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Report No: PAD4699

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT

IN THE AMOUNT OF EUR 132.6 MILLION
(US\$150.0 MILLION EQUIVALENT)
FROM THE SCALE-UP WINDOW

TO THE

REPUBLIC OF SENEGAL

FOR AN

ENERGY ACCESS SCALE UP PROJECT (PADAES)

February 10, 2022

Energy and Extractives Global Practice
Western and Central Africa Region

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CURRENCY EQUIVALENTS

Exchange Rate Effective December 31, 2021

Currency Unit = EUR

US\$1 = XOF 580

US\$1 = EUR 0.88347027

FISCAL YEAR

January 1 - December 31

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ABBREVIATIONS AND ACRONYMS

AFD	French Development Agency (<i>Agence Française de Développement</i>)
AfDB	African Development Bank
ANER	Senegalese Agency for Renewable Energy (<i>Agence Nationale pour les Énergies Renouvelables</i>)
APA	Alternate Procurement Arrangements
ASA	Advisory Services and Analytics
ASER	Senegalese Agency for Rural Electrification (<i>Agence Sénégalaise d'Électrification Rurale</i>)
BEST	Battery Energy Storage Technology
CER	Rural Electrification Concession (<i>Concession d'Électrification Rurale</i>)
CERC	Contingent Emergency Response Component
CoC	Code of Conduct
COVID-19	Coronavirus Disease
CPF	Country Partnership Framework
CRSE	Energy Sector Regulatory Commission (<i>Commission de Régulation du Secteur de l'Énergie</i>)
CTS	Technical Monitoring Committee
DA	Designated Account
DHS	Demographic and Health Surveys
DPF	Development Policy Financing
DSCR	Debt Service Coverage Ratio
E&S	Environmental and Social
ERR	Economic Rate of Return
ESCP	Environmental and Social Commitment Plan
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESRS	Environmental and Social Review Summary
ESS	Environmental and Social Standards
FCFA	Franc of the Financial Community of Africa (<i>Franc de la Communauté Financière d'Afrique</i>)
FM	Financial Management
GDI	Gender Development Index
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIZ	German Development Agency (<i>Gesellschaft für Internationale Zusammenarbeit</i>)
GIS	Geographical Information System
GoS	Government of Senegal
GM	Grievance Mechanism
GRM	Grievance Redress Mechanism

GRS	Grievance Redress Service
HEIS	Hands-on Enhanced Implementation Support
HFO	Heavy Fuel Oil
HH	Household
HV	High Voltage
IDA	International Development Association
IFC	International Development Association
IFR	Interim Financial Report
IPF	Investment Project Financing
kWh	Kilowatt Hour
LMP	Labor Management Procedures
LNG	Liquefied Natural Gas
LV	Low Voltage
M&E	Monitoring and Evaluation
MCC	Millennium Challenge Corporation
MFD	Maximizing Financing for Development
MG	Megawatt
MPA	Multiphase Programmatic Approach
MPE	Ministry of Petroleum and Energy (<i>Ministère du Pétrole et de l'Énergie</i>)
MSME	Micro, Small and Medium-sized Enterprise
MV	Medium Voltage
NPV	Net Present Value
OE	Owner's Engineer
OMVG	Gambia River Development Organization (<i>Organisation pour la Mise en Valeur du Fleuve Gambie</i>)
OMVS	Senegal River Development Organization (<i>Organisation pour la Mise en Valeur du Fleuve Sénégal</i>)
PADAES	Senegal Energy Access Scale Up Project (<i>Projet d'Amélioration de l'Accès à l'Électricité au Sénégal</i>)
PAP 2A	Priority Action Plan - Adjusted and Accelerated
PASE	Electricity Sector Support Project (<i>Projet d'Appui au Secteur de l'Électricité</i>)
PASER	Rural Electrification Action Plan (<i>Plan d'Action Sénégalais d'Électrification Rurale</i>)
PBC	Performance-Based Conditions
PDO	Project Development Objective
PIU	Project Implementation Unit
PNUER	Emergency National Rural Electrification Plan (<i>Programme National d'Urgence d'Électrification Rurale</i>)
POM	Project Implementation Manual
P.P.	Percentage Points
PPSD	Project Procurement Strategy for Development
PRES	Economic and Resilience Program (<i>Programme de Résilience Économique et Sociale</i>)
PSE	Emergency Plan for Senegal (<i>Plan Sénégal Emergent</i>)

PV	Photovoltaic
RAP	Resettlement Action Plan
ROGEAP	Regional Off-grid Electrification Access Project
RPF	Resettlement Policy Framework
SE4ALL	Sustainable Energy for All
SEA/SH	Sexual Exploitations and Abuse/Sexual Harassment
SENELEC	Senegal National Electricity Company (<i>Société Nationale d'Électricité du Sénégal</i>)
SEP	Stakeholder Engagement Plan
SHS	Solar Home System
SME	Small and Medium Enterprise
SOP	Series of Projects
SPN	Specific Procurement Notices
SSA	Sub-Saharan Africa
SWER	Single-Wire Earth Return
RNU	Single National Registry (<i>Registre National Unique</i>)
ToR	Terms of Reference
VfM	Value for Money
VRE	Variable Renewable Energy
WAEMO/UEM OA	West African Economic and Monetary Union (<i>Union Economique et Monétaire Ouest Africaine</i>)
WAPP	West Africa Power Pool
WBG	World Bank Group
WTP	Willingness to Pay



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DATASHEET

BASIC INFORMATION

Country(ies)	Project Name	
Senegal	Senegal Energy Access Scale Up Project	
Project ID	Financing Instrument	Environmental and Social Risk Classification
P176620	Investment Project Financing	Substantial

Financing & Implementation Modalities

<input type="checkbox"/> Multiphase Programmatic Approach (MPA)	<input checked="" type="checkbox"/> Contingent Emergency Response Component (CERC)
<input type="checkbox"/> Series of Projects (SOP)	<input type="checkbox"/> Fragile State(s)
<input type="checkbox"/> Performance-Based Conditions (PBCs)	<input type="checkbox"/> Small State(s)
<input type="checkbox"/> Financial Intermediaries (FI)	<input type="checkbox"/> Fragile within a non-fragile Country
<input type="checkbox"/> Project-Based Guarantee	<input type="checkbox"/> Conflict
<input type="checkbox"/> Deferred Drawdown	<input type="checkbox"/> Responding to Natural or Man-made Disaster
<input type="checkbox"/> Alternate Procurement Arrangements (APA)	<input type="checkbox"/> Hands-on Enhanced Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
15-Mar-2022	30-Jun-2027

Bank/IFC Collaboration

No

Proposed Development Objective(s)

Increase access to electricity services for households, enterprises, and critical public facilities in Senegal.

Components

Component Name	Cost (US\$, millions)
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Component 1: Grid densification and extension	135.00
Component 2: Electricity access for a resilient and inclusive Post COVID-19 recovery	15.00
Component 3: Capacity building and implementation support	10.00
Component 4: Contingent Emergency Response	0.00

Organizations

Borrower: Republic of Senegal

Implementing Agency: Senegal National Electricity Company (Société Nationale d'Électricité du Sénégal - SENELEC)

PROJECT FINANCING DATA (US\$, Millions)**SUMMARY**

Total Project Cost	160.00
Total Financing	160.00
of which IBRD/IDA	150.00
Financing Gap	0.00

DETAILS**World Bank Group Financing**

International Development Association (IDA)	150.00
IDA Credit	150.00

Non-World Bank Group Financing

Counterpart Funding	10.00
Borrower/Recipient	10.00

IDA Resources (in US\$, Millions)

	Credit Amount	Grant Amount	Guarantee Amount	Total Amount
Senegal	150.00	0.00	0.00	150.00



Scale-up Facility (SUF)	150.00	0.00	0.00	150.00
Total	150.00	0.00	0.00	150.00

Expected Disbursements (in US\$, Millions)

WB Fiscal Year	2022	2023	2024	2025	2026	2027
Annual	3.00	16.50	40.50	60.00	22.50	7.50
Cumulative	3.00	19.50	60.00	120.00	142.50	150.00

INSTITUTIONAL DATA

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

Education, Gender, Health, Nutrition & Population

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	● Moderate
2. Macroeconomic	● Substantial
3. Sector Strategies and Policies	● Substantial
4. Technical Design of Project or Program	● Moderate
5. Institutional Capacity for Implementation and Sustainability	● Moderate
6. Fiduciary	● Moderate
7. Environment and Social	● Substantial
8. Stakeholders	● Moderate
9. Other	● Moderate
10. Overall	● Moderate



COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

Yes No

Does the project require any waivers of Bank policies?

Yes No

Environmental and Social Standards Relevance Given its Context at the Time of Appraisal

E & S Standards	Relevance
Assessment and Management of Environmental and Social Risks and Impacts	Relevant
Stakeholder Engagement and Information Disclosure	Relevant
Labor and Working Conditions	Relevant
Resource Efficiency and Pollution Prevention and Management	Relevant
Community Health and Safety	Relevant
Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Relevant
Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant
Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Not Currently Relevant
Cultural Heritage	Relevant
Financial Intermediaries	Not Currently Relevant

NOTE: For further information regarding the World Bank’s due diligence assessment of the Project’s potential environmental and social risks and impacts, please refer to the Project’s Appraisal Environmental and Social Review Summary (ESRS).

Legal Covenants

Sections and Description



FA, Schedule 2, Section I, D.1: Without limitation to Section 5.03 of the General Conditions, the Recipient shall pay an amount of not less than the equivalent of EUR 8,900,000 as counterpart funds for the Project, at a time and for the financing of expenditures (including all expenditures for the implementation of measures required under the resettlement action plans and environmental impact mitigation for Project activities) as reflected in the Annual Work Plans and Budgets approved by the Association.

Sections and Description

FA, Schedule 2, Section I, E.1: The Recipient shall, not later than one (1) month after the Effective Date for the Fiscal Year in which this Agreement shall become effective, and September 1 of each subsequent Fiscal Year, consolidate and furnish to the Association (or cause the Project Implementing Entity to consolidate and furnish to the Association) for the Association's no objection, a consolidated annual program of activities proposed for implementation under the Project during the following Fiscal Year, together with a proposed budget which shall include the funds from the Credit, as well as counterpart funds and any other funds which may become available for the implementation of the Project.

Sections and Description

PA, Schedule, Section I, A.4 (a): Without limitation to the provisions of Section I.A.3 of this Agreement, the Project Implementing Entity shall, no later than four (4) months after the Effective Date: (a) recruit the following additional staff for the PIU: (i) an accountant; (ii) a procurement specialist; (iii) a contract management specialist; (iv) a social specialist; (v) an Occupational Health and Safety specialist; (vi) a sexual exploitation and abuse/sexual harassment specialist; and (vii) two technical advisors.

Sections and Description

PA, Schedule, Section I, A.4 (b): Without limitation to the provisions of Section I.A.3 of this Agreement, the Project Implementing Entity shall, no later than four (4) months after the Effective Date: amend the Project Operation Manual in order to incorporate the guidelines, instructions, missions and services for the Project, in form and substance acceptable to the Association; as a result of such amendment, the amended Project Operation Manual shall provide a detailed description of the Project and specify roles and responsibilities for the implementation of the Project, and set forth the rules, methods, guidelines and procedures for the carrying out of the Project, including: arrangements for the coordination of the Project; financial management, with the detailed policies and procedures; procurement management procedures and contract management plan; institutional administration, coordination, and day-to-day execution of Project activities; monitoring and evaluation including the results framework and the monitoring indicators for the Project; reporting; information and communication of activities; guidelines for assessing potential environmental and social impacts of the activities included in the Project and designing appropriate mitigation, management, and monitoring measures in respect of such impacts; and such other technical and organizational arrangements and procedures as shall be required for the effective implementation of the Project.

Sections and Description

PA, Schedule, Section I, B.2 (a): The Project Implementing Entity shall, not later than one (1) month after the Effective Date for the Fiscal Year in which this Agreement shall become effective, and September 1 of each subsequent Fiscal Year, consolidate and furnish to the Association for the Association's no objection, a consolidated annual program of activities proposed for implementation under the Project during the following Fiscal Year, and the proposed budget showing sources of financing for all budgeted costs which shall include the funds from the Credit, as well as counterpart funds and any other funds which may become available for the implementation of



the Project.

Sections and Description

ESCP: Project Grievance Mechanism will be operational no later than three months after the Effective Date of the legal agreements entered into between the Association and the Recipient for the financing of the Project and maintained throughout the Project's implementation period.

Conditions

Type	Financing source	Description
Effectiveness	IBRD/IDA	FA, Article V, 5.01: Subsidiary Agreement has been entered into between the Recipient and the Project Implementing Entity in accordance with Section I.B of Schedule 2 to this Agreement.



I. STRATEGIC CONTEXT

A. Country Context

1. **The robust economic performance in Senegal pre- Coronavirus disease (COVID-19) has failed to translate into substantive improvements of living standards or reduced inequality.** Over the 2016-2019 period, Senegal's average annual real Gross Domestic Product (GDP) growth reached 6.1 percent, outperforming the West African Economic and Monetary Union – WAEMU (*Union Economique et Monétaire Ouest Africaine, UEMOA*) by 0.7 percentage points (p.p.) and the Sub-Saharan Africa (SSA) average by 3.3 p.p. However, despite strong growth, poverty reduction remained modest, while the share of consumption of the bottom 40 percent of the population contracted during the same period, and the Gini coefficient stagnated at 0.35. New estimates indicate that poverty declined from 43 percent in 2011 to 37.8 percent in 2018-2019¹. With an average 1 p.p. reduction per year, Senegal's track record falls short of the one achieved by the 15-best performing SSA countries, which saw their poverty rates decline by 1 to 3.4 p.p. per year². In terms of gender inequalities, the Gender Development Index (GDI), is 0.870, placing the country below the SSA average³. For the Gender Inequalities Index⁴ the country ranks 130 out of 162 due to lower educational attainment (with 10.3 percent of adult women having reached at least a secondary level of education compared to 26.5 percent of men), high prevalence of adolescent birth rates and lower female participation in the labor market (35.0 percent compared to 57.5 for men), among others.

2. **The COVID-19 outbreak halted years of strong economic performance, through a combination of a COVID-19 induced global recession, disruptions in supply chains, and containment measures.** As a result, growth dropped from 4.4 percent in 2019 to 1.5 percent in 2020. This first recession since 1990 was driven by weak activity in the service sector, particularly real estate, the hospitality and tourism industry, and information and communications technology. Inflation increased from 1 percent in 2019 to 2.5 percent in 2020 due to higher transport and food prices stemming from confinement measures and supply chain disruptions. The social protection system is well established but is not yet leveraged as a platform to boost the equity and efficiency of shock responses and social spending across sectors.

3. **The Government of Senegal (GoS) has engaged in numerous efforts to mitigate socio-economic impacts of the pandemic and return to the initial growth trajectory facilitating an inclusive and resilient recovery.** On top of containment measures, the GoS has put in place a comprehensive support and recovery plan, the Economic and Social Resilience Program (*Programme de résilience économique et sociale – PRES*), underpinned by a dedicated Solidarity Fund at the Central Bank of Western African States – FORCE-COVID-19. The main objectives of PRES are to upgrade the health system and mitigate the economic fallout, while providing targeted support to vulnerable households and firms. In particular, it allowed the GoS to pay for the electricity bills of the most vulnerable households of Senegal (975,000)

¹ Enquête Harmonisée sur les Conditions de Vie des Ménages (EHCVM) 2018/19.

² Between 2005 and 2015 poverty reduction in several countries in SSA exceeded 1 p.p. per year: Tanzania (-2.6 p.p.); Rwanda (-1.5 p.p.) and Ghana (-1.3 p.p.). Over the same period, Senegal reduced poverty at an annual rate of 0.43 p. p. and only by 0.65 p.p. per year between 2011 and 2018. Source: World Bank staff calculations using PovCalNet 2020 harmonized surveys and Macro Poverty Outlook Fall 2019 for the evolution between 2011 and 2018.

³ Sub-Saharan Africa is 0.894.

⁴ UNDP, 2020. Human Development Report, Senegal. <http://hdr.undp.org/sites/default/files/Country-Profiles/SEN.pdf>



between May and June 2020 – for a total cost of US\$34 million. In addition, the GoS issued on September 5, 2020, a new version of its Priority Action Plan - Adjusted and Accelerated (PAP 2A). The PAP 2A, spanning 2021-23, seeks to ensure that the economy is on track to meet the objectives of the Emergence Plan for Senegal (*Plan Sénégal Emergent – PSE*), by fostering a domestic-driven recovery that addresses the setbacks of the pandemic. The PAP 2A reaffirms the strategic objectives of the PSE, including the domestic objective to reach universal access to reliable and affordable electricity by 2025, allowing the transformation of the economy and improving the living standards of the population. To this end, the PAP 2A seeks to accelerate the improvement of the legal and regulatory framework of the power sector through the recent adoption of an updated electricity code that fosters competition and transparency, strengthening the mission of the regulator, unbundling the public utility to improve efficiency, and optimizing rural concessions for electrification.

4. **Supporting the universal energy access goal will not only support the country’s economic recovery and job creation, but also ensure the recovery is framed to ensure a more sustainable, resilient, and equitable economy.** Expanding energy access is a key driver of long-term economic transformation, job creation and human development. Short-run impacts include social benefits, such as lighting for reading and enhanced security. Those benefits are particularly crucial objectives from the perspective of women and girls in rural areas who bear a significant burden because of the lack of energy access. Time spent on household chores, such as collecting firewood and water for drinking and burning high-polluting charcoal and kerosene for cooking and lighting, prevents their full and active participation in educational and economic activities. Moreover, with electrification, businesses can improve their productivity and new opportunities arise for micro, small, and medium-sized enterprises⁵. Furthermore, education and health outcomes often significantly improve through the electrification of schools and clinics. Consequently, electrification is central to ensuring Senegal’s economic recovery will be inclusive and fully support the objective of economic structural transformation.

B. Sectoral and Institutional Context

Table 1: Key metrics of the Senegalese power sector

Electricity Access rate (2020) ⁶	78.6 percent National; 96.2 percent Urban; 55 percent Rural
Installed capacity (Nov 2021) ⁷	1,599 MW (1,140 MW thermal, 75 MW regional hydro, 226 MW solar, 159 MW wind)
Electricity mix (Nov 2021) ⁸	thermal 71.3 percent, hydro 4.7 percent, renewables 24.1 percent
Average cost of supply (2020)	US\$0.24/kWh (expected to increase this year to about 25-26 USc/kWh with higher fuel prices)
Average tariff (2020)	US\$0.21/kWh
Average T&D losses (2020)	18.4 percent
Debt Service Coverage Ratio (DSCR) (earnings before interest, taxes, depreciation and amortization (EBITDA)/debt service) (2020) ⁹	2.49

⁵ Increasing Human Capital by Electrifying Health Centers and Schools through Off-Grid Solar Solutions, World Bank Group, 2020.

⁶ LPDSE Mid-Term Review, October 2021.

⁷ SENELEC, November 2021.

⁸ SENELEC Nov 2021 (total may not add to 100 percent due to rounding).

⁹ World Bank analysis, 2022.



5. **An uneven distribution of electricity access is contributing to Senegal’s persistent economic inequalities.** Senegal has one of the highest electrification rates on the continent at 78.6 percent. Only South Africa, Ghana, Gabon, Eswatini and a few island states exceed it. Yet this high electrification rate is masking profound disparities – across urban and rural areas, geographies, and income groups. The latest Demographic and Health Surveys Program (DHS) reveals a strong correlation between poverty and lack of electricity access. Nearly all of Senegal’s richest households (as per wealth index used by DHS in 2019) have access to electricity, in comparison to 4.6 percent of the poorest households. Electrification is now almost exclusively a matter of reaching the bottom 40 percent as Figure 1 shows. Urban electrification has reached 96.2 percent, while rural electrification rate lags at 55 percent. Figures 1 and 2 illustrate the significant difference in the electrification rates in the urban center of Dakar and elsewhere. In particular, the southern regions of Senegal, the Casamance, which has historically suffered from lack of investment, has some of the lowest rates of electrification in Senegal except for Ziguinchor region (80 percent).

Figure 2: Percentage of households in Senegal with and without electricity per wealth quintiles¹

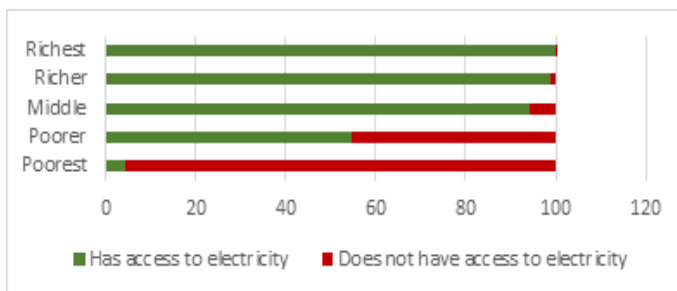
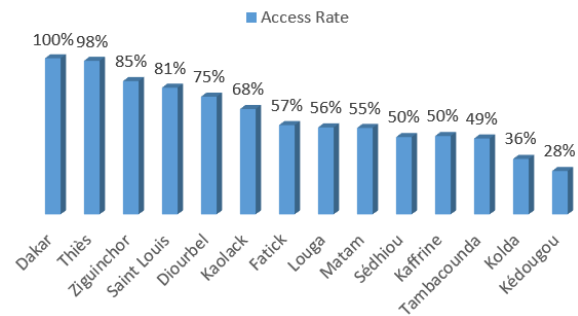


Figure 1: Senegal electricity access rates by region in 2020¹



6. **Senegal’s electrification efforts accelerated in the past three years but have not yet reached the pace needed to meet Government’s universal electricity access target of 2025.** The electrification rate rose from 62 percent in 2017 to an estimated 78.6 percent today. This still leaves, however, around four million¹⁰ Senegalese without electricity access, most of whom belong to the poorest population strata. Basic public institutions providing critical social services (including health centers, schools, and community centers) are often not electrified. According to most recent available data, only 57¹¹ percent of schools and 61 percent of health centers¹² (2017) have access to electricity. Moreover, while some public facilities that are connected may have their electricity service cut by SENELEC because failure to pay their bills, many others contribute to accumulation of arrears of unpaid bills of public entities since SENELEC does not interrupt the service due to the sensitivity of such action. While dedicated budget line items exist in theory at the ministerial levels, the Ministry of Petroleum and Energy (*Ministère du Pétrole et de l’Energie* - MPE) needs to assertively work with the Ministries of Finance and Budget, Education, and Health to determine a way to ensure that this funding is in fact used for its intended purpose. Recourse from time to time to cross-debt compensation between SENELEC and the state seems not sustainable nor is a real solution to the public entities' arrears.

¹⁰ Trackingsdg7.esmap.org

¹¹ National report on Education (RNSE); Ministry of Education, 2020.

¹² Continuous survey on health and care services, National Agency for Statistics and Demography (*Agence Nationale de la Statistique et de la Démographie* – ANSD), 2017.



7. **Senegal has favorable conditions to maintain its position as one of the continent's electrification leaders and reach universal access before the SDG7 target year of 2030.** Its population patterns make it feasible for the grid to reach the vast majority of the population at reasonable costs, as confirmed by various geospatial planning exercises. In addition, the national distribution utility, SENELEC, has adequate institutional, technical and financial capacity to service large numbers of new customers. Senegal has also a well-performing off-grid market which can be leveraged to electrify residual populations located too far from the grid to be economically reached by SENELEC. The country has initiated an ambitious energy transition agenda, with which energy access efforts can align and become more inclusive, resilient and sustainable. Finally, Senegal has sufficient institutional capacity to drive ambitious electrification efforts at the policy level, although coordination across various agencies and development partners could be improved. However, as Senegal is entering into last mile electrification efforts, it will need to streamline and adapt its electrification approaches to address specific needs and connection barriers for low-income and remote households.

8. **The Senegalese Agency for Rural Electrification (*Agence Sénégalaise d'Electrification Rurale, ASER*) has been supporting rural electrification by mostly overseeing the award of rural electrification concessions (*Concession d' Electrification Rurale, CERs*).** In addition, the Senegalese Agency for Renewable Energy (*Agence nationale pour les énergies renouvelables, ANER*) promotes the use of renewables and is particularly involved in off-grid electrification programs involving solar solutions. While institutional capacity of the energy sector entities is generally adequate, there are some overlapping roles and responsibilities across several agencies, including MPE, ASER and ANER that must be addressed to avoid duplications institutional obstacles to electrification efforts.

9. **The scale-up of rural access was held back by poor performance of the CER model and an overly complex institutional framework.** Under the Rural Electrification Action Plan (*Plan d'action sénégalais d'électrification rurale, PASER*) in 1998, the country was divided into 10 concessions that were awarded to private sector companies who agreed to minimum required investments to connect households. SENELEC remained the operator of the already electrified villages, and six concessions were awarded to private-sector operators between 2011 and 2015. However, as of December 2020 the six private concessionaires had only connected 46 percent of the overall target of 106,601 households¹³. Based on these results, the GoS has decided to substitute the CER model with an "*affermage model*" by 2035, with SENELEC progressively reincorporating all 10 concessions while only leaving the Operation and Maintenance of distribution infrastructure to private contractors.¹⁴

10. **Financial sustainability of the power sector remains the key determinant for improved reliability and increased access to affordable electricity.** The recently completed Third Multi-Sectoral Structural Reforms Development Policy Financing (DPF) (P170366) supported key sector reforms, including: (i) diversification of the country's costly and polluting energy mix towards lower carbon technologies; (ii) improved commercial performance and financial viability of the utility in the short to medium term (i.e., before the change in generation mix fully materializes); and (iii) improved sector governance and policy reforms including increased private sector participation. The above reforms are all aimed at improving the financial viability of the sector by reducing costs of electricity supply, thus paving

¹³ Source: Mid-term Review of the current LPDSE.

¹⁴ Source: Strategy, Roadmap & Action Plan for Senegal's Electric Power Sector (*Stratégie, Feuille de Route & d'un Plan d'Actions pour le secteur énergie électrique du Sénégal*).

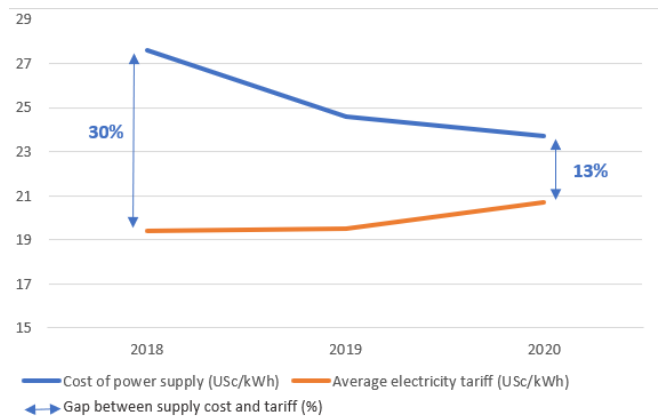


the way towards the provision of affordable electricity services to large numbers of new customers. Through improved sector sustainability, the reforms will gradually eliminate the need for subsidies from the state budget, thus widening the fiscal space for other sectors (e.g. education or health).

11. **The sector’s new legislative framework has to be finalized to complete Senegal’s energy transition.** As industrial electricity demand in Senegal is largely dominated by Small and Medium Enterprises (SMEs), creating appropriate regulation and incentives for small-scale, decentralized investments in renewable energy production will be crucial to achieve Senegal’s clean energy targets at least cost, while ensuring grid stability and service quality. Although legislative and regulatory reforms to facilitate private investment in large, centralized renewable energy facilities and gas-to-power projects are well advanced, the existing regulatory frameworks and feed-in tariffs for small-scale renewable energy investments need to be finalized. In this regard, besides the tariff regime decided by Energy Sector Regulatory Commission (*Commission de Régulation du Secteur de l’Énergie*, CRSE), it is particularly urgent to finalize contract model and set all required technical standards for autoproduction and rooftop solar¹⁵.

12. **The World Bank’s DPF series¹⁶ (2017-19) has also helped improve cost-recovery of electricity tariffs.** The improving cost recovery of electricity tariffs was timely, as demand growth has been fast with electricity sales having expanded by an average of 7.6 percent per annum since 2017, and this trend has continued throughout 2020 and 2021 despite the COVID-19 pandemic. Effective from December 2019, electricity tariffs increased on average by 10 percent, while leaving the tariffs paid by customers with the lowest consumption largely untouched. Specifically, tariffs paid for low voltage (LV) consumers other than the lowest consumption tranche by 10 to 15 percent and tariffs for medium and high voltage (HV) consumers were increased by 6 percent. As a result, in 2020, SENELEC average tariff increased to about 21 USc/kWh, bringing tariffs closer to their cost-reflective level. With a cost of supply at 23.7 USc/kWh in 2020, compared to 27.6 USc/kWh in 2018, cost recovery increased to about 87 percent in 2020 compared to 70 percent in 2018, albeit the cost recovery deteriorated again in 2021 with increases in fuel prices in international markets (see figures 3 and 4 below).

