# Project Information Document (PID)

Concept Stage | Date Prepared/Updated: 17-May-2019 | Report No: PIDC26631

## BASIC INFORMATION

### A. Basic Project Data

| Country | Project ID | Parent Project ID (if any) | Project Name |
|---|---|---|---|
| Senegal | P169744 | | Project to Promote a Shift towards Lower Carbon Power Generation in Senegal (P169744) |
| **Region** | **Estimated Appraisal Date** | **Estimated Board Date** | **Practice Area (Lead)** |
| AFRICA | Oct 31, 2019 | Jan 15, 2020 | Energy & Extractives |
| **Financing Instrument** | **Borrower(s)** | **Implementing Agency** | |
| Investment Project Financing | Ministry of Finance | SENELEC | |

**Proposed Development Objective(s)**

to promote a shift towards lower carbon technologies in the power sector in Senegal

## PROJECT FINANCING DATA (US$, Millions)

### SUMMARY

| | |
|---|---|
| **Total Project Cost** | 150.00 |
| **Total Financing** | 150.00 |
| **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 |

| Environmental and Social Risk Classification | Concept Review Decision |
|---|---|

| | |
|---|---|
| Substantial | Track II-The review did authorize the preparation to continue |

Other Decision (as needed)

## B. Introduction and Context

Country Context

**1. Senegal is experiencing high growth since 2014. As a result, poverty is estimated to have reduced markedly, though it remains relatively high.** Growth exceeded 6 percent since 2014 and remained strong in 2018 at an estimated rate of 6.8 percent. Moreover, the long-term outlook remains positive. Higher growth has benefitted from a favorable external environment and good climatic conditions boosting agricultural production. Growth has been also driven by stronger competitiveness deriving from structural factors, such as improved infrastructure and financial deepening. This performance contrasts with decades of low and volatile growth. Moreover, a GDP rebasing process completed in 2018 increased GDP by around 30 percent compared to the previous measure. As a result, GDP per capita is estimated at around $1,397 in 2018, which would upgrade Senegal as a lower middle-income country. Thanks to high growth, monetary poverty has been on a downward trend, from 38 percent in 2011 (using the $1.90 per day international poverty line) to a still high 33.5 percent in 2018[1], the majority of whom were in rural areas.

**2. Continued high growth and a transition towards a more diversified and competitive economy will require reinforcing the macro-fiscal framework and implementing reforms to address remaining structural constraints.** Fiscal challenges arose in 2017 in part due to a lack of adjustment of domestic oil derivatives and electricity prices in the context of high international oil prices. This resulted in lower tax revenues from oil derivatives such as gasoline and diesel (0.6 percent of GDP in 2018), and higher energy subsidies (around 1 percent of GDP). The government has been implementing measures to increase revenues and cap expenditures to attain the agreed fiscal deficit targets. More broadly, maintaining high growth levels will require addressing persistent structural constraints, in particular in energy, ICT, agriculture, land and labor markets, which affect the efficiency of investment, competitiveness and private-sector growth.

**3. Reducing the cost of energy is a crucial element to reduce fiscal pressures and support the macro-fiscal framework, to improve financial sustainability of the electricity sector, and to promote broader access to energy.** In 2016, due to low oil prices, the tariff was close to being cost reflective. However, as oil prices increased by 40 to 50 % the following year, the cost of electricity services increased in Senegal given that it is 67 % of installed capacity is based on HFO fired generation (83 % of energy generated is from HFO). Consequently, the subsidy requirements soared to 1.1 % of GDP in 2018. Government was reluctant to increase tariffs to cover this fiscal burden due to affordability concerns– as electricity tariffs in Senegal ($0.19 c/kWh) are close to double the global average. The recent decrease in international oil prices might contribute to reduce fiscal pressures. For instance, for an oil barrel of US$65 dollars, tariff compensation to SENELEC would reduce to CFAF 111 billion (0.8 percent of GDP) in 2019. However, the power sector in Senegal remains vulnerable to price shocks as each additional dollar increase in oil price would increase the compensation by around CFAF 2.3 billion. As part of power sector reforms, government intends to promote a structural shift in the energy mix to improve

[1] Source: WB estimates, the current official data is from 2011 with a figure of 38 percent of the population living on under US$1.90 a day (2011 PPP).

the financial sustainability of the sector.

