Project Information Document (PID)

Concept Stage | Date Prepared/Updated: 09-Jun-2022 | Report No: PIDC33769

BASIC INFORMATION

A. Basic Project Data

Country	Project ID	Parent Project ID (if any)	Project Name
Madagascar	P178701		Digital and Energy Connectivity for Inclusion in Madagascar (DECIM) (P178701)
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Practice Area (Lead)**
EASTERN AND SOUTHERN AFRICA	Dec 05, 2022	Feb 22, 2023	Energy & Extractives
Financing Instrument	**Borrower(s)**	**Implementing Agency**	
Investment Project Financing	Ministère de l'Economie et des Finances (MEF)	Ministre de l'Energie et des Hydrocarbures (MEH), Ministre du Développement Numérique, de la Transformation Digitale, des Postes et des Télécommunicat	

Proposed Development Objective(s)

The Project Development Objective is to expand access to renewable energy and digital services, and increase inclusion

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	250.00
Total Financing	250.00
of which IBRD/IDA	250.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Development Association (IDA)	250.00
IDA Credit	250.00

Environmental and Social Risk Classification	Concept Review Decision
Substantial	Track II-The review did authorize the preparation to continue

Other Decision (as needed)

B. Introduction and Context

Country Context

1. Madagascar has embarked on a positive trajectory, with the first peaceful and democratic transfer of power taking place during the 2019 presidential elections shoring up hope for long term stability. Economic growth had been improving consistently before the impact of the COVID-19 pandemic, with Gross Domestic Product (GDP) growth accelerating from 2.3 percent in 2013 to 5.2 percent in 2019. These achievements were underpinned by an ambitious economic reform program, aiming to attract private sector investments. President Andry Rajoelina has presented his overall program, "Madagascar's Emergence Initiative" (IEM), which is framed around three main pillars: i) improving basic social services; ii) strengthening governance and democracy; and iii) promoting economic growth. Efforts have been deployed to reduce ministerial operational spending and improve efficiency through performance monitoring.

2. However, growth remains insufficient, with low investment being a key factor holding back activity and job creation in the country. Growth before the COVID-19 crisis remained insufficient to boost living standards, as it barely surpassed population growth and was significantly weaker than the previous investment-led upturn of the mid-2000s[1]. Private and public investment averaged about 19 percent of GDP over the period 2013-19 (in nominal term), lower than most peers and trending down from the early 2010s as capital spending in the private sector decelerated[2]. Low investment rates in the private sector in recent years reflect persistent policy uncertainty, the lack of a level playing field in major sectors of the economy, barriers to domestic and international trade, insufficient investor protection, and constrained access to land, capital, labor, and digital connectivity.

3. The COVID-19 pandemic has led to a sharp decline in economic activity. The recession in 2020 due to COVID-19 was about three times deeper in Madagascar than in the rest of Sub-Saharan Africa. Businesses with access to digital platforms have fared better as they were able to ensure the continuity of their activities and consequently, protect jobs[3]. However, overall, Madagascar was not sufficiently well equipped to leverage digital technologies, and the pandemic has highlighted the need for accelerating digital adoption in Madagascar to boost resilience. Activity had started to recover in 2021 but was disrupted in 2022 by new bouts of the pandemic, a series of extreme weather events and the fallout from the conflict in Ukraine.

[1] World Bank. Madagascar Economic Update : Navigating Through the Storm. 2022.
[2] *Ibid.*
[3] *Ibid*.

4. A key challenge for Madagascar is to ensure that positive macroeconomic developments benefit the poor. Overall, GDP per capita increased at an average pace of 0.7% per year from 2013 to 2019, which was insufficient to create opportunities to lift a share of the population out of poverty. Poverty affects an estimated 78 percent of the population[4], compared with an average of 42 percent for the rest of Sub-Saharan Africa, and Madagascar is one of only seven countries worldwide[5] where real per capita income is lower today than in 1960. High informality of the Malagasy economy is compounded by a sharp segmentation between various parts of the economy and society, with large parts of the country being marginalized and excluded. The bulk of the population continues to live in rural areas and low-productive subsistence agriculture absorbs an estimated 75 percent of the workforce. This is partly explained by the lack of connectivity constraining agricultural productivity - poor transport access, limited access to electricity (which impedes the use of water pumps or storage, milling and cold chain facilities that could help decrease post-harvest losses), limited access to communications and broadband services and mobile money (which reduces farmers' ability to gain information about market conditions, make informed production decisions and negotiate competitive prices), further isolating rural communities and adversely impacting their livelihood. This situation poses constraints to broad-based development, which may further aggravate fragility risks amid growing economic hardship in lagging regions.

5. To improve living standards and reduce poverty, it is essential that Madagascar increases its growth potential substantially and attracts new investments in sectors that will help drive structural transformation. Reversing current trends will require both economy-wide and sector-specific reforms to accelerate and deepen the pace of economic transition. This notably means boosting "bright spots" in the economy, particularly in the ICT/digital sector, which has a large untapped potential to support structural transformation, including the technology-intensive business process outsourcing (BPO) sector. According to the 2020 Madagascar Country Economic Memorandum[6] (CEM), this sector is not only contributing to job creation at the fastest pace, but it is also resilient to shocks, and has significant linkages with other sectors of the economy. In addition, better access to infrastructure, including energy, especially for underserved communities, will be key to support the post-crisis recovery and accelerate structural transformation, while improving the delivery and access to basic services will be crucial to not only support social and economic progress, but also reduce popular grievances which fuel risks of renewed instability. Particular emphasis needs to be placed on expanding opportunities for all groups of society, with a focus on populations that are most at risk of exclusion, including women and youth. Empowering women and girls will be particularly important in supporting the demographic transition that is needed in rural settings where fertility rates remain high. Likewise, it will be essential to build human capital to foster economic and human development.

