

ACTION AGENDA AND INVESTMENT PROSPECTUS









SENEGAL'S SE4ALL RURAL ELECTRIFICATION

ACTION AGENDA AND INVESTMENT PROSPECTUS 2018





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ACRONYMS

ANER Agence Nationale pour les Énergies Renouvelables

ANEV Agence Nationale des Eco-villages

ANSD Agence Nationale de la Statistique et de la Démographie

ASER Agence sénégalaise d'électrification rurale

CRSE Commission de Régulation du Secteur de l'Electricité

DO Diesel oil

ESMAP Energy Sector Management Assistance Program

ERIL Électrification Rurale d'Initiative Locale

FCFA Franc des colonies françaises d'Afrique (UEMOA)

GBM Groupe de la Banque Mondiale

FO Fuel oil

HT Haute Tension

KFW Kreditanstalt für Wiederaufbau

kW kilowatt kWh kilowatt-heure

MEDER Ministère de l'Energie et du développement des Energies renouvelables

MW Mégawatt

MT Movenne Tension

OMVS
 Organisation pour la mise en valeur du fleuve Sénégal
 Organisation pour la mise en valeur du fleuve Gambie
 PASER
 Programme d'Action Sénégalais d'Électrification Rurale

PLE Plan d'électrification local

PNER Programme National d'Électrification Rurale

PNUD Programme des Nations Unies pour le développement PNUER Programme National d'Urgence d'Électrification Rurale

PPER Plan Prioritaire d'Électrification Rurale

PPP Partenariat Public-Privé
PSE Plan Sénégal Émergent

PUDC Programme d'Urgence de Développement Communautaire

SE4ALL Sustainable Energy for All

SIG Système d'information géographique

UN United Nations

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PREAMBLE

In the context of the initiative "Sustainable Energy For All – SE4ALL", the United Nations defined for 2030 three objectives that link Energy Policy, Carbon Mitigation and World Poverty Reduction initiatives, namely: (i) Guarantee universal access to modern energy services; (ii) To double the world's energy efficiency rate; and (iii) to double the percentage of renewable energies in the world energy mix. In the context of that initiative, ESMAP Program (Energy Sector Management Assistance Program), World Bank's Support Program for the Energy Sector, has put in place a Technical Assistance Program – which targets in an initial phase 5 african countries, including Senegal – aiming at providing access to modern energy services to 200 million africans. Choice of Senegal is justified by the ambition established by its Government and the actions already implemented towards increasing access to electricity for its population living in rural areas.

ESMAP's technical assistance to Senegal is focused on bringing to the Government advice on choosing the most appropriate approaches, from the institutional, technical and economic perspectives, towards the design and implementation of Energy Access Programs in rural areas and the improvement of the Energy Sector Governance. Therefore, the Government together with the World Bank identified 3 components for the technical assistance, namely:

- the Reinforcement of the rural electrification sector through (i) Detailed local studies for the rural electrification of two not yet awarded concessions (Concession de Foundiougne and Concession de Ziguinchor Oussouye Bignona Sédhiou), (ii) an Organizational, Technical and Financial Audit of the Projects, Programs and Strategy of ASER including recommendations for optimization of its implementation process and (iii) the implementation of a Control and Impact Evaluation System of ASER's Projects and Programs;
- the development of an Action Agenda, National Investment Plan for Rural Electrification and Prospectus;
- the improvement of Governance and Energy Sector Management through (i) the implementation of a Control and Impact Evaluation System of Energy Policy in place (ii) the improvement of the Energy Information System of Senegal (SIE) and (iii) the review of the institutional, legal and regulatory framework of the energy sector.

The present document constitutes the Prospectus for the Action Agenda and National Investment Plan for Rural Electrification according to the Terms of Reference and the methodology proposed by the Consultant. It provides a vision for universal access, the organization of investment programs and plans for implementation, the financing requirements and the financing strategy.

EXECUTIVE SUMMARY

INTRODUCTION

Senegal is committed with the Sustainable Energy for All (SE4ALL) agenda being electricity access in rural areas one of the key priorities of the "Plan for Emerging Senegal" (PSE - Plan Sénégal Emergent) and of the SE4ALL Action Agenda which sets the target of achieving universal access in Senegal already by 2025 – 5 years ahead of the SE4ALL target date.

The present document details the Action Agenda and presents an Investment Prospectus for rural electrification in Senegal, identifying and prioritizing the least cost distribution and off-grid investments to be funded and providing a roadmap with clear and actionable programs together with a credible funding strategy and supporting institutional framework.

The aim of the Investment Prospectus is to obtain funding to complete the on-going urgency program and for the second phase of the National Rural Electrification Program (PNER) that will start in 2018. The PNER's on-going urgency program "Programme National d'Urgence d'Electrification Rurale – 2015 to 2017" (PNUER) is practically entirely financed, the Government of Senegal wishes also to mobilize funds for the second phase of the PNER: the Additional Programs for Universal Access (2018-2025).

CONTEXT AND COUNTRY BACKGROUND

Senegal's growth and stable political and economic context offer a solid "ground" for low cost funding and investment in infra-structures - key to maintain future growth ambitions and debt sustainability. Senegal's good governance, strong economic growth - reinforced by the Plan Senegal Emergent – and low inflation combined with a regional currency pegged to the Euro and guaranteed by the French treasury offer one of the best macro-economic and political contexts in Sub-Saharan Africa for infra-structure funding and deployment. Public debt sustainability is dependent on ability to maintain growth through a robust deployment of infra-structures funded with debt at a reasonable cost.

Senegal's energy sector perspectives on Generation and Transmission are key to support recent decisions on power price reduction – aiming at improving Senegal's competitiveness and growth – and to enable an affordable rural electrification investment program. On Generation, the estimated cost reduction from the diversification from oil through the introduction of coal, renewables, hydro regional imports and natural gas based power generation will reduce cost of grid-based rural electrification and minimize required compensations to Senelec resulting from recent decision to reduce electricity price. On Transmission, the growing High Voltage infra-structure offers opportunities for further demand growth and scale economies while enabling new starting points for grid extension across the country.

Strong historical performance on urban electrification and under-achievement on rural electrification implies need to change model for rural areas. The electrification rate in Senegal's urban areas reached 90% in 2009, while rural areas only reached 30% in 2015. The slower progress is partly due to the underperforming results of the Rural Electrification Action Plan (PASER) – which was based on the creation of 10 rural electrification concession areas to be managed by the private sector. This model – despite being innovative and despite the promises coming from the award of 6 concession areas - has experienced many difficulties and obstacles.

The Rural Electrification Program (PNER) approved in 2015 to accelerate rural electrification offers an opportunity for lenders and investors to deliver on the SE4ALL Agenda in Senegal and to help build an example for the rest of Africa. The PNER was approved in 2015 to accelerate rural electrification through the launch of an Urgency Program to the period between 2015 - 2017 and to deliver on the Plan Senegal Emergent (PSE) goal of universal access through the preparation of an investment plan until 2025. The Investment Plan from 2018 to 2025 constitutes the basis for the current Investment Prospectus.

ACTION AGENDA I: VISION FOR UNIVERSAL ACCESS

Universal access for Senegal means reaching all citizens, businesses, social facilities and other clients, with reliable energy in sufficient quantity, quality and duration at affordable prices. Grid extension and micro/mini-grids will be given priority together with the universal usage of pre-paid metering that allows consumers to use the energy they need as they can pay for it while allowing concessionaires to effectively manage such a disperse infra-structure in an efficient way. Individual solutions based on Solar Home Systems will only be allowed in the future in very small and isolated settlements.

By 2025 14.234 rural villages and more than one million rural clients should be electrified mostly through grid extension (12.556 villages and 95% of rural clients), but also through solar only or solar-diesel hybrid mini-grids (1.215 villages and 4% of rural clients). Rural electrification - which will represent an additional generation capacity requirement of 180 MW by 2025 - will come from the "ramification" of the planned Medium Voltage backbone (the "dorsales") and from an ambitious mini-grid program in the Eastern part of the country. Individual Solar Home Systems will electrify only 464 settlements representing less than 1% of rural clients.

ACTION AGENDA II: PRIORITY ACTION AREAS AND INTERVENTIONS

Existing and ongoing projects are being finalized with recent decision to harmonize tariffs expected to facilitate progress in the 6 concession areas awarded. Significant progress is still expected in the 6 concession areas as only recently some of them have started their activities. Also, the decision to harmonize tariffs with Senelec will result in a significant cost reduction for consumers in concession areas and expected improvement in customer adoption.

The Urgency Plan is already under-way with interventions organized in 4 key areas: MV backbone deployment (the "dorsales"), Densification along existing MV grid, Densification of already electrified villages and Mini-Grids. The target of reaching 60% of all rural clients means almost doubling in 3 years the number of electrified clients in rural areas. PUDC and other initiatives are starting to have significant impact but may require some more time to complete implementation.

The Additional Plan for Universal Access action is structured along 6 key Axis: 1. Decentralized Grids - where 100% solar and hybrid mini-grids are given priority together with the rehabilitation of existing ones. 2. MV Extension – mostly through the "ramification" of PNUER MV backbone. 3. Distribution – both to reach new villages and to densify already electrified ones. 4. Internal installations – taking pre-paid metering to all customers and incentivizing adoption through financing and subsidization of grid connection and internal installations. 5. Gender – offering special support to electrification

of women and promoting equal opportunities for both men and women arising from the rural electrification program. **6. Capacity, Coordination and Engineering** – recognizing that a lot of preparation is required for such an ambitious program.

ACTION AGENDA III: IMPLEMENTATION PLAN AND PROGRAMS

Implementation of priority action areas towards universal access will be organized in 3 different programs:

- the consolidation program to be launched in 2018: where the backbone investments will be leveraged and ramified together with an ambitious mini-grid program in the East to electrify 170.000 additional clients in a highly efficient way;
- the coverage program to be launched in 2021: where all 14.234 rural villages will receive at least their first electrification and a further 150.000 clients will be electrified:
- the completion program to be launched in 2024: where all rural inhabitants in each village across the country will have the opportunity to be connected and benefit from full universal access to electricity, allowing rural electrification to reach more than 1 million clients with a 100% target access rate.

In each period, higher priority will be given to launching a new Program, but previously launched programs may still coexist – to reflect the different speeds of development in different parts of the country and with different actors. Each program can be considered as a "building block" or "layer" of rural electrification towards universal access with concrete investments associated. Also the on-going and planned investments under the PNUER not yet deployed by end of 2017 will be completed in parallel with the other on-going programs.



FUNDING REQUIREMENTS

Planned investments under the PNUER are almost fully funded with only 45 Billion FCFA missing, but additional investments from 2018 to 2025 of 374 Billion FCFA have no commitments yet. The on-going project and PNUER are pratically entirely financed, at this stage only 45 billion FCFA are missing. The Additional Program for Universal Access has not secured any financing at this stage and therefore represents the majority of the necessary funds, a total of 374 billion FCFA (\$623 million).

The decisions on tariff harmonization and reduction are expected to result in an aggregated 168 Billion FCFA exploration deficit in the rural energy sector during the period 2018-2025 that will also require compensation. Based on the EU study the harmonization of tariffs is estimated to require a compensation close to 89 Billion FCFA to the concessionaires of PASER. Additional rural clients to be connected outside PPER will require an estimated additional compensation of 78,7 Billion FCFA just to cover operational costs – not including any type of remuneration on investment.

Despite a total funding requirement until 2025 of 587 Billion FCFA (45B + 374B + 168B FCFA), current priority for Senegal is to mobilize funds of 254,8 Billion FCFA (\$425M) required until 2020. Current priority includes finalizing the PNUER with 45 Billion FCFA funding, starting the 2018 "Consolidation" Program which requires an additional 154 Billion FCFA and guaranteeing effective cross-subsidization mechanisms so that concessionaires can have sufficient resources and adequate compensation to provide electricity with quality to 75% of the rural population by 2020.

FINANCING SYNDICATION STRATEGY

The need to harmonize and lower tariffs while also reducing compensations from the State Budget to Senelec limits significantly access to Private Financing without some sort of public guarantee and requires a strong and determined effort on power sector efficiency and operational cost reduction. Only under very optimistic and challenging assumptions for power sector cost evolution it will be possible to avoid compensations to Senelec and develop a sustainable and "bankable" power system where the sector can cross-subsidize the rural operational deficit. Nevertheless, the application of a levy on consumers of 0,7 FCFA/KWh will mobilize already 26 Billion during the 2018-2025 period for the Rural Electrification Fund.

Financing of rural electrification will be mostly Public or Public guaranteed, and therefore needs to be done in an effective way to support economic growth while pursuing a prudent debt strategy that keeps cost of borrowing at reasonable rates, as recommended by IMF. Commercial loans imply higher interests and financial costs which would make universal access more expensive for Senegal and therefore should ideally be avoided and limited to blended and more affordable solutions.

The recommended financing strategy for investments – that can maximize debt sustainability and maintain impact on State Budget at reasonable levels – is based on:

- Maximization of Grants, ideally those that are project specific or that can be blended with other sources and that do not represent a trade-off with other sectors. Targets of 11,6Billion/year up to 22,1Billion/year could be envisaged considering historical results and GDP growth, but require strong donor support and an active role of ASER.
- Maximization of Concessional loans, both bilateral and multi-lateral, if required procurement does not constrain or increase equipment acquisition costs. Macro-economic perspectives offer a potential to significantly increase public loans allocated to rural electrification up to 14,7Billion/year.

- Selective use of Private sector blended funding opportunities supported on public guarantees and adequate contractual structures. It is possible and desirable to use available blended funding opportunities where Commercial or Development Finance can be blended with concessional finance and grants resulting in low interest and long tenors.
- Leveraging Climate financing opportunities. The Paris Agreement envisages 100 Billion of climate finance for development per year by 2020. Proactive procurement and origination of climate finance opportunities can provide access to new sources of grants and concessional loans as ASER is already pioneering in the Voucher Scheme project.

State Budget contribution will remain the key source of funding, but donor support is critical as without a significant increase in grants and loans relative to what was verified in recent years the contribution from the State Budget may require a significant increase. Without cost efficiency and increase in support from donors, concessional lenders and/or innovative private sector and carbon financing, achieving rural electrification targets would require very significant increases in State Budget allocation (up to 380Billion or 50 Billion/year), potentially undermining investment in other key sectors for Senegal.



A NEW STRATEGY AND INSTITUTIONAL FRAMEWORK

Limited historical progress and ambitious rural electrification Program require institutional changes and a new strategy. Such changes have to be implemented in two phases in order not to further delay implementation:

- Until 2020, immediate institutional improvement will be focused on the creation of Project Management Units in charge of direct contracting of equipment and works, using public funding under coordination of a reinforced ASER, on tariff harmonization between concessionaires and SENELEC and on the award of the remaining concessions.
- After 2020, the existing Concession model will be simplified with clearer separation of activities and geographies. Regional Distribution Concessions will constitute the basis for operating the distribution grid and off-grid infra-structure in the future, in both urban and rural areas. The long term model will require a new regulatory approach with a compensation system which can facilitate the intended changes on the concession model and the implementation of a unique tariff system.

Based on lessons learned, the proposed new strategy employs a modified approach for rural electrification development based on a coherent scheme to aggregate the market for rural electricity service expansion under a simplified set of implementing mechanisms. A decision to centralize rural electrification planning and program management underpins this new strategy, in order to reduce complexity and eliminate overlapping roles. The second step is to develop scaled-up service territories with sustainable long-term electrification service and business plans.

Under the new strategy Rural Electrification shall be implemented on a model of scaled, multi-technology electricity service territories or concessions comprising the entire territory of the country to be managed by duly licensed concession holders.





Senegal is committed with the Sustainable Energy for All (SE4ALL) agenda being electricity access in rural areas one of the key priorities of the "Emerging Senegal Plan" (PSE - Plan Sénégal Emergent) and of the SE4ALL Action Agenda which sets the target of achieving universal access in Senegal already by 2025 – 5 years ahead of the SE4ALL target date.

Access to energy, particularly access to electricity services, is a major challenge for the countries of the African continent and is an indispensable condition for economic and social development. In this context, the Sustainable Energy for All (SE4ALL) initiative was launched by the United Nations to mobilize actions and resources in order to achieve universal access to electricity services by 2030. Senegal under its SE4ALL country Action Agenda has imposed the ambitious horizon of 2025 to achieve universal access to electricity services.

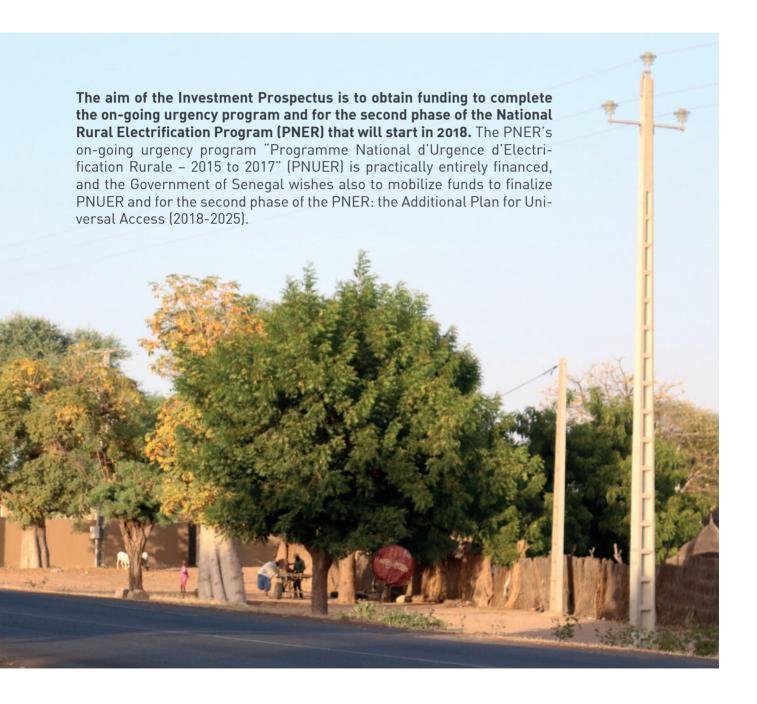
Indeed, universal access to energy in rural areas has become a Government of Senegal priority and is considered in the "Emerging Senegal Plan" (PSE – Plan Sénégal Emergent) as a fundamental factor for economic development and for the fight against poverty. The main objective of the PSE plan is the emergence of Senegal to promote economic growth with a strong impact on human development.

The present document details the Action Agenda and presents an Investment Prospectus for rural electrification in Senegal, identifying and prioritizing the least cost distribution and off-grid investments to be funded and providing a roadmap with clear and actionable programs together with a credible funding strategy and supporting institutional framework.

The present document is the SE4ALL Investment Prospectus for rural electrification and was prepared under a Technical Assistance funded by the World Bank and supervised by MEDER (Ministere de l'Energie et du Developpement des Energies Renouvelables) and ASER (Agence Sénégalaise d'Electrification Rurale) which included also the preparation of a detailed investment plan and financing strategy for the period 2018-2025 – the Additional Plan for Universal Access.



The technical support study was developed by the Consultant Gesto Energy, in collaboration with the Sustainable Engineering Lab of the Earth Institute at Columbia University. The study included a Geospatial Network Planning and Mapping to identify the least-cost electrification strategy and infra-structure to take electricity to all the villages and settlements in Senegal with less than 5.000 inhabitants (the rural villages). The planned infra-structure was prioritized and budgeted in order to develop an investment plan with concrete projects, timeline and funding requirements – the detailed Action Agenda. The study also included the development of a financing strategy and a rapid analysis and review of the institutional framework in place.



The National Program for Rural Electrification (PNER) was approved and adopted in April 2015. This plan defines a strategy for rural electrification, with an intermediate step that targets an electricity access rate of 60% in 2017 and a minimum rate of 30% per Department. This new government strategy is structured in 3 components: The conclusion of the previous programs, an Urgency Plan for the period 2015 to 2017 ("Plan National d'Urgence d'Electrication Rurale" - PNUER) and an Additional Plan for Universal Access until 2025 ("Programme Complémentaire pour l'Accés Universel à l'horizon 2025") which includes also the award of the 4 remaining concessions.

PLANS	PNER			
PROGRAMS	Programs and projects in progress	PNUER	Universal Access Complementary Program by 2025	
PROJECTS	- The 6 existing concessions - The ERIL projects - The project owner delegate conventions no 17, 19, 20 - The Spain's debt cancellation project - The convention of PPP - The community Development Emergency Program	- Component 1: "Dorsales" - Component 2: Electrification of settlements near the grid - Component 3: Grid densification - Component 4: Electrification via diesel or hybrid mini-grids	- Allocation of the remaining concessions - Least cost network planning for universal access (SE4ALL initiative)	
OBJECTIVES	To reach an electrification rate of 60% in 2017: approximately 450 000 households		Taux An electrification rate of 100% in 2025: approximately 970 000 households	

Figure 2.1 – Programs and projects of the PNER (Source: ASER)

The on-going Urgency Program with a total estimated investment of 146 Billion FCFA is only missing 45 Billion FCFA. To date it received relevant contributions from the State of Senegal and other partners (part of which is implemented by the PUDC programme («Emergency Community Development Programme»). The Government of Senegal wishes with this Investment Prospectus to finalize funding of PNUER and to start mobilizing resources for 2018 and onwards (the Additional Plan).

CONTEXT AND COUNTRY BACKGROUND

3.1 COUNTRY BACKGROUND

Senegal's growth and stable economic context offer the potential for low cost funding and investment in infra-structures – key to maintain future growth ambitions and debt sustainability. Senegal's good governance, strong economic growth – reinforced by the Plan Senegal Emergent – and low inflation combined with a regional currency pegged to the Euro and guaranteed by the French treasury offer one of the best macro-economic and political contexts in Sub-Saharan Africa for infra-structure funding and deployment. Public debt sustainability is dependent on ability to maintain growth through a robust deployment of infra-structures funded with debt at a reasonable cost.

Senegal is the westernmost country in Africa's mainland with a total area of 196.700 km2 and an estimated population of around 14,7 million people in 2016. Senegal has a coastline of more than 500 km and is bordered by Mauritania to the north, Mali to the east, Guinea to the southeast, and Guinea-Bissau to the southwest. Senegal also borders and surrounds Gambia.

According to the 2013 National Census the rural population in Senegal accounted for 55% of the total country population with 7,4 million people living in rural areas across more than 14.000 villages. The population is organized in 14 regions with the Western regions of the country being more dense and the Eastern inland regions less dense (see following figure with all the rural villages mapped, with different colors according to the region).



According to the Ibrahim Index of African Governance, Senegal scored 62,4 (out of 100) in overall governance in 2014, which positions Senegal as 9th in Africa (out of 54). Senegal was the only top ten performer to have improved in all the four main governance components: Safety & Rule of Law, Participation & Human rights, Sustainable Economic Opportunity and Human Development.

Senegal has experienced in the recent past relevant economic growth with GDP in 2016 to grow 6,6%, up from 6,5% growth in 2015. This growth reflects a good performance in agriculture, renewed dynamism in the secondary sector due to refining, chemicals, cement, energy, and the startup of Plan Sénégal Emergent (PSE)-related projects. Prospects for growth remain solid according to IMF with 7% growth expected in the medium term as the reforms under the PSE start to produce results. By 2025 Senegal's GDP is expected to double.