Figure 3: SENELEC tariff cost recovery gap (USc/kWh)

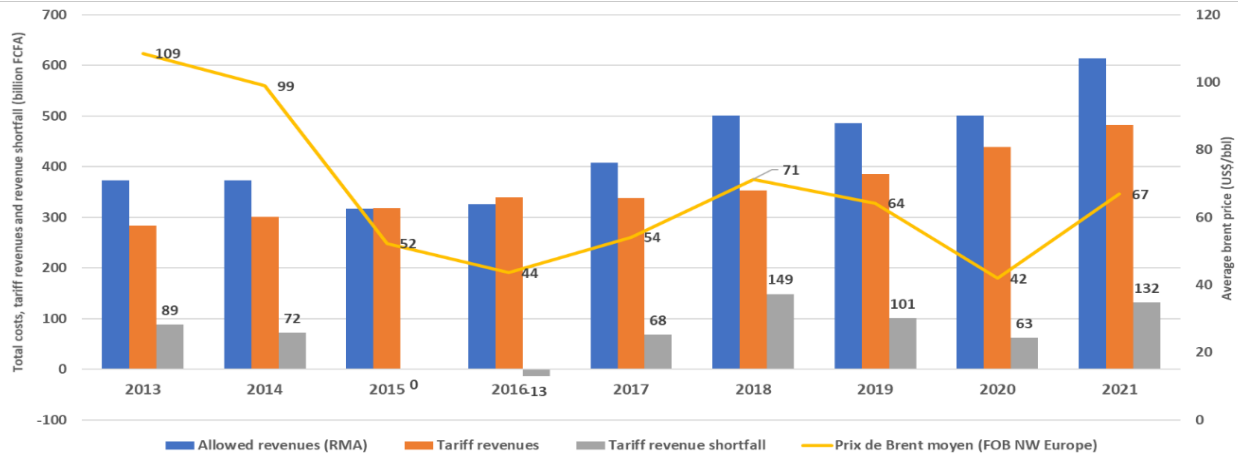


¹⁵ The implementation decrees of the recent passed electricity law should try to resolve partly this issue. The World Bank provides technical advice to the preparation of these decrees.

¹⁶ Senegal Structural Reform DPF Series (P159023, P164525, P170366).



Figure 4: SENELEC’s Costs, Tariff Revenues, and Tariff Revenue Shortfall (2013 – 2021)



Note: Numbers for 2021 are World Bank estimates as of October 2021. The final eligible costs, and hence the resulting revenue shortfall, will depend on the development of fuel prices for the rest of the year, among other aspects affecting the final determination of allowed revenues to be earned by SENELEC.

13. **The change in generation mix is key to turning around the financial situation of the sector, and hence delinking the sector’s dependence on imported fuels, bringing down the costs of supply and ensuring affordable service delivery to those newly connected.** Substantial gas discoveries have been made off the coast of Senegal with the Sangomar, Tortue and Yakaar/Teranga reserves suitable to deliver gas for domestic power generation. While there is still uncertainty as to when the natural gas resources will be available to the power sector, and how the gas would be exploited, analysis by the World Bank shows their effective use could drive down generation cost enough to eliminate the need for sector subsidies in the medium term.¹⁷

14. **Thanks to Senegal’s ongoing energy transition efforts, additional demand from new connections funded by the project will already be met with a significantly cleaner energy mix.** From 2025 onwards, Senegal will benefit from one of the lowest carbon emission intensities on the continent. The above reforms have already led to a gradual shift of Senegal’s generation mix towards lower cost and lower carbon energy sources, with several solar and wind generation projects commissioned in 2019 and 2020. As of November 2021, total renewable generation capacity had more than doubled to 460 MW (composed of 226 MW of solar photovoltaic (PV), 159 MW of wind power and 75 MW of regional hydro generation) from only 218 MW in 2018. SENELEC is further progressing with plans for importing hydropower and for converting the large majority of thermal generation units from Heavy Fuel Oil (HFO) to natural gas, first from imported liquefied natural gas (LNG), and later from domestic sources. As a result of all the efforts to clean the grid and accelerate the integration of Variable Renewable Energy (VRE), the share of Renewable Energy in Senegal’s energy mix will increase during the lifetime of the project, as stated in the latest Power Generation Masterplan (from 29 percent in 2021 to 30 percent in 2027). Over this period, Renewable Energy installed capacity will significantly increase by 49 percent from 460 MW to 683 MW.

15. **Consequently, from 2025 onwards, Senegal’s grid’s emission factor is expected to be cut by**

¹⁷ See Annex 4 for further details on the change of Senegal’s generation mix.



more than half from 515 g CO₂/kWh to below 250 g/kWh¹⁸, outperforming current Organisation for Economic Co-operation and Development (OECD) and even European Union (EU) levels¹⁹. As energy represents about one third of total greenhouse gas (GHG) emissions, these efforts will help Senegal be one of the few countries to overachieve on its emission reduction commitments under the Paris Accord (five percent reduction compared to Business-as-Usual by 2025 under its unconditional objective and 23 percent if international support is provided).

16. **The Government has adopted an ambitious universal electricity access target by 2025, but the strategy to achieve it, including least-cost electrification plan, needs to be finetuned.** The PSE aims at reaching universal access to affordable, reliable, and sustainable energy by 2025 - five years ahead of the Sustainable Development Goal 7²⁰. This objective is also a key pillar of the *Lettre de Politique de développement du secteur de l'énergie 2019-2023* (Letter of Development Policy for the Energy Sector), which intends to catalyze the transformation and “emergence” of the Senegalese economy. Within this context, affordable electrification is not only seeking to improve the quality of life of households, but also to become a crucial driver to foster productivity and the adoption of modern technologies, to facilitate access to markets and to improve human capital and service delivery in critical areas including health care and education. The higher-level strategic plans mentioned above have been complemented by several operational plans/programs. The 2015 *Programme National d'Urgence d'Electrification Rurale* (Emergency National Rural Electrification Plan – PNUER) supported grid expansion efforts (primarily via SENELEC), while also leveraging private sector-led electrification with solar home systems (SHS). The program, however, resulted only in a modest increase of electrification rate from 38 percent in 2015 to 42.3 percent in 2018, until tariffs between SENELEC and the CERs were harmonized in 2018²¹, which enabled the scale-up of connections also inside the rural concessions.

17. **In 2017, the World Bank funded “Senegal SE4ALL Rural Electrification Plan”, following a geospatial least-cost analysis,** which recommended that, to reach universal access by 2025, 95 percent of clients should be electrified through grid extension, 4 percent through mini-grids, and 1 percent through standalone SHS. This plan was further updated and reformulated into the *Plan Opérationnel pour l'Accès Universel* (Operational Plan for Universal Access) and its Investment Prospectus, both published in April 2020. The 2020 Operational Plan presents a pathway for electrifying the remaining households, including (i) 13,819 non-electrified localities in rural areas, representing around 317,000 households; and (ii) the peri-urban areas, representing another 420,000 households without electricity access at the cost of

¹⁸ World Bank team analysis (October 2021).

¹⁹ In 2019, the GHG emissions intensity of power generation in the OECD countries was 290 g/kWh and 255 g/kWh for EU countries. (World Bank staff calculation using IEA's 2020 Global CO₂ emission factor database).

²⁰ SDG 7 aims to ensure access to affordable, reliable, sustainable and modern energy for all by 2030.

²¹ Disparities between per kWh electricity tariffs charged within the CERs compared to the SENELEC concession area led MPE to undertake a tariff harmonization study in 2017. Implementing the study has required significant restructuring of the CER contracts and requires GoS subsidies of around US\$50 million paid in compensation to the functioning CERs over three years. Through the tariff harmonization, CERs are requested by CRSE to apply the SENELEC first tranche price for consumers of the “Petite Puissance” category. CERs are compensated for their revenue shortfall as determined by CRSE. The impact on connection rates is difficult to assess because at the same time, CERs are no longer obliged to pre-finance the internal wiring of customers as was the case before harmonization. Even though the harmonization was a strong demand of rural households and as such may have a positive effect on the willingness to subscribe to electricity service, there are other factors such as cost of wiring and the stretch of the network. One might recall the *Afrik Initiative Résultats Rapides*, which resulted in doubling COMASEL electrification rate (from 22 percent to 50 percent) in 100 days thanks to the funding of the wiring costs and the upfront fees for subscribing to electricity service.



US\$1.3 billion. The Plan integrates grid densification and extension, mini-grids and off-grid solar systems, calling for a much higher percentage of the population to be electrified through SHS solutions. However, the geospatial analysis is outdated and needs to be optimized using more rigorous techno-economic least-cost criteria. The update can also leverage recent improvements in geospatial planning data and algorithms.

18. **The GoS' Distribution Master Plan 2019-2035 provides a road map to universal access.** The purpose of the Distribution Master Plan, recently completed and financed under the World Bank-funded Electricity Sector Support Project (PASE; P125565), was to propose, year by year from 2021 to 2025, an investment program in terms of HV, Medium Voltage (MV) and LV infrastructure. The investments previewed in the Master Plan were aimed at (i) reaching quasi-universal access, i.e. 95 percent of households by 2025, and, (ii) satisfying a demand of about 1.5 GW by 2025, i.e. about twice the demand of the base year 2019. With respect to the proposed investments to meet demand, the cost of the overall program to expand the transmission and distribution network was estimated at approximately FCFA 550 billion²² (equivalent to about US\$990 million). The GoS cannot finance this alone and is actively seeking partnerships with public and private sector actors.

19. **The World Bank is assisting the Government to update existing plans with improved geospatial least-cost analysis.** To fully capitalize on recent advances of geospatial mapping techniques, MPE and SENELEC have asked the World Bank for assistance in updating the country's key planning documents guiding implementation of the GoS's Universal Access Program including the Operational Plan for Universal Access. The update has three key objectives, namely: (i) to improve pro-poor targeting of electrification efforts through the identification and georeferencing of vulnerable households; (ii) to garner the very substantial, and hitherto unused cost reduction opportunities lying in the systematic consideration of well-established low-cost electrification technologies (including Single-wire earth return "SWER" and shield wire electrification schemes as well other technology advances, such as battery storage enabling hybrid mini-grids); (iii) to leverage improvements in geospatial planning tools and methodologies, including for better estimates of residential, productive and institutional electricity demand; and (iv) to facilitate a more effective and better coordinated mobilization of additional donor funding for the GoS's universal access agenda. The first phase of this update will address grid densification only, however, a second phase will address all electrification modalities – both on and off-grid.

20. **In order to achieve electrification goals, roles and responsibilities among major sector actors will need to be rebalanced.** With incremental grid extension and densification investments progressively reaching more remote areas and hence becoming ever more costly, a stronger leadership and planning role of MPE is needed as provided for in the Electricity Code and via an integrated least cost plan. To date, MPE is indeed responsible for the oversight of national electrification planning and implementation. However, in reality, SENELEC, with its strong technical, planning and procurement expertise, is effectively dominating the most critical sector planning, investment and implementation decisions. Moving forward, it will be crucial for the MPE to take a robust leadership role in the implementation of the OP, including its design, supervision of next phases while ensuring strict compliance with all relevant technical standards, least-cost principles and the most efficient possible competitive procurement arrangements.

²² This amount comprises the following investments: extension and reinforcement of the transmission and distribution (feeders, looping, section harmonization, rehabilitation, etc.) network, implementation of the *Programme prioritaire d'accès en urbain et périurbain* (Priority urban and peri-urban access program) and the Rural Electrification Program.



21. **The GoS’s grid electrification approach fails to reach low-income and vulnerable households.** As shown previously in Figure 1, the majority of remaining unelectrified households belong to the poorest, most vulnerable households, many of which are likely to be female headed²³. These households have been systematically excluded from electrification efforts due to a combination of supply and demand-side barriers. Yet, many of them are under-the-grid. In 2018, the coverage rate of rural areas amounted to 52 percent, whereas the rural access rate only reached 42 percent. This gap shows that a significant portion of households living in electrified rural localities are not connected because of both difficulties with respect to affordability and procedural issues as well as other issues with obtaining new connections.

22. **Access barriers result from a non-inclusive connection policy.** To date, no connection fee is required for households located within 40 meters of SENELEC’s grid. Pre-payment customers are only required to pay fees related to the installation of the meter and administrative costs (amounting to US\$9). However, to meet SENELEC’s minimum connection requirements, new customers need to pay for the installation of interior wiring in their house. Especially for the majority of poor households, this creates an unsurmountable affordability barrier as it implies having to spend an average of US\$79 for wiring and related labor of dwellings they often do not even own. In addition to these costs, the customer also needs to pay COSSUEL - *Comité Sénégalais pour la Sécurité des Usagers de l'Electricité* (Senegal Committee for the Security of Electricity Users) around US\$17 for the mandatory verification of the conformity of the installation. Finally, households and enterprises located beyond the 40 meters “free connection perimeter” are required to pay upfront for the full cost of design and construction of the needed line extension. This policy might be viewed as creating an undue burden on affected individuals and businesses, as they are required to carry the full cost of infrastructure that will ultimately turn into SENELEC assets and serve other customers in the future.

23. **Access barriers also result from indiscriminate advance billing and an ill-targeted social tariff system.** SENELEC’s current billing policy requires all new customers under post-payment to provide a deposit equal to two months of expected bill payments, creating further access barriers for micro, small and medium-sized enterprises (MSME). Furthermore, a large part of the Government’s budget is spent to compensate for a tariff freeze that does not exclusively target the poorest households. Indeed, all customers, even the wealthiest ones, are entitled to receive their first 150 kWh at the much-reduced tariff rate regardless of capacity and energy use.

24. **The World Bank is assisting SENELEC with the piloting of low-cost technical solutions and streamlining of connection procedures for poor households in rural, urban, and peri-urban areas.** The most widespread of technical solutions to be considered include standardized, load-limited connections (aka “minimum service kits” or “ready boards”) with internal wiring schemes that adhere to technical specifications and are customized for low-income households. Ready boards, which many other SSA countries have successfully adopted, can dramatically reduce the cost of “lifeline” connections, and provide a well-adapted least-cost solution for the provision of grid-based electricity access to poor households who only use electricity for lighting and a limited set of low-consumption appliances. Furthermore, connection uptake can be improved through simplifying procedures and offering education/awareness support to households during the application process.

²³ <https://data.unwomen.org/country/senegal>, accessed 6 December 2021. Women are 6 percent more likely to be below the international poverty line and are less likely to be formally employed.



25. **In parallel, GoS needs to strengthen its approach for accelerating electrification in unserved areas under the Universal Access Program** by (i) optimizing least-cost electrification planning to leverage the least-cost grid, mini grid and off-grid technologies; (ii) reducing grid extension costs with the use of low-cost technical solutions, such as SWER; and (iii) finetuning existing mini grid and off-grid solar business models, supported by the private sector, to also expand to the poorest and most vulnerable households, such as through developing sustainable end-user subsidy mechanism.

26. **The last mile electrification efforts need to be not only more inclusive but also more resilient, as low-income populations are likely to suffer most from climate change.** As detailed in Annex 2, Senegal is highly vulnerable to the effects of climate change and ranks 144th out of 181 countries on measures of vulnerability. Access to electricity can help these households to adapt to climate change, such as through the use of appliances (e.g., for cooling and for productive activities, such as solar water pumps and cold chain for small-holder farmers, improving food security etc.). Experience from rural electrification efforts in Africa, however, show that targeted support is often needed for households to increase access to appliances and to development their productive use. Support for productive uses will also improve economic and financial sustainability of electrification efforts. In addition, resilience will be enhanced through electrification of schools and healthcare clinics, which will be able to provide better health and education services and build human capital.

27. **The electricity system overall will also need to become more resilient.** The Climate and Disaster Risk Screening completed by the World Bank indicates that it is at high risk of river, urban and coastal floods, water scarcity, extreme heat and wildfire²⁴ - all major threats to power generation, transport, and distribution infrastructure. As energy is a vital precondition for many other infra services such as water, sanitation, and broadband, as well as key input for economic activity, the power sector's high degree of climate vulnerability represents major risks of macro-relevant economic disruption. These "supply-side climate risks" are compounded by elevated levels of energy poverty and inequality which are further increasing vulnerability to climate change²⁵ and reducing the productivity of human capital. Accordingly, the World Bank's Lifelines report calculates that the cost of disruption to the power sector due to natural shocks in Senegal was about 1.43 percent of GDP in 2019²⁶. Given this context, climate risks will be fully integrated in project design, and measures to strengthen the resilience of the infrastructure built through the project will be included.

28. **Senegal needs to capitalize on investment synergies in the electricity and telecommunications sectors.** While many of its African peers are closely coordinating the roll-out of electricity networks with digital and mobile communications infrastructure, Senegal needs to redouble its efforts to more systematically seize the opportunities of cross network investments. A common example is the equipment of transmission tower shield wires with fiber optics and the commercialization of spare space on network towers and poles to telecom operators. Recent World Bank experience across the region has shown that the early integration and close coordination of network planning in between the power and

²⁴ <https://thinkhazard.org/en/report/217-senegal>

²⁵ World Bank, 2018. Lifelines, the Resilient Infrastructure Opportunity, Global Facility for Disaster Reduction and Recovery (GFDRR).

²⁶ "Hallegatte, Stephane; Rentschler, Jun; Rozenberg, Julie. 2019. Lifelines: The Resilient Infrastructure Opportunity. Sustainable Infrastructure; Washington, DC: World Bank. © World Bank. <https://openknowledge.worldbank.org/handle/10986/31805> License: CC BY 3.0 IGO."



telecommunications sectors can achieve substantial cost reductions and additional sources of commercial income for power utilities while significantly accelerating the implementation of universal access agendas across sectors.

29. **There is a strong rationale for the focus on grid densification.** With the large share of unconnected Senegalese households living “under the grid”, streamlining grid densification and access of vulnerable households represents by far the fastest and most efficient way for SENELEC and MPE to reduce energy poverty. Therefore, the project’s stringent focus on grid densification will help SENELEC address the most critical affordability barriers to obtaining grid connections and fully capitalize on all “least-cost opportunities” to drive grid-electrification over the next three to five years. In this way, the project will allow to significantly speed-up advances of the country’s universal access agenda in the short-to medium-term in parallel to the ongoing implementation of longer-term efforts and massive grid extension, and off-grid investments still needed to reach the country’s most remote localities.

C. Relevance to Higher Level Objectives

30. **The proposed project will contribute to Senegal’s Sustainable Energy for All (SE4All) commitments.** Within the framework of SE4All, the United Nations (UN) has set three critical objectives for 2030 namely: (i) ensure universal access to modern energy services; (ii) double the global rate of improvement in energy efficiency; and (iii) double the proportion of renewable energies in the global energy mix. Senegal has strongly engaged in the SE4ALL initiative and the GoS’s PES prioritizes access to modern electricity services accordingly by targeting universal access to electricity in 2025, i.e., five years before the SE4All deadline. At the sectoral level, intermediate objectives are broken down in the Letter of Development Policy of the Sector of Energy (LPDSE, 2019-2023), to achieve a rate of electrification of urban of 95 percent and a rate of electrification of rural areas of 75 percent in 2022.

31. **The proposed project supports the implementation of the World Bank Group’s (WBG) Country Partnership Framework (CPF) for the Republic of Senegal for the period FY20-FY24²⁷.** It is strongly aligned with Focus Area No. 2 of the CPF “Boost competitiveness and job creation through private sector-led growth” and its Objective 2.2 “Lower energy cost and carbon footprint and optimize the energy mix”. Firstly, electrification through densification will improve the quality of service, by relieving the saturation of networks serving peri-urban localities. This is particularly important for Senegal, where 80 percent of firms experience an average of five outages per month, representing annual sales losses of five percent in 2015, the most recent time period for which this data is available. Experience shows that a decrease of one percentage point of the frequency of outages generates an increase of 2.7 percent of the revenues of firms. Secondly, the acceleration of electrification allowed by the project will foster the development of new businesses and income generating activities through the development of productive uses of electricity. The project will target vulnerable groups such as women and young people suffering from unemployment and support them to acquire productive machines and develop new businesses. Finally, the project will contribute to the CPF Outcome and Indicator “Rural households having access electricity” (percent).

32. **Maximizing Financing for Development (MFD).** With Senegal’s power grid being publicly owned

²⁷ Report No. 143333-SN; discussed by the Board of Executive Directors on February 11, 2020.



and operated, the project’s investments in grid densification exclusively fall into the “public investment” category. The project’s focus on public investment in grid densification is mainly justified by the prevalence of ongoing financing programs and donor support for the market development of private sector-led off-grid and minigridd electrification solutions including the World Bank-supported Regional Off-grid Electricity Access Project (ROGEAP; P160708). Furthermore, efforts are underway to “unbundle” the power sector to increase private sector participation beyond generation, and, following the failure of Senegal’s rural concession model (see section B above), a private sector-led “*affermage*” model is being developed for parts of SENELEC’s rural distribution grid. Therefore, the project can be categorized as “project that supports public sector operations after careful consideration of private sector solutions.” However, despite its public investment focus, the project will support MFD through carefully dovetailed sub-activities, namely developing private sector financing solutions for productive use of electricity (see sub-component 2.3).

33. **The proposed operation will support the WBG COVID-19 response.** While improving electricity access of vulnerable households will contribute to "Pillar 2. Protect the poor and most vulnerable" by improving their living standards and foster income generating activities, the project’s geospatially targeted investments in the electrification of rural health clinics will improve the delivery of critical health care in the event of disasters and allow for the safe storage of vaccines. Moreover, the project will contribute to “Pillar 3. Sustainable Business Growth and Job Creation”, through improved electricity access that will stimulate “Post-COVID-19” economic recovery and employment. Finally, “Pillar 4. Strengthen policies, institutions and investments for Rebuilding Better” will also be supported through the project as Component 3 will focus on capacity building and policy strengthening of key institutions of the energy sector, namely the MPE and SENELEC. The project will support the MPE with the update and steering of the Universal Access Program, promoting inclusive and sustainable recovery.

34. **Finally, the proposed project will help meet the WBG twin goals of ending extreme poverty and boosting shared prosperity while contributing to the WBG Next-Generation Africa Climate Business plan²⁸.** Providing electricity connections will increase access to energy services for poor households in rural and urban areas enabling opportunities to study and work, contributing to raising the quality of life and improving agricultural activity and economic interaction. Increased access to reliable electricity supply will not only lower costs and improve the profitability of business enterprises but is also key to enabling the set-up of new private sector-led enterprises, which stimulates GDP growth. Lastly, by supporting a cleaner grid, developing access, and strengthening resilience, the project will also respond to the objectives of the WBG Next-Generation Africa Climate Business plan.

PROJECT DESCRIPTION

A. Project Development Objective (PDO)

PDO Statement

35. Increase access to electricity services for households, enterprises, and critical public facilities in Senegal.

²⁸ <https://openknowledge.worldbank.org/handle/10986/34098>



PDO Level Indicators

36. The following indicators have been selected to measure progress toward achievement of the PDO:
- (a) People provided with new or improved electricity service (number); of which urban (percent); of which rural (percentage); of which women (number);
 - (b) MSMEs provided with new or improved electricity services (number); of which female-managed and/or female-owned (percent);
 - (c) Public institutions provided with new or improved electricity service (number); of which health clinics (number); of which schools (number).

B. Project Components

37. **The project applies lessons learned and best practice electrification principles on “both sides of the meter.”** Following least-cost electrification principles, Component 1 will use geospatial technology to target localities with existing MV infrastructure that are not fully electrified to aggressively and cost-effectively move Senegal towards its goal of universal access and reach last-mile households (HHs). With large numbers of potential consumers located under or near existing MV infrastructure, grid densification is an obvious and transformative investment supported by the World Bank. Components 2 and 3 simultaneously address non-infrastructure barriers to connection such as the unaffordability of interior wiring for vulnerable HHs, and the lack of awareness of consumers on the connection process. Moreover, recognizing that electrification in and of itself does not necessarily lead to economic growth, Component 2 will provide technical assistance for productive uses of electricity to develop income-generating opportunities, especially for women.

Component 1: Grid densification and extension (US\$135 million equivalent, of which IDA US\$125 million equivalent, GoS US\$10 million)

38. **Component scale and scope.** This component aims to electrify around 200,000 households near the existing electricity network and within SENELEC’s concession areas. Among those households, an estimated 60 percent live in urban areas and 40 percent in rural areas. The electrification of large numbers of structures through grid densification follows best practices in least-cost electrification approaches as it is a highly cost-effective opportunity to achieve a significant reduction of energy poverty.

39. **Addressing both rural and urban access needs.** In rural areas, in addition to addressing energy needs for productive use and lighting for domestic and commercial activities, the project will also help beneficiaries to substantially reduce their current use of kerosene and alternative fuels, thus leading to both public health and climate co-benefits from the reduction of harmful indoor pollution and carbon emissions. Meanwhile, in many of SENELEC’s urban and peri-urban concession areas, the increasing urbanization and rapid population growth has created an increasing need to counteract the proliferation of electricity theft and the need to regularize illegal connections. Curbing electricity theft and commercial losses will not only contribute to the financial recovery of SENELEC, but also benefit affected populations as illegal connections pose a significant safety risk to households. With basic infrastructure already in place, and the potential for connecting large numbers of households at comparatively low cost, grid densification presents a high-value opportunity for World Bank support to efficiently address both urban and rural access needs.



40. **Emphasis on affordability and service quality.** Component 1 will provide funding to cover the full cost of new connections. This will help lower the affordability barriers to household connections while improving SENELEC’s hitherto limited economic incentive to serve poor populations with low consumption patterns and limited revenue potential. In addition to funding large numbers of new connections, investments in grid rehabilitation and reinforcements will lead to reduced congestion and voltage drop issues. Therefore, even households, businesses and public facilities already connected to SENELEC’s grid will benefit from the project’s investments through the resulting improvement of overall electricity service quality.

41. **Component design will maximize climate co-benefits.** The project’s emphasis on rehabilitation and reinforcement investments will strengthen the climate change resilience of SENELEC’s grid against flooding and other climate related weather events, while reducing GHG emissions from technical losses. Moreover, grid densification will generate GHG savings by replacing polluting diesel gensets and kerosine lamps. Finally, the project investments in state-of-the-art metering technology will emission reductions by allowing households, public institutions and businesses to better monitor and control their electricity consumption while allowing SENELEC to adopt pricing regimes incentivizing greater energy efficiency and demand-side management.

Sub-component 1.1: Design, supply, and installing or updating electricity distribution infrastructure (US\$126 million equivalent, of which IDA US\$116 million, GoS US\$10 million)

42. **A significant step towards the implementation of the GoS’s Distribution Master Plan 2019-2035.** Sub-component 1.1 is closely linked to SENELEC’s Distribution Master Plan 2019-2035, recently completed with funding from the PASE. The Master Plan includes a first five-year investment program to reach (i) “quasi-universal” access to grid electricity (i.e. 95 percent of households) by 2025; and (ii) satisfy a demand of about 1.5 GW by 2025, (i.e. about twice the demand of the base year 2019). The total cost of the corresponding investments to expand the transmission and distribution network was estimated at approximately FCFA 550 billion (equivalent to about US\$990 million). Sub-component 1.1 will absorb a large share of the identified needs for network densification and thus make an important contribution to the investment program.

43. **Sub-component targeting grid densification in already-electrified localities.** The sub-component will comprise the design and construction of: (a) 760 km of MV lines; (b) 820 MV/LV distribution substations; (c) 2,708 km of LV lines; and (d) last-mile connection equipment, including service drops and prepaid meters. SENELEC is presently procuring the services for the preparation of detailed design documents for all related works and goods. Using SENELECs long list of localities for densification and the results of ongoing geospatial analysis, the project will optimize the selection of localities, line routings, households, public facilities and businesses to be connected in such way to maximize the number of beneficiaries in each of the selected priority areas. The preliminary cost estimation for Sub-component 1.1 is presented in Table 2 below.

