §2.2, the OPEX can be derived using the following assumptions:

- O&M fixed component: 1.5 % of CAPEX per year
- O&M Variable component: 0.02 EUR/MWh, this is representing the cost of losses

7) CBA and Comparison of Project Alternatives

Using all the above benefits (Production costs savings, impacts on losses, impacts on reliability) and externalities (shadow price of CO2) as well as above costs (§2.2).

Three indicators are computed:

- The Economic Net Present Value
- The Economic Internal Return Rate
- The Economic Cost/Benefit Ratio

These are evaluated on an Excel spreadsheet and provide the following results.

	Strategy 1: 400 kV – TTC of 2.5 GW			Strategy 2: 765 kV – TTC of 5 GW		
Discount Rate (from Inputs)	8%	10%	12%	8%	10%	12%
ENPV (No SPC) MEUR	5581	4175	3206	10609	7846	5954
ENPV (Low SPC) MEUR	5037	3669	2734	10065	7340	5482
ENPV (High SPC) MEUR	4493	3178	2283	9486	6832	5024
EIRR (No SPC)	54%	54%	54%	52%	52%	52%
EIRR (Low SPC)	39%	39%	39%	43%	43%	43%
EIRR (High SPC)	30%	30%	30%	37%	37%	37%
BCR (No SPC)	10,24	8,24	6,78	14,16	11,20	9,04

BCR (Low SPC)	5,39	4,39	3,66	8,46	6,75	5,52
BCR (High SPC)	3,73	3,05	2,56	6,14	4,92	4,04

Clearly, the Strategy 2 shows higher Net Present Values of the project, as well as higher Benefit / Cost Ratios, while having Return Rates of the same order than the Strategy 1. The above results are based on the following economic flows.

Year	Total Benefits (EUR M)	Total Costs (No SPC, EUR M)	CO2 Cost savings (Low SPC, EUR M)	Total Costs (Low SPC, EUR M)	CO2 Cost savings (High SPC, EUR M)	Total Costs (High SPC, EUR M)	Net Benefit (No SPC, EUR M)	Net Benefit (Low SPC, EUR M)	Net Benefit (High SPC, EUR M)
0	0,0	552,8	0,0	552,8	0,0	552,8	-552,8	-552,8	-552,8
1	234,1	8,2	-135,2	143,4	-267,2	275,4	225,9	90,7	-41,3
2	244,7	8,2	-141,6	149,8	-276,9	285,1	236,5	94,8	-40,4
3	262,4	8,2	-148,1	156,3	-286,5	294,7	254,2	106,1	-32,3
4	273,5	8,2	-154,5	162,7	-296,2	304,4	265,4	110,8	-30,8
5	285,8	8,2	-161,0	169,2	-305,8	314,0	277,6	116,6	-28,3
6	774,8	8,4	0,0	8,4	0,0	8,4	766,4	766,4	766,4
7	713,7	8,4	0,0	8,4	0,0	8,4	705,3	705,3	705,3
8	701,4	8,4	0,0	8,4	0,0	8,4	693,0	693,0	693,0
9	701,3	8,4	0,0	8,4	0,0	8,4	692,9	692,9	692,9
10	689,0	8,4	0,0	8,4	0,0	8,4	680,6	680,6	680,6
11	676,8	8,4	0,0	8,4	0,0	8,4	668,4	668,4	668,4
12	661,0	8,4	0,0	8,4	0,0	8,4	652,7	652,7	652,7
13	666,7	8,4	0,0	8,4	0,0	8,4	658,3	658,3	658,3
14	672,3	8,4	0,0	8,4	0,0	8,4	663,9	663,9	663,9
15	677,9	8,4	0,0	8,4	0,0	8,4	669,5	669,5	669,5
16	683,5	8,4	0,0	8,4	0,0	8,4	675,1	675,1	675,1
17	689,1	8,4	0,0	8,4	0,0	8,4	680,7	680,7	680,7
18	694,7	8,4	0,0	8,4	0,0	8,4	686,3	686,3	686,3
19	700,3	8,4	0,0	8,4	0,0	8,4	691,9	691,9	691,9
20	705,9	8,4	0,0	8,4	0,0	8,4	697,5	697,5	697,5
21	711,5	8,4	0,0	8,4	0,0	8,4	703,1	703,1	703,1
22	717,1	8,4	0,0	8,4	0,0	8,4	708,7	708,7	708,7
23	722,7	8,4	0,0	8,4	0,0	8,4	714,3	714,3	714,3
24	728,3	8,4	0,0	8,4	0,0	8,4	719,9	719,9	719,9
25	733,9	8,4	0,0	8,4	0,0	8,4	725,5	725,5	725,5
26	739,5	8,4	0,0	8,4	0,0	8,4	731,1	731,1	731,1
27	745,1	8,4	0,0	8,4	0,0	8,4	736,7	736,7	736,7
28	750,7	8,4	0,0	8,4	0,0	8,4	742,3	742,3	742,3
29	756,3	8,4	0,0	8,4	0,0	8,4	747,9	747,9	747,9
30	761,9	8,4	0,0	8,4	0,0	8,4	753,5	753,5	753,5
31	767,5	8,4	0,0	8,4	0,0	8,4	759,1	759,1	759,1
32	773,1	8,4	0,0	8,4	0,0	8,4	764,7	764,7	764,7
33	778,7	8,4	0,0	8,4	0,0	8,4	770,3	770,3	770,3
34	784,3	8,4	0,0	8,4	0,0	8,4	775,9	775,9	775,9
35	789,9	8,4	0,0	8,4	0,0	8,4	781,5	781,5	781,5