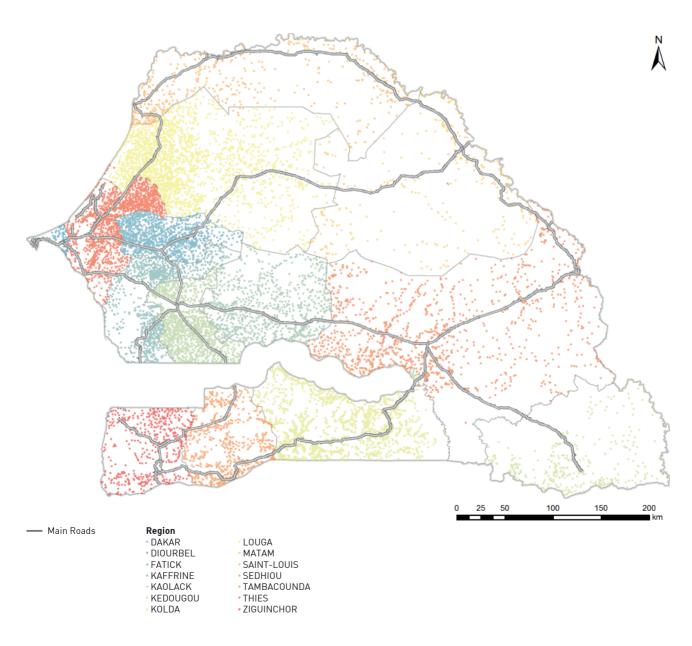


Figure 3.1 – GIS database of Senegal's rural settlements (Source: ASER)

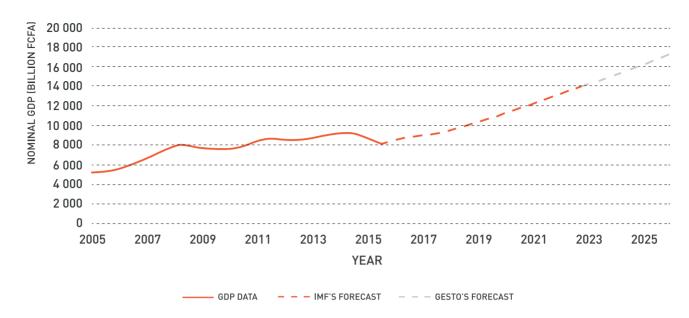


Figure 3.2 – Estimated GDP growth (Source: IMF, GESTO Analysis)

Macroeconomic context for Senegal is stable with low levels of inflation (below 1%) and a controlled level of public debt (which reached 59% of GDP in 2016). The estimated growth of GDP together with a prudent debt policy will be critical to bring level of public debt down to 52,5% by 2021 as envisaged by IMF.

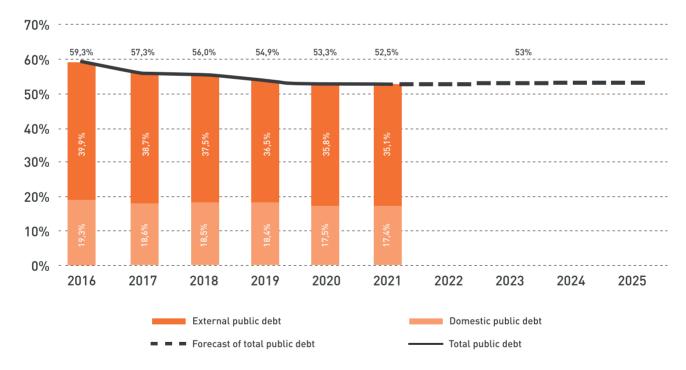


Figure 3.3 – Forecast of the public debt-to-GDP ratio to 2025 [Source: IMF, GESTO Analysis]

Senegal's currency is the West Africa FCFA franc which is shared with other 14 countries representing a combined population of 150 million people. The FCFA franc is pegged to the Euro (1 Euro = 655,957 FCFA franc) and is guaranteed by the French Treasury implying almost no convertibility risk.

Good governance, a stable and promising macro-economic context, together with limited convertibility risks makes Senegal an excellent country to invest or lend to.

3.2 SENEGAL ENERGY SECTOR

Senegal's energy sector perspectives on Generation and Transmission are key to support recent decisions on power price reduction – aiming at improving Senegal's competitiveness and growth – and to enable an affordable rural electrification investment program. On Generation, the estimated cost reduction from the diversification from oil through the introduction of coal, renewables and natural gas based power generation will reduce cost of grid-based rural electrification and minimize required compensations to Senelec resulting from recent decision to reduce electricity price. On Transmission, the growing High Voltage infra-structure offers opportunities for further demand growth and scale economies while enabling new starting points for grid extension across the country.

3.2.1 GENERATION

Senegal's generation installed capacity in 2015 was close to 898 MW consisting mainly of thermal power stations based on Heavy Fuel Oil partly owned by Senelec (498 MW) and Independent Power Producers. Additionally, Senegal benefits from part of the exploitation of the hydroelectric power stations of Manantali – 66 of 200 MW - and Félou – 15 of 60 MW - located in Mali. Finally, 75 MW of gas turbines are operational mostly for backup and peak operation as they currently run on diesel. The use of petroleum products, mainly imported, implies a high production cost historically close

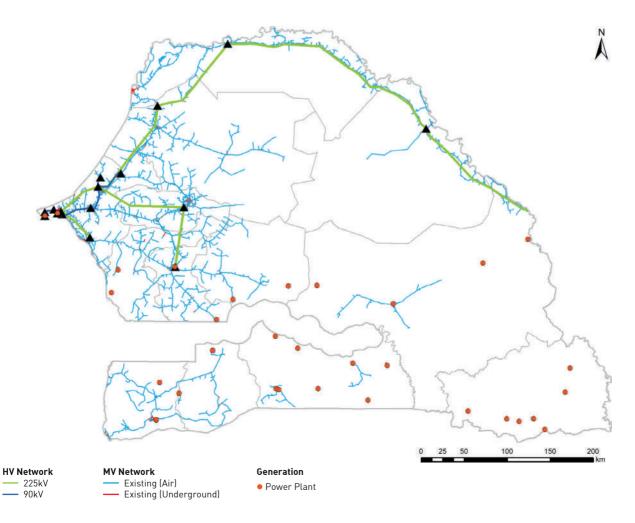


Figure 3.4 – Mapping of production plants and current grid network (Source : Analysis Gesto, Data: Senelec, ASER)

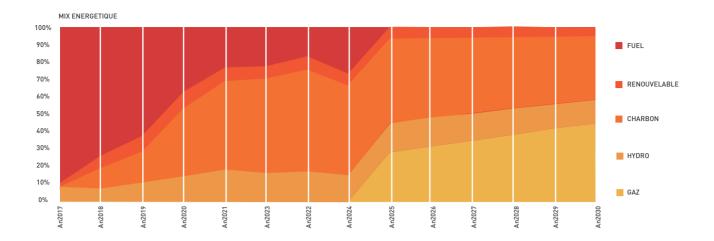


Figure 3.5 – Evolution of the production mix estimated by Senelec (Source : Senelec)

to 90 FCFA / kWh, representing one of the highest production costs in the sub-Saharan region. The reduction in the international price of oil has allowed for a decrease in generation cost down to an estimated value of 75 FCFA/kWh in 2016.

For the non-interconnected network, SENELEC has power stations in the towns of Ziguinchor and Tambacounda together with a network of low-power isolated secondary and regional power plants to meet the demand of small towns and villages in the Kaolack, Tambacounda, Kolda and Ziguinchor regions, all of which operate on diesel. These centers have low profitability and very high production costs. The location of these power plants is detailed in the following figure.

GENERATION PLAN TO 2030

The Senegalese government under the "Emerging Senegal Plan" (PSE) aims also to reduce the cost of generation to a value between 60 and 70 FCFA / kWh, while responding to an expected strong increase in demand.

To this end, the production mix will be modified to less costly generation sources such as coal and renewable energies, including solar and wind. Senelec has considered different scenarios for the diversification of the energy mix under the "Production plan 2017-2030", including the construction of several coal-fired power stations, hydroelectric plants from the region (OMVG, OMVS) and the usage of locally-sourced gas (discovered off the coast of Saint-Louis). Electricity imports from the region (OMVG, OMVS, WAPP) and renewables may still offer additional opportunities to reduce costs in the future.

The baseline scenario considered by Senelec allows the average cost of production to reach FCFA 62.3 per kWh (10,4 \$ cents/kWh) in 2025. The evolution of the generation mix is characterized by the addition of coal based generation from 2017-2018 and of natural gas based generation from 2024-2025 as can be seen in the following figure. Apart from some growth in hydro, a still limited role from renewables is envisaged.

Even considering a conservative scenario for the evolution of generation costs - that may occur if fuel prices increase or if natural gas has to be imported as LNG - the costs are expected to decrease significantly until 2025, as can be seen in Figure 3.6, offering not only a lower cost for grid based power that can be taken to rural areas through grid extension, but also a key lever to minimize or even eliminate required compensations to Senelec resulting from recent decision to reduce electricity price by 10%.

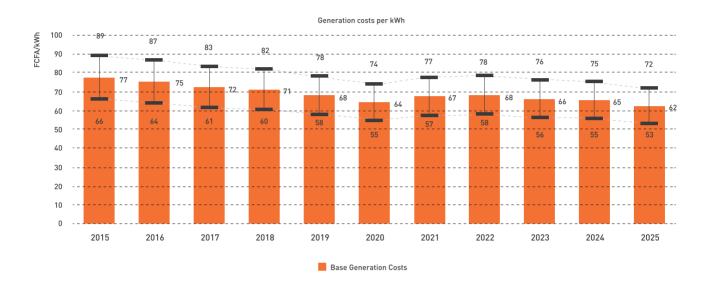


Figure 3.6 – Energy generation cost scenarios
(Source: Base Case – SENELEC; Low and High Cost cases – Gesto Energy analysis)

3.2.2 TRANSMISSION

The current high-voltage (HV) network is owned and operated by SENELEC and OMVS/SOGEM and consists of an international 225kV link connecting the Manantali hydro power plant in Mali to Dakar through the northern border with Mauritania. This axis is extended to the Touba and Kahone substations in order to ensure the evacuation of power from the plants installed in this region and the demand of the regions of Diourbel, Kaolack, Kaffrine and Fatick. This HV network also includes the 90kV and 225kV voltages used to supply the urban areas of Dakar, Thiès and Mbour.

The medium voltage level (MV) as can be observed in Figure 3.4 is divided in two distinct networks. The interconnected network extends over most of the north and western area of Senegal by connecting the main towns and villages to the HV network. For the southern regions, there are several Medium Voltage autonomous mini-grids in Ziguinchor, Kolda, Tambacounda and Velingara that constitute the non-interconnected network.

TRANSMISSION PLANS

The planned power grid is shown in Figure 3.7. In terms of planned HV network, there is a large 225kV interconnection project with neighbouring countries within the framework of the Senegal River Development Organizations (OMVS) and the Gambia River (OMVG) passing through Tambacounda. The planned High Voltage grid will enable Senegal to benefit from part of the production of the hydroelectric power stations of Kaléta in Guinea and Gouina in Mali and to interconnect the Southwest (Ziguinchor, Sédhiou and Kolda) and Southeast (Tambacounda and Kedougou) parts of the country.

For the Medium Voltage level, the on-going Urgency Plan (PNUER) until 2017 intends to build a series of "backbone" MV lines called "dorsales" to bring the interconnected grid closer to rural areas. A significant part of these "backbone" lines will be built under the PUDC program. These planned lines are shown in Figure 3.7 and will become starting points for new Medium and Low Voltage distribution lines.

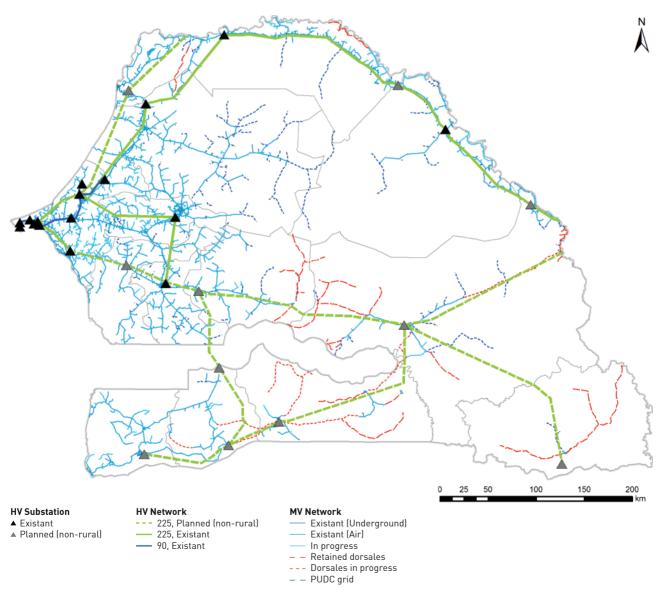


Figure 3.7 - Planned network (Source: GESTO Analysis; Data: ASER)

3.2.3 DISTRIBUTION

Strong historical performance on urban electrification and under-achievement on rural electrification implied need to change model for rural areas. Electrification rate in urban areas in Senegal achieved 90% already in 2009 and in rural areas remained close to 30% in 2015. The slower progress is partly due to the underperforming results of the Rural Electrification Action Plan (PASER) – which was based on the creation of 10 rural electrification concession areas to be managed by the private sector. This model – despite being innovative and despite the promises coming from the award of 6 concession areas - has experienced many difficulties and obstacles.

Electrification rate in urban areas of Senegal increased significantly during the decade 2000-2010 when it grew from just 58% to 90% (Figure 3.8). A target of 95% urban electrification rate - considering population growth and increasing urbanization - was set for SENELEC in 2017. SENELEC already has more than 1 million clients.

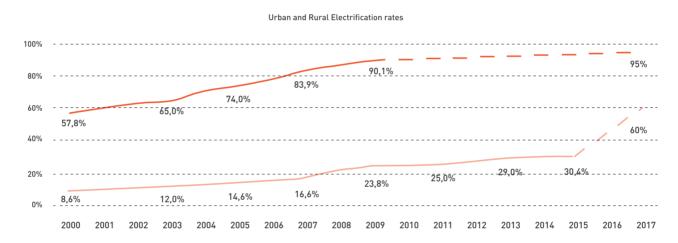


Figure 3.8 – Urban and Rural historical and target electrification rates (Source: GESTO Analysis; Data: SIE 2010, PSE, CRSE, ASER 2015)

Overall, by the end of 2015, the electrification rate of rural households was 30.4%, equivalent to 225.895 rural domestic households electrified out of a total of about 744,000 households located in rural areas. If we add services customers, the total number of rural customers is estimated to be 237,151. Given the low level of demand of rural consumers the total consumption in 2015 is estimated to be only 112 GWh with a peak load of only 33 MW. Moreover, the coverage rate of villages in rural areas is estimated at only 20.1% with 2,863 villages electrified out of the 14,235 villages existing throughout the territory – as can be seen in the following figure.

The slower progress is partly due to low incomes of the rural population and to the underperforming results of the Rural Electrification Action Plan (PASER). In 1998, given the low rate of rural electrification in the country, the State of Senegal carried out a reform of the electricity sector and launched **PASER** with the objective of increasing rural electrification rate to 60% by 2022.

Under this Plan the country was divided into 10 concessions for allocation to private sector companies with minimum required investments - the Priority Rural Electrification Programs (PPERs). Senelec remained as the operator of electrified villages until 2002 – the Senelec rural perimeter - and was not allowed to participate in PASER in order to avoid competition with private initiatives. In addition, Local Rural Electrification (ERIL) initiatives were authorized and incentivized to accelerate the electrification of communities outside the PPER or Senelec areas of intervention – in many cases funded through international cooperation.

Despite the great interest and mobilization of funds by the international community only 6 out of 10 concessions have been awarded and those awarded have encountered numerous barriers such as the complexity of the tendering and contracting administrative procedures, difficulties in delivery of promised tax exemptions, limited cooperation with Senelec and local population resistance due to price and level of service differences to those being offered by Senelec.

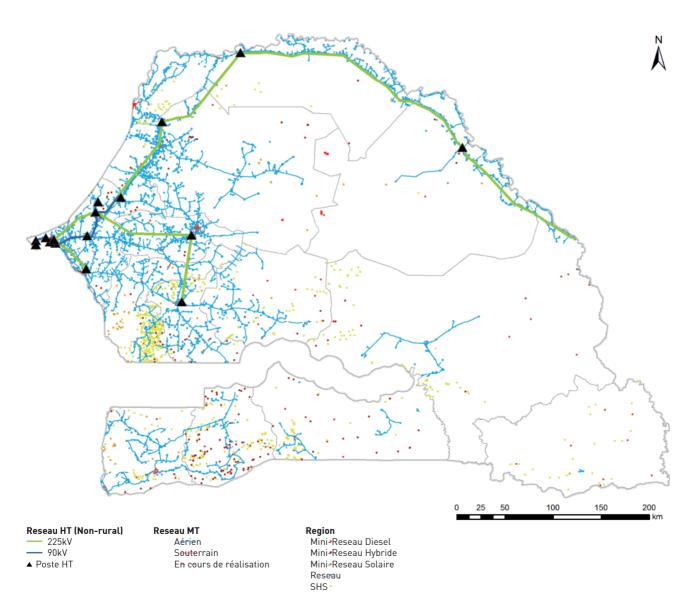


Figure 3.9 - Electrified settlements in 2015 (Source: GESTO Analysis, Data: ASER)





ACTION AGENDA PART I: VISION FOR UNIVERSAL ACCESS

4.1 UNIVERSAL ACCESS DEFINITION

Universal access for Senegal means reaching all citizens, businesses, commerce and others with reliable energy in sufficient quantity, quality and duration at affordable prices. Grid extension and micro/mini-grids will be given priority together with the universal usage of pre-paid metering that allows consumers to use the energy they need as they can afford it while allowing concessionaires to effectively manage such a disperse infra-structure in an efficient way. Individual solutions based on Solar Home Systems will only be allowed in the future in very small and isolated settlements.

Access to electricity can have different meanings. One may have access to electricity if electricity has reached its village, independently of being connected or not (Coverage or availability rate). One may have access if its house or business is connected to the grid or to a decentralized electricity generation solution (electrification rate). However, being connected may not be sufficient to satisfy the demand for energy and thus achieve robust economic and social development. Indeed, a poor quality of energy supply associated with high prices and/or a lack of safety can greatly limit its use while increasing the risk of accidents.

The multi-tier framework – developed by World Bank under the Sustainable Energy 4 All initiative – definition of access is used to establish the minimum intended level of access for Senegal rural areas. This multi-attribute framework includes seven dimensions (Capacity, Duration, Reliability, Quality, Affordability, Legality and Safety) as shown in the following figure which are then combined in order to define 5 Tiers or levels of access.

			TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
				Very Low Power Min 3 W	Low Power Min 50 W	Medium Power Min 200 W	High Power Min 800 W	Very High Power Min 2 kW
				Min 12 Wh	Min 200 Wh	Min 1.0 kWh	Min 3.4 kWh	Min 8.2 kWh
				Lighting of 1,000 lmhrs per day and phone charging	Electrical lighting, air circulation, television, and phone charging are possible			
				Min 4 hrs	Min 4 hrs	Min 8 hrs	Min 16 hrs	Min 23 hrs
ATTRIBUTES	2. Duration			Min 1 hrs	Min 2 hrs	Min 3 hrs	Min 4 hrs	Min 4 hrs
ATTRI	3. Reliability						Max 14 disruptions per week	Max 3 disruptions per week of total duration <2 hours
	4. Quality						Voltage proble use of desired	ems do not affect the appliances
	5. Affordability						package of 36	dard consumption 5 kWh per annum is f household income
	6. Legality							ne utility, prepaid card rized representative
	7. Health and 9	Safety						t accidents and igh risk in the future

¹ The minimum power capacity ratings in watts are indicative, particularly for Tier 1 and Tier 2, as the efficiency of end-user appliences is critical to determining the real level of capacity, and thus the type of electicity services that can be performed.

Figure 4.1 – Multi-tier framework criteria (Source : ESMAP)

The Tiers or levels are determined by the combination of different criteria along the 7 dimensions. The PASER established 4 levels of Service (S1, S2, S3 and S4). The level of service S1 corresponds to Tier 1 (power below 50 W) which is considered a very low level of access normally recommended for the poorest households, with very low energy consumption – limited to five light points and possibly phone charging. Levels of service S2 and S3 correspond to Tier 2 (power capacity below 200 W) which also represents a low level of access allowing the use of a lighting system, recharge of mobile phone batteries and, potentially, a Fan or television. S4 and Grid based electrification corresponds normally to Tier 3 and above – depending on quality of service and cost.

Towards 2025 the following criteria and goals for universal access are considered:

- Coverage rate (availability): All villages and settlements will have electricity service available.
- **Electrification rate (connections)**: All citizens ,commerces, businesses and others will have the possibility to be connected to the grid or to a decentralized power source. However, some people may not want to be connected or may not afford internal installations. As set out in Senegal's Country Action Agenda the goal is 100% with a minimum threshold of 90% (to account for such situations). Investments are accounted for 100% and include funds to help poorer families and women to connect thus contributing for gender equality.
- Capacity: In villages in densely populated areas and villages with more than 500 inhabitants, a minimum service of 200 W (Tier 3 or S4) shall be considered in order to meet energy demand. In isolated small villages Tier 2 (S2 or S3) will be the minimum level of service.
 Individual solar home systems which are seen by rural populations as "pre-electrification" and because the units are located inside people's houses imply difficulties in payment collection and in operation and maintenance, have only been considered for the Tier 2 isolated small villages and also for all very poor clients who can't sign for a SL1 service, but can acquire a solar lamp.
- **Duration**: in order to allow economic development, a 24-hour service for villages in dense areas and villages with more than 500 inhabitants and a minimum of 8 hours of service for the remaining isolated small villages are considered.

Experience with diesel or even diesel/solar hybrid mini-grids shows that fuel logistics can be costly and complex (with outages specially in small and isolated places), operation with very low loads technically challenging and that in some cases lack of funds resulted in fuel savings through reduction in hours of service (down to 4 hours per day). In order to avoid problems in ensuring adequate service and duration diesel only or diesel/solar hybrid electrification will not be considered in settlements with less than 100 inhabitants. In dense areas, small settlements (with less than 100 inhabitants) will be electrified either through grid extension or 100% solar based mini/micro-grids (Figure 4.2).



Figure 4.2 – Proposed technologies by type of settlement



- **Reliability & Quality**: In order to cope with the increase in energy consumption, it will be necessary to ensure reserve capacity to guarantee a good level of reliability. Thus, a reserve capacity of at least 20% is considered in the planning criteria. Also, a maximum level of acceptable interruptions will be defined.
- Affordability and Pre-paid metering: Differentiated tariffs between Senelec and Concessions have generated a lot of resistance to electrification. A single tariff system for the whole country and for domestic customers, irrespective of the technology used, will be implemented. Universal use of pre-paid metering will allow consumers to use the energy they need as they can pay for it while allowing concessionaires to effectively manage such a disperse infra-structure in an efficient way.
- Safety: Safety requirements and regulation will be developed and implemented in order to avoid/ minimize accidents.

Review of current situation in Senegal shows that current model of fixed price per month is not working correctly; it promotes energy waste and avoidable pressure on the infra-structure (also, in the case of diesel or hybrid mini-grids it results in unsustainable management of the fuel costs). Fixed monthly fees need to be replaced by metering (even if with a minimum monthly payment) as a pre-condition for the success and sustainability of rural electrification. It is not possible to manage a billing infra-structure with traditional meter reading in such a disperse environment. Despite having a higher investment upfront, pre-paid meters are the only viable solution to have kwh based billing across Senegal rural areas. Additionally, pre-paid metering have significant other economic and social benefits.

From a pure economic perspective, pre-paid metering offers the possibility for consumers to avoid over-paying and better managing their power needs, while significantly reducing cost of service in more disperse and rural areas.