44. **Sub-component geographic distribution.** The proposed densification investments and their geographic distribution is the result of a compromise between two conflicting objectives, namely (i) SENELEC’s ambition to connect as many beneficiaries as possible; and (ii) the GoS’s commitment to strive for regional equity. While the first objective would favor new connections in already well-served urban



areas with inexpensive per-household connection cost, the second objective would exclusively support investments in notoriously underserved, less densely populated rural areas where per-connection expenditures can easily reach three to five times the cost of urban areas. Moreover, in addition to the large connection cost differences, the substantial disparities in average household consumption makes SENELEC’s opportunity cost of investments in rural connections even greater. Given the importance of finding an optimal solution and transparent approach to solving this complex trade-off, the below list of localities will be reviewed to ensure that planned connections adhere to least-cost electrification principles.

Table 2: Sub-component 1.1 budget estimate

Items	Unit	Quantity	Estimated Amount (US\$ million)
MV Network	km	761	24
MV/LV Substations	U	820	26
LV Network	km	2,708	42
Connection Supply	U	200,000	15
Meters Supply	U	200,000	5
Installation of Meters and Connections	U	200,000	4
Social and environmental impacts’ mitigation activities (e.g. compensation of People Affected by the Project (PAPs))	NA	NA	10 ²⁹
Total			126

45. **Three categories of densification investments.** In each selected locality, densification investments can be divided into the following categories:

- (a) LV line drops and limited network extensions. The densification and limited extension of the distribution network will be aimed at connecting large residual clusters of unserved populations in proximity to the existing distribution network.
- (b) LV and MV network reinforcements. To accommodate the resulting additional loads from the above activity, this category of works will include the rehabilitation and reinforcement of existing lines and transformers and construction of new distribution substations. Network reinforcements will improve the reliability and quality of supply, improve power flow and reduce technical losses and operating costs, all of which will contribute to better service for all of SENELEC’s customers, new and existing.
- (c) Grid modernization and automation investments. In addition to the densification and reinforcement of the LV grid, the sub-component will include the installation of remote-control systems for distribution substations, switches, and overhead circuit breakers. Paired with future upgrades to SENELEC’s system-wide Supervisory Control and Data Acquisition (SCADA) system, these upgrades will drive the continuous reduction of Non-Distributed Energy, Overall Efficiency, and Average Waiting Time in case of LV failure in line with the utility’s performance contract provisions.

46. **Assessment and mitigation of environmental and social Impacts.** Based on recommendations of the Environmental and Social Management Framework (ESMF) and the Resettlement Policy Framework (RPF), this component will also include the preparation of Environmental and Social Impact Assessments

²⁹ Corresponds to counterpart funds.



(ESIAs) and Resettlement Action Plans (RAPs), as well as the support to the implementation of identified measures (the cost of the identified measures, including the compensation payment of identified PAPs is covered through the counterpart funds, this component will support the recruitment of an organization that will help in the implementation of those measures).

47. **Investments targeting loss reduction and climate change mitigation.** The component's investments in distribution and metering infrastructure are expected to result in significant reductions of both technical and commercial losses. While the reinforcement and rehabilitation of distribution lines and substation equipment will reduce technical losses, commercial losses will decline as large numbers of illegal connections will be regularized. Further, all new connections will include state-of-the-art meters allowing for better control of households' electricity expenses and measures on energy efficiency will be advertised to customers. As a result, the activities implemented under Component 1 are expected to lead to an estimated loss reduction from the current 19 percent to below 15 percent within the project's investment perimeter.

48. **Infrastructure investments designed for greater climate change resilience.** Engineering design and bidding documents for electrification works will address risks and issues identified in the recently completed Climate & Disaster Risk Screening for Senegal and will fund complementary civil works to ensure that the distribution networks densified under the project will be resilient to climate risks including seasonal flooding. Examples of specific design elements for the MV/LV network extensions and reinforcements to enhance climate resiliency could include (i) proper design of poles and conductors for power lines to withstand the threats of flooding, forest fires and extreme temperatures; (ii) consideration of a minimum height of 1 m for the installation of domestic equipment to reduce flood risk and other technical provisions to ensure proper drainage; (iii) the systematic segmentation of MV networks and installation of remotely controlled MV/LV substations to improve the quality of supply, implement automatic default search, and reduce the amount of un-served energy to customers; (iv) the implementation of alarm systems to warn operators of flooding risks; (v) network meshing opportunities to provide multiple supply points to the distribution system and thus reduce exposure to load shedding; and (vi) requirements in the line routing of MV lines to minimize pruning and bush clearing, thus reducing risk of damage from wildfires. The obligation of the construction contractors to provide spare parts for SENELEC's maintenance teams will be expressly included in the construction tender documents.

49. **Identification and use of "cross-infra" synergies with mobile communication and digital development investments.** The benefits of electricity for productive use and economic growth can be amplified when combined with the delivery of digital services. Therefore, World Bank and GoS teams are proactively exploring potential synergies with digital development projects including the parallel deployment of fiber optics and the commercialization of spare space on distribution poles for the installation of cellular relay stations by telecommunications operators.

Sub-component 1.2: Owner's Engineer (OE) (US\$9 million equivalent, of which IDA US\$9 million)

50. **Implementation oversight.** This sub-component will fund the recruitment of one or more firms to serve as Owner's Engineer (OE) to ensure the sound implementation of Sub-component 1.1. The OEs will also oversee the installation of ready boards as part of Sub-component 2.1, described below, as well as the connection of public facilities and MSMEs as part of Sub-components 2.2 and 2.3. In view of the



geographical spread of the infrastructure for Sub-component 1.1, the procurement for the OEs will be separated into two lots, each supervising three works lots. The OEs will be recruited early to support SENELEC with the preparation of tender documents and assist the Project Implementation Unit (PIU) during evaluation and contract award.

51. Integrated planning, coordination, and supervision system. In addition to general implementation oversight responsibilities, the OE will assist SENELEC with ensuring that construction of the distribution grid and installation of last mile equipment under Sub-components 1.1, 2.1 and 2.2. will be carried out in accordance with international quality standards and monitor the proper execution of the safeguard procedures. For this purpose, the OEs will assist SENELEC and the PIU in setting up an integrated planning, coordination and supervision system covering all related equipment purchases, procurement and engineering services and works funded by the project.

52. Integration of design features for enhanced climate change resilience. Finally, to ensure the resiliency and sustainability of project investments, the OE will also be responsible for ensuring that engineering design and bidding documents for electrification works will consider the most pertinent climate and disaster risks for SENELEC’s distribution assets including the ones identified in the above-mentioned Risk Screening.

Component 2: Electricity Access for a Resilient and Inclusive Post COVID-19 Recovery (US\$15 million equivalent, of which IDA US\$15 million)

53. Fostering a robust and socially equitable post COVID-19 recovery. Alongside the improvement of access and connectivity through Component 1, Component 2 will fund complementary activities aimed at strengthening the resilience of Senegal’s vulnerable populations, critical public service delivery and local enterprise against the impacts of climate change and economic shocks like the one caused by COVID-19.

54. Ensuring climate resilience of vulnerable households, essential public facilities, and local development actors. Access to expanded, reliable and affordable electricity is critical to enable the delivery of basic social services³⁰ (such as education, water, digital and health). As detailed in Annex 2, it also enhances the resilience of communities to climate change impacts and economic disruption. Sub-component 2.1 addresses the cost-barrier to connection of internal wiring and Sub-component 2.2 addresses connections for critical public infrastructure. In addition, Sub-component 2.3, the project will seek opportunities where access to electricity can improve resiliency of economic sectors particularly exposed to climate change, such as the agricultural value chain.

Sub-component 2.1 Fostering Sustainable Resilience of Vulnerable Populations (US\$5 million equivalent, of which IDA US\$5 million)

55. Addressing connection cost barriers through the introduction of “ready boards”. Ready boards are low-cost wiring solutions for low-income households and consist of a portable LV pre-wired installation in a box, with an earth leakage isolator switch, a light point and socket outlets all well-protected though “Miniature Circuit Breakers”. To poor households, ready boards provide an easily

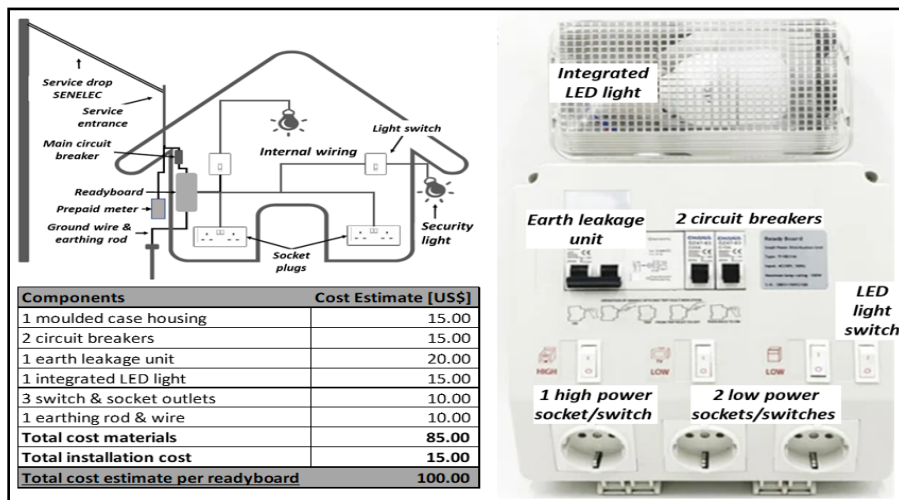
³⁰ World Bank, 2018. Lifelines, the Resilient Infrastructure Opportunity (Global Facility for Disaster Reduction and Recovery).



adoptable low-cost alternative to conventional house wiring with built-in safety measures. To utilities like SENELEC, they provide a highly standardized “ready-to-use” solution with minimal installation time to support large electrification initiatives and swiftly drive connectivity amongst households in areas where new lines have been constructed. Figure 5, below, presents an example design of a ready board and its integration into a small household’s internal wiring scheme.

56. **Roll-out of ready boards installation program across selected localities.** The sub-component will finance the supply and installation of ready boards for 40,000 vulnerable households out of the 200,000 connections funded under Sub-component 1.1. The use of ready boards will improve revenue management from SENELEC, reduce commercial losses, further accelerate the speed of SENELECs access program and significantly improve customer safety and satisfaction. In line with Sub-component 1.1, the installation of ready boards will follow a 60/40 percent mix between urban and rural beneficiaries. In order to tailor the standard ready board technology widely used through Eastern and Southern Africa to the specific needs of larger households prevalent in rural Senegal, SENELEC is currently receiving World Bank-funded technical support to develop a modular kit with optional low-cost extensions to connect secondary dwellings to the same ready board and meter.

Figure 5: Standard ready board and internal wiring scheme example³¹



57. **Targeting of vulnerable households and improved resilience of livelihoods.** Vulnerable households registered in Senegal’s Single National Registry (*Registre National Unique, RNU*) and not yet connected to the grid will be eligible under the new “Lifeline Connection Policy” to receive free ready board connections under Sub-component 2.1. upon submission of an application at the local SENELEC office. Although new Lifeline Connections are aimed at improving the resiliency and livelihoods of low-income households listed in the RNU, the provision of ready boards will also benefit a significant number of existing micro enterprises. Therefore, the activities under this sub-component are also expected to lead to the creation of new and more resilient productive and commercial activities by the beneficiaries.

58. **Expected reduction of commercial losses.** With the connection of low-income households under a new Lifeline connection policy, the project will likely result in a corresponding significant reduction of

³¹ Selected ready boards will be adapted to the Senegalese context (landscape, structure of households, etc.) and to SENELEC's technical requirements to ensure the "electrical safety" of end users.



commercial losses through the “regularization” of households that were previously illegally connected. To safeguard SENELEC’s cash flow and revenue in this new customer segment while mitigating fraud and unauthorized overloading, all Lifeline connections will be equipped with prepaid meters and power consumption limiters. Outreach to illegally connected customers will be critical so that people understand the legal implications of electricity fraud as well as the low cost and safety benefits of having their connection regularized under the Lifeline program.

59. **Close coordination of implementation and communication efforts.** Sub-component 2.1 will need to be closely coordinated with the implementation of investments under Sub-component 1.1, as well as customer outreach and citizen engagement campaigns under Component 3. Not only do all households in selected localities need to be informed that connections will be available, but beneficiaries identified through the RNU need to be aware that they qualify for the project-funded ready boards. Additionally, many households and businesses who will have the opportunity for a connection will likely need assistance understanding the conditions and procedures required to apply for a customer account.

Sub-component 2.2: Fostering Resilience of Critical Public Services (US\$5 million equivalent, of which IDA US\$5 million)

60. **This sub-component will finance access to grid-based electricity services for an estimated 600 healthcare centers and 200 schools.** The activity will increase the resilience of essential public services, especially the health sector, by adapting to new needs including economic shocks, pandemics, and the climate change-driven spread of both vector-borne and non-communicable diseases. While schools need electricity to better prepare their students for a job world dominated by remote work and digital services, health centers need to invest in enhanced vaccine storage and their capacity to react to the public health effects of increasing temperatures, more frequent heavy rains and runoff such as increased gastrointestinal illnesses, malnutrition and respiratory illnesses. During appraisal, the task team worked closely with the Ministries of Health and Education as well as the World Bank’s Health and Education Global Practices to identify the electricity needs of rural schools and health centers and compute detailed connection cost estimates. Health centers and schools serving the largest number of inhabitants and thus having the highest suppressed energy demand will be prioritized. This prioritization exercise and subsequent system design work is currently being initiated to ensure that electrification activities can begin soon after project effectiveness. At present, SENELEC is working with the Ministries of Health and Education to further refine the list of schools and hospitals/clinics for connection and will leverage inputs from the geospatial analysis to finalize the selection. This work, along with an exploration of opportunities to provide digital services to connected public services, is ongoing.

Sub-component 2.3: Fostering Resilience of MSMEs (US\$5 million equivalent, of which IDA US\$5 million)

61. **This sub-component will fund the substitution of costly and polluting diesel gensets of rural auto-producers with much cleaner, grid-based electricity services.** Many rural enterprises situated outside the 40 m SENELEC’s “free connection perimeter” currently meet their electricity needs by auto-production from individual diesel gensets, as they would otherwise be required to fund the design and construction of grid extensions themselves. The use of these generators results in high negative impacts as their cost of operation is often double or more that of grid electricity and the exhaust is hazardous to



public health, local environment and the global climate³². The sub-activity will provide grid connections to approximately 700 eligible MSMEs located outside of this perimeter, but less than 500 m³³ from the existing grid. SENELEC and MPE will develop a fair and transparent selection methodology for the selection of MSMEs that would benefit from this sub-component. The methodology will consist of a simplified cost-benefit evaluation developed as part of the ongoing geospatial analysis and be based on a well-defined set of criteria including connection cost, local revenue-generation and job creation opportunities, electricity consumption, as well as expected local fiscal revenues and GHG emission reductions. Moreover, the selection methodology will be devised in such way to prioritize revenue-generation opportunities for women-led enterprises.

62. **Maximizing the economic development impact of rural electricity services.** By lowering the cost and improving the quality of electricity services for MSMEs, Sub-component 2.3 will improve the resilience of rural livelihoods and enhance the development impact of electrification investments for selected localities through improved productivity of local industries as well as enhanced job creation and revenue generation opportunities.

63. **Enhancing the economic viability of rural electricity services.** The connection of MSMEs outside, but within a reasonable distance from the 40 m perimeter, is a potentially attractive investment as the addition of commercial “anchor customers” can significantly improve both SENELEC revenues and margins from the provision of local electricity services, and by extension the economic viability of the utility’s rural concession areas.

64. **Providing complementary technical assistance for productive use and resilient economic activities.** To ensure a lasting impact of Component 1 in terms of economic growth, this sub-component will also comprise technical assistance activities targeted at maximizing the impact of electrification efforts on rural livelihoods and revenue generation. This will include a value chain analysis and business case assessment to understand existing products, services, value chains, and activities where electricity can act as an enabler or a catalyst. The assessment will help inform entrepreneurship training for micro and small businesses, particularly women-owned enterprises, that can benefit from purchasing electrical equipment for productive uses but have limited awareness and/or risk-aversion. The training will aim at increasing awareness of available equipment for various productive uses and include business development support to ensure that enterprises that connect to the grid and purchase electrical equipment can effectively manage cost and generate a profit. The training and technical assistance will ensure that the beneficiaries are aware of the cost structures, understand the size of the potential market, and can effectively finance their transition to electrified production. Given the prevalence of small-scale agriculture in Senegal, technical assistance will focus on improving productivity of existing production processes and the transformation of agricultural products as well as the creation of new lines of climate-resilient agriculture practices and economic activities.

65. **Developing on-bill financing schemes for productive use of electricity.** Working with local commercial institutions and equipment suppliers, the project will finance a study to assess the feasibility

³² In Sub-Saharan Africa, CO₂ and sulfur dioxide (SO₂) emitted from generators are respectively equal to about 20 percent and 50 percent of the total emissions from vehicles. Source: The Dirty Footprint of the Broken Grid. The Impacts of Fossil Fuel Back-up, Generators in Developing Countries, IFC, 2021.

³³ Parameters to be finalized with SENELEC and MPE.



of on-bill financing schemes for productive use equipment, such as grain mills or power carpentry tools, using a loan from a microfinance institutions or equipment leasing company. The loan will then be paid off month by month through a surcharge on the MSME's monthly electricity bill.

66. **Targeting gender gaps in productive use of electricity.** To simultaneously address persistent gender gaps in employment and human endowments, this technical assistance will explicitly target women led MSMEs by studying what mechanisms could be developed to provide financial assistance for equipment financing as well as technical and enterprise development support in pertinent areas and critical local industries including weaving, sewing and other artisanal crafts. Such interventions can be quite transformational for women, as they are more likely to have income-generating activities in the home, and regularized access to electricity can have a critical impact on their domestic care burdens, productivity, and commercialization. However, as women have more limited access to commercial credit, the project will provide support for the development of tailored financial services (including the above on-bill financing scheme) as well as technical and enterprise support activities to address specific challenges faced including in accessing capital, collateral, financial and technical literacy.

67. **Developing resilient income-generating opportunities for women.** Developing and offering training opportunities for women specific to the installation of interior wiring and/or small appliance repair can create powerful “win-win” situations both in terms of addressing non-infrastructure barriers to connection as well as improving access of women and women's groups to electric appliances for productive and households use. Moreover, both the lack of qualified electricians to install interior wiring (including ready boards) and the cultural sensitivities limiting the entry of male workers into female-led households, create a unique job market for women. Similarly, with respect to small appliance repair, field work yielded empirical evidence of women and women's groups working together to purchase small or medium-sized appliances, only to find their money wasted when it breaks, and a technician is not available to perform the needed repairs. Therefore, enabling women to undertake simple appliance repair work themselves and for each other, will significantly improve the sustainability of programs focused on productive use of electricity.

Component 3: Capacity building and implementation support (US\$10 million equivalent, of which IDA US\$10 million)

68. **Ensuring the robust institutional oversight of the national access and related low-carbon and climate-resilient energy transition agenda.** The objective of this sub-component is to support energy sector institutions, including SENELEC and MPE, in their objective of providing all of Senegal with quality, affordable, and reliable electricity while further improving the power sector's carbon footprint and resilience to climate change and economic shocks. Moreover, Component 3 will support the necessary “rebalancing” of institutional roles and responsibilities and enable MPE take full ownership of the Universal Access Program and its design and supervision.

Sub-component 3.1: Capacity building for institutions in the power sector (US\$6 million equivalent, of which IDA US\$6 million)

69. **Support to the MPE in the oversight of the Universal Access Program.** MPE has established a Steering Committee and a Technical Monitoring Committee (CTS) to oversee the Universal Access



Program. The project will provide financial support to cover operational costs of the CTS and recruit its key staff (including experts in planning and geospatial analysis, rural electrification and safeguards). In addition, the planning and monitoring capacities of the CTS and MPE will be strengthened by (i) acquiring specific geospatial and least-cost planning tools for access and (ii) providing specific training on their use. Additional workshops and training will be financed to strengthen technical (e.g., single-phase technology, ready boards, etc.) and operational capacities (e.g., contract management, project budgeting, environmental and social (E&S) safeguards, etc.) of MPE and other actors the Universal Access Program (SENELEC, ASER, etc.).

70. **Strengthening the MPE to lead the cross-institutional stakeholder dialogue.** As the driver of the Universal Access Program, the MPE will need support to work with other ministries to develop and implement policy solutions to non-infrastructure access barriers³⁴ particularly those relating to up-front costs and bill payment for public sector customers. Technical assistance will be required to support MPE as it engages with Ministries of Health and Education to establish fully funded budget line items and processes needed for the timely payment of electricity bills of schools and health institutions. The project will also be an opportunity to study how the existing connection policies and tariff structures are made more efficient and inclusive. This will entail the analysis and development of alternative solutions to the undifferentiated “broadband application” of the current social tariff.³⁵

71. **Provision of technical support and capacity building for SENELEC.** Technical assistance and capacity reinforcement for SENELEC will include support in the planning and implementation of investments under Components 1 and 2. Supported activities may include all or some of the following:

- (i) Training on geospatial analysis and access planning. Training in geospatial tools for electrification planning will be conducted, with particular attention to how to maximize the number of households and enterprises within a defined service obligation area that is more nuanced and inclusive than the current 40m policy. Additionally, support will be provided to SENELEC to increase the frequency by which least-cost electrification planning is updated, and to better integrate poverty, public service, economic development and climate change considerations in these analyses. Training activities and geospatial tools would be optimized to complement ongoing work by other donors and contribute to the ongoing update of SENELEC’s GIS database of the transmission and distribution grid.
- (ii) Improved resilience of the power grid. Trust-funded Advisory Services and Analytics (ASA) work will assess the topology of the transmission and distribution network and identify measures to improve its flexibility and resilience in a context of expected more frequent extreme weather events (flooding, extreme heat, etc.). Practices currently adopted by SENELEC for the operation and maintenance of the network, particularly under climate related disruptions, will also be reviewed to identify possible improvements. Options to be considered could include, among others: (i) reengineering of processes for outage management and fast service restoration supported by information systems, advanced metering infrastructure (AMI) and SCADA; (ii) adopting state-of-art technologies (drones, augmented reality, etc.) to assess condition of key network assets (main power transformers, etc.); and (iii) incorporation of “live line maintenance” practice to reduce frequency and duration of planned outages. Based on the results of the trust-funded study, the project may cover follow-on analytical work.

³⁴ See section B above.

³⁵ See section B above.



- (iii) Capacity building on operation and maintenance of distribution infrastructure. Trainings will focus on the following aspects: operations and maintenance of single-phase technology, protection systems for distribution networks, operation and maintenance of underground lines, command and control systems, and operation of on-load tap changers.
- (iv) Reinforcement of SENELEC's regional presence. SENELEC's Distribution and Commercial Directorates within the regional offices will be the critical focal points to (i) undertake supervisory or operational work during construction and (ii) open, manage, and maintain the 200,000 new customer accounts to be created by the project. Therefore, the provision of logistical and staffing support, including the payment of salaries and provision of vehicles, was identified as a critical success factor, and may be covered under this sub-component.
- (v) Reinforcement of SENELEC's capacity for logistics and stock management. SENELEC will benefit from trainings on the management of its warehouses to ensure optimal planning and safe storage of material. The sub-component will also finance the procurement of new software for the planning of deliveries and management of warehouses and stocks.
- (vi) Reduction of commercial losses: The sub-component will fund ASA work to assess current non-technical losses and identify of priority measures and actions to reduce them, especially by addressing electricity theft.
- (vii) Implementation of identified measures to reduce non-infrastructure barriers to connection. A Connections Working Group comprised of representatives from the GoS as well as SENELEC has already undertaken an audit of the connections process within SENELEC to identify ways to streamline and accelerate it. Identified areas of improvement include procurement procedures for connection equipment, improved stock management, a tablet-based account subscription platform, and a review of existing customer informational brochures tailored for the low literacy rates prevalent in rural and peri-urban areas. The project will support the implementation of some of these initiatives as well as a study to examine opportunities for SENELEC to offer a pre-financing mechanism for internal wiring.

72. **Design and implementation of customer outreach campaign.** Along with the proper planning and implementation of works, the success of the project will hinge on households in localities selected for grid densification investments to be aware of upcoming connection campaigns and submit a timely request for connection. To mitigate this significant demand risk, this sub-component will support SENELEC with the design and implementation of comprehensive community outreach and awareness campaigns. The campaigns will inform people in target areas of the opportunity to connect, the related costs (where applicable) and procedures to open an account with SENELEC, the benefits and costs of electricity services, as well as the payment mechanisms, procedures, and safety practices of the electrification process. Campaigns shall commence well before the completion of distribution investments as many customers may require time to save or mobilize financing for interior wiring costs. Related communication measures will need to address both male and female-headed households as well as vulnerable customers eligible for internal wiring solutions offered free of charge through Sub-component 2.1.

73. **Addressing employment gender gaps at SENELEC.** The sub-component will fund technical assistance work to enhance women's employment and related policies and measures in the energy sector while focusing on SENELEC as a key stakeholder. During project preparation, an initial gender gap analysis was conducted with a specific focus on gender gaps in employment and overall workplace policies at SENELEC to establish a baseline and help start the design of targeted interventions that can narrow



existing gaps by providing opportunities for women to access technical and non-technical positions and relevant training. It was found that at SENELEC, the percentage of women employees was at 20.4 percent across all posts at managerial level but only 7.4 percent in technical jobs. SENELEC lacks targeted recruitment- or promotion policies, flexible work options as well as an encompassing gender policy. In order to define specific interventions, aspects around recruiting, retaining and promoting women at both institutions will need to be further assessed, and lessons learned leveraged from Ethiopia, South Asia, and other parts of SSA. Interventions based on these assessments may include, amongst others, institutional policy design and adoption, data collection, HR reforms, tailored recruitment strategies and communication efforts, and internship opportunities with the aim for women to access technical positions at increased numbers.

Sub-component 3.2: Project preparation, implementation, monitoring and coordination (US\$4 million equivalent, of which IDA US\$4 million)

74. **Funding of PIU staffing and operations.** This sub-component finances the operational costs of the PIU situated within SENELEC and project supervision costs. It also includes the acquisition of vehicles necessary for the PIU for supervision of works, as well as the purchase of office equipment. Financing will also be provided for incremental operating costs for the PIU.

75. **Retroactively financed E&S studies.** The preparation of two E&S documents (Stakeholder Engagement Plan (SEP) and Labor Management Plan) has been pre-financed by SENELEC. These expenditures incurred after September 1, 2021 and did not exceed US\$200,000 equivalent.

Component 4: Contingent Emergency Response Component (US\$0 million)

76. **A Contingent Emergency Response Component (CERC)** with zero allocation may be used to contribute to an emergency response through the timely implementation of activities in response to an eligible national emergency. The CERC could also be used to channel additional funds should they become available as a result of said emergency. For the Senegalese energy sector, emergency conditions may arise subsequent to extreme weather events, including flooding. Should the CERC be triggered, all expenditures will be made in accordance with paragraph 11 of the Investment Project Financing (IPF) Policy and will be reviewed and accepted by the World Bank before any disbursement is made. In accordance with paragraphs 11 and 12 of the IPF Policy, this component would provide rapidly disbursing support to finance goods (positive list agreed with the Government), works, and services needed for response, mitigation, and recovery and reconstruction. Operating costs that are eligible for financing would include the incremental expenses incurred for early recovery efforts arising from the impact of a major crisis.