Sectoral and Institutional Context

**4. Senegal's power sector is characterized by a vertically integrated state-owned utility, SENELEC, carrying out transmission, distribution and energy purchase in most of the country.** SENELEC also owns about half of the country's generation capacity, with the remainder being owned by independent power producers (IPPs) that generate electricity and sell it to SENELEC. In 1998, given the low rate of rural electrification in the country, the Government of Senegal (GoS) launched the Rural Electrification Action Plan (PASER) and divided the country into 10 concessions for allocation to private sector companies – concessionaires (CER) – who have the monopoly for electricity distribution within their concessions. 6 out of 10 concessions have been awarded to private stakeholders, which have encountered numerous barriers delaying their connection progress. SENELEC remains the major electricity service provider in rural areas, covering 96 percent of clients compared to CERs' 4 percent and was recently awarded the remaining 4 concessions.

**5. The sector is overseen by the Ministry of Petroleum and Energy (MPE).** An independent Electricity Regulatory Commission (*Commission de Régulation du Secteur de l'Electricité*, CRSE) was established in 1998 with the responsibility of approving revenue requirements for the sector and overall regulation, including licensing and leading IPP tender processes. The sector also includes the rural electrification agency (*Agence Sénégalaise d'Electrification Rurale*, ASER). Energy efficiency strategy and standards are set by the agency for energy saving and management (*Agence pour l'économie de et la Maîtrise de l'Energie*, AEME), created in 2011**.**

**6. The regulatory system of electricity pricing is transparent, but suffers from weak implementation, resulting in frequent budgetary arrears to the utility.** The regulator, CRSE, publishes on a quarterly basis, the maximum allowed revenues for SENELEC to cover their costs and, by comparing this figure with the revenue given the current level of tariffs, demonstrates any tariff revenue shortfall. As a result, it calculates the corresponding tariff adjustment, or the level of budgetary 'compensation' needed to cover the additional costs not covered by revenues from electricity sales. The government then has the option of adjusting the tariffs accordingly or compensating the utility. This information is published on the CRSE website, which allows the effects of changing economic conditions, including increasing production costs on SENELEC's maximum allowed revenues to be tracked. Budgeting of the required tariff compensation by the government is not consistently or fully implemented, resulting in payments arrears, particularly when the amounts are significant.

**7. The Government of Senegal is fully committed to modernize the electricity grid, and in so doing, to reduce the carbon intensity of the power sector.** Government is fully engaged to shift the energy mix from a high reliance on HFO and diesel and supplemented by coal, towards a grid that is modern, and more reliable through a greater diversification of the energy mix consisting of a predominance of natural gas, renewable energy and hydropower, with a decreasing share of expensive thermal power. At the end of 2018, Heavy fuel oil (HFO) represented 67 percent of the 940 MW of installed capacity and coal 12 percent, with solar and imported hydro power representing the remaining 12 and 9 percent respectively. Coal plant is currently dispatching around 100MW to the grid as baseload capacity. With the support of the multisectoral reform Development Financing (DPF) (series currently ongoing), government has initiated a phase out of the use of heavy fuel oil for power generation. The World Bank is of the view that by 2025, the installed capacity is expected to have a minimum of 22 percent renewables, (including solar, wind and hydro), 64 percent gas and 8 percent coal. The share of coal in the mix will be substantially reduced thanks to the recent natural gas discoveries in Senegal and the development of renewable energies together with increased in imported hydropower. Furthermore, Senegal is modernizing its long-term planning and dispatching capabilities, and will be able to absorb higher levels of renewable energy over time through reinforcing the grid and adopting new methods to integrate variable renewable energy as technology further develops.