From a social perspective, pre-paid metering has good acceptability, is transparent thus reducing conflicts between concessionaires and clients and allows for the involvement of the population in the distribution of scratch cards and payment methods, generating jobs and acceptance of electricity services. Harmonization also in terms of metering and payment methods is desirable to mitigate perceived differences between concessionaires – which currently undermines the rural electrification process.

Implementation of pre-paid metering without easy access to payment methods cannot be considered "universal access" as consumers will be without access to electricity until they are able to recharge the meter. Current implementation of pre-paid metering in Senegal, in many cases with very limited payment methods and distant shops, needs urgent improvement through adequate regulation and supervision in terms of quality of service.

4.2 RURAL ELECTRIFICATION 2025 VISION

By 2025, 14.234 rural villages and more than one million rural clients should be electrified mostly through grid extension (12.556 villages and 95% of rural clients), but also through solar only or solar-diesel hybrid mini-grids (1.215 villages and 4% of rural clients). Rural electrification - which will represent an additional generation capacity requirement of 180 MW by 2025 – will come from the "ramification" of the planned Medium Voltage backbone (the "dorsales") and from an ambitious mini-grid program in the Eastern part of the country. Individual Solar Home Systems will electrify only 464 settlements representing less than 1% of rural clients.

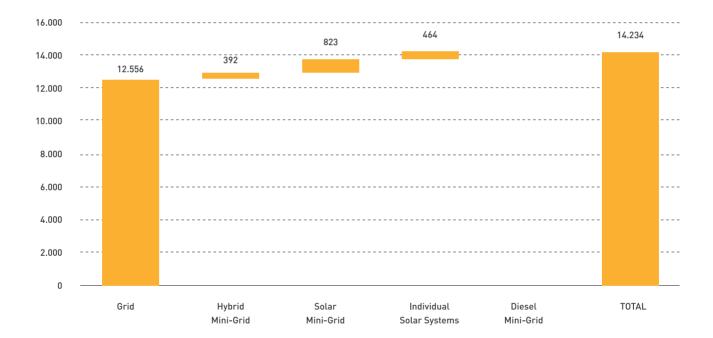


Figure 4.3 – Number of rural settlements according to the type of electrification technology (Source: GESTO & Earth Institute Analysis)

The result of the network expansion modelling until 2025 is mapped in Figure 4.4 and shows a clear densification of the planned medium voltage network in the western areas of the country, where the population density and consumption are higher, together with a large number of off-grid solutions in the Eastern part of the country. This densification is mostly done through "ramifications" of the existing and planned Medium Voltage backbone (the "dorsales"). In the Eastern part of the country a significant number of villages will be electrified through an ambitious mini-grid program.

The least cost 2025 vision shows a strong expansion of the network to connect 95% of the rural population to the national grid. Regarding the rest of the population 4% will be electrified through mini hybrid (solar and diesel) and mini-solar grids and the remaining 1% by individual solar systems.

Figure 4.6 shows the distribution of electrified villages by technology. About 12,550 of the existing 14,234 villages will be electrified through grid extension, representing 88.2% of all rural villages. In addition, 8.54% of villages will be electrified through mini-grids, including 5.78% from 100% solar solutions and 2.75% from hybrid solutions. Finally, 3.26% will be electrified with individual solar systems.

It is important to note that in 2025 there will no longer exist villages electrified from diesel only mini-grids. Although diesel based mini-grids were considered as an alternative by the Geospatial Network Expansion model, the cost reduction in solar and storage technologies resulted that hybrid solutions were always preferable to diesel only mini-grids from an economic perspective.

By 2025 the entire rural population – meaning 9,6 million inhabitants - will be electrified representing a total of around 1 million clients. Figure 4.5 shows the total number of electrified households and social and productive businesses, services and infrastructure by type of technology.

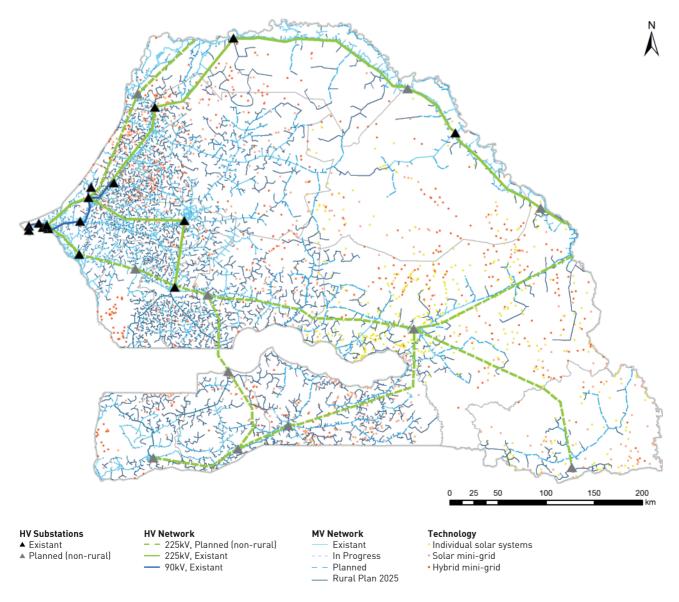


Figure 4.4 - Network expansion model results and planned HV network (Source: GESTO & Earth Institute Analysis)



Figure 4.5 – Breakdown of clients by type and technology in 2025 (Source: GESTO & Earth Institute Analysis)

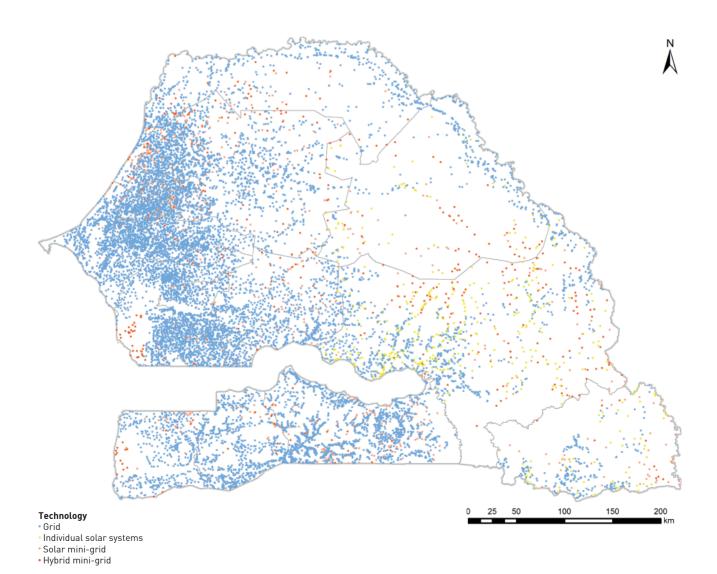


Figure 4.6 – Rural settlements by electrification technology in 2025 (Source: GESTO & Earth Institute Analysis)

During the period 2015-2025 there will be an increase of about 773,900 customers, of which approximately 516,800 between 2018 and 2025. Looking at Figure 4.7, as would be expected, the areas where the network is currently present coincide with the areas with the largest number of customers in 2015. However, there will be strong customer growth in all Concessions from 2018 to 2025, with the exception of Foundiougne and Mbour, where the electrification rate by 2017 is significantly higher compared to other concessions.

The Concession of Thies-Bambey-Diourbel-Mbacké-Tivaoune will be the one with most clients in 2025 (157 thousand) and the Concession of Mbour the one with least clients (29 thousand). Ziguinchor-Sedhiou is currently the concession area with more clients but will become the 5th in terms of number of customers. It is interesting also to note that although today the majority of rural clients are within the Senelec rural perimeter, future electrification will come mostly from outside of Senelec perimeter.

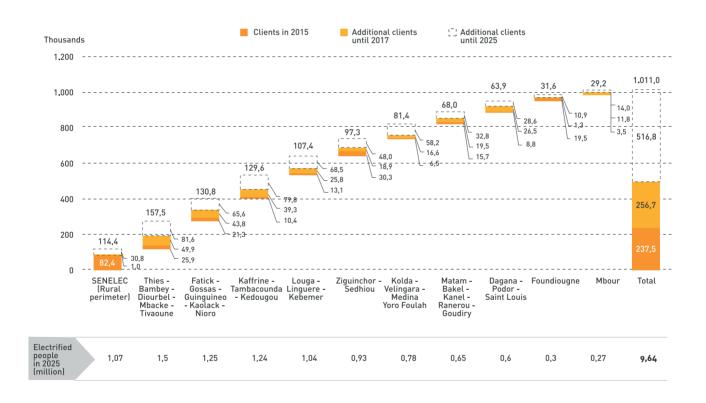


Figure 4.7 – Total clients balance and electrified population by rural concessions (Source: GESTO & Earth Institute Analysis)

^(*) These values correspond to the sum of domestic clients and services

4.2.1 IMPACT ON GENERATION

The total rural electricity consumption in 2025 is estimated at 608 GWh, which corresponds to a consumption peak of 181.3 MW. Figure 4.8 below shows the evolution of the peak consumption between 2015 and 2017 and between 2017 and 2025, differentiated by type of electrification technology.

The interconnected system will require a reinforcement in generation capacity of at least 150 MW (difference between required capacity in 2025 and 2015) due to rural electrification. It is interesting to notice that capacity allocated to individual solar will be reduced as many settlements currently electrified through solar home systems will become connected to the main grid or upgraded to solar/hybrid mini-grids. In 2025 no diesel only mini-grids will remain.

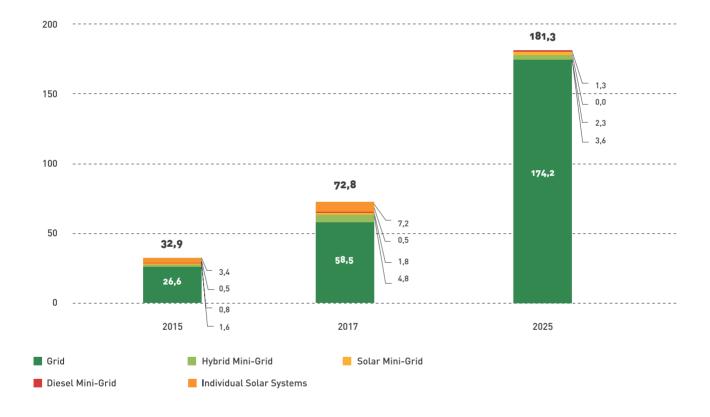


Figure 4.8 – Rural consumption load for the years 2015, 2017 and 2025 by type of technology (Source: GESTO & Earth Institute Analysis)

4.2.2 IMPACT ON HIGH VOLTAGE TRANSMISSION NETWORK

Investment in the Medium Voltage Network without reinforcements in the High Voltage network can result in a reduction in quality of service for certain regions. For example, MV lines with very long lengths between generation and consumption can lead to large technical losses as well as to voltage drops, which result in poor quality of service. For regions in this potential situation, it is recommended to install HV / MV substations in order to better control the network voltages.



Several HV/MV sub-stations are recommended:

- In the department of Linguère, in order to cope with the excessive lengths of the MV lines, the installation of a sub-station 225/30kV in the town of Linguère is recommended, benefiting from the project under study (not yet planned) by Senelec to build a new direct 225kV line from Touba to the North of the Country.
- Three additional 225/30 kV transformer stations are recommended along the existing and planned HV lines. These sub-stations will ensure the supply of the regions of Podor, Kolda and the departments of Koungheul and Koumpentoum, which are far away from the main production centers.
- In the department of Kébémer, due to high density of electrified population in 2025, it would be necessary to extend the 90kV network to this area.

High voltage network recommendations together with existing and planned HV infra-structure are presented in Figure 4.9.

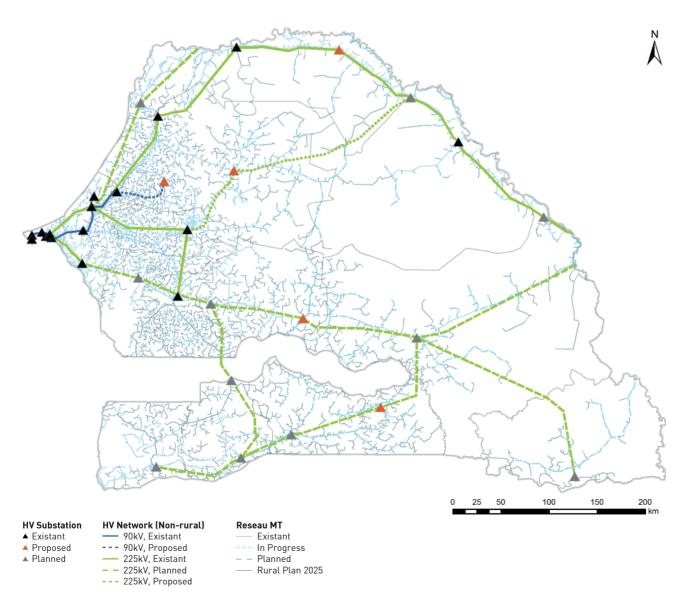


Figure 4.9 – Proposed electric grid in 2025 (Source: GESTO & Earth Institute Analysis)

ACTION AGENDA PART II: PRIORITY ACTION AREAS **AND INTERVENTIONS**

Priorities are set out in the Rural Electrification Plan (PNER) and organized in three key interventions: the on-going rural electrification projects, the Urgency Plan (PNUER) and the Additional Plan to reach universal access until 2025. Priority action areas are presented in this chapter for each of the three key interventions.



5.1 ON-GOING RURAL ELECTRIFICATION PROJECTS AND TARIFF HARMONIZATION

Existing and ongoing projects are being finalized with recent decision to harmonize tariffs expected to facilitate progress in the 6 concession areas awarded. Significant progress is still expected in the 6 concession areas as only recently some of them have started their activities. Also, the decision to harmonize tariffs with Senelec will result in a significant cost reduction for consumers in concession areas and expected improvement in customer adoption.

Among the various ongoing initiatives for rural electrification (Concessions, ERIL, Implementation agreements, Indian project, Myna PPP, ...) the Priority Programs for Rural Electrification (PPER) of the 6 awarded Concessions are the ones with the highest expected impact in the next years given the contractual obligation to electrify 106.601 customers and the limited progress so far.

As already addressed in chapter 2 the priority intervention by the Government regarding existing projects is the harmonization of tariffs with Senelec – which is considered to be one of the reasons behind the limited adoption by consumers.

Customers with the service levels S1, S2 and S3 and also S4 using solar panels currently pay a flat monthly fee. The following figure shows an estimation of the cost per kWh if we consider an average estimated consumption for each service level and compares it with the Senelec and the grid S4 tariffs. Flat fee tariffs can be up to 7 times more expensive on a kWh basis than variable tariffs. Variable tariffs based on kWh are also 20% to 30% higher in concessions, but the difference

is not so substantial. These differences are more evident as inside each concession area several villages electrified before 2002 remain with Senelec (the Senelec rural perimeter) and therefore customers just some km apart face significant differences which creates a negative public opinion on concessions and a lot of resistance to adoption.

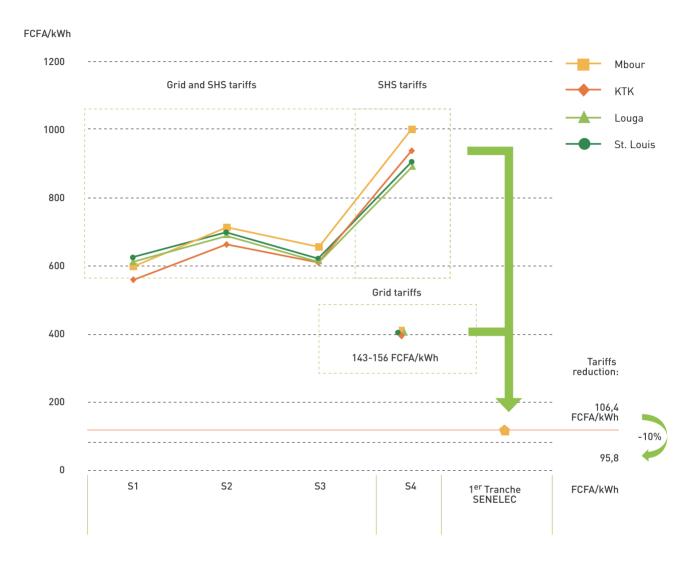


Figure 5.1 – Comparison of different tariffs in Senegal (Concessions and Senelec) (Source: GESTO Analysis, Data: ASER, PLE, SENELEC)

A study is being finalized on how to harmonize tariffs and CRSE is currently in the process of establishing the detailed rules for such process. In a first phase, the flat fee billing structure will remain but the flat fee price will be subject to a significant reduction. The price reduction will significantly improve adoption but will represent a deficit which has to be compensated potentially through cross-subsidization as funding for such additional financing has not yet been secured. However, without further power sector efficiency, cross-subsidization may result in an increase of the overall power sector deficit. In a second phase progressively with the introduction of prepaid meters all customers will be able to pay based on the kWh they consume – even if they are required to pay a minimum monthly fee.

5.2 THE URGENCY PLAN FOR RURAL ELECTRIFICATION (PNUER)

The Urgency Plan is already under-way with interventions organized in 4 key areas: MV backbone deployment (the "dorsales"), Densification along existing MV grid, Densification of already electrified villages and Mini-Grids. The target of reaching 60% of all rural clients means almost doubling the number of electrified clients in rural areas. PUDC and other initiatives are starting to have significant impact but may require some more time to complete implementation.

The "Programme National d'Urgence d'Electrification Rurale" - PNUER – is an ambitious urgency plan for the period 2015 to 2017 structured in 4 components:

- Component 1: create MV backbone lines called «Dorsales» to reinforce the network's reach into less dense areas and to combat the disparity between regions in terms of electrification. These lines will become starting points for further grid extension and include those being implemented by PUDC.
- Component 2: Connect all villages up to 1 km of the MV network irrespective of its population size. The electrification of these villages will be divided into three phases:
- Phase 1: electrification of villages 1 km from existing MV lines.
- Phase 2: electrification of villages within 1 km of the MV lines resulting from programs and projects under implementation
- Phase 3: electrification of villages up to 1 km of the backbone lines («Dorsales») built under component 1.

As part of this component, it was estimated the achievement of about 80,000 household connections. It should be noted that there are villages currently electrified by decentralized technologies who will also be connected to the network to ensure better service.

- Component 3: densification of the low voltage network to improve the electrification rate of already connected villages. In total, 560 villages will benefit from this component, with an average of 1.5 km of LV network and 45 additional electrified households per village. In total, 25,200 households could benefit from access to electricity.
- Component 4: creation of decentralized mini-grids, either diesel, solar or hybrid solar-diesel for the electrification of villages. In this context, a total of 392 villages will be electrified, enabling access to electricity for 17,936 additional households away from the networks. Also, 100.000 portable solar lamps were distributed.

As a whole, the PNUER will allow for the electrification of 3,196 villages distributed throughout the territory. The total number of households that will be electrified is above 120,000 households, which together with already electrified and on-going projects will allow Senegal to reach 470.000 electrified households – representing 60% of the population.

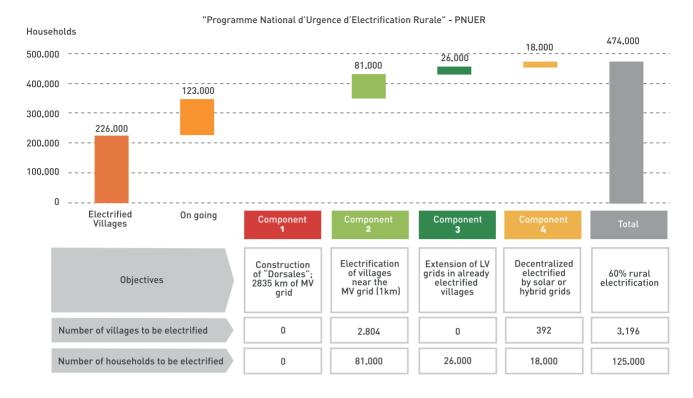


Figure 5.2 – PNUER connection targets (Source: ASER)

The PNUER is being partially implemented by the on-going "Programme d'Urgence de Développement Communautaire" (PUDC) and by other initiatives coordinated by ASER and funded by the State budget. Investment in PNUER has been estimated at 146 billion FCFA (\$243M). At the beginning of 2016, about 100 billion FCFA (\$166M) had been financed by the State, among others, with 45 billion FCFA still missing.

Even with funding available, the target of reaching 60% of all rural clients means doubling, in 3 years, the current rate of rural electrification – which represents an enormous implementation challenge. PUDC and other initiatives are starting to have significant impact but may require some more time to complete implementation.



5.3 THE ADDITIONAL PLAN FOR UNIVERSAL ACCESS

The Additional Plan for Universal Access action is structured along 6 key Axis: 1. Decentralized Systems - where 100% solar and hybrid mini-grids are given priority together with the rehabilitation of existing ones. 2. MV Extension – mostly through the "ramification" of PNUER MV backbone. 3. Distribution – both to reach new villages and to densify already electrified ones. 4. Internal installation – taking pre-paid metering to all customers and incentivizing adoption through financing of grid connection and internal installations. 5. Gender – offering special support to electrification of women and promoting equal opportunities for both men and women arising from the rural electrification program. 6. Capacity, Coordination and Engineering – recognizing that a lot of preparation is required for such an ambitious program.

The Additional Plan for Universal Access has been organized into four major Axis subdivided into 10 initiatives, as well as two cross-cutting Axis, as presented below.

5.3.1 DECENTRALIZED SYSTEMS

This Axis aims to promote and rehabilitate decentralized systems in disperse and isolated areas with low consumption where connection to the national network is not technically or economically justified. Nearly 33,000 customers will be electrified by 2025 with decentralized solutions. A total of 15.4 MW will be installed, including 7.8 MW of hybrid systems, 4.5 MW of 100% solar systems and 3 MW of individual solar systems. Majority of these decentralized systems will be based on Low Voltage mini-grids - 499 km of low-voltage lines will be installed. Overall, this program will represent an investment of 33.4 billion FCFA (\$56M).

To facilitate the development of these infrastructures, this Axis has been subdivided into three initiatives:

5.3.1.1. Individual Solar and Transitional Solutions (including rehabilitation)

This includes investments in individual solar home systems in very small and isolated villages (in the east part of the country) which do not economically justify the investment in a mini-grid and where comparison with other levels of service is limited. In addition, this initiative will also finance rehabilitation of existing systems the acquisition of and transitional systems, such as solar portable lamps, to mitigate the lack of access to electricity and to provide minimum comfort in villages that will only be connected after 2020.

5.3.1.2. PREM off-grid

PREM stands for "Project Energétique Multi-sectorial", meaning Multi-sectorial energy projects. This initiative includes the installation of photovoltaic systems for the electrification of community services (such as schools, clinics, ...) in villages with more than 250 inhabitants without access to electrical services before 2020. In addition, in order to promote productive activities in settlements electrified with 100% solar based solutions, this initiative will also consider the installation of small thermal units specifically to support specific productive uses.

5.3.1.3. Solar / Hybrid Mini-grids (including rehabilitation)

This initiative represents more than 75% of the Program's investment and is focused on deployment and rehabilitation of mini and micro-grids using solar or diesel/solar hybrid solutions.

5.3.2 EXTENSION MV NETWORK

The objective of this Axis is to extend the national medium voltage network in order to reach 88% of all rural villages (12.551 villages). Thus, 12,500km of medium voltage lines will be installed under this program, which represents an estimated total investment of 150.0 billion FCFA (\$250M).