6. In addition, development prospects in Madagascar continue to be hampered by the country's vulnerability to frequent, deep, and persistent climatic shocks and other natural disasters. It has one of the highest cyclone risks among African countries, with an average of 3 to 4 cyclones affecting the country each year. On average, natural disasters are estimated to cost the economy about 1 percent of GDP each year, with devastating consequences for rural communities and agriculture-based activities. Beyond the frequency and severity of these shocks, other factors of fragility such as poverty, weak infrastructure, lack of access to public services and financial protection systems can turn even moderate events into severe humanitarian crises. With environmental sustainability expected to worsen, the need to strengthen climate change adaptation and mitigation in Madagascar has never been more acute.

[4] Living below the $1.90 international poverty line (2011 PPP), according to the latest data available (2012).
[5] Out of 138 for which there are data.
[6] http://documentos.bancomundial.org/curated/es/699781575279412305/pdf/Madagascar-Country-Economic-Memorandum-Scaling-Success-Building-a-Resilient-Economy.pdf

Sectoral and Institutional Context

7. Energy is an enabler of Digital Development and *vice versa*. Access to energy is necessary for mobile network providers to deploy and maintain their infrastructure and for individuals to charge their communication devices and thus fundamental to connecting individuals and businesses to the digital economy. Conversely, access to good-quality communication and broadband services can enable electric utilities and private energy service providers to carry out their core activities more efficiently, e.g., by leveraging digital financial services and Pay-As-You-Go (PAYGO) solutions to facilitate financial access to energy solutions such as solar home systems. Therefore, adopting a coordinated approach to exploit synergies in the mutual deployment of energy and ICT holds potential for improving access to both services.

8. Madagascar's infrastructure access—to electricity and digital—is among the lowest in Sub-Saharan Africa and in the world. Similar issues can be found across infrastructure sectors. Decades of under-investment and poor management have led to insufficient and deteriorating infrastructure, which severely impairs the country's ability to generate economic opportunities, particularly in rural areas. Poor prioritization of projects and the impact of frequent natural disasters have further resulted in infrastructure quality in Madagascar being ranked 106 out of 131 countries in the 2020 Global Innovation Survey, falling 58 places from 2013. While challenging topography plays a part, with much of the population living in isolation along thin coastlines and on rugged high plateaux, insufficient and poorly managed public investment, underperforming State-Owned Enterprises (SOEs) and the inability to attract private investors all play a part.

Energy sector

9. Only about 33.7 percent of the population have access to electricity, compared with an average 48.4 percent for Sub-Saharan Africa in 2020[7], which places the country in the list of the top 13 access-deficit countries in the world. Some areas in the country are currently experiencing a decline in the level of electrification as population growth is outpacing the annual increase in electrification. Even in larger and better-connected urban centers, electricity service quality is poor, severely impairing key export-oriented industries. Frequent power outages and voltage fluctuations mean an average company outside the capital city loses almost a seventh of sales per year. Female-headed households have lower access to electricity compared to male-headed households, which means that women are less able to pursue income-generating activities and accumulate physical and human capital.

10. The Ministry of Energy and Hydrocarbons (*Ministère de l'Energie et des Hydrocarbures*, MEH) sets government policy and provides strategic coordination of the energy sector and oversight of JIRAMA's electricity sector activities. Public electricity service in Madagascar is provided by JIRAMA, a vertically integrated state-owned utility that operates most of the country's grid infrastructure. Grid-based electricity in three larger networks covering the major urban centers of Antananarivo, Toamasina, and Fianarantsoa is provided by JIRAMA, which is responsible for distribution, transmission, and roughly half of generation. JIRAMA also owns and operates about 115 operating centers including 95 isolated grids. These 95 isolated grids, spread over the whole territory, are made up of distribution networks with voltage levels of up to 20 kV. Private sector companies supply power to JIRAMA under independent power producer (IPP) and rental power arrangements. The Electricity Sector Regulator (*Autorité de Regulation de l'Electricité*, ARELEC) regulates tariffs and market entry. The Rural Electrification Agency *(Agence de Développement de l'Electrification Rurale*, ADER) is responsible for rural electrification through grid extension and/or off-grid and mini-grid systems. The current legal and regulatory framework of the sector is based on the updated Electricity Law – Codelec adopted in 2018 aiming to develop renewable energy sources, to attract and secure potential investors and developers, to ensure

[7] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?end=2020&most_recent_value_desc=false&start=1996&view=chart

quality of service and to contribute to the improvement of the governance of the electricity sector, in terms of transparency and accountability. Special arrangements to promote rural electrification with ADER and '' Fonds National de l'Energie Durable'' (FNED) have been strengthened.

11. The Government of Madagascar's (GoM) electrification agenda is laid out in the 2015 New Energy Policy (NEP 2015-2030), reinforced in particular by the *Plan Emergence Madagascar* (PEM) and the second ''Velirano'' (Commitment) which confirms the presidential priority commitment to this sector. The stated objective is to allow the greatest number of people to have access to electricity services at a socially acceptable price, in order to support the country's sustainable and inclusive development and to raise electrification to at least 50 percent by 2025 and make progress towards SDG-7[8] through both grid and off-grid solutions. With the support of the IDA-funded "Electricity Sector Operations and Governance Improvement Project" (ESOGIP, P151785) and ''Least-Cost Electricity Access Development Project'' (LEAD, P163870), several additional tools were produced recently underpinning the Government's electrification approach: (i) the Least Cost Development Plan (LCDP) which guides decision making in power generation and distribution systems, to meet demand, choose the best mix of technology types and the optimum in terms of production and investment cost; (ii) geospatial analysis planning tools, which have enabled the identification of least-cost technology solutions for electrification determining how to optimally expand the electrical grid while identifying potential locations for economically viable mini-grid sites and suggesting priority focus areas for private sector stand-alone solar companies; and (iii) an off-grid market assessment that mapped out areas that could be served by off-grid solutions, estimated the size of the potential commercial off-grid market, took stock of electricity access and energy needs in social institutions, identified barriers/risks across the local off-grid solar (OGS) value chain, and reviewed the regulatory structure as it pertains to the products and range of distribution models.