77. **Detailed project budget.** Table 3, below, provides a detailed, itemized budget for the project

Table 3: Project’s components and costs

Component	Total Cost (US\$ millions)	IDA financing (US\$ millions)	GoS financing (US\$ millions)
Component 1: Grid densification and extension	135	125	10
<i>Sub-component 1.1: Design, supply, and installing or updating</i>	<i>126</i>	<i>116</i>	<i>10</i>



Component	Total Cost (US\$ millions)	IDA financing (US\$ millions)	GoS financing (US\$ millions)
<i>electricity distribution infrastructure</i>			
<i>Sub-component 1.2: Owners Engineers</i>	9	9	0
Component 2: Electricity Access for a Resilient and Inclusive Post-COVID Recovery	15	15	0
<i>Sub-component 2.1 Fostering Sustainable Resilience of Vulnerable Populations</i>	5	5	0
<i>Sub-component 2.2: Fostering Resilience of Critical Public Services</i>	5	5	0
<i>Sub-component 2.3: Fostering Resilience of MSMEs</i>	5	5	0
Component 3: Capacity building and implementation support	10	10	0
<i>Sub-component 3.1: Capacity building for institutions of the power sector</i>	6	6	0
<i>Sub-component 3.2: Project preparation, implementation, monitoring and coordination execution and implementation</i>	4	4	0
Component 4: Contingent Emergency Response Component	0	0	0
Total	160	150	10

C. Project Beneficiaries

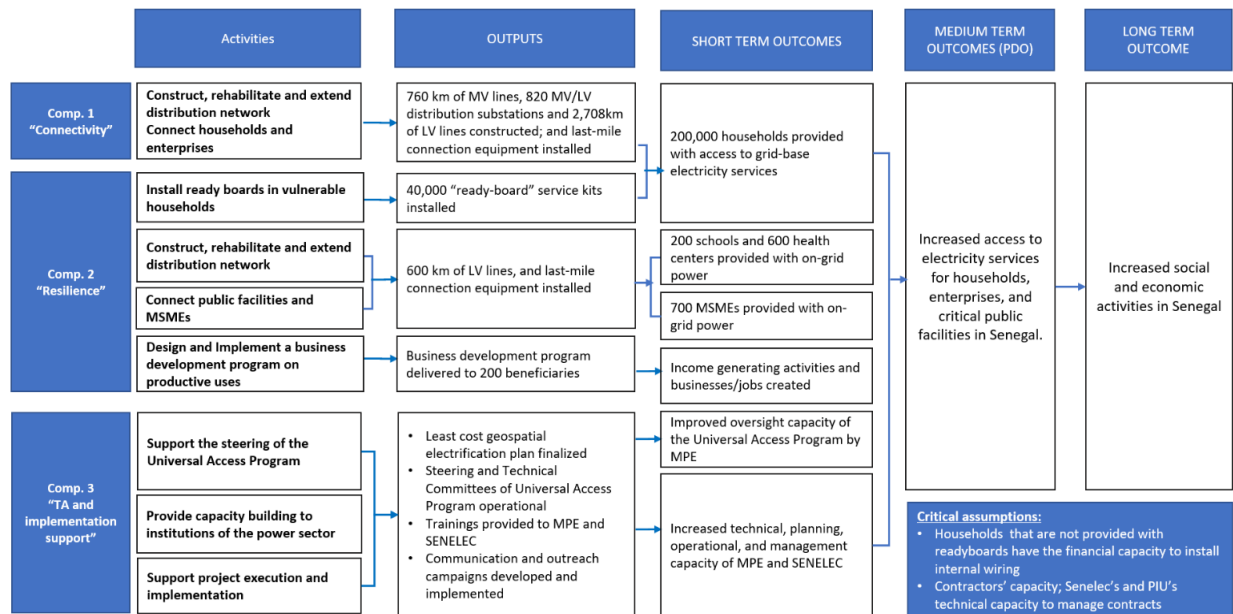
78. **The project’s direct beneficiaries will amount to about 1.6 million people through the connection of 200,000 households to the grid³⁶.** Of the above households, 40,000 vulnerable households will be provided with “ready boards”, standardized connection kits tailored to the needs of poor Senegalese households consisting of internal wiring, switches, plugs for different types of appliances, and built-in efficient household lighting solutions. Through the combined provision of electricity connections and ready boards, households are expected to benefit from significantly reduced levels of indoor pollution from the substitution of kerosene and other polluting alternative fuels and for lighting and cooking. In addition, about 700 MSMEs, 200 schools, and 600 health facilities will benefit from new or improved electricity services. In addition, the project has a focus on closing gender gaps to benefit female-managed and/or female-owned enterprises and vulnerable households. Therefore, provision of on-grid electricity service would have a transformative impact on socioeconomic life of the population living in the project areas.

³⁶ The average number of people per household is estimated at 7.9 by 2025 in Senegal’s Distribution Masterplan 2019-2035.



D. Results Chain

Figure 6: PADAES Project Results Chain



E. Rationale for World Bank Involvement and Role of Partners

79. **There is a clear rationale for the World Bank to support grid electrification in Senegal.** The GoS is deeply committed to reducing the disparities between rural and urban rates of electrification and improving rural livelihoods, as outlined in the PSE and other official policy goals and documents. Even amongst rural areas, electrification rates vary widely by region and, in general, the proposed locations for the World Bank investments have some of the lowest rates of electrification in Senegal and are also amongst the most poor and vulnerable. The Casamance region in particular has suffered from a lack of investment and the GoS has specifically identified Departments in the region as economic growth hubs in the PSE. However, as discussed previously, the public-private partnership approach of electrification through a concessionaire model has not achieved desired results and there is a need for public sector financing to intervene and accelerate the rates of electrification. Building on its long-standing engagement with Senegal in the energy sector and in collaboration with efforts planned and underway by other donors, the World Bank is uniquely positioned to have a measurable impact. The World Bank also has an opportunity to contribute to capacity development for sector actors on best practices from other countries, especially in Africa, in the application of Geographical Information System (GIS) technology to identify least cost electrification approaches.

80. **The proposed operation, together with the complementary Regional Electricity Access and Battery Energy Storage Technology (BEST) Project (P167569), will cover close to 30 percent of the access gap and is strongly aligned with current World Bank engagements in the sector.** Firstly, through its focus on grid densification, the proposed operation will be complementing the grid extension investments of the US\$130 million Regional Electricity Access and BEST Project (P167569) approved in June 2021 and will mostly connect localities within a 100-km radius of substations belonging to the Gambia River



Development Organization (*L'Organisation pour la mise en Valeur du Fleuve Gambie*, OMVG) in Southern Senegal. Together, the two projects will cover an estimated 30 percent of the estimated investment needs for Senegal to reach universal access and connect around 300,000 households³⁷. Whereas these two projects focus on on-grid electrification, off-grid investments are currently supported by ROGEAP, fostering the development of a regional market for off-grid products and services in West Africa. In addition, the proposed operation will build on three other ongoing engagements³⁸ of the World Bank that foster access: PASE, as previously mentioned, the OMVG Interconnection Project (P146830) and the Senegal River Development Organization (*L'Organisation pour la Mise en Valeur du Fleuve Sénégal*, OMVS) Transmission Expansion Project (P147921). In addition to improving the operational and commercial performance of SENELEC, PASE is improving access in the country through: (i) the construction of MV backbones, extending the coverage of the national network³⁹; (ii) the densification of electrified localities; and (iii) the last-mile connection of vulnerable households. The proposed operation will integrate lessons learned from PASE, especially related to the use of a national socio-economic database, the RNU, to identify the most vulnerable households of Senegal that will benefit from subsidized internal wiring. Finally, both regional projects OMVG and OMVS are extending the coverage of the national network by building HV lines to connect Senegal to countries of the West Africa Power Pool (WAPP) and import low cost and clean electricity.

81. **The proposed operation is an opportunity to collaborate with the other technical and financial partners working in Senegal to have a transformative impact on electrification rates and to encourage sector reform.** Other donors are collaborating with SENELEC and MPE to close the access gap. Some of the larger electrification projects include a US\$550 million energy focused program funded by the Millennium Challenge Corporation (MCC) entered into force with the GoS on September 9, 2021. This includes approximately US\$60 million to support electrification in rural and peri-urban areas both in terms of grid rehabilitation and extension as well as consumer demand and utility support to address non-infrastructure barriers to connection. French Development Agency (*Agence Française de Développement*, AFD) anticipates support to construction for grid extension in 73 localities located in and around Ziguinchor and Matam. In addition to on-grid electrification efforts underway, there is significant funding mobilized for off-grid, last-mile electrification. German Development Agency (*Gesellschaft für Internationale Zusammenarbeit*, GIZ) is supporting last-mile electrification through support for mini-grids throughout the country, namely delivered as local rural electrification initiatives (ERILs). Other major interventions in off-grid electrification include the African Development Bank (AfDB) US\$15 million project funding the construction of 30 solar minigrids for the electrification of 180 villages. The Islamic Development Bank and the Saudi Development Fund are also collectively providing nearly US\$40 million for the electrification of close to 160 villages via solar minigrids. Working in collaboration with other technical and financial partners as well as MPE and SENELEC, the proposed World Bank investment is poised to make a transformative improvement in the national rate of modern electricity access in Senegal.

F. Lessons Learned and Reflected in the Project Design

82. **Investment optimization through geospatial least cost electrification planning.** With funding from the World Bank, MPE will be updating its least cost electrification planning for Senegal, capitalizing

³⁷ i.e. 40 percent of households to be connected to close the access gap.

³⁸ Details on the World Bank Portfolio related to energy access in Senegal can be found in Annex 1.

³⁹ Between 200 and 250 villages will be connected by the end of 2022.



on recent advances of geospatial mapping techniques. The objective of this analysis is to (i) identify households that will be connected through densification under Component 1 and Sub-component 2.1 – selecting the most cost-effective connections, and (ii) articulate the Universal Access Program around the selection of least-cost technologies (on-grid, mini grid and off-grid) to connect households across the country. MPE will also be provided with specific training to ensure ownership and regular updates of this analysis. Experience in the region has shown various successes in the implementation of access programs articulated around least cost planning principles, with Rwanda being a prime example.

83. Ensuring a win-win for both users and service providers, by fostering productive uses. Critically, evaluation impacts of past electrification projects in SSA, funded both by World Bank and other donors, demonstrate that electrification alone generally does not provide expected benefits and must be coupled with interventions on the consumer side. Taking this into account, the project contemplates special support to foster electricity demand, especially through productive uses of electricity. Thus, through the progressive move of rural customers from the subsidized social tariff to more profitable commercial tariff segments, SENELEC's operating margins will improve gradually, further strengthening the financial viability of the sector. In this way, the project will contribute to overcoming the financial constraints of the sector on three fronts by boosting income generation for vulnerable households and businesses, improving SENELEC's revenue base and, by extension, increasing the GoS fiscal revenues.

84. Non-infrastructure barriers addressed in the project's components. As in other SSA countries, non-infrastructure barriers to connection are created through an inefficient and non-inclusive connections policy. These issues are addressed both at the institutional level in Sub-component 3.1 and the HH level in Sub-components 1.1, 2.1, and 2.3. Taking affordability for lower consumption customers into account, the infrastructure contemplated in Component 1 of the project will be complemented by Component 2, which includes the adoption and implementation of a "Lifeline Connection Policy" and the provision of ready boards customized for low-income households. Ready-boards have recently been used in a World Bank-funded electrification project in Madagascar and are well-known through much of SSA as a means to lower the cost of connection for lower consumption customers. For the potential customers who will not be entitled to project-funded ready boards, outreach activities will commence early in the project and prior to construction completion so that HHs and businesses can save the necessary fees for interior wiring over a period of time. All potential customers will need outreach and support to navigate the subscription process with SENELEC, which requires, amongst other things, that the potential client provide copies of identification documents and proof of residence.

85. Project design focused on loss reduction and the use of incentives to curb electricity theft. An important co-benefit of well-designed densification projects is the significant reduction of both technical and commercial losses and improvements of service quality. Replicating those best practices and design provisions, the project includes a significant allocation for distribution grid rehabilitation and upgrades while covering the full cost of internal wiring for the most vulnerable households. Therefore, the project will not only help reduce technical distribution losses and service interruptions, but also provide strong incentives for poor customers to regularize illegal individual or shared "cascade connections" where existing users sell electricity to their neighbors, frequently while earning significant margins.

86. Addressing other "non-technical" bureaucratic and procedural barriers to electricity access. Experience within low electricity access countries in the region and globally have demonstrated the



widespread prevalence of very significant additional barriers to access resulting from a deep-seated “heritage” of inefficient and overly restrictive administrative procedures and requirements to qualify for new connections. As poor households are the principal victims, those “non-technical” barriers must be diligently analyzed and addressed through a dedicated set of activities. Consequently, to address those important additional uptake constraints for the most vulnerable populations (including female-headed households) and to mitigate exclusion resulting from SENELEC’s housing quality and ownership requirements, Sub-component 3.1 will support the utility to critically analyze and streamline their current procedures to obtain new connections.

87. Ensuring readiness for a swift start of project implementation. The execution of large infrastructure investments in Senegal, whether financed by World Bank or other partners, often experience delays because of a persistent lack of implementation readiness or capacity by the implementing entity at the time of project effectiveness. To minimize delays, the project will build on existing arrangement by using the existing PIU within SENELEC and will reinforce its capacity through additional staff and training to prepare and implement the PADAES. Additionally, it is currently planned to use remaining funding from the PASE for the services of consulting services to undertake designs. This would allow the SENELEC to accelerate (a) the preparation of main bidding documents and the evaluation of offers; and (b) the elaboration and implementation of E&S safeguards plans.

88. Early onboarding of the OE(s). The timely recruitment and mobilization of an experienced OE(s) will be a factor critical to the project’s success. Within this context, the World Bank will continue to help the client ensure and early onboarding and avoid the repetition of recruitment delays experienced under the PASE which led to critical bottlenecks and a major and persistent slowdown of project implementation. The timely contracting of OE to support SENELEC will also be essential for inter-project coordination purposes as the utility will be managing two World Bank access projects in parallel, as well as additional access projects from other donors (MCC, AFD, KfW, AfDB and others).

89. Capturing lessons learned from other World Bank-funded rural electrification projects in Senegal. The Rural Electrification Carbon Finance Project (P158709) is a standalone carbon finance operation implemented through ASER and targeting rural households as beneficiaries from the sale of carbon credits as a result of the emission reductions generated through the project. This project, approved in 2016, has been proven problematic, not being able to disburse. Currently it is in the process of being cancelled. The main reasons for failure are directly related to the carbon finance design. Throughout the years since the creation of carbon funds at the World Bank, it has been shown that standalone carbon finance (CF) operations (i.e. not associated with a lending operation) are difficult to implement, because of the ex-post nature of the carbon finance investments and hence the absence of a clear incentive for the implementing entity to implement the project. In addition, the main beneficiaries of the CF operation were the households that were going to receive a subsidy to their electricity connection, not the implementing entity. The World Bank is under discussion on how to capture the Emission Reductions benefit through the PADAES Project and hence solving the main problem identified in the CF operation.

90. A procurement strategy built on lessons learned from World Bank access projects. Some access activities financed under the PASE in Senegal registered important delays in the supply of equipment due to the shortage of containers and raw material during the COVID-19 pandemic. The logistical issues were exacerbated by the low capacity of the utility to plan and undertake the storage of key materials (e.g.



cables, poles, etc.) before the start of construction and installation works. To avoid similar bottlenecks, the project has established a procurement strategy tailored to the local context and the capacity of the utility. Therefore, the densification of the distribution network will be realized under a turnkey contract, which will place liability for just-in-time delivery of materials and equipment on the contractors. In contrast, the connection of households will be realized under separate supply and installation contracts to maximize the use of local labor and capitalize on the economics of scale for the acquisition of key “last mile” equipment including cables and meters. To address weaknesses identified under the PASE, SENELEC will receive capacity building on inventory management and logistics, and will be assisted by the OE to define and implement logistics arrangements for equipment supply and installation works (e.g. testing of material, reception in warehouses, use of a virtual warehouse system, etc.). As demonstrated by the World Bank financed Mozambique Energy for All Project (P165453), the separation of supply and installation contracts (i) allows lower material cost, thanks to increased competition and (ii) fosters the participation of local companies for installation/construction works.

III. IMPLEMENTATION ARRANGEMENTS

A. Institutional and Implementation Arrangements

91. **Strategic oversight by MPE with SENELEC leading implementation.** The MPE will have an oversight role in the implementation of the project. The Steering Committee of the Universal Access Program which is hosted by MPE will oversee all access projects which are part of the Program, including the PADAES. SENELEC, the national electric utility, will be the implementing agency for Components 1 and 2 related to grid densification, as well as technical assistance activities of Component 3 targeting the utility. Although SENELEC is still the fiduciary agent, the MPE will lead the technical implementation of the activities related to the steering of the Universal Access Program, including technical assistance activities to reinforce its planning and monitoring capacities.

92. **Maintaining an experienced PIU within SENELEC.** The PIU hosted by SENELEC has been responsible for the implementation of the PASE since 2012. Going forward, it will be responsible for procurement, financial management (FM), implementation of safeguard instruments, and monitoring and reporting for both the Regional Electricity Access and BEST Project (P167569) and PADAES. This will allow significant economies of scale on supervision costs. Although the PIU has demonstrated a good track record and is familiar with World Bank procedures, it will be strengthened to increase its capacity to effectively implement activities of the three projects in parallel, specifically with respect to fiduciary (procurement and FM), E&S safeguards, and technical expertise. The structure of the reinforced PIU is presented in Annex 2.

93. **Close coordination between MPE and SENELEC’s PIU.** The PIU will work in close collaboration with the MPE in the procurement and FM of activities of Component 3 related to the steering committee of the Universal Access Program. The MPE will assist the PIU in the preparation of Terms of Reference (ToRs) for these activities and will be responsible for their implementation and supervision. A protocol will be prepared and signed by MPE and SENELEC to clarify their roles in the implementation of such activities.



B. Results Monitoring and Evaluation Arrangements

94. **PIU and OE(s) responsibilities.** The PIU within SENELEC will be responsible for the overall monitoring and reporting of project progress to the World Bank, with inputs from the MPE for Sub-component 3.1. As noted previously, the OE(s) will oversee implementation of Sub-components 1.1, 2.1, 2.2, and 2.3, from a technical perspective and will report on progress indicators to the PIU. As needed, the PIU will organize regular meetings involving relevant actors to review progress and address issues that may arise.

95. **Progress reporting format and responsibilities.** Monitoring of results and outcomes, in accordance with the project results framework, will be reported in the project progress reports. The baseline survey will follow the multi-tier access framework to capture the current levels of electricity service in the targeted distribution network reinforcement/extension areas and will collect and report sex-disaggregated data. The Monitoring and Evaluation (M&E) Specialist of the PIU will implement and coordinate all M&E activities under the project. Furthermore, the World Bank will provide regular implementation support to the project over its lifetime and will monitor progress on results and outcomes to assess the achievement of the PDO and to take corrective measures if needed.

96. **Midterm review timing and content.** The midterm review of the project will be conducted two to three years after project effectiveness. The midterm review will provide the opportunity to thoroughly evaluate the overall project performance and the achievement of the PDO. Any adjustments to the project will be discussed, agreed, and implemented as necessary.

C. Sustainability

97. **Sector sustainability.** The sustainability of the Senegalese power sector and the investments financed under this project will depend upon (a) the financial health of SENELEC and its ability to generate sufficient revenues to fully cover its expenditures; (b) SENELEC's ability to maintain and operate the assets sustainably; and (c) the GoS's continued commitment to support an ambitious sector reform and energy transition. Under both PADAES as well as the ongoing PASE, a significant budget is dedicated towards capacity building of MPE and SENELEC. The technical support will continue to be targeted at ensuring that future electrification needs in Senegal are met in the most efficient possible way while promoting the continued recovery of SENELEC's financial and commercial performance. Thus, the training activities will be centered around improving understanding of low-cost connection technologies, the optimization of operating costs, and streamlining of SENELEC's commercial functions and procedures including all processes involved in connecting new customers.

98. **Technical sustainability.** The technical sustainability of densification investments will be ensured by supporting the technologies most appropriate to the Senegalese context, as well as ensuring ongoing quality assurance. All supported grid extension and connection solutions (including SWER and ready board technologies) will have to meet international quality standards. Quality assurance activities under Component 3 will support implementation and acceptance of these standards.

99. **Demand-side sustainability – household use of electricity.** Increased electricity use and demand will reduce the energy expenditures of households by introducing a less-expensive, more efficient energy



supply. The project will fund capacity building and awareness raising activities targeted at fostering the efficient use of electricity by households, resulting in higher both higher penetration rates and progressive substitution of inefficient alternative energy sources including for lighting and cooking. Optimizing distribution lines within a community will balance the costs of investment in grid densification with expected future streams of utility/concession revenues, thus having a positive effect on the consumer-related costs.

100. **Demand-side sustainability – commercial use of electricity.** To enhance the sustainability of commercial use of electricity, the project will include a set of capacity building activities centered on productive use and encourage entrepreneurial activities that benefit from electrification, targeting men, women, and youth differently, given their diverse needs and uses of electricity. Value chain actors and village-level enterprises also need to understand markets, improve productivity, and manage finances. Thus, throughout project implementation, the Project will endeavor to engage with other technical and financial partners to solidify essential collaborations focusing on value chain and income-generating activity support.

IV. PROJECT APPRAISAL SUMMARY

A. Technical, Economic and Financial Analysis

Technical analysis

101. **The project approach is capitalizing on global best practices.** The project will help increase electricity access in urban and rural areas covered by SENELEC by extending and densifying the distribution network with the objective of installing 200,000 new connections, with prepaid meters and internal wiring (ready boards) for 40,000 vulnerable households. In addition, the project will help automatize the distribution grid through the installation of remote terminal units and telecommunication equipment in MV/LV stations. The project's electrification approach including its prioritization of densification investments builds on successful access projects financed by the World Bank globally. This approach has been instrumental in the rapid scaled-up of electricity access in countries that were nearing universal access (including Vietnam, Lao People's Democratic Republic, and Tunisia).

102. **Project technical design based on sound analytical foundation.** The technical design of the project is considered sound and presents no unusual construction or operational challenges. Sub-component 1.1 is based on the updated Distribution Master Plan 2019-2035 with the assistance of internationally recognized consulting firms and pre-identification of target zones from SENELEC. The final scope will be established by (i) low-cost geospatial study to fine tune the localities and households that will benefit from the connections and (ii) a feasibility study from consulting services to carry out the preliminary design studies for the extension, restructuring, reinforcement and densification of the HV and MV network in already electrified localities. The final studies will be reviewed by World Bank staff during project implementation to ensure that the final investments will be technically sound and appropriate to the country's needs.

103. **Project design addressing critical access barrier to vulnerable households.** Particularly in Senegal's peri-urban and rural concession areas, electricity connections remain unaffordable to many poor



households as SENELEC traditionally expects its customers to have internal wiring installed prior to receiving the electricity connection while covering all related expenses. As SENELEC has thus far not adopted ready boards as a long-proven and well-established low-cost solution to the internal wiring issue and dramatically reduce the cost of “lifeline” connections for poorer households who only use electricity for lighting and a very limited set of low-consumption appliances. The project will help SENELEC capitalize on this valuable opportunity to both reduce the cost of connecting vulnerable households and accelerating its ongoing electrification projects.

104. Use of a rigorous least-cost approach. SENELEC is currently recruiting consulting services to complete preliminary design studies for Sub-component 1.1. Knowing that the project cannot absorb all the identified needs for densification and extension of networks, it will follow a rigorous least-cost methodology informed by the World Bank-commissioned geospatial analysis to maximize the number of beneficiaries. This information will be provided to the design consultant who will complete the engineering designs on behalf of SENELEC, who will in turn complete the construction tender documents.

105. Value-for-money through systematic use of least-cost technologies. The technical works activities of the projects are not associated with unusual operational challenges as the concept of electrification is well known and proven in Senegal. A competitively recruited engineering firm will undertake design studies for Component 1 and define low-cost distribution technologies to increase system efficiency. In areas where conditions permit, the project will implement least cost technologies that provide the most adequate level of service to customers located in peri-urban and rural areas at the lowest possible costs. The design study will also determine the adequate size of distribution transformers installed to lower technical losses. In addition, the connection of new households will include the installation of prepaid meters. For poor households where internal wiring is a challenge, the project will include the installation of ready boards to ensure safe and efficient use of electricity. Cost estimates done during pre-identification from SENELEC have been appraised and are deemed to be in line with current market prices.

106. Use of tailored technical solutions. The main technical challenge of the project will be the design, procurement, and implementation of ready boards because they are yet to be used in Senegal. The technical and commercial specifications will be completed by SENELEC. The technical specifications will define the maximum capacity, type of meter, number/type of outlets, number/type of LED lights, length of internal wiring, etc. and the implementation of this component. The ready boards kits will have to be adapted to the specificities of the Senegalese households. Additionally, the standard specifications of SENELEC for interior wiring should be updated/adapted to consider ready board. The World Bank team will support SENELEC through feedback from ready board projects in other African countries (South Africa, Rwanda, Uganda, Tanzania) in order to refine the economic impact, procurement approaches, communication challenge, implementation preparation and other implementation challenges. The implementation (supply, installation, communication) will be carried out in a single lot to ensure a complete and coherent approach of the ready board system.

107. Recruitment of the OE to ensure compliance with project design and quality standards. As part of the project, the OE will be competitively recruited. The OE will be a reputable international engineering company and will help ensure that construction is carried out in accordance with designs and international quality standards. Technical aspects of the infrastructure to be built under the project are summarized in



Annex 2.

108. **Integration of climate resilience considerations.** The finalization of bidding document for extension and densification of the distribution network will integrate a climate risk assessment, site assessment and vulnerability risk analysis, and propose resilience measures that can be incorporated into the project design, including the detailed engineering design, location, and environmental management plan.

109. **Outreach activities.** Through outreach efforts contemplated as part of Sub-component 1.1, households and businesses located within the project area will be informed about impending electrification works in their area and will receive support to fully understand the connection processes and documentation required to apply.

Economic and financial analysis

110. **Access to electricity for households, healthcare centers, schools and electrification of micro, SMEs has the potential to bring significant economic benefits.** An economic analysis was carried out to assess the development impact in terms of expected benefits and costs over the project lifetime (assumed to be 40 years). The economic analysis is consistent with the new World Bank guidelines on economic analysis and relies on a standard cost-benefit methodology, which compares the present value of incurred costs to the stream of attributable benefits under two scenarios, i.e., the “with project” and “without project” scenario. The economic analysis derives the Net Present Value (NPV) of each of the proposed project components for which benefits can be clearly identified, as well as a NPV of the proposed project as a whole, using a social discount rate of 6 percent to present all costs and benefits at a common point in time. In line with the general practice, we also present the Economic Rate of Return (ERR) for each of the components and an overall project ERR.

111. **The economic analysis is confined to the project activities that generate quantifiable benefits for which an economic value can be clearly identified and measured.** In this respect, the analysis focuses on the following components: (i) Sub-component 1.1 on network strengthening and expansion to provide grid access to 160,000 households plus 40,000 vulnerable households and improving the quality of service for household, business and critical public facilities (US\$116 million); (ii) Sub-component 2.1 on supply and installation of ready-boards to those 40,000 vulnerable low-income households connected to the grid under Sub-component 1.1 (US\$5 million); (iii) Sub-component 2.2 on grid electrification of healthcare centers and schools (US\$5 million); and (iv) Sub-component 2.3 on electrification of MSMEs with enhanced focus on electrification of women-led MSMEs (US\$5 million). Separately, Sub-component 1.2 aims at ensuring technical coherence and proper timing of all investments and Sub-component 3.2 aims at funding costs of the PIU and project supervision costs (US\$4 million). In the analysis, the cost of Sub-components 1.2 and 3.2 are apportioned across the other sub-components as they aim to support in proportion to the investment costs of each of the sub-components funded by the project.

112. **The project also aims at supporting capacity building for institutions of the power sector (Sub-component 3.1, US\$6 million).** The benefits of this capacity building are difficult to measure with benefits extending beyond this project (i.e., the benefits realized under this sub-component relating to the establishment of the Steering Committee and CTS of the Universal Access Program within the MPE will



not only benefit the current project but also future access projects in Senegal). Therefore, the benefits and costs of this sub-component are not considered in the economic analysis presented here.

113. **The project is also expected to bring some benefits from reduced GHG emissions.** In addition to the quantifiable benefits discussed above, the economic analysis also considers the additional benefit derived from reduced GHG emissions. The impact of the project on GHG emissions is calculated as the difference between the emissions associated with the level of service proposed by the project compared to the emissions associated with the current alternatives. The analysis is undertaken in accordance with the World Bank GHG Accounting Methodology for Energy Access Investment Operations.

114. **While the analysis does not consider other indirect benefits, it is expected that the project will contribute towards other economic benefits that are more difficult to quantify and monetize.** These indirect benefits include improved air quality from reduced consumption of kerosene, reduced poisoning and accidental fires, and wider benefits that can be linked to access to modern electricity solutions such as improved health, improved connectivity, and improved security. Access to modern energy solutions is also expected to increase income generating opportunities and improve the socio-economic situation of households and MSMEs, with expected positive impact on education and overall lifestyle. This means that the results from the economic analysis can be considered as conservative estimates of the overall economic benefits of the project.