Year	Total Benefits (EUR M)	Total Costs (No SPC, EUR M)	CO2 Cost savings (Low SPC, EUR M)	Total Costs (Low SPC, EUR M)	CO2 Cost savings (High SPC, EUR M)	Total Costs (High SPC, EUR M)	Net Benefit (No SPC, EUR M)	Net Benefit (Low SPC, EUR M)	Net Benefit (High SPC, EUR M)
36	795,5	8,4	0,0	8,4	0,0	8,4	787,1	787,1	787,1
37	801,1	8,4	0,0	8,4	0,0	8,4	792,7	792,7	792,7
38	806,7	8,4	0,0	8,4	0,0	8,4	798,4	798,4	798,4
39	812,3	8,4	0,0	8,4	0,0	8,4	804,0	804,0	804,0
40	818,0	8,4	0,0	8,4	0,0	8,4	809,6	809,6	809,6

ANNEX 2: Angola Generation system (2025)

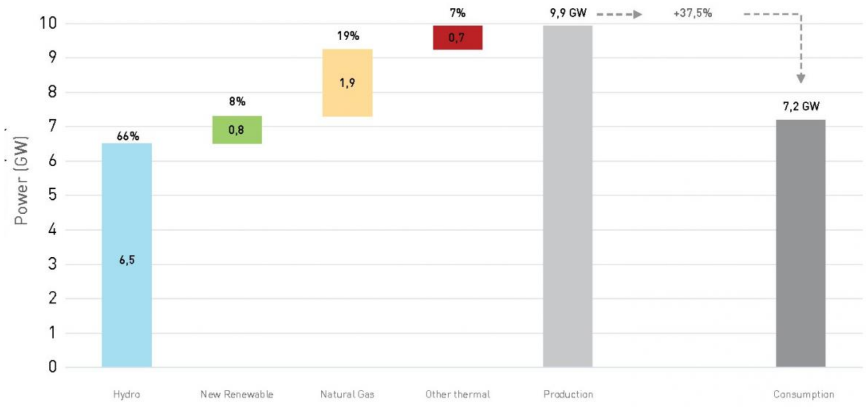
In order to meet the expected power demand in a secure way, even in years of reduced water flow, Angola will have in 2025 around 9.9 GW of installed power, with a strong focus on hydropower and natural gas.

Hydropower will reach 6.5 GW of installed power (66% of the total), favouring the balance between cost competitiveness and regional development in the post-2017 period, with the phasing of Caculo Cabaça and a higher focus on new rivers and basins - such as the river Queve with the Balalunga and Cafula projects, the river Catumbela with the Cacombo, Lomaum 2 and Calengue projects, the rivers Cune, Cunhinga and Cutato with the hydrothermal project, the river Cunene with Jamba-Ya-Mina, Jamba-Ya-Oma and the international Baynes project, and other smaller hydro projects throughout the country.

