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Report No: PAD2615

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT PAPER

ON A

PROPOSED ADDITIONAL CREDIT

IN THE AMOUNT OF EUR 48.0 MILLION
(US\$56 MILLION EQUIVALENT)

AND A

PROPOSED ADDITIONAL GRANT

IN THE AMOUNT OF SDR 9.9 MILLION
(US\$14 MILLION EQUIVALENT)

TO THE

REPUBLIC OF NIGER

FOR THE

ELECTRICITY ACCESS EXPANSION PROJECT

August 4, 2018

Energy and Extractives Global Practice
Africa Region

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CURRENCY EQUIVALENTS

(Exchange Rate Effective May 31, 2018)

Currency Unit	=	EUR
US\$1	=	EUR 0.85623769
US\$1	=	SDR 0.70589066

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AFD	<i>Agence Française de Développement</i> (French Development Agency)
AF	Additional Financing
AfDB	African Development Bank
ANPER	<i>Agence Nigérienne pour la Promotion de l'Électrification en milieu Rural</i> (Nigerien Agency for the Promotion of Rural Electrification)
BOAD	<i>Banque Ouest Africaine de Développement</i> (West African Development Bank)
CGP	<i>Cellule des Grands Projets</i> (Large Project Unit)
CPF	Country Partnership Framework
DPF	Development Policy Financing
EC	European Commission
ECOWAS	Economic Community of West African States
EIB	European Investment Bank
EIRR	Economic Internal Rate of Return
ESIA	Environmental and Social Impact Assessment
ESMAP	Energy Sector Management Assistance Program
ESMF	Environmental and Social Management Framework
EU	European Union
FIRR	Financial Internal Rate of Return
FM	Financial Management
FNPV	Financial Net Present Value
GBV	Gender-based Violence
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoN	Government of Niger
GRM	Grievance Redress Mechanism
GRS	Grievance Redress Service
HFO	Heavy Fuel Oil
HV	High Voltage
IFC	International Finance Corporation
IFR	Interim Financial Report
IPP	Independent Power Producer
IsDB	Islamic Development Bank
ISR	Implementation Status and Results Report
LV	Low Voltage
M&E	Monitoring and Evaluation
MoE	Ministry of Energy

MTF	Multi-Tier Framework
MV	Medium Voltage
NELACEP	Niger Electricity Access Expansion Project
NEPD	National Electrification Policy Document
NES	National Electrification Strategy
NESAP	Niger Solar Electricity Access Project
NIGELEC	<i>Société Nigérienne d'Electricité</i> (Nigerien Electricity Company)
NPF	New Procurement Framework
NPV	Net Present Value
PAP	Project-Affected Person
PDES	<i>Plan de Développement Economique et Social</i> (Plan for Economic and Social Development)
PIM	Project Implementation Manual
PIU	Project Implementing Unit
PPP	Public-Private Partnership
PV	Photovoltaic
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SCADA	Supervisory Control and Data Acquisition
SDDCI	<i>Stratégie pour le Développement Durable et la Croissance Inclusive</i> (Strategy for Sustainable Development and Inclusive Growth)
SIEIN	<i>Sécurité des Installations Electriques Intérieures au Niger</i> (Indoor Electrical Installations Safety in Niger)
SONICHAR	<i>Société Nigérienne du Charbon</i> (Nigerien Coal Company)
SORAZ	<i>Société de raffinage de Zinder</i> (Refinery Company of Zinder)
TA	Technical Assistance
TCN	Transmission Company of Nigeria
T-line	Transmission line
VAT	Value Added Tax
WAPP	West African Power Pool
WBG	World Bank Group
WTP	Willingness-to-Pay

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Senior Global Practice Director:	Riccardo Puliti
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REPUBLIC OF NIGER
ADDITIONAL FINANCING ELECTRICITY ACCESS EXPANSION PROJECT
(P164090)

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ADDITIONAL FINANCING DATA SHEET

Republic of Niger

Additional Financing Electricity Access Expansion Project (P164090)

AFRICA REGION

Energy & Extractives Global Practice

Basic Information – Parent							
Parent Project ID:	P153743	Original EA Category: B - Partial Assessment					
Current Closing Date:	31-Dec-2021						
Basic Information - Additional Financing (AF)							
Project ID:	P164090	Additional Financing Type (from AUS):		Restructuring, Scale Up			
Regional Vice President:	Hafez Ghanem	Proposed EA Category:		B - Partial Assessment			
Country Director:	Soukeyna Kane	Expected Effectiveness Date:		31-Dec-2018			
Senior Global Practice Director:	Riccardo Puliti	Expected Closing Date:		31-Dec-2023			
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Borrower							
Organization Name	Contact	Title	Telephone/Fax	Email			
Republic of Niger	Ministry of Planning	-	+227 2072 5322 +227 2072 4020	-			
Project Financing Data - Parent (Electricity Access Expansion Project-P153743) (in US\$, millions)							
Key Dates							
Project	Ln/Cr/TF	Status	Approval Date	Signing Date	Effectiveness Date	Original Closing Date	Revised Closing Date
P153743	IDA-57550	Effective	16-Dec-2015	13-Jan-2016	21-Jun-2016	31-Dec-2021	31-Dec-2021
P153743	IDA-D0980	Effective	16-Dec-2015	13-Jan-2016	21-Jun-2016	31-Dec-2021	31-Dec-2021

Disbursements										
Project	Ln/Cr/TF	Status	Currency	Original	Revised	Cancelled	Disbursed	Undisbursed	% Disbursed	
P153743	IDA-57550	Effective	US\$	54.50	54.50	0.00	27.66	31.43	50.74	
P153743	IDA-D0980	Effective	US\$	10.50	10.50	0.00	0.35	10.38	3.38	
Project Financing Data - Additional Financing (Additional Financing Electricity Access Expansion Project-P164090) (in US\$, millions)										
<input type="checkbox"/> Loan <input type="checkbox"/> Grant <input checked="" type="checkbox"/> IDA Grant <input checked="" type="checkbox"/> Credit <input type="checkbox"/> Guarantee <input type="checkbox"/> Other										
Total Project Cost:			162.00	Total Bank Financing:			70.00			
Financing Gap:			0.00							
Financing Source - Additional Financing (AF)								Amount		
International Development Association (IDA)								56.00		
IDA Grant								14.00		
European Investment Bank (EIB)								70.00		
European Commission (EC) Grant								22.00		
Total								162.00		
Policy Waivers										
Does the project depart from the CAS in content or in other significant respects?								No		
Explanation										
Does the project require any policy waiver(s)?								No		
Explanation										
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Locations					
Country	First Administrative Division	Location	Planned	Actual	Comments
Niger		Zinder		X	
Niger		Tahoua		X	
Niger		Maradi		X	
Niger		Dosso		X	
Niger		Agadez		X	
Niger		Tillabery		X	
Niger		Diffa	X		
Niger		Niamey		X	
Niger		Various rural localities	X		
Institutional Data					
Parent (Electricity Access Expansion Project-P153743)					
Practice Area (Lead)					
Energy and Extractives					
Contributing Practice Areas					
Additional Financing (Additional Financing Electricity Access Expansion Project-P164090)					
Practice Area (Lead)					
Energy and Extractives					
Contributing Practice Areas					
Consultants (Will be disclosed in the Monthly Operational Summary)					
Consultants Required? No consultant is required.					

I. Introduction

1. This Project Paper seeks the approval of the Executive Directors to provide additional financing (AF) for the Niger Electricity Access Expansion Project (NELACEP, P153743) in the form of an additional International Development Association (IDA) credit in the amount of EUR 48.0 million (US\$56 million equivalent) and a grant in the amount of SDR 9.9 million (US\$14 million equivalent) to the Republic of Niger. The parent project, financed through an IDA credit in the original amount of EUR 49.6 million (US\$54.5 million equivalent) and an IDA grant in the original amount of SDR 7.6 million (US\$10.5 million equivalent), was approved by the Board on December 16, 2015, and became effective on June 21, 2016. The AF leverages parallel co-financing in the amount of US\$70 million (credit) from the European Investment Bank (EIB) and in the amount of US\$22 million (grant) from the European Union (EU). This would be the first AF for the project, bringing total IDA financing under the project to US\$135 million equivalent, of which US\$110.5 million credit and US\$24.5 million grant.

2. The Project Development Objective (PDO) of the parent project, the NELACEP (P153743), is to increase access to electricity in the Recipient's territory¹. It was designed as a first step for the World Bank engagement in the energy sector after decades of absence to address power sector issues and low access to electricity. The NELACEP is financing urgent investments in the expansion, reinforcement, densification, and rehabilitation of medium/low voltage (MV/LV) distribution systems to expand and improve access to electricity in seven major urban areas and technical assistance (TA) to develop a comprehensive long-term road map for electrification and to strengthen the institutions of the energy sector.

3. The parent project has two components: the first component is providing support for the extension and reinforcement of distribution systems; and the second component is supporting the strengthening of institutional capacity in the electricity sector.

4. The proposed AF is seeking to scale up the development effectiveness of a well-performing parent project by: (a) financing a new transmission component to address the bottlenecks in the transmission systems in Niamey; (b) delivering additional results through the financing of additional infrastructure that will expand access in both urban and rural areas; and (c) further strengthening institutional capacity to improve power sector planning. The activities supported by the proposed AF are consistent with the existing PDO of the parent project. Thus, no changes are proposed to the PDO. The project will be restructured to extend the closing date from December 31, 2021, to December 31, 2023, to allow sufficient time to implement the proposed additional activities. The disbursement estimates and schedule, implementation schedule, and Results Framework will also be revised in line with the proposed new activities and proposed closing date extension. The safeguards instruments were updated to cover the new component and activities that are financed by the proposed AF and other donors.

II. Background and Rationale for Additional Financing

A. Country Context

5. **Located in the Sahel, Niger is a landlocked and sparsely populated country in West Africa.** The population was 20.7 million in 2016 on a land area of 1,267,000 km². Most Nigeriens (three-quarter of the population) live in the west and south of the country on about

¹ As stated in the Financing Agreement.

12 percent of the land area where most arable land is located. About 80 percent of the population live in rural areas. The population growth is currently 3.9 percent per year and presents a major challenge with increasing pressure on government capacity to deliver citizen-centered public services.

6. **Niger's overall development indicators are very poor.** Niger has been ranked at the bottom or near the bottom of the United Nations Human Development Index (HDI) since 2000. Per capita gross domestic product (GDP) was US\$895 in 2015 (constant 2011 US\$), making Niger one of the poorest nations in the world. Life expectancy at birth is estimated at about 61 years. About seven Nigeriens out of ten are illiterate and only about four out of ten female students in primary school reach 6th grade. Although poverty rates have fallen, this has been outweighed by rapid population growth rates, resulting in a large increase in the absolute number of poor people in Niger. Between 2005 and 2014, the incidence of income poverty fell from about 54 percent to about 45 percent. The absolute number of people living in poverty, however, rose from 6.8 million in 2005 to 8.2 million in 2014, an increase of one-fifth or 1.4 million people.

7. **The agricultural sector dominates the economy, and there are few indications of diversification.** Agriculture accounts for 40 percent of GDP, whereas sectors such as manufacturing (6 percent of GDP), construction and public works (3 percent of GDP) are nascent. The production of electricity, gas, and water (1 percent of GDP) are relatively small and underdeveloped. With a contribution of around 40 percent of GDP, the tertiary sector is dominated by the import and export trade and its health is dependent on the cost of transportation. More than 60 percent of GDP is generated in the informal sector.

8. **Niger has endured the impact of multiple shocks.** Niger finds itself at the heart of a turbulent region marked by political and religious violence in northern Nigeria, separatist and armed movements in northern Mali, and intercommunal violence and state collapse in southern Libya. It has affected Niger in important ways, including a state of emergency in the southeastern region of Diffa and the influx of an estimated 198,000 refugees and 137,000 internally displaced persons. In addition to security and humanitarian challenges, Niger has also recently had to cope with the economic downturn in Nigeria, unfavorable weather conditions, and the depressed level of commodity prices.

9. **A new development strategy and plan aims to break the poverty trap.** In May 2017, the Government of Niger (GoN) adopted the *Stratégie pour le Développement Durable et la Croissance Inclusive* (Strategy for Sustainable Development and Inclusive Growth, SDDCI) - Niger 2035. The first plan for the implementation of the SDDCI, the *Plan de Développement Economique et Social* (Plan for Economic and Social Development, PDES) 2017–2021, was adopted in September 2017. The overall strategy seeks to address main constraints to development, including national security, public administration, human capital (education and health), population growth as well as economic growth, rural development, and private sector development. The PDES is articulated around five axes: (a) cultural renaissance; (b) social development and demographic transition; (c) acceleration of economic growth; (d) governance and security; and (e) sustainable management of environment. To accelerate the economic growth and social development, the PDES builds on the revitalization and modernization of the rural world focusing on increased agricultural productivity, private sector participation, and empowerment of women and youth employment.

10. **To support economic growth and promote social development, the GoN has prepared an ambitious National Electrification Strategy to accelerate on- and off-grid**

electrification. Sustainable expansion of basic services to the general population, including access to energy services, plays a key role in the national development strategy as it is recognized that electricity is needed for human capital development (education, health care, access to water, information) and critical for the rural economy (irrigation, agri-businesses, income-generating activities, youth employment, women’s empowerment). Electricity access has been increasing annually at a rate of 1.3 percent in Niger and would reach only 11.5 percent by 2030 at the current pace and current population growth, far behind the Sustainable Development Goal of universal access by 2030. To change this trajectory, the GoN has prepared a National Electrification Policy Document (NEPD) and an ambitious National Electrification Strategy (NES), which are formulated around two main pillars: (a) on the demand side, to ensure, on the basis of a principle of social justice, universal access to electricity for all Nigeriens by 2035 in line with the SDDCI - Niger 2035 and make electricity the driver and enabler of the modernization and development of rural areas in support of the decentralization process and (b) on the supply side, promote public-private partnerships (PPPs), with a view to tapping into domestic energy resources to generate 80 percent of the supply by 2035. The NEPD and the NES were validated in July 2017 and are slated for the GoN’s adoption by end of September 2018. The NES is well aligned with the Sahel Alliance target of doubling access by 2022.

B. Sector and Institutional Context

11. **Niger is confronted with multifaceted challenges in the electricity sector.** The challenges consist of the following: (a) lack of access to modern energy services for the rural areas, where access is less than 1 percent, and for urban areas, which may have connectivity but have poor and unreliable access; (b) the need to promote energy security taking into account fast growing demand and need to expand domestic generation capacity to counterbalance the heavy dependence on imports from Nigeria and high-cost domestic fuel-based generation; (c) the need to promote financial sustainability of the utility; and (d) the need to pursue sequential reforms in the sector to ensure its financial sustainability and equilibrium while the customer base and service areas of *Société Nigérienne d'Electricité* (Nigerien Electricity Company, NIGELEC) grow.

- **Niger has one of the lowest electricity access rate in Sub-Saharan Africa, at 10 percent, with large disparities between urban and rural areas.** Electricity access rate varies between 20 percent and 40 percent in smaller cities and stands at around 50 percent in Niamey. Less than 1 percent of the rural population, which accounts for 83 percent of the total population, has access to electricity in Niger.
- **Electricity demand is growing at a faster pace than the GDP.** Over 2001–2015, electricity demand grew at 16 percent per year, much faster than the GDP growth of about 4 percent, and it is expected to grow more than 10 percent per year during 2015–2020, albeit from a very low consumption base. This is among the highest growth rates for electricity demand in the world and is partly attributed to the high rate of population growth and low baseline. Power supply, which is heavily dependent on imports of cheap electricity from Nigeria, reached 86.5 percent of total supply in 2010 but declined to 72.3 percent in 2016 because demand exceeded the capacity of the transmission line (T-line) from Nigeria.² Domestic generation is based mainly on costly oil fuels. Nationwide aggregated installed capacity is only about 170 MW

² The North Core Regional Interconnector Project (P162933) that is under preparation will address this constraint.

(excluding mining operations), of which 130 MW is in the Western grid (Niamey, Tillabery, Dosso).

- **While the financial and technical performance of NIGELEC has been adequate over the past few years given the small size of the grid, the electricity sector is striving to manage its challenges of increased cost of generation, sustained growth in energy demand, and need to significantly increase energy access.** The state-owned utility, NIGELEC, served 355,528 customers in 2017 and the number will be multiplied by 1.6 by 2023 with ongoing and planned investments including the parent project, the proposed AF, and financings by other donors. NIGELEC has shown a positive net operating profit over the past decade. However, the utility will need to sustain this financial performance in the short to medium term as generation and import costs are likely to increase and as servicing the debt for new investments will need to be absorbed. To this end, the GoN has embraced strong reforms (regulator, Electricity Act, new tariffs, debt restructuring) to sustain the sector financially and improve its overall performance. IDA is supporting this effort through the multisector Development Policy Financing (DPF) for Second Public Investment Reform Support Credit (P159969) and the parent project.
- **The fragmentation of the grid does not allow to efficiently manage the available capacity.** The electricity system was composed of six unconnected systems. The West Zone includes the capital Niamey and some of the most populated centers such as Dosso and Tillabery. This network is currently supplied through a 132-kV interconnection with northern Nigeria (Birnin-Kebbi substation, up to 120 MW) and the Gorou Banda thermal power plant. The Center East Zone includes the urban centers of Zinder, Maradi, and Tahoua and some of Niger's largest industries such as the Malbaza cement plant. Electricity demand is increasing rapidly in this area, which is partly supplied by a second 132 kV interconnection with Nigeria (Katsina substation, up to 60 MW). The West and Center East electrical zones account for more than 90 percent of Niger's electricity consumption. The Northern Zone was developed to provide electricity for the operations of the mining sector and related urban centers, such as Arlit and Agadez. Power supply is mostly provided by *Société Nigérienne du Charbon* (SONICHAR), which operates a generating plant using local coal. The Eastern Zone provides electricity to smaller urban centers in the eastern part of the country, such as Diffa, with power provided by small diesel units. The Southern Zone provides electricity to localities bordering Benin. Finally, 144 isolated centers are supplied (either continuously or for only a few hours) by small diesel units, at prohibitive costs. Through the Niger Solar Electricity Access Project (NESAP, P160170), IDA is supporting the solar hybridization of the isolated diesel units to reduce generation cost and increase access to electricity and quality of service.