115. **The economic analysis shows that the project is economically viable even without any consideration of environmental externalities.** Using a social discount rate of 6 percent, the baseline NPV of the project is estimated at US\$124 million and ERR of 11.5 percent. Furthermore, when considering the impact of the project on reduction of CO2 emissions, the net benefits increase to between US\$153 million and US\$183 million, depending on the assumptions around the social cost of carbon. A summary of the project economic analysis is provided below and further detail as well as the project financial analysis from the point of view of the national utility, SENELEC, is provided in Annex 4, with all monetary values presented in NPV terms (US\$2021).

Table 4: Summary of project economic analysis

Discount rate	[%]	6%
Economic rate of return		
ERR	[%]	11.5%
ERR+GHG - BankGuidanceValues (low)	[%]	12.8%
ERR+GHG - BankGuidanceValues (high)	[%]	14.1%
Total costs	[US\$M]	602
Total benefits	[US\$M]	726
NPV, before environmental benefits	[US\$M]	124
Lifetime GHG emissions reduction (net impact)	[MtCO2e]	1.75
Avoided GHG emissions - shadow price of carbon (low)	[US\$M]	29.3
Avoided GHG emissions - shadow price of carbon (high)	[US\$M]	58.7
NPV (including environment, low)	[US\$M]	153
NPV (including environment, high)	[US\$M]	183



116. **In addition to the economic analysis, the impact of the project was assessed from the point of view of the national utility, SENELEC.** According to the regulatory methodology in place, SENELEC recovers all eligible costs through allowed revenues set by the sector regulator, CRSE. Therefore, if the credit associated with the project is included in the regulatory asset base of SENELEC, the resulting tariff revenue shortfall or the need for tariff increases will be relatively higher compared to a scenario in which the project credit is paid by the GoS, and hence excluded from the allowed revenues to be recovered by SENELEC. Specifically, the required notional tariff increase is estimated at 4.1 percent per annum to allow SENELEC to recover all project related CAPEX and other costs, plus OPEX and wholesale supply costs, compared to one percent per annum when the Project CAPEX and other costs are funded by the GoS, and hence not included in allowed revenues of SENELEC. Alternatively, if the project related costs are included in the regulatory asset base of SENELEC but the GoS decides to keep the tariffs unchanged, the resulting tariff revenue shortfall would need to be funded by compensation payments from the State budget. In this case, the compensation amounts provided from the State budget to SENELEC would not only need to pay for the project CAPEX and other costs through a depreciation allowance during the regulatory asset lifetime (25 years) but also allow SENELEC to earn what the regulator deems a reasonable rate of return on investment (set by the regulator today at 11.73 percent per annum, nominal pre-tax rate of return). Hence, the impact of the project on allowed revenues of SENELEC would be the sum of the project investment costs (US\$2021 131 million) and the sum of the return on invested capital (US\$2021 184 million). The total undiscounted costs to be included in the allowed revenue of SENELEC under the scenario of no tariff increases equals US\$2021 315 million to allow SENELEC to recover the project related investment costs over the period 2023 to 2049. The payments from the state budget to compensate for any resulting tariff revenue shortfall, unless there is an upward revision to tariffs, is likely to exceed payments that would be associated with the Government repaying the loan themselves (i.e., if the loan is not on-lent to SENELEC). Further detail is provided in Annex 4.

Rationale for public sector provisioning/financing, if applicable

117. **The GoS adopted an ambitious plan of achieving universal access by 2025. However, electrification projects, despite their significant development benefit, are often not commercially viable.** Reaching universal access to reliable and affordable electricity is a development priority for the GoS, which was reaffirmed in the Priority Action Plan 2 - Adjusted and Accelerated PAP 2A) adopted by the GoS in September 2020 in which the GoS reaffirmed its objective to extend electricity access to everyone in Senegal by 2025. There is, therefore, a need to significantly accelerate the rate at which electricity access is provided through government intervention. This is especially the case since the initial consumption of those newly connected is expected to be below that of those households already connected and also in view of the fact that the project is also aimed to target poor households whose connection charges and internal wiring will be subsidized. Further to that, the project will finance electrification of public buildings (hospitals, medical centers, public schools), which are at the heart of the socio-economic development in any community, and thus a key priority for sustained development of the country.

Value added of the World Bank's support

118. **Value added of the World Bank's support comes from its extensive experience in supporting the development of the power sector and access projects not only in Senegal but also in the region and**



worldwide. The World Bank has been supporting the energy dialogue in Senegal over many years, which places the World Bank in a unique position to design and implement an effective program that helps to further develop the power sector in Senegal with focus on expanding access. In this regard, the World Bank will also leverage the local knowledge acquired on other access projects supported by the World Bank in Senegal: Regional Electricity Access and BEST Project (P167569). Further to that, the World Bank will also leverage the knowledge acquired in the region with similar albeit not very widespread technologies (such as ready boards to provide electricity to households where housing quality does not allow for internal wiring to be installed in a safe manner).

B. Fiduciary

(i) Financial Management

119. **FM Assessment.** An assessment of the FM arrangements of the PASE' PIU under the oversight of SENELEC was carried out in October 2021. It entailed a review of its capacity and its ability to record, control, and manage the project resources and produce timely, relevant and reliable information for the key stakeholders including the GoS and the World Bank, thereby determining whether the FM arrangements in place are acceptable. The assessment complied with the FM Manual for World Bank-Financed Investment Operations that became effective on March 1, 2010, and as last revised in September 2021. These arrangements ensure that the implementing entity: (a) uses project funds only for the intended purposes in an efficient and economical way; (b) prepares accurate and reliable accounts as well as timely periodic financial reports; (c) safeguards assets of the project; and (d) has acceptable auditing arrangements. The FM arrangements for the PADAES will rely on the existing fiduciary arrangements in place for the ongoing PASE. These arrangements include:

- (a) an FM team familiar with the World Bank procedures. The existing FM team, comprising an administrative and financial officer and one accountant, is understaffed given the additional workload of this project and the Regional Electricity Access and BEST (P167569). The PASE PIU should finalize the ongoing recruitment of an accountant to maintain a satisfactory FM team;
- (b) a multi-project accounting software, which will easily integrate the proposed project's accounts;
- (c) an internal auditor recruited to conduct ex-post reviews of all projects supervised by the PIU;
- (d) an administrative and FM manual in place that needs to be completed with PADAES specificities procedures.

120. **The overall performance of the PASE project in FM was Satisfactory at the last FM supervision undertaken in October 2021.** The accounting system and internal control in place operate satisfactorily to handle additional activities. The auditors have issued an unqualified opinion on the 2020 financial statements of the project.

121. **The overall risk for the project is rated as Moderate.** It is considered that the FM arrangements satisfy the World Bank's minimum requirements under World Bank IPF Policy, and, therefore, are adequate to provide, with reasonable assurance, accurate and timely FM information on the status of the project required by the World Bank. As mitigation measures, the PASE' PIU will be required no later than four (4) months after effectiveness to (i) finalize the accountant recruitment and (ii) update the administrative and financial section of the Project Operation Manual (POM).



(ii) Procurement

122. **Procurement regulations.** The Recipient is procuring under the proposed project in accordance with the “World Bank Procurement Regulations for IPF Borrowers” dated November 2020 (“Procurement Regulations for IPF Borrowers”); of the “Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants” (Anti-Corruption Guidelines) dated October 15, 2006 and revised in January 2011 and as of July 1, 2016; and other provisions stipulated in the Financing Agreement.

123. **Overall procurement approach.** The implementation of Sub-component 1.1 will be through an Engineering, Procurement, Construction (EPC) approach, also known as turnkey contracts, that include the supply and installation of MV/HV equipment (conductor, poles, transformer, etc). The turnkey lots will be distributed according to the SENELEC delegations and the contract amounts will range from US\$13 million to US\$20 million (Dakar, South, Center, Center-East 1, Center-East 2 and North). The procurement of connections will be separated in three separate contracts including (i) the acquisition of single-phase prepayment meters; (ii) the acquisition of connection equipment; and (iii) their installation for 200,000 new connected customers (including the connections of 40,000 vulnerable households to be provided with readyboards under Sub-component 2.1).

124. **Procurement approach for grid densification.** Sub-components 1.1 and 1.2. will be divided as follows:

- (a) Six lots turn key EPC contracts for the Sub-component 1.1 for Supply and installation of equipment for the Extension and Densification of the MV / LV Distribution Network;
- (b) One lot for the acquisition of meters; one lot for the acquisition of connection equipment and; one lot for the installation by a service provider;
- (c) One lot for the acquisition of ready boards and for the installation of ready boards; and
- (d) One contract for the OE overseeing all MV/LV works including the connection works and installation of ready boards and meters.

125. **Procurement approach for the provision of vulnerable households with ready boards.** The supply and installation of ready boards and internal wiring for 40,000 vulnerable households under Sub-components 2.1 will be procured as a combined supply and installation contract. This integrated procurement approach will be followed to allow for adjustments of the ready board technical design and user features after an initial pilot phase during which 4,000-5,000 ready boards will be installed and household-level feedback collected.

126. **Overview of procurement arrangements.** A summary of the proposal of the Procurement Plan that reduces the total number of contracts and procurement procedures is presented in Annex 1. SENELEC has shared with the World Bank the Project Procurement Strategy for Development (PPSD) to confirm this Procurement Plan.

126. **Detailed design and tender documents.** Technical studies are expected to be finalized in the last trimester of 2022, and the OEs will be recruited prior to their finalization to actively participate in their review and prepare the bidding documentation for construction works. This would allow the start of construction within the first semester of 2023.



127. **Institutional arrangements.** As part of the execution of the activities of the PADAES, SENELEC will have the fiduciary responsibility and will carry out the procurement activities of the project. Like PASE, the project will use the Commission and the SENELEC Procurement Unit for the implementation of procurement procedures. It will be based on the PIU of PASE.

128. **Capacity and risk assessment.** This PIU has a dedicated procurement specialist and an assistant. This PASE team, responsible for procurement, has good experience of the World Bank's Directives. Since 2012, with the implementation of the PASE (P125565), SENELEC has experience in the implementation of projects financed by the World Bank, on the procedures following the January 2011 guidelines revised in July 2014 and using World Bank standard procurement documents. The PIU team was trained on the World Bank's New Procurement Framework. However, given the lack of practice of the procedures subject to the Regulations, additional training of officers is necessary.

129. **Procurement delays.** In view of the workload related to the preparation and the implementation of both the PASE and the Regional Electricity Access and BEST Project and the lack of practice of the procedures subject to the new Regulation, there are risks of delays in project implementation and procurement that may hinder the proper execution of project activities. This risk will be mitigated through additional training for the PIU and hiring of additional procurement staff.

130. **Overall procurement risk.** Based on the experience of the project and based on the above factors, the procurement risk is assessed as Moderate.

C. Legal Operational Policies

	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

D. Environmental and Social

131. **The overall project E&S Risk classification for this project is Substantial.** This project is being implemented under the Environmental and Social Framework (ESF). The project is rated Moderate for social risks and Substantial for environmental risks. This classification considers the capacity of the implementing agency and other stakeholders involved to implement activities in line with ESF requirements, the COVID-19 context, as well as sensitivity of some regions in regard with security aspects (case of Casamance). An ESRS for the project appraisal stage was prepared and disclosed on December 16, 2021.

132. **Eight of ten Environmental and Social Standards (ESS) have been considered relevant:** ESS1 (Assessment and Management of E&S Risks and Impacts); ESS2 (Labor and Working Conditions); ESS3 (Resource Efficiency and Pollution Prevention and Management); ESS4 (Community Health and Safety); ESS5 (Land Acquisition, Restrictions on Land Use and Involuntary Resettlement); ESS6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources); ESS8 (Cultural Heritage); and



ESS10 (Stakeholder Engagement and Information Disclosure). The COVID-19 context has also been considered in the development of relevant instruments. The project will rely on the PASE's E&S staff to monitor the management of E&S risks and impacts related to the project. These are: the E&S specialist (playing a coordination role), one environmental specialist, and one social specialist. Additional experts (part time consultants) will be recruited under the Regional Electricity Access and BEST Project (P167569) and, as the experts mentioned above, will also support both Regional Electricity Access and BEST Project and this project in the management of specific risks: one Occupational Health and Safety specialist, one social specialist with experience in resettlement, and one Sexual Exploitation and Abuses/Sexual Harassment (SEA/SH) specialist.

133. **Measures to mitigate risks and impacts risks have been set out in the prepared documents⁴⁰:** the ESMF in line with ESS1, (RPF) in line with ESS5, SEP including grievance mechanism (GM) in line with ESS10, Labor Management Procedures (LMP) in line with ESS2, and SEA/SH Prevention and Response Action Plan (included in ESMF)⁴¹ in line with the World Bank Good Practice Note on Addressing SEA/SH in IPF operations.

134. **Commitments regarding the management of risks are captured in the Environmental and Social Commitment Plan (ESCP)⁴²** negotiated and agreed with the GoS, including the obligation for contractors to prepare, as part of their contract, a Contractor-Environmental and Social Plan (C-ESMP) before starting the field activities. The required E&S instruments along with the timing for their preparation are captured in the ESCP. Additionally, the ESCP sets out a summary of measures (including the preparation of E&S instruments) and actions to address potential E&S risks and impacts of the project, as well as targeted training and support to the E&S specialists. If needed, the ESCP will be updated to consider findings of the subsequent E&S assessments, the World Bank E&S due diligence, and results of engagement with stakeholders.

135. **E&S standard risks.** The project will result in a range of E&S risks and impacts, all of which will need to be mitigated. While these impacts may be varied, no irreversible environmental or social impacts are expected. Potential risks and impacts are associated among others with the construction of 760 km of MV lines; 820 MV/LV distribution substations; 2,708 LV lines to expand grid coverage and maximize the number of new connections. The main E&S risks and impacts identified in frameworks documents are related to (i) potential vegetation clearing; (ii) labor and working conditions including traffic safety and labor influx; (iii) nuisances like dust and noise; (iv) poor construction-related waste management; (v) the potential impact of line construction and excavations on cultural heritage sites; (vi) occupational health and safety issues related to civil works, including contamination risk to COVID-19; (vii) impacts on birds and wildlife present in the distribution lines area; (viii) poaching; (ix) community health and safety, with potential risk related to security in Casamance; and (x) the potential acquisition of land leading to the loss or disruption of income or livelihood activities for individuals or groups of people, as well as restricting access to natural resources. However, most of the risks and impacts likely to be generated from the project activities will be site-specific, temporary, and manageable to an accepted level by applying good

⁴⁰ <https://projects.worldbank.org/en/projects-operations/document-detail/P176620?type=projects>

⁴¹ ESMF was disclosed on January 3, 2022; RPF was disclosed on December 22, 2021; SEP was disclosed on December 20, 2021; LMP was disclosed on December 17, 2021. The SEP may be revised if needed to reflect any change or development in the project or in relation to stakeholders' feedback.

⁴² ESCP was disclosed on December 16, 2021.



construction industry best practices.

136. **The ESMF has provided general expected risks and impacts as well as mitigation measures**, including guidance for the E&S screening process prior to the preparation of site-specific instruments (ESIAs/ESMPs). The assessment also considers the preparation of waste management procedures as part of C-ESMPs. Specific instruments are expected to provide a specific analysis regarding activities impacts on biodiversity, cultural heritage, and pollution.

137. **Key social concerns relate to:** civil works, economic and/or physical displacement, community health and safety as a result of traffic movements and labor influx; the presence of workers (SEA/SH, communicable disease transmission, including COVID-19, and risks to community/social cohesion); security risks in Casamance, conflicts and grievance management. Working conditions of those employed to undertake civil works activities will need to be managed in order to protect the workforce and meet Good International Industry Practices (GIIP) in relation to occupational health and safety, and physical and economic displacement.

138. **Mitigation measures for site-specific impacts will be managed through the implementation of required E&S risk management documents (ESIA/ESMP; RAP).** These documents will be prepared as per the result of the E&S screening process, in line with ESMF guidance, and disclosed on both in-country and on the World Bank external website. Risks include variation in institutional capacity and readiness; physical and/or economic displacement impacts from project activities; and risks related to SEA/SH; and the exclusion of women from project benefits. Persons with disabilities, the landless, elders and youth may also be excluded from decision-making, resettlement benefits, consultation, job access, and access to electricity if the project is not properly monitored or designed. Without the proper stakeholder engagement activities in place, there also is a risk of elite capture. Land acquisition with possible physical and/or economic displacement will require inclusive and transparent consultation with affected persons/communities and assessment of risks and impacts on vulnerable groups (including women/children, and others). Other risks include labor risks (including child labor); community health and safety; and stakeholder risks. Given the expanded scope of the ESF and the lack of experience and familiarity with the ESF in the PIU the Recipient's institutional capacity to implement the project under the ESF is considered weak.

139. **Timing of works.** Works will not start before disclosure of site specific instruments and eventual compensations paid by SENELEC.

140. **SEA/SH.** The project has a moderate risk of SEA/SH. The project will be implemented in urban, peri-urban and rural areas in all 14 regions of the country. The electrification activities will be carried out at essential public facilities such as clinics or schools, which women and girls may access in their daily activities. This risk level could likely increase for several reasons such as the direct access that project actors will have to decisions affecting women and girls through activities supporting the promotion of productive uses (vulnerable groups such as women and girls will be identified for business transformation, processing of agricultural products and even equipment acquisition). In line with this level of risk, the recommendations of the Good Practice Note on addressing Sexual Exploitation and Abuse and Sexual Harassment in the Context of Financing Investment Projects Involving Major Civil Works will apply. This will involve the development of a SEA/SH mitigation plan which will include a code of conduct (CoC),



included in the ESMF, for workers and project staff addressing SEA/SH behaviors and sanctions for non-compliance, awareness-raising activities for workers and communities on SEA risks, and an accountability and response framework for dealing with SEA/SH complaints in a confidential and ethical manner, with a survivor-centered approach, including referral pathways to assist potential survivors.

141. **Strengthening of GBV-specific skills.** To enhance capacity, a SEA/SH specialist will be hired in the PIU to support project implementation. For supervision, a social/environmental specialist must be included in the Owner Engineer's team with GBV-specific skills to supervise issues related to SEA/SH (e.g., supervise signing of CoCs, verify working GM for SEA/SH is in place, refer cases where needed) and work with GBV service providers as entry points into service provision to raise awareness of the GM.

142. **Organizational capacity and competency.** Institutional and implementation arrangements of the project will build on existing strengths of the ongoing PASE: presence of E&S specialists familiar with World Bank Operational policies, with experience in conducting E&S screening for sub-projects, include E&S clauses in bidding documents, conduct field supervision missions. Gaps and weaknesses mainly related to the lack of familiarity of clients with the ESF and ESSs requirement, will be addressed through capacity building and training sessions, especially regarding stakeholders' engagement, labor management, Occupational Health and Safety, consideration of vulnerable, address SEA/SH will be organized by the World Bank, with the support of key consultants throughout the life of the project. The PIU will work closely with contractors to ensure that Quality Control and Occupational Health and Safety plans are in place and meet World Bank requirements.

143. **Monitoring and reporting.** The ESMF, and site-specific instruments to be prepared include/will include monitoring commitments. The ESMPs that will be elaborated for contractors/subcontractors to be hired for the civil works, will also include monitoring commitments. The World Bank will require E&S monitoring performance reporting during implementation on a quarterly basis.

144. **Contracted workers.** Contractor and subcontractor recruitment plans will be critical to ensure transparency in local hiring and in meeting project labor procedure requirements.

145. **Grievance Mechanism (GM).** A project-specific GM is set up in the SEP to handle complaints and issues. The GM is specially designed to collect, collate, review and redress stakeholders' concerns, complaints, and grievances. This process will be carried out using dedicated communication materials, which will be developed to help stakeholders become familiar with the grievance redress channels and procedures. The GM will be accessible and understandable for all stakeholders in the project and for the entire project life. The GM will be communicated to all relevant stakeholders and will also be applicable for any contractor that will provide service for the project during the construction and operations phase. The GM includes measures for the management of SEA/SH incidents, detailing the procedures, entry points, GBV service referrals and accountability mechanisms for complainants. The GM is expected to be operational three months after the effectiveness of the project financing.

Gender

146. **Gender Gaps – status quo.** Despite continuing inequalities, the condition of Senegalese women has improved substantially in recent years. For example, female-to-male employment ratio in Senegal



increased alongside the average years of education of working-age women, helping in reducing crucial gender gaps. However, important gaps that could be addressed through access to electricity remain, for example for productivity, time-poverty as well as lower employment and entrepreneurship opportunities, all of which hinder progress (Annex 3).

147. **Project-relevant gender gaps.** Several dimensions addressed by the project present an important gender gap: even though female-headed households do not seem to be disadvantaged for their access to electricity in Senegal, the issue of women's time poverty needs to be considered. Namely an increase in access would substantially benefit women due to their disproportionate higher load from domestic tasks who can therefore save an important amount of time when electricity is available and if they can access time-saving electrical appliances. Also, entrepreneurship opportunities for women are constrained; only 14.1 percent of firms in Senegal have women in top management positions, slightly below the SSA average and considerably below the global average.

148. **Sector-specific gender gaps.** Moreover, Senegalese women are underrepresented in the energy sector. In the electricity, water and gas industry labour force, 87 percent of the employees are men. Specifically, at SENELEC, the representation of women employees was found to be over 20 percent across all posts and for managerial positions but only 7.4 percent in technical positions, who are mostly supervisors and workers (86 percent), responsible for carrying out field activities as fitters, recorders, mechanics, roundsmen and technical controllers.

149. **Proposed key gender-related project activities.** The project can, therefore, support activities to close identified gender gaps in the energy sector such as: (a) encouraging individual consumers, communities and women-led businesses to connect and/or to adopt productive uses of electricity and facilitating access to equipment that target women's time poverty and increase entrepreneurship opportunities for disadvantaged populations; and (b) increasing opportunities for women to be recruited, retained and promoted in the energy sector workforce, in particular in technical positions at key public institutions by addressing the main barriers linked to the absence of equal employment measures and gender policies. In addition, opportunities for strengthening the school-to-work transition pipeline will be explored.

150. **Pending gender assessments.** Additional assessments will be conducted on (i) potential barriers for access and uses of electricity, including affordability, access to information, productive uses of electricity for on-farm and off-farm activities, as well as electricity access and use in the informal sector; (ii) mechanisms to promote time-saving equipment and appliances that could be deployed in rural areas with the objective of reducing women's time poverty; and (iii) ways to improve recruitment, retention, and promotion of women in technical positions at SENELEC.

151. **M&E.** Dedicated indicators will track progress of gender interventions, including for the percentage of SMEs managed or owned by women provided with new or improved electricity services, with the target of 30 percent among the firms that benefit from this support being more than double of the prevalence of women-led enterprises in Senegal. A specific indicator for the participation of these kinds of businesses participating in business development programs linked to productive uses of energy is also included. An additional indicator with a target percentage of 10 percent for women employed in technical jobs at SENELEC will monitor the increase of women in these type of positions from the current



baseline of 7.4 percent. Other output and gender-related indicators will be included in the POM.

Citizen engagement

152. **Critical importance of citizen engagement in electricity access projects.** The project has integrated citizen engagement interventions throughout the implementation through periodic consultations and an effective GM to ensure that the project impact and development objectives are sustainable; that is, households and MSMEs consuming electricity.

153. **Project citizen engagement mechanisms.** Citizen engagement interventions will build on consultation activities and GM to enhance beneficiaries' voice and participation throughout the implementation of the project. Through periodic consultations and an effective grievance redress mechanism (GRM), beneficiaries' feedback will help build community ownership and thereby reinforce the project's impact and sustainability. The SEP was developed after extensive consultations with the GoS and other partners including non-governmental organizations has provided the basis for identification of stakeholders that will be targeted by citizen engagement interventions. The POM will include a specific section on citizen engagement mechanisms and interventions such as public consultations, consultations with affected communities, focus groups and how the feedback will be integrated into project activities. The feedback received from the periodic consultations will be integrated into the Project interventions and will inform course corrections as and if necessary, during implementation. In addition to the consultations, the project will develop a GM to address complaints effectively and in a timely manner. The GM will be supported by communication activities and will ensure that all project stakeholders are aware of the GM uptake locations and the procedures for submitting and processing complaints.

154. **Proposed awareness building activities.** As previously noted, the project will support activities to increase the awareness of citizens on (i) the SENELEC application process for requesting a connection to the grid; (ii) the benefits of the program for vulnerable households and SMEs (Sub-component 2.1.); and (iii) the safe and efficient use of electricity, as well as its productive uses. It is particularly important that potential beneficiaries from Sub-components 1.1 and 2.1 are contacted and informed well in advance of the actual opportunities to connect as time may be required to a) save money for interior wiring (for the non-RNU connections), and collect the requisite documentation needed to apply for a connection. Furthermore, existing information on the use of the Woyofal meters, such as tracking daily and monthly consumption, needs to be provided to potential customers and potentially adapted for customers with a low literacy level. Communication outreach, including specific gender-sensitive awareness campaigns and information, will be conducted to inform the citizens about the diverse advantages of electricity service, whether in terms of income-generating opportunities, labor-saving devices, or quality of life benefits. Events at the community level will be organized by the project in close collaboration with the SENELEC. Both newly connected and existing customers will be informed about the role of the call center at SENELEC, as the formal platform for customers to provide feedback on the quality of service.

V. GRIEVANCE REDRESS SERVICES

155. Communities and individuals who believe that they are adversely affected by a WB supported project may submit complaints to existing project-level GRMs or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's



Independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and World Bank Management has been given an opportunity to respond. Information on how to submit complaints to the GRS is provided at: <http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service>. Complaints may be submitted to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

VI. KEY RISKS

156. **Overall risk is Moderate as several factors could jeopardize expected outcomes and benefits.** These include: (i) tight financial conditions possibly affecting government transfers to SENELEC; (ii) lack of clear leadership, planning and coordination for universal access; and (iii) E&S risks. The project design, the relative strength of Senegalese institutions, and the continuous dialogue with key counterparts and donors are important mitigating factors.

157. **Risks related to macroeconomics are Substantial.** A key factor is the depth and duration of the COVID-19 pandemic, the speed at which the vaccine is rolled-out (globally and locally), government policies to mitigate and contain any further outbreaks, and the impact of the pandemic on the production and associated shipping logistics for equipment and materials. Tighter than expected financial conditions in international markets and tensions in international trade may put pressure on financing the current account deficit and affect central government's transfers to SENELEC, the implementing agency of PADAES. **Mitigation measures:** As the above risk are related to Senegal's macro-environment, they cannot be entirely mitigated through measures by the proposed operation itself. The above risks will however be addressed through fiscal support measures and budget reforms under the proposed First Equitable and Resilient Recovery DPF (P172723). Moreover, Government's comprehensive and determined response to support poor and vulnerable households and firms, while staying committed to fiscal and debt sustainability and supported by the Central Bank of West African States (*Banque Centrale des États de l'Afrique de l'Ouest*, BCEAO) monetary policy tools mitigates these risks. The project will monitor closely the financial situation of SENELEC, to avoid any negative impact on the pace of the connection of households. Pandemic issues that may specifically impact the project will be mitigated through proper health and safety planning and advance planning with respect to construction and equipment procurements.

158. **Risks related to sector strategy and policies are Substantial.** The strategy for universal access, described in the Operational Plan for Universal Access, needs to be optimized as it does not follow a transparent least cost approach based on technoeconomic criteria and other stated GoS priorities. Consequently, several donors have been conducting their own studies to prepare rural electrification projects, resulting in uncoordinated efforts and risks of duplication. **Mitigation measures:** The World Bank will support the GoS with the realization of an electrification plan based on geospatial analysis and a least cost approach. This plan will be used by the country and its financial partners as the unique operational document to implement the UAP. In addition, the World Bank will support the MPE in effectively steering this project, through the financing of the PIU supporting the Steering Committee and targeted capacity building. Close coordination with other donors will be maintained throughout the Project to further ensure complementary and coordinated efforts.



159. **The E&S risk is Substantial.** As described in section D, no irreversible environmental risks and impacts are anticipated, and the majority of the risks and impacts likely to be generated from the project activities will be site-specific, temporary, and manageable to an acceptable level by applying industry best practices for construction.⁴³ **Mitigation measures:** Required instruments have been carefully prepared with the client and publicly disclosed, as required by the ESF. Furthermore, it will be important to prioritize the ESMPs and RAPs once the specific locations for Sub-component 1.1 are finalized in the geospatial analysis.

⁴³ See section



VII. RESULTS FRAMEWORK AND MONITORING

Results Framework

COUNTRY: Senegal

Senegal Energy Access Scale Up Project

Project Development Objectives(s)

Increase access to electricity services for households, enterprises, and critical public facilities in Senegal.