Natural gas will reach 1.9 GW (19% of the total) with the doubling of Soyo and the conversion to natural gas of several turbines and/or small combined cycles in Cabinda, Luanda, Benguela and Namibe. The power sector will therefore contribute to the gasification of the main industrial clusters of the country, increasing their efficiency, reducing costs and decreasing diesel related subsidies.

These values are complemented with an additional 800 MW of installed capacity in renewable energies, around 8% of the total installed power, and 700 MW of installed capacity of other thermal-based generation, representing around 7% of the total.

INSTALLED CAPACITY BY ENERGY SOURCE IN 2025



In order for these evolutions to take place until 2025, all of the 5 Systems will have to develop:

Northern System

- In Soyo, the whole of the gas potential and of the 400 kV corridor will be put to profit with the installation of two 360 MW additional units to the 720 MW currently under construction, giving a total of 1,440 MW. The gas currently available allows the power plants to operate only in peak and mid-peak times
- or alternatively to operate at half-load in order to guarantee available reserve. It will also be possible for these units to operate in “dual-fuel” mode – with either LNG, Butane or Diesel – in dry years so as to maximize production.
- In Luanda new generation capacity is not planned, with the exception of the replacement of groups 4 and 5 in Cazenga with a medium-sized natural gas combined cycle that will in the future ensure power regulation in Luanda. Until 2025, groups 1, 2 and 3 in Cazenga will be decommissioned and the barges of Boavista Power Plant will be relocated to Benguela (80 MW) and Namibe (40 MW). The remaining thermal power plants in Luanda will operate as backup.

- The Caculo Cabaça hydropower plant will be built in phases, with 1,000 MW installed until 2025 with an operating regime close to base load.
- The Zenzo 1 and Túmulo do Caçador hydropower plants, which are highly competitive projects, should be studied in detail and initiated within the 2025 timeframe only if there are evolutions in demand, such as a new intensive industry large scale project or the construction of a high capacity export axis.

Central System

- In the river Queve two high priority hydropower projects will be developed: next to Porto Amboim, the Balalunga project (also known as Quilengue) with 220 MW and upstream the Cafula project with 400 MW, with regulation capacity and a high potential for irrigation. The solution considered for Cafula is
- Compatible with the possible construction of the Utiundumbo dam in the post-2025 period, in reverse mode with Cafula.
- In the river Catumbela, in the upstream part, the Cacombo project will be built in order to regulate the river's flow, and in the downstream part the projects of Lomaum 2 with 160 MW and Calengue with around 200 MW will be built.
- In the rivers Cutato, Cune and Cunhinga – in the Bié province – several medium-sized and large hydropower plants integrated in the hydrothermal project will be built, with a planned total power installed capacity between 200 MW and 450 MW until 2025, depending on the evolution of demand. Thermal generation in the Central system will come mainly from the hydrothermal project which includes a 300 MW biomass-based generation. In addition, the Boavista barges, operating with LNG and with a total of 80 MW, will be moved to Lobito. The power plants of Quileva and Biópio would work mainly as backup.

Southern System

- Namibe will be reinforced with 80 MW in turbines, of which 40 MW correspond to the barge currently operating in the Boavista power plant (Luanda).
- The Jamba Ya Mina and Jamba Ya Oma hydropower projects, despite their main objective being the regulation of the Cunene river, will play a major role in supporting the Center-South corridor and the cities of Lubango and Menongue – whose supply in 2025 will be mainly based on the transmission of energy from other systems and from Baynes and Namibia further south.
- In the Southern border, the Baynes hydropower project will move forward until 2025 with a total power between 400 and 600 MW, of which we can assume 200 to 300 MW will be available for Angola.