12. **The GoN has put in place the institutional and legal framework necessary to address sector challenges, but further measures will be required.** The GoN liberalized the power sector with the approval of the Electricity Act of May 2016, which ended the monopoly of NIGELEC by opening up the sector to private sector participation, particularly in generation and in rural electrification. The Electricity Act also enacted the creation of: (a) a new energy sector regulator, the *Autorité de Régulation du Secteur de l'Energie au Niger* (Energy Sector Regulatory Authority of Niger, ARSE), created in December 2015; and (b) a rural electrification agency, the *Agence Nigérienne pour la Promotion de l'Electrification en milieu Rurale* (Nigerien Agency for the Promotion of Rural Electrification, ANPER), created in May

2013. In a very short time, ARSE has achieved commendable results with the GoN adopting all decrees³ mandated by the Electricity Act. In October 2017, the GoN approved the first tariff adjustment since 1994. Based on a cost-coverage approach, the new tariff methodology allowed an overall increase of 20 percent with a pro-poor social tranche and a multiannual electricity tariff adjustment covering 2018–2020 and 2021–2022. The new tariff became effective in January 2018. This increase will help ensure that the utility has the ability to invest in generation, transmission, and distribution assets to increase access. The GoN has also implemented NIGELEC’s debt restructuring plan which brought the ratio of equity to permanent capital below 50 percent.⁴ As part of the implementation of the Electricity Act, contractual relationships between the State and NIGELEC and between NIGELEC and its customers will be clarified through (a) a concession contract between the State and NIGELEC; (b) a new service standard between NIGELEC and its customers with establishment of service quality requirements; and (c) a performance contract between the State and NIGELEC. The effectiveness and effects of these reforms need to be monitored going forward, and, if needed, adjustment measures triggered to maximize impact on the financial viability of the sector. Efforts need to be sustained to improve the operational performance of NIGELEC, including addressing the low bill collection rate (currently at 80 percent), high transmission and distribution losses (21 percent), grid fragmentation, and challenges associated with NIGELEC’s capacity to cope with electricity access acceleration and increase in the customer base.

13. While Niger will have to rely on fossil fuel for power generation, plans are in place to increase electricity imports and to develop renewable energy resources such as domestic hydropower and solar, combined with coal, which will lower the cost of service.

The GoN and NIGELEC have developed an ambitious generation plan for 2016–2027 with major power generation and transmission investments to enable expansion of electricity services. The plan considers short-term supply domestic options at high generation cost (diesel/heavy fuel oil [HFO]) (in the absence of additional transmission capacity for imports), while cheaper options (hydro, coal, solar, or additional imports from Nigeria) become available in the medium and long run. A Least Cost Power Development Plan⁵ is under preparation with World Bank support to further strengthen the planning in the sector. Four major projects constitute the main pillar of the plan: (a) Gorou Banda diesel power plant (100 MW in 2020)⁶; (b) Kandadji hydroelectric plant (130 MW by 2023) supported by the World Bank; (c) Sakaldamna coal power plant (200 MW up to 600 MW by 2023) likely financed by the private sector through an Independent Power Producer (IPP); and (d) a new 330 kV double circuit interconnection line with the West African Power Pool (WAPP) to increase imports from Nigeria (400 MW by 2024), as part of the North Core/Dorsale Nord Regional Power Interconnector Project (P162933) supported by the World Bank and a number of donors. The Gorou Banda will contribute to meet the demand increase, although at a high generation cost.

14. Solar photovoltaic (PV) generation is a potential solution in the short/medium term to complement or displace diesel/HFO generation, reduce generation costs, and

³ Grid code, licensing, captive production, private sector participation, independent power production, and so on.

⁴ This resulted from the retrocession of the amount of CFAF 67.6 billion, which was the share of the GoN in the Gorou Banda thermal power plant, into a participation in the capital of NIGELEC.

⁵ Supported by the AF - Kandadji Niger Basin Water Resources Program APL2A (P148972).

⁶ The first phase of the Gorou Banda plant of 80 MW supported by the Islamic Development Bank (IsDB) and the *Banque Ouest Africaine de Développement* (West African Development Bank, BOAD) was commissioned in April 2017 and the remaining 20 MW will be financed by African Development Bank (AfDB) and commissioned in 2020.

curtail tariff adjustments. The GoN has identified up to 100 MWp grid-connected solar PV generation potential, for which the Government already secured the financing for 20 MWp at Gorou Banda (*Agence Française du Développement* [French Development Agency, AFD]) and 7 MWp plant at Malbaza (EximBank India) – both currently being developed as public projects to be owned and operated by NIGELEC. The plan also includes a site of 30 MWp at Gorou Banda (near Niamey) and four other sites of around 10 MWp each in the regions of Maradi, Zinder, Tillabery (Lossa), and Dosso. Finally, AFD and the EU are financing a hybrid/diesel power plant of around 19 MW (13 MWp solar and 6 MW thermal) in Agadez. The GoN has the opportunity to develop this potential equivalent to the size of the diesel power plant at Gorou Banda in the short/medium term, which would contribute to lowering generation costs to meet additional demand in the medium term.

15. Grid densification and extension is central to the NES and the least cost solution to provide access to electricity services to most Nigeriens. The NES articulates a multipronged investment approach to expand access by upgrading, reinforcing, expanding, and densifying existing transmission and distribution systems; constructing new transmission and distribution systems; developing isolated mini-grids; and promoting stand-alone solar products. The NES was developed based on a least cost access expansion using a planned, systematic approach for effective geo-spatial implementation of electrification. The access expansion plan set out in the NES acknowledge the geographical, demographic, and socioeconomic development potential of localities throughout the territory of Niger. Grid extension is the least cost solution in densely populated areas in the southern part of the country and will contribute to provide access to electricity to 85 percent of the population by 2035. Decentralized mini-grids are suitable solutions to electrify 5 percent of the population living in localities far from the grid with reasonable population density. The remaining part of the population (10 percent) dispersed throughout the country would have basic services for light and cellphone charging through stand-alone solar systems (including solar home and pico-PV systems). In this context, the large majority of the rural population could be connected through the grid, while off-grid systems could be developed in parallel.

16. World Bank interventions in Niger are aligned with the NES. The Niger Solar Electricity Access Project (NESAP - P160170) is supporting the creation of a solar market with the promotion of stand-alone solar systems as well as private sector-led electrification through solar-based mini-grids. The ongoing Multi-Tier Framework (MTF) survey financed by ESMAP would provide useful information to establish access baseline for the proposed AF activities. Off-grid electrification is increasingly supported by other donors, including India EximBank (50 villages solar electrification project), ECOWAS⁷ Bank for Investment and Development (EBID, US\$10 million for solar electrification), BOAD (47 villages by 2019), IsDB (27 big rural towns), and International Renewable Energy Agency (IRENA, 100 villages) with Abu Dhabi Fund for Development (ADFD).

17. The Government has requested the World Bank's support to further develop solar energy in Niger, including pre-feasibility studies, capacity building, and transaction advisory services for private sector investments in solar projects. As a first step, the World Bank is supporting, through the ESMAP⁸ Trust Fund, the technical analysis of the second phase of the Gorou Banda plant (first phase developed by AFD) as well as for the solar plant in Dosso - Lossa and the integration of solar capacity in the Center Eastern grid supplying Tahoua, Maradi, and Zinder regions. Launched in March 2018, the study is expected to be completed

⁷ Economic Community of West African States

⁸ Energy Sector Management Assistance Program.

in September 2018. It will analyze technical options including hybridization and solar storage as well as implementation modalities with particular attention to private sector participation in the financing structuring. Through the proposed AF, the World Bank will further support the institutional capacity to develop solar energy in the Republic of Niger. The Government requires further assistance in the planning, procurement, and negotiation of IPP and PPP projects in the power sector. The proposed AF would finance a comprehensive package of transaction advisory assistance (covering technical, legal, and financial aspects) and associated capacity building for key energy sector entities, including the Ministry of Energy (MoE), NIGELEC, and ANPER. The aim is to facilitate private sector investments offering value for money in the generation segment by streamlining the selection and the closing of IPPs/PPPs in a timely, transparent, and cost-effective manner. The International Finance Corporation (IFC) is interested in being part of the assessment and supporting solar power development in Niger. The World Bank's team is working together with IFC to provide the best support to the Government.

C. Higher-level Objectives to which the Project Contributes

18. **The proposed AF is well aligned with the World Bank Group's (WBG) twin goals of reducing extreme poverty and promoting shared prosperity, with the WBG's Systematic Country Diagnostic (SCD)⁹, and the WBG's FY18–FY22 Niger Country Partnership Framework (CPF)¹⁰.** The World Bank Group's support to the electricity sector is a critical part of the CPF, which is clustered around three focus areas: (a) rural productivity and incomes which aim to increase Niger's low levels of productivity and household incomes in rural areas; (b) human capital and social protection; and (c) governance for jobs, service delivery and growth. The proposed AF will support increased and improved access to energy services through distribution network upgrading, densification, extension, and new connections in Niamey and seven regional capital cities: Dosso, Tillabery, Tahoua, Zinder, Maradi, Agadez, and Diffa. This will contribute to increase availability of power and improve supply reliability, which are critical to economic activities and growth. The AF will also extend and densify the grid in selected rural areas, which in turn will support the first focus area of rural productivity and incomes. To achieve the outcomes of the first focus area, the CPF recognizes that several ongoing projects in the electricity sector will contribute to these outcomes, including the Electricity Access Expansion Project (P153743), the proposed AF to the NELACEP, the Niger Solar Electricity Access Project (NESAP) (P160170, with Additional Financing expected in FY20), the Regional Off Grid Electrification Project (P160708 - ROGEP), the North Core/Dorsale Nord Regional Power Interconnector Project (P162933), and a multisector DPF for Second Public Investment Reform Support Credit (P159969).

19. **The proposed AF supports World Bank engagement under the Sahel Alliance, which seeks to improve development impacts by addressing five key development challenges, including energy poverty.** At the international level, there is a growing recognition that energy poverty results in reduced economic opportunities and lower productivity, and this may be a contributor to fragility. The Sahel Alliance sets a target of doubling access within five years in Sahel countries. The increase in electricity access resulting from the project contributes to that goal. The World Bank is championing the energy access agenda in Niger and is mobilizing other donors to fund the implementation of the NES. World Bank engagement through the proposed AF will send the right signal to leverage financing from other donors in increasing funding for access to electricity in Niger. The AFD, AfDB,

⁹ Report No. 115661-NE

¹⁰ Report No. 123736-NE

IsDB, and EU are engaged in the electricity access space in Niger and close coordination is put in place and driven by the World Bank to create the synergies.

20. **The proposed AF has leveraged EIB and EU parallel co-financing to finance additional activities that will further increase the overall impact of IDA financing.** The EIB has confirmed its interest to provide parallel co-financing in the amount of a US\$70 million equivalent credit by the EIB and is discussing with the EU to mobilize a grant amount of US\$22 million equivalent to finance upgrading and extension of the transmission and distribution network and new connections in support of the project objective of increasing access. This will leverage the IDA investment in the proposed AF by a factor of 2.3. The activities to be financed by the EIB/EU will be implemented independently and in parallel with IDA-financed activities. However, they will contribute to the energy sector goal of increasing access to electricity in the country. While close coordination will be ensured among co-financiers, each institution will retain the fiduciary responsibilities of its investments, including its own procurement, financial management (FM) procedures, and supervision of the implementation of activities and safeguards instruments. With regard to the latter, the safeguards instruments have been prepared following the World Bank policies and approved by both the financiers, namely the World Bank and EIB (which manages the grant from the EU on its behalf). Joint supervision missions will be organized and the owner's engineer will be financed by IDA to enhance coordination and efficacy and oversee the implementation of safeguards instruments. NIGELEC and the GoN have appreciated the collaboration of IDA and the EIB and have indicated its strong preference for joint missions to minimize transaction costs.

D. Original Project Description and Performance

21. **Parent project performance.** The parent project was approved on December 16, 2015, and became effective on June 21, 2016. Project ratings for 'Overall Implementation Progress' and 'Progress towards the PDO' have been consistently rated 'Satisfactory' to 'Moderately Satisfactory' over the last 24 months in the project Implementation Status and Results Reports (ISRs). The last ISR, filed on June 29, 2018 rates 'Progress towards the PDO' and 'Overall Implementation Progress' as Satisfactory and Moderately Satisfactory, respectively. Project implementation is progressing satisfactorily and on track despite some delays observed. As of end-June 2018, 80 percent of the project funds were committed. Under Component 1, all contracts are committed except for the installation contract for electricity connections of new customers. Construction works are progressing well and the first household connections are expected by end of 2018 or early 2019. Key TA activities under Component 2 are completed, that is, development of a NES and support to the Government to develop decrees to operationalize the new Electricity Law and the energy regulator. All the decrees are adopted and published, including the grid code, the delegation of public service (concession and licensing), the development of IPPs, and so on.

22. The overall disbursement rate of the project is 43 percent (about US\$28 million) as of end-July 2018, which is 24 percent above the original projection. The project's FM and procurement performances are both rated Satisfactory. The current FM and procurement arrangements are deemed sufficient to properly handle the proposed AF resources. The GoN is in compliance with the project's two dated legal covenants, namely the appointment of an independent auditor and the procurement and setup of an accounting software. The first audit of the project was finalized on June 14, 2018, and no major issue was reported. The safeguards rating is currently Moderately Satisfactory, mainly due to the delay in the hiring of a social development specialist and in reporting on follow-up actions for closing the compensations of persons affected by the project.

Parent Project Components

23. The parent project has two components:

- **Component 1: Extension and reinforcement of distribution systems (IDA US\$52.6 million equivalent).** The component consists of investments in distribution systems in Niamey and six regional capital cities in Niger: Dosso, Maradi, Zinder, Tahoua, Tillabery, and Agadez. The investments concern (a) extension, reinforcement, densification, and rehabilitation of MV and LV distribution networks in secondary cities; (b) reinforcement of the MV backbone network and rehabilitation/reinforcement of substations feeders to improve the service quality for existing customers and allowing new customers to connect to the grid; (c) subsidized electricity connections for 60,000 new customers in Niamey and the selected six regional capital cities; and (d) construction supervision throughout the country. All major construction works contracts have been awarded and equipment supply and contractors mobilization are progressing as planned. The physical works on distribution networks have started in the seven localities and are currently progressing well with an execution rate varying between 40 percent and 87 percent depending on the cities. Overall, 12,492 poles (73 percent) out of 17,030 poles have been erected and 136 cabin substations (85 percent) out of 159 are being constructed. Prepaid meters and connections materials are procured and connection of new customers will start in the second half of 2018. At the current pace, it is expected that all construction works will be completed by end-December 2019, which is two years before the original closing date. The component performance was rated Satisfactory as per the ISR of November 2017 and Moderately Satisfactory in the ISR of June 2018 to reflect delays observed recently in the construction works.
- **Component 2: Strengthening institutional capacity in the electricity sector (IDA US\$8.72 million equivalent).** This component finances capacity building for the MoE as well as for NIGELEC. For the MoE, it supports capacity to (a) develop sector policies and regulations and articulate a strategic vision for the sector; (b) establish and operationalize the Energy Regulator; and (c) develop an NES and measures to expand access in the rural areas. For NIGELEC, Component 2 supports capacity strengthening in distribution system planning and improvement in system operation (default detection equipment and study of Supervisory Control and Data Acquisition [SCADA]). In addition, it will support NIGELEC in project implementation. All TA activities are proceeding as planned. The regulator is functional with proper staffing. All decrees for the application of the Electricity Act have been passed and the new tariff has been in effect since January 2018. The concession contract between the State and NIGELEC was signed on May 14, 2018 whilst the performance contract is scheduled for signature in October 2018. The NES has been validated and the preparation of the electrification master plan has started. The component performance is rated Satisfactory according to the ISR of June 2018.

E. Rationale for Additional Financing

24. **The proposed AF will maximize the developmental impacts of the parent project and contribute to scale up access to electricity in the Republic of Niger.** The parent project is supporting 60,000 new connections. The proposed AF will provide electricity connection to 70,000 additional customers through IDA financing while EIB (including EU) financing will

allow 30,000 new connections. Altogether, the number of customers will increase by 45 percent and the overall access rate¹¹ will increase to 16 percent compared to 11 percent in 2017. Given that the parent project is proceeding successfully, with all construction works signed and progressing steadily, the proposed AF will increase the impacts of the original project by further expanding access and supporting new connections in all six regional capitals supported by the original financing and in a new secondary city (Diffa) as well as in about 90 rural areas through grid extension and densification. The project locations are selected based on a least cost planning for access acceleration. To expand access in a sustainable way, the proposed AF will combine investments in access expansion with those that have reinforcement of the transmission and distribution network so that the existing and new users can also benefit from high levels of service that the grid should deliver. As a first investment toward the implementation of the recently developed NES, the proposed AF will constitute a central piece of the overall electricity access road map in Niger. The proposed AF will support access to electricity in all regional capitals and selected villages around them. In a country where the capacity of key institutions need to be built, the proposed AF will provide TA to support the implementation and monitoring of the reform and planning capacity of the MoE as well as operational capacity of NIGELEC.

25. Scaling up access to electricity will require strengthening and restructuring of the transmission and distribution infrastructure to allow the flow of additional generation to meet the demand. During the last decade (2007–2017), electricity demand grew at a pace of 8 percent in the Western Grid, more than doubling the demand from 65 MW to 145 MW. It is projected that the demand will further increase by 11.5 percent per year to peak at 605 MW by 2030 because of the GoN’s willingness to accelerate access. In the past three years, NIGELEC added 80,000 new consumers to its customer base. Meanwhile, limited investments took place to reinforce the transmission and distribution network to respond to the demand growth. Consequently, the existing transmission network in Niamey is not sufficient to provide reliable electricity to end users to sustainably support access. The situation will worsen as the number of new customers continue to grow as part of various initiatives to increase access to electricity. As indicated earlier, 160,000¹² new connections are to be financed by the parent project and the proposed AF, which will be complemented by 65,000 and 46,000 new customers financed by the AFD and AfDB, respectively. Overall, donor-financed projects alone will connect 271,000 new customers within the next 3–5 years, which is an increase of 76 percent in the number of customers. Therefore, there is a need to upgrade the transit capacity of the transmission network to address the existing bottlenecks, respond to the demand, and allow the supply of new capacity through new power plants and increased import through the North Core/Dorsale Nord Regional Power Interconnector Project. Investments in the transmission networks are needed to preserve the benefits of the parent project and allow for more access expansion. These benefits may not materialize if the key bottlenecks in the transmission system are not addressed. The proposed AF will help release the current stress and bottlenecks in the transmission network by upgrading it to carry more electrons to serve the demand as well as equipping NIGELEC and the sector at large with new tools to accommodate the management of a bigger system and customer base. To cope with the challenges of rapid electrification expansion on NIGELEC’s commercial and operational capacity, the proposed AF will provide budget to outsource connection works to contractors as currently arranged in the parent project.