**8. The proposed operation will support Senegal's transition to lower carbon technologies in the power sector and enable it to exceed its commitments in the Paris Accords**. Senegal's strategic master plan for electricity generation outlines how Senegal intends to more than double the generation capacity from around 940 MW to 2.5 GW by 2030, through a reliance of a mix of domestic gas and imported hydropower for baseload power generation, which will be supplemented by as much intermittent renewable energy (from solar and wind) that the nascent grid can absorb. GHG emissions per MWh is expected to fall from 0.59 tCO2/MWh in 2018 to 0.37 tCO2/MWh in 2025, which represents a 37% reduction. In addition, GHG emissions in the power sector are expected to be reduced by 1.3 million tons by 2021 compared to a counterfactual without gas, which is equivalent to a GHG reduction of 32% by 2021, and 44% by 2026. This is a much more ambitious result than anticipated in Senegal's Nationally Determined Commitment pursuant to the Paris Accord, where it adopted an emission reduction target of 4% in the unconditional scenario and 15% in its conditional plus scenario by 2025. These emission reductions relative to the counterfactual are achieved through the substitution of HFO from the grid in favor of a mix of gas and renewable energy, and curbing future investments in coal.

**9. In line with the Paris Accords, the GoS took the decision to refrain from investing in further coal fired plants.** In 2011, Senegal had planned 1,100 MW of coal fired generation for baseload capacity by 2025, as it had a clear price advantage relative to HFO. Through Bank support, Senegal agreed in 2016 to reduce its planned coal investments to 395 MW. Senegal may have the option to further substitute about 270 MW of coal in the generation plan with renewables and gas-based generation, and therefore reduce the total coal installed capacity to the 115MW which is already under operation (8% in the mix by 2025). This strategy depends on the availability of gas from domestic production coming on stream earlier than anticipated. No further coal is anticipated thereafter.

**10. The donor community is supporting the GoS in implementing the transition to lower carbon technologies in the power sector.** The key donors present in the energy sector are developing interventions to support the GoS in implementing the transition to a cleaner energy mix through activities on gas, renewables energies and increase in hydropower imports (see table below).

| Intervention | IFI |
|---|---|
| **Renewable energy** | |
| Scaling solar program | IFC, MIGA |
| Battery storage | KfW, WB/IFC, MCC, KIAT |
| Upgrade of dispatching system to integrate RE and battery storage | AfD, WB, KIAT |
| Reinforcement of the grid to absorb higher amount of RE | MCC, WB |
| Wind IPP guarantee | MIGA |
| **Gas** | |
| Institutional, legal and regulatory framework for midstream and downstream | WB, MCC |
| Update of the LCPDP to integrate the new developments of gas | WB |
| Technical assistance to develop the feasibility studies on the gas transport system | IFC, WB |
| High level design of gas midstream company as a PPP | IFC |
| Conversion of HFO based plants to gas | WB, IFC |
| Support to develop pipeline midstream infrastructure and support gas purchase | WB |

| | |
|---|---|
| Finance of the transport SPV company | WB, IFC |
| Feasibility Study & Transaction Advisory Services for new 400 MW IPP gas power plant | Global Infrastructure Facility (GIF), WB |
| **Hydropower** | |
| OMVG project to allow the increase of hydropower imports | WB, AfDB, EIB, AfD, IDB, KfW, BOAD, Kuwait Fund for Arab Economic Development |

**11. The recent gas discoveries in Senegal provides an opportunity to shorten the lead time to sustainably shift the fuel mix and enable the development of renewable energies**. Accelerating the deployment of solar and other renewable energy, remains a strategic pillar for the sector. In addition to the 40 MW which they have commissioned in 2016, SENELEC has planned 323 MW of grid-connected solar capacity by 2023. Together with 158.7 MW expected from wind energy by 2020, the country will surpass its renewable energy targets. Based on recent analytical work in Senegal, further increasing renewable energy integration requires (i) improving dispatch capabilities to optimize and flexibly use conventional plants (ramp rates and part-loads) to manage the variability of renewable energy and (ii) to improve the stability of the grid related to 'inertia' (measured in seconds). Without sufficient inertia, the system will reach critical levels of under-frequency which may cause the system to collapse.