Eastern System

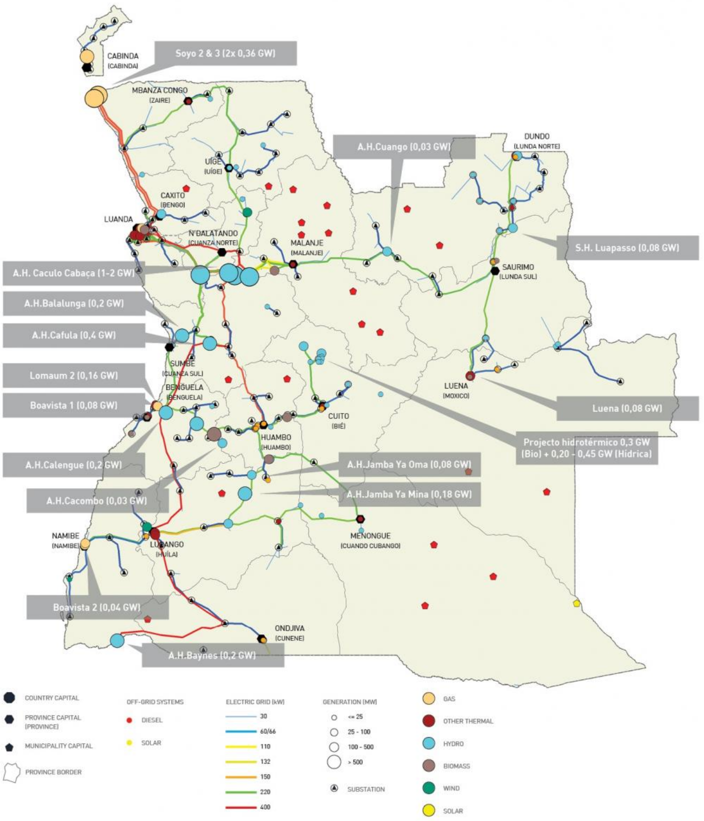
- In the Lunda Norte and Lunda South provinces the construction of the Hydroelectric System of Luapasso is planned, composed of 3 projects with a total of 80 MW of installed power. In addition, the construction of a medium-sized hydropower plant is planned in the Cuango river that, while the north east high voltage transport axis is not completed, can electrify "off-grid" thousands of people living in that region.
- In Moxico, the city of Luena will need 80 MW of thermal power until 2025 in order to guarantee n-1 security levels should a problem with the planned transmission line occur. Luau, Cazombo, Luacano and Muconda municipality townships will be powered by one or more hydropower plants to be installed in the Cassai river.

Cabinda

- The Fútila power plant will grow up until 235 MW based on 2 medium-sized combined cycles, with 100 MW each, complemented with a simple-cycle turbine of 40 MW operating as backup - the 2 existing turbines will be converted into one of the future combined cycles by installing a steam turbine.

- The Fútila power plant will be converted to operate with natural gas produced on-shore in Cabinda and will be connected at 220 kV with the city of Cabinda and with the DRC.

MAP OF GENERATION, NETWORKS AND SUBSTATIONS OF RNT IN 2025



ANNEX 3: DRC Generation system

Operational

	Station	Nb units	Unit Cap (MW)	Capacity (MW)	Type	Community	Coordinates	River
West	Inga I	6	58	348	Reservoir		05°31'01"S 13°37'19"E	Congo River
West	Inga II	8	170	1360	Run of river		05°31'44"S 13°37'14"E	Congo River
West	Zongo-1A	3	13	39			-	-
West	Zongo-1B	2	15	30			-	-
West	Zongo-2	3	50	150	Run of river		04°46'57"S 14°54'22"E	Inkisi River
South	Busanga	4	60	240			-	-
South	Koni	3	14,04	42,12			-	-
South	Nseke	5	65	325	Run of river		10°18'15"S 25°24'24"E	Lualaba River
South	Nzilo	4	27	108	Run of river		10°29'59"S 25°27'45"E	Congo River
South	Mwadingusha	6	13,05	78,3	Reservoir		10°44'42"S 27°14'41"E	Lufira River
North	Mobayi			11,25	Reservoir		-	Ubangui river
East	Rutshuru			13,8	Run of river	Rutshuru	01°13'33"S 29°27'36"E	Rutshuru River
East	Mutwanga			9.4	Run of river	Mutwanga	00°20'24"N 29°45'36"E	-

Operational

	Station	Nb units	Unit Cap (MW)	Capacity (MW)	Type	Community	Coordinates	River
East	Ruzizi I	-	-	40	Reservoir	-	-	Ruzizi River
East	Ruzizi II	-	-	45	Reservoir	-	-	Ruzizi River