Project Development Objective Indicators

Indicator Name	PBC	Baseline	Intermediate Targets	End Target
			1	
Increase access to electricity services for households, enterprises, and critical public facilities				
People provided with new or improved electricity service (Number)		0.00	790,000.00	1,580,000.00
Of which urban (Percentage)		0.00	60.00	60.00
Of which rural (Percentage)		0.00	40.00	40.00
Of which women (Number)		0.00	395,000.00	790,000.00
Micro, small and medium-sized enterprises provided with new or improved electricity services (Number)		0.00	350.00	700.00
Female-managed and/or female-owned (Percentage)		0.00	30.00	30.00
Public institutions provided with new or improved electricity service (Number)		0.00	400.00	800.00



Indicator Name	PBC	Baseline	Intermediate Targets	End Target
			1	
Health clinics (Number)		0.00	300.00	600.00
Schools (Number)		0.00	100.00	200.00

Intermediate Results Indicators by Components

Indicator Name	PBC	Baseline	Intermediate Targets	End Target
			1	
Component 1: Grid densification and extension				
Lines constructed, reinforced or rehabilitated under the project (Kilometers)		0.00	1,735.00	3,470.00
MV lines constructed, reinforced or rehabilitated under the project (Kilometers)		0.00	380.50	761.00
LV lines constructed, reinforced or rehabilitated under the project (Kilometers)		0.00	1,354.50	2,709.00
Distribution assets financed under the project are resilient to flooding (Percentage)		0.00	100.00	100.00
Additional distribution transformer capacity installed (Kilovolt-Amphere(KVA))		0.00	22,875.00	45,750.00
Households provided with new electricity service under the project (Number)		0.00	100,000.00	200,000.00
Overall SENELEC recovery rate (Percentage)		81.50	84.00	85.20
Component 2: Electricity Access for a Resilient and Inclusive Post COVID-19 Recovery				
Adoption of a lifeline connection policy for vulnerable households (Yes/No)		No	Yes	Yes
Vulnerable households connected to the grid under the project (Number)		0.00	20,000.00	40,000.00



Indicator Name	PBC	Baseline	Intermediate Targets	End Target
			1	
Beneficiaries of a technical assistance promoting productive use of electricity (Number)		0.00	100.00	200.00
of which women (Percentage)		0.00	50.00	50.00
Component 3: Capacity building and implementation support				
Least cost geospatial electrification plan developed and adopted by the Universal Access Program Steering Committee (Yes/No)		No	Yes	Yes
Consumer awareness campaign developed and implemented (Yes/No)		No	Yes	Yes
People trained in technical, planning, and management areas (Number)		0.00	150.00	250.00
Percentage of women in technical positions at SENELEC (Percentage)		7.40	8.50	10.00
Grievances received and addressed within the project Grievance Mechanism specific timeframe (Percentage)		0.00	100.00	100.00

Monitoring & Evaluation Plan: PDO Indicators					
Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
People provided with new or improved electricity service	The indicator will measure the number of people provided with access to electricity under the project by household connections.	Annually	Project progress report and SENELEC annual	Compilation of evidences of connections	M&E specialist at the PIU and SENELEC



	The average number of people per household is estimated at 7,9 by 2025 in Senegal Distribution Masterplan 2019-2035		report.		
Of which urban	The indicator will measure the number of women provided with access to electricity under the project by household connections.	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and Senelec
Of which rural	The indicator will measure the percentage of people provided with access to electricity under the project in rural areas.	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and Senelec
Of which women	The indicator will measure the number of women provided with access to electricity under the project by household connections.	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and Senelec
Micro, small and medium-sized enterprises provided with new or improved electricity services	This indicator will measure the number of small and medium enterprises provided with new or improved electricity services under the project	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and SENELEC



Female-managed and/or female-owned	This indicator will calculate the percentage of female-headed enterprises out of the total enterprises provided with new or improved electricity service under the project	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and Senelec
Public institutions provided with new or improved electricity service	This indicator will measure the number of public institutions (clinics, and/or schools, and/or administrative centers) provided with new or improved electricity service under the project.	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and Senelec
Health clinics	This indicator will measure the number of public institutions (clinics, and/or schools, and/or administrative centers) provided with new or improved electricity service under the project.	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and Senelec
Schools	This indicator will measure the number of public institutions (clinics, and/or schools, and/or administrative centers) provided with new or improved electricity service	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and Senelec



	under the project.				
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Monitoring & Evaluation Plan: Intermediate Results Indicators

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Lines constructed, reinforced or rehabilitated under the project	This indicator will measure the length of total lines constructed or rehabilitated under the project.	Annually	Project progress report and Senelec annual report.	Compilation of evidences such as reception reports, final drawings, GPS coordinates and geospatial data base.	M&E specialist at the PIU and SENELEC
MV lines constructed, reinforced or rehabilitated under the project	This indicator will measure the length of MV lines constructed or rehabilitated under the project	Annually	Project progress report and SENELEC annual report.	Compilation of evidences such as reception reports, final drawings, GPS coordinates and geospatial data base.	M&E specialist at the PIU and SENELEC
LV lines constructed, reinforced or rehabilitated under the project	This indicator will measure the length of LV lines constructed or rehabilitated under the project	Annually	Project progress report and SENELEC annual report.	Compilation of reception reports, final drawings, GPS coordinates and geospatial data base	M&E specialist at the PIU and SENELEC
Distribution assets financed under the project are resilient to flooding	This indicator will verify if the design of constructed lines includes strengthening	Annually	Project progress report and	Compilation of evidences such as reception reports, and	M&E specialist at the PIU and Senelec



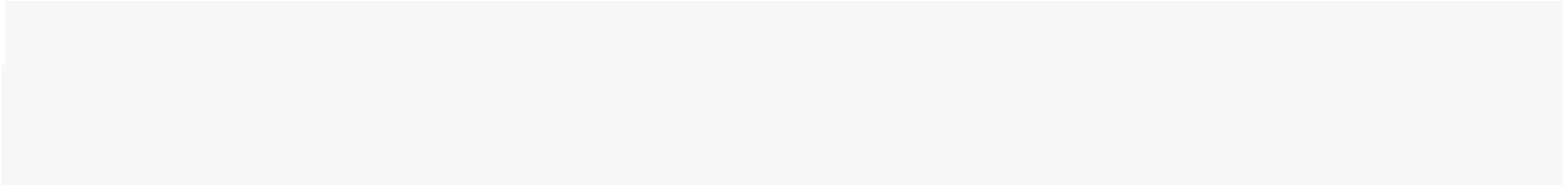
	measures to increase resiliency to flooding		Senelec annual report.	final drawings. The percentage will be equal to the total length of constructed MV lines (km) that are resilient to flooding divided by the end target (km)	
Additional distribution transformer capacity installed	This indicator will calculate the additional distribution transformer capacity installed under the project.	Annually	Project progress report and Senelec annual report.	Compilation of evidences such as reception reports	M&E specialist at the PIU and Senelec
Households provided with new electricity service under the project	This indicator will measure the number of households connected to the grid under the project.	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and Senelec
Overall SENELEC recovery rate	It is the total energy billed divided by the total energy dispatched.	Annually	Senelec's performance contract	Review of performance contract	M&E specialist at the PIU and Senelec
Adoption of a lifeline connection policy for vulnerable households	This indicator will verify the adoption of a lifeline connection policy	Annually	Government and Senelec websites	Collection of a copy of the decision	Ministry of Petroleum and Energy and SENELEC



Vulnerable households connected to the grid under the project	The indicator will measure the number of vulnerable people integrated in the National Registry (Registre National Unique -RNU) provided with access to electricity under the project by household connections.	Annually	Project progress report and Senelec annual report.	Compilation of evidences of connections	M&E specialist at the PIU and Senelec
Beneficiaries of a technical assistance promoting productive use of electricity	The indicator will measure the number of people who took part in the business development program financed under the project.	Annually	Project progress report and Senelec annual report.	List of participants	Ministry of Petroleum and Energy
of which women	The indicator will measure the percentage of females who took part in the business development program financed under the project.	Annually	Project progress report and Senelec annual report.	List of participants	Ministry of Petroleum and Energy
Least cost geospatial electrification plan developed and adopted by the Universal Access Program Steering Committee	This indicator will verify the adoption of a Least cost geospatial electrification plan, as the core document to update and implement the Universal Access Program	Annually	Government website	Collection of a copy of the decision	Ministry of Petroleum and Energy and SENELEC
Consumer awareness campaign developed and implemented	This indicator will verify the realization of a consumer awareness campaign aiming	Annually	Government website	Collection of a copy of the decision	Ministry of Petroleum and Energy and SENELEC



	to increase the awareness of citizens on (i) the SENELEC application process for requesting a connection to the grid, (ii) the benefits of the project offered to vulnerable households and MSMEs (sub-component 2.1.) and (iii) the safe and efficient use of electricity				
People trained in technical, planning, and management areas	This indicator will measure the number of sector staff benefiting from technical, planning, and management trainings under the project	Annually	Project progress report and Senelec annual report.	List of participants	M&E specialist at the PIU and SENELEC
Percentage of women in technical positions at SENELEC	This indicator will measure the percentage of women that hold a technical position at Senelec.	Annually	Project progress report and Senelec annual report.	List from Human Resources	M&E specialist at the PIU and Senelec
Grievances received and addressed within the project Grievance Mechanism specific timeframe	This beneficiary feedback indicator will measure the percentage of grievances received that have been addressed within the project Grievance Redress Mechanism specific timeframe.	Annually	Project progress report and Senelec annual report.	Compilation and evidences	M&E specialist at the PIU and Senelec





ANNEX 1: Implementation Arrangements and Support Plan

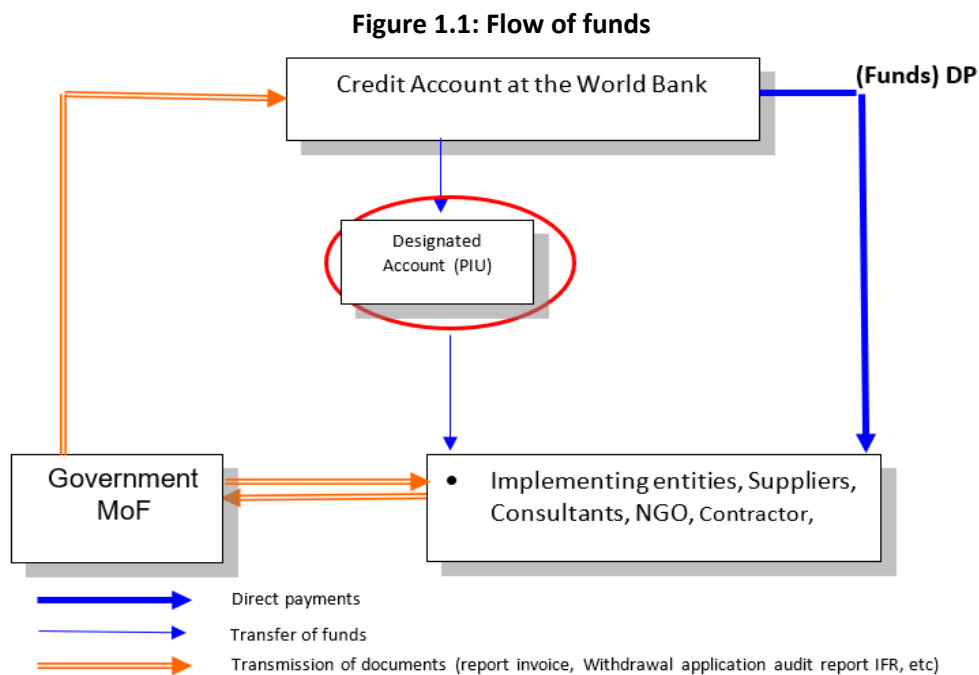
Financial Management

- Accounting arrangements.** The FM team is understaffed given the additional workload of this project and another upcoming project. The PASE PIU is finalizing the ongoing accountant recruitment to reinforce the team. The SYSCOHADA is the current accounting standards in use for ongoing World Bank-financed projects in Senegal and will be applicable. Annual financial statements will be prepared by the PIU in compliance with SYSCOHADA standards. The PIU will customize the existing multi-project accounting software to include the bookkeeping of the project.
- Budgeting arrangements.** The project will prepare an annual budget based on agreed annual work program. The budget should be adopted before the beginning of the year and its execution will be monitored on a quarterly basis and reports of budget monitoring and variance analysis will be prepared and included in the Interim Financial Report (IFR). Annual draft budgets will be submitted to the steering committee who have the oversight role and then be submitted to the World Bank for non-objection no later than November 30, every year.
- Financial Reporting arrangements.** The PIU will prepare each quarter an IFRs for the project in form and content satisfactory to the World Bank. These IFRs will be submitted to the World Bank within 45 days after the end of the quarter to which they relate. FM team will prepare Project' Financial Statements in compliance with SYSCOHADA and World Bank requirements.
- External auditing arrangements.** The Disbursement and Financial Information letter (DFIL) will require the submission of Audited Financial Statements for the project to IDA within six months after the end of each fiscal year end by an auditor with qualifications and experience satisfactory to the World Bank. The audit report should reflect all the activities of the project. The ToR of the external auditor of the PASE were revised to include external audit of the project. Following the World Bank's formal receipt of these statements from the Recipient, the World Bank also makes them available to the public.
- Internal control and internal auditing arrangements.** An annex to the existing manual will be set up to provide a description of administrative and financial procedures for specific aspects of the project. The current internal auditor will carry out ex-post reviews for the project. The internal auditor's work program is updated to include ex-post reviews of the project in a quarterly basis.
- Banking arrangements.** A designated account (DA) for the project will be opened in commercial banks acceptable to IDA. The DA will be managed by the Directorate of Public Expenditure Management (*Direction de l'Ordonnancement des Dépenses Publiques, DODP*) of the entity assigned with the overall responsibility of payments. Arrangements for the management of the DA will be described in the updated manual, and in the DFIL.
- Disbursement arrangements.** Disbursements would be transactions-based whereby withdrawal applications will be supported with Statement of Expenditures (SOE). The following disbursement



methods may be used under the project: reimbursement, advance, direct payment and special commitment as specified in the DFIL and in accordance with the Disbursement Guidelines for IPF, dated September 2021. Documentation will be retained at the PIU for review by World Bank staffs and auditors. The DFIL will provide details of the disbursement methods, required documentation, Das ceiling and minimum application size. These arrangements have also been discussed and agreed during negotiations of the Financing Agreement.

8. **Flow of funds arrangements.** Flow of funds arrangements for the project is presented in Figure 1.1 below:



9. **FM action plan.** The following actions need to be taken in order to enhance the FM arrangements for the project:

Table 1.1: FM Action Plan

Action	Date due by	Responsible
<ul style="list-style-type: none"> Finalize the accountant recruitment (under Regional Electricity Access and BEST Project financing); Update the administrative and financial section of the POM 	Four months after effectiveness	PIU/PASE

10. The Table 1.2 specifies categories of eligible expenditures.



Table 1.2: IDA Credit Categories of Eligible Expenditure

Category	Amount of Credit Allocated (expressed in EUR)	Percentage of Expenditures to be Financed (inclusive of Taxes)
(1) Goods, works, non-consulting services, and consulting services, Incremental Operating Costs and Training for Parts (1), (2) and (3) of the project	132,600,000	100%
(2) Emergency Expenditures under Part 4 of the project	0	
TOTAL AMOUNT	132,600,000	

Procurement

11. Procurement regulations. The Recipient is procuring under the proposed project in accordance with the "World Bank Procurement Regulations for IPF Borrowers" dated November 2020 ("Procurement Regulations for IPF Borrowers"); of the "Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants", dated October 15, 2006 and revised in January 2011 and as of July 1, 2016; and other provisions stipulated in the Financing Agreement.

12. Procurement capacities and risk assessment. The fiduciary responsibility rests with SENELEC which will carry out the procurement activities of the project. As part of the execution of the activities of the PADAES, SENELEC will have the fiduciary responsibility and will carry out the procurement activities of the project. Like PASE, the project will use the Commission and the Procurement Unit of SENELEC for the implementation of procurement procedures. SENELEC will rely on the PIU of PASE which has a dedicated procurement specialist and an assistant. This PASE team, responsible for procurement, has valuable experience on the World Bank's Directives. Since 2012, with the implementation of the PASE 1 and PASE 2. SENELEC has experience in the implementation of projects financed by the World Bank, on the procedures following the Directives of January 2011 revised in July 2014 and the use of standard tender documents of the World Bank. The PIU team was trained on the World Bank's New Procurement Framework. However, given the lack of practice of the procedures subject to the Regulations, additional training of officers is necessary. In addition, in view of the workload related to the preparation of the project and the implementation of the PASE and the Regional Electricity Access and BEST Project (P164044), the team will need to be reinforced by another procurement specialist.

13. On the use of STEP, the last procurement review of the PASE found that all project activities are registered in STEP, successive updates are subject to the World Bank's approval. The review noted a good improvement in the archiving of documents in STEP. Also, the review noted an overall satisfactory execution of procurement procedures, including the preparation of tender documents, requests for proposals, evaluation of bids / proposals, award, and publication of contracts. However, some areas for improvement were noted.

14. Mitigation measures. The following mitigation measures were agreed: (a) strengthening of the team by the recruitment of a procurement specialist; (b) training of staff on the World Bank's procurement procedures, particularly on the Procurement Regulations steps; (c) updating the implementation manual



to support the specificities of the procurement regulations; (d) improvement of the contract management system; (e) streamlining of procurement procedures; (f) improving and systematizing the archiving of documents related to the award and execution of contracts in STEP; and (g) ensuring the ongoing update of SENELEC's supplier database to ensure that those invited have the required qualifications and are interested in the services.

15. **Supply of material risk assessment.** Based on the experience of the project and based on the above factors, the risk is assessed as Moderate.

16. **Advertisement:** The Recipient shall prepare and submit to the World Bank a General Procurement Notice (GPN) and the World Bank will arrange for publication of GPN in United Nations Development Business (UNDB) online and on the World Bank's external website. The Recipient may also publish it in at least one national newspaper.

17. The Recipient shall publish the Specific Procurement Notices (SPN) for all goods, works, non-consulting services, and the Requests for Expressions of Interest (REOIs) on their free-access websites, if available, and in at least one newspaper of national circulation, and in the official gazette. For open international procurement selection of consultants using an international shortlist, the Recipient shall also publish the SPN in UNDB online and, if possible, in an international newspaper of wide circulation; and the World Bank arranges for the simultaneous publication of the SPN on its external website.

18. **Procurement manual.** The PASE has an POM including a section on procurement and execution procedures, describing procurement modalities, roles and responsibilities, methods, and requirements. This manual, validated by the World Bank, will require an update to take into account the new specificities of the procurement regulations applicable to this project. The manual will be updated by the Recipient and agreed with the World Bank no later than four months following the entry into force of the project.

19. **Procurement methods.** The project will be based on procurement methods and procurement approach in accordance with the Procurement Regulations and as described in the PPSD.

20. **Procurement documents.** In the event of competitive and international procurement of goods, works and services other than consultancy services, the Recipient must use the applicable standard procurement documents of the World Bank with a minimum of modifications deemed acceptable to the World Bank to meet any specific project conditions, if necessary.

21. The national open market approach is a competitive bidding process usually used for public procurement in the Recipient's country, it can be used to purchase goods, works or services. other than those of consultants, provided that it meets the requirements of paragraphs 5.3 to 5.6 of the Procurement Regulations.

22. Operational costs financed by the project, if any, will be additional expenses, including office supplies, communication costs, rental fees, expenses for utilities, consumables, transport, and housing. per day, supervision costs and salaries of locally recruited support staff. This service will be procured based on procurement procedures stipulated in the POM, accepted, and approved by the World Bank.



23. **PPSD.** As part of project preparation, the Recipient has developed the PPSD, describing the extent to which procurement activities are able to support project operations for the achievement of project development objectives and deliver value for money (VfM). The PPSD considers the institutional arrangements for procurement; roles and responsibilities; thresholds, procurement methods, and due diligence as well as requirements for performing procurement. It also includes a detailed assessment and description of the Government's capacity to execute procurement and manage contract implementation within an acceptable governance structure and accountability framework. Other points considered will be market behaviors, trends, and capacities (i.e. market analysis) to inform the Procurement Plan. The PPSD concludes that the operational context allows the transparent and successful execution of the contracts that are to be implemented by this project.

24. **Procurement plan.** The initial procurement plan covering the first 18 months of project implementation was approved during negotiations. It will be updated by the procurement entity annually or as needed to reflect needs during project implementation. Updates to the Procurement Plan will be submitted to the World Bank for no objection and the PPSD will be updated accordingly.

Table 1.3: Major contracts for Components 1, 2 and 3

Component	Description	Estimated Total Cost (in US\$) and Risk Level	Contract Type	Review	Selection Methods/ Market Approach	Evaluation Methods	Comment
1.1	Densification and extension of the distribution network	91,500,000 Moderate	Works	Prior	Request for bids Open International	Qualifying criteria/lowest evaluated cost	Works contract with six lots
1.1, 2.2, 2.3	Meters (160,000 clients + 40,000 vulnerable + health centers + schools + MSMEs)	6,900,000 Moderate	Goods	Prior	Request for bids Open International	Qualifying criteria/lowest evaluated cost	One contract
1.1, 2.2, 2.3	Connection equipment (160,000 clients + 40,000 vulnerable + health centers + schools + MSMEs)	21,450,000 Moderate	Goods	Prior	Request for bids Open International	Qualifying criteria/lowest evaluated cost	One contract
1.1, 2.2, 2.3	Connection + Meters (160,000 clients + 40,000 vulnerable + health centers + schools + MSMEs)	5,150,000 Moderate	Works	Post	Request for bids Open International	Qualifying criteria/lowest evaluated cost	One contract
3.1	Outreach and Communication campaign	700,000 Low	Consulting Services	Post	QCBS Open International	Technical and financial scores combined	TBD
1.2	OE for Sub-components 1.1,	9,000,000 Moderate	Consulting Services	Prior	QCBS Open	Technical and financial scores	Contract with two



Component	Description	Estimated Total Cost (in US\$) and Risk Level	Contract Type	Review	Selection Methods/ Market Approach	Evaluation Methods	Comment
	2.1, 2.2, and 2.3				International	combined	lots: North (DAKAR , DRCO, DRN) / South (DRCE-1, DRCE-2, DRS)
2.1	Ready Board Base Option (40,000 vulnerable)	5,000,000 Moderate	Works	Post	Request for bids Open International	Qualifying criteria/lowest evaluated cost	One contract
3	Acquisition of 4x4 Vehicles and Motorcycles for SENELEC and SPE-MPE	1,000,000 Low	Goods	Prior	Request for bids Open International	Qualifying criteria/lowest evaluated cost	Two contracts

PIU and Steering Committee

25. Figures 1.2 and 3 show the structure of the PIU as well as the strategic oversight of the Universal Access Program by MPE as described in section III.A.



Figure 1.2: Structure of the PIU⁴⁴

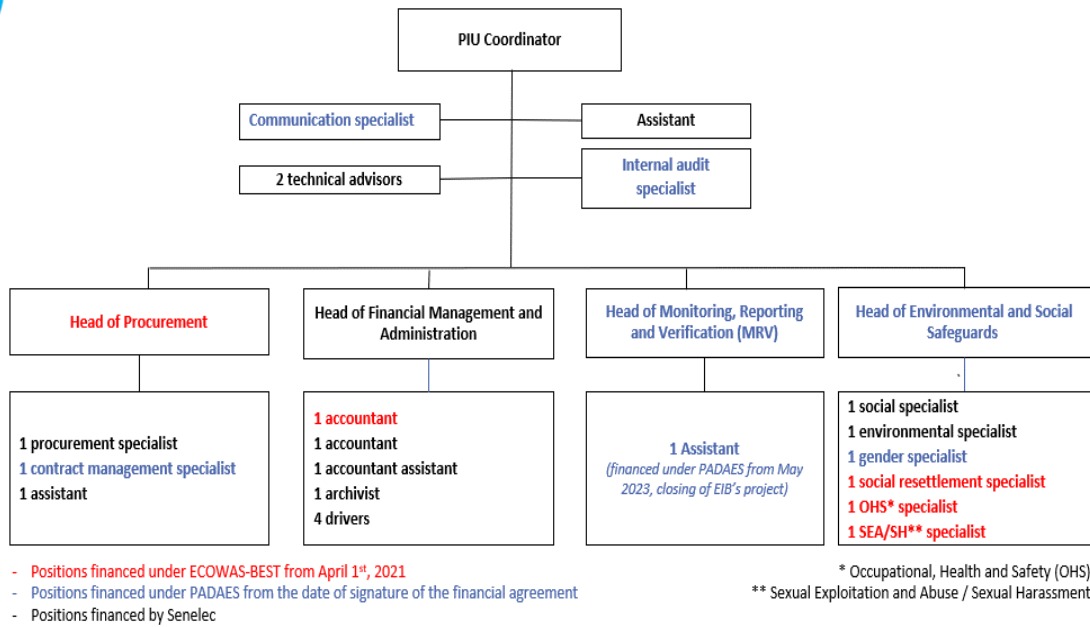
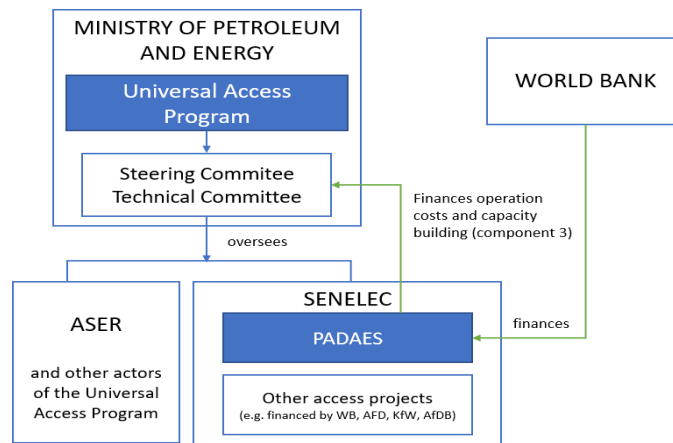


Figure 1.3: Strategic oversight of the MPE



Implementation Support Plan and Resource Requirements

26. **Implementation support plan.** Implementation support will initially focus on providing the technical support needed for accelerating the preparation and launching of bidding documents for the grid densification activities under Component 1 of the project. Moreover, the existing PIU, which has gained experience on the use of World Bank procedures and on the implementation of similar projects, will be further reinforced to meet additional capacity and implementation needs and ensure continued compliance with key IDA provisions including on procurement, fiduciary aspects, safeguards, governance, ACG etc. In addition, several Owner Engineers will be hired to provide support to SENELEC to adequately

⁴⁴ The safeguard team will also include a consultant that will be funded by EIB to focus on EIB's activities.



supervise all related works and activities. The plan is presented below:

Table 1.4: Overall implementation support plan

Time	Focus	Skills Needed	Resource Estimate
First 12 months	<ul style="list-style-type: none"> Reinforce PIU Recruit supervisory engineers Capacity building (safeguard, FM, Procurement) Finalize investments design and bidding documents Procurement Safeguard assessments and implementation 	Task management Technical staff Safeguards FM Procurement	US\$200,000
12–48 months	<ul style="list-style-type: none"> Technical implementation support Social and environmental safeguard implementation support Gender mainstreaming activities support M&E implementation support FM and procurement implementation support 	Specialists in: energy, social, environment, gender, M&E, FM, procurement	US\$800,000

Table 1.5: World Bank team skills mix

Skills Needed	Annual Number of Staff Weeks	Annual Number of International Trips	Comments
Senior energy specialist (Task Team Leader)	20	0	Field based
Senior energy specialist (Co-Task Team Leader)	14	0	Field based
Energy specialist	6	2	HQ based
Senior energy economist	4	1	HQ based
Consultant (Extended-Term Consultant)	8	2	HQ based
Financial analyst	6	1	HQ based
Procurement specialist	6	0	Field based
Social safeguard specialist	8	2	Field based
Environmental safeguard specialist	8	0	Field based
Gender specialist	4	1	Field based
FM specialist	6	0	Field based
M&E specialist	6	1	HQ based



ANNEX 2 – Disaster and Climate Risks in Senegal

Climate Vulnerability Context

1. This annex details the climate and hazard risks for which data is available that may inform the design, siting and other aspects of the project to increase the resilience of the assets and operation. The proposed project is designed to improve overall technical capabilities and informational resources for operation of the power system. Considerations of existing and future climate and hazard risks may affect the sustainability of the project and are detailed in this annex. Of particular risk, Table 2.1, are flooding (high in most regions for coastal, urban and river flood risk), wildfires (high risk in all regions), water scarcity, and extreme heat (medium to high current risk, with expected increases as climate change continues).