**12. Recent stability studies on renewable energy integration concluded that due to weak spinning reserves/frequency regulation capacity in Senegal, significant curtailment of renewable energy would be necessary to maintain grid stability**. To reduce renewable energy curtailment, improve grid stability and a facilitate a smooth integration of a large share of renewable energy generation in the grid, it is key for the Government to carry out critical investments in the grid, and on gas fired generation the short-term. Examples include a mix of flexible gas fired generation, battery storage solutions and grid/dispatching upgrades. SENELEC will also need to improve its planning capacity and define new dispatch rules with real time dispatching of renewable resources. By 2030, Senegal intends to have 30 % renewables in the grid.

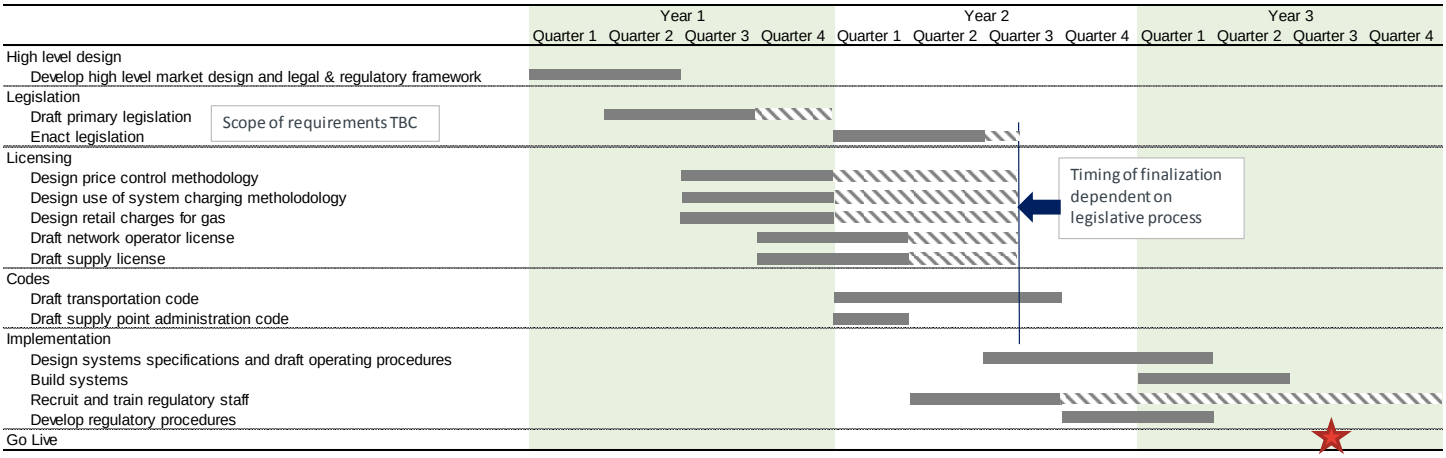
**13. The Government is exploring different gas-to-power options.** The recent discoveries by Cairn Energy and Kosmos Energy put projected oil reserves at 513 million barrels and 416 billion cubic feet of associated and 2 trillion cubic feet of non-associated gas. These, together with gas-only finds at Tortue by Kosmos Energy of 1.5 Tcf – to be developed by BP - have the potential to significantly reduce the cost of service in Senegal and enable Senegal to become an energy exporter. According to analysis carried out by the Bank, the value of switching to domestic gas for SENELEC is approximately 115 billion FCFA per annum (200 MUSD) (depending on the price of gas and fuel oil) – which is approximately the annual financial gap (in 2017, 2018 and forecast 2019) between revenues from consumers and its required (regulated maximum allowed) revenues. This means that a switch to gas would all but eliminate the need for extra fiscal support to the sector and lead to lower tariffs over time. Should domestic gas be delayed, there are opportunities to import LNG, and the value of doing so to SENELEC was estimated to be 50 billion FCFA per annum (86 MUSD), subject to a minimum 5-year usage. The government's plan is to substitute gas for HFO (expected by 2024-25). The MCC/Power Africa has funded a preliminary report to support converting existing power plants to gas and/or dual fuel and there is a potential to convert up to 400MW.