12. According to the geospatial analysis, in terms of penetration rate, about 50 percent of new connections under the NEP should be provided through the large-scale deployment of off-grid technologies, while 50 percent of the connections shall be achieved through the grid and mini-grid. Grid connections only constitute the least-cost solution in the central and northern parts of the country due to the existence of basic grid infrastructure in the Antananarivo, Fianarantsoa, and Toamasina central areas and the ongoing expansion of the northern grids including Mahajanga, Antsiranana, Nosy Be, and Sambava. Offgrid solutions could be deployed in the rest of the country, particularly in the south and west, where the electricity access situation is most critical. Total Investments for achieving the GoM target by 2035 amount to US$2.7 billion mostly in mini-grids and stand-alone solar devices. The first phase of the investment plan is being financed by the LEAD project, approved in 2019. Consistent with the implementation approach of the NEP to prioritize socially equitable and grid-based renewable energy solutions at least cost, LEAD supports (i) cost-effective, priority investments in grid extension and densification; (ii) the Off-Grid Market Development Fund (OMDF) providing working capital and results-based financing (RBF) to eligible off-grid solar provider and financial institutions; (iii) off-grid electrification of health facilities; as well as (iv) technical assistance.

[8] https://sustainabledevelopment.un.org/sdg7.

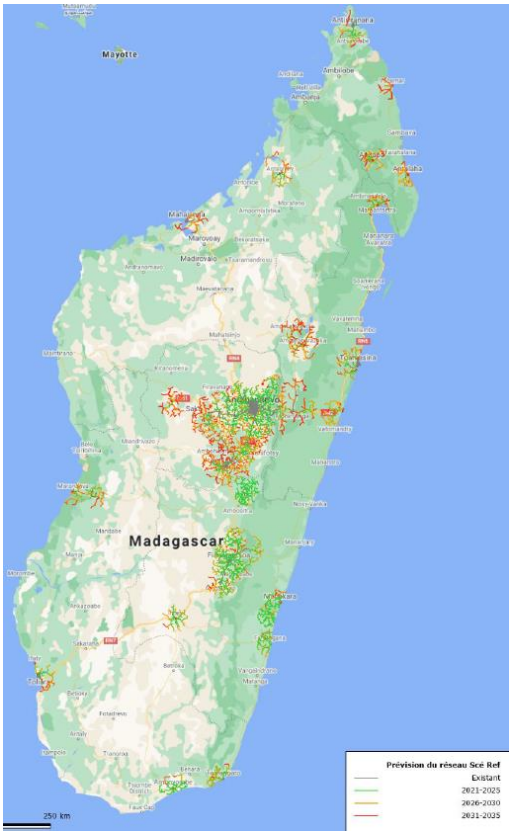
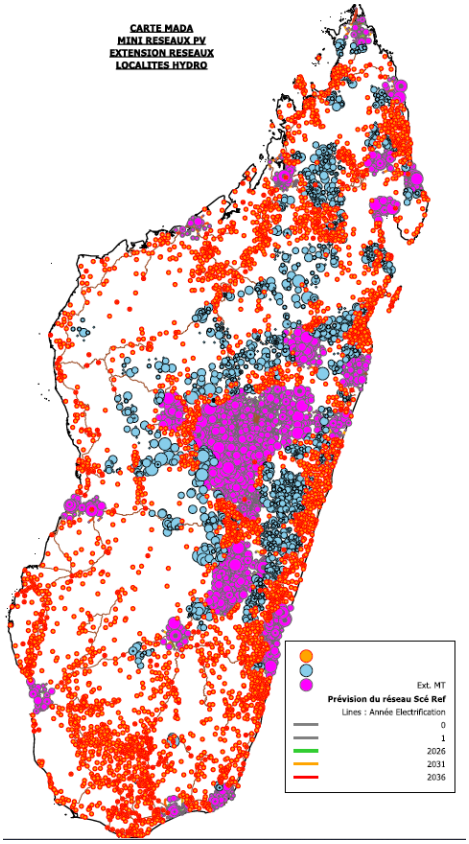


Figure 2 a: Grid extension



Figures 2b: Mini grid

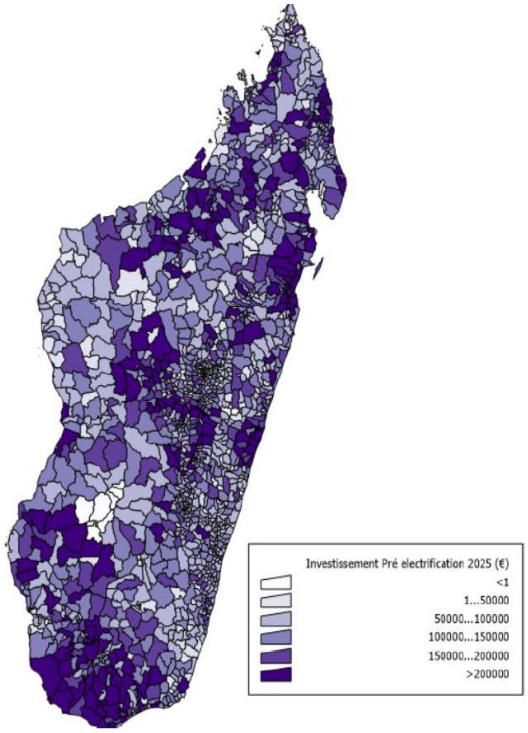


Figure 2c: Standalone solar

Standalone solar	49%
Mini Grid	13%
Grid	38%

The main bottlenecks in scaling up the current electrification efforts are described below:

13. JIRAMA's financial performance continues to be a key obstacle to grid densification and extension efforts. The utility's financial health has significantly declined over the past decade, leaving insufficient resources to invest in access expansion. Between 2008 and 2021, tariff revenues fell from US$0.20 per kilowatt hour (kWh) to US$0.13 per kWh in nominal terms and the financial cost of service increased from US$0.17 per kWh to US$0.24 per kWh as the share of thermal power production increased from 15 percent to over 45 percent today. This resulted in JIRAMA's cost recovery rate falling from 118 percent in 2008 to 60 percent in 2021; its operating margin declining from 14 percent in 2008 to −39 percent in 2021. Government transfers, while significant,[9] fell short of closing the cash flow gap and JIRAMA has accumulated arrears to suppliers over the years amounting to US$293m at the end of 2019. The precarious financial situation left JIRAMA unable to invest in and maintain its infrastructure. System losses are currently about 27 percent, the availability of installed generation capacity declined from 71 percent to 55 percent, and its reserve margin fell from +35 percent to −5 percent. Barely able to maintain its existing service level, investment in access expansion has been deprioritized, leading to a decline in the grid access rate as population growth outpaced new connections. Between 2008 and 2021, JIRAMA completed only around 12,000 connections per year, falling far short of the growth in the number of households of about 130,000 per year.

14. Despite the potential for cost-effective grid-electrification in urban and peri-urban areas, progress in densifying and regularizing connections in these areas has been slow to date. Although over half of the population is without access to electricity in urban and peri-urban areas, little progress has been achieved with regards to connecting households in these areas. In addition to JIRAMA's precarious financial situation described above, low consumer affordability hampers further advances. Connection costs range between US$240 to US$420 per connection in urban and peri-urban areas. While the current connection policy foresees that, poorer customers pay US$7-10 for a connection including wiring kit, and monthly bill of between US$2-3, including the meter rental costs. However, this only covers the service drops and does not include e.g. poles for which customers are still charged the full price. Further, JIRAMA's has little financial incentive to add large numbers of mostly low consumption, low-tariff consumers nor to regularize households with informal, shared connections provided by so-called "meter lords" as their higher consumption due to the shared connection tends to place them in a higher residential tariff category.

15. Hybridization of JIRAMA's isolated grids (IG) has started but remains timid. JIRAMA manages the operation of about a hundred isolated grids spread throughout the island, representing a total peak load of about 116MW and consisting mainly of diesel power plants. In almost half of these centers, JIRAMA has ceded production to private operators through energy supply contracts. Consumption in isolated grids currently accounts for around 20 percent of the country's total electricity consumption. To reduce its production costs and its dependence on hydrocarbons, JIRAMA started in 2018 the hybridization of these isolated grids. 45 sites have been prioritized, but to date 9 hybridization projects have been completed and 10 are in progress. The delays are due to the difficulties in signing purchase contracts due to the lack of a solid base and reference on the JIRAMA side. Indeed, no feasibility study was available at the time of the calls for tender and the selection procedures were not sufficiently clear to guarantee transparency.

[9] Over 2014–2017, on average, fiscal resources equivalent to 1.1 percent of GDP per year have been transferred from the Government budget to JIRAMA to compensate for the financial hemorrhage. The power sector's contribution to the Government's quasi-fiscal deficit reached 2.15 percent of GDP in 2016.

16. JIRAMA has already begun its digitization with the support of the ESOGIP project financed by the World Bank, contributing to the improvement of its operational performance. Operational since 2019, the MATSELAKA system is already deployed in all JIRAMA's operating sites. Intending to implement a new management model at JIRAMA, including (i) improving the collection rate, (ii) reducing losses, and (iii) improving the quality of service, MATSELAKA has become an essential performance lever. The system also enhances the value of its users and stimulates changes in habits, the working environment, the organization of services, control, and management. Currently, several modules are functional: Sales and Customer Service, Maintenance, Purchasing/Inventory, Fixed Assets, Finance, HR, and Business Intelligence, allowing JIRAMA to perform in several areas. For example, these improvements have enabled JIRAMA to reduce its losses from 35 percent in 2016 to 27 percent in 2021 and to record 15 billion Ariary in additional revenue for the first half of 2021 compared to 2020, for the 6 agencies in Tana. These efforts deserve to be sustained and require continuous improvement.

17. Although 15 percent of new connections shall be made through mini grids, these cover only a very small fraction of the population. Since the creation of ADER in 2004, some 147 mini grids have been built serving about 400 localities. The total installed capacity is 17,7 MW, dominated by renewable energy (RE) at 57 percent. By comparison, RE was less than 20 percent before 2010. Nevertheless, 35 operating centers are currently shut down for various reasons, including in particular: the ability to pay for the population in the centers powered by generators, remoteness of villages, financial capacity of companies, intermittency of biomass resources, high cost of fuel and operating costs, customer dissatisfaction (limited-service life, breakdowns, high tariffs, noise pollution, etc.) and climate-related disturbances (droughts) affecting hydro availability. The sub-sector faces various challenges, including (i) financing remains very limited for the sub-sector and access to credit is difficult for operators, which limits investments and delays access planning, even though several donors are working in rural electrification; (ii) private operators have low capacity to set up projects and operate power stations in rural areas. Although technically competent, their capacity in management, monitoring, reporting, and marketing of electricity is insufficient and needs to be strengthened to properly manage these power plants; (iii) operators with structures and organizations based in Antananarivo manage several power plants that are scattered across the island; remote management is difficult, in addition to the difficulty of monitoring and collecting revenues from subscribers. In this respect, the insertion of new remote management technology is an option to ensure operation; (iv) the production plants built are mostly diesel thermal plants. The experience with these plants has shown the difficulty to make their electrical installations viable given their operating cost which increases with the price of diesel while the purchasing power of rural households is very low in Madagascar; (v) The capacity to pay of rural populations is a crucial parameter for the development of rural electrification, whether, with mini-grids or solar kits, and (vi) given the objectives that the government has set for the development of access to rural electrification, ADER needs to strengthen its capacity in terms of staffing, skills, and resources.