This Axis has been subdivided into two initiatives:

5.3.2.1. Key "Dorsales" (duplication)

This initiative focuses on reinforcing the capacity of the existing and planned "Dorsales", in order to serve future rural consumption growth. The implementation of this initiative will represent an investment of about 7.8 billion FCFA (\$13M), which corresponds to 652 km of duplication of installed lines.

5.3.2.2. Ramifications

As its name suggests, this initiative creates "ramifications" starting from the backbone MV infra-structure (the "Dorsales") in order to extend the network to all villages where grid based electrification is the least cost option. The investment under this initiative represents the highest amount of all initiatives, close to 142 billion FCFA (\$237M).

5.3.3 DISTRIBUTION LV & MV

This Axis aims to extend distribution networks and connect new customers in villages to be electrified from the interconnected national grid. Thanks to this program, approximately 524,900 customers will be electrified through the installation of 8,104 MV/LV transformer substations to reduce the voltage and through the installation of 6,259 km of low voltage lines in order to reach the final consumers. Overall, the estimated investment will reach the amount of 108.2 billion FCFA (\$180M).

This Axis has been subdivided into three initiatives:

5.3.3.1 First electrification

This initiative aims to promote "availability" through the first electrification of a large number of villages. This initiative invests mostly on the installation of low voltage network and transformer stations in order to electrify the first customers in electrified villages.

5.3.3.2. Densification LV & MV

This initiative aims to consolidate and densify the low voltage grid after "first electrification" increasing the number of clients in already electrified villages. Thus, both the low-voltage network and the internal medium-voltage network to meet the demand of these rural settlements will be developed.

5.3.3.3. PREM Network

The objective of this initiative is to promote access to electricity for productive activities through the extension of the low-voltage network – the grid based "multi sectorial energy projects". Some productive activities may be relatively distant from villages – for example, a farm – and may require relevant investments to extend the grid.

5.3.4 INTERNAL INSTALLATION

This Axis includes investment, financing and subsidization of internal facilities for households, businesses and services. It aims to promote and facilitate the electrification of new customers, as well as to promote the reduction of commercial losses in the electricity system through the installation of prepaid meters. The total investment for the implementation of this program is 62.6 billion FCFA (\$104M).

This Axis is divided into two initiatives:

5.3.4.1 Encouragement of electrification

This initiative aims to facilitate adoption in villages connected to the network, financing and subsidizing the investments required for the internal installations in the customer's houses or even some appliances (eg. TV). This initiative includes also marketing and communication campaigns to incentivize adoption.

5.3.4.2 Universal Prepayment

This initiative aims to promote the installation of prepaid meters for all rural customers to ensure affordability (customers consume what they can afford), to facilitate billing, optimize efficiency and personnel costs while reducing commercial losses.



5.3.5 PROGRAMS OF GENDER IN RURAL ELECTRIFICATION

Energy poverty deprives people of an acceptable standard of living and fosters a vicious circle of poverty, especially among women and girls. The assessment of "gender" in the rural electrification program conducted by ASER in 2014 reveals gender disparities that have a considerable impact on the sustainable development of this sector in Senegal. The majority of women depend on biomass as their main source of energy for cooking and heating, with the use of firewood estimated at more than 70%. Women and girls provide more labour and work longer to manage the household energy system, i.e. collect firewood and seek water for household care. Smoke from inhaled firewood and air pollution has negative impacts on the health of women and children. Energy can offer productive opportunities and prove to be effective against poverty. Lack of access to modern energy contributes to the feminization of poverty and reduces the chances of women and girls to engage in income-generating and educational activities for their socio-economic empowerment. Income-generating activities developed through access to electricity not only generate income for disadvantaged groups, but also strengthen their financial capacities to pay for energy tariffs and grid connection.

The assessment of "gender" in the on-going rural electrification programs in Senegal reveal a gender neutral energy policy, with priority given to technical operations at the expense of social inclusion. The program has no gender mandate, there is no long-term monitoring of socio-economic impacts, female staff are poorly represented in decision-making positions, and recruitment mechanisms are not gender sensitive. The communication strategy does not always take account of sensitive communication media, to facilitate access to information, consultation and participation of disadvantaged groups in the operation of the rural electrification program.

This program aims to facilitate the implementation of ASER's Gender Action Plan by increasing women's access to electricity and maximize the added value of electricity for women in order to combat discrimination, strengthen their economic power and ensure that the employment opportunities arising from this plan of action and investment also benefit women. It also focuses on the electrification of social infrastructure (schools, health centers, maternity wards) to help combat the vulnerability of women and children in rural areas. An investment of 2.8 billion FCFA is considered.

5.3.6 CAPACITY, COORDINATION, PROJECT AND ENGINEERING

A project of this scale requires coordination and capacity building to create and develop the skills required for a successful implementation. This Axis includes the necessary investments for the creation of such capacities, for the coordination and development of projects (owners engineering) and for the carrying out of technical studies in order to facilitate the execution of the program. The investments included in this Axis were estimated at 5% of the total CAPEX, representing a total of 17,7 billion FCFA (\$29,5 M).

Figure 5.3 presents a synthesis of the investments per Axis and initiative.

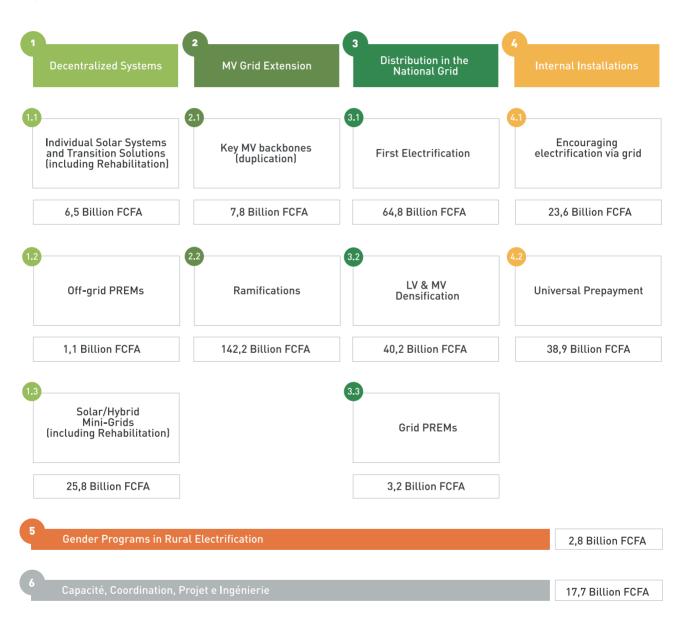


Figure 5.3 – Proposed Axis and Initiatives for the Additional Plan for Universal Access (Source: GESTO & Earth Institute Analysis)

ACTION AGENDA PART III: IMPLEMENTATION PLAN AND PROGRAMS



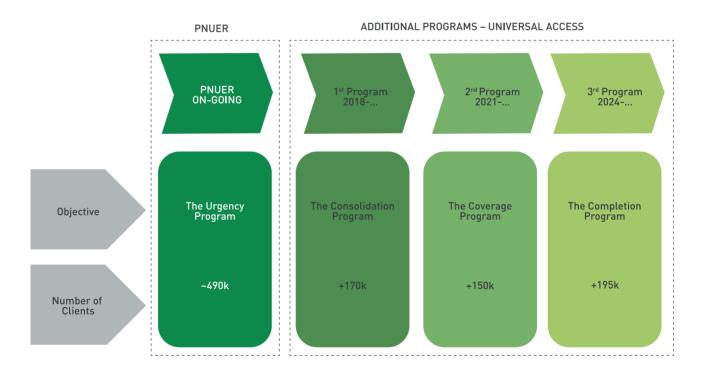


Figure 6.1 – Implementation programs (Source: GESTO Analysis)

The on-going realization of PNUER is a short term priority and its infra-structure will be further developed by the Additional Plan for Universal Access. Three Additional Programs are to be developed between 2018 and 2025. The PNUER aims at electrifying a total population of 4.7 million and 494.000 clients, corresponding to an increase from 32,2% electrification rate verified at the end of 2016 to 60% - considering expected population by end of 2017. The results are shown in Figure 5.2.

Under the PNUER, about 247,000 new households will be electrified, which corresponds to an increase of more than 2.5 million electrified inhabitants. Concerning services, commercial and productive infrastructures, almost 9,100 additional customers will be electrified. In total, about 494,000 rural customers (domestic and services / others) will be electrified at the end of the PNUER, either from the grid or from decentralized electrification solutions. In terms of coverage, by the end of PNUER, 51% of rural villages will be connected. At the end of this program, all departments will achieve electrification rate above 30%.

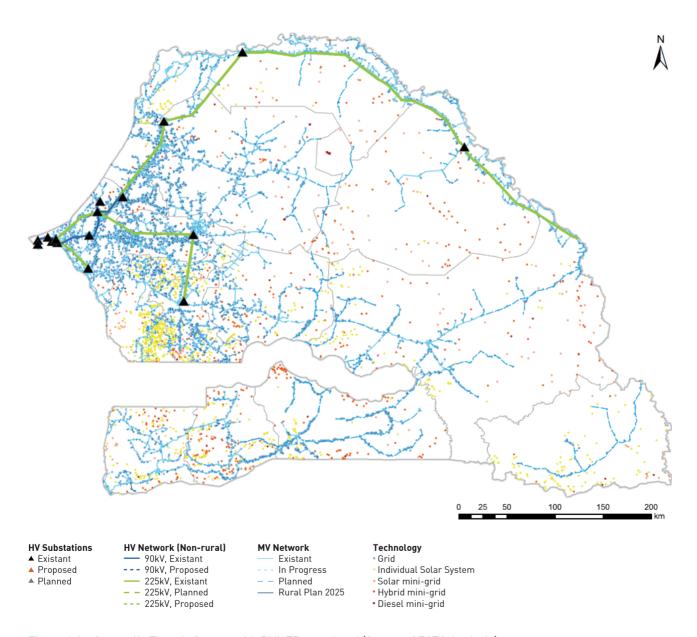
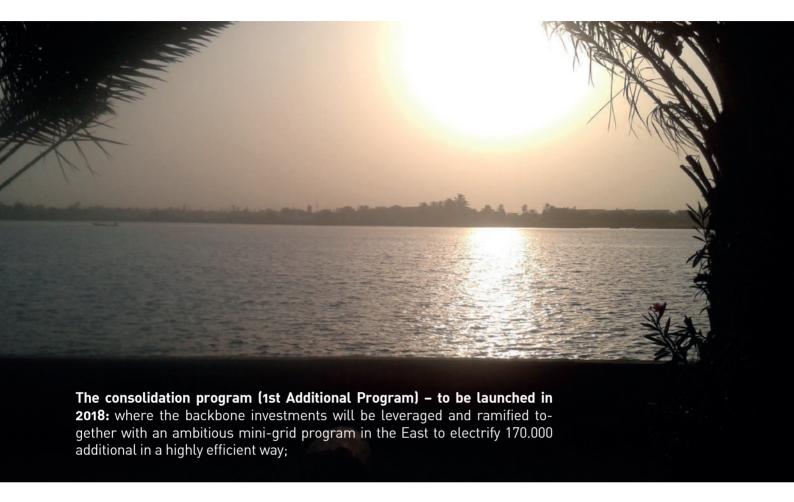


Figure 6.2 – Senegal's Electric System with PNUER completed (Source: GESTO Analysis)

Table 6.1– Results by Department – PNUER (electrification rate considering 2017 population) (Source: GESTO Analysis)

Region	Department	Electrified Settlements (#)	Coverage Rate (%)	Electrified People (millions)	Rural Electrification Rate (%)	Clients (thousands)	Demand (MV
DAKAR	RUFISQUE	46	97,9%	0,08	90%	8,48	1,37
	DIOURBEL	202	55,2%	0,08	52%	8,07	1,22
DIOURBEL	MBACKE	207	57,3%	0,15	60%	15,35	2,40
	BAMBEY	262	55,2%	0,18	61%	19,38	3,02
	GOSSAS	105	55,6%	0,06	62%	6,33	0,97
FATICK	FATICK	252	65,1%	0,24	71%	25,90	4,09
	FOUNDIOUGNE	344	89,4%	0,22	82%	22,83	3,50
	MALEM HODAR	65	38,7%	0,04	46%	4,19	0,65
KAFFRINE	BIRKELANE	74	43,8%	0,04	51%	4,40	0,67
KAFFKINE	KOUNGHEUL	108	30,6%	0,06	41%	6,14	0,94
	KAFFRINE	113	47,1%	0,10	62%	10,23	1,61
	GUINGUINEO	114	63,0%	0,06	63%	6,14	0,93
KAOLACK	KAOLACK	241	47,3%	0,13	52%	13,93	2,14
	NIORO DU RIP	348	59,9%	0,21	65%	21,48	3,29
	SALEMATA	33	45,8%	0,02	58%	2,41	0,27
KEDOUGOU	KEDOUGOU	75	40,1%	0,04	47%	4,41	0,49
	SARAYA	50	53,2%	0,03	66%	3,33	0,37
	MEDINA YORO FOULA	140	29,2%	0,06	32%	6,21	0,68
KOLDA	VELINGARA	136	25,9%	0,07	32%	7,64	0,86
	KOLDA	242	37,5%	0,10	43%	10,49	1,16
	KEBEMER	364	39,5%	0,12	45%	12,66	1,90
LOUGA	LOUGA	452	50,2%	0,17	54%	18,03	2,72
	LINGUERE	323	41,9%	0,14	43%	14,60	2,20
	RANEROU FERLO	89	59,3%	0,05	66%	4,72	0,52
МАТАМ	MATAM	124	86,7%	0,15	82%	15,41	1,85
	KANEL	110	73,8%	0,11	75%	11,39	1,36
	SAINT-LOUIS	96	71,1%	0,08	75%	7,96	1,25
SAINT-LOUIS	DAGANA	114	52,3%	0,09	59%	8,99	1,40
	PODOR	211	80,8%	0,29	78%	31,29	5,03
	BOUNKILING	123	48,8%	0,09	60%	9,78	1,54
SEDHIOU	SEDHIOU	150	71,4%	0,11	68%	11,43	1,77
	GOUDOMP	152	50,5%	0,09	57%	9,75	1,50
	BAKEL	100	53,5%	0,07	64%	7,85	0,90
	KOUMPENTOUM	92	44,0%	0,07	55%	7,49	0,86
MBACOUNDA	GOUDIRY	78	28,6%	0,05	44%	5,51	0,63
	TAMBACOUNDA	215	31,8%	0,11	40%	11,49	1,28
	MBOUR	178	87,3%	0,23	78%	24,70	3,97
THIES	THIES	278	72,8%	0,24	73%	25,24	3,98
	TIVAOUANE	525	53,6%	0,21	60%	22,32	3,42
	OUSSOUYE	67	85,9%	0,03	82%	3,62	0,55
ZIGUINCHOR	ZIGUINCHOR	61	68,5%	0,05	68%	5,05	0,78
	BIGNONA	176	53,5%	0,17	68%	17,59	2,78
	TOTAL	7.235	50,8%	4,70	60%	494,18	72,83

6.1 THE CONSOLIDATION PROGRAM



The 1st Additional program, to be launched in 2018, represents a total investment of 155,58 billion FCFA (\$259M) and, being the next program soon to be deployed, it is the key priority in terms of funding mobilization. List of projects is detailed in Annex to the present Prospectus. Ideally, the program would be implemented in 3 years, until 2020.

When PNUER and the consolidation program are finalized Senegal will electrify 170.000 new rural clients (if completed by 2020 could allow reaching 75% of the total rural households) through ramifications of existing MV infra-structure – mostly in the western part of the country and the "dorsales" deployed under PNUER – and am ambitious mini-grid program in the Eastern part of the country.

During the implementation of the program, the new 225kV HV lines included in the OMVG project are expected to be implemented. In order to avoid excessive lengths of the MV lines and to ensure the quality of service in the Koungheul department, a 225 / 30 kV substation is recommended on the 225 kV axis near the town of Koungheul.

The expected situation at the end of PNUER and consolidation program is mapped in Figure 6.3.

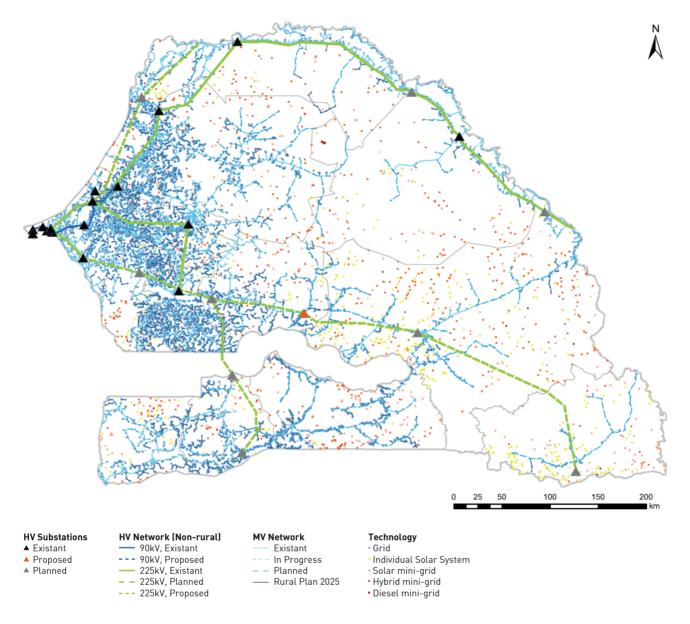


Figure 6.3 – Electric System of Senegal with Consolidation Program completed (Source: GESTO & Earth Institute Analysis)

During this period, 166,653 households will be electrified, corresponding to an increase of more than 1.65 million inhabitants. Regarding commercial and productive services during this period, 5,207 additional customers will be electrified. In total, about 666,000 rural customers (domestic and services) will be electrified by the end of PNUER and the Consolidation Program.

In relation to the coverage rate, considering PNUER and the Consolidation Program, 77% of all rural villages will be electrified. As expected, this Program allows for a significant increase in coverage rate. All departments – except Medina Yoro Foulah – will reach a coverage rate in excess of 50%, including all the Eastern Departments who will benefit from the ambitious mini-grid program.

Table 6.2– Results by Department – PNUER and Consolidation Program implemented (Source: GESTO & Earth Institute Analysis)

DAKAR RUFISQUE 46 97,9% 0,08	Rural Electrification Rate (%)	Clients (thousands)	Demand (MW
MBACKE 327 90,6% 0,21	84,9%	8,69	1,56
BAMBEY	80,6%	13,47	2,23
FATICK FATICK FATICK FATICK FOUNDIOUGNE FO	81,8%	22,35	3,80
FATICK FATICK 378 97,7% 0,31 FOUNDIOUGNE 381 99,0% 0,24 MALEM HODAR 119 70,8% 0,06 BIRKELANE 154 91,1% 0,07 KOUNGHEUL 183 51,8% 0,09 KAFFRINE 194 80,8% 0,13 GUINGUINEO 163 90,1% 0,08 KAOLACK 473 92,7% 0,23 NIORO DU RIP 550 94,7% 0,29 SALEMATA 49 68,1% 0,03 KEDOUGOU 107 57,2% 0,05 SARAYA 82 87,2% 0,04 MEDINA YORO FOULA 209 43,6% 0,08 KOLDA 299 43,6% 0,13 KOLDA 391 60,5% 0,15 KOLDA 391 60,5% 0,15 LOUGA 697 77,4% 0,25 LINGUERE 523 67,9% 0,22 RANEROU FERLO 112 74,7% 0,05 MATAM 134 93,7% 0,16 KANEL 137 91,9% 0,13 SAINT-LOUIS 123 91,1% 0,09 SAINT-LOUIS 123 91,1% 0,09 SAINT-LOUIS 123 91,1% 0,09 SAINT-LOUIS 123 91,1% 0,09 SAINT-LOUIS 188 74,6% 0,11 PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,11 GOUDOMP 264 87,7% 0,05 MATAM 131 62,7% 0,07 TAMBACOUNDA 391 57,8% 0,14 BAKEL 141 75,4% 0,10 GOUDOMP 264 87,7% 0,09 TAMBACOUNDA 391 57,8% 0,17 THIES 71MOUNDA 391 57,8% 0,17 THIES 71MOUNDA 73,9% 0,00 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 2IGUINCHOR 80 89,9% 0,06	83,3%	28,31	4,81
FOUNDIOUGNE 381 99,0% 0,24	79,7%	8,80	1,47
MALEM HODAR 119 70,8% 0,06	84,4%	32,92	5,69
BIRKELANE	84,7%	25,54	4,30
KAFFRINE KOUNGHEUL 183 51,8% 0,09 KAFFRINE 194 80,8% 0,13 GUINGUINEO 163 90,1% 0,08 KAOLACK KAOLACK 473 92,7% 0,23 NIORO DU RIP 550 94,7% 0,29 SALEMATA 49 68,1% 0,03 KEDOUGOU KEDOUGOU 107 57,2% 0,05 SARAYA 82 87,2% 0,04 MEDINA YORO FOULA 209 43,6% 0,08 KOLDA YELINGARA 269 51,2% 0,13 KOLDA 391 60,5% 0,15 KEBEMER 611 66,3% 0,19 LOUGA 697 77,4% 0,25 LINGUERE 523 67,9% 0,22 MATAM 134 93,7% 0,16 KANEL 137 91,9% 0,13 SAINT-LOUIS 123 91,1% 0,09 SAINT-LOUIS 123 91,1% 0,09 SAINT-LOUIS 188 74,6% 0,11 PODOR 237 90,8% 0,33 SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,16 KOUMPENTOUM 131 62,7% 0,09 TAMBACOUNDA 391 57,8% 0,17 TAMBACOUNDA 773 78,9% 0,30 TIMOUNCHOR 80 89,9% 0,06	67,6%	6,64	1,12
KOUNGHEUL	82,4%	7,62	1,26
RAOLACK KAOLACK KAOL	55,6%	9,10	1,52
KAOLACK	77,3%	13,83	2,36
NIORO DU RIP 550	80,4%	8,42	1,39
SALEMATA	83,1%	23,88	3,99
KEDOUGOU KEDOUGOU 107 57,2% 0,05 SARAYA 82 87,2% 0,04 MEDINA YORO FOULA 209 43,6% 0,08 VELINGARA 269 51,2% 0,13 KOLDA 391 60,5% 0,15 KEBEMER 611 66,3% 0,19 LOUGA 697 77,4% 0,25 LINGUERE 523 67,9% 0,22 RANEROU FERLO 112 74,7% 0,05 MATAM 134 93,7% 0,16 KANEL 137 91,9% 0,13 SAINT-LOUIS 123 91,1% 0,09 SAINT-LOUIS 123 91,1% 0,09 PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,13 SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 GOUDOMP 264 87,7% 0,10 <tr< td=""><td>83,7%</td><td>29,95</td><td>5,01</td></tr<>	83,7%	29,95	5,01
SARAYA 82 87,2% 0,04	66,6%	2,99	0,37
MEDINA YORO FOULA 209 43,6% 0,08	55,3%	5,65	0,69
KOLDA VELINGARA 269 51,2% 0,13 KOLDA 391 60,5% 0,15 KEBEMER 611 66,3% 0,19 LOUGA 697 77,4% 0,25 LINGUERE 523 67,9% 0,22 RANEROU FERLO 112 74,7% 0,05 MATAM 134 93,7% 0,16 KANEL 137 91,9% 0,13 SAINT-LOUIS 123 91,1% 0,09 SAINT-LOUIS 123 91,1% 0,09 PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,11 PODOR 237 90,8% 0,33 SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 GOUDOMP 264 87,7% 0,10 KOUMPENTOUM 131 62,7% 0,09 TAMBACOUNDA 391 57,8% 0,17 THIE	81,6%	4,47	0,55
KOLDA 391 60,5% 0,15 KEBEMER 611 66,3% 0,19 LOUGA 697 77,4% 0,25 LINGUERE 523 67,9% 0,22 RANEROU FERLO 112 74,7% 0,05 KANEL 137 91,9% 0,13 SAINT-LOUIS 123 91,1% 0,09 SAINT-LOUIS DAGANA 160 73,4% 0,11 PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,13 SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 GOUDOMP 264 87,7% 0,10 KOUMPENTOUM 131 62,7% 0,09 TAMBACOUNDA 391 57,8% 0,17 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 ZIGUINCHOR ZIGUINCHOR 80 89,9% 0,06	41,5%	8,71	1,05
KEBEMER 611 66,3% 0,19	52,4%	13,48	1,67
LOUGA LOUGA 697 77,4% 0,25 LINGUERE 523 67,9% 0,22 RANEROU FERLO 112 74,7% 0,05 MATAM 134 93,7% 0,16 KANEL 137 91,9% 0,13 SAINT-LOUIS 123 91,1% 0,09 DAGANA 160 73,4% 0,11 PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,13 SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 BAKEL 141 75,4% 0,10 KOUMPENTOUM 131 62,7% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,06	60,6%	15,93	1,93
LINGUERE 523 67,9% 0,22	67,1%	20,25	3,31
RANEROU FERLO 112 74,7% 0,05 MATAM 134 93,7% 0,16 KANEL 137 91,9% 0,13 SAINT-LOUIS 123 91,1% 0,09 DAGANA 160 73,4% 0,11 PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,13 SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 BAKEL 141 75,4% 0,10 KOUMPENTOUM 131 62,7% 0,09 GOUDIRY 183 67,0% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,06	74,0%	26,36	4,33
MATAM MATAM 134 93,7% 0,16 KANEL 137 91,9% 0,13 SAINT-LOUIS 123 91,1% 0,09 DAGANA 160 73,4% 0,11 PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,13 SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 BAKEL 141 75,4% 0,10 KOUMPENTOUM 131 62,7% 0,09 GOUDIRY 183 67,0% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,06	62,6%	22,64	3,72
KANEL 137 91,9% 0,13	72,1%	5,52	0,67
SAINT-LOUIS 123 91,1% 0,09 DAGANA 160 73,4% 0,11 PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,13 SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 KOUMPENTOUM 131 62,7% 0,09 GOUDIRY 183 67,0% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 20 0 89,9% 0,06	83,7%	17,01	2,27
SAINT-LOUIS DAGANA 160 73,4% 0,11 PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,13 SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 BAKEL 141 75,4% 0,10 KOUMPENTOUM 131 62,7% 0,09 GOUDIRY 183 67,0% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 21GUINCHOR 80 89,9% 0,06	82,4%	13,46	1,78
PODOR 237 90,8% 0,33 BOUNKILING 188 74,6% 0,13 SEDHIOU 5EDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 BAKEL 141 75,4% 0,10 KOUMPENTOUM 131 62,7% 0,09 GOUDIRY 183 67,0% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	81,8%	9,41	1,62
BOUNKILING 188 74,6% 0,13	69,8%	11,58	1,98
SEDHIOU SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 BAKEL 141 75,4% 0,10 KOUMPENTOUM 131 62,7% 0,09 GOUDIRY 183 67,0% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	80,8%	35,18	6,26
SEDHIOU SEDHIOU 190 90,5% 0,14 GOUDOMP 264 87,7% 0,14 BAKEL 141 75,4% 0,10 KOUMPENTOUM 131 62,7% 0,09 GOUDIRY 183 67,0% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	76,1%	13,43	2,32
GOUDOMP 264 87,7% 0,14	82,5%	14,99	2,56
BAKEL 141 75,4% 0,10	80,9%	14,86	2,50
KOUMPENTOUM 131 62,7% 0,09 GOUDIRY 183 67,0% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	75,5%	10,01	1,26
AMBACOUNDA GOUDIRY 183 67,0% 0,09 TAMBACOUNDA 391 57,8% 0,17 MBOUR 203 99,5% 0,27 THIES THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	63,6%	9,30	1,18
MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	70,8%	9,64	1,20
MBOUR 203 99,5% 0,27 THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	56,4%	17,54	2,14
THIES THIES 374 97,9% 0,30 TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	85,0%	29,16	5,18
TIVAOUANE 773 78,9% 0,30 OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	84,7%	31,48	5,44
OUSSOUYE 71 91,0% 0,04 ZIGUINCHOR 80 89,9% 0,06	77,6%	31,44	5,25
ZIGUINCHOR ZIGUINCHOR 80 89,9% 0,06	82,5%	3,91	0,66
	81,9%	6,55	1,12
2,0,10,10,10,10,10,10,10,10,10,10,10,10,1	77,3%	21,58	3,73
	77,070	21,00	0,70