**14. The viability of developing the gas-to-power value chain depends on the adequate development of the midstream and downstream in parallel to the upstream.** Currently, Senegal does not have an institutional, legal and regulatory framework for midstream and downstream gas. It's development in parallel with upstream efforts is an imperative to ensure that demand and efficient use of gas is aligned with supply. A perceived disconnect would lead to delays in development of gas – and real ex-post delay in development of demand could be extremely costly to Senegal – as recently experienced in Ghana. Development of the midstream and downstream should progress in a transparent

manner with the participation of all key stakeholders in the decision-making process. In addition, adequate planning and timely implementation of the physical infrastructure for pipelines is needed. On the downstream, there is a need to ensure the financing and implementation of the conversion of existing HFO plants and new gas-based generation capacity in a timely manner to be able to use the gas once it is available.

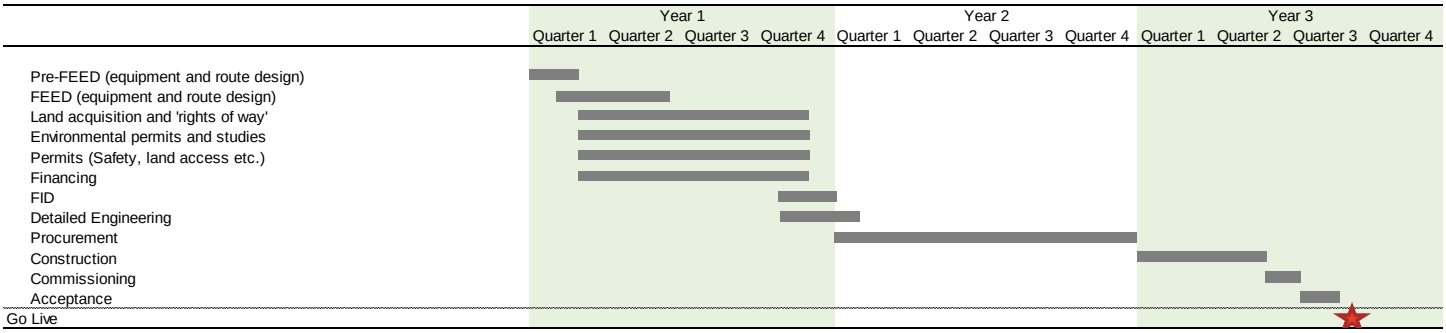
**15. The recently approved Gas-to-Power Strategy lays out the key principles to develop the gas value chain in Senegal and to optimize the use of private sector capital in gas-fired power generation.** As part of the DPF series, the government approved in November 2018 a Gas-to-Power Strategy that aims to set out the principles to improve sector regulation and provide a legal framework for private sector participation in gas fired generation. These include: (i) the development of a legal and regulatory framework for the midstream and downstream gas sector; (ii) the separation of roles between the owner of the gas transport system and the gas aggregator; (iii) the majority participation of private sector in the midstream section, with a public minority participation through a competitive process; and (iv) open access to the gas network system. To ensure that Senegal's electricity market can benefit from domestic gas production, the strategy also lays out the need to develop the midstream gas network system and provides a fast-track timeline for the conversion of existing public HFO plants and IPPs as well as new generation capacity via IPPs in parallel to the upstream development. As part of the planned new gas generation capacity to be installed, GoS, requested funding support from the Global Infrastructure Facility (GIF) through the World Bank for preparatory work/feasibility studies towards procuring a 400MW IPP. The GIF funding for feasibility studies, complements the ongoing energy sector work and lays the foundation on which to structure the first transaction/project of the country's energy transition. The following Gantt charts show the critical path for midstream and downstream development as per the gas to power strategy.