Under construction or proposed - -

	Station			Capacity (MW)	Type	Community	Coordinates	River
West	Inga III	-	-	11000	Run of river		05°31′08″S 13°36′25″E	Congo River
West	Kakobola Dam	-	-	10.5				Lufuku River
East	Ruzizi III	-	-	145	Reservoir			Ruzizi River
East	Ruzizi IV	-	-	287	Reservoir			Ruzizi River
South centre	Katende	-	-	64	Run on river		06°20′48″S 22°27′02″E	Lulua River

Longer term

West	Grand Inga	-	-	up to 40000 after inclusion of Inga 1, 2, 3…	Run on river		05°32′45″S 13°33′25″E	Congo River

ANNEX 4. CBA for a larger project

The Economic Analysis should ideally take into account other transmission investments that will be related to evacuating the 2.5 GW target for Strategy 1 and the 5 GW target for Strategy 2, i.e. investments in lines and components for compensating the reactive power and ensuring an acceptable voltage profile along the lines.

These investments can typically consist in transmission lines from Soyo to Catete (near Luanda) followed by other lines towards either the Namibian border or the Zambian border, as follows.

Name	Length
	km
Soyo - Inga (Camp Kin)	**190**
Soyo -Catete	**388**
To Zambia border (Mwinilinga)	
Catete - Cap Elev	230
Cap Elev - Xamuteba	320
Xamuteba - Saurimo	380
Saurimo - Luao(1)	301
Luao - Mwinilinga(1)	399
Total Zambia border (Mwinilinga)	**1,630**
To Namibia border (Baynes)	
Catete - Porto Amboin	325
Porto Amboin - Benguela	279
Benguela - Moçamedes	403
Moçamedes - Baynes (1)	280
Total Namibia border (Baynes)	**1,287**

The above table aims at providing an order of magnitude of the investments that could be coupled with the Inga-Soyo Interconnector, thereby shaping roughly the bases for an economic analysis that would target not only the Inga-Soyo interconnector but longer transmission lines.

The following table show the CBA results using the same revenues than the base case, but investments multiplied by 10 or 15, which are in fact extensions of the sensitivity on CAPEX (which comprised CAPEX increased by a factor of 200% and 300 % in chapter 5).

The results below show that even when multiplying the CAPEX by a factor 5, the project remains profitable. When considering a factor 7.5, the project reaches the profitability limit for Strategy 2 (765 kV) and is not profitable anymore for Strategy 1 (400 kV).

	CAPEX multiplied by ..		CAPEX multiplied by ..	
	Strategy 1 500%	**Strategy 1** 750%	**Strategy 2** 500%	**Strategy 2** 750%
ENPV (No SPC) MEUR	2165	908	5166	3491
ENPV (Low SPC) MEUR	1659	402	4660	2985
ENPV (High SPC) MEUR	1167	-89	4152	2477
EIRR (No SPC)	17%	12%	20%	15%
EIRR (Low SPC)	15%	11%	18%	14%
EIRR (High SPC)	13%	10%	17%	13%
BCR (No SPC)	1,84	1,24	2,50	1,68
BCR (Low SPC)	1,54	1,09	2,18	1,53
BCR (High SPC)	1,33	0,98	1,94	1,41

Note:

- for both Strategy 1 and Strategy 2, the number of conductors from Catate (near Luanda) to the border (whether border to Namibia or border to Zambia) can be reduced since part of the power evacuated through Inga- Soyo will be consumed around Soyo and/or Catete, leaving only a fraction of the power exported from Inga reaching one of these borders. The investments per km would then be low than those estimated for the Soyo-Inga interconnector.
- The above results are based on several parameters, among which the “Cost of Emergency Energy” in DRC , which has been assumed here to be 180 EUR/MWh, and could represent the cost of alternative supply systems like gensets or solar PV with batteries and inverters, or a mix of these with Unserved Energy, itself values usually between 1,000 and 2,000 EUR/MWh. The assumption of 180 EUR/MWh is likely lower, i.e. conservative, and is worth to be analysed more in depth in a feasibility study, as well as the amount of the energy not served in the DRC West grid.

ANNEX 5. Preliminary Grid Modelling, load flow and losses computations

1. Introduction

This prefeasibility study evaluates the technical performance of potential interconnections between Angola and the Democratic Republic of Congo (DRC). The analysis focuses on steady-state grid modelling and load flow calculations for four scenarios addressing the two voltage levels (400 kV and 765 kV) and two time horizons (current grid configuration and future grid with the commissioning of Inga 3).