2. National level estimates for climate changes show a median increase in temperature above 4°C in nearly all months by the end of the century, with the 90th percentile estimates exceeding 6°C⁴⁵. Changes in precipitation show a median value with little deviation from current levels except for slight increases in June-November, where the 10th and 90th percentiles project changes of -81 mm to +105 mm in the months of August and September, respectively. These changes may exacerbate existing natural hazard events, Table 2.1, which show high risk in many locations for flooding, water scarcity, wildfire and heat⁴⁶. Climate change is particularly expected to impact sea level rise, posing challenges for coastal populations and infrastructure.

Table 2.1: Hazard Risks

	Coastal Flood	Urban Flood	River Flood	Wildfire	Extreme Heat	Water Scarcity
Senegal	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
Saint Louis	<i>N/A</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
Kedougou	<i>N/A</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
Sedhiou	<i>N/A</i>	<i>Low</i>	<i>Low</i>	<i>High</i>	<i>Medium</i>	<i>High</i>

Climate Change and Natural Hazard Risks

3. The consideration of exposure and future risks in the design, construction and operation of the proposed project assets will increase the resilience of the project, including the mitigation measures mentioned. Specific hazards are described below, for which data is available, and specific aspects of resilience in the project are discussed briefly.

Flooding

4. Flooding risks vary throughout the country, although flooding is a noted ‘high risk’ hazard for the country overall. Available information for the depth of water under an expected 0.01-annual flood

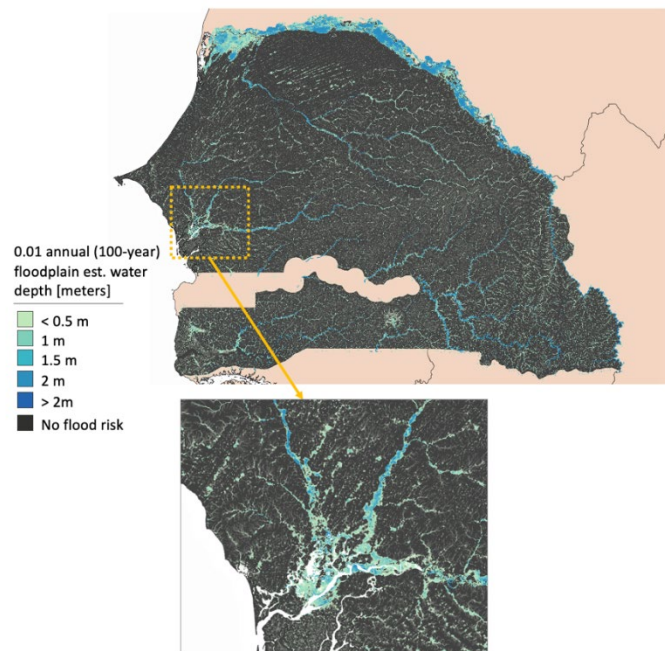
⁴⁵ Climate Change Knowledge Portal, “Senegal” (2021). The World Bank.

⁴⁶ ThinkHazard! (2021) The World Bank.



probability (“100-year flood”) is shown in Figure 2.1⁴⁷. Flooding is particularly widespread at depths of 1 meter or more around the river deltas along the coast and the Northern border with Mauritania along the Senegal River. In a 30-year project timeframe, this means that there is a 26 percent likelihood of a 0.01-annual probability event occurring at least once. It should be noted that the data presented in Figure 2.1 is based on historical data, which is limited both by the available historical record and ongoing climate changes. Climate change models show that in West Africa, particularly along the Sahel region, flooding events may change in magnitude and frequency, although more research is needed to quantify these changes⁴⁸.

Figure 2.1: Estimated depth of water in 0.01-annual probability flood event (“100-year”)⁴⁹



Extreme Heat and Wildfire

5. The risk for extreme heat and wildfire hazards under current climate conditions is rated as ‘high’ in Senegal in nearly all regions, Figure 2.2. For wildfires, the annual risk varies across the country from 5 percent or lower along the coastal and island regions to as much as 60 percent and higher in the southern and western regions of the country⁵⁰, and climate change is expected to exacerbate this⁵¹. Over a project lifetime, this poses high risks to transmission and distribution infrastructure, although this risk can be

⁴⁷ FATHOM Flooding Data (2021). World Bank.

⁴⁸ Hirabayashi et al, Global flood risk under climate change, *Nature Climate Change*, 3, 816-821, 2013.

⁴⁹ Flooding is concentrated along waterways at depths up to two meters. Flooding extent is particularly broad along the Northern border of the country around the Senegal River, along the border with Mauritania.

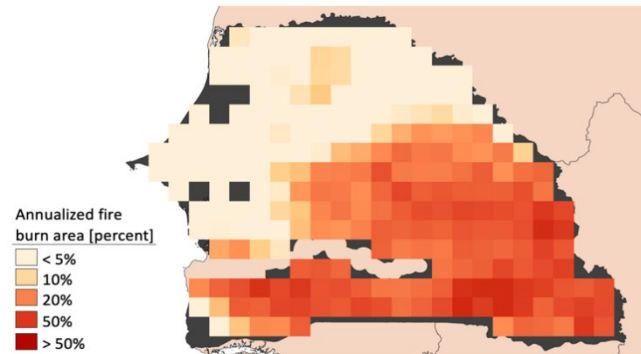
⁵⁰ Fire risk is calculated as the total percent of land area (data for each 0.25° x 2 grid, approximately 25km x 25 km) burned each year based upon all available data for 1997-2015. Calculations done by the authors, with data from: Giglio, L., Randerson, J., & Van der Werf, G. (2013). Analysis of daily, monthly, and annual burned area using the fourth - generation global fire emissions database (GFED4). *Journal of Geophysical Research: Biogeosciences*, 118(1), 317-328.

⁵¹ Liu, Y., Stanturf, J. A., & Goodrick, S. L. (2009). Trends in global wildfire potential in a changing climate. *Forest Ecology and Management* 259:685-697, 259(2010), 685–697. <https://doi.org/10.1016/j.foreco.2009.09.002>



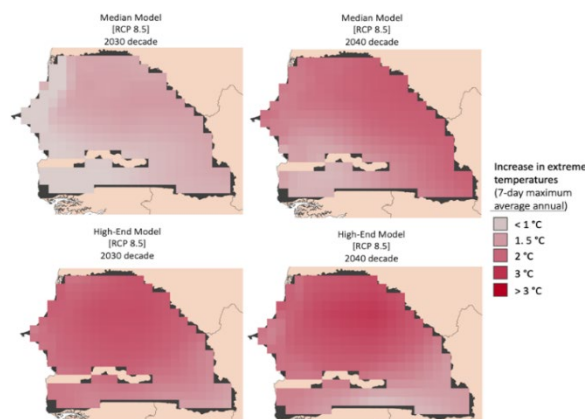
mitigated through project design (choice of infrastructure including steel or cement poles instead of wood) and site selection, as well as ongoing vegetation management strategies to reduce bushfire likelihood and proximity to assets.

Figure 2.2: Annualized fire impact in each region, based on 25-year historical average



6. Extreme heat is already rated as a ‘high’ risk in many areas of the country. This is expected to increase under climate change, with high-end projections exceeding 6°C by the end of the century, as noted above. For this project, an evaluation of the increase in the average 7-day maximum yearly temperature over the 2030 and 2040 decades shows increases of 1.5-3°C⁵² (Figure 2.3). The highest areas of projected increase are in the central and northern parts of the country, with the median models in the 2040 decade showing changes of around 2°C. The higher end models for both the 2030 and 2040 decades indicate increases of 3°C in many regions. Higher temperature may exacerbate existing risks including fire and water scarcity. Additionally, increases in temperature may decrease the efficiency of the transmission of electricity as well as the efficiency of storage units.

Figure 2.3: The increased annual 7-day maximum average temperature for the 2030 and 2040 decades, relative to historical values



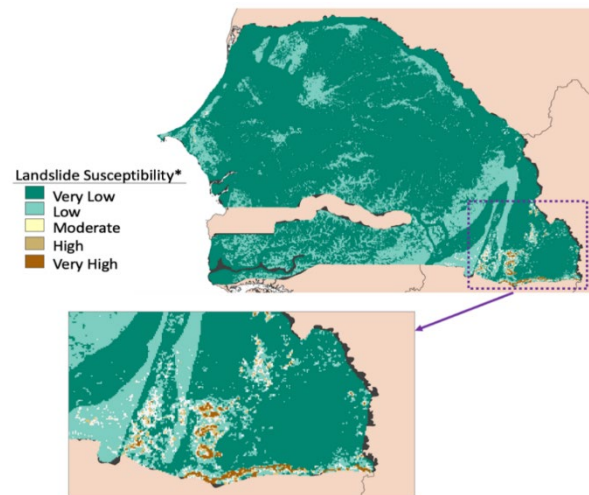
⁵² Decadal values represent the average of the annual 7-day maximum average temperature for each year within the corresponding decade. The 2030 decade represents the average value for the years 2030-2039, for example. Values are the increase, in degrees Celsius, above the 30-year historical baseline (calculated as the average of annual 7-day maximum temperatures from 1970-1999). Calculations completed by the authors, based on data from NASA Center for Climate Simulation, NASA NEX-GDDP (2019).



Landslides

7. Landslides are rated as a 'low' risk for Senegal nationally, but the southeastern region of the country has medium- very high risks. Figure 2.4 shows the landslide susceptibility for the project region, with the most susceptible regions shown in brown⁵³. While site-specific information on soil type, slope and other factors needs to be evaluated to determine the exact risk in different locations, this susceptibility data can inform regions where more detailed studies and consideration of mitigation options may have higher benefits relative to potential incurred damages from the hazard.

Figure 2.4: Landslide susceptibility map for study region



Overall risk for most of Senegal is Very Low – Low, although in the southeastern parts of the country, there are many areas of High – Very High susceptibility. Areas of high susceptibility should be further analyzed for soil type and other factors that affect landslides if the regions are part of the project development area.

Project Resilience Considerations

8. Each of the three components of this project increase the resilience of the communities receiving electricity access, increase the overall resilience of the power system through technical assistance and, as design and siting decisions are made, can be designed to withstand climate and hazard shocks where applicable.

Resilience 'of' Project Considerations

9. For Components 1 and 2 of this project, consideration of the risks detailed above will improve the resilience and operation of the infrastructure. Specifically, consideration of flooding, increased losses from heat, and damage from fires are important for operational performance and maintenance and repair cost budgeting. For the medium- and low-voltage network proposed, substations and ancillary equipment, the consideration of fire and flood protective infrastructure can be assessed using cost-

⁵³ Broeckx, J., Vanmaercke, M., Duchateau, R., & Poesen, J. (2018). A data-based landslide susceptibility map of Africa.



benefit analysis over the project lifetime. Component 3 includes technical feasibility studies and technical assistance, focused on selection of appropriate sites and design parameters. Siting equipment away from higher risk regions will improve the resilience of the project. Each of these can be considered as the project continues.

Resilience ‘Through’ Project Considerations

10. The increased availability, quality and affordability of electricity generated through the project will maximize the number of households provided with services. This includes the new electrification of rural households, with an estimated 200,000 new households being connected through network extension. In addition to household uses, Sub-component 1.3 of the project includes support for income-generating activities. This includes vocational training and equipment purchases, especially for women and youth. The focus of Component 2 is on the electrification of public buildings including health centers, hospitals and schools that are currently without electricity. The increase of service quality and other factors may benefit the surrounding communities in many ways including health and learning quality, among others.

11. Another aspect of resilience created through this project is the integration with ongoing projects, leading to an overall coordinated effort for planning, implementation, operation and other duties within SENELEC and MPE. This includes performance-based contracts, especially for the off-grid solutions for public buildings. It also includes the collection and inventory of existing assets and information, such as the number of households connected, the costs and metering equipment used, and other aspects important for effective management of the power system. Finally, the project is also contributing to the low-carbon and climate-resilient transition in Senegal, as it will allow for an update of the Distribution Master Plan that utilizes low-cost electrification technologies, georeferenced data and other data that can inform ongoing progress towards the nearing goal of universal electricity access within Senegal by 2025.



ANNEX 3 – Gender Gap Analysis

1. Access to reliable household energy, clean and efficient cookstoves or productive-use equipment can reduce energy poverty, time spent on drudgery and give women and men additional income-earning opportunities. Economic opportunities and social dynamics affect which of the above have the highest impact and are realistic to be achieved. Specifically, in Senegal, the gender context and some key elements are discussed below.
2. **Background.** In spite of continuing inequalities, the condition of Senegalese women has improved substantially in recent years. According to the International Labour Organization (ILO), female-to-male employment ratio in Senegal increased from 0.46 to 0.60 between 2006 and 2011, and the average years of education of working age women grew 27 percent during the same period. However, in Senegal, the overall legal framework for women is still lagging behind global advances. For instance, there are still legal restrictions that prevent women from performing the same job as men and women’s asset ownership is low and is not protected by law.
3. **Access to electricity and time-poverty.** The above set-backs are not reflected in access to electricity. Namely, the Senegal Poverty Monitoring Survey 2010 – 2011 showed a substantial gender-gap in electricity access favoring female headed households at 69.4 percent in comparison to 45.7 percent of those headed by males. Nevertheless, the issue of time poverty also needs to be considered. Even though male-headed households have lower electricity access, an increase in access would substantially benefit women due to their disproportionately higher load from domestic tasks – with women doing several more hours of housework daily on average such as laundry and cooking than men – that can substantially save time when electricity is available.
4. **Employment in the electricity sector.** On average, Senegalese women have lower labor participation than men, 35 versus 59 percent. Men also represent a higher share of the electricity, water and gas industry labor force-87 percent of the employees in the sector are men while only 13 percent women. Furthermore, electricity, water and gas were the sectors with the lowest share of female employees among sectors surveyed by the National Survey of SMEs in Senegal in 2014.
5. **Entrepreneurship.** Only 14.1 percent of firms in Senegal have females in top management positions. This is slightly below the average in Sub-Saharan countries (15.4 percent) and across all countries (18.2 percent) with these kinds of businesses facing multiple challenges. For example, women-led firms are shown to have more limited access to financial services including through MFIs and have more challenges accessing critical information and reaching full business literacy. A number of examples are available that show the added value of entrepreneurship programs in Senegal targeted specifically at women. For example, the Energy Opportunities for Women in Senegal (EOWS) project aimed at increasing the effectiveness of women-led businesses through productive uses of energy generally in off-grid areas, including helping them acquire the necessary equipment and source of energy. An important takeaway from the Tambacounda region in Senegal, where the project has supported 124 women’s groups (representing 5,357 women) is that, when women serve last-mile markets as entrepreneurs, they can contribute to developing new markets and establishing trust.



ANNEX 4 – Economic and Financial Analysis

- 1. Gaining access to electricity for households, healthcare centers, schools and electrification of micro, small & medium enterprises has the potential to bring significant economic benefits.** An economic analysis was carried out to assess the development impact in terms of expected benefits and costs over the assumed 40-year economic lifetime of project investments. The economic analysis is consistent with the new World Bank guidelines on economic analysis and relies on a standard cost-benefit methodology, which compares the present value of incurred costs to the stream of attributable benefits under two scenarios, i.e., the “with Project” and “without Project” scenario. The economic analysis derives the NPV of each of the proposed project components for which benefits can be clearly identified, as well as a NPV of the proposed project as a whole, using a social discount rate of 6 percent to present all costs and benefits at a common point in time. In line with the general practice, we also present the ERR for each of the components and an overall project ERR.
- 2. The economic analysis is confined to project activities that generate quantifiable benefits for which an economic value can be clearly identified and measured.** In this respect, the analysis focuses on the following components: (i) Sub-component 1.1 on network strengthening and expansion to provide grid access to 160,000 households plus 40,000 vulnerable households and improving the quality of electricity services to household, businesses and critical public facilities already connected in these areas by relieving existing substations close to saturation and minimizing voltage drop issues (US\$116 million); (ii) Sub-component 2.1 on supply and installation of ready-boards to those 40,000 vulnerable low-income households connected to the grid under Sub-component 1.1 (US\$5 million); Sub-component 2.2 on grid electrification of healthcare centers and schools (US\$10 million); and (iv) Sub-component 2.3 on electrification of MSMEs with enhanced focus on electrification of women-led businesses (US\$5 million). Separately, Sub-component 1.2 aims at hiring an experienced engineering firm to assist SENELEC and ensure technical coherence and proper timing of all investments and related procurement and implementation activities of the above Sub-components (US\$9 million) and Sub-component 3.2 aims at funding costs of the PIU and project supervision costs, including the preparation and implementation of the ESIA's and RAPs (US\$4 million). In the analysis, the cost of Sub-components 1.2 and 3.2 are apportioned across the other sub-components in proportion to the investment costs of each of the sub-components, as set out in Table 4.1, below.
- 3. The project also aims at supporting capacity building for institutions of the power sector (Sub-component 3.1, US\$6 million).** The benefits of this capacity building are nevertheless difficult to measure with benefits extending beyond this project (i.e., the benefits realized under this sub-component relating to the establishment of the Steering Committee and CTS of the Universal Access Program within the MPE will not only benefit the current project but also future access projects in Senegal). Therefore, the benefits and costs of this sub-component are not considered in the economic analysis presented here.



Table 4.1: Summary of Project Costs for the Economic Analysis

Component:	Beneficiaries	(US\$ million)		
		Direct CAPEX	Other Project costs apportioned	Total Project costs assessed in the economic analysis
Sub-component 1.1:	160,000 households	88.8	8.8	97.6
Sub-component 1.1:	40,000 low-income households	27	3.2	30.4
Sub-component 1.2:	ready boards for low-income households	5		
Sub-component 2.2:	schools and health clinics	5	0.5	5.5
Sub-component 2.3:	MSMEs	5	0.5	5.5
Subtotal:		131	13	144
Sub-component 1.2:	OE	9		
Sub-component 3.2:	project execution and implementation support	4		
Costs to be apportioned to other sub-components		13		
Total costs assessed		144		
Costs whose associated benefits extend beyond this Project		6		
Total project costs		150		

4. **The investment, operation and maintenance, and any other costs were derived from market assessments, World Bank recent experience of similar projects in Senegal and in the region and discussions with the key sector stakeholders in Senegal.** The costs are considered over the economic lifetime of the assets and for the purposes of the economic analysis, costs are adjusted downwards to exclude taxes, duties and other transfer payments (i.e., only economic costs are considered). On the benefits side, the analysis considers willingness to pay (WTP) for grid electricity and avoided costs of current alternatives as relevant. The below paragraphs elaborate on avoided costs and WTP for electricity considered in the analysis.

5. **To estimate the benefit of switching to the grid, we rely on estimates of WTP for electricity for household customers and estimates of avoided costs of current alternatives for non-residential customers.** Most of the unelectrified households and businesses meet their basic needs by using kerosene, candles, dry cell batteries and/or diesel generators. For estimates of WTP for electricity access we relied on a nationally representative survey of households and firms undertaken by the MCC) in Senegal between March and June 2018.⁵⁴ The dataset contains detailed information on 2,775 households and 1,072 formal and informal enterprises in all 14 regions.

(a) **WTP:** According to the survey results, a vast majority of households are willing to pay a price that is significantly higher than the average grid electricity tariff paid by households today. Specifically, for reliable electricity, most households were willing to pay 24-35 percent more than the average actual tariff with the average tariff, as referred in the survey, being 17 USc/kWh. In other words, in 2018 the WTP of most households in Senegal was between 21 to 23 USc/kWh of reliable electricity service (i.e., a service without power cuts or voltage drops).

⁵⁴ Deutschmann, J.W., Postepska, A., Sarr, L., 2021, Measuring willingness to pay for reliable electricity: Evidence from Senegal. World Development 138. <https://doi.org/10.1016/j.worlddev.2020.105209>.



(b) **Avoided costs:** Non-residential customers (as well as some better off households) rely in general on diesel generators to get electricity and some also rely on standalone solar systems. Cost of self-generation is assumed to be 35 US\$/kWh including taxes, duties and transfer payments.⁵⁵ For the economic analysis, these costs are adjusted to net of taxes, duties and transfer payments. It has been conservatively assumed that about 35 percent of the current expenditure are taxes, duties and other transfer payments.

6. **The project is also expected to bring benefits from reduced GHG emissions.** In addition to the quantifiable benefits discussed above, the economic analysis also considers the additional benefit derived from reduced CO₂ emissions. The impact of the project on GHG emissions is calculated as the difference between the emissions associated with the level of service proposed by the project compared to the emissions associated with the current alternatives. The analysis is undertaken in accordance with the *World Bank GHG Accounting Methodology for Energy Access Investment Operations*. Detail of the economic and financial analysis is provided below, with all monetary values presented in NPV terms (US\$2021).

7. **While the analysis does not consider other indirect benefits, it is expected that the project will contribute towards other economic benefits that are more difficult to quantify and monetize.** These indirect benefits include improved air quality from reduced consumption of kerosene, reduced poisoning and accidental fires, and wider benefits that can be linked to access to modern electricity solutions such as improved health, improved connectivity, and improved security. Access to modern energy solutions is also expected to increase income generating opportunities and improve the socioeconomic situation of households and MSMEs, with expected positive impact on education and overall lifestyle. This means that the results from the economic analysis can be considered as conservative estimates of the overall economic benefits of the Project.

Sub-components 1.1 and 2.1 on network strengthening, expansion and connection of households

8. Sub-component 1.1. concerns design, supply, and installation of electricity distribution networks in already connected localities, including the following investments: a) 760km of MV lines; b) 820 MV/LV distribution substations; c) 2,708 km of LV lines to expand grid coverage and connect about 160,000 households and 40,000 vulnerable households to the grid; d) last-mile connection equipment, including service drops and pre-paid meters for those newly connected. Separately, Sub-component 2.1 concerns the provision of ready boards for those 40,000 low-income vulnerable households connected under Sub-component 1.1. These new connections are supposed to be realized over the period 2023 to 2025 with around 20,000 new connections added to the grid in 2023, 80,000 new connections in 2024 and 100,000 new connections added to the grid in 2025. The key inputs, assumptions and results of the analysis for Sub-component 1.1 and 2.1 are summarized below, with results showing that these sub-components are economically viable with net benefits evaluated at 118 million US\$2021 and ERR of 11.7 percent. Furthermore, when considering the impact of these interventions on reduction of CO₂ emissions, the net

⁵⁵ This is a regional estimate as for Senegal such data is not available. The MCC survey also contains some results on the WTP for reliable electricity among grid connected firms. Among surveyed firms, more than 70 percent of formal firms and almost 50 percent of informal firms were willing to pay a higher price than what they were already paying through the grid (the median formal firm reported paying 28 US\$/kWh, whereas the median informal firm reported paying 23 US\$/kWh).



benefit increases to between 141 and 164 million US\$2021, depending on the assumptions around the social cost of carbon.

Table 4.2: Sub-components 1.1 and 2.1 - Summary of Key Inputs, Assumptions, and Results

Key inputs, assumptions and results of the analysis	Unit	Value	Source
CAPEX cost related to the densification and extension of the distribution network	<i>US\$ million</i>	92	<i>Project design</i>
Supply and installation of meters, connection equipment (160,000 households + 40,000 vulnerable)	<i>US\$ million</i>	24	<i>Project design</i>
Ready boards for vulnerable households	<i>US\$ million</i>	5	<i>Project design</i>
<i>Apportioning of other project related costs</i>	<i>US\$ million</i>	12	<i>Calculated</i>
<i>Total funded by the Project</i>	<i>US\$ million</i>	133	<i>Calculated</i>
Operation and maintenance costs related to the CAPEX	<i>% initial CAPEX</i>	1	<i>Assumption</i>
Total O&M costs over project lifetime	<i>US\$ million</i>	19	<i>Calculated</i>
Number of new grid connections	<i>Number</i>	201,096	<i>Project design</i>
Economic lifetime of assets funded by the project	<i>Years</i>	40	<i>Assumption</i>
Electricity consumption when connected, urban households	<i>kWh/year</i>	1,293	<i>Assumption</i>
Electricity consumption when connected, rural households	<i>kWh/year</i>	961	<i>Assumption</i>
Electricity consumption when connected, low-income households	<i>kWh/year</i>	365	<i>Assumption</i>
Annual growth rate in electricity consumption	<i>Percent</i>	3	<i>Assumption</i>
Incremental levelized cost of generation (off-take point)	<i>US\$/kWh</i>	13.4	<i>Calculated</i>
Total incremental cost of generation to meet the incremental demand of those newly connected	<i>US\$ million</i>	423	<i>Calculated</i>
Total costs over project lifetime	<i>US\$ million</i>	575	<i>Calculated</i>
Consumption of those newly connected over project lifetime (NPV terms)	<i>GWh</i>	3,158	<i>Calculated</i>
LCOE over project lifetime to supply those newly connected	<i>US\$/kWh</i>	18.2	<i>Calculated</i>
WTP for reliable electricity supply, 160,000 households (simple average WTP)	<i>US\$/kWh</i>	22.0	<i>MCC survey of HHS in Senegal</i>
WTP for reliable electricity supply, 40,000 vulnerable households (lower bound WTP)	<i>US\$/kWh</i>	21.1	<i>MCC survey of HHS in Senegal</i>
Total benefits over project lifetime	<i>US\$ million</i>	693	<i>Calculated</i>
Total net benefit, excluding externalities	<i>US\$ million</i>	118	<i>Calculated</i>
ERR, excluding externalities	<i>percent</i>	11.7	<i>Calculated</i>
GHG emissions with the Project	<i>MtCO_{2e}</i>	3.1	<i>Calculated</i>
GHG emissions without the Project (based on Tier 1 and Tier-2 values)	<i>MtCO_{2e}</i>	4.5	<i>Calculated</i>
Impact of the project on GHG emissions (if negative, emission reduction)	<i>MtCO_{2e}</i>	-1.4	<i>Calculated</i>
GHG benefits – low social cost of carbon	<i>US\$ million</i>	23	<i>Calculated</i>
GHG benefits – high social cost of carbon	<i>US\$ million</i>	46	<i>Calculated</i>
Total net benefit- with GHG emissions - low SCC	<i>US\$ million</i>	141	<i>Calculated</i>
Total net benefit- with GHG emissions - high SCC	<i>US\$ million</i>	164	<i>Calculated</i>

Note: The analysis was undertaken for all households together as well as separately for the 160,000 households and 40,000 low-income households when costs under Sub-component 1.1. were allocated to each group of households on a cost per connection basis and costs of ready-boards were allocated to the low-income households. When considering the 40,000 low-income households, the derived net economic benefit is negative at



US\$17.9 million (US\$2021) in view of the relatively low consumption of those low-income households and fixed costs of connection and ready boards. The results for each group of households is presented under Summary of the Project Economic Analysis below.

Sub-component 2.2 on grid electrification of healthcare centers and schools

9. Sub-component 2.2 aims at connecting healthcare centers and schools to the grid. The key inputs, assumptions and results of the analysis for Sub-component 2.2 are summarized below, with results showing that this sub-component brings net economic benefits evaluated at US\$3.5 million (US\$2021) and ERR of 9.2 percent. Furthermore, when considering the impact on reduction of CO₂ emissions, the net benefits increase to between US\$6.5 million and US\$9.6 million (US\$2021), depending on the assumptions around the social cost of carbon.