6.2 THE COVERAGE PROGRAM

The "coverage" Program (2nd Additional Program) - to be launched in 2021: where all 14.234 rural villages will receive at least their first electrification and a further 150.000 clients will be electrified

This Program, to be launched in 2021, aims at availability of electrical services for all rural villages in the country. Total investment in this program is similar to the previous one – 153.59 billion FCFA (\$256M) – but with different priorities. Figure 6.4 shows the situation of the Senegalese electricity system when the Coverage Program and the preceding Programs are implemented. The target implementation calendar for the Coverage Program is 3 years, until 2023.

The MV network will reach its maximum extension through longer ramifications – as required to achieve universal access – and all rural villages will be electrified. An increased investment in ramifications will be required as they tend to be longer and therefore more expensive. On Distribution, investment in first electrification will remain the key priority but densification of already electrified villages will almost double relative to the previous program.

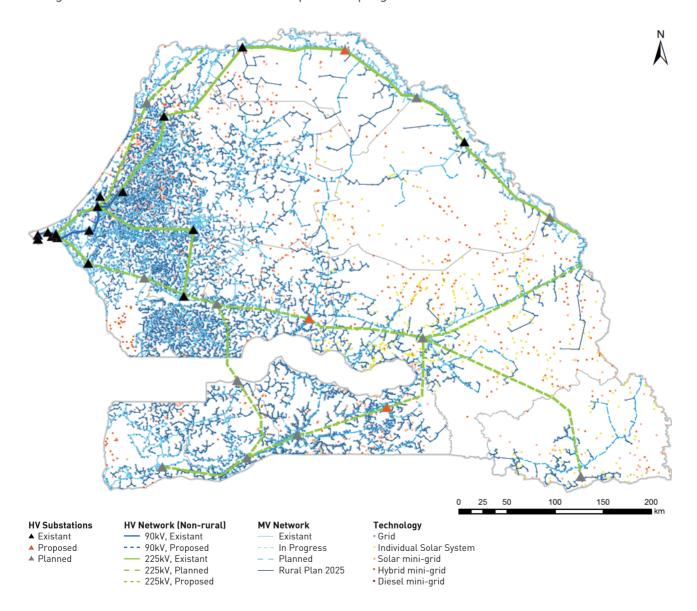


Figure 6.4 - Electric System of Senegal end of the "Coverage" Program (Source: GESTO & Earth Institute Analysis)

During this program implementation target period (2021 to 2023) new 225kV HV lines are expected to be built. Two new sub-stations are recommended: the first near Velingara, with the mission of supplying the region of Kolda; the second in the department of Podor in order to cope with the excessive lengths of the MV lines.

Table 6.3- Results by Department - end of the "Coverage" Program (Source: GESTO & Earth Institute Analysis)

Region	Department	Electrified Settlements (#)	Coverage Rate (%)	Electrified People (millions)	Rural Electrification Rate (%)	Clients (thousands)	Demand (MW
DAKAR	RUFISQUE	47	100,0%	0,09	85,0%	9,42	1,86
	DIOURBEL	366	100,0%	0,15	85,0%	15,36	2,76
DIOURBEL	MBACKE	361	100,0%	0,24	85,0%	25,17	4,66
	BAMBEY	475	100,0%	0,30	85,0%	31,22	5,80
	GOSSAS	189	100,0%	0,10	85,0%	10,17	1,86
FATICK	FATICK	387	100,0%	0,34	85,0%	35,90	6,80
	FOUNDIOUGNE	385	100,0%	0,27	85,0%	27,73	5,10
	MALEM HODAR	168	100,0%	0,09	85,0%	9,02	1,65
KAFFRINE	BIRKELANE	169	100,0%	0,08	85,0%	8,49	1,54
KAFFRINE	KOUNGHEUL	353	100,0%	0,14	85,0%	15,03	2,70
	KAFFRINE	240	100,0%	0,16	85,0%	16,43	3,06
	GUINGUINEO	181	100,0%	0,09	85,0%	9,65	1,74
KAOLACK	KAOLACK	510	100,0%	0,25	85,0%	26,43	4,81
	NIORO DU RIP	581	100,0%	0,31	85,0%	32,86	6,00
	SALEMATA	72	100,0%	0,04	85,0%	4,13	0,55
KEDOUGOU	KEDOUGOU	187	100,0%	0,09	85,0%	9,37	1,23
	SARAYA	94	100,0%	0,05	85,0%	5,02	0,68
	MEDINA YORO FOULA	479	100,0%	0,19	85,0%	19,23	2,52
KOLDA	VELINGARA	525	100,0%	0,23	85,0%	19,23	3,15
	KOLDA	646	100,0%	0,23	85,0%	24,14	3,17
	KEBEMER	921	100,0%	0,27	85,0%	27,75	4,93
LOUGA	LOUGA	901	100,0%	0,31	85,0%	32,69	5,84
	LINGUERE	770	100,0%	0,32	85,1%	33,41	5,94
	RANEROU FERLO	150	100,0%	0,07	85,0%	7,04	0,94
MATAM	MATAM	143	100,0%	0,18	85,0%	18,67	2,75
	KANEL	149	100,0%	0,14	85,0%	14,95	2,18
	SAINT-LOUIS	135	100,0%	0,10	85,0%	10,57	1,98
SAINT-LOUIS	DAGANA	218	100,0%	0,15	85,0%	15,23	2,83
	PODOR	261	100,0%	0,38	85,0%	40,04	7,80
	BOUNKILING	252	100.0%	0,16	85,0%	16,21	3,04
SEDHIOU	SEDHIOU	210	100,0%	0,16	85,0%	16,71	3,12
	GOUDOMP	301	100.0%	0,16	85,0%	16,90	3,09
	BAKEL	187	100.0%	0,12	85,0%	12,11	1,67
	KOUMPENTOUM	209	100,0%	0,13	85,0%	13,45	1,84
AMBACOUNDA	GOUDIRY	273	100,0%	0,12	85,0%	12,49	1,69
	TAMBACOUNDA	676	100,0%	0,28	85,1%	28,70	3,78
	MBOUR	204	100,0%	0,30	85,0%	31,53	6,16
THIES	THIES	382	100.0%	0,32	85,0%	34,20	6,48
	TIVAOUANE	980	100,0%	0,35	85,0%	37,05	6,74
	OUSSOUYE	78	100,0%	0,04	85,0%	4,37	0,80
ZIGUINCHOR	ZIGUINCHOR	89	100,0%	0,07	· · · · · · · · · · · · · · · · · · ·	7,34	1,37
ZIOOINCHUK	BIGNONA	329	100,0%	0,24	85,0% 85,0%	25,61	4,83
	TOTAL	14.233	•		85%		

With this program, about 144,500 additional households will be connected, corresponding to an increase of more than 1.4 million inhabitants. For commercial and productive services, 4,800 additional customers will be electrified during this period. In total, together with the preceding programs, about 815,450 rural customers (domestic and services / others) will be electrified by the end of 2023.

At the end of this program, all rural communities will have access to electrical services, with a coverage rate of 100%. The rate of household electrification – if the current program and the previous ones are completed by 2023 - will be 85%.

6.3 THE COMPLETION PROGRAM

The Completion program (3rd Additional Program) – to be launched in 2024: where all rural inhabitants in each village across the country will have the opportunity to be connected and benefit from full universal access to electricity, allowing rural electrification to reach more than 1 million clients with a 100% target access rate

The completion program is expected to be launched in 2024 as a final effort to reach universal access by 2025. Once all villages will have access to electrical services, the investments to be made by this program mainly concern the densification of the low voltage network and the reinforcement/duplication of key Medium Voltage corridors. The total investment in this program is substantially lower than in previous programs – only 65.60 billion FCFA (\$109M) – mostly because of the limited investment on Medium Voltage infra-structure.

Apart from the HV infra-structure and the duplication of key "dorsales", the map shown in the following figure is very similar to the one at the completion of the "coverage" program.

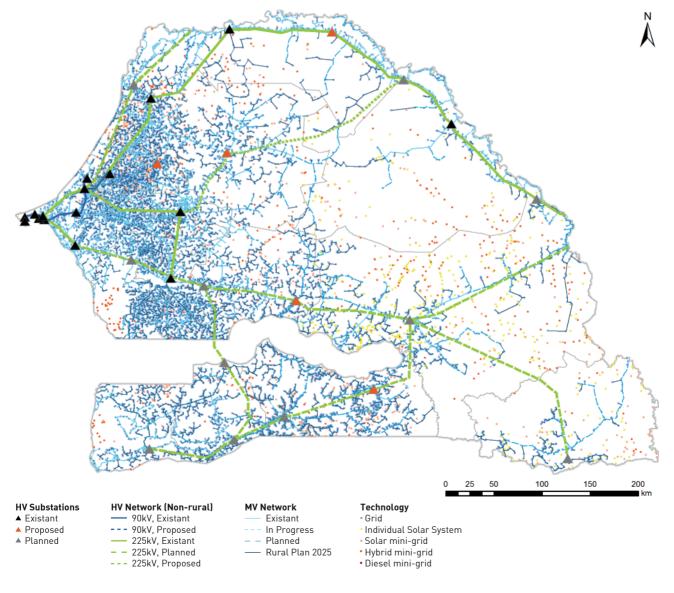


Figure 6.5 - Electric System of Senegal end 2025. (Source: GESTO & Earth Institute Analysis)

The recommended reinforcements for the HV network include a 90kV extension to Kébémer due to high population density and a new substation in Linguère area to cope with the excessive lengths of the MV lines. SENELEC is considering linking Touba to the northeast through a new 225kV corridor that could support the recommended Linguère substation.

Table 6.4 – Results by Department – target for 2025 [Source : Analyse Gesto & Earth Institute]

ent	Electrified Settlements (#)	Coverage Rate (%)	Electrified People (millions)	Rural Electrification Rate (%)	Clients (thousands)	Demand (MW)
UE	47	100,0%	0,11	100,0%	11,70	2,38
EL	366	100,0%	0,18	100,0%	19,05	3,55
Œ	361	100,0%	0,30	100,0%	31,31	5,99
Y	475	100,0%	0,37	100,0%	38,75	7,43
S	189	100,0%	0,12	100,0%	12,61	2,38
K	387	100,0%	0,42	100,0%	44,54	8,73
JGNE	385	100,0%	0,33	100,0%	34,45	6,55
DDAR	168	100,0%	0,11	100,0%	11,18	2,11
NE	169	100,0%	0,10	100,0%	10,53	1,97
EUL	353	100,0%	0,18	100,0%	18,58	3,46
NE	240	100,0%	0,19	100,0%	20,38	3,92
NE0	181	100,0%	0,11	100,0%	11,96	2,23
СК	510	100,0%	0,31	100,0%	32,79	6,18
J RIP	581	100,0%	0,39	100,0%	40,71	7,69
ATA	72	100,0%	0,05	100,0%	5,12	0,71
OU	187	100,0%	0,11	100,0%	11,60	1,58
Ά	94	100,0%	0,06	100,0%	6,25	0,87
O FOULA	479	100,0%	0,23	100,0%	23,84	3,23
\RA	525	100,0%	0,28	100,0%	29,23	4,04
Δ.	646	100,0%	0,29	100,0%	29,94	4,07
ER	921	100,0%	0,33	100,0%	34,29	6,33
4	901	100,0%	0,39	100,0%	40,55	7,52
RE	770	100,0%	0,40	100,0%	41,09	7,60
FERLO	150	100,0%	0,08	100,0%	8,81	1,21
4	143	100,0%	0,22	100,0%	23,17	3,52
L	149	100,0%	0,18	100,0%	18,62	2,79
UIS	135	100,0%	0,12	100,0%	13,11	2,54
IA	218	100,0%	0,18	100,0%	18,87	3,63
R	261	100,0%	0,47	100,0%	49,76	10,00
ING	252	100,0%	0.19	100,0%	20,13	3,90
U	210	100,0%	0,20	100,0%	20,73	4,00
MP	301	100,0%	0,20	100,0%	20,97	3,97
	187	100,0%	0,14	100,0%	15,00	2,13
TOUM	209	100,0%	0,16	100,0%	16,67	2,35
RY	273	100,0%	0,15	100,0%	15,49	2,16
JNDA	676	100,0%	0,34	100,0%	35,34	4,82
R	204	100,0%	0,37	100,0%	39,18	7,90
5	382	100,0%	0,40		42,45	8,30
NE	980	100,0%	0,44	100,0% 100,0%	45,86	8,64
JYE		· ·				1,03
			-			1,75 6.19
NA	327	100,0%	0,30	100,0%	31,83	0,17
	IOR A	IOR 89 A 329	IOR 89 100,0% A 329 100,0%	IOR 89 100,0% 0,09 A 329 100,0% 0,30	IOR 89 100,0% 0,09 100,0% A 329 100,0% 0,30 100,0%	IOR 89 100,0% 0,09 100,0% 9,12 A 329 100,0% 0,30 100,0% 31,83

With this program, 185,313 additional households will be electrified, which corresponds to an increase of over 1.86 million inhabitants connected. In terms of commercial and productive services, an additional 10,000 customers will be electrified.

At the end of this program, all villages and the entire rural population will be electrified, corresponding to a total of 10 million people and 1 million customers. The total peak rural demand in 2025 will be 181.3 MW.





7.1 INVESTMENT FUNDING REQUIREMENTS

Planned investments until 2017 are almost fully funded with only 45 Billion FCFA missing, but additional investments from 2018 to 2025 of 374 Billion FCFA have no commitments yet. Ongoing projects and PNUER have been almost fully funded with only 45 Billion FCFA missing. The Additional Plan for Universal Access has not secured any funding yet and therefore represents the majority of required funding with a total investment of 374 Billion FCFA.

7.1.1 URGENCY PLAN (PNUER)

The investments required to implement the PNUER are estimated to be close to 146 Billion FCFA (\$243M). At the beginning of 2016 around 100 Billion FCFA had been assured. A total funding of 45 Billion FCFA is still required to complete the PNUER.

7.1.2 THE ADDITIONAL PLAN FOR UNIVERSAL ACCESS

The Additional Plan for Universal Access requires a total funding of 374,8 Billion FCFA (\$624,7M), representing an average of 46,9 Billion FCFA per year (\$78,2M/year). This means almost maintaining the level of investment of the PNUER of 48,66 Billion FCFA per year.

The key Axis in terms of investment are the Extension of the MV network requiring 150 Billion FCFA (\$250M) to extend more than 12.000 kms of MV lines and the Axis on Distribution in the national grid requiring 108 Billion FCFA (\$180M) to connect more than half a million customers. Together these two axis represent around 70% of the total investment requirements. The next table splits the total investment per Axis, Initiative and Program that constitute the Additional Plan for Universal Access. Investments in centralized generation or high voltage transmission are not included in the rural electrification investment program as they will serve also other purposes.

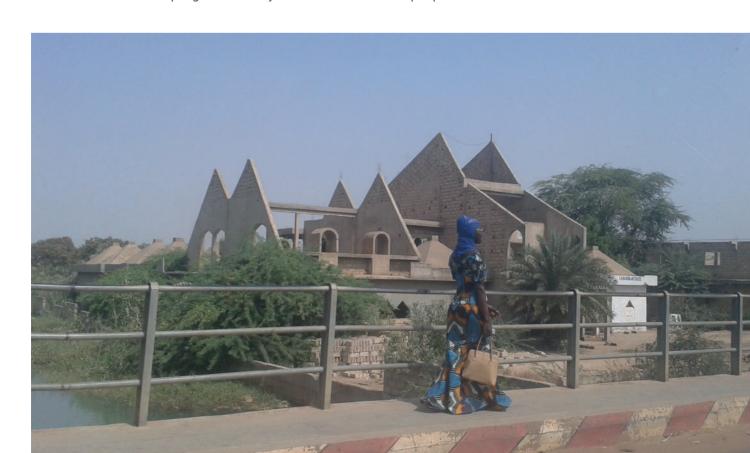


Table 7.1 – Investment required by key axis for the 2018-25 complementary programme (Billion FCFA) (Source: GESTO Analysis)

PROGRAMS AND COMPONENTS	1 st Program « Consolidation »	2 nd Program « Coverage »	3 rd Program « Completion »	Total
1. DECENTRALIZED SYSTEMS	16,57	9,27	7,61	33,44
1.1 Individual Solar and Transitional Solutions (including Rehabilitation)	3,62	1,86	1,05	6,53
1.2 PREM off-grid	0,52	0,44	0,16	1,12
1.3 Solar / Hybrid Mini-grids (including Rehabilitation)	12,43	6,96	6,39	25,78
2. MV GRID EXTENSION	64,84	77,85	7,33	150,02
2.1 Key "Dorsales" (duplication)	0,04	0,46	7,33	7,83
2.2 Ramifications	64,80	77,38	-	142,19
3. DISTRIBUTION IN THE NATIONAL GRID	42,64	37,42	28,18	108,24
3.1 First electrification	36,70	28,09	-	64,80
3.2 Densification LV & MV	4,10	7,92	28,18	40,20
3.3 PREM Network	1,84	1,40	-	3,24
4. INTERNAL INSTALLATIONS	24,57	22,11	15,88	62,56
4.1 Encouragement of electrification	8,47	6,77	8,38	23,62
4.2 Universal Prepayment	16,11	15,34	7,49	38,94
5 PROGRAMS OF GENDER IN RURAL ELECTRIFICATION	1,05	1,05	0,70	2,80
6 CAPACITY, COORDINATION, PROJECT AND ENGINEERING	5,90	5,90	5,90	17,71

The following figure splits the 2018-2025 investment according to technology with 320 Billion FCFA (\$533M) being invested in grid extension. The preferred off-grid technology in terms of investment is the 100% solar mini-grids with 14,2 Billion FCFA total investment (\$24M). In total, mini-grids represent an investment of 26,5 Billion FCFA (\$44M).

Although the investment plan does not consider any new diesel based mini-grid, the investment plan considers reinforcement of the low voltage networks in several existing diesel based mini-grids in preparation of future inter-connection to the grid.

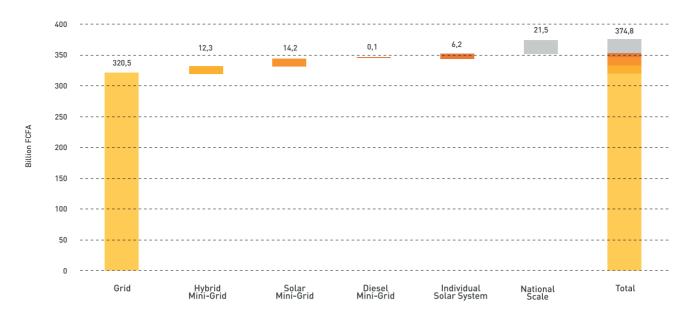


Figure 7.1 - Investments needs for the period 2018-2025 by type of electrification technology (Source: GESTO Analysis)

Figure 7.2 presents the investments split by geographic area or perimeter – independently of who implements them. The concession of Kaffrine - Tambacounda – Kédougou is the one with highest funding requirements as a lot of decentralized solutions are considered and MV lines tend to be longer. Similar situation is verified in the concession of Matam – Kanel – Ranérou – Goudiry.