**Implementation plan for the legal and regulatory framework**

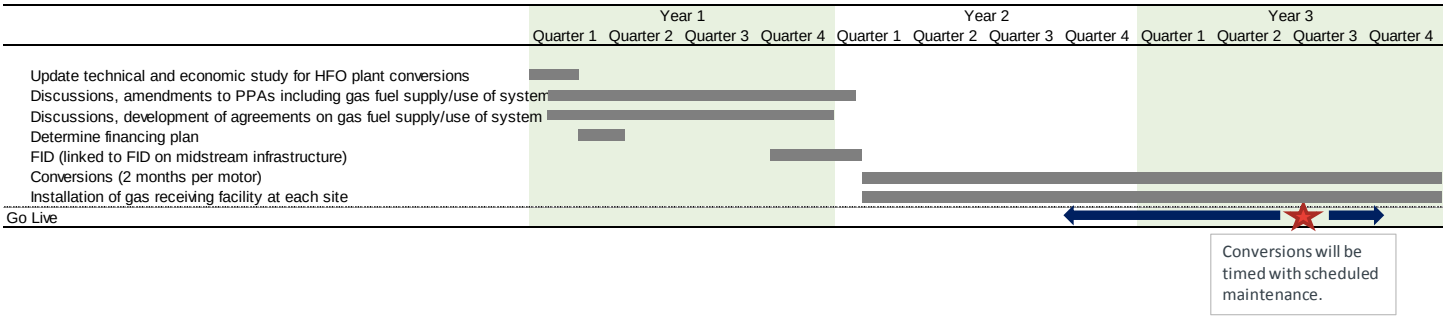



Note: GoS will determine what form of legislative amendments are required. Enacting primary legislation brings uncertainty around timeline.

**Implementation plan for midstream insfrastructure**




**Implementation plan for downstream - gas supply agreements and conversions from HFO to gas**




**16. Following the MFD principles, the proposed interventions aim to use public funds to leverage private funds in the promotion of gas-to-power and renewable energies.** According to the approved gas-to-power strategy the gas transport company will be constituted through a PPP scheme with a minority of public participation. The proposed intervention in the project is to develop an enhancement package to be able to leverage the adequate private funds and provide adequate security for private investors. Similarly, on battery storage, an innovative scheme will be developed to allow the private sector to provide ancillary services to allow the integration of RE. This, in its turn will require credit enhancements (including perhaps a payment guarantee) to secure payments on the contract between the private sector and SENELEC.

**17. In its efforts to reach universal access by 2025, Senegal intends to rely on gas fired generation.** Senegal must continue to contend with two priorities: (i) to continue to meet energy demand which is growing at 8 % annually and requires a doubling of the grid every 9 years, and (ii) to accelerate electricity access which currently stands at 65 % toward universal access by 2025. While there is a recognition that solar prices continue to fall - prices of solar PV have fallen by 75 % over the past decade and solar storage prices by 50 % in the last 18 months - in a sense, the technology disruption is not yet sufficiently impactful for a fast growing economy to rely entirely on a technology that is either intermittent in the case of solar PV, or too expensive relative to other technologies in the case of solar with storage. For that reason, the Gas-to-Power Strategy adopted as part of the DPF series highlights the key role of domestic gas production to meet Senegal's goal to achieve universal access by 2025, which is five years earlier than that mandated by the Sustainable Development Goals.

**18. Senegal has one of the highest electricity access rates in West Africa, but high inequalities between urban and rural areas as well as geographic disparities.** The current access rate in Senegal is relatively high by regional standards,

estimated at 65 percent[2] of households (against 62 percent in Cote d'Ivoire and 58 percent in Nigeria, for example, or about 28 percent in Guinea and Mali). While Senegal has almost achieved full electrification in urban areas (about 88 percent), rural access remains low at an estimated 38 percent, hindered by inadequate infrastructure and high tariffs. Basic social services (health centers, schools, etc.) are also often not electrified. Regional disparities are also prevalent with regions such as Kaffrine, Kolda, Kédougou with rural access rates estimated at between 9 and 12 per cent, while others such as Diourbel and Thiès feature rural access as high as 55 and 76 per cent respectively.