¹¹ On-grid access only.

¹² Including 30,000 new connections expected from the EIB’s parallel co-financing.

F. Consideration of Other Options

26. The World Bank considered preparing a new operation. However, given the precise alignment of the proposed activities with the PDO of the parent project (P153743), additional financing was seen as a more efficient option in response to the Government's written request for support, dated November 21, 2017.

G. Project Design

27. The proposed AF will finance one new component on upgrading the transmission systems in Niamey; the scale-up of the parent project's Component 1 (Extension, reinforcement, and densification of distribution systems); and Component 2 (Strengthening institutional capacity in the electricity sector).

III. Proposed Changes

Summary of Proposed Changes	
The activities under the AF are aligned with the PDO of the parent project. The proposed AF will expand and maximize the development impact of the parent project by: (a) upgrading the transmission systems in the Western Grid (Zone Fleuve) including replacement of the existing 66 kV T-line with a 132 kV T-line to increase the transmission capacity in Niamey and the Western Grid and upgrading, reinforcement, and construction of feeders and substations; (b) scaling up the activities under Component 1 of the parent project in Niamey and in seven regional cities and expand its scope to rural areas through further investments in densification, reinforcement, and extension of the distribution systems to increase access to electricity and connect new customers; and (c) reinforcing the existing TA of the current Component 2 to further support the capacity of sector entities to strengthen operational capacity of the utility, improve power sector planning with the MoE, and increase institutional capacity to develop solar energy in the energy mix. Components and costs have changed to take into account new activities. The project Results Framework will be revised accordingly. The closing date will also be extended by two years to allow sufficient time to implement the additional activities.	
Change in Implementing Agency	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Change in Project's Development Objectives	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Change in Results Framework	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Change in Safeguard Policies Triggered	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Change of EA category	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Other Changes to Safeguards	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Change in Legal Covenants	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Change in Loan Closing Date(s)	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Cancellations Proposed	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Change in Disbursement Arrangements	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Reallocation between Disbursement Categories	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Change in Disbursement Estimates	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Change to Components and Cost	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>

Change in Institutional Arrangements	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Change in Financial Management	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Change in Procurement	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Change in Implementation Schedule	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
Other Change(s)	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Development Objective/Results		
Project's Development Objectives		
Original PDO The PDO is to increase access to electricity in the Recipient's territory.		
Change in Results Framework		
Explanation: The project Results Framework has been updated to reflect the impact of the IDA financing in the proposed AF activities, to include the World Bank's new corporate results indicators and to incorporate indicators on citizen engagement and gender. The end target dates of the results indicators have been extended to match with the proposed project closing date extension.		
Compliance		
Conditions		
Source of Fund	Name	Type
IDA	Subsidiary Agreement between the Recipient and NIGELEC Section I (B) of Schedule 2 of the Financing Agreement (Section 10.01 of the General Conditions)	Effectiveness
Description of Condition		
The Subsidiary Agreement has been executed on behalf of the Recipient and the Project Implementing Entity, in accordance with the provisions of Section I (B) of Schedule 2 of the Financing Agreement (Section 10.01 of the General Conditions).		
Source of Fund	Name	Type
IDA	Project Implementation Manual. Article V, 5.01 of the Financing Agreement	Effectiveness
Description of Condition		
The Recipient has updated the Project Implementation Manual in accordance with the provisions of Article V, 5.01 of the Financing Agreement, in a manner satisfactory to the Association, to cover the execution of the additional activities to be carried out under the project.		
Risk		
Risk Category	Rating (H, S, M, L)	
1. Political and Governance	Moderate	
2. Macroeconomic	Substantial	
3. Sector Strategies and Policies	Moderate	

4. Technical Design of Project or Program	Moderate								
5. Institutional Capacity for Implementation and Sustainability	Substantial								
6. Fiduciary	Substantial								
7. Environment and Social	Moderate								
8. Stakeholders	Low								
9. Other (Security)	Substantial								
OVERALL	Substantial								
Finance									
Loan Closing Date - Additional Financing (Additional Financing Electricity Access Expansion Project - P164090)									
Source of Funds	Proposed Additional Financing Loan Closing Date								
IDA	December 31, 2023								
Loan Closing Date(s) - Parent project (Electricity Access Expansion Project: P153743 - December 31, 2021)									
Explanation:									
The current closing date of the parent project is December 31, 2021. An extension of the project closing date to December 31, 2023 is proposed to allow for completion of activities, particularly those proposed under the AF.									
Ln/Cr/TF	Status	Original Closing Date	Current Closing Date	Proposed Closing Date	Previous Closing Date(s)				
IDA-57550	Effective	31-Dec-2021	31-Dec-2021	31-Dec-2023	31-Dec-2021				
IDA-D0980	Effective	31-Dec-2021	31-Dec-2021	31-Dec-2023	31-Dec-2021				
Change in Disbursement Estimates (including all sources of Financing, US\$, millions)									
Explanation:									
Disbursement estimates are updated to reflect the additional activities to be supported under the AF and the proposed new closing date. Disbursement estimates are only for IDA financing.									
Fiscal year	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	
Annual	10.00	12.50	15.50	28.00	28.00	20.50	15.00	5.50	
Cumulative	10.00	22.50	38.00	66.00	94.00	114.50	129.50	135.00	
Allocations - Additional Financing (Additional Financing Electricity Access Expansion Project - P164090)									
Source of Fund	Currency	Category of Expenditure	Allocation				Disbursement %(Type Total)		
			Proposed				Proposed		
IDA	US\$	Goods, works, non-consulting services, consultants' services, Operating Costs and Training for Parts 1.A, 1.C, 2.A(i), 2.B, 2.C i), 2.C(iii), 2.D(i), 2.E	70,000,000.00				100.00		

		and 3 of the Project		
		Total:	70,000,000.00	

Component

Change to Components and Cost

Explanation:

The proposed AF will finance additional activities to those of the parent project as described below. These activities will be financed in parallel by IDA, the EIB, and the EU.

Component 1. Upgrading and Reinforcement of the Transmission Systems in the Western Grid

(Estimated AF cost: US\$49.60 million equivalent, of which IDA US\$12.00 million and EIB US\$37.60 million). Through this component, the proposed AF aims to upgrade and strengthen the transmission network that supplies the Western Grid (Zone Fleuve), especially the city of Niamey and the regions of Dosso and Tillabery. The investment part of this component is divided in two separate, but complementary, subcomponents.

- **Subcomponent 1.A. Upgrading of the Existing Transmission Loop in Niamey** (Estimated cost: IDA US\$10.5 million equivalent). The subcomponent will finance the upgrading and reinforcement of the transmission loop in Niamey, which is the backbone of the entire Western Grid system. It will involve the construction of a new 132 kV double-circuit line with a bigger section to replace the existing 66 kV line between Gorou Banda and Niamey II substations via Rive Droite, Goudel, and Niamey Nord substations. The objective of this investment is to eliminate bottlenecks in the transmission system that have arisen because of increased demand and generation capacity in the Niamey region. The upgraded T-line will allow the evacuation of the available power or future supply (mainly solar, hydro, and import of cleaner energy from Nigeria), which will improve the supply to all customers in the Western Grid System (Niamey, Dosso, and Tillabery) by increasing the transit capacity and power availability while minimizing losses and improving the reliability of electricity supply (N-1 security).
- **Subcomponent 1.B. Reinforcement of the Transmission System of the Western Grid in Niamey and Dosso Region** (Estimated cost: EIB US\$37.60 million equivalent). Parallel co-financing from EIB will further reinforce the Western Grid System by investing in (a) the construction of an underground T-line and a new 132/20 kV 50 MVA substation in Niamey downtown to address the growing load center; (b) the reinforcement of the Goudel substation with a new 132/20 kV 50 MVA transformer; (c) the reinforcement of the overloaded part of the T-line that supplies Tillabery from Goudel substation from 66 kV to 132 kV and construction of a new substation at Bangoula; (d) the construction of a new 132/20 kV transformer station at Rive Droite to replace a discarded stations; and (e) the reinforcement of the link between Dosso-Balleyara through the construction of a new 132 kV T-line and the reinforcement and construction of substations.
- **Subcomponent 1.C. Owner's Engineer for Supervision of Construction Works in the Transmission Systems** (Estimated cost: IDA US\$1.50 million equivalent). This subcomponent will finance consultancy services for the control and supervision of construction works on the T-lines and stations. The owner's engineer will also monitor compliance with safeguard instruments (environmental and social) related to construction. To ensure consistency and synergies with the EIB parallel co-financing, the scope of work of the owner's engineer will also include the supervision of activities financed by the EIB/EU. In a weak capacity setting such as in Niger, the arrangement will ensure capacity building, harmonize the implementation of activities, ensure efficiency during implementation, and provide assurance to other donors with less presence in the country. This is also consistent with recent findings in Implementation Completion and Results Reports (ICRs) of similar projects, which demonstrate that there is a higher likelihood of success at coordination if the

owner's engineer is financed by IDA, which enables the World Bank team to quickly address any shortcomings found during supervision.

Component 2. Extension, Reinforcement, and Densification of MV and LV Networks (Estimated AF cost: US\$96.80 million equivalent, of which IDA US\$46.70 million, EIB US\$28.10 million, and EU US\$22.00 million). This component is a scale-up of activities of Component 1 of the parent project (Extension and reinforcement of distribution systems) and will consist of investments in the distribution systems in Niamey and seven regional capitals: Dosso, Tillabery, Tahoua, Zinder, Maradi, Agadez, and Diffa (new city added), as well as in selected rural areas. The component will also finance the construction of the Network Control Center for the distribution systems in Niamey to support NIGELEC's operational capacity. The investments include (a) the extension, reinforcement, and rehabilitation of the distribution systems in Niamey, mainly Phase 1 and part of Phase 2 of the distribution master plan of the capital city; (b) the extension, reinforcement, densification, and rehabilitation of MV and LV networks, reinforcement of the MV backbone network, and rehabilitation/reinforcement of substation feeders; (c) the construction of the Distribution Network Control Center in Niamey; and (d) electricity connections. These investments will also reduce technical losses and improve the reliability of electricity supply. The component includes four investment subcomponents:

- **Subcomponent 2.A. Extension, Reinforcement, and Rehabilitation of the Distribution Systems in Niamey** (Estimated cost: US\$54.00 million equivalent, of which IDA US\$13.90 million, EIB US\$28.10 million, and EU US\$12.00 million).
 - *Extension, reinforcement, and rehabilitation of the distribution systems in Niamey (Phase 1-A)* (Estimated cost: IDA US\$13.90 million equivalent). This subcomponent, financed by IDA, will cover investments of part 1 of the first phase (Phase 1-A) of the distribution master plan for the city of Niamey. It will finance the construction of 13 new MV feeders (11 underground cables and two overhead cables), including five at Goudele station, three at Niamey Nord, and five at Niamey 3. The subcomponent will also rehabilitate 38 MV/LV cabin stations and construct 189 km new LV lines to densify the LV network and supply end users.
 - *Reinforcement and Rehabilitation of the MV and LV networks and substations feeders in Niamey (Phase 1-B and Phase 2-A)* (Estimated cost: US\$40.10 million equivalent, of which EIB US\$28.10 million and EU US\$12.00 million). The EIB and EU resources will help accelerate the implementation of the Niamey distribution master plan. This subcomponent will finance the remaining activities of Phase 1 (Phase 1-B) and part of the investments in Phase 2 (Phase 2-A) of the distribution master plan. The activities to be financed include the creation of eight new switching stations, construction and rehabilitation of transformer stations and feeders, and construction of new LV lines.
- **Subcomponent 2.B. Construction of the Distribution Network Control Center of Niamey** (Estimated cost: IDA US\$5.30 million equivalent). The subcomponent will build and equip a Network Control Center in Niamey using state-of-the-art technology to collect, transmit, and process all data required for the remote control of the distribution network in Niamey, to improve quality of service and optimize operation and maintenance conditions. The subcomponent will finance the supervision engineer.
- **Subcomponent 2.C. Extension, Reinforcement, Densification, and Rehabilitation of MV and LV Distribution Networks in Seven Regional Cities and Selected Rural Areas** (Estimated cost: US\$20.20 million equivalent, of which IDA US\$14.70 million and EU US\$5.50 million).
 - *Extension, reinforcement, densification, and rehabilitation of LV and MV distribution networks in Agadez, Diffa, Maradi, Tahoua, Tillabery, and Zinder* (Estimated cost: IDA US\$10.50 million equivalent). The subcomponent will finance activities to scale up the activities financed under the original project to improve supply and access in six regional capital cities: Agadez, Diffa, Maradi, Tahoua, Tillabery, and Zinder.

- *Extension, Reinforcement, Densification, and Rehabilitation of LV and MV Distribution Networks in Dosso* (Estimated cost: EU US\$1.40 million equivalent). EU resources will finance the reinforcement, expansion, and densification of the MV and LV network in Dosso.
- *Electrification of Selected Rural Localities through MV and LV Networks Expansion* (Estimated cost: US\$8.30 million equivalent, of which IDA US\$4.20 million and EU US\$4.10 million). The subcomponent will support further access to electricity in rural areas. IDA resources will be used to electrify 51 rural localities in Agadez, Diffa, Maradi, Tahoua, and Zinder regions. The EIB, with EU funds, will provide electricity in 38 localities in Dosso and Tillabery as well as in Niamey vicinity and along the 132 kV Dosso-Balleyara T-line.
- **Subcomponent 2.D. Electricity Connections** (Estimated cost: US\$15.00 million equivalent, of which IDA US\$10.50 million and EU US\$4.50 million). This subcomponent will finance meters, connection equipment, and material and subsidize connection fees for about 70,000 new customers in addition to the 60,000 connections supported in the original financing. EU financing will support 30,000 additional connections to bring the total connections under the AF to 100,000 new beneficiaries of electricity services in the targeted areas. The financing will be in the form of grants to significantly reduce the current connection fees which are around US\$200. Under this scheme, the customer will pay about US\$20 to get connected by NIGELEC.
- **Subcomponent 2.E. Owner's Engineer for Supervision of the Construction of Distribution Networks** (Estimated cost: IDA US\$2.30 million equivalent). This subcomponent will finance the owner's engineer for the supervision of proposed distribution activities under the AF. It will also support the supervision of activities financed by the EIB/EU to ensure synergies with the parallel co-financing.

Component 3. Strengthening Institutional Capacity in the Electricity Sector and Support for Project Management (Estimated AF cost: IDA US\$8.50 million equivalent). This component includes three main TA activities to support the capacity building of the MoE and the strengthening of operational capacity of NIGELEC and project management. The AF will finance institutional capacity of the MoE, including (a) development of a long-term capacity building plan for the MoE; (b) setting up of a planning unit to reinforce the planning of capacity within the MoE and update and monitor the implementation of the planning tools developed under the original project including the NES and investment prospectus and the generation and transmission planning; (c) building and strengthening of the MoE's capacity on the development of new power generation projects, mainly solar power, including studies on technical design, financing structuring, and advisory services for private sector participation; (d) trainings and South-South exchange on solar energy (both off-grid and on grid) with other developing countries in Africa and Asia; and (e) strengthening of the operational capacity of the unit in charge of indoor installations control and testing and calibration of meters (*Sécurité des Installations Electriques Intérieures au Niger, SIEIN*).

The TA to NIGELEC will finance (a) the upgrading of the protection plan of the transmission network; (b) the acquisition of training equipment for the NIGELEC training center; (c) further studies for future projects; and (d) trainings. The studies will include safeguards studies for which terms of reference will be reviewed and cleared by the World Bank safeguards team when the topics are selected. The component will also finance project management costs.

Current Component Name	Proposed Component Name	Current Cost (US\$, millions)	Proposed Cost (US\$, million)	AF (US\$, millions)				Action
				Total	IDA	EIB	EU	
—	Component 1. Upgrading and Reinforcement of Transmission	—	49.60	49.60	12.00	37.60	0	New component

	Systems in the Western Grid							
Component 1: Extension and reinforcement of distribution systems	Component 2. Extension, Reinforcement, and Densification of MV and LV Networks	56.28 ¹³	153.08	96.80	46.70	28.10	22.00	Name and cost revised
Component 2: Strengthening institutional capacity in the electricity sector	Component 3. Strengthening institutional capacity in the electricity sector and support for project management	8.72	17.22	8.50	8.50	0.00	0.00	Cost revised
	Contingencies	-	7.10	7.10	2.80	4.30	0.00	Cost revised
	Total	65.00	227.00	162.00	70.00	70.00	22.00	

IV. Appraisal Summary

<p>Economic and Financial Analysis</p> <p>Explanation:</p> <p>The economic and financial analyses were prepared for the two main investment components: transmission component (Component 1) and distribution component (Component 2). Alternatives were also considered to analyze the impacts of the activities. Details of the economic and financial analyses are included in Annex 3.</p> <p>Rationale for public financing. The rationale for public sector financing for the additional investments rests primarily on the present characteristics of the Niger power sector: (a) low electricity access in the country requires government intervention as a development priority to ensure energy supply and increase access to electricity; (b) upgrading and expanding transmission and distribution networks are not normally conducive to public-private arrangements in environments with a low customer base, particularly if those investments are not linked to a private and bankable project; and (c) the scale of investments required or long payback periods. It is also highly unlikely that a private investor will finance the proposed investments given the status of the Niger power sector.</p> <p>World Bank's added value. The World Bank Group has over the years been a close partner of the GoN in the development of its electricity sector, particularly in generation, transmission, and distribution. The World Bank is therefore well positioned to continue its commitment to the expansion and modernization of electricity supply in Niger, also building on its experience in similar projects in Niger and in the region. Furthermore, World Bank financing will enable the GoN to source financing under terms that would support the financial viability of the utility, which is critical for increasing access to electricity and supporting inclusive economic growth.</p> <p>Economic Analysis</p> <p>The proposed AF is economically viable with an economic internal rate of return (EIRR) of 26.2 percent (which is attributed as follows: 56 percent for Component 1 [transmission] and 8.3 percent for Component 2 [distribution]) for the base case.</p>
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¹³ This figure includes a contingency amount of US\$3.28 million.

The transmission component will allow power generated across the country and imported from Nigeria to deliver power to the main grid's existing and new customers, particularly to the capital Niamey, and shows very strong returns. The economic net present value (NPV) of the component is US\$247.4 million and the EIRR 56 percent (discount rate of 6 percent).