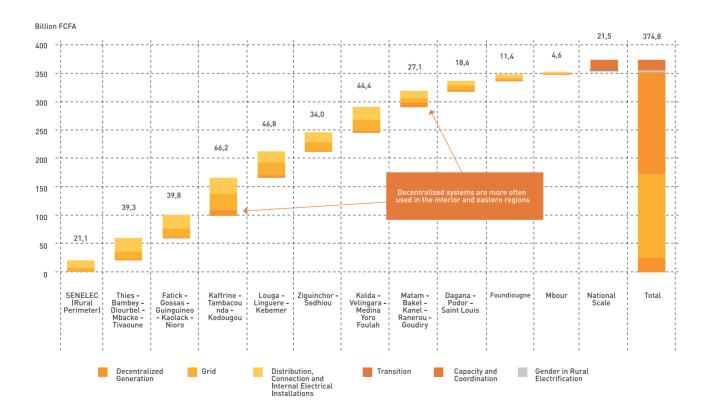


Figure 7.2 – Investments requirements distributed per Concession area (Source: GESTO Analysis)

7.2 RURAL ENERGY SECTOR EXPLORATION DEFICIT

The decisions on tariff harmonization and reduction are expected to result in an aggregated 168 Billion FCFA exploration deficit in the rural energy sector during the period 2018-2025 that also require funding. Based on the EU study the harmonization of tariffs is estimated to require a compensation close to 89 Billion FCFA to the concessionaires. Additional rural clients to be connected outside PPER will require an estimated additional compensation of 79 Billion FCFA just to cover operational costs – not including any type of remuneration on investment.

7.2.1 CONCESSION'S PRIORITY PROJECTS FOR RURAL ELECTRIFICATION (PPER)

The PPER (Priority Projects for Rural Electrification) to be implemented by the selected concessionaires – the most relevant existing and on-going initiative – have secured more than 50% of the estimated 62,79 Billion FCFA (\$105M) investment through private sector based funding with the remaining being assured by the Senegal Government. However, significant part of the private funding was based on the revenue expectations of the concessionaires which is about to change significantly due to the decision to harmonize tariffs with Senelec.

A study funded by the European Union to help Senegal define the procedure for tariff harmonization has estimated the required compensations to concessionaires due to tariff reduction. The study preliminary report identifies a need of 32 Billion FCFA (\$53M) for the period 2017-2019 as described in the following table which is presented in the EU report.

Only 21 Billion FCFA (\$35M) have to do with compensation to concessionaires, as the study also accounts for investments in pre-paid meters and incentive measures to facilitate connection – which are already accounted for in the Additional Plan for Universal Access investment plan.

By 2019, a total compensation of 11 Billion FCFA per year is estimated. We have considered that such value would remain constant until 2025 in order to calculate the funding gap arising from the harmonization of tariffs – which accounts to a total of 88,7 Billion FCFA (\$148M) for the period between 2017 and 2025.

The recent decision to reduce tariffs by 10% does not significantly impact the estimated harmonization costs as concessionaires will also benefit from a 10% reduction in the cost of electricity they acquire from Senelec to provide to their clients.

Table 7.2 – Tariff harmonization -related costs (Source: UE)

Cost Elements [Billion CFA] – 2017-2019				
Compensation				
Domestic users CER TP 70%	871	7336	9495	17702
Public lighting	91	176	248	515
Financial costs of compensation (10% / year)				
Quarterly Compensation	36	306	396	738
Half-yearly compensation	51	428	554	1033
Implementation Costs				
Control and Management (5%)	44	367	475	886
Communication (5% over 18 months)	350	536	-	886
Support and assistance				
Pre-payment				
Investment*	1709	1188	2002	4899
Financial expenses (8% over 5 years)	137	208	891	1236
User connection fees				
Investment	481	1317	1555	3353
Financial expenses (8% over 5years)	35	105	619	759

7.2.2 OPERATIONAL CASH FLOW FROM SERVICING RURAL CLIENTS OUTSIDE PPER

Electrification of clients outside PPER will not benefit from the compensation system that is being implemented. However, concessionaires will only electrify and serve those customers if the revenue coming from billing such clients, at least, covers the operational costs associated or if an additional compensation is put in place. There is no benefit in deploying infra-structure that cannot be properly operated and maintained.

The following figure shows an estimation of the running costs of serving rural clients in 2025 – without any remuneration or repayment of investments - according to the type of technology: national grid, hybrid/solar mini-grid or individual solar system. The Operational Expenditure already reflects some efficiency on network 0&M costs in remote areas.

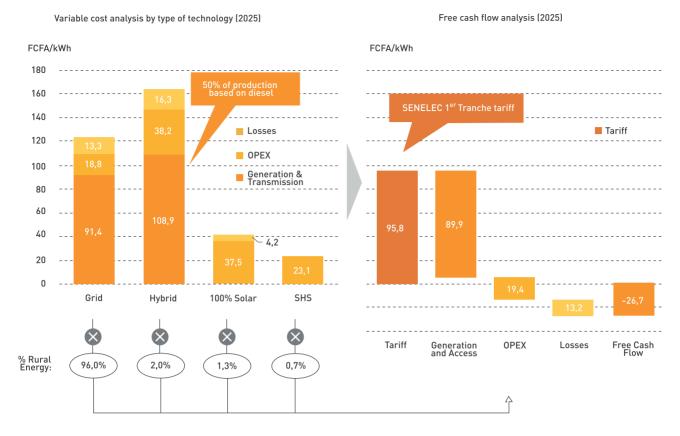


Figure 7.3 - Calculation of total operating free cash flow per kWh

The analysis shows that with the revised and harmonized tariffs the rural revenues will not be sufficient to pay for running costs, with each kWh sold potentially generating a loss of 26,7 FCFA. Given the importance of the national grid (96% of total rural energy consumption), the deficit is mostly a result of the very small spread between the authorized tariff of 95,8 FCFA/kWh and the price to be paid to Senelec of 91,4 FCFA/kWh, leaving only 4,4 FCFA/kWh to pay for losses and the operational expenditure associated with servicing such a disperse number of clients – even considering efficient outsourcing and use of pre-paid metering. Another contribution for the deficit will be the exploration of solar/diesel hybrid mini-grids where the revenues will not be sufficient to pay even for the fuel required to operate such mini-grids, resulting in reduction in number of hours. However, 100% solar systems if provided through grants or other sources of funding could be profitably operated and maintained – as most of the cost comes from Capital expenditure.

It is critical to find ways to reduce costs, both generation and transmission costs as well as Operating Expenditures (OPEX). On Generation and Transmission Costs for grid connected customers – the vast majority of rural clients in 2025 - Senegal needs to explore further opportunities to reduce its generation cost through more electricity imports from the region (OMVG, OMVS, WAPP) and more renewables while minimizing capital and financing costs on such infra-structure. On hybrid mini-grids it is critical to maximize and create mechanisms to upgrade the solar and battery capacity, minimizing unsustainable usage of diesel generators. On Operating Expenditures it is critical to (i) introduce pre-paid metering using scratch cards or tokens that can be sold by local retailers benefiting from mobile and mobile payment technology, (ii) deploy adequate communication and information systems that allow for remote monitoring of infra-structure and losses, (iii) recruit and train outsourced local teams that can remotely solve problems and improve quality of service (iv) improve engineering, procurement and fiscalization / quality control procedures to minimize failures and maintenance requirements. In the long term, if all clients – both urban and rural - within a concession area could be serviced by the same distribution company there would be economies of scale and geography that could further reduce operational costs.

The following figure shows the total deficit associated with servicing rural clients outside PPER in each year until 2025 totalling 78,7 Billion FCFA. Without some sort of compensation or significant cost reduction the concessionaires will not be able to service their areas and may eventually run out of business.

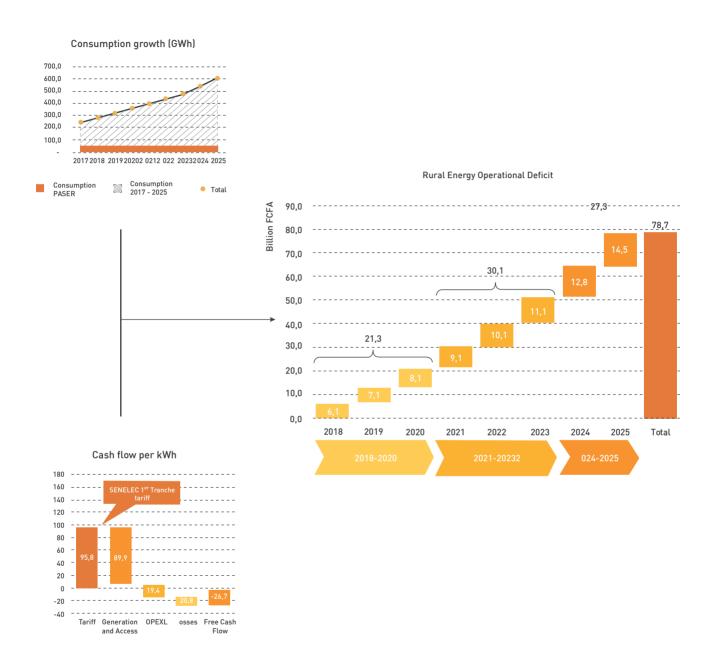


Figure 7.4 – Calculation of total deficit from rural clients outside PPER (Source : GESTO Analysis)

7.2.3 TOTAL COMPENSATION REQUIREMENTS

Additionally to the funding of investments in rural electrification infra-structure it will be necessary to find adequate mechanism to guarantee that concessionaires can run a sustainable business that allows them to adequately serve the millions of rural consumers that will be electrified until 2025. This can be achieved – while costs are not substantially reduced - through cross-subsidization to be implemented either through a reduction in the cost of electricity paid to Senelec or through other compensation mechanisms such as an increase in the rural electrification levy charged to all electricity consumers. Reduction in the tariff paid by concessionaires to Senelec is the more actionable solution in the short term, but it will reduce the overall revenues of Senelec, potentially increasing the required annual compensation by the State to Senelec.

The total compensation requirements to concessionaires (both PASER/PPER and additional clients) amounts to 167,5 Billion FCFA until 2025. This value will be distributed in an even way along the various periods, as shown in the following figure.

Concessions compensation Billion FCFA 180 167.5 49,6 160 27,3 140 78,7 63,6 120 30,1 100 ΩN 60 52,8 40 20 1,4 **PNUER** 2018 2021 2024 Unique Total 2023 2025 Tariff 2020 PASER Clients: Operation Deficit - PNER Harmonization of tariffs Rural Clients (2018-2025)

Figure 7.5 – Total compensations to the concessionaires (Source: GESTO Analysis)

7.3 PRIORITY FUNDING REQUIREMENTS

Despite a total funding requirement until 2025 of 587 Billion FCFA (45B + 374B + 168B FCFA), current priority for Senegal is to secure funds of 254,8 Billion FCFA (\$425M) required until 2020. Current priority includes finalizing the PNUER with 45 Billion FCFA funding, starting the 2018 "Consolidation" Program which requires an additional 154 Billion FCFA and guaranteeing concessionaires can have sufficient resources and adequate compensation to provide electricity with quality to 75% of the rural population by 2020.

Total funding requirements including the compensations to concessionaires amount to a total of 587 Billion FCFA (~\$980M). If the different Programs are implemented within their target periods the expected requirements per period is the following:

- 2015-2017: 46,4 Billion FCFA (\$77M)
- 2018-2020: 208,4 Billion FCFA (\$347M)
- 2021-2023: 217,2 Billion FCFA (\$362M)
- 2024-2025: 115,2 Billion FCFA (\$192M)

The funding requirements estimated per period are outlined in the following figure:

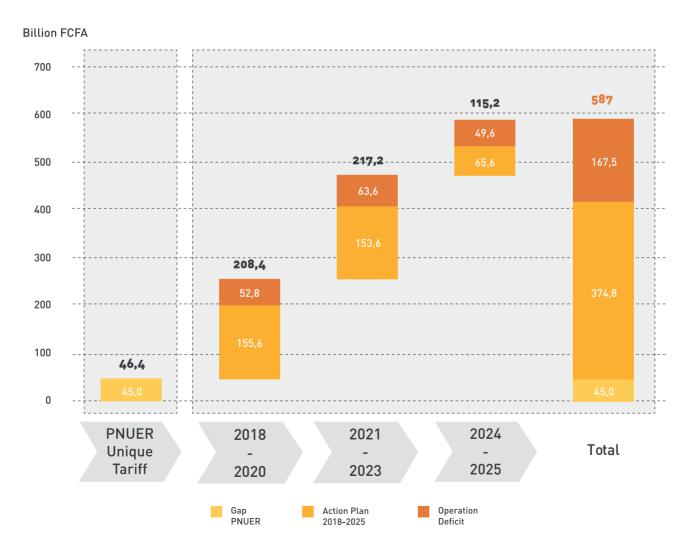


Figure 7.6 – Total funding requirements to achieve universal access (Source: GESTO Analysis)

Current priority is securing required funding until 2020. This includes finalizing the PNUER with 45 Billion FCFA funding, starting the 2018 "Consolidation" program which requires an additional 154 Billion FCFA and guaranteeing concessionaires can have adequate remuneration to provide electricity with quality to 75% of the rural population (which implies 52,8 Billion FCFA compensations to concessionaires).

The Consolidation Program requirements are detailed in the following figure with Medium Voltage Extension and Distribution being the key investments – similarly to what happens in the total 2018-2025 program.

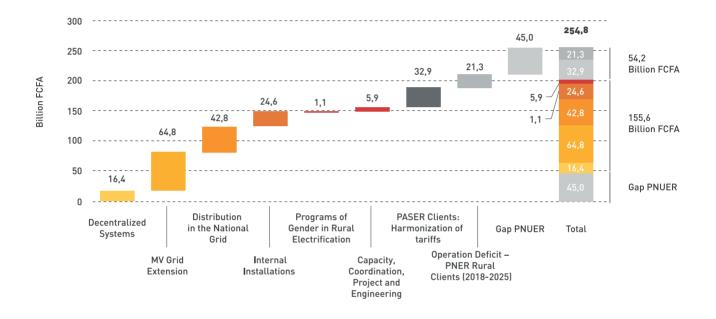


Figure 7.7 – Investment requirements by Axis / Initiative for the period 2018 – 2020.



Given the importance and priority of these investments Annex 1 details the required 156 Billion FCFA (\$260M) into 109 Projects, organized per initiative and Axis. The concession geographical scope is a key variable used to organize and cluster Projects not only because of geographical proximity but also to facilitate coordination with concessionaires which will be key in operating the built infra-structure.

The following figure outlines the 109 Projects per investment budget. The average project required 1,4 Billion FCFA (\$2,3M) with the largest project – MV ramification in the Fatick - Gossas - Guinguineo - Kaolack – Nioro concession - accounting for 14 Billion FCFA (\$23M). More than half of the projects require an investment below 500 Million FCFA (\$0,83M) each but can be bundled in order to organize larger scale projects.

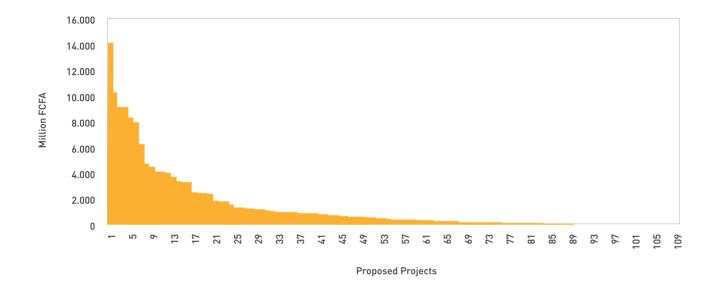


Figure 7.8 - Investment requirements per project (Consolidation Program) (Source: Gesto Analysis)



FINANCING SYNDICATION STRATEGY

The requirements for funding are substantial and amount to 587 Billion FCFA only for the rural electrification component. The amount does not consider reinforcements in generation or High Voltage transmission which will be required to supply both the rural and urban consumers.

The financing syndication strategy reviews the different possible sources of funding, both private and public, in order to propose a realistic and credible plan to raise sufficient funding at the least cost.

8.1 POWER SECTOR REVENUES AND PRIVATE FUNDING

The need to harmonize and lower tariffs while also reducing compensations from the State Budget to Senelec limits significantly access to Private Financing without some sort of public guarantee and requires a strong and determined effort on power sector efficiency and operational cost reduction. Only under very optimistic and challenging assumptions for power sector cost evolution it will be possible to avoid compensations to Senelec and develop a sustainable and "bankable" power system where the sector can fund the rural operational deficit. Nevertheless, the application of a levy on consumers of 0,7 FCFA/KWh will mobilize already 26 Billion during the 2018-2025 period for the Rural Electrification Fund.

Private sector financing corresponds to all financial resources that can be raised by entities ruled under private law based on the expected revenues of the power sector. It includes both Equity and Debt.

Private entities will invest and will be able to raise debt if they have a reasonable expectation to pay back the loans and to receive their investment back with an adequate remuneration. Private sector funding potential – in terms of value to be raised and cost/interest - will depend on the investment framework and on the expected revenues and costs of the power sector.

8.1.1 SENELEC

Historically, the tariffs charged by Senelec to its clients have not been able to cover Senelec's costs as can be seen in the following figure. The compensations paid by the State to Senelec have just been sufficient to pay for running cost but not to remunerate and depreciate the assets. This is mostly due to very high generation costs – mostly based on oil – but also to energy losses above 20%.

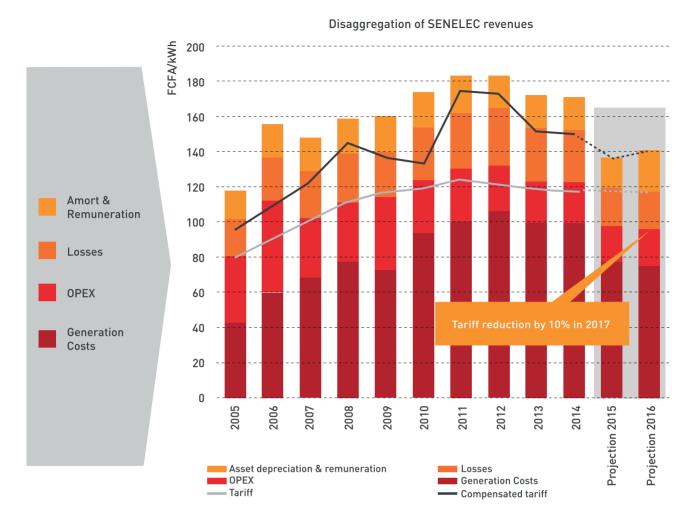


Figure 8.1 – Historical P&L summary of Senelec per kWh (Source : GESTO Analysis)

Power sector and Senelec's situation is expected to improve until 2025 because of the expected reduction in generation cost. The following figure shows the expected evolution according to 3 different scenarios of generation cost and operational efficiency. The base case – coming from Senelec's most recent Production plan – is complemented with a high and low sensitivity scenarios depending on whether generation cost could be reduced or increased by 15% and different operational efficiency targets could happen.

In the base case Senelec will continue to require relevant compensations from the State Budget until 2025 - above 50 Billion FCFA/year until 2023. However, in the Best Case Scenario by 2020 there could be no requirement for compensation, or in the Worst Case Scenario it could grow to above 150 Billion FCFA/year.

The analysis shows why power sector efficiency is a major priority of the Government of Senegal and why the Government of Senegal gives high priority to further improve current expectations and ambition regarding power sector efficiency, namely optimizing energy mix, reducing power sector losses, improving operational efficiency and introducing proven low cost technologies. Senegalese consumers already pay a high energy tariff and therefore it is the option of the Government of Senegal to reduce energy tariffs and to impose ambitious efficiency targets on the power sector.

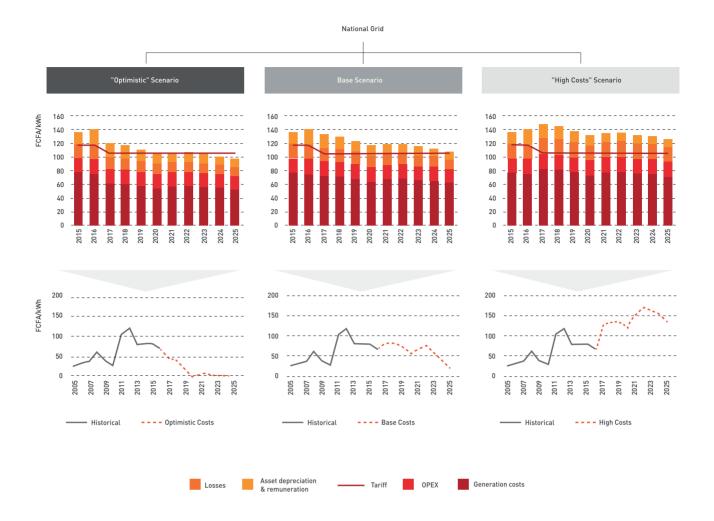


Figure 8.2 – Total available cash flow from Senelec and estimated compensation under different scenarios (Source : GESTO Analysis)

The need to improve efficiency will imply a very significant pressure from the regulator on Senelec and Concessionaires on efficiency targets potentially resulting in a situation where "regulated revenues" (including compensations) will not totally cover costs. This happens when the operators are not able to improve efficiency as quickly as the regulator imposes them to and results in "regulatory risk". This typical adjustement process and risk – which happens in many regulated power markets across the globe – is not favourable for private sector funding. Financial entities will price such risk resulting in a higher cost to be paid by power consumers and, potentially, Senegalese tax payers.

The proposed financing syndication strategy acknowledges the impact of an intended efficiency improvement process and therefore opts to favour private funding with public guarantees and innovative contractual frameworks that can benefit from carbon or blended financing available, as will be presented in the next sub-chapter. This type of private funding, being public guaranteed, will count as public debt and is therefore considered together with public debt.

8.1.2 CONCESSIONAIRES

Existing framework for private sector participation was created under the PASER and is based on Concession contracts or Delegated Management contracts and a "price-cap" type of regulation. CRSE established a maximum price for the sale of energy and based on that "price-cap" different operators bid for the required amount of subsidies on investment in order to be awarded concessions. However, the operator assumes full demand risk and is not compensated if energy sales are below expectations. Given rural demand uncertainty this investment framework has resulted in cautious and slow investment progress with limited potential for raising debt. Furthermore, the investment commitments of concessionaires are limited to priority projects established in the tenders with no clear framework for additional investments.

The decision to harmonize and reduce tariffs will have a very positive impact on adoption by rural clients and will facilitate implementation of PPER targets – concessionaires will receive compensations and, with the appropriate compensation mechanism in place, will be able to adequately operate and maintain the PPER investments.

However, any investment outside PPER will hardly be funded and developed by concessionaires under the current framework. The decision to harmonize and reduce tariffs, as all Senegalese have to be treated equally, implies that tariff based revenues will not cover operational costs in rural areas. A revised framework will be approved to guarantee that concessionaires will be able to profitably operate new assets – either through compensations or through reduction in the cost of price paid to Senelec for power. It is the option of the Government of Senegal to change the PASER approach and to have infra-structure deployment led by MEDER and ASER mostly through Conventions and direct contracting of materials and works but with higher involvement from concessionaires to guarantee adequate operation of such assets and infrastructures.

The need to compensate concessionaires with 167 Billion FCFA over the period 2018-2025 and raise funding for such compensations could be reduced if higher efficiency could be achieved. External financing will be easier to raise for deployment of new infra-structure. Funding operational deficit will most likely have to come from State Budget or from cross-subsidization – if it would be possible to implement it – and therefore it is critical to improve power sector efficiency.