**19. Achieving universal access requires an increase in supply to meet the growing demand and address affordability issues.** The government has the objective of achieving universal access by 2025, closing notably the rural-urban electricity access gap. The national electrification strategy has determined that 95% of the connections will come from grid extensions that will require about 180MW of additional supply into the SENELEC network by 2025. In addition, one of the key constraints to accelerate the increase of electricity access has been the high cost of electricity and its related affordability issue, especially in rural areas. The shift to lower carbon energies including domestic gas and renewable energy will also entail a reduction of electricity generation costs, allowing to facilitate the objective of achieving universal access.

### Relationship to CPF

**20.** A new CPF for FY19-24 is under preparation. The project is closely aligned with the priorities in the CPF. The focus area of boosting competitiveness and job creation through private-sector led growth is supported by objective 2.2 'lower energy cost and optimize energy mix.' There is a direct link between this objective and the PDO for this project, which is focused on optimizing the fuel mix and transitioning towards a cheaper and cleaner fuel mix.

**21.** The project's emphasis on strengthening the institutional capacity of the relevant agencies in Senegal also fits with objective 3.3, on improving the government's effectiveness, efficiency and transparency.

## C. Proposed Development Objective(s)

to promote a shift towards lower carbon technologies in the power sector in Senegal

### Key Results (From PCN)

**PDO Indicators**

- Increase in percentage of gas fired power generation (percentage)
- The quantity of gas supplied to power plants (MMcf/month);
- Carbon intensity of energy mix (tCO2/MWh)
- Beneficiaries/female (number/percent)

**Intermediate indicators**

- Conversion of HFO-based power plants to gas fired power plants (MW converted)
- Development of the gas pipeline infrastructure (km)
- Capacity of battery storage constructed (MWh)
- Upgrade of the SCADA system to integrate battery storage (Yes/No)
- Gas Law and its associated decrees approved (yes/no)

[2] Source: SE4ALL Global Tracking Framework

- Decrease in number of outages (Number/per year)

### D. Concept Description

For Senegal, given the high dependency on HFO and the large potential for gas and RE development, the main intervention to reduce cost of electricity is through diversification of energy mix. The project, therefore, will support the MPE and SENELEC, and other relevant key sector agencies, with technical assistance and investment in support of private and public-private projects in the transition toward cleaner and cheaper fuels (gas-to-power, renewables IPPs with storage solutions).

In accordance with the gas-to-power strategy recently approved by the government, the private sector will be present in the gas transport company with a majority and will convert to gas their respective IPPs. The role of aggregator will remain in public hands through SENELEC.

| Legal Operational Policies | Triggered? |
|---|---|
| Projects on International Waterways OP 7.50 | No |
| Projects in Disputed Areas OP 7.60 | No |

Summary of Screening of Environmental and Social Risks and Impacts

ESS risk is substantial but easily manageable by applying rigorous E&S measures. The conversion of power plants from HFO to gas would have environmental, health and safety impacts from works, transporting equipment before it is installed, and from disposal of old equipment. The development of the gas pipeline would have environmental impacts, health and safety impacts, and may lead to some land acquisition. The ESF standards would apply to the activities or commitments covered by the guarantee, which would have to be strictly defined during Preparation, including the exact point at which gas will be owned and managed by Senelec. Under C.2., impacts of battery storage would be from civil works, including health and safety impacts during transport, installation, operation and disposal.

**Note** To view the Environmental and Social Risks and Impacts, please refer to the Concept Stage ESRS Document**.**

## CONTACT POINT

### World Bank

Manuel Luengo
Senior Energy Specialist

### Borrower/Client/Recipient

Ministry of Finance

### Implementing Agencies

SENELEC
Makhtar Cisse
CEO
makhtar.cisse@senelec.sn

## FOR MORE INFORMATION CONTACT

The World Bank
1818 H Street, NW
Washington, D.C. 20433
Telephone: (202) 473-1000
Web: http://www.worldbank.org/projects

## APPROVAL

| | |
|---|---|
| Task Team Leader(s): | Manuel Luengo |

### Approved By

| | | |
|---|---|---|
| Practice Manager/Manager: | | |
| Country Director: | | |