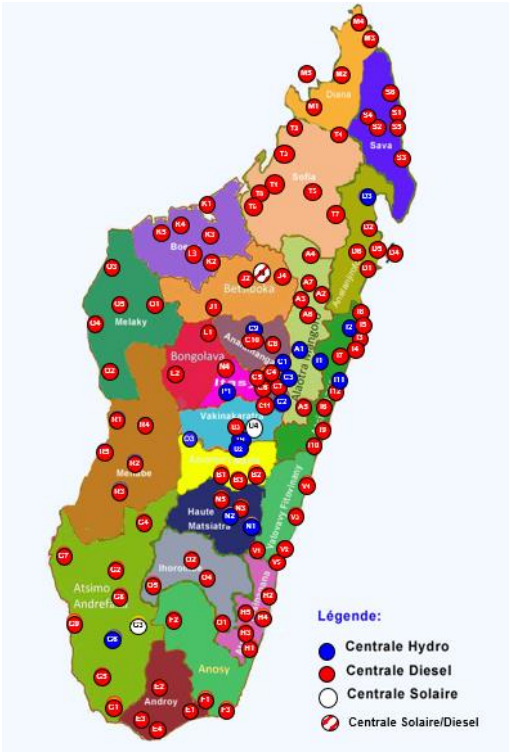


Figure 3a: Isolated grids managed by JIRAMA

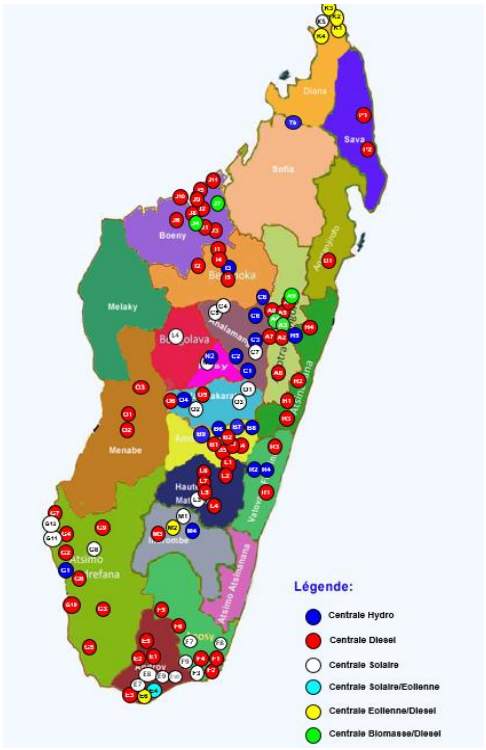


Figure 3b: Mini grids developed with ADER

18. While in 2018 the *Scaling Up Renewable Energy Program* (SREP) has prepared an Investment Plan proposing a 21.4 million SREP funding for mini-grids and the hybridization of JIRAMA's isolated grids, subject to WB and AfDB co-financing, the investment plan remains unfunded. The implementation of the plan was halted due to (i) JIRAMA's decision to move forward unilaterally with the hybridization of these isolated grids, which led to the non-commitment of some donors to support the plan, (ii) the government's delay in submitting the necessary documents, including the feasibility study report of the investment plan. However, the Bank, through the ESOGIP project, has continued to finance feasibility studies for ten potential mini-hydro projects for rural electrification. With the studies completed, the next step for the government is to find a source of funding for the construction and operation of these sites.

19. Despite current financing mechanisms put in place under LEAD, the OGS market remains nascent and is not yet reaching remote areas. Established to manage the off-grid market development fund, OMDF is a new structure in the energy sector in Madagascar. BAMBOO capital/BFVSG was selected for the assignment. OMDF offers two packages for distributors, including (i) a subsidy (quality of service, geographical bonus, PAYGO, start-up fund) and (ii) a line of credit. In addition, an independent auditor (IVA) has been recruited to ensure the actual verification of sales made by distributors. Currently, the subsector faces many challenges: a legal vacuum that has not allowed some telecom operators to enter the solar kit distribution sector on clearly established basis, lack of understanding of the system/procedure by the distributors, the flaw in the collaboration between the OMDF and the IVA, the complexity of verifications at the final clients level and companies under the OMDF focus on wealthier and urban/peri-urban consumers that have been waiting for an electricity connection by JIRAMA or are JIRAMA customers suffering under the low quality of service being provided to them. Some of these problems are in the process of being resolved while others require reform.

Digital sector

20. On the Digital side, despite progress in recent years, Madagascar ranks relatively low in terms of connectivity and accessibility of broadband services. Internet usage is rapidly progressing, reaching some 22 percent of the population in 2021, up from just 5.1 percent in 2016 [10]. Nevertheless, this penetration rate remains one of the lowest in the world and is notably well below the regional average for Sub-Saharan Africa at 33 percent. Fixed broadband penetration, which is particularly important for businesses and government, stands at 0.6 percent in the island.

21. The Government of Madagascar (GoM) has put ICT is at the heart of its 2018 development strategy, "Madagascar's Emergence Initiative". The strategy identifies the development of ICT as one of its six priority sectors for economic growth. Two dedicated digital priorities are included in the PEM - *Priority 22: Make Madagascar a player in the digital revolution*, and *Priority 26: Provide modern [...] telecommunications infrastructure*, with the sub-goals of developing ICT access networks and increasing the number of users of telecommunications services through "the introduction of free competition".