The next figure shows the aggregated compensation required for both urban and rural operators under the 3 scenarios – considering only operational deficit in the rural sector and no cash flow requirements for new investments in rural areas outside PPER. With higher efficiency it would be possible to envisage by 2025 a financially sustainable energy sector where power sector revenues could cover costs without support from the State Budget – with all clients supporting the cost differences across the country. It will be key to promote efficiency and the use of proven low cost technologies.

Independently of being able to deliver higher efficiency, the Government of Senegal decided already to implement a symbolic tax – as already implemented in several other countries – on all clients to fund rural electrification. A symbolic fee of 0,7 FCFA/kWh will be charged on all consumers and the revenues of such fee will be used to fund the Rural Electrification Fund (FER) allowing to raise during the period 2018-2025 around 26 Billion FCFA. An increase in such fee and/or a decrease in the tariff paid by concessionaires to Senelec are being considered as possible mechanisms to solve compensation requirements from tariff harmonization and rural operational deficit.

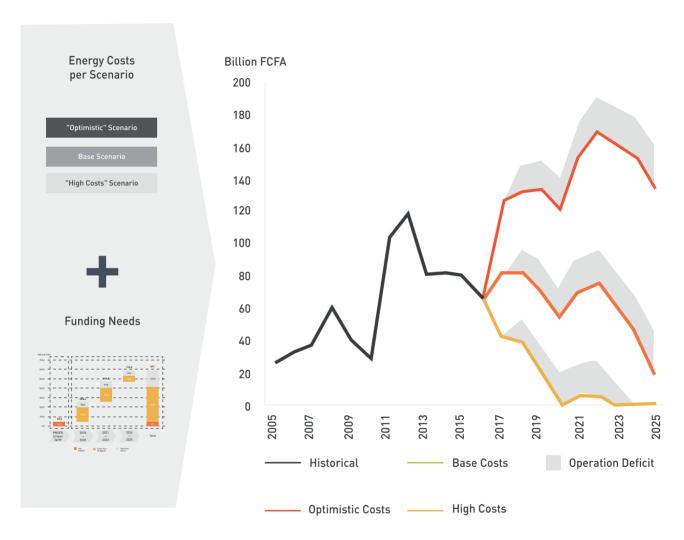


Figure 8.3 - Total estimated compensation Senelec + Concessionaires (Source : GESTO Analysis)

8.2 PUBLIC FUNDING AND SYNDICATION STRATEGY

Financing of rural electrification will be mostly Public or Public guaranteed, and therefore needs to be done in an effective way to support economic growth while pursuing a prudent debt strategy that keeps cost of borrowing at reasonable rates, as recommended by IMF. Commercial loans imply higher interests and financial costs which would make universal access more expensive for Senegal and therefore should ideally be avoided and limited to blended and more affordable solutions.

Public funding has been historically the major source of funding for rural electrification. And considering the limitations presented on chapter 7.1 on private funding is expected to remain the major source.

For the 2015-17 period the annual public investment planned under the PTIP (Senegal Triennial Public Investment Program) for the energy sector is 102 Billion FCFA (\$170M) per year. These values do not include the compensations to Senelec – when revenue from tariffs are not sufficient to pay for the approved revenues by CRSE – which in 2014 represented an additional allocation from the State Budget of 82 Billion FCFA (\$137M) according to CRSE. Although compensations have an "extraordinary" nature they have been substantial for the last 10 years (average of 61 Billion FCFA).

Regarding rural electrification, around 35 Billion FCFA (\$58M) per year are currently planned under the PTIP representing 34,7% of the total public energy investment under the PTIP and 1,1% of total funds available to the State (from taxes, loans and grants) in the period 2015-17 according to IMF projections. A more detailed analysis of the sources of funding show that, contrary to other energy investments where loans represent the majority of the funding, rural electrification has relied significantly on State Budget (which represents 60% of the expected public investment).

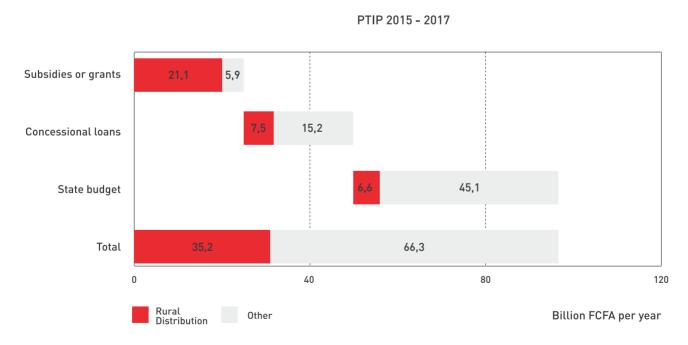


Figure 8.4 – Average Annual Investment by source of funding under PTIP 2015-2017 (Source: Ministry of Finance of Senegal, GESTO Analysis)

For the period 2018-2025 Senegal needs to raise an average of 73 Billion FCFA/year (587 Billion FCFA in total), which means more than doubling the 2015-17 estimated investment. This cannot be done only through the State Budget as it would undermine available resource in other key sectors.

IMF in its most recent Staff Report (November 15, 2016) said "The challenge of meeting infrastructure development objectives without undermining debt sustainability will require continuing efforts to improve the quality of investment while pursuing a prudent debt strategy that keeps the cost of borrowing at reasonable rates".

The following figure outlines the major "external" public funding alternatives to the State Budget, organized according to expected cost. Senegal should maximize access to the less expensive sources of funding. Comercial loans can be very expensive and, in many situations, it may be better to use the State Budget or simply defer investments.

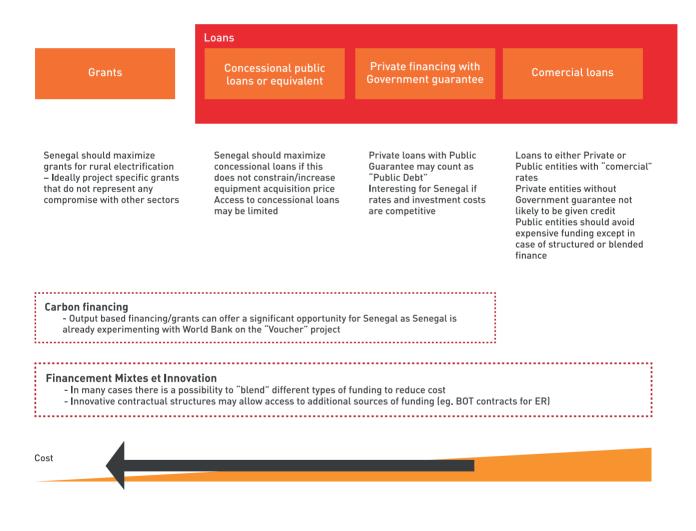


Figure 8.5 – Public funding alternatives

The recommended financing strategy for investments – that can maximize debt sustainability and maintain impact on State Budget at reasonable levels - is based on:

- **Maximization of Grants**, ideally those that are project specific or that can be blended with other sources and that do not represent a trade-off with other sectors. Targets of 11,6Billion/year up to 22,1Billion/year could be envisaged considering historical results and GDP growth, but require strong donor support and an active role of ASER.

Subsidies or grants are least cost sources of funding as they do not need repayment and therefore should be maximized. Grants may be country or project specific:

- For example, in the case of country specific grants, a multi-lateral institution may have a certain budget to support projects in a given country on a number of priority areas. It is than up to the country to select in which area to allocate such grants, according to its priorities.
- If a grant is project specific it is many times the result of an application made or supported by the host country. Project specific grants compete with other countries and projects and do not represent a trade-off between different sectors within the country.

As Senegal continues its growth path and becomes a more developed economy the access to country specific grants may be reduced. However, the access to project specific grants may be increased depending on the ability and organization of the country.

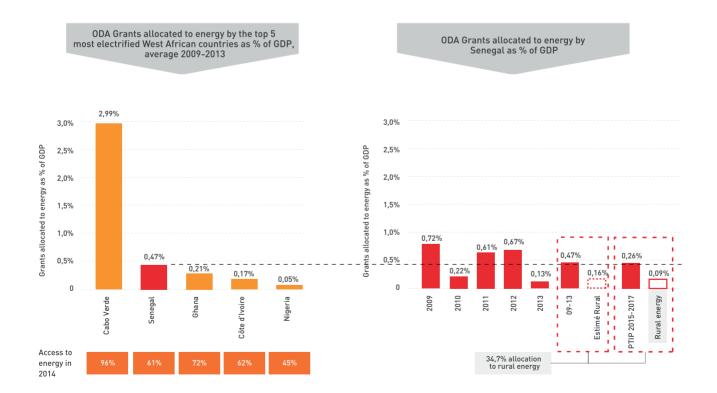


Figure 8.6 – Analysis of ODA for energy

The previous graphs compare the average ODA grants allocated to energy as a percentage of GDP of the 5 most electrified West African countries. During the period 2009-2013 Senegal ranked second with ODA for energy representing on average 0,47% of GDP, more than double that of Ghana or Cote d'Ivoire. The 2015-17 allocation to energy of only 0,26% of expected GDP is significantly below the 2009-13 historical average.

Maximizing grants, ideally project specific grants, is key for rural electrification to happen without undermining significantly other sectors or the macro-economic stability of the country. Donor support is critical together with adequate organizational setup to maximize project specific opportunities. We consider a base target of maintaining the percentage of GDP allocated to rural electrification during 2015-17 for the 2018-2025 period which would yield on average 11,6 Billion FCFA/year (93 Billion FCFA over the period) and a more ambitious target taking into consideration the GDP percentage of the 2009-13 period. The more ambitious target would represent 22,1 Billion FCFA/year (177 Billion FCFA over the period).

- **Maximization of Concessional loans**, both bilateral and multi-lateral, if required procurement does not constrain or increase equipment acquisition costs. Macro-economic perspectives offer a potential to significantly increase public loans allocated to rural electrification up to 14,7Billion/year.

Concessional loans are amounts financed directly to the State (with the repayment being a direct responsibility of the State) under special conditions, usually by international institutions, for use in specific projects. Special conditions are, in general, interest rates more attractive than those normally found on the market, maturity period or a combination of both;

The reduced historical usage of public loans for rural electrification and Senegal's controlled level of public debt offer the potential for a higher usage of loans for rural electrification. Furthermore, the international relevance of rural access - given the Sustainable Energy 4 All Agenda, the Sustainable Development Goals and the African Development Bank New Deal for Energy - together with the level of priority to rural electrification by the Senegalese government offer the potential to easily raise loans with high level of concessionality. The higher the level of concessionality – lower interest rates and longer tenors – the lower the cost of rural electrification for Senegal and the lower the impact on its debt sustainability path.

A more detailed analysis of the potential of concessional loans to fund rural electrification shows that it would be sustainable – maintaining IMF's current path to 52,5% debt-to-GDP ratio and an allocation of 1,1% of new loans to rural electrification – to raise 14,7 Billion FCFA (\$25M) on average each year through concessional loans. This is a relevant increase relative to what could be achieved if the 2015-2017 effort (% of GDP) would be maintained – 10,2 Billion FCFA/year.

- Selective use of Private sector blended funding opportunities supported on public guarantees and adequate contractual structures. It is possible and desirable to use available blended funding opportunities where Comercial or Development Finance can be blended with concessional finance and grants resulting in low interest and long tenors.

Private funding without a sustainable and stable framework will be hard and expensive to mobilize. However, significant financial resources are available for the private sector by Development Finance Institutions with more attractive conditions than pure Comercial loans, but normally require some sort of Public Guarantee – potentially counting as Public Debt under IMF rules.

In recent years several institutions have started offering "Blended" funding opportunities, which have the potential to offer interest rates and maturities closer to those that can be obtained with concessional loans. "Blended" financing joins Comercial or Development Finance loans with concessional or even grant components. For example, IFC has been funding renewables in several African countries in a joint partnership with the 5,8 Billion USD Clean Technology Fund (CTF) where CTF funds 50% of the loan with very low concessional rates.

It is estimated that this type of financing structure could provide as debt up to 75% of the investment with an average cost of 3 to 4% and maturities of up to 15 years. This type of financing combined with 25% equity would make the investment viable with an attractive average cost of capital potentially close or even below 7%. Further combination or "blending" of grants could further improve the costs.

Development Finance Institutions have traditionally funded mostly BOT (Build Operate Transfer) or BOO (Build Own and Operate) types of Public-Private partnerships, supported by Sovereign Guarantees. Although this type of contractual frameworks have not been applied often to rural electrification it is possible and desirable to develop innovative contractual frameworks in this area – ideally also with a focus on climate financing opportunities.

- Leveraging Climate financing opportunities. The Paris Agreement envisages 100 Billion USD of climate finance for development per year by 2020. Proactive procurement and origination of climate finance opportunities can provide access to new sources of grants and concessional loans – as ASER is already pioneering in the Voucher Scheme project.

A key source of low cost funding in the years to come will be "Climate Financing" where a target exists to mobilize 100 Billion USD for development every year. Rural electrification avoids deforestation, usage of querosene and improves the capability of populations to adapt to the impacts of climate change. Furthermore, solar based mini-grids join the benefits of rural electrification with the mitigation potential of renewable energies.

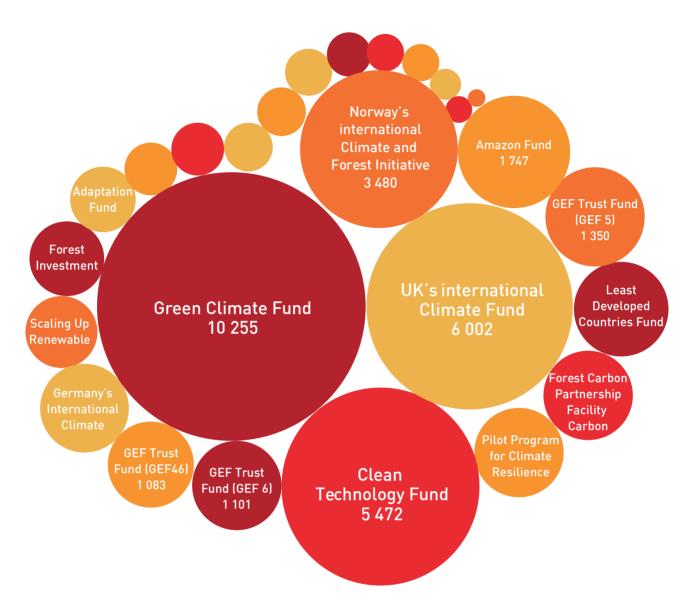


Figure 8.7 – Climate finance funds. (Source: www.climatefundsupdate.org)

Climate funds have raised already more than 40 Billion USD with less than half currently allocated. Most of these financial resources are allocated either as grants or as concessional loans. Green Climate Fund, UK's International Climate Fund, Clean Technology Fund and Norways's International Climate and Forest Initiative are some of the largest Climate Funds.

Senegal and ASER are successfully pioneering one innovative Rural Electrification Carbon Finance Project under the Ci-Dev (Carbon Initiative for Development) from the World Bank with the support of the "Partnership for Market Readiness Fund" to finance grid connections through an innovative voucher scheme generating carbon credits.

ASER will give high priority to develop internal competences on carbon financing and to become a key partner of climate finance institutions in bringing climate finance resources into rural electrification. Leveraging climate financing opportunities will be one of the key strategic levers to maximize both grants and concessional loans to Senegal's ambitious rural electrification program.

Even with a significant increase in grants and loans relative to recent years (PTIP 2015-17) a substantial contribution from the State Budget may be required without higher efficiency – in particular to fund exploration deficit and compensations. Without cost efficiency and increase in support from donors, concessional lenders and/or innovative private sector and carbon financing, achieving rural electrification targets should require very significant increases in State Budget allocation (up to 380Billion or 50 Billion/year), potentially undermining investment in other key sectors for Senegal.

The following graph summarizes the analysis on the different sources of funding into two different levels of ambition regarding the maximization of grants and concessional or equivalent loans (through blended or climate financing):

- Maintaining the level of investment planned for 2015-17 as a percentage of GDP: Such scenario would still be ambitious as GDP is expected to grow at 7% per year until 2025. This implies a significant growth in the 2015-17 expected values.
- An ambitious increase in the level of grants and loans: Such scenario is very ambitious but doable as it is based on reaching historical values on grants and on a debt path to 52,5% debt-to-GDP as envisaged by IMF.

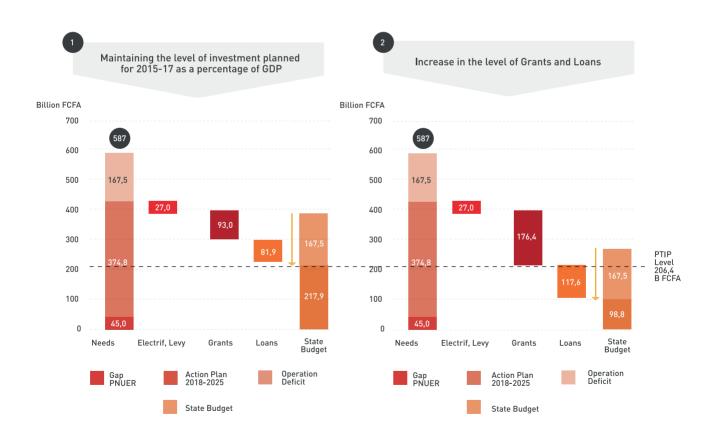


Figure 8.8 – Financing syndication strategy summary. Two possible scenarios. (Source: Analyse Gesto)

In both scenarios the financing strategy remains the same, but the results differ. The analysis shows that even in the more ambitious scenario a significant effort will still be required from the State Budget, above the high values registered during the PNUER (2015-17).

Grants and concessional or equivalent loans will hardly be available to fund exploration deficit and required compensations. Parallel to raising grants and loans, Senegal is committed to increase power sector efficiency in order to reduce the effort on State Budget of such compensations.

In summary, Senegal's ambitious agenda on universal access and rural electrification can only be achieved with continued Budget support together with the support of international donors and other international financiers through grants and concessional or equivalent loans. Senegal will continue to be at the fore-front in identifying and originating innovative and climate oriented projects that can be an example for other countries and rural electrification programs.



A NEW STRATEGY AND INSTITUTIONAL FRAMEWORK

9.1 INSTITUTIONAL FRAMEWORK IMPROVEMENT: A 2 STEP PROCESS

Limited historical progress and ambitious rural electrification Program require institutional changes and a new strategy. However, such changes have to be implemented in two steps in order not to further delay implementation.

Current institutional framework is complex and involves many different actors and initiatives. For example, although the territory has been divided into concessions, there can be innumerous initiatives and actors inside the same concession area, including Senelec. Senelec continues to electrify the rural villages under its perimeter, in many cases, within rural concession area perimeter. Implementing agreements signed directly between the Government and different actors such as Senelec, PNUD, MYNA (PPP) or ASER also electrify villages within concession areas. ERILs and other projects with grants are also being developed, parallel to Concessions. Although concessionaires are expected to operate all these assets in the future they are not being involved in the technical specifications or construction supervision.

The following picture tries to give an overview of the actors involved and the current complex situation:

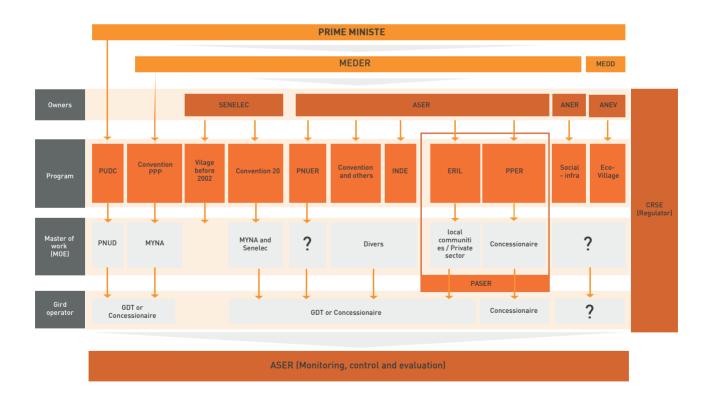
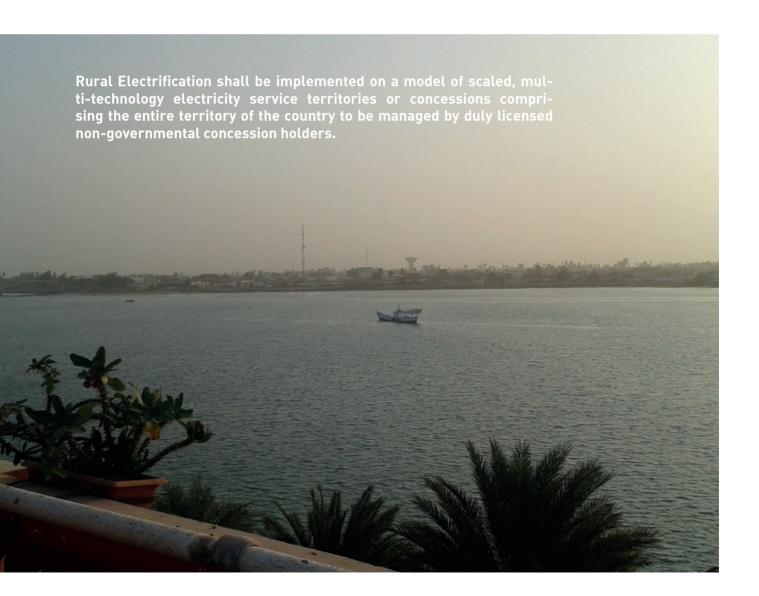


Figure 9.1 – Current institutional framework for rural electrification (Source: GESTO Analysis)

Achieving universal access by 2025 requires not only funds, but also a new strategy and significant institutional reform. However, introducing significant changes in the current institutional framework may result in further delaying the implementation of the rural electrification program. For example, 10 years have passed in order to implement the concession model. Therefore, the institutional reform will be structured on two steps or phases:

- A first phase, until 2020, focused on introducing immediate improvements on the existing framework working together with existing players , on tariff harmonization between concessionaires and Senelec and on the award of the remaining 4 concessions.
- A second phase, after 2020, which will introduce deeper reforms on the Concession Model and its supporting Regulation.

Based on lessons learned, the proposed new strategy employs a modified approach for rural electrification development based on a coherent scheme to aggregate the market for rural electricity service expansion under a simplified set of implementing mechanisms. A decision to centralize rural electrification planning and program management underpins this new strategy, in order to reduce complexity and eliminate overlapping roles. The second step is to develop scaled-up service territories with sustainable long-term electrification service and business plans.



9.2 IMMEDIATE INSTITUTIONAL IMPROVEMENT: PROJECT MANAGEMENT UNITS, TARIFF HARMONIZATION AND AWARD OF REMAINING CONCESSIONS

Until 2020, immediate institutional improvement will be focused on the creation of Project Management Units in charge of direct contracting of equipment and works, using public funding, under coordination of a reinforced ASER, on tariff harmonization between concessionaires and SENELEC and on the award of the remaining concessions.

In the short term the priority will be focused on improving the existing institutional framework to enable the effective deployment of infra-structure (PNUER and "Consolidation Program"), on addressing the tariff differences between SENELEC and the Concessionaires and on awarding the remaining 4 concession areas.

In the recent past, in order to respond to urgency needs, the Government of Senegal has signed several "implementation agreements" or Conventions with SENELEC, ASER and PUDC. Under these "Conventions", ASER, SENELEC or PUDC act as "Project Implementation Units" with funding coming directly from the State. These conventions, in particular the one with PUDC, where a dedicated Project Management Unit was setup, have been very effective in terms of infra-structure deployment. However, concessionaires which will manage the infra-structure in the future, have not been involved in these initiatives.