The distribution component—expected to provide electricity services to 70,000 new customers in six (6) different urban centers and rural areas—should also provide good economic returns to Niger. The component is economically viable with an NPV of US\$15.6 million and an EIRR of 8.3 percent.

The sensitivity analysis for two components indicates that the expected economic returns are solid.

Financial Analysis

The proposed project has a financial internal rate of return (FIRR) of 6.6 percent for the base case and positive impacts on NIGELEC's cash flows, reducing financial stress on the utility's finances. The financial net present value (FNPV) is US\$142.7 million. The financial return will improve with the recent tariff increase and future possible adjustments.

The detailed economic and financial analysis of the project as well as NIGELEC's financial analysis are provided in Annex 3.

Technical Analysis

Explanation:

The project uses well-established technologies and presents no unusual construction or operational challenges. The equipment and the technologies involved in construction and operation of substations and T-lines are standardized and well-known. Project costs are based on estimates derived from recently contracted works on MV/LV lines and substations financed by the parent project. NIGELEC is familiar with the technologies and technical specifications and bidding documents are readily available from the ongoing project for activities under Component 2. The cost estimates have been evaluated and are aligned with current market prices.

The T-lines to be constructed in Niamey using monopod pylons which were recently used to evacuate the power from Gorou Banda to Niamey 2. The existing right-of-way was found sufficient to implement the new line and dismantle the old one safely. A detailed technical study will be conducted to design the T-lines and select the technological options. Lessons learned from the existing 132 kV lines will be used in the project. The construction work will be conducted while electricity supply is ensured and power cuts limited. The situation was correctly managed when the first circuit of the 132 kV T-line connecting Gorou Banda substation and Rive Droite substation was built in replacement of the then existing 66 kV lines.

As for project implementation, NIGELEC recently worked on the construction of T-lines to evacuate the power generated at Gorou Banda power plant and has constructed new substations. The Project Implementing Unit (PIU) has in-house project engineers for the control of transmission/substation works. Moreover, there is budget for project management that can be used to hire engineers and technical staff, when required. Two owner's engineers will be contracted to support oversight of activities under Components 1 and 2 and the implementation of the Distribution Network Control Center in Niamey. The owner's engineers will help ensure that design, construction, and commissioning are carried out in accordance with international quality standards. To ensure the technical coherence and coordination of construction activities funded by the parallel co-financing of EIB, the owner's engineers will also be charged to supervise the implementation of both IDA and EIB investments.

Financial Management Analysis

Explanation:

The FM rating of the project was Satisfactory following the last FM supervision mission conducted in January 2018, and the current arrangements are expected to remain during the implementation of the AF. The project is managed and implemented by the GoN through the *Cellule des Grands Projets* (Large Project Unit, CGP), which is the PIU within NIGELEC. The FM team comprises a chief of fiduciary unit, a principal accountant, and an accountant assistant for the financial management of the project. The chief of fiduciary unit is responsible for the overall financial management of the project. The principal accountant of the project is qualified and has broad experience in donor-funded projects. The FM staffing and arrangement are adequate for the financial management during the additional financing period of the project and no additional staffing is proposed.

NIGELEC will open two separate accounts for the proposed AF in a commercial bank acceptable to the World Bank and on terms and conditions acceptable to the World Bank and will function under the double signature of the NIGELEC Director General and the project coordinator. Further details about disbursements to the project will be included in the disbursement procedures described in the Disbursement and Financial Information Letter (DFIL) and the administrative, financial, and accounting procedures manual. Appropriate procedures for accounting, custody, approvals, and settlement are in place and are operating satisfactorily.

There are no overdue audit reports, no overdue interim financial reports (IFRs) nor ineligible expenditures under NELACEP. The first audited financial statements of NELACEP, for FY2017 (year ended December 31, 2017) were completed on June 14, 2018, and no issue was reported.

Procurement Analysis

Explanation:

Procurement for the proposed AF will be carried out in accordance with the New Procurement Framework (NPF) and World Bank Procurement Regulations for IPF Borrowers dated July 2016 and revised November 2017; the ‘Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants (revised as of July 1, 2016)’; and the provisions stipulated in the Financing Agreement. National Competitive Bidding shall be in accordance with procedures acceptable to the World Bank. A Project Procurement Strategy for Development (PPSD), including a risk and market analysis, was prepared by NIGELEC. The review of all contracts will be according to thresholds in the NPF¹⁴. Twenty-seven (27) procurement activities were identified in the PPSD under IDA financing. Out of these, seven activities will use 82 percent of IDA resources. The PPSD analyzes that the national, regional and international markets have the experience and capacity to support the implementation of the proposed AF. NIGELEC has demonstrated its mastery of competitive bidding process. The risk assessment provides mitigation measures to address the capacity of contractors, delays as well as security issues. A procurement plan was prepared in May 2018, and will be updated regularly.

The procurement arrangements for the AF will be based on the existing arrangements in place under the Electricity Access Expansion Project (P153743) and Niger Solar Electricity Access Project (NESAP, P160170). The existing Project Coordination Unit (NIGELEC) will be responsible for the coordination and management of the AF. NIGELEC will be responsible for the project planning, financial and procurement management, monitoring and evaluation (M&E), and internal auditing. NIGELEC has already demonstrated strong capacity for procurement. All major contracts under the parent project were signed and about 80 percent of the funds were committed during the first year of implementation. The procurement has remained ‘Satisfactory’ since the first ISR.

¹⁴ Thresholds for contracts subject to the World Bank prior review are (a) US\$10,000,000 for works, (b) US\$2,000,000 for goods and services other than consultant services, (c) US\$1,000,000 for consultant firms, and (d) US\$300,000 for individual consultants. All other contracts shall be archived for post review.

Social Analysis

Explanation:

Social safeguards. The proposed activities under the AF involve construction or civil works with minor social impacts. Nevertheless, OP/BP 4.12 on Involuntary Resettlement triggered in the parent project is applicable to the AF as physical displacement and economic displacement of project-affected persons (PAPs) may be involved. The social safeguard documentation of the parent project, including the Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF), has been updated to reflect the revised project scope including the EIB/EU-financed activities and was published in-country and on the World Bank website on June 19, 2018. The Integrated Safeguards Data Sheet was updated and disclosed on June 22, 2018. Two Environmental and Social Impact Assessments (ESIAs) have been prepared for the upgrading of the transmission systems in Niamey and surroundings as well as for the construction of the T-line between Dosso and Balleyara covering both IDA and EIB/EU-financed activities. The Resettlement Action Plan (RAP) has been prepared for the activities in Niamey and surroundings. The RAP for the Dosso-Balleyara T-line will be prepared once the detailed design is completed to allow the precise identification of land affected by the footprint of pylons and compensation of people losing their assets before the start of construction works. The ESIAs and the RAP were published in-country and on the World Bank website on June 19, 2018.

A report on the implementation of social safeguards instruments for the construction activities under the parent project has been completed with proposed recommendations to further improve the social impact of the project, notably on capacity reinforcement, training, and grievance registration and awareness campaign. About 98 percent of PAPs have been compensated. The remaining 2 percent (13 persons) are those who moved out of the project area in the meantime. An action plan has been set up to extend the contract of the usher in charge of the payment of the compensation of these PAPs from a secured escrow account (in case they show up later).

Gender. The original NELACEP was gender informed with a strong approach to address the project's different implications and impacts on women and men. The proposed NELACEP AF project will adopt the World Bank's new approach to integrating gender into operations, which calls for (a) conducting gender analysis to identify the key gender gaps; (b) designing interventions to address the gaps; and (c) adopting M&E mechanisms and indicators to measure the changes in outcomes between women and men. Cultural norms in Niger restrict women's mobility, their participation in the public sphere, and their access to public information or networks, which accentuate their inequality and disadvantage in relation to men. Together with very low literacy rates, these restrictions may keep poor women, female household heads (who constitute 16 percent of all household heads in Niger), and female entrepreneurs from learning about the possibility of getting an electricity connection or successfully applying for and obtaining a connection. The gender gaps the project will address have to do with women's lack of access to the public sphere, which prevent them from, for example, getting information about the availability of electricity connections or applying for and getting a connection. Consequently, the project will develop and implement actions to ensure that women, including female household heads, have the same access as men and take advantage of the benefits of an electricity connection by reducing the application barriers women may face due to the open-market approach for subscription to the services. The AF project will adopt gender-targeted actions and indicators, primarily in Component 2, including (a) conducting a survey of potential new clients to identify their constraints, mainly for women, to obtaining an electricity connection; (b) designing information campaigns about the project and its benefits (including the availability of subsidies) targeted to reach female household heads and SME entrepreneurs with limited access to information and to stimulate their demand for a connection; (c) building the capacity of project staff managing the application process to ensure that female and male clients are treated equally and provided assistance to complete the application successfully; and (d) enabling mechanisms for low-income women and households and businesses headed by women to benefit from connections subsidies and to use modern energy to improve the productivity of their businesses. The M&E system of the parent project will be

strengthened with additional sex-disaggregated and gender-related outcome and intermediate indicators to monitor and report on the progress and results of implementing the gender-related actions. Data from the Niger MTF survey will help establish the baseline and target values for measuring progress in reducing gender gaps in electricity services and inform the gender-targeted actions. Three indicators in the results framework will be disaggregated by sex. Other gender-relevant intermediate indicators will be included in the Project Implementation Manual (PIM): number of customers (women and men and male and female household heads and entrepreneurs) who applied for a connection; number of new customers (individuals, households, and businesses) connected to electricity; percentage by sex; and number and percentage of female customers who say they are comfortable using the meter to check their electricity consumption and/or contacting a service provider.

Labor influx and gender-based violence (GBV). The project will involve construction works in eight cities (including Niamey) and selected villages. The arrival of external male workers for construction and rehabilitation of the proposed infrastructures may occur and could potentially have negative impacts on the local population, especially women and girls who might engage in relations with campsite workers. Potential negative consequences of such transitional relations include contracting sexual transmitted infections, adolescent pregnancy, and sexual and gender-based violence. *Mitigation:* As part of the preparation of the project, various consultations were held with the communities in the project area between September 2017 and March 2018. An ESMF and RPF have been prepared for activities under Component 2 where specific sites are not known. In addition to the ESMF and RPF, ESIA and RAP have been completed for Component 1. To prevent and address the potential social risks related to the labor influx, codes of conduct on child protection and GBV will be integrated in the bidding documents and in the contracts of all employees, contractors, and consultants contributing to the implementation of the project's infrastructure. A compliance team will also be established to coordinate and monitor the application of the codes of conduct. A procedure specific to GBV will be included in the Grievance Redress Mechanism (GRM).

Citizen engagement. The proposed AF will introduce a clear plan for citizen engagement in the project. The citizen engagement plan will highlight methods to be used by the PIU to communicate with stakeholders who may be affected by the project, including information and education campaigns as well as consultations that reach groups that typically do not have access to information (women, the poor, and youth), setting up ways for citizens to engage (including disadvantaged groups). The goal of the citizen engagement plan is (a) to build a trusting relationship with affected communities and other interested stakeholders and (b) to receive feedback from beneficiaries. A beneficiary survey, financed under the parent project, will be conducted in sample villages to gather baseline data to understand key issues around electricity connections, consumer satisfaction, communication with the utility, gender, and social issues. This survey will be done using a mixed methods approach of data collection, focus group discussions, and analysis and will be carried out in two stages: gather baseline data and gather impact-level data at project completion. The citizen engagement plan will take advantage of the information and experience about the beneficiaries, their energy use, needs, and concerns gathered by ESMAP MTF survey. The engagement with beneficiary communities has started with consultations of key stakeholders as part of the environmental and social safeguard studies. A beneficiary satisfaction survey will be carried out and published, ensuring equal participation of men and women. The citizen engagement plan will build on and strengthen the existing grievance redress mechanism. An indicator to this effect has been added to the project Results Framework.

Strengthening social safeguards and gender capacity. Strengthening NIGELEC's capacity to recognize and address gender gaps, to deal with female as well as male customers, and to monitor progress and results of gender activities will require trainings and TA throughout project implementation. This entails hiring a gender consultant, preferably with experience in energy projects that support the mainstreaming of gender in project implementation. Meanwhile, the PIU is recruiting a senior social safeguard specialist and will hire a gender specialist, preferably a woman, as permanent staff. Furthermore, NIGELEC's and other service providers' capacity to carry out gender-focused analysis, actions, and M&E will need to be strengthened through training on gender differences and

implications. This will require assigning project funding to cover the costs of the gender consultant, the capacity-building activities, and monitoring and reporting on the gender activities and results.

Environmental Analysis

Explanation:

The policies triggered under the parent project are the following: OP/BP 4.01 - Environmental Assessment, OP/BP 4.12 - Involuntary Resettlement, and OP/BP 4.11 - Physical Cultural Resources. These policies remain relevant for the proposed AF. No new safeguards policies are triggered and the safeguard category for the project remains category B.

Through Component 1, Upgrading and Reinforcement of Transmission Systems in the Western Grid, which aims at strengthening the transmission network that supplies the city of Niamey and the Western Grid System, the AF will involve the construction of new 132 kV double-circuit lines with a bigger section to replace the existing 66 kV line between the Gorou Banda and Niamey II substations via the Goudel substation and to connect Dosso to Balleyara. As the T-line paths are known, two ESIA's, including Environmental and Social Management Plans (ESMPs), have been prepared for activities in Niamey and surroundings and for the Dosso-Balleyara T-line, consulted upon and disclosed in-country and on the World Bank's website on June 19, 2018.

In addition, as the AF Component 2 will finance grid extension and densification in Niamey and seven secondary cities, Dosso, Tillabery, Tahoua, Zinder, Maradi, Agadez, and Diffa (new city added), the AF will lead to an expansion of the project intervention areas. Therefore, the ESMF of the parent project was updated to reflect the revised project scope and lessons learned during the parent project implementation and was published in-country and on the World Bank website on June 19, 2018.

Climate and disaster risks. A climate and disaster risk screening has been completed for the proposed AF. The screening identified three key drivers for climate hazards in Niger, namely extreme temperature, drought, and winds. It is projected that temperature will increase by 1–1.6°C between 2020 and 2049.¹⁵ The team has confirmed that the overall climate risk to the project's outcomes is low with regard to these hazards. These extreme climate hazards can cause increase in power demand and stress the power transmission and distribution systems. These adverse climate effects will be mitigated by building more resilient infrastructure. The team will ensure that the design of the transmission and distribution systems take into account an expected increase in demand caused by the abovementioned temperature increase. Technical specifications for equipment will be developed accordingly. All civil works and transmission and distribution systems (lines, towers, poles, and so on) will be designed to resist high temperatures and wind effects, building on strong international and proven national standards. As for the expected civil works for the substations, the design of the drainage systems will account for expected increased flooding. Finally, there will be strengthening of the capacity to maintain the system, with focused training on extreme events and how to undertake preventive maintenance (for example, cleaning of drainage infrastructure before the rainy season). These aspects will be monitored during project implementation.

Greenhouse gas (GHG) accounting. GHG accounting has been undertaken for the project, which will result in GHG emission reductions. Through transmission network strengthening, the project will reduce the expanding T-line losses by 2 percent, which will avoid 352,000 tCO₂ over the economic life of 50 years for IDA-financed activities. In addition, the project will provide new or improved electricity services to users through grid extension. It allows grid electricity to substitute for self-generation using GHG-intensive fuel-burning lighting devices such as kerosene lamps, oil lamps, and candles. Using the World Bank's GHG guidance on energy access operations and the total generation required for new or improved connection, the grid extension will therefore avoid 162,600 tCO₂ over the economic life of 40 years for IDA-financed activities. Overall, about 514,600 tCO₂ will be saved during the project economic lifetime for IDA-financed activities. An assessment for the entire project

¹⁵ World Bank Climate Change Knowledge Portal: Niger Dashboard.

including other sources of financing (EIB and EU) yields a total GHG reduction of 760,306 tCO₂ for the project economic lifetime. See annex 3 for more details.

Risk

Explanation:

The overall risk rating for the parent project and the AF is Substantial. Key risks include the following:

Macroeconomic. The macroeconomic risks are rated Substantial consistently with the risks rating in the CPF. These risks are derived from depressed commodity prices, the persistence of Nigeria's economic crisis, and security challenges that could affect the macroeconomic and fiscal situation of the country. Commodity price shocks could continue adversely affecting government revenue and the balance of payments. High security outlays and the cost for hosting refugees would also challenge fiscal stability both by diminishing public revenues and diverting priority spending away from economic and social priorities. Security challenges could induce cost overrun for the proposed AF as bidders could factor the risk in the price. Security issues could also delay the implementation of activities.

Institutional capacity for implementation and sustainability. These risks are kept Substantial as in the parent project because the sector is under a significant change and unprecedented investment in the national grid. Going forward, NIGELEC will have a central role in the implementation of the electrification plan. NIGELEC has to cope with these challenges with many projects under way at the same time, which will stretch the company's capacity and may create delays in implementation. Moreover, NIGELEC is still in the learning curve with regard to FM, procurement, and contract management as exposure to World Bank-financed projects started only with the original financing. The implementation arrangements will remain the same as under the parent project with the existing PIU (CGP) in charge of fiduciary, safeguards, and monitoring aspects of the parent project under the oversight of Deputy Chief Executive Officer (*Sécretaire Générale*) of NIGELEC. Overall, NIGELEC will be responsible for implementation of the activities financed by the AF. Although the implementation arrangements have been satisfactory under the parent project, further reinforcement of the PIU is planned with the recruitment of a social specialist to reinforce safeguards monitoring. NIGELEC is also considering options to reinforce its technical team.

Fiduciary risk. The overall fiduciary risk is kept Substantial considering that the experience in World Bank procurement and financial management policies is quite recent and the overall fiduciary risk in the country. This is consistent with the risk rating in recent ISRs for the parent project. Since the AF will rely on the existing arrangements that have been governing the parent project, the FM risk rating remains Substantial. The FM arrangements for the AF will be based on the existing arrangements in place under the parent NELACEP (P153743). The FM system of the parent project provides reasonable assurance that World Bank loan proceeds are being used for the intended purpose. There are no overdue audit reports, no overdue IFRs, nor ineligible expenditures under the parent project. However, a slight delay was observed in meeting the dated covenant on recruiting the external auditor of the project. The covenant was completed on April 16, 2018. The first audited financial statements of the parent project, for FY16 and FY17 (year ended December 31, 2017) were completed on June 14, 2018 and no issue was reported.

The procurement risk rating for the AF is Substantial. During the preparation of the two projects implemented by NIGELEC, a procurement capacity assessment was conducted and the overall projects risks were rated High for the Niger Solar Electricity Access Project (NESAP, P160170) because of nonexistent experience with solar electricity and Substantial for the Electricity Access Expansion Project (P153743).