The primary objectives are:

- To compare active power losses for equivalent power transfers at both voltage levels, i.e. for both strategies S1 and S2.
- To assess future power flow patterns once Inga 3 is operational and exporting power through Angola.
- To evaluate the reactive power compensation needs along the transmission corridors in Angola.

2. Study Context

The commissioning of the 11 GW Inga 3 hydropower project—planned around 2035—will radically alter regional power exchanges. Beyond meeting domestic demand in the DRC, Inga 3 is expected to supply power to Zambia, Namibia, and Angola (including the capital city Luanda) through transmission corridors crossing Angola.

Two voltage levels are evaluated:

- **400 kV interconnection**: Extends the existing Angolan network and enables transfers up to approximately 2.5 GW.
- **765 kV interconnection**: Requires new dedicated corridors but supports larger transfers up to **5 GW**. It is however noted that Angola does not yet have the 765 kV voltage level among its standards for construction and operation.

Each voltage level is assessed under the phase 1 (Soyo transfer to Inga and Kinshasa) and future operating conditions.

3. Methodology

3.1 Grid Modelling

Load flow models were developed to represent:

- The existing Angola and DRC networks.
- The candidate interconnection routes at 400 kV and 765 kV.
- The future network expansions associated with Inga 3.

Steady-state simulations were carried out under peak export/import operating conditions to evaluate line loadings, system losses, voltage profiles, and reactive power balances.