22. Digital transformation indeed holds great promise for Madagascar. Numerous studies have demonstrated that increased broadband penetration is associated with a high impact on economic growth, especially in low- and middle-income countries[11]. The estimates for Africa are at the higher end, with 2.46 percent of additional GDP growth associated with a 10 percent higher broadband penetration. Broadband infrastructure can also increase employment while enabling digital enterprises[12]. These effects would in-turn help lift the Malagasy economy. Similarly, digital technologies can have a tangible potential impact on poverty reduction, as well as on inclusion - through improved access to public services, and government efficiency. The *2030 Agenda for Sustainable Development* recognizes that the spread of ICT offers great potential to accelerate human progress and develop knowledge societies.

23. The main agencies in charge of promoting the expansion of digital infrastructure and digital adoption are the line ministry and regulator. The Ministry of Digital Development, Digital Transformation, Posts and Telecommunications (MNDPT), has a mandate to guide, coordinate and implement the Government's policy on the telecommunications and ICT sub-sectors, and to guarantee access to ICT for all by developing the telecommunication infrastructure networks and fostering adoption of ICTs, particularly in rural areas. The Regulatory Authority for Communication Technologies (ARTEC), under the aegis of MNDPT, has responsibilities, amongst others, for granting licenses and authorizations, to study and propose to MNDPT policies aiming at defining, completing or modifying the legal or economic framework for telecommunications and ICT, to ensure the management of scarce resources (spectrum, numbering, right of way, etc.), to promote technological innovation, to ensure compliance with the regulations in force in the sector, to protect the interests of consumers and citizens, and to ensure that competition between operators is fair. ARTEC is also in charge of the

[10] "Unique" mobile-broadband subscriptions per 100 inhabitants. Source: GSMA Mobile Broadband Capable Connections / GSMA SIMs Per Unique Subscriber (Feb 2021) / United Nations Population (2020).

[11] Briglauer and Gugler (2019); Katz and Callorda (2018); Koutroumpis (2018); Endquist et al. (2018), ITU (2020). In line with these findings, reaching the AU's 2030 "*Digital Transformation for Africa*" goal of universal and affordable internet coverage combined with appropriate human capital investment is estimated to raise real GDP growth per capita by 5 percentage points. per year, while reducing the poverty headcount by 2.5 percentage points. per year across SSA. See: Choi, J., Dutz, M., Usman, Z. 2019. *The Future of Work in Africa: Harnessing the Potential of Digital Technologies for All*. World Bank.

[12] Shapiro and Hassett, 2012; Hjort and Poulsen, 2019.

financial management of the ICT Development Fund (FDTIC), created in 2007, whose mandate is to improve digital connectivity and adoption[13].

24. While large investments have been made in submarine cables, gaps remain in middle and last mile connectivity. As highlighted in the *Digital Economy Country Assessment* for Madagascar, completed in 2020, the country is relatively well served by international submarine cables[14]. The incumbent operator, Telma, is covering most of Madagascar's core network with over 10,000km of fiber cables, but the country's backbone network remains expensive, in part because of the dominant position of Telma. Mobile broadband coverage is incomplete, with 3G mobile covering 78 percent of the population and 4G 67 percent (See Figure 4). Remote and rural areas suffer from persistent market failures from an economic point of view, i.e., private operators do not consider investing in these areas for fear of not being profitable enough, due to high infrastructure deployment and maintenance costs, and lowest levels of income and weak consumer demand. Therefore, significant investments would be required to expand last-mile connectivity in rural, remote areas.

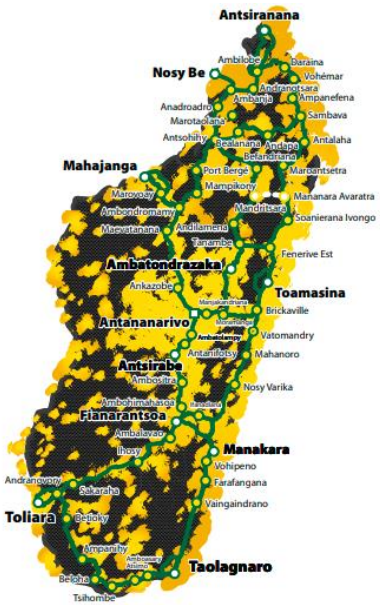


Figure 4: Telma's 4G coverage
Source: Telma (2022).

25. While a coverage gap persists, the bigger problem is the very large usage gap, which prevents widespread access to broadband, due to a combination of supply-side and demand-side constraints. Around 72 percent of those covered by broadband networks, or around 15.5 million people[15] do not appear to be using broadband services. This usage gap is higher than in comparable low-income economies in Africa[16]. It highlights the existence of underlying factors other than the unavailability of the network hindering people from using internet. A key constraint in Madagascar is the unaffordability of services and devices for most of the population. While mobile cellular and mobile broadband baskets have fallen significantly since 2016, these services remain too expensive for a large portion of the population. Mobile devices are similarly unaffordable for a large part of the population. The cheapest smartphone costs 87 percent of the average monthly income and even the cheapest feature phone costs 28 percent. As a consequence, only a third of households possess a mobile phone, and fewer than two fifths of these are smartphones. The unaffordability of devices is also partly due to high taxes and duties on ICT equipment, while the second-hand market for ICT devices is limited. Overall, while low income, demographics and coverage limitations can perhaps

[13] Since its creation in 1996, the body in charge of managing the Fund has never been established, although this has been discussed several times over the years. In the absence of an appropriate structure, the current situation is as follows: on the one hand, ARTEC plays the role of cashier, responsible for collecting the operators' contributions and paying the expenses financed by the Fund; on the other hand, the Minister in charge of ICT plays the role of authorizing the commitments.

[14] There are currently three international submarine cables in use. For two of them, EASSy and METISS, Telma, the former incumbent, is a landing party, while Orange is a landing party for LION. Additional upgrades to the international connectivity are expected from one additional cable, 2Africa, in 2023.