Security risks. There are persisting security concerns, particularly in security-sensitive areas such as the northern part of Tillabery and Diffa. If security deteriorates, it will likely affect the implementation activities of the proposed project. The project will build on NIGELEC regional offices' and local

presence and the involvement of local authorities and communities as is the case in the parent project and other projects financed by donors. Local communities and local authorities are informed about the project activities and briefings are shared by local authorities with contractors using information they gather about security threats in their areas. Contractors have local staff in their team and coordinate with security forces for their missions outside the main cities. The team confirmed with the World Bank's corporate security that supervision missions can still take place in sensitive zones (such as Tillabery and Diffa) subject to the usual security clearance, guidance, and measures. Nevertheless, the fragile nature of Niger poses substantial security risks.

V. World Bank Grievance Redress¹⁶

28. Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit <http://www.worldbank.org/GRS>. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

¹⁶ The project has a functional grievance redress mechanism (GRM) in place. This was confirmed by a social safeguard audit which took place in February/March 2017 by a World Bank consultant, supervised by the team's social specialist (ISR No. 3 of May 3, 2017).

Annex 1. Revised Results Framework¹⁷

Project Development Objective Indicators	Cumulative Target Values									Comments
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	YR6	YR7	End Target	
People provided with new or improved electricity service (Number) (Core)	0	0	48,640	179,200	339,200	467,200	601,600	736,000	736,000	Target values revised
of which females (percentage)	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	
Non-household connections provided with access to electricity under the project (Number)	0	0	1,000	4,500	9,100	10,700	13,100	15,000	15,000	Target values revised
Direct project beneficiaries (Number)	0	0	49,640	183,700	348,300	477,900	614,700	751,000	751,000	Target values revised
Intermediate Results Indicators	Cumulative Target Values									Comments
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	YR6	YR7	End Target	
Household provided with access to electricity under the project (Number)	0	0	7,600	28,000	53,000	73,000	94,000	115,000	115,000	Target values revised
of which, connections provided to female-headed households (%)			5	10	15	16	16	16	16	New gender indicator Based on percent of households headed by women nationally (2010)
Number of total electricity connections completed in urban areas under the project (Number)	0	0	8,600	32,500	61,000	81,500	103,700	125,500	125,500	Target values revised

¹⁷ The result framework captures only IDA financing to avoid double counting as EIB and EU will manage their investments in parallel and independently.

Number of total electricity connections completed in rural areas under the project (Number)	0	0	0	0	1,100	2,200	3,400	4,500	4,500	New indicator
Transmission lines rehabilitated under the project (km)		0	0	0	5	15	25	35	35	New indicator
Distribution lines constructed or rehabilitated under the project (km)	0	0	105	590	1,120	1,480	1,800	2,030	2,030	Target values revised
Distribution lines constructed under the project in urban areas (km) (Sub-type)	0	0	70	380	710	910	1,110	1,260	1,260	Target values revised
Distribution lines constructed under the project in rural areas (km) (Sub-type)		0	0	20	50	85	105	135	135	New indicator
Distribution lines rehabilitated under the project (km) (Sub-type)	0	0	35	190	360	485	585	635	635	Target values revised
Number of times MV feeders affected by the project are cut off (Number)	85	85	80	65	45	40	40	40	40	No change
Substation supply capacity (MW) ¹⁸	270	270	270	350	390	425	435	455	455	Target values revised
Cities with completed georeferenced electricity systems (Number)	1	1	2	4	6	7	7	7	7	No change
National Electrification Strategy adopted by the Government	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No change

¹⁸ Capacity of high voltage/medium voltage (HV/MV) substations that feed electricity to the cities included in the projects. The parent project will finance 90 MVA (72 MW) and the AF will finance 50 MVA (40 MW). The remaining will be financed by other projects.

Project-related grievances registered under the project GRM and addressed (Percentage)	0	0	100	100	100	100	100	100	100	100	No change
of which, grievances submitted by women (%)	0	0	30	30	30	30	30	30	30	30	New gender indicator
Beneficiary satisfaction survey completed and published	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	New indicator
Percent survey completed by women (%)	0	0	50	50	50	50	50	50	50	50	New indicator

Estimated Results from EIB and EU Investments¹⁹

Results Indicators	Cumulative Target Values									Comments
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	YR6	YR7	End Target	
People provided with new or improved electricity service (Number)	-	-	-	-	-	4,500	18,300	26,500	26,500	
of which females (percentage)	-	-	-	-	-	49.6	49.6	49.6	49.6	
Non-household connections provided with access to electricity under the project (Number)	-	-	-	-	-	500	1,700	3,500	3,500	
Number of total electricity connections completed in urban areas under the project (Number)	-	-	-	-	-	4,500	18,000	26,000	26,000	
Number of total electricity connections completed in rural areas under the project (Number)	-	-	-	-	-	500	2,000	4,000	4,000	

¹⁹ This represents an estimate of additional results expected from EIB/EU financing. The figures may slightly differ from EIB own estimate.

Results Indicators		Cumulative Target Values								Comments
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	YR6	YR7	End Target	
Transmission lines constructed or rehabilitated under the project (km)	-	-	-	-	-	20	95	109	109	
Distribution lines constructed or rehabilitated under the project (km)	-	-	-	-	-	95	250	362	362	
Distribution lines constructed or rehabilitated under the project in urban areas (km) (Sub-type)	-	-	-	-	-	70	150	217	217	
Distribution lines constructed under the project in rural areas (km) (Sub-type)	-	-	-	-	-	25	100	145	145	
Substation supply capacity (MW)	-	-	-	-	-	-	48	104	104	Additional capacity added with the financing of 130 MVA HV/MV stations

Annex 2. Detailed Description of New Project Activities

Niger: Additional Financing Electricity Access Expansion Project (P164090)

1. The activities proposed under the AF will scale up the original activities and expand their scope to address transmission bottlenecks in the Western Grid, particularly in Niamey, the main load center. The AF is organized around three main components: (1) upgrading and reinforcement of the transmission systems in the Western Grid; (2) extension, reinforcement, and densification of MV and LV networks in Niamey, seven regional capital cities and selected rural areas; and (3) strengthening institutional capacity in the electricity sector. Table 2.1 provides the overall cost estimation by component, further detailed by component hereafter.

Table 2.1. AF Costs and Financing by Component and Source

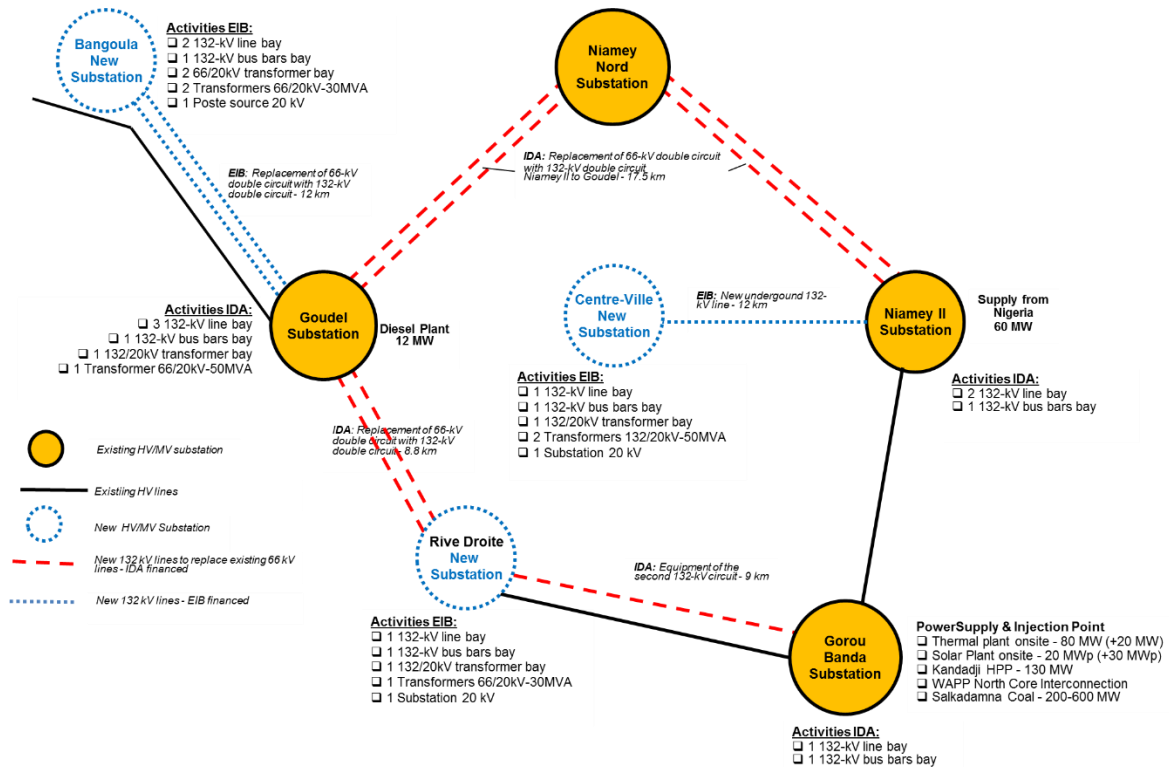
Proposed Component Name	Estimated Cost (US\$, millions)	IDA Financing (US\$, millions)	EIB Co-Financing (US\$, millions)	EU Co-Financing (US\$, millions)
Component 1. Upgrading and Reinforcement of the Transmission Systems in Western Grid	49.60	12.00	37.60	0.00
<i>Subcomponent 1.A. Upgrading of the Existing Transmission Loop of Niamey</i>	<i>10.50</i>	<i>10.50</i>	<i>0.00</i>	<i>0.00</i>
<i>Subcomponent 1.B. Reinforcement of the Transmission System of the Western Grid in Niamey and Dosso Region</i>	<i>37.60</i>	<i>0.00</i>	<i>37.60</i>	<i>0.00</i>
<i>Subcomponent 1.C. Owner's Engineer for Construction Works in the Transmission Systems</i>	<i>1.50</i>	<i>1.50</i>	<i>0.00</i>	<i>0.00</i>
Component 2. Extension, Reinforcement, and Densification of MV and LV Networks	96.80	46.70	28.10	22.00
<i>Subcomponent 2.A. Extension, Reinforcement, and Rehabilitation of the Distribution Systems in Niamey</i>	<i>54.00</i>	<i>13.90</i>	<i>28.10</i>	<i>12.00</i>
<i>Extension, reinforcement, and rehabilitation of the distribution systems in Niamey (Phase 1-A)</i>	<i>13.90</i>	<i>13.90</i>	<i>0.00</i>	<i>0.00</i>
<i>Reinforcement and Rehabilitation of the MV and LV networks and substations feeders in Niamey (Phase 1-B and Phase 2-A)</i>	<i>40.10</i>	<i>0.00</i>	<i>28.10</i>	<i>12.00</i>
<i>Subcomponent 2.B. Construction of the Distribution Network Control Center of Niamey</i>	<i>5.30</i>	<i>5.30</i>	<i>0.00</i>	<i>0.00</i>
<i>Subcomponent 2.C. Extension, Reinforcement, Densification, and Rehabilitation of MV and LV Distribution Networks in Seven Regional Capital Cities and Selected Rural Areas</i>	<i>20.20</i>	<i>14.70</i>	<i>0.00</i>	<i>5.50</i>
<i>Extension, reinforcement, densification, and rehabilitation</i>	<i>10.50</i>	<i>10.50</i>	<i>0.00</i>	<i>0.00</i>

Proposed Component Name	Estimated Cost (US\$, millions)	IDA Financing (US\$, millions)	EIB Co-Financing (US\$, millions)	EU Co-Financing (US\$, millions)
<i>of LV and MV distribution networks in Agadez, Diffa, Maradi, Tahoua, Tillabery, and Zinder</i>				
<i>Extension, Reinforcement, Densification, and Rehabilitation of LV and MV Distribution Networks in Dosso</i>	1.40	0.00	0.00	1.40
<i>Electrification of Selected Rural Localities through MV and LV Networks Expansion</i>	8.30	4.20	0.00	4.10
Subcomponent 2.D. Electricity Connections	15.00	10.50	0.00	4.50
Subcomponent 2.E. Owner's Engineer for Supervision of the Construction of Distribution Networks	2.30	2.30	0.00	0.00
Component 3. Strengthening Institutional Capacity in the Electricity Sector and Support for Project Management	8.50	8.50	0.00	0.00
Subcomponent 3.A. Technical Assistance to the Ministry of Energy	3.00	3.00	0.00	0.00
Subcomponent 3.B. Technical Assistance to NIGELEEC	4.00	4.00	0.00	0.00
Subcomponent 3.C. Project Management	1.50	1.50	0.00	0.00
Contingencies	7.10	2.80	4.30	0.00
Total	162.00	70.00	70.00	22.00

Component 1: Upgrading and Reinforcement of the Transmission Systems in the Western Grid (Estimated AF cost: US\$49.60 million equivalent, of which IDA US\$12.00 million and EIB US\$37.60 million)

2. Through this component, the proposed AF aims to upgrade and reinforce the transmission loop of Niamey which supplies the Western Grid (River Zone or Zone Fleuve), including the city of Niamey and the regions of Dosso and Tillabery. The investment will allow the evacuation of new solar and hydro capacity as well as the import of cleaner electricity from Nigeria. The component is divided in two separate subcomponents. The first subcomponent will be financed with IDA resources and will upgrade the existing transmission loop in Niamey from 66 kV to 132 kV to increase the transit capacity. The second subcomponent will be funded by the EIB. The second component is part of the progressive expansion of the transmission systems in the Western Grid and will consist of (a) construction of a new HV/MV substation in Niamey downtown to address the growing load center; (b) reinforcement of the Goudel substation with a new 132/20 kV 50 MVA transformer; (c) reinforcement of the overloaded part of the T-line that supplies Tillabery from Goudel substation from 66 kV to 132 kV and construction of a new substation at Bangoula; (d) construction of a 132/20 kV substation at Rive Droite to replace a discarded substation; and (e) construction of a new 132 kV T-line between Dosso-Balleyara and reinforcement and construction of the associated substation. The component will also finance the owner's engineer.

Figure 2.1. Diagram of Niamey Power System and Project Activities in the Transmission Systems



Subcomponent 1.A. Upgrading of the Existing Transmission Loop of Niamey (Estimated cost: IDA US\$10.5 million equivalent)

3. With IDA financing, the subcomponent will upgrade 66 kV lines to a full 132 kV loop that connects four main HV/MV substations supplying Niamey and the Western Grid. The main goal of the investment is to eliminate bottlenecks in the transmission system in Niamey that have arisen because of increased demand and to evacuate the power injected or to be injected at Gorou Banda power station, including 100 MW Gorou Banda thermal power, 130 MW Kandadji hydro power, 50 MW solar power, import power from Nigeria (WAPP North Core Project), and 200–600 MW Sakaldamna coal power. The project will improve supply to all customers by increasing the transit capacity while minimizing losses and improving the reliability of electricity supply (N-1 security). From 145 MW in 2017, it is projected that the demand in Niamey and the Western Grid will reach 605 MW in 2030. The subcomponent will finance the following investments to upgrade the transmission loop to 132 kV lines:

- Upgrading of the Gorou Banda - Rive Droite - Goudel T-line. The existing line consists of (a) a 9 km long 132 kV double circuit segment between Gorou Banda and Rive Droite, with one only circuit equipped, and (b) a 66 kV single circuit segment with 8.8 km length between Rive Droite and Goudel. The investment will equip the second 132 kV circuit of the 9 km line between Gorou Banda and Rive Droite and replace the existing 147 mm² AACSR conductor with a double circuit 300 mm² ACSR conductor between Rive Droite and Goudel, raising the voltage to 132 kV. The existing steel towers between Rive Droite and Goudel will be replaced with monopod pylons using the existing rights-of-way.
- Upgrading of the Niamey 2 - Niamey Nord - Goudel T-line. The existing line consists of a 17.5 km long 66 kV double circuit 117 mm² AAC Aster conductor.

The 66 kV line will be replaced with a double circuit 300 mm² ACSR conductor, upgrading the line to 132 kV. The existing steel towers will be replaced with monopod pylons using the existing rights-of-way.

- Extension of a 132 kV bus bars and construction of a new 132 kV line bay at Gorou Banda substation.
- Extension of a 132 kV bus bars and construction of a new 132 kV line bay toward Niamey Nord/Goudel at Niamey 2 substation.
- Construction of one new 132 kV bus bar and two new 132 kV line bays at Goudel substation (one toward Gorou Banda and one toward Niamey Nord/Niamey 2).

4. Overall, the transmission loop in Niamey will be upgraded with 132 kV double circuit lines. The transit capacity from Gorou Banda to Goudel will increase from the current 30 MW to 200 MW while the transit capacity from Niamey 2 to Goudel will increase from the current 60 MW to 200 MW at the end of the project.

Table 2.2. Costs of IDA-Financed Activities for Subcomponent 1.A

Item	Description	Estimated Cost (US\$)
1	Construction of the second circuit of the 132 kV T-line Gorou Banda - Rive Droite (9 km and accessories)	470,000
2	Upgrade of the 66 kV Rive Droite - Goudel T-line (8.8 km of 300 mm ² ACSR conductor - 132 kV double circuit line and accessories)	1,716,000
3	Upgrade of the 66 kV Niamey 2 - Niamey Nord - Goudel T-line (17.5 km of 300 mm ² ACSR conductor - 132 kV double circuit line and accessories)	3,005,000
4	Extension of the 132 kV bus bars and construction of a new 132 kV line bay at Gorou Banda substation	1,352,000
5	Extension of the 132 kV bus bars and construction of a new 132 kV line bay at Niamey 2 substation	1,352,000
6	Construction of one new 132 bus bar and two new 132 kV line bays at Goudel substation	2,605,000
	Total	10,500,000

Subcomponent 1.B. Reinforcement of the Transmission System of the Western Grid in Niamey and Dosso Region (Estimated cost: EIB US\$37.60 million equivalent)

5. This subcomponent will be co-financed in parallel by the EIB. The subcomponent will reinforce the transmission network of the Western Grid to address the growing demand in North Niamey, downtown, and the high development potential area covering Dosso, Balleyara to Filingué and start the expansion of the transmission system. More specifically, the following activities will be financed:

- Replacement of a portion of the existing 66 kV line connecting Goudel to Tillabery with a 132 kV T-line and construction of a new 132/66/20 kV substation (30 MVA) at Bangoula. The existing T-line will be replaced with a double circuit 300 mm² ACSR conductor 132 kV line over 12 km. Considering the urbanization and its associated demographic pressure, this activity will address the increasing load in the northern part of Niamey. The line is also strategic to connect the second HV loop that is projected as part of the future development of the transmission network.