The objective is to replicate the successful experience with PUDC and ASER, but with a stronger involvement of concessionaires. The 4 concessionaires, Senelec and PUDC, will create six Project Management Units under coordination of ASER. Project Management Units will work in a similar way to PUDC ensuring procurement and coordination/fiscalization of a set of projects. Public funding with key contracts (EPC model) of materials and works will be the key model for project implementation, despite flexibility for innovative contractual models. ASER will be reinforced and will have a coordination and supervision role over concessionaires and Project Management Units, including the hosting and management of a rural electrification integrated geographical information system with the geographical coordinates of all pre-paid meters to be used by Concessionaires and/or Project Management Units.

Regarding tariff harmonization, implementation is urgent and therefore funding will come from the gains in efficiency in the power sector and from cross subsidization from urban clients: through a differentiated reduction per concessionaire in the electricity tariff paid by concessionaires to Senelec and/or through an increase in the Rural Electrification Levy.

Regarding the award of the remaining concession areas, in order to allow for a quick startup the Government decided to award those concessions directly to SENELEC.

9.3 LONG TERM INSTITUTIONAL REFORM: REVISED AND SIMPLIFIED CONCESSION MODEL

After 2020, the existing Concession model will be simplified with clearer separation of activities and geographies. Regional Distribution Concessions will constitute the basis for operating the distribution grid and off-grid infra-structure in the future, in both urban and rural areas.

The Action Plan for rural electrification (PASER) structured Distribution in rural areas into 10 different concession areas to be allocated to private companies and a series of villages within those concessions that had already been electrified and remained with Senelec (the Senelec perimeter). 6 concessions have been awarded and are owned or partially owned by international utilities such as ONE (Maroc), STEG (Tunisie) or EDF (France). According to a rapid assessment of rural electrification actors, undertaken during the preparation of the investment prospectus, despite the slow progress in rural electrification the concessionaires are seen as having adequate management, technical and financial capacity.

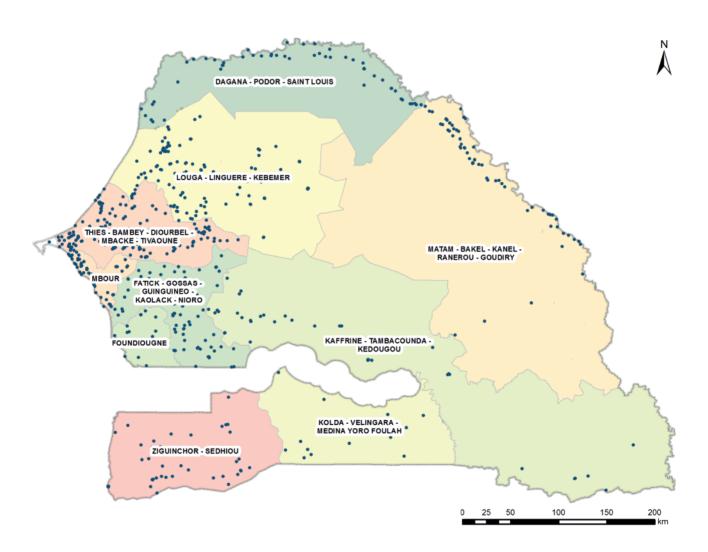


Figure 9.2 – The 10 rural concessions and the Senelec perimeter (Source: ASER)

The lack of performance of concessionaires seems to be related with the complexities of setting up a new model (e.g. fiscal issues), with the regulatory model put in place – "price cap" regulation – that transfers too much risk to concessionaires and with limited separation of activities and geographies – that result in coordination problems with Senelec and significant price differences between adjacent areas. The identified problems are design flaws that can be corrected.

An improved concession model can become effective – as is the case in many other countries. In fact, the Government of Senegal just decided to extend the concession model to the rest of the country by awarding the remaining 4 concession areas directly to Senelec. The current concessionaires are perceived as being sound and reliable partners that can help Senegal move forward its ambitious rural electrification agenda.

The concession model seems appropriate for operation of distribution activities as concessionaires have the possibility to invest and own assets thus being able to upgrade and improve the infrastructure. In each concession area, it will be up to the concessionaire to optimize the inter-play of grid and off-grid electrification and to potentially involve sub-contracting of other private parties. New private led initiatives have to be agreed and implemented together with concessionaires – meaning the ERIL model will be discontinued in the future.

In the long term, after 2020, the institutional framework will be progressively simplified. The number of actors will be reduced and their actions better articulated. The simplification will happen in terms of actors but also in terms of geography. Ideally, the different projects implemented inside a concession area (SENELEC, ERILs and others) will be transferred for operation by the respective concessionaires. Remuneration of invested assets may remain with the initial investor until total depreciation of the assets – avoiding compensation between operators –, but ownership and operation will be transferred. This requires a more complex regulation model but will increase scale, avoid duplication of teams and avoid inefficiencies – thus reducing the overall cost of electrification. In the future, after 2020, a regional distribution concession model will become the basis for operation of distribution activities – both urban and rural – across the country.

Finally, a more effective separation of activities will be implemented in order to improve levels of service and accountability. Senelec will play a role as Distribution Concessionaire (in the yet non awarded areas), but in order to improve coordination and avoid conflicts of interest it is important to better separate the Distribution activities from the Transmission and Generation activities. All Distribution companies will receive equal treatment, independently of being or not part of Senelec.

9.4 LONG TERM INSTITUTIONAL REFORM: REGULATORY MODEL

The long term model will require a new regulatory approach with a compensation system – which can facilitate the intended changes on the concession model and the implementation of a unique tariff system.

Politically it has been decided that all Senegalese should pay for electricity according to the same rules, independently of where they live. However, providing electricity services across Senegal has different costs according to the geographical area or technology used.

It is only possible to establish one unique tariff system for all power consumers in Senegal if a compensation system is created. Each supplier will sell electricity at the same price - established by CRSE – with some suppliers receiving more than required and others less. The compensation system can be based on a "clearing house" model whereby surpluses are transferred to cover the deficits or on differentiating price paid to Senelec by each concessionaire – with Senelec ultimately requesting compensation from the State if required. CRSE will study and propose the design and implementation of the future compensation system.

A compensation system managed by CRSE has also other advantages as it allows to combine different remuneration schemes – for example PPER with other activities –, it allows to remunerate different actors – for example, ERILs or other contractors – facilitating restructuring of distribution perimeters and it allows to compensate suppliers with significantly higher running costs – such as diesel – allowing for a more sustainable operation.

Until universal access is achieved a lot of uncertainty will remain over the level of consumption of rural consumers – also considering the impact of pre-paid metering on behavior and usage. Demand uncertainty is inconsistent with "price cap" type of regulation as only price is fixed and all the demand risk is transferred to the operators. A combination of "price cap" and "cost plus" regulation will be implemented starting with shorter regulation periods and ex-post compensations based on a "cost plus" approach and progressively – as demand uncertainty is reduced – enlarging the regulatory periods while reducing ex-post adjustments. In the long term distribution activities will be regulated under a "price cap" type of regulation.



ANNEX – INVESTMENT OPPORTUNITIES

PROJECT PROJECT CODE		AXIS	PROGRAM	INVESTMENT (MILLION FCFA)	
SD.1 - TBDMT	Solutions solaires individuels et de transition dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Systèmes Décentralisés	Consolidation	42,82	
SD.1 - FGGKN	Solutions solaires individuels et de transition dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Systèmes Décentralisés	Consolidation	47,23	
SD.1 - KTK	Solutions solaires individuels et de transition dans la concession de Kaffrine - Tambacounda - Kedougou	Systèmes Décentralisés	Consolidation	2.012,01	
SD.1 - LLK	Solutions solaires individuels et de transition dans la concession de Louga - Linguere - Kebemer	Systèmes Décentralisés	Consolidation	135,42	
SD.1 - ZS	Solutions solaires individuels et de transition dans la concession de Ziguinchor - Sedhiou	Systèmes Décentralisés	Consolidation	185,43	
SD.1 - KVM	Solutions solaires individuels et de transition dans la concession de Kolda - Velingara - Medina Yoro Foulah	Systèmes Décentralisés	Consolidation	185,87	
SD.1 - MBKRG	Solutions solaires individuels et de transition dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Systèmes Décentralisés	Consolidation	836,94	
SD.1 - DPS	Solutions solaires individuels et de transition dans la concession de Dagana - Podor - Saint Louis	Systèmes Décentralisés	Consolidation	148,13	
SD.1 - FDN	Solutions solaires individuels et de transition dans la concession de Foundiougne	Systèmes Décentralisés	Consolidation	26,93	
SD.1 - MBR	Solutions solaires individuels et de transition dans la concession de Mbour	Systèmes Décentralisés	Consolidation	0,33	
SD.2 - SNL	PREMs hors réseau dans la concession de SENELEC	Systèmes Décentralisés	Consolidation	0,15	
SD.2 - TBDMT	PREMs hors réseau dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Systèmes Décentralisés	Consolidation	1,16	
SD.2 - FGGKN	PREMs hors réseau dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Systèmes Décentralisés	Consolidation	1,81	
SD.2 - KTK	PREMs hors réseau dans la concession de Kaffrine - Tamba- counda - Kedougou	Systèmes Décentralisés	Consolidation	186,81	
SD.2 - LLK	PREMs hors réseau dans la concession de Louga - Linguere - Kebemer	Systèmes Décentralisés	Consolidation	20,24	
SD.2 - ZS	PREMs hors réseau dans la concession de Ziguinchor - Sedhiou	Systèmes Décentralisés	Consolidation	21,86	
SD.2 - KVM	PREMs hors réseau dans la concession de Kolda - Velingara - Medina Yoro Foulah	Systèmes Décentralisés	Consolidation	97,09	
SD.2 - MBKRG	PREMs hors réseau dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Systèmes Décentralisés	Consolidation	106,52	
SD.2 - DPS	PREMs hors réseau dans la concession de Dagana - Podor - Saint Louis	Systèmes Décentralisés	Consolidation	80,37	
5D.2 - FDN	PREMs hors réseau dans la concession de Foundiougne	Systèmes Décentralisés	Consolidation	2,01	
SD.3 - SNL	Mini-Réseaux Solaire/Hybride dans la concession de SENELEC	Systèmes Décentralisés	Consolidation	255,29	
SD.3 - TBDMT	Mini-Réseaux Solaire/Hybride dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Systèmes Décentralisés	Consolidation	158,80	
SD.3 - FGGKN	Mini-Réseaux Solaire/Hybride dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Systèmes Décentralisés	Consolidation	214,14	

PROJECT CODE			PROGRAM	INVESTMENT (MILLION FCFA)	
SD.3 - KTK	Mini-Réseaux Solaire/Hybride dans la concession de Kaffrine - Tambacounda - Kedougou	Systèmes Décentralisés	Consolidation	3.593,94	
SD.3 - LLK	Mini-Réseaux Solaire/Hybride dans la concession de Louga - Linguere - Kebemer	Systèmes Décentralisés	Consolidation	1.328,04	
SD.3 - ZS	Mini-Réseaux Solaire/Hybride dans la concession de Ziguinchor - Sedhiou	Systèmes Décentralisés	Consolidation	481,40	
SD.3 - KVM	Mini-Réseaux Solaire/Hybride dans la concession de Kolda - Velingara - Medina Yoro Foulah	Systèmes Décentralisés	Consolidation	1.180,19	
SD.3 - MBKRG	Mini-Réseaux Solaire/Hybride dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Systèmes Décentralisés	Consolidation	3.848,94	
SD.3 - DPS	Mini-Réseaux Solaire/Hybride dans la concession de Dagana - Podor - Saint Louis	Systèmes Décentralisés	Consolidation	592,74	
SD.3 - FDN	Mini-Réseaux Solaire/Hybride dans la concession de Foundiougne	Systèmes Décentralisés	Consolidation	774,62	
ER.1 - SNL	Les dorsales clés (duplication) dans la concession de SENELEC	Extension Réseau MT	Consolidation	39,42	
ER.2 - SNL	Ramification dans la concession de SENELEC	Extension Réseau MT	Consolidation	229,79	
ER.2 - TBDMT	Ramification dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Extension Réseau MT	Consolidation	10.328,85	
ER.2 - FGGKN	Ramification dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Extension Réseau MT	Consolidation	14.185,92	
ER.2 - KTK	Ramification dans la concession de Kaffrine - Tambacounda - Kedougou	Extension Réseau MT	Consolidation	8.440,32	
ER.2 - LLK	Ramification dans la concession de Louga - Linguere - Kebemer	Extension Réseau MT	Consolidation	9.218,12	
ER.2 - ZS	Ramification dans la concession de Ziguinchor - Sedhiou	Extension Réseau MT	Consolidation	9.194,91	
ER.2 - KVM	Ramification dans la concession de Kolda - Velingara - Medina Yoro Foulah	Extension Réseau MT	Consolidation	4.781,71	
ER.2 - MBKRG	Ramification dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Extension Réseau MT	Consolidation	1.341,43	
ER.2 - DPS	Ramification dans la concession de Dagana - Podor - Saint Louis	Extension Réseau MT	Consolidation	2.539,50	
ER.2 - FDN	Ramification dans la concession de Foundiougne	Extension Réseau MT	Consolidation	3.800,76	
ER.2 - MBR	Ramification dans la concession de Mbour	Extension Réseau MT	Consolidation	741,29	
DRN.1 - SNL	Première électrification dans la concession de SENELEC	Distribution dans le Reseau National	Consolidation	46,27	
DRN.1 - TBDMT	Première électrification dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Distribution dans le Reseau National	Consolidation	6.408,30	
DRN.1 - FGGKN	Première électrification dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Distribution dans le Reseau National	Consolidation	7.980,34	
DRN.1 - KTK	Première électrification dans la concession de Kaffrine - Tambacounda - Kedougou	Distribution dans le Reseau National	Consolidation	4.125,76	

PROJECT PROJECT CODE		AXIS	PROGRAM	INVESTMENT (MILLION FCFA)	
DRN.1 - LLK	Première électrification dans la concession de Kolda - Velingara - Medina Yoro Foulah	Distribution dans le Reseau National	Consolidation	4.109,89	
DRN.1 - MBKRG	Première électrification dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Distribution dans le Reseau National	Consolidation	1.001,55	
DRN.1 - DPS	Première électrification dans la concession de Dagana - Podor - Saint Louis	Distribution dans le Reseau National	Consolidation	1.190,43	
DRN.1 - FDN	Première électrification dans la concession de Foundiougne	Distribution dans le Reseau National	Consolidation	2.562,95	
DRN.1 - MBR	Première électrification dans la concession de Mbour	Distribution dans le Reseau National	Consolidation	542,11	
DRN.2 - SNL	Densification BT & MT dans la concession de SENELEC	Distribution dans le Reseau National	Consolidation	887,18	
DRN.2 - TBDMT	Densification BT & MT dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Distribution dans le Reseau National	Consolidation	645,52	
DRN.2 - FGGKN	Densification BT & MT dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Distribution dans le Reseau National	Consolidation	443,46	
DRN.2 - KTK	Densification BT & MT dans la concession de Kaffrine - Tamba- counda - Kedougou	Distribution dans le Reseau National	Consolidation	326,91	
DRN.2 - LLK	Densification BT & MT dans la concession de Louga - Linguere - Kebemer	Distribution dans le Reseau National	Consolidation	192,04	
DRN.2 - ZS	Densification BT & MT dans la concession de Ziguinchor - Sedhiou	Distribution dans le Reseau National	Consolidation	373,83	
DRN.2 - KVM	Densification BT & MT dans la concession de Kolda - Velingara - Medina Yoro Foulah	Distribution dans le Reseau National	Consolidation	197,52	
DRN.2 - MBKRG	Densification BT & MT dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Distribution dans le Reseau National	Consolidation	292,97	
DRN.2 - DPS	Densification BT & MT dans la concession de Dagana - Podor - Saint Louis	Distribution dans le Reseau National	Consolidation	401,29	
DRN.2 - FDN	Densification BT & MT dans la concession de Foundiougne	Distribution dans le Reseau National	Consolidation	42,70	
DRN.2 - MBR	Densification BT & MT dans la concession de Mbour	Distribution dans le Reseau National	Consolidation	294,02	
DRN.3 - SNL	PREMs Réseaux dans la concession de SENELEC	Distribution dans le Reseau National	Consolidation	2,31	
DRN.3 - TBDMT	PREMs Réseaux dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Distribution dans le Reseau National	Consolidation	320,42	
DRN.3 - FGGKN	PREMs Réseaux dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Distribution dans le Reseau National	Consolidation	399,02	
DRN.3 - KTK	PREMs Réseaux dans la concession de Kaffrine - Tambacounda - Kedougou	Distribution dans le Reseau National	Consolidation	206,29	
DRN.3 - LLK	PREMs Réseaux dans la concession de Louga - Linguere - Kebemer	Distribution dans le Reseau National	Consolidation	228,61	
DRN.3 - ZS	PREMs Réseaux dans la concession de Ziguinchor - Sedhiou	Distribution dans le Reseau National	Consolidation	208,23	
DRN.3 - KVM	PREMs Réseaux dans la concession de Kolda - Velingara - Medina Yoro Foulah	Distribution dans le Reseau National	Consolidation	205,49	

PROJECT PROJECT CODE		AXIS	PROGRAM	INVESTMENT (MILLION FCFA)	
DRN.3 - MBKRG	PREMs Réseaux dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Distribution dans le Reseau National	Consolidation	50,08	
DRN.3 - DPS	PREMs Réseaux dans la concession de Dagana - Podor - Saint Louis	Distribution dans le Reseau National	Consolidation	59,52	
DRN.3 - FDN	PREMs Réseaux dans la concession de Foundiougne	Distribution dans le Reseau National	Consolidation	128,15	
DRN.3 - MBR	Première électrification dans la concession de Foundiougne	Distribution dans le Reseau National	Consolidation	27,11	
II.1 - SNL	Encouragement de l'électrification via le réseau dans la concession de SENELEC	Distribution dans le Reseau National	Consolidation	64,49	
II.1 - TBDMT	Encouragement de l'électrification via le réseau dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Distribution dans le Reseau National	Consolidation	1.628,57	
II.1 - FGGKN	Encouragement de l'électrification via le réseau dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Distribution dans le Reseau National	Consolidation	1.884,65	
II.1 - KTK	Encouragement de l'électrification via le réseau dans la concession de Kaffrine - Tambacounda - Kedougou	Distribution dans le Reseau National	Consolidation	874,20	
II.1 - LLK	Encouragement de l'électrification via le réseau dans la concession de Louga - Linguere - Kebemer	Distribution dans le Reseau National	Consolidation	985,53	
II.1 - ZS	Encouragement de l'électrification via le réseau dans la oncession de Ziguinchor - Sedhiou	Distribution dans le Reseau National	Consolidation	1.018,72	
II.1 - KVM	Encouragement de l'électrification via le réseau dans la concession de Kolda - Velingara - Medina Yoro Foulah	Distribution dans le Reseau National	Consolidation	612,04	
II.1 - MBKRG	Encouragement de l'électrification via le réseau dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Distribution dans le Reseau National	Consolidation	187,50	
II.1 - DPS	Encouragement de l'électrification via le réseau dans la concession de Dagana - Podor - Saint Louis	Distribution dans le Reseau National	Consolidation	374,15	
II.1 - FDN	Encouragement de l'électrification via le réseau dans la concession de Foundiougne	Distribution dans le Reseau National	Consolidation	640,99	
II.1 - MBR	Encouragement de l'électrification via le réseau dans la concession de Mbour	Distribution dans le Reseau National	Consolidation	197,60	
II.2 - SNL	Prépaiement Universel dans la concession de SENELEC	Distribution dans le Reseau National	Consolidation	3.373,48	
II.2 - TBDMT	Prépaiement Universel dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Distribution dans le Reseau National	Consolidation	2.495,93	
II.2 - FGGKN	Prépaiement Universel dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Distribution dans le Reseau National	Consolidation	2.445,89	
II.2 - KTK	Prépaiement Universel dans la concession de Kaffrine - Tamba- counda - Kedougou	Distribution dans le Reseau National	Consolidation	1.153,78	
II.2 - LLK	Prépaiement Universel dans la concession de Louga - Linguere - Kebemer	Distribution dans le Reseau National	Consolidation	1.404,58	
II.2 - ZS	Prépaiement Universel dans la concession de Ziguinchor - Sedhiou	Distribution dans le Reseau National	Consolidation	1.889,31	
II.2 - KVM	Prépaiement Universel dans la concession de Kolda - Velingara - Medina Yoro Foulah	Distribution dans le Reseau National	Consolidation	748,32	
II.2 - MBKRG	Prépaiement Universel dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Distribution dans le Reseau National	Consolidation	796,83	

PROJECT CODE	PROJECT	AXIS	PROGRAM	INVESTMENT (MILLION FCFA)
II.2 - DPS	Prépaiement Universel dans la concession de Dagana - Podor - Saint Louis	Distribution dans le Reseau National	Consolidation	646,12
II.2 - FDN	Prépaiement Universel dans la concession de Foundiougne	Distribution dans le Reseau National	Consolidation	839,32
II.2 - MBR	Prépaiement Universel dans la concession de Mbour	Distribution dans le Reseau National	Consolidation	312,89
CCPI - SNL	Capacité, Coordination, Projet e Ingénierie dans la concession de SENELEC	Capacité, Coordination, Projet e Ingénieriel	Consolidation	194,60
CCPI - TBDMT	Capacité, Coordination, Projet e Ingénierie dans la concession de Thies - Bambey - Diourbel - Mbacke - Tivaoune	Capacité, Coordination, Projet e Ingénieriel	Consolidation	875,20
CCPI - FGGKN	Capacité, Coordination, Projet e Ingénierie dans la concession de Fatick - Gossas - Guinguineo - Kaolack - Nioro	Capacité, Coordination, Projet e Ingénieriel	Consolidation	1.096,57
CCPI - KTK	Capacité, Coordination, Projet e Ingénierie dans la concession de Kaffrine - Tambacounda - Kedougou	Capacité, Coordination, Projet e Ingénieriel	Consolidation	831,09
CCPI - LLK	Capacité, Coordination, Projet e Ingénierie dans la concession de Louga - Linguere - Kebemer	Capacité, Coordination, Projet e Ingénieriel	Consolidation	718,46
CCPI - ZS	Capacité, Coordination, Projet e Ingénierie dans la concession de Ziguinchor - Sedhiou	Capacité, Coordination, Projet e Ingénieriel	Consolidation	696,75
CCPI - KVM	Capacité, Coordination, Projet e Ingénierie dans la concession de Kolda - Velingara - Medina Yoro Foulah	Capacité, Coordination, Projet e Ingénieriel	Consolidation	481,42
CCPI - MBKRG	Capacité, Coordination, Projet e Ingénierie dans la concession de Matam - Bakel - Kanel - Ranerou - Goudiry	Capacité, Coordination, Projet e Ingénieriel	Consolidation	336,20
CCPI - DPS	Capacité, Coordination, Projet e Ingénierie dans la concession de Dagana - Podor - Saint Louis	Capacité, Coordination, Projet e Ingénieriel	Consolidation	239,64
CCPI - FDN	Capacité, Coordination, Projet e Ingénierie dans la concession de Foundiougne	Capacité, Coordination, Projet e Ingénieriel	Consolidation	350,33
CCPI - MBR	Capacité, Coordination, Projet e Ingénierie dans la concession de Mbour	Capacité, Coordination, Projet e Ingénieriel	Consolidation	84,04

TECHNICAL DATA

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