Table 4.3: Sub-component 2.2 Summary of Key Inputs, Assumptions, and Results

Key inputs, assumptions and results of the analysis	Unit	Value	Source
Sub-component allocation (initial CAPEX)	<i>US\$ million</i>	5	<i>Project design</i>
<i>Apportioning of other project related costs</i>	<i>US\$ million</i>	0.5	<i>Calculated</i>
<i>Total funded by the Project</i>	<i>US\$ million</i>	5.5	<i>Calculated</i>
Operation and maintenance costs related to the CAPEX	% initial CAPEX	1	<i>Assumption</i>
Total O&M costs over project lifetime	<i>US\$ million</i>	0.8	<i>Calculated</i>
Number of medical centres to be connected	<i>Number</i>	606	<i>Project design</i>
Number of schools to be connected	<i>Number</i>	206	<i>Project design</i>
Economic lifetime of assets funded by the Project	<i>Years</i>	40	<i>Assumption</i>
Average electricity consumption when connected	<i>kWh/year</i>	3,000	<i>Assumption</i>
Annual growth rate in electricity consumption	<i>Percent</i>	3	<i>Assumption</i>
Incremental levelized cost of generation (off-take point)	<i>US\$/kWh</i>	13.2	<i>Calculated</i>
Total incremental cost of generation to meet the incremental demand of those newly connected	<i>US\$ million</i>	7	<i>Calculated</i>
Total costs over project lifetime	<i>US\$ million</i>	13.4	<i>Calculated</i>
Consumption of those newly connected over project lifetime (NPV terms)	<i>GWh</i>	54	<i>Calculated</i>
LCOE over project lifetime to supply those newly connected	<i>US\$/kWh</i>	25	<i>Calculated</i>
Avoided costs of current alternatives (economic costs)	<i>US\$/kWh</i>	26	<i>Assumption based on regional estimate</i>
Total benefits over project lifetime	<i>US\$ million</i>	16.9	<i>Calculated</i>
Total net benefit, excluding externalities	<i>US\$ million</i>	3.5	<i>Calculated</i>
ERR, excluding externalities	<i>percent</i>	9.2	<i>Calculated</i>
GHG emissions with the Project	<i>MtCO₂e</i>	0.06	<i>Calculated</i>
GHG emissions without the Project	<i>MtCO₂e</i>	0.30	<i>Calculated</i>
Impact of the project on GHG emissions (if negative, emission reduction)	<i>MtCO₂e</i>	-0.24	<i>Calculated</i>
GHG benefits – low social cost of carbon	<i>US\$ million</i>	3.0	<i>Calculated</i>
GHG benefits – high social cost of carbon	<i>US\$ million</i>	6.0	<i>Calculated</i>
Total net benefit- with GHG emissions - low SCC	<i>US\$ million</i>	6.5	<i>Calculated</i>
Total net benefit- with GHG emissions - high SCC	<i>US\$ million</i>	9.6	<i>Calculated</i>



Sub-component 2.3 on grid electrification of micro, small & medium enterprises with enhanced focus on electrification of women-led MSMEs

10. Sub-component 2.3 aims at connecting micro, small & medium enterprises with enhanced focus on electrification of women-led MSMEs to the grid. The key inputs, assumptions and results of the analysis for Sub-component 2.3 are summarized below, with results showing that this sub-components brings net economic benefits evaluated at US\$2.7 million (US\$2021) and ERR of 9.5 percent. Furthermore, when considering the impact on reduction of CO₂ emissions, the net benefits increase to between US\$6.2 million and US\$9.7 million (US\$2021), depending on the assumptions around the social cost of carbon.

Table 4.4: Sub-component 2.3 Summary of Key Inputs, Assumptions, and Results

Key inputs, assumptions and results of the analysis	Unit	Value	Source
Sub-component allocation	<i>US\$ million</i>	5	<i>Project design</i>
<i>CAPEX to be included in the analysis</i>	<i>US\$ million</i>	4	<i>Project design*</i>
<i>Apportioning of other project related costs</i>	<i>US\$ million</i>	0.5	<i>Calculated</i>
<i>Total cost funded by the Project considered in the analysis</i>	<i>US\$ million</i>	4.5	<i>Calculated</i>
Operation and maintenance costs related to the CAPEX	<i>% initial CAPEX</i>	1	<i>Assumption</i>
Total O&M costs over project lifetime	<i>US\$ million</i>	0.6	<i>Calculated</i>
Number of new grid connections	<i>Number</i>	700	<i>Assumption</i>
Economic lifetime of assets funded by the Project	<i>Years</i>	40	<i>Assumption</i>
Average electricity consumption when connected	<i>kWh/year</i>	4,000	<i>Calculated</i>
Annual growth rate in electricity consumption	<i>Percent</i>	3	<i>Assumption</i>
Incremental levelized cost of generation (off-take point)	<i>US\$/kWh</i>	13.2	<i>Calculated</i>
Total incremental cost of generation to meet the incremental demand of those newly connected	<i>US\$ million</i>	8.2	<i>Calculated</i>
Total costs over project lifetime	<i>US\$ million</i>	13.3	<i>Calculated</i>
Consumption of those newly connected over project lifetime (NPV terms)	<i>GWh</i>	62	<i>Calculated</i>
LCOE over project lifetime to supply those newly connected	<i>US\$/kWh</i>	21.5	<i>Calculated</i>
Avoided costs of current alternatives (economic costs)	<i>US\$/kWh</i>	26	<i>Assumption based on regional estimate</i>
Total benefits over project lifetime	<i>US\$ million</i>	16.0	<i>Calculated</i>
Total net benefit, excluding externalities	<i>US\$ million</i>	2.7	<i>Calculated</i>
ERR, excluding externalities	<i>percent</i>	9.5	<i>Calculated</i>
GHG emissions with the Project	<i>MtCO₂e</i>	0.07	<i>Calculated</i>
GHG emissions without the Project	<i>MtCO₂e</i>	0.34	<i>Calculated</i>
Impact of the project on GHG emissions (if negative, emission reduction)	<i>MtCO₂e</i>	-0.27	<i>Calculated</i>
GHG benefits – low social cost of carbon	<i>US\$ million</i>	3.5	<i>Calculated</i>
GHG benefits – high social cost of carbon	<i>US\$ million</i>	6.9	<i>Calculated</i>
Total net benefit- with GHG emissions - low SCC	<i>US\$ million</i>	6.2	<i>Calculated</i>
Total net benefit- with GHG emissions - high SCC	<i>US\$ million</i>	9.7	<i>Calculated</i>

* The additional US\$1 million allocated to this sub-component by the project concerns technical assistance for which benefits are expected to extend beyond the project. Therefore, the costs are not included in the economic analysis of



the project as the benefits are difficult to quantify.

Summary of the Project Economic Analysis

11. The economic analysis shows that the project is economically viable even without any consideration of environmental externalities. Using a social discount rate of 6 percent, the baseline NPV of the project is estimated at US\$124 million (US\$2021) and ERR of 11.5 percent. When considering the impact of the project on net reduction of CO₂ emissions, the net benefits increase to between US\$153 million and US\$183 million (US\$2021), depending on the assumptions around the social cost of carbon.

Table 4.5: Summary of Project Economic Analysis

Sub-component	NPV (US\$2021 million)			ERR (%)			Net impact on GHG emissions (MtCO ₂ e)*
	Without GHG Benefits	With GHG Benefits (Low)	With GHG Benefits (High)	Without GHG Benefits	With GHG Benefits (Low)	With GHG Benefits (High)	
Sub-component 1.1 160,000 households	135.9	152.4	169.0	14.3	15.2	16.1	-0.89
Sub-component 1.1 and 1.2 40,000 low-income households	-17.9	-11.6	-5.3	1.0	2.7	4.5	-0.35
Total for households connected by the project	117.9	140.7	163.7	11.7	12.8	13.9	-1.24
Sub-component 2.2 Healthcare centers and schools	3.5	6.5	9.6	9.2	12.1	15.2	-0.24
Sub-component 2.3 MSMEs with focus on electrification of women-led MSMEs	2.7	6.2	9.7	9.5	14.1	18.8	-0.27
Project (aggregate result)	124.2	153.5	182.9	11.5%	12.8%	14.1%	-1.75

**if negative, emission reduction over the expected economic lifetime of the project (assumed to be 40 years).*

12. A switching value analysis was also undertaken for the project as a whole with switching values being those that bring the ERR from the baseline estimate of between 11.5 to 14.1 percent (depending on whether social cost of carbon are included or not) to the hurdle rate of 6 percent (i.e. assumed social cost of capital). This analysis was done for total project costs and total project expected benefits. Specifically, a 21 percent increase in total costs would result in ERR of 6 percent (as opposed to the currently expected ERR of 11.5 percent, excluding incremental benefits from GHG emission reduction). Alternatively, a 17 percent decrease in expected project benefits would result in ERR of 6 percent (again excluding incremental benefits from GHG emission reduction).

Summary of the Project Financial Analysis

13. **In addition to the economic analysis, a financial analysis of the project has been undertaken from the point of view of the national utility, SENELEC.** According to the regulatory methodology in place, SENELEC recovers all eligible costs through allowed revenues set by the sector regulator, CRSE. During the



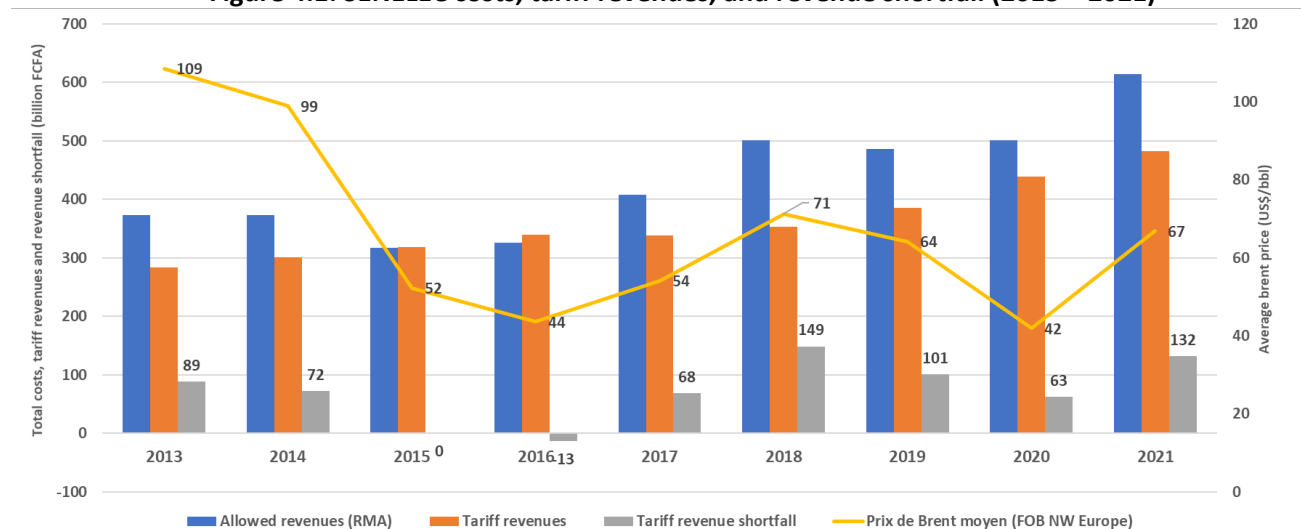
project preparation it was not yet decided whether the loan associated with the project would be paid by the GoS and hence not included in SENELEC's regulatory asset base or whether the Project loan would be on-lent to SENELEC and hence would increase SENELEC's regulatory asset base. In turn, an increase to SENELEC's regulatory asset base would increase its allowed revenue requirement to be recovered through tariff revenues and compensation paid from the State budget if allowed revenues exceed tariff revenues i.e. in a situation when tariffs are set below eligible costs.

14. As of today, and despite the tariff increase that took place towards the end of 2019 when tariffs increased on average by 10 percent, SENELEC does not recover all eligible costs through tariffs, with the tariff revenue shortfall being covered by compensation from the State budget. Furthermore, for a country that is currently relying largely on imported fuel for electricity generation, the tariff revenue shortfall increases when fuel prices on international markets increase and the shortfall decreases when fuel prices fall, as can be seen from Figure 4.1 below.

15. For each group of future customers that will be connected to the grid by the Project, we compared the current average tariff paid by similar existing customers to the incremental costs of supply incurred by SENELEC due to the new connections under two scenarios:

- (a) The project loan is paid by the GoS, and hence excluded from the allowed revenues to be recovered by SENELEC;
- (b) The project loan is on-lent by the GoS to SENELEC and SENELEC recovers these costs through the allowed revenues throughout the regulated lifetime of assets funded by the project (25 years according to the regulatory methodology in place, as set by CRSE).

Figure 4.1: SENELEC costs, tariff revenues, and revenue shortfall (2013 – 2021)



Note: Numbers for 2021 are World Bank estimates as of October 2021. The final eligible costs, and hence the resulting revenue shortfall, will depend on the development of fuel prices for the rest of the year, among other aspects affecting the final determination of allowed revenues to be earned by SENELEC.



Table 4.6: Required notional tariff increases for SENELEC to recover incremental costs due to customers connected by the project

Sub-components	Current average tariff for similar customers (FCFA/kWh)	(i) Minimum annual tariff increase to recover OPEX and wholesale costs of supply	(ii) Minimum annual tariff increase to recover all costs
Sub-component 1.1 and 1.2: Network strengthening, expansion and connection of 160,000 households and 40,000 vulnerable households including ready-boards for low-income households	91.2	1.0%	4.1%
Sub-component 2.2: Grid electrification of healthcare centers and schools	141.2	2.8%	3.7%
Sub-component 2.3: Grid electrification of micro, small & medium enterprises with enhanced focus on electrification of women-led MSMEs	143.5	2.8%	3.3%

Source: World Bank estimates based on current average tariffs for a similar group of customers and project financial analysis.

16. The required notional tariff increase was derived for each group of new customers that would allow SENELEC to recover its incremental costs of supply due to the new connections for the two scenarios: (i) OPEX and wholesale costs of supply under a scenario in which the project costs are funded by the GoS; and (ii) OPEX, wholesale costs of supply, depreciation costs and a reasonable rate of return on the investment related to the project if the project related loan is on-lent to SENELEC and SENELEC needs to recover these costs through allowed revenues. The resulting notional tariff increases required to recover these costs are summarized above.

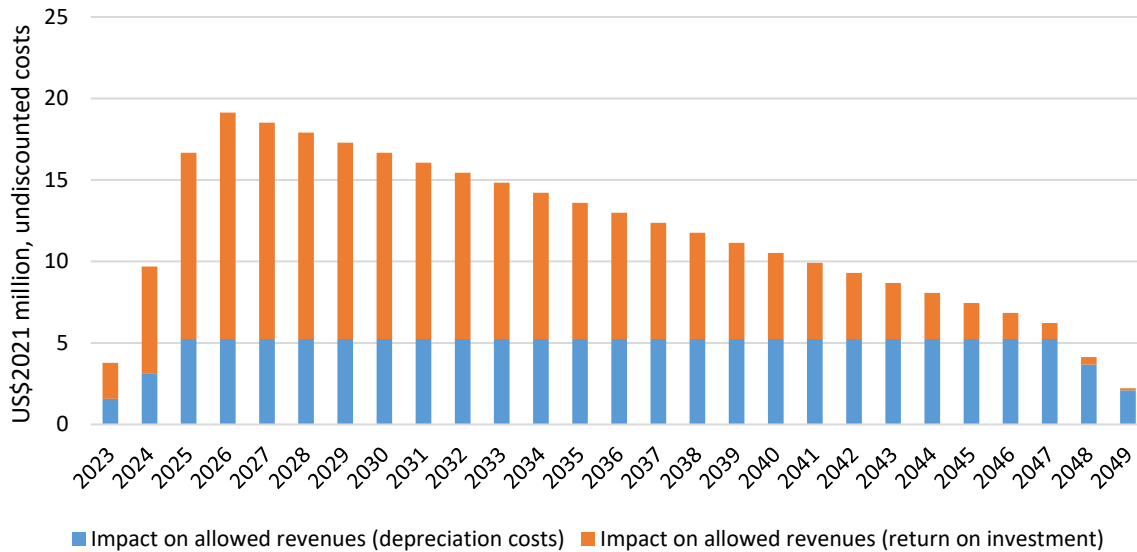
17. If the credit associated with the project is included in the regulatory asset base and hence the allowed revenues, the required notional tariff increase for those incremental customers is considerably higher, especially for the residential customer category that pay a relatively lower tariff today. Specifically, the required notional tariff increase is estimated at 4.1 percent per annum to allow SENELEC to recover all project related CAPEX and other costs, plus OPEX and wholesale supply costs, compared to one percent per annum when the project CAPEX and other costs are funded by the GoS, and hence not included in allowed revenues of SENELEC.

18. Alternatively, if the project related costs are included in the regulatory asset base of SENELEC but the GoS decides to keep the tariffs unchanged, the resulting tariff revenue shortfall would need to be funded by compensation payments from the State budget. In this case, the compensation amounts provided from the State budget to SENELEC would not only need to pay for the project CAPEX and other costs through a depreciation allowance during the regulatory asset lifetime (25 years) but also allow SENELEC to earn what the regulator deems a reasonable rate of return on investment (set by the regulator today at 11.73 percent per annum, nominal pre-tax rate of return). The impact of the project on allowed revenues is depicted in the chart below, where the sum of the blue bars equals the project investment costs (US\$131 million in US\$2021) and the sum of the orange bars equals the return on invested capital (US\$184 million in US\$2021). Hence the total undiscounted costs to be included in the allowed revenue



of SENELEC under the scenario of no tariff increases equals US\$315 million to allow SENELEC to recover the project related investment costs over the period 2023 to 2049. However, there is an opportunity cost of money to the GoS if it funds the project related investment cost instead of on-lending the funds to SENELEC, which is not captured here.

Figure 4.2: Project impact on allowed revenues of SENELEC



Source: World Bank estimates

Changing the energy mix to reduce costs

19. **Senegal aims to increase the share of renewable generation and to substitute, over time, oil-based power generation with generation using LNG at Karpowership and later with generation from domestic gas, when it comes online.** Senegal imports 75 MW of hydro generation from its share of the OMVS power plants, Manantali and Felou, in Mali and has actively been increasing other forms of renewable generation. As of November 2021, Senegal had in service 226 MW of grid-connected solar capacity. In addition, 158 MW of wind turbines were installed in 2019 and 2020, bringing Senegal’s total grid connected renewable generation capacity to 460 MW. Going forward the Senegalese energy mix is forecast to decarbonize further from around 20 percent of generation coming from renewables today to close to 30 percent by 2026/27. In terms of capacity, the installed capacity from renewables is forecast to increase from the current 29 percent as of November 2021 to 43 percent by 2027 if new generation is procured least cost, as shown in Table 4.7 and Figure 4.3 below⁵⁶.

⁵⁶ This are World Bank estimates based on optimization model, it does not reflect the official LCDP.



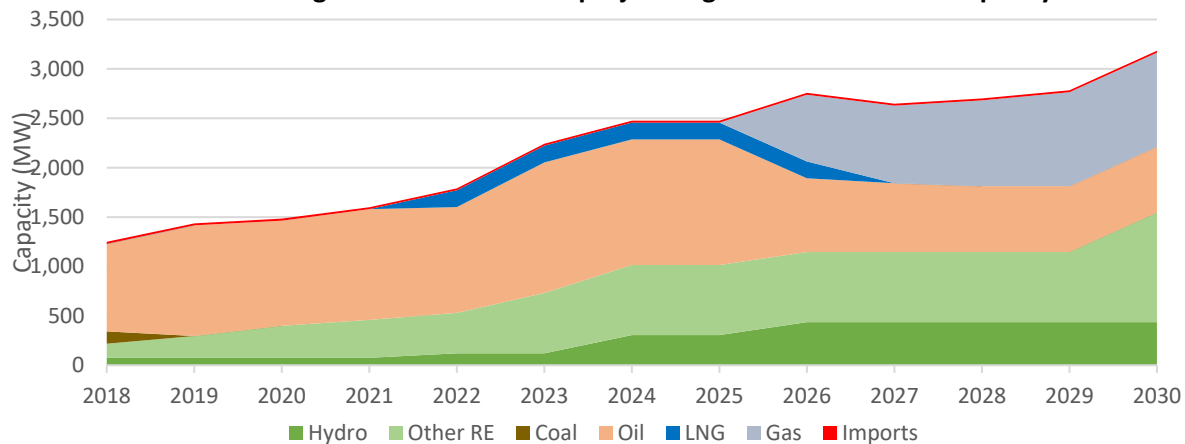
Table 4.7: Current and projected renewable generation installed capacity

MW	2020	2021	2022	2023	2024	2025	2026	2027
Hydro	75	75	121	121	305	305	436	436
Solar PV	166	226	251	451	551	551	551	551
Wind	159	159	159	159	159	159	159	159
Total RES	400	460	531	731	1015	1015	1146	1146
RES share	27%	29%	30%	33%	41%	41%	42%	43%

Source: Actuals for 2020 and data for 2021 are based on installed capacity as of November 2021 as provided by SENELEC, World Bank estimates thereafter based on an economic investment and dispatch. Capacity figures as at the end of each year with the exception of the 2021 data. RES share is provided in terms of total capacity installed as at the end of each year.

Note: New hydro generation includes Gouina (2022), Souapiti (2024) and Kaleta (2024), and new solar PV generation includes 60 MW of scaling solar projects plus 300 MW of generic projects that would be economical to develop based on projected costs. The timing as to when Senegal can begin importing power from Souapiti and Kaleta depends on commissioning of the OMVG transmission project. The development of generic solar PV projects in 2023 and 2024 depends on efficient procurement and project development and investment in system operations to allow greater penetration of intermittent generation.

Figure 4.3: Current and projected generation installed capacity



Source: World Bank estimates

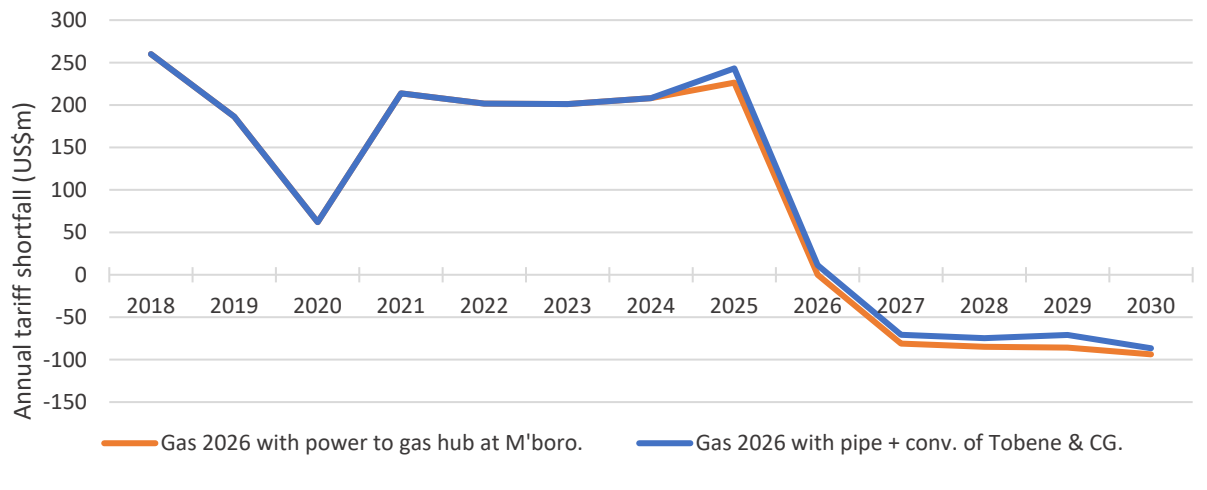
Note: Karpowership is assumed to switch from HFO to LNG in 2022 and continue to run on LNG until it departs in 2026 to coincide with the arrival of domestic gas. When domestic gas becomes available, some of Senegal's newer existing plants may be converted from HFO to burn gas (e.g. Tobene and Contour Global), plus new combined cycle gas turbines are assumed to be installed on an economic basis to burn gas, largely displacing more expensive and polluting oil-fired generation. Over time new hydro and solar PV generation is developed on an economic basis.

20. **Analysis by the World Bank shows that shifting the generation mix away from expensive and polluting oil fired generation could eliminate the need for the Government to subsidize the sector.** Substantial gas discoveries have been made off the coast of Senegal. Sangomar (being developed by Cairn/Woodside), Tortue and Yakaar/Teranga (being developed by BP) could deliver gas to the Senegal power sector by 2023. Before the arrival of domestic gas, analysis by the World Bank suggests that SENELEC's annual tariff shortfall will be largely unchanged over time. However, the arrival of domestic gas



(assumed to be around 2026) provides the opportunity for SENELEC to accelerate the shift away from oil fired generation and reduce its annual tariff shortfall.

Figure 4.4: SENELEC's annual tariff shortfall could decline with the arrival of domestic gas



Source: World Bank estimates

Note: the size of the SENELEC's annual tariff shortfall is uncertain and depends, inter alia, on future oil and LNG prices, the quantity and price of domestic gas, the timing as to when domestic gas becomes available, the competitive procurement of generation and the level of customer tariffs. For the purposes of this projection, domestic gas is assumed to become available in large quantities in 2026 at a price of around US\$5 per MMBtu at the offshore delivery point, new power stations are assumed to be procured competitively as IPPs, and end user tariffs are held constant.



Table 4.8: Scenario for reducing SENELEC's annual tariff shortfall

	Actuals	Actuals	Actuals	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Senelec (GWh)	2,117	2,140	1,910	1,918	1,374	1,681	1,888	1,888	58	63	64	66	74
Oil	2,114	2,123	1,869	1,872	1,327	1,634	1,841	1,841	11	16	17	20	27
Other RE	3	17	41	47	47	47	47	47	47	47	47	47	47
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0
IPPs (GWh)	1,924	2,314	2,904	3,233	4,138	4,217	4,423	4,865	7,168	7,669	8,209	8,785	9,397
Hydro	321	323	356	359	544	544	544	544	912	912	912	912	912
Other RES	212	270	455	686	733	1,107	1,107	1,107	1,107	1,107	1,107	1,107	1,107
Imports	11	16	0	0	0	0	0	0	0	0	0	0	0
Oil	1,244	1,402	2,093	2,143	1,551	1,256	1,462	1,904	44	54	55	56	241
LNG	0	0	0	0	1,266	1,266	1,266	1,266	18	0	0	0	0
Gas	0	0	0	0	0	0	0	0	5,084	5,593	6,132	6,707	7,093
Coal	135	303	0	45	45	45	45	45	2	3	3	3	45
Total power supplied (GWh)	4,038	4,454	4,815	5,152	5,512	5,898	6,311	6,753	7,225	7,731	8,272	8,851	9,471
Technical and commercial losses	698	825	902	954	1,021	1,094	1,170	1,253	1,341	1,434	1,535	1,642	1,757
Exports	10.66	15.51	17.1	0	0	0	0	0	0	0	0	0	0
In country sales (GWh)	3,329	3,614	3,895	4,197	4,491	4,804	5,140	5,499	5,884	6,297	6,738	7,209	7,714
Tariff revenues (FCFA m)	354,097	387,269	440,412	482,557	506,713	539,762	575,577	617,098	660,765	707,460	757,399	810,815	867,953
Exports	1,040	1,500	1,540	0	0	0	0	0	0	0	0	0	0
In country sales	353,057	385,769	438,872	482,557	506,713	539,762	575,577	617,098	660,765	707,460	757,399	810,815	867,953
Total costs of the year (FCFA m)	498,881	497,093	481,638	591,963	617,281	649,995	689,631	750,468	666,925	668,645	716,450	771,924	820,477
Fixed costs	120,852	132,209	140,900	179,292	190,914	202,756	215,395	228,814	243,131	258,446	275,021	292,970	312,416
Pipeline and conv. costs	0	0	0	0	0	0	0	9,214	9,214	9,214	9,214	9,214	9,214
Variable costs	378,029	364,884	340,738	412,671	426,367	447,239	474,236	512,440	414,580	400,985	432,214	469,740	498,847
Average cost of supply (FCFA/kWh)	149	137	123	141	137	135	134	136	113	106	106	107	106
Average cost of supply (US\$/kWh)	26.9	23.4	21.4	25.7	25.1	24.7	24.5	24.9	20.7	19.4	19.4	19.5	19.4
Tariff revenue shortfall (FCFA m)	145,824	111,324	42,766	109,406	110,568	110,233	114,054	133,370	6,160	-38,815	-40,950	-38,890	-47,475
Tariff revenue shortfall (US\$m)	263	190	74	200	202	201	208	243	11	-71	-75	-71	-87

Source: World Bank estimates for the years 2021 and thereafter.

Note: The projected tariff shortfall is dependent on the development of the costs of fuel on international markets, the quantity and timing of availability of domestic gas and gas prices, the level of demand and the procurement cost for new generation. New generation is assumed to be developed by IPPs which spreads over time the cost faced by SENELEC for the new generation. We note that 'Total costs of the year' correspond to the regulated costs incurred by SENELEC to supply electricity in the country (i.e. SENELEC has other unregulated revenues and hence incurs other costs, which are not captured in this analysis). The tariff revenue shortfall is the difference between 'Total costs of the year' and 'In country sales' and excludes the effect of k-factor adjustments to better reflect the underlying cost of supply for each year.