- Reinforcement of the existing 66 kV transformer at Goudel substation with one new 132/20 kV transformer of 50 MVA capacity and construction of related bays. This will complement the reinforcement of the T-line between Goudel and Bangoula.
- Construction of a new 12 km long underground 132 kV T-line and creation of a new gas insulated substation in Niamey downtown. This substation will bring the supply close to a major load center in the network to reduce losses and improve the supply reliability.
- Construction of a new 132/20 kV transformer station (30 MVA) at Rive Droite at the site of the discarded station.
- Construction of a new 132 kV T-line between Dosso and Balleyara and reinforcement of the 132/33/20 kV substation in Dosso and creation of a new 132/33 kV substation (20 MVA) at Balleyara. Currently, there is a 183 km long 33 kV line connecting Dosso-Balleyara and Filingué. The proposed investment will construct a new T-line between Dosso and Balleyara which is 85 km long and the substation at Balleyara to reduce losses and address demand growth in a high development potential area covering Dosso, Balleyara to Filingué.

6. The transit capacity from Goudel to Bangoula and from Dosso to Balleyara will increase to 200 MW.

Table 2.3. Costs of EIB-financed Activities for Subcomponent 1.B

Item	Description	Cost (US\$)
1	Replacement of the existing 66 kV line connecting Goudel to Tillabery with a 132 kV T-line and construction of a new 132/66/20 kV substation (30 MVA) at Bangoula	7,200,000
2	Reinforcement of the existing 66 kV transformer (132/20 kV - 50 MVA and bays) at Goudel substation	2,520,000
3	Construction of a new 12 km long underground T-line (132 kV) and creation of a new gas insulated substation in the downtown of Niamey	13,890,000
4	Construction of a 132 kV T-line between Dosso and Balleyara and reinforcement of the 132/33/20 kV in Dosso and creation of a new 132/33 kV substation (20 MVA) at Balleyara	10,020,000
5	Construction of a new 132/20 kV transformer station (30 MVA) at Rive Droite	3,970,000
	Total	37,600,000

Subcomponent 1.C. Owner's Engineer for Construction Works in the Transmission Systems
(Estimated Cost: IDA US\$1.50 million equivalent)

7. This subcomponent will finance consultancy services for the control and supervision of construction works on the T-lines and stations financed under the proposed AF. The owner's engineer will also monitor compliance with safeguard instruments (environmental and social) related to construction. To ensure consistency with the EIB parallel co-financing, the scope of work of the owner's engineer will also include the supervision of activities financed by the EIB/EU. In a weak capacity setting such as in Niger, the arrangement will ensure capacity building, harmonize the implementation of activities, ensure efficiency during implementation, and provide assurance to the donors with less presence in the country.

Component 2. Extension, Reinforcement, and Densification of MV and LV Networks (Estimated AF cost: US\$96.80 million equivalent, of which IDA US\$46.70 million, EIB US\$28.10 million, and EU US\$19.00 million)

8. This component is a scale-up of activities of Component 1 of the original project (Extension and reinforcement of distribution systems) and will consist of investments in the distribution systems in Niamey and seven regional cities: Dosso, Tillabery, Tahoua, Zinder, Maradi, Agadez, and Diffa (new city added). The component will also finance the construction of the Network Control Center for the distribution systems in Niamey to support NIGELEC’s operational capacity. The investments include: (a) extension, reinforcement, and rehabilitation of the distribution systems in Niamey, mainly Phase 1 and partially Phase 2 of the distribution master plan of the capital city; (b) extension, reinforcement, densification, and rehabilitation of MV and LV networks, reinforcement of the MV backbone network, and rehabilitation/reinforcement of substations feeders; (c) construction of the Distribution Network Control Center in Niamey; (d) electricity connections; and (e) construction supervision throughout the country. The component will be financed in parallel with IDA and EIB/EU resources.

Subcomponent 2.A. Extension, Reinforcement, and Rehabilitation of the Distribution Systems in Niamey (Estimated cost: US\$54.00 million equivalent, of which IDA US\$13.90 million, EIB US\$28.10 million and EU US\$22.00 million)

Extension, reinforcement, and rehabilitation of the distribution systems in Niamey (Phase 1-A) (Estimated cost: IDA US\$13.90 million equivalent)

9. This subcomponent will cover investments of part 1 of the first phase (Phase 1-A) of the distribution master plan for the city of Niamey. The distribution master plan of Niamey consists of a forecast of demand growth and required investments in the MV and LV networks (lines, substations, transformers, feeders, poles) to serve the load and improve and maintain the quality of supply for 2015–2030. These investments will also reduce technical losses and improve the reliability of electricity supply. It is divided in four phases up to 2030. This subcomponent will finance the construction of 13 new MV feeders (11 underground cables and two overhead cables) including five at Goudel station, three at Niamey Nord, and five at Niamey 3 substation. The subcomponent will also rehabilitate 38 MV/LV cabin stations and construct 189 km new LV lines to densify the LV network and supply end users.

Table 2.4. Costs of IDA-Financed Activities in Subcomponent 2.A

Item	Description	Cost (US\$)
1	Construction of 13 new MV feeders	8,200,000
2	Rehabilitation of 38 MV/LV cabin stations	740,000
3	Construction of 189 km new LV lines	4,960,000
	Total	13,900,000

Reinforcement and Rehabilitation of the MV and LV networks and substations feeders in Niamey (Phase 1-B and Phase 2-A) (Estimated cost: US\$40.10 million equivalent, of which EIB US\$28.10 million and EU US\$12.00 million)

10. The EIB and EU resources will help accelerate the implementation of the Niamey distribution master plan. This subcomponent will finance the remaining activities of Phase 1 (Phase 1-B) and part of the investments in Phase 2 (Phase 2-A) of the distribution master plan. As part of Phase 1-B, the subcomponent will finance the following investments:

- Creation of three switching stations to migrate the MV network to a spindle structure at Plateau 1, Plateau 2, and Madina stations with the rearrangement of MV feeders and the construction of associated backup MV lines
- Conversion of the overhead feeders to underground feeders in downtown Niamey
- Rehabilitation of MV feeders at various stations, including Madina, Zone Industrielle, Gaweye, Grand Marché, BCEAO, Koira Kano, Grand Standing, and Rive Droite
- Rearrangement of MV feeders at Hamdallaye and Goudel stations by dividing the feeder at Hadallaye in two segments (aerial and underground) and splitting the feeder at Goudel in two
- Construction of 402 MV/LV stations: 56 cabin stations of 630 kVA each in the center of Niamey, 158 cabin type stations (400 kVA each) in the area surrounding the downtown, 56 cabin type stations (250 kVA each), and 132 pole-mounted stations (160 kVA each) in new expansion areas of the Niamey
- Construction of a new MV underground feeder from Niamey 3 station
- Construction of 92 km new LV lines

11. As part of the implementation of Phase 2-A of the distribution master plan, the following construction works will be financed:

- Replacement of the 20 kV switchgear at Niamey Nord and Niamey 3 stations.
- Construction of 14 new MV feeders (eight underground cables and six overhead cable).
- Creation of five switching stations and the rearrangement of MV feeders at Stade, Aviation, AR1, AR2, and ORTN C2 stations.
- Rehabilitation of 88 cabin stations (250 kVA each).
- Construction of 180 new MV/LV stations. This represents 60 percent of new MV/LV transformer stations planned in Phase 2 of the Niamey distribution master plan.
- Construction of 169 km of new LV lines to densify the LV network and supply end users. This represents 60 percent of LV lines planned in Phase 2 of the Niamey distribution master plan.

Table 2.5. Costs of EIB/EU-financed Activities in Subcomponent 2.A

Item	Description	Cost (US\$)
	Phase 1-B	
1	Creation of three switching stations at Plateau 1, Plateau 2, and Madina	1,290,000
2	Conversion of the overhead feeders to underground feeders in downtown Niamey	850,000
3	Rehabilitation of MV feeders at Madina, Zone Industrielle, Gaweye, Grand Marché, BCEAO, Koira Kano, Grand Standing, and Rive Droite	1,700,000

Item	Description	Cost (US\$)
4	Rearrangement of MV feeders at Hamdallaye and Goudel stations	460,000
5	Construction of 402 MV/LV stations and LV lines	12,300,000
6	Creation of a new MV feeder and construction of LV lines	3,000,000
	Phase 2-A	
6	Replacement of the 20 kV switchgear at Niamey Nord and Niamey 3 stations	660,000
7	Construction of 14 new MV feeders (8 underground cable and 6 overhead cable)	8,520,000
8	Creation of five switching stations and the rearrangement of MV feeders at Stade, Aviation, AR1, AR2, and ORTN C2 stations	600,000
9	Rehabilitation of 88 cabin stations (250 kVA each)	1,720,000
10	Construction of 180 new MV/LV stations	4,640,000
11	Construction of 169 km of new LV lines	4,360,000
	Total	40,100,000

Subcomponent 2.B. Construction of the Distribution Network Control Center of Niamey
(Estimated Cost: US\$5.30 million equivalent)

12. The subcomponent will build and equip a Network Control Center in Niamey using state-of-the-art technology to collect, transmit, and process all data required for the remote control of the distribution network in Niamey, to improve quality of service and optimize operation and maintenance conditions. The Network Control Center will be integrated in the existing information management system as well as in the national SCADA and dispatch center that will be financed by AFD. The subcomponent will also finance the cost for a supervision engineer.

Subcomponent 2.C. Extension, Reinforcement, Densification, and Rehabilitation of MV and LV Distribution Networks in Seven Regional Capital Cities and Selected Rural Areas
(Estimated cost: US\$20.20 million equivalent, of which IDA US\$14.70 million and EU US\$5.50 million)

Extension, reinforcement, densification, and rehabilitation of LV and MV distribution networks in Agadez, Diffa, Maradi, Tahoua, Tillabery, and Zinder (Estimated cost: IDA US\$10.50 million equivalent)

13. The subcomponent will finance activities to complement those financed in the original project to improve supply, reduce technical losses, and improve access in six regional capital cities: Agadez, Diffa, Maradi, Tahoua, Tillabery, and Zinder. This subcomponent includes the creation of 54 new transformer substations (36 cabin stations and 18 pole-mounted stations); the reinforcement of 29 new transformer substations (five cabin stations and 24 pole-mounted stations, two of which will be converted to cabin stations); the rehabilitation of seven cabin stations; and the construction of approximately 36 km of MV line and 300 km of LV line.

14. **For the city of Agadez**, the construction of five cabin stations is planned as well as the reinforcement and the conversion of five existing pole-mounted stations into cabin stations.

15. **For the city of Diffa**, the activity will consist of the construction of eight new pole-mounted stations and the reinforcement of three stations. The MV and LV lines will be expanded with the construction of 4.2 km of MV lines and 15.5 km of LV lines. Diffa was not covered in the original financing.

16. **For the city of Maradi**, the AF will involve the construction of 14 new cabin stations and 117.3 km of LV lines in 14 areas of the town and the construction of 18.8 km of MV lines. One pole-mounted station and two cabin stations will be also reinforced.

17. **For the city of Tahoua**, it is planned to construct 10 new stations (five cabins and five pole-mounted) with associated LV lines. Four pole-mounted stations will be converted into cabin stations and the LV network will be expanded and reinforced in five areas of the city. This will require the construction of 5 km of MV lines and 70.4 km of LV lines.

18. **For the city of Tillabery**, the subcomponent will involve the construction of four new pole-mounted stations with associated LV lines. Two pole-mounted stations will be reinforced, with one converted into a cabin station. This will need the construction of 1.5 km of MV lines and 13.8 km of LV lines.

19. **For the city of Zinder**, the construction works will consist of creation of 13 new stations (1 pole-mounted and 12 cabins) with associated LV lines, reinforcement of 12 pole-mounted stations to be converted into cabins, rehabilitation of six cabin stations and one pole-mounted station, the installation of one overhead distribution switch, replacement of 10 overhead distribution switches, and reinforcement of three feeders for a distance of 8.5 km. Overall, about 13 km of MV lines and 82 km of LV lines will be constructed.

Extension, Reinforcement, Densification, and Rehabilitation of LV and MV Distribution Networks in Dosso (Estimated cost: EU US\$1.40 million equivalent)

20. EU resources will finance the reinforcement, expansion, and densification of the MV and LV network in Dosso. Two new stations will be constructed (cabin and pole-mounted) which will require 1 km of MV line, the rehabilitation of an existing station, and the reinforcement of 12 existing stations (1 pole-mounted and 11 to be converted to cabin type stations). Extension and densification works will consist of the construction of about 47 km of LV lines in nine areas of the city.

Electrification of Selected Rural Localities through MV and LV Networks Expansion (Estimated cost: US\$8.30 million equivalent, of which IDA US\$4.20 million and EU US\$4.10 million)

21. The subcomponent will support further access to electricity in rural areas. The AF resources will be used to electrify 51 rural localities, including four in Agadez, five in Diffa, 16 in Maradi, 14 in Tahoua, and 12 in Zinder. For that end, 96 km of MV lines and 196 km of LV lines will be constructed along with 90 new MV/LV stations to supply a total population of 68,000 people.

22. In addition to World Bank financing, the EIB with EU funds will provide electricity to 34,000 people in 38 localities in Dosso region (18 villages), in Niamey vicinity (10 villages) and Tillabery region, and along the 132 kV Dosso-Balleyara line (10 villages). Overall, 145 km of MV lines will be constructed for rural electrification.

Subcomponent 2.D. Electricity Connections (Estimated cost: US\$15.00 million equivalent, of which IDA US\$10.50 million and EU US\$4.50 million)

23. This subcomponent will finance the meters, connection equipment, and material and subsidize connection fees for about 70,000 new customers in addition to the 60,000 connections supported in the IDA original financing. The EIB/EU financing will support 30,000 additional

connections to bring the total connections under the AF to 100,000 new beneficiaries of electricity services in the targeted areas. Table 2.6 provides a breakdown of connections by region.

Table 2.6. Number of Connections Planned under the AF by Region

Regions	IDA Financing	EIB/EU Co-Financing	Total
Agadez	6,000	—	6,000
Diffa	2,500	—	2,500
Dosso	—	4,500	4,500
Maradi	16,000	—	16,000
Niamey	19,500	23,000	42,500
Tahoua	10,500	—	10,500
Tillabéri	—	2,500	2,500
Zinder	15,500	—	15,500
Total	70,000	30,000	100,000

24. The financing will be used to subsidize the connection fees as in the original project with the expectation to facilitate access to low-income households. The investments for access to electricity under the project will include the acquisition of connection equipment, procurement of meters, and installation works. The financing will be in the form of grants which will significantly reduce the current connection fees, which is around US\$200. Under this scheme, the customer will pay about US\$20 to get connected by NIGELEC. To address the challenges of rapid electrification expansion on NIGELEC’s commercial and operational capacity, the connection work will be outsourced to contractors, as in the parent project.

Subcomponent 2.E. Owner’s Engineer for Supervision of the Construction of Distribution Networks (Estimated cost: IDA US\$2.30 million equivalent)

25. The supervision of the MV works (rehabilitation and strengthening of the substations) and the LV works (strengthening, rehabilitation, densification, and extension of the network) will be done by an owner’s engineer, to be recruited on a competitive basis under the project. The owner’s engineer will also monitor compliance with safeguard instruments (environmental and social) related to construction. The scope of work of the owner’s engineer will include the supervision of activities financed by the EIB/EU.

Component 3. Strengthening Institutional Capacity in the Electricity Sector and Support for Project Management (Estimated cost: IDA US\$8.50 million equivalent)

26. This component includes three main TA activities to support the capacity building of the MoE and the strengthening of operational capacity of NIGELEC and project management.

Subcomponent 3.A. Technical Assistance to the Ministry of Energy (Estimated cost: IDA US\$3.00 million equivalent)

27. The AF will finance institutional capacity of the MoE on power sector planning, development of generation projects, and trainings. Activities planned under this subcomponent include (a) development of a long-term capacity building plan for the MoE; (b) setting up of a planning unit to reinforce the planning of capacity within the MoE and update and monitor the implementation of the planning tools developed under the parent project including the NES and investment prospectus and the generation and transmission planning; (c) building and strengthening of the capacity of the MoE on the development of new power generation projects, mainly solar power, including studies on technical design, financing structuring, and advisory

services for private sector participation; (d) trainings and South-South exchange on solar energy (both off-grid and on grid) with other developing countries in Africa and Asia; and (e) strengthening of the operational capacity of the unit in charge of indoor installations control and testing (SIEIN). This will include the construction of a laboratory and acquisition of testing and meter calibration equipment (laboratory and portable equipment) to support the implementation of the concession contract and performance contract by systems operators. SIEIN will provide independent expertise in litigations related to the application of service standards and the “cahier de charges” between the utility and customers.

Subcomponent 3.B. Technical Assistance to NIGELEC (Estimated cost: IDA US\$4.00 million equivalent)

28. The TA to NIGELEC will finance (a) the upgrading of the protection plan of the transmission network; (b) the acquisition of training equipment for the NIGELEC training center; (c) consultancy service for further technical studies for planned investments in network expansion and access to electricity; and (d) trainings. These further studies will include safeguards studies for which terms of reference will be reviewed and cleared by the World Bank safeguards team when the topics are selected.

Subcomponent 3.C. Project Management (Estimated cost: IDA US\$1.5 million equivalent)

29. The subcomponent covers all activities related to project implementation, including the recruitment of additional project staff, the purchase of vehicles for site supervision, the acquisition of computers and office equipment, training, audits, and other operational costs.

Annex 3. Economic and Financial Analysis

Niger: Additional Financing Electricity Access Expansion Project (P164090)

I. Introduction

1. **Project objective and costs.** The PDO is to increase access to electricity in the Recipient's territory. The AF will allow to expand and maximize the development impacts expected from the parent project by (a) upgrading the transmission capacity in the Western Grid and reinforcing and constructing feeders and substations; (b) scaling up the distribution activities in Niamey and in regional cities (Agadez, Diffa, Dosso, Maradi, Tahaoua, Tillabery, and Zinder) and expanding the scope in the rural areas; and (c) reinforcing capacities by providing TA to support the power utility (NIGELEC) and the MoE.