[15] Author's calculations, based on GSMA data, 2021.

[16] World Bank. 2021 *World Development Report: Data for better lives*

explain the underperformance in absolute terms, Madagascar, lack of affordability explains much of its failings relative to regional relative peers with similar characteristics. Given its GDP per capita, Madagascar should have a much higher mobile penetration[17]. These issues are reinforced by low levels of literacy and digital skills, as well as low perceived value of services in part due to the lack of relevant content.

26. On the supply side, the main bottlenecks to further network expansion are a lack of sectoral competition, the dominant position of the incumbent, and a relatively weak regulatory authority which lacks independence. A Telecom Law adopted in 2005 in parallel to Telma's privatization, allowed for opening the market after a short exclusivity period. Yet, 17 years later, only slow progress has been made towards full liberalization. High wholesale prices, combined with the lack of market dominance regulation, despite Telma's significant market power, impact the entire broadband value chain, as competition is distorted, and abuse of dominance unchecked. In particular, Telma's effective control over the optical fiber backbone, and lack of regulation of wholesale tariffs, has restricted access to the backbone and international bandwidth by other providers and impeded investment in network expansion. While, admittedly, the legal framework provides guarantees for the independence of the regulator, in practice the ARTEC lacks independence, especially from the MNDPT. As such, it cannot exercise its statutory powers to, inter alia, establish rules and sanctions. The regulator is also weak and lacks technical capacity. One manifestation of these weaknesses is the high prices and limited affordability noted above. These also contribute to relatively low mobile internet speeds (despite higher speeds for fixed broadband). In addition, poor governance and performance of the FDTIC have limited its impact in rural areas[18]. Improvements in the legal and regulatory framework are required that would allow other operators to deploy fiber and compete on a level playing field, as well as innovative approaches to coordinating investments with the energy sector, create new opportunities and can create new levers and incentives to remedy some of the existing shortcomings.

27. Madagascar is marked by significant digital divides, along socio-economic, gender and urban-rural lines, which can further widen inequalities. Digital exclusion is primarily an issue of poverty and socioeconomic factors. Women, the elderly, those who live in rural areas, those who have lower levels of income or education and other vulnerable groups, including persons with disabilities are less likely to adopt mobile internet because the above-mentioned demand-side barriers are starker for them. Access to broadband Internet is mainly in urban areas, and there is a very large digital divide between Antananarivo and the rest of the country. For example, 27.1% of the population in urban areas report using internet services regularly, i.e., at least once a week, compared to only 5.4% in rural areas[19]. Similarly, 50.0% of men report owning a mobile phone, compared to 43.6% of women[20].

[17] Salience Consulting for IFC. 2021 *Digital Infrastructure Deep Dive in Madagascar*.
[18] Not only has FDTIC's lack of performance limited its ability to disburse funds for rural connectivity projects, but the Fund has had a negative impact on market competition. Indeed, the Fund does not benefit all operators in the telecommunications market, although they all contribute to it. In practice, only one operator, Telma, has benefited from the Fund.
[19] Afro barometer Surveys, 2018.
[20] *Ibid*.

Relationship to CPF

28. The proposed Digital and Energy Connectivity for Inclusion in Madagascar (DECIM) project is well-aligned with the new Country Partnership Framework (CPF), currently under development, which focuses on the role of infrastructure (both physical and digital) in boosting productivity, connecting people to markets, and improving living conditions and access to services. The first High-Level Outcome (HLO) - *Improved economic opportunities,* will focus on growing the pie in an inclusive and green manner and taking a chance on a few sectors to push for structural transformation, including energy and telecom/digital. The CPF envisions concentrated interventions targeting these sectors supported by selected reforms with potential for creating jobs and driving growth but doing so in a manner that limits elite capture.

29. DECIM is also well-aligned with the WBG twin goals, and the key sectoral strategies (the *Energy Sector Directions Paper*, and the WBG/African Union *Digital Economy for Africa* (DE4A) Initiative). Specifically:

a) **Electricity connections will create new opportunities for study and work**, particularly in rural areas, contributing to raising the quality of life and improving safety at night, stimulating off-farm activity and economic interaction, and supporting the digital economy development agenda. Increased access to a reliable electricity supply will also be key to enabling the setup of new private sector-led enterprises and related job creation.

b) **Increased adoption of broadband internet also has great potential to accelerate Madagascar's economic growth**, by increasing productivity, lowering transaction costs, supporting the optimization of supply chains, and enabling innovation across nearly every social and economic sector. Digital transformation enables entrepreneurship, with businesses and individuals using the internet to create new applications and services in areas such as ecommerce, digital trade and financial services. Likewise, it allows the public sector to deliver services to citizens and businesses more effectively and more inclusively, including in sectors that are critical to inclusive growth, such as education, health, and agriculture.

c) **Extending energy including renewable energy-based off-grid systems and broadband and communication services, in tandem, to underserved areas, schools and health centers will contribute to improving learning outcomes and improved health care thereby supporting human capital development**.

30. DECIM is aligned with the thematic pillars of the WBG post-COVID crisis recovery strategy, with its emphasis on *build back better* and on Green, Resilient and Inclusive Development (GRID). The move towards greater home schooling and teleworking has greatly boosted data consumption, which in turn has increased the level of electricity consumption (bytes and watts) while at the same time reducing the requirement for the physical movement of goods and people (moving bits, not shifting atoms). In addition to COVID, the Ukraine conflict is having an impact on rising fuel and food prices.

31. The project will provide enabling and cross-cutting contributions to virtually all existing and pipeline projects in the Madagascar portfolio, in the sense that they are all reliant on good digital connectivity and access to electricity. On the energy side, the project will leverage on LEAD and ESOGIP experience to tackle the issue of electricity access and accelerate the reforms agenda. Specifically, the off-grid experience with OMDF and health centers electrification could be a solid foundation for other sectors such as education, agriculture.