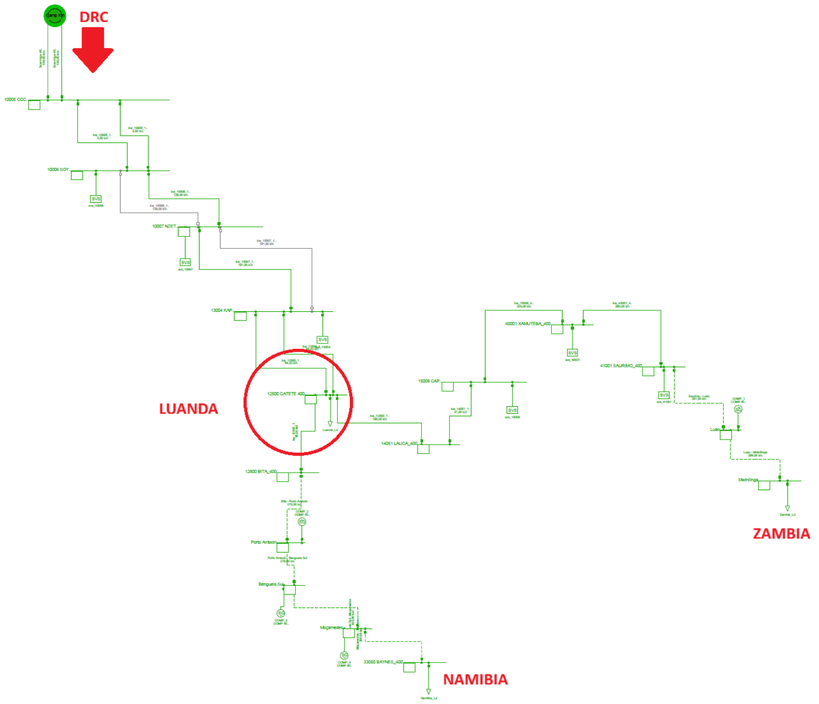


Figure 33: 400kV scenario SLD

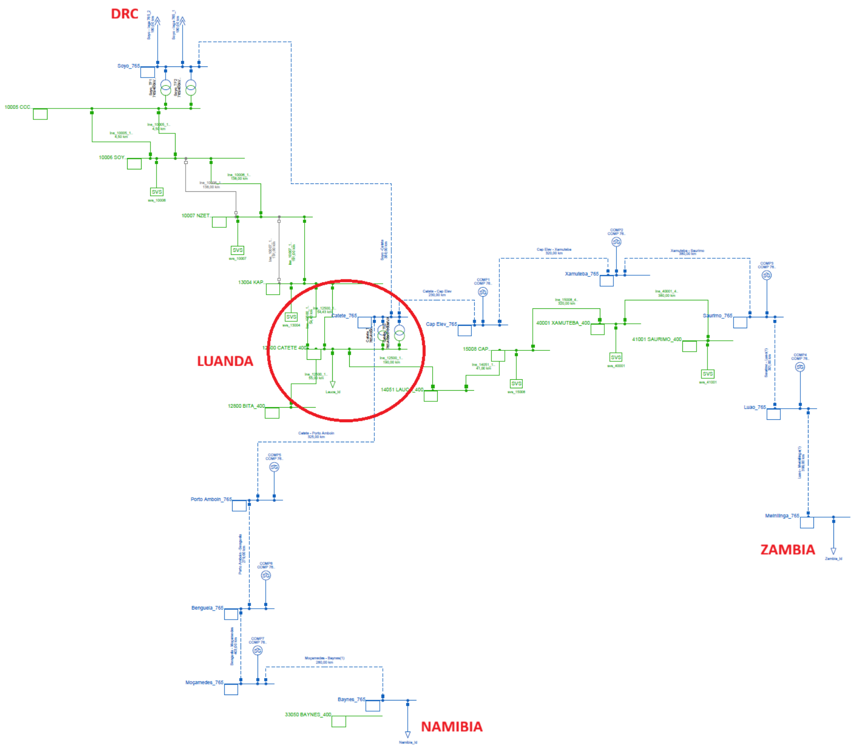


Figure 34: 765kV scenario SLD

The length of the lines is listed below:

Name	Length (km)
Benguela - Moçamedes	403
Cap Elev - Xamuteba	320
Catete - Cap Elev	230
Catete - Porto Amboin	325
Luao - Mwinilinga(1)	399
Moçamedes - Baynes(1)	280
Porto Amboin - Benguela	279
Saurimo - Luao(1)	301
Soyo -Catete	388
Xamuteba - Saurimo	380

3.2 Scenarios

Four scenarios were created:

Voltage level	Present situation	Future situation (Inga 3)
400 kV	Scenario 1: 600 MW transfer Angola → DRC	Scenario 3: Inga 3 exports through Angola (up to 2.5 GW)
765 kV	Scenario 2: 600 MW transfer Angola → DRC	Scenario 4: Inga 3 exports through Angola (up to 5 GW)

4. Scenarios for Phase 1: Soyo to Inga & Kinshasa, Loss Comparison for 600 MW Transfer

The present-day simulations aim to quantify the efficiency of the 400 kV and 765 kV options under identical transfer conditions (600 MW south-to-north flow).

4.1 Scenario 1 – 400 kV Interconnection

The losses on the interconnection lines are the following:

Name	Length	Active Power	Losses
	km	**MW**	**kW**
Soyo-Inga 400kV L1	180	302.7	2,042.7
Soyo-Inga 400kV L2	180	302.7	2,042.7

Leading to the global grid losses bellow :

Name	Losses, P
	MW
Summary Grid	177.7

4.2 Scenario 2 – 765 kV Interconnection

With the 765kV the losses are reduced at the interconnection:

Name	Length	Active Power	Losses
	km	**Terminal i in MW**	**kW**
Soyo - Inga 765_1	180	302.2	648.2
Soyo - Inga 765_2	180	302.2	648.2

But the losses at the global grid level remains similar:

Name	Losses, P
	MW
Summary Grid	177.3

4.3 Comparison

The 765kV voltage level allows a reduced amount of losses at the interconnection site but the limited transfers through the new corridors and the losses created by the new 400/765kV transformers are limiting the efficiency of the 765kV on a more global scale. The introduction of Inga 3 and high transfers through the grid should make a difference.

5. Scenarios for Phase 2: Inga to Soyo, with Inga 3 commissioned (2035 Horizon)

The commissioning of Inga 3 fundamentally changes power flow directions. The present simple grid model consists of an extension of the interconnector to three destinations in Angola (equivalent loads): i) Luanda, ii) border with Zambia and iii) border with Namibia. Hence, the large injections from Inga 3 will supply:

- The DRC internal grid,
- Luanda (Angola),
- Zambia and Namibia via transit through Angola.

This will result in high power flow leading to more losses and need for reactive power compensation.

5.1 Scenario 3 – 400 kV With Inga 3

When power transfer pushed to its maximum, the interconnection can provide 2,5GW from RDC to Angola.