2. The estimated costs of the additional activities are provided in Table 3.1.

Table 3.1. Project Cost Breakdown for the Additional Activities

Cost Category	Project Costs, including EIB and EU (US\$, millions)	Of Which IDA (US\$, millions)
Upgrading of the transmission capacity	49.6	12.0
Scaling up the distribution activities in selected centers and rural areas	96.8	46.7
Reinforcing capacities and providing TA	8.5	8.5
Contingency	7.1	2.8
Total Project Costs	162.0	70.0

3. **Rationale for public financing.** The rationale for public sector financing for the additional investments rests primarily on the present characteristics of the Niger power sector: (a) low electricity access in the country requires government intervention as a development priority to ensure energy supply and increase access to electricity; (b) upgrading and expanding transmission and distribution networks are not normally conducive to public-private arrangements, particularly if those investments are not linked to a private and bankable project; and (c) the scale of investments required or long payback periods. It is also highly unlikely that a private investor will finance the proposed investments given the status of Niger power sector.

4. The scope of overall sector investments in generation, transmission, distribution, and capacity building is beyond the available financial resources of the GoN. Several multilateral and bilateral partners and various lending institutions are supporting the GoN's energy sector development program. However, the combined financial support from these partners is still inadequate to meet the sector investment needs. As part of the ongoing reforms, legal and regulatory changes are being made to promote private investments on segments of the sector that are more conducive for private participation, such as generation.

5. **World Bank's added value.** The World Bank Group has, over the years, been a close partner of the GoN in the development of its electricity sector, particularly in generation, transmission, and distribution. The World Bank is therefore well positioned to continue its commitment to the expansion and modernization of electricity supply in Niger, also building on its experience in similar programs in Niger and in the region.

6. Drawing upon its rich expertise and experience, the World Bank engagement will enable adoption of best practices in design and execution of network expansion, thus ensuring

technically and socially efficient delivery. Furthermore, World Bank financing will enable the GoN to source financing under terms that would support the financial viability of the utility, which is critical for increasing access to electricity and support inclusive economic growth.

Methodology for the Economic and Financial Analysis

7. The project economic analysis seeks to assess the net economic benefits of the proposed transmission and distribution investment to Niger’s society; the financial analysis assesses the investment impacts on the power utility’s (NIGELEC) finances.

8. **Development impacts expected from the proposed investment.** The PDO is to increase access to electricity in the Recipient’s territory. This will be done by financing the implementation of transmission and distribution investment benefitting households, small businesses, and public institutions and capacity building. The additional transmission investment will allow the full transmission of the power generated by the new Gorou Banda plant (80 MW), the upcoming solar PV plant (20 MW), and of the Kandadji hydro as well as the import from Nigeria. The additional distribution investment will be carried out in eight main urban centers of Niger: Niamey, Agadez, Diffa, Dosso, Maradi, Tahoua, Zinder, and Tillabery over 2020–2023. The distribution investments will be expanded to selected rural areas near the urban centers. In each urban center, the project impacts are expected to be felt at three levels: (a) improvements in the quantity and quality of the electricity services available in the center due to upgrading and strengthening of the networks and a reduction in distribution losses; (b) increased consumption and improved quality of electricity services in the selected urban areas from the upgrading, rehabilitation, and densification of the distribution network; and (c) electrification of new urban and rural developments currently without NIGELEC’s distribution network. It is estimated that over 2020–2023, a total of 70,000 new customers—representing an increase of about 32 percent in NIGELEC’s 2016 customer base—will be connected to the NIGELEC distribution networks through the extensions included in the project. Important increases in the electricity consumption of each center are therefore expected.

9. For each of the abovementioned eight centers, the level of access to electricity services in 2016, the number of customers in 2017, and the additional customers expected over the next three years due to the project are provided in Table 3.2.

Table 3.2. Electricity Access in the Selected Project Centers

Urban Center	Estimated Current Access (2016)	Number of Customers (2017)	Expected Additional Customers from the Project (IDA Financing)	Expected Additional Customers from the Project (EIB and EU Financing)
Niamey	59	161,196	19,500	23,000
Agadez	35	20,013	6,000	—
Dosso	48	26,557	—	4,500
Diffa	—	9,798	2,500	—
Maradi	41	40,813	16,000	—
Tahoua	31	38,722	10,500	—
Tillabery	40	25,037	—	2,500
Zinder	26	33,392	15,500	—
8 Centers	—	355,528	70,000	30,000

II. Economic Analysis

Economic Benefits Evaluation Criteria

10. The economic analysis seeks to estimate the net economic benefits of the proposed transmission and distribution investment to Niger's society over the investment economic life by comparing (a) the benefits streams of the additional availability and consumption of electricity by the households and commercial and productive users and the improvements in quality from the project to (b) the stream of economic costs (additional capital expenditures, generation and transmission and distribution costs) associated with the additional electricity services used by the consumers affected by the project.

11. For each of the two main components, the transmission investments and the distribution investments, the economic benefits and costs of delivering additional electricity have been estimated by assessing the impacts of the investment on the availability of electricity for two scenarios: a 'without-the-project' scenario where no such transmission or distribution investment is carried out and a 'with-the-project' scenario comprising project investment in network strengthening, rehabilitation, densification, and extension.

Main Assumptions of the Economic Analysis

12. The main assumptions therefore relate to the economic value of the electricity consumed, the economic costs of the electricity supplied to the load center, and the associated technical losses.

- **Project economic investment.** The total investment requirement has been provided in Table 3.1 for each of the two physical components, including all sources of funding. These economic costs exclude the value added tax (VAT) and duties applicable in Niger on imported equipment and are in constant 2017 US\$.
- **Economic life of the project.** The economic life of the transmission expansion component of the project is set to 50 years and that of the distribution network expansion component is set to 40 years.
- **Economic value of the additional electricity consumed.** The additional electricity made available through the proposed investment will benefit new customers living in non-electrified urban, peri-urban, and rural areas. In the absence of specific surveys of the values assigned to electricity services in Niger, for this analysis, limited checks on the costs of using small stand-alone diesel systems and on charges from electrified households were carried out. In the initial project, it has been assumed conservatively that the economic value/willingness-to-pay (WTP) for quality services are as follows: US¢20 per kWh (CFAF 106 per kWh).²⁰ The estimated WTP values are likely to be quite conservative as the expenditures incurred in Niger for small stand-alone diesel generators or other energies and of payments made for accessing electricity services are expected to be significantly higher.
- **Availability and costs of imports and domestic generation.** Three separate power grids currently provide electricity to the urban centers, each with their own

²⁰ Using an exchange rate of US\$1 = CFAF 530.

generation mix and outlook. The generation/transmission least cost master plan and demand/supply balances for the grids are being prepared under the Kandadji project. For this economic and financial analysis, two key assumptions regarding the availability and costs of electricity, imported from Nigeria or generated domestically, were therefore made. Regarding Nigeria’s power supplies and following exchanges with NIGELEC, the base case assumptions are that supply will remain at the 2017 level on the saturated 132 kV line supplying Niamey and that the costs to Niger will not change drastically over the planning period. Regarding new generating facilities in Niger, the following is considered: the Gorou Banda 80 MW diesel units on the outskirts of Niamey (commissioned in 2017), the 20 MW solar PV generation plan, the Kandadji multipurpose hydroelectric project (to be commissioned in 2022–2023), the Sakaldamna coal project (to be commissioned in 2022–2025) with the related transmission network interconnecting six of the subject urban centers (Agadez in the northern part and Diffa in the extreme southeast of Niger remaining isolated from the national power grid), and solar PV plants. Additionally, the 330 kV interconnector being developed under the North Core/Dorsale Nord Regional Power Interconnector Project will increase the amount of supply from Nigeria to Niger (at the Gorou Banda power station).

- **Supply costs.** The five grids (Fleuve, Centre, Est, Nord, and Ouest) are not yet connected into a national interconnected system. In the current generation and transmission program, three systems will be interconnected around 2023–2024 once the proposed Sakaldamna coal project and the associated T-lines are commissioned. Estimates of generation programs and generation costs for each of the three grids (Fleuve, Centre, and Nord) have therefore been made in conjunction with NIGELEC. Up to their assumed interconnection in 2022, the economic costs of electricity supply will vary for each separate power system depending upon the generation mix/sources supplying the additional demand in each center at a given time. Table 3.3 summarizes how the average cost of energy supplied was derived for the economic and financial analysis.

Table 3.3. Energy Supplied Cost Derivation

Generation Source	Contribution in Generation Cost (%)	Unit Cost	Generation Cost	
		CFAF/kWh	CFAF/kWh	US\$/kWh
TCN ²¹	44	30.10	13.196	0.025
Sakaldamna	24	70.00	16.543	0.031
Kandadji	12	30.10	3.587	0.007
Gourou Banda	7	98.87	6.792	0.013
SORAZ ²²	5	100.00	5.500	0.010
Solar	5	50.00	2.492	0.005
SONICHAR	3	70.00	2.279	0.004
Total	100	-	50.389	0.095

²¹ Transmission Company of Nigeria

²² Société de raffinage de Zinder

- **Transmission and distribution operation and maintenance costs.** Incremental transmission costs are estimated to represent about 2 percent of transmission investment capital expenditures (Component 1). Incremental distribution costs are estimated to represent 3 percent of the distribution network expansion capital expenditures (Component 2).
- **Distribution costs.** Due to the amount of additional energy Component 1 (transmission expansion) will make available to the power network, incremental distribution costs are estimated to be immaterial. Incremental distribution costs are estimated to be US¢2 per kWh (10 percent of average tariff).
- **Transmission losses reduction.** Transmission losses reduction because of the network expansion and upgrade is assumed to be 2 percent for the IDA financing component (3 percent for the entire project), bringing the total transmission and distribution losses down to 10.33 percent (9.33 percent for the entire project including EIB and EU financings) from the current level of 12.33 percent. The resulting additional energy is considered available to retail customers.
- **Environmental and social impacts.** Only minor negative environmental and social impacts are expected and are therefore not factored in this analysis. Positive social impacts such as improved lighting conditions, improved air quality (substitution from kerosene lamps or from stand-alone small gasoline generators), and lower noise levels are also not included.
- **Additional GHG emissions.** The additional emissions related to the implementation of this distribution project have been estimated based on the additional demand to be served and transmission losses savings projected with the upgrade of the transmission system.
- **Sensitivity analysis.** Impacts on the net economic benefits of key variables such as increased generation costs, investment cost overruns, decreased expected benefits to reflect lower WTPs, or lower expected electricity usages have been assessed through the sensitivity analysis.

Project NPVs and EIRR - Base Case

13. A preliminary base case NPV and the EIRR for the project as a whole are presented in Table 3.4. Overall, the proposed project is expected to yield substantial net economic benefits and economic return (EIRR of 26.2 percent for IDA-financed activities). When the financings of the EIB and EU are included, the EIRR is at 14.2 percent, which is still robust.

Table 3.4. Project NPVs and EIRRs - Base Case

Investment	IDA Financing		IDA, EIB, and EU Financings (Entire project)	
	NPV (at 6% discount rate) (US\$, millions)	Estimated EIRR (%)	NPV (at 6% discount rate) (US\$, millions)	Estimated EIRR (%)
Component 1: Transmission Investment	247.4	56.0	214.1	24.7
Component 2: Distribution Investment	15.6	8.3	1.7	6.1
Component 1 and 2	263.0	26.2	225.2	14.2

Project Net Economic Benefits - Sensitivity Analysis

14. The proposed project is expected to provide substantial positive net economic benefits under a wide range of situations. The key factors affecting project net economic impacts would be increases in project investment costs and in the generation costs of the additional electricity made available through the project and increases in economic benefits. The results of the sensitivity analysis are provided in Table 3.5. These initial results show an expected very high economic return for the transmission component and a positive return for the distribution component.

Table 3.5. Sensitivity Analysis of IDA Financing (Switching Values)

	Unit	Original Value	Switching Value	Change (%)
Transmission Component				
WTP	US¢/kWh	20.0	13.62	-32
Cost of energy supplied	US¢/kWh	9.0	14.87	+56
CapEx (Cost overrun)	US\$, thousands	12,000	250,688	+1,989
Distribution Component				
WTP	US¢/kWh	20.0	18.4	-8
Cost of energy supplied	US¢/kWh	9.5	10.6	+12
CapEx (Cost overrun)	US\$, thousands	46,700	60,438	+29
Expected usage growth	%	1.5		
Project (Component 1 + 2)				
WTP	US¢/kWh	20.0	14.6	-27
Cost of energy supplied	US¢/kWh	9.0	13.1	+46
CapEx (Cost overrun)	US\$, thousands	58,700	329,207	461
Expected usage growth	%	1.5		

15. The switching values are the values beyond (or below, depending on the sign of the change) which the project becomes economically nonviable.

GHG Emissions and Climate Co-benefits

16. GHG accounting has been undertaken for the project, which will result in GHG emission reductions of 515,000 tCO₂ during the project economic lifetime for IDA financed activities. An assessment for the entire project including other sources of financing (EIB and EU) yields to a total GHG reduction of 760,306 tCO₂ for the project economic lifetime. Tables 3.6.A and B summarize the results of the assessment.

Table 3.6.A. GHG Emission Estimate for IDA-Financed Activities

		Lifetime Energy	Carbon Emission before the Project (+)	Carbon Emission after the Project (-)	Carbon Emission Reduction (=)
		(GWh)	tCO ₂ /MWh	tCO ₂ /MWh	tCO ₂
Energy balance					
Energy at busbar (Component 2 - new customers)	Grid	5,607	0.8	0.771	162,606
Transmission loss saving (Component 1)	Grid	440	0.8	0.000	352,000
Total GHG Emission Saving (tCO₂)					514,606

Table 3.6.B. GHG Emission Estimate for the Entire Project (including EU and EIB)

		Lifetime Energy	Carbon Emission before the Project (+)	Carbon Emission after the Project (-)	Carbon Emission Reduction (=)
Energy balance		(GWh)	tCO ₂ /MWh	tCO ₂ /MWh	tCO ₂
Energy at busbar (Component 2 - new customers)	Grid	8,011	0.8	0.771	232,306
Transmission loss saving (Component 1)	Grid	660	0.8	0.000	528,000
Total GHG Emission Saving (tCO₂)					760,306

III. Financial Analysis

17. The financial analysis of the proposed investment in the transmission and distribution networks seeks to assess the FIRR and the expected impacts on NIGELEC cash flows from the implementation of the investment in the transmission network and in the eight urban centers. The indicator selected to carry this financial assessment is the impact on NIGELEC's cash flows.

Project Impacts on NIGELEC Finances

18. The methodology and main assumptions to estimate the project FIRR are described below:

- **Tariff adjustments in early 2018.** It has been assumed that the average tariff adjustment from the current levels will be in the order of 20 percent. However, different categories of consumers will be affected differently.
- **Payments of the VAT and import duties by NIGELEC.** The financial analysis assumes that the project and NIGELEC will not be paying the VAT and duties on imported equipment. NIGELEC will however be paying all other duties and fees and the taxes on net business income.
- **Financing plan.** All project costs will be financed through a blend of an IDA credit under standard IDA credit terms and an IDA grant. The financing plan is provided in Table 3.7.

Table 3.7. Financing Plan

IDA Financing	Amount (US\$, millions)	Interest Rate (%)	Share (%)
IDA Grant	11.3	0.00	16.14
IDA Credit (IDA Terms)	58.7	0.75	83.86
Total	70.0	0.63 ^a	100.00
All Financings (IDA, EIB, EU)	Amount (US\$, millions)	Interest Rate	Share (%)
IDA Grant	11.3	0.00	16.14
IDA Credit (IDA Terms)	58.7	0.75 ^a	83.86
EIB Credit	70.0	1.75	43.21
EU	22.0	0.00	13.58
Total	70.0	1.03	100.00

Note: a. The rate used as weighted average cost of capital to calculate FNPV.

19. **FIRR.** The estimated FIRR for Components 1 and 2 as well as the combined FIRR are presented in Table 3.8, indicating that the proposed investment should provide NIGELEC with a good financial rate of return, particularly as it would benefit from concessional financing terms with lower interest rates.

Table 3.8. Project Financial NPVs and FIRRs - Base Case

Investment	IDA Financing		IDA, EIB, and EU Financings (Entire project)	
	FNPV (at 0.44% discount rate) (US\$, millions)	Estimated FIRR (%)	FNPV (at 1.38% discount rate) (US\$, millions)	Estimated FIRR (%)
Component 1: Transmission investment	120.0	16.9	72.5	4.7
Component 2: Distribution investment	22.7	2.2	-27.4	-0.5
Component 1 and 2	142.7	6.6	45.1	1.8

20. **Project financial viability.** The financial analysis also assessed the impacts of the project on NIGELEC's financial cash flows assuming that by early 2018, electricity tariffs will be increased by 20 percent, consistent with the recent tariff increase. For this preliminary analysis, it is assumed that (a) the project new clients will pay an average of US¢16 per kWh (CFAF 85 per kWh); (b) NIGELEC electricity bill collection performance will be 94 percent; and (c) the investment cost will correspond to the base case cost estimates. The overall FIRR and FNPV of the project are sensitive to the average tariff and the cost of energy supplied. The results of the sensitivity analysis are presented in Table 3.9.

Table 3.9. Sensitivity Analysis for IDA-Financed Activities (Switching Values)

	Unit	Original Value	Switching Value	Change (%)
Transmission Component				
Average tariff	US¢/kWh	15.6	14.2	-9
Cost of energy supplied	US¢/kWh	9.5	10.5	+10
CapEx (Cost overrun)	US\$, thousands	12,000	104,612	+772
Distribution Component				
Average tariff	US¢/kWh	15.6	14.7	-5
Cost of energy supplied	US¢/kWh	9.5	10.2	+7
CapEx (Cost overrun)	US\$, thousands	46,700	62,645	+34
Project (Component 1 + 2)				
Average tariff	US¢/kWh	15.6	14.3	-8
Cost of energy supplied	US¢/kWh	9.5	10.4	+9
CapEx (Cost overrun)	US\$, thousands	58,700	183,989	+213

NIGELEC Financial Analysis

A. Historical Analysis

21. NIGELEC's key operational and financial indicators for 2015–2017, presented in Table 3.10, show that the company has performed relatively well compared to other utilities in the Western Africa subregion.