Name	Length	Active Power	Losses
	km	MW	kW
Soyo-Inga 400kV L1	180	1,248.3	40,327
Soyo-Inga 400kV L2	180	1,248.3	40,327

In this simplified model, the power from the interconnector is divided equally between Luanda and each of the neighboring countries (Namibia and Zambia), hence in three equal parts.

Name	Act.Pow. (MW)
Luanda_Ld	850
Namibia_Ld	850
Zambia_Ld	850

Along the 400kV corridors, reactive power compensation is needed to avoid voltage collapse. The amount of reactive power compensation to maintain a 1pu voltage level along the corridors from Luanda to the borders is the following:

Name	Terminal	Reactive Power (Mvar)
COMP_1	Luao	-255.7
COMP_2	Porto Amboin	-270.1
COMP_3	Benguela Sul	-324.4
COMP_4	Moçamedes	-419.8
Total		**-1,270**

5.2 Scenario 4 – 765 kV With Inga 3

When power transfer pushed to its maximum, the 765kV interconnection can transfer 5GW from RDC to Angola.

Name	Length	Active Power	Losses
	km	MW	kW
Soyo-Inga 400kV L1	180	2,494.2	21,243.3
Soyo-Inga 400kV L2	180	2,494.2	21,243.3

The power is divided equally between Luanda and the neighbouring countries (Namibia and Zambia).

Name	Act.Pow. (MW)
Luanda_Ld	1,900
Namibia_Ld	1,900
Zambia_Ld	1,900

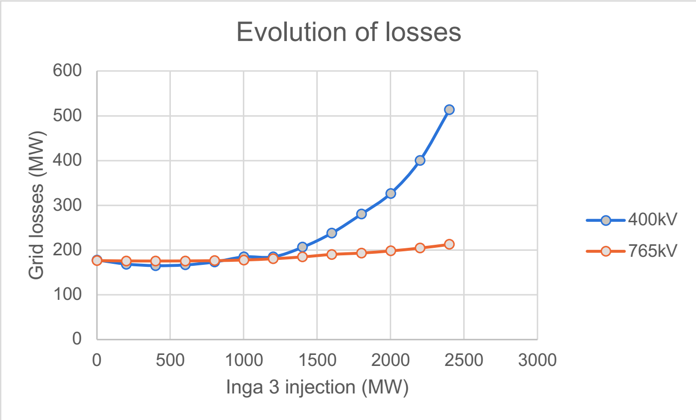
Along the 400kV corridors, reactive power compensation is needed to avoid voltage collapse. The amount of reactive power compensation to maintain a 1pu voltage level along the corridors from Luanda to the borders is the following :

Name	Terminal	Reactive Power (Mvar)
COMP1	Cap Elev_765	-1,504.9
COMP2	Xamuteba_765	-1,393.8
COMP3	Saurimo_765	-1,359.5
COMP4	Luao_765	-2,232.4
COMP5	Porto Amboin_765	-1,497.8
COMP6	Benguela_765	-1,363.1
COMP7	Moçamedes_765	-1,887.3
Total		**-11,238.8**

5.3 Evolution of Losses

Depending on the Inga 3 injection towards Angola through the interconnection, the amount of losses in the grid evolves as follows:

Inga 3 injection	400kV Grid losses	765kV Grid losses
(MW)	(MW)	(MW)
0	177.7	176.4
200	168.7	175.7
400	165.1	175.5
600	166.7	175.7
800	173.3	176.3
1000	184.7	177.7
1200	184.7	180.5
1400	206.2	184.7
1600	237.9	190.2
1800	280.1	193.3
2000	326.3	198
2200	400.2	204.4
2400	513.2	212.4



If the change of power flow direction first shows a sign of loss reduction in the grid, the losses quickly rise afterwards as the injection grows. With its higher voltage level, the 765kV scenario represents a better solution for low losses in the grid at high injection.

6. Conclusion

The 765kV scenario represents lower losses in the grid and a higher injection capacity whereas the 400kV level scenario represents lower reactive power compensation need. It is therefore critical to compare costs to determine whether the reduced losses and increased transfer capability of the 765 kV option outweigh the higher compensation requirements and infrastructure investment associated with this voltage level. It is nevertheless noted that Angola does not yet have the 765 kV voltage level among its standards for construction and operation.