Table 3.10. Summary of NIGELEC's Recent Operational Performance (2015–2017)

Key Operational Indicators	Value			Average/Growth Rate
	2015	2016	2017	2015–2017
Sales of electricity (GWh)	823	851	893	4.2%
of which:				
Low voltage (GWh)	604	638	666	5.0%
Medium voltage (GWh)	218	213	227	2.0%
Number of clients	298,516	324,086	345,422	7.6%
System losses (%) - Total	19.7	20.9	22.1	20.9
of which:				
Distribution	10.6	12.6	12.9	12.0
Transmission	9.1	8.3	9.2	8.9
Power purchased from Nigeria (%)	76.4	72.3	73.8	74.2
Power generated in Niger (%)	23.6	27.7	26.2	25.8
Specific fuel consumption (NIGELEC thermal plants) (g/kWh)	234.0	235.4	218.5	–3.4%
Average revenue (US¢/kWh)	15.13	15.31	15.44	1.3%
of which:				
LV customers	15.00	15.22	15.27	1.0%
MV customers	15.55	15.60	15.93	1.0%
Cost of service (US¢/kWh)	14.98	15.93	15.37	15.40
Power purchased cost (US¢/kWh)	3.80	3.80	4.10	3.90
Power generated cost (US¢/kWh)	51.90	44.50	16.60	37.70
Power supply cost (US¢/kWh)	7.20	7.90	6.80	7.30
Operating charges coverage ratio	1.17	1.15	1.25	1.19
Cost of service coverage ratio ^a	1.01	0.96	1.00	0.99
Average collection rate (%)	89.70	91.60	102.20	94.50

Note: Exchange rate: US\$1 = CFAF 539.

a. Excluding cost of equity.

22. The evolution of NIGELEC's financial performance over 2015–2017 shows that the power utility was able to generate financial resources from its operations, albeit with fluctuations (zig-zag trend). This evolution is due to the following main factors: (a) NIGELEC's tariffs remaining broadly constant over the last 10 years (in 2001, the Government opted for a tariff decrease benefitting water pumping for irrigation and in 2012 for a tariff decrease for the first tranche—social tranche—of domestic users); (b) a relatively small increase in NIGELEC's revenues due to the supply constraints; (c) a decrease in the net operating results due to an increase in thermal generation in Niger related to the unavailability of additional electricity imports from Nigeria; (in 2017, 74 percent of the electricity available to Niger was imported through the two interconnectors with Nigeria); (d) an increase in other costs in particular staff costs; and (e) the impact of the fiscal regime (*Impot du Revenu Fiscal*) leading to a negative net financial result in 2016, which reverted to positive territory in 2017. Table 3.11 provides a historical view of NIGELEC's financial performance in the last six years (2012–2017).

Table 3.11. Summary of NIGELEC’s Historical Financial Results (2012–2017)

Key Ratios	2012	2013	2014	2015	2016	2017
Net income (continuing operation) – US\$ million	6	4	5	2	(2)	2
Revenue growth %	—	10.7	9.3	12.7	4.9	0.2
Current ratio	1.0	0.8	1.0	1.0	1.1	0.9
EBITDA margin (excluding subsidy)	0.20	0.14	0.18	0.14	0.11	0.20
EBITDA margin (with subsidy)	0.20	0.16	0.20	0.14	0.13	0.20
Net margin (excluding non-recurring income)	0.05	0.03	0.04	0.01	–0.01	0.01
Net margin (including non-recurring income)	0.02	0.02	0.02	0.02	0.00	0.02
Operating charges coverage ratio	1.25	1.20	1.25	1.17	1.15	1.25
Long-term debt/equity ratio	0.23	0.24	0.49	0.71	1.06	0.54
Debt service – US\$ million	33	30	42	37	45	103
Free cash flow – US\$ million	20	18	25	20	17	29
DSCR	0.63	0.61	0.58	0.53	0.38	0.28
Interest coverage ratio	9.41	11.09	3.94	6.15	5.57	10.08

Note: DSCR = Debt service coverage ratio; EBITDA = Earnings before interest, tax, depreciation, and amortization.

B. Financial Projections

23. **Niger power sector and NIGELEC’s investment program.** Master plans for generation and transmission investment and for rural electrification are under preparation. This large investment program will need a comprehensive assessment of its financial impacts.

24. **Regarding generation,** the 80 MW HFO thermal plant at Gorou Banda is operational, albeit constrained by the lack of transmission facilities. The Kandadji multipurpose hydroelectric project is now expected to be commissioned in 2023–2024; the Sakaldamna coal project (with possible installed capacity varying between 200 MW and 600 MW) and the associated T-lines (and the development of the mine and of coal briquettes plant) could be commissioned around 2025; a possible second phase of 25 MW for the SONICHAR coal power plant for the Agadez region power system could be operational in 2018 as would be a 8 MW extension of the SORAZ refinery power plant; solar PV installations of 20–30 MW are also discussed.

25. **Regarding transmission,** a large transmission 330 kV investment project is under preparation in the context of the WAPP North Core project and the Sakaldamna coal power project. These projects will support the development of a national grid interconnecting at least the two main sub-grids and strengthening the interconnection with Nigeria.

26. **Regarding distribution,** through AFD financing, a master distribution plan for the capital Niamey has been completed. Finally, rural electrification is expected to pick up to significantly increase access to electricity services in the rural areas of Niger.

27. **NIGELEC’s financial outlook.** The deteriorating financial performance of NIGELEC has been largely because Niger had to increase its thermal generation (Aggreko and NIGELEC’s generation); Nigeria through TCN continued, however, to provide 72 percent in 2016 and 74 percent in 2017 of Niger’s electricity supply at low and stable tariffs (about US¢4 per kWh). The quality of imports is, however, deteriorating, notably in the hot season. Inexpensive imports have allowed the GoN to maintain tariffs at relatively low levels, not

reflecting cost increases and even reducing end users' tariffs for irrigation and the social tranche consumers.

28. Looking forward, a tariff adjustment of about 20 percent and a new tariff schedule were in effect as of January 2018, which should improve NIGELEC's financial situation.

29. The expected financial stress will be linked to significant increases in generation costs as domestic production should significantly increase to meet fast growing demand in response to the supply constraint on the existing T-lines from Nigeria and liquidity problems to finance fossil fuels. In the short run, the Gorou-Banda (80 MW) diesel units will have substantial impacts on NIGELEC's finances. It should be noted that the Kandadji multipurpose hydroelectric project on the Niger River, expected to come on stream in 2020–2021, is highly seasonal with an output of only about 30 MW during the dry season. The ambitious Sakaldamna coal project (likely to be conceived as an IPP operation) may also have a heavy impact on NIGELEC's finances. Moreover, the WAPP interconnection lines will need to be paid back by NIGELEC.

30. NIGELEC's financial situation is projected to be sustainable during 2018–2027 as it is expected to generate revenues above its cost of service. Table 3.12 provides a summary of NIGELEC's projected financial performance, painting a relatively stronger financial position.

Table 3.12. Summary of NIGELEC's Projected Financial Results (2018–2027)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Sales of electricity (GWh)	1,137	1,367	1,538	1,731	1,948	2,193	2,470	2,764	3,090	3,462
Average revenue (US¢/kWh)	17.63	17.63	17.63	17.63	17.63	17.63	21.74	21.30	20.91	20.56
Cost of service (US¢/kWh)	12.51	13.01	13.37	11.89	13.48	13.00	16.58	16.29	16.01	15.39
Power purchased cost (US¢/kWh)	6.05	6.76	6.64	6.53	6.65	6.83	8.22	8.22	8.22	8.15
Power generated cost (US¢/kWh)	14.71	14.48	14.55	17.35	18.71	18.92	18.85	18.80	18.93	19.08
Power supply cost (US¢/kWh)	8.54	9.10	9.50	7.71	7.69	7.82	8.83	8.77	8.75	8.67
Operating charges coverage ratio	1.69	1.63	1.59	1.90	1.86	1.83	1.64	1.60	1.58	1.59
Cost of service coverage ratio	1.41	1.35	1.32	1.48	1.31	1.36	1.31	1.31	1.31	1.34
Average collection rate (%)	90.50	96.60	97.70	97.70	97.70	97.70	94.30	98.20	98.20	98.10

31. NIGELEC is also projected to be able to honor its debt service obligations as it is expected to generate cash flows above its debt service requirement. Table 3.13 provides a summary of the key ratio related to NIGELEC's projected financial performance.

Table 3.13. Summary of NIGELEC's Projected Financial Performance (2018–2027)

Key Ratios	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Revenue growth %	—	19.6	12.0	11.7	7.9	12.6	34.7	9.0	9.6	9.8
Current ratio	1.0	0.8	0.9	1.2	1.2	1.2	1.4	1.3	1.3	1.4
EBITDA margin (excluding subsidy)	0.41	0.39	0.37	0.47	0.46	0.45	0.39	0.38	0.37	0.37
EBITDA margin (with subsidy)	0.41	0.39	0.37	0.47	0.46	0.45	0.39	0.38	0.37	0.37

Key Ratios	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Net margin (excluding non-recurring income)	0.24	0.22	0.20	0.27	0.21	0.23	0.21	0.21	0.21	0.23
Net margin (including non-recurring income)	0.24	0.22	0.20	0.27	0.21	0.23	0.21	0.21	0.21	0.23
Operating charges coverage ratio	1.69	1.63	1.59	1.90	1.86	1.83	1.64	1.60	1.58	1.59
Long-term debt/equity ratio	1.74	2.23	2.56	2.28	2.29	2.20	1.92	1.72	1.56	1.32
Debt service – US\$ million	9	15	18	20	21	21	20	18	16	15
Free cash flow – US\$ million	97	110	118	170	178	197	227	238	255	283
DSCR	10.6	7.3	6.5	8.4	8.5	9.5	11.5	13.1	15.6	18.9
Interest coverage ratio	10.6	7.3	6.5	8.4	8.5	9.5	11.5	13.1	15.6	18.9

Note: DSCR = Debt service coverage ratio; EBITDA = Earnings before interest, tax, depreciation, and amortization.

32. A sensitivity analysis performed on key variables such as average retail price, US\$/CFAF exchange rate, and IPP/import price yields the results summarized in Table 3.14. The outputs are cumulative or average for the projection period.

Table 3.14. Sensitivity Analysis on NIGELEC’s Projected Financial Results (2018–2022)

		EBITDA	Net Income	Operating Charges Coverage Ratio	Cost of Service Coverage Ratio
		US\$, millions	US\$, millions	US\$, millions	
0	Base scenario	1,917	1,061	1.69	1.35
1	Current retail price (CFAF 83 per kWh) Change vs. Base	1,435 (481)	587 (474)	1.53 (0.16)	1.20 (0.15)
2	US\$/CFAF exchange rate (+10%) Change vs. Base	1,835 (81)	980 (81)	1.64 (0.05)	1.31 (0.04)
3	US\$/CFAF exchange rate (–10%) Change vs. Base	2,004 87	1,138 77	1.75 0.06	1.38 0.04
4	IPP + Import price (+10%) Change vs. Base	1,718 (198)	863 (198)	1.59 (0.10)	1.27 (0.07)
5	IPP + Import price (–10%) Change vs. Base	2,120 203	1,221 160	1.81 0.12	1.42 0.07

Table 3.15. NIGELEC’s Historical Financial Results (2012–2017)

Income Statement (US\$, millions)	2012	2013	2014	2015	2016	2017
Revenues	117	129	141	159	167	168
Power sales	95	100	115	124	130	138
Domestic sales	95	99	115	124	130	138
LV sales	68	73	83	91	97	102
MV sales	27	27	32	34	33	36
Export sales	0.3	0.2	0.0	0.0	0.0	0.0
Other revenues	17	21	23	33	32	27
Subsidy	0	4	2	1	3	0

Provisions reversal and charges transferred	5	5	1	1	2	3
Operating costs	(93)	(108)	(114)	(136)	(146)	(134)
Purchased power	(24)	(25)	(28)	(36)	(37)	(37)
Purchased fuel	(24)	(33)	(31)	(37)	(48)	(40)
Salaries	(16)	(16)	(18)	(19)	(21)	(22)
Other costs	(29)	(35)	(36)	(44)	(40)	(35)
EBITDA	24	21	28	23	21	33
Provisions and depreciation	(13)	(13)	(13)	(15)	(16)	(24)
Earnings before interest and taxes (EBIT)	11	8	15	8	6	9
Net interest expense	(2)	(2)	(6)	(3)	(3)	(3)
Tax	(3)	(3)	(3)	(3)	(4)	(4)
Net income (Continuing operation)	6	4	5	2	(2)	2
Net extraordinary income (+)/Expense (-)	(3)	(1)	(2)	1	1	1
Net income (including extraordinary results)	2	2	3	3	(1)	3
Balance Sheet (US\$, millions)	2012	2013	2014	2015	2016	2017
Property, plant, and equipment (PP&E)	167	173	197	245	292	445
Other fixed assets	0	1	1	3	4	4
Financial assets	5	8	10	7	6	7
Prepaid expenses	2	3	3	3	5	1
Account receivables	27	22	26	39	50	47
Inventories	17	23	25	30	34	29
Other non-cash current assets	5	8	24	34	52	10
Cash	6	7	7	13	21	23
Total assets	229	245	293	375	464	565
Common stock	15	16	16	17	18	143
Retained earnings	2	2	3	3	(0)	3
Investment subsidy	16	15	14	14	14	18
Reserves and other equity	73	76	84	93	102	99
Long-term debt	25	26	57	90	140	143
Long-term liabilities and provisions	38	35	38	40	41	41
Account payables	21	26	31	56	66	48
Tax payables	24	25	24	28	48	36
Revolving debt	9	14	15	22	18	21
Other short-term debts	5	9	10	13	16	13
Total equity and liabilities	229	245	293	375	464	565
Cash Flow (US\$, millions)	2012	2013	2014	2015	2016	2017
(+) EBITDA	24	21	28	23	21	33
(-) Tax	(3)	(3)	(3)	(3)	(4)	(4)
(-) Change in working capital (WC)	(32)	(14)	(41)	(17)	(18)	(90)
(=) Cash flow from operations	(11)	4	(17)	3	(1)	(61)
(-) Capital expenditure	(15)	(22)	(40)	(66)	(66)	(182)

(+) Asset disposals	0	1	0	5	4	5
(=) Cash flow from investing	(15)	(21)	(40)	(61)	(62)	(177)
(+) Non-recurring activities	0	0	(0)	0	1	0
(-) Dividend payment	10	9	18	12	(11)	24
(-) Debt repayment	(31)	(28)	(36)	(34)	(42)	(100)
(+) Equity injection	4	1	4	10	12	136
(+) Debt drawdown	41	32	69	69	94	101
(+) Investment subsidy	0	0	0	1	2	5
(=) Cash flow from financing	25	13	55	58	57	166
Net change in cash	(1)	(4)	(1)	(0)	(6)	(72)

Table 3.16. NIGELEC's Projected Financial Results (2018–2027)

Income Statement (US\$, millions)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Revenues	244	292	327	365	394	444	598	651	714	784
Power sales	200	241	271	305	343	387	537	589	646	712
Other revenues	42	49	54	59	49	55	59	61	65	69
Subsidy	0	0	0	0	0	0	0	0	0	0
Provisions reversal and charges transferred	1	1	1	2	2	2	2	2	3	3
Operating costs	(144)	(179)	(206)	(192)	(212)	(242)	(365)	(407)	(452)	(494)
Purchased power	(60)	(78)	(80)	(123)	(144)	(168)	(288)	(317)	(349)	(382)
Purchased fuel	(59)	(73)	(98)	(40)	(38)	(41)	(40)	(40)	(42)	(45)
Salaries	(26)	(27)	(28)	(29)	(30)	(33)	(37)	(50)	(61)	(67)
EBITDA	100	113	121	173	182	201	233	245	262	290
Provisions and depreciation	(30)	(32)	(35)	(50)	(76)	(75)	(80)	(82)	(87)	(89)
Earnings before interest and taxes (EBIT)	70	81	87	123	106	126	153	163	175	201
Net interest expense	(9)	(15)	(18)	(20)	(21)	(21)	(20)	(18)	(16)	(15)
Tax	(2)	(3)	(3)	(3)	(4)	(4)	(6)	(6)	(7)	(7)
Net income (Continuing operation)	58	63	65	99	81	101	127	139	152	179
Net extraordinary income (+)/Expense (-)	0	0	0	0	0	0	0	0	0	0
Net income (including extraordinary results)	58	63	65	99	81	101	127	139	152	179
Balance Sheet (US\$, millions)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Property, plant, and equipment (PP&E)	944	1,137	1,281	1,373	1,375	1,358	1,316	1,273	1,225	1,175
Account receivables	46	55	61	68	75	84	115	126	137	151
Other account receivables	18	18	19	19	20	20	22	22	23	24
Inventories	39	45	53	52	54	56	56	56	57	57
Cash	4	0	0	36	55	72	116	167	219	327
Total assets	1,051	1,255	1,414	1,548	1,579	1,590	1,626	1,644	1,661	1,734
Common stock	118	118	118	118	118	118	118	118	118	118

Retained earnings	13	15	13	14	(9)	21	25	22	31	34
Investment subsidy	58	57	56	55	54	53	52	51	50	49
Reserves and other equity	139	140	156	223	249	228	265	291	298	344
Long-term debt	571	736	876	935	939	923	882	828	773	721
Long-term liabilities and provisions	46	48	50	51	53	55	57	60	63	66
Account payables	37	43	51	43	40	40	38	43	48	53
Tax payables	28	29	30	30	31	32	35	36	37	39
Revolving debt	0	0	0	0	0	0	0	0	0	0
Other short-term debts	42	70	65	79	104	121	154	197	244	310
Total equity and liabilities	1,051	1,255	1,414	1,548	1,579	1,590	1,626	1,644	1,661	1,734
Cash Flow (US\$, millions)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
(+) EBITDA	100	113	121	173	182	201	233	245	262	290
(-) Tax	(2)	(3)	(3)	(3)	(4)	(4)	(6)	(6)	(7)	(7)
(-) Change in working capital (WC)	(76)	(85)	(92)	(109)	(103)	(106)	(126)	(111)	(113)	(119)
(=) Cash flow from operations	21	25	26	61	75	91	101	127	142	164
(-) Capital expenditure	(330)	(224)	(178)	(142)	(76)	(57)	(37)	(36)	(37)	(36)
(+) Asset disposals										
(=) Cash flow from investing	(330)	(224)	(178)	(142)	(76)	(57)	(37)	(36)	(37)	(36)
(+) Non-recurring activities										
(-) Dividend payment	(2)	(2)	(1)	(2)	18	(6)	(8)	(4)	(10)	(11)
(-) Debt repayment										
(+) Equity injection	11	2	13	68	1	9	40	22	15	48
(+) Debt drawdown	228	165	141	60	4	(16)	(41)	(54)	(54)	(52)
(+) Investment subsidy	7	27	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
(=) Cash flow from financing	244	192	152	125	22	(14)	(9)	(37)	(50)	(15)
Net change in cash	(65)	(7)	0	44	21	20	55	54	55	112

Annex 4. Map