On the digital side, there are obvious synergies with the Digital Governance and Identification Management System Project (P169413, PRODIGY), which aims to build the government's institutions and in-house capacity to deliver better public services faster, through digitization. DECIM will improve the infrastructure and connectivity for the government and the general population, which will further help to increase the coverage and the quality of digitally enabled public services, including through service delivery models adapted to low-connectivity environments. Lastly, the operation will establish the digital connectivity foundation that existing and future sectoral projects in the Madagascar portfolio can build on to develop appropriate digital solutions to maximize their impact. In particular, the project will collaborate directly with existing operations in the Social Protection, Education and Private Sector Development portfolios, extending these ongoing initiatives through complementary digital investments.

C. Proposed Development Objective(s)

The Project Development Objective is to expand access to renewable energy and digital services, and increase inclusion

Key Results (From PCN)

PDO-level Indicators:

Expand access to renewable energy services:
- People provided with new or improved electricity service (number)

Expand access to digital services
- Percent of population that is covered by a broadband cellular signal (3G+)

Increase digital inclusion
- Percent of the population using the internet (disaggregated by gender & urban/rural)

Intermediate indicators:

Energy:
- Enterprises provided with new on-grid/mini-grid electricity service (number)
- Households provided with new on-grid/mini-grid electricity access (number)
- Public facilities provided with new on-grid/mini-grid electricity service (number)
- Households and businesses provided with new off-grid electricity access (number)
- Number of public facilities provided with new or improved electricity access (number)
- Generation capacity of energy rehabilitated (Megawatts)
- Renewable energy generation capacity rehabilitated under the project (Megawatts)

Digital:
- People provided with new or improved broadband services under the project (number)
- Cost of 1GB of mobile data per month (US$, and as % of monthly GNI per capita)
- Public institutions benefitting from new or improved broadband internet services under the project (number, disaggregated by urban/rural)

- People provided with a broadband enabled device under the project (number, disaggregated by gender & urban/rural)
- People trained through digital skills programs under the project (number, disaggregated by gender & urban/rural)

Energy and Digital

- Private capital investment mobilized under the project (estimate, US$M)
- Newly built or upgraded infrastructure, under the project, that is resilient to climate-related shocks and follows energy efficiency and renewable energy standards (Percentage)

D. Concept Description

32. This project proposes a set of interventions to increase access to reliable and affordable energy and digital infrastructure and increase inclusion among underserved communities. The rationale for focusing on both energy and ICT sectors is because energy is an enabler of ICT and *vice versa,* while lack of access to one is a constraint on service deployment of the other, as noted above. This approach of combined energy and digital projects ("watts and bytes") has already been used to good effect in the *Sustainable Energy and Broadband Access in Rural Mozambique* project (P175295). The proposed project aims to maximize the positive impact on the poor, thereby supporting more equitable growth, and to boost resilience to future crises, with spillover benefits to mitigating climate change and promoting adaptation.

33. On the digital side, the project addresses both supply- and demand-side issues, with tailored incentives to encourage private sector deployment of mobile broadband infrastructure and services across uncovered areas. Given the remaining digital coverage gap in Madagascar, which is estimated to affect at least 6 million people living in rural and remote communities, this will require some level of public subsidy, as proposed in Sub-component 1.2, leveraging funds from this project as well as from the FDTIC. The much larger percentage of the population estimated to be affected by the usage gap (i.e., those that have coverage but do not use the service, for reasons of lack of affordability of devices, lack of skills, lack of relevant content etc.), which account for around 15.5 million people, are addressed in Component 2 and through the regulatory reform and technical assistance envisaged in Component 3. As a rough rule of thumb, the usage gap can be addressed by getting markets to perform more efficiently and by targeted interventions on devices and on digital skills and literacy, but the coverage gap requires hard infrastructure investments. While the most significant funding gap is the one related to the deployment and maintenance of broadband networks that support digitization, attention is thus also focused on demand-side interventions to boost demand to create the business incentive for further network roll-out and to stimulate adoption and productive use of digital technologies. One of the key principles underpinning the project is also that improving universal access and adoption of broadband and other digitally enabled services will require a strong push to ensure no one is left behind, hence a key focus on digital inclusion[21].

[21] Policy Paper Series No. 5 After Access: Paper No. 7 (2018) After Access 2018: A demand-side view of mobile Internet from 10 African countries https://researchictafrica.net/2019_after-access_africa-comparative-report/ April 2019.

34. On the energy side, to reach the maximum number of electrified households with the principle of least cost, the project aims at deploying a combination of technologies (i) Densification and extension of networks to extend the existing networks, notably the isolated grids of JIRAMA, and to increase the number of connected households in the already electrified regions, (ii) Mini-grids for regions that are too far from the existing grids and that need to benefit from their means of production given the high cost of interconnection, as well as (iii) Dissemination of solar kits for remote areas. To this end, the project aims to increase the share of renewable energy in the energy mix through the hybridization of JIRAMA's isolated grids while adding energy storage, the exploitation of renewable energy resources to supply rural areas as well as the improvement of the quality of service of operators. The project will be based on existing structures, including JIRAMA for the grids, the Ministry via ADER for the mini-grids, and the OMDF for the distribution of solar kits. These structures will be strengthened through the project.

35. Wherever feasible, the project will favor a private-sector led approach, utilizing locally driven, bottom-up initiatives wherever relevant. Realistically, in two sectors dominated by public ownership, this may not always be possible. But the focus of this project is on decentralized solutions. By prioritizing small scale initiatives implemented at the local level, the use off-grid/mini-grid power solutions in underserved areas, combined with cell-towers and community WiFi, then it should be possible to ensure that local communities are the driving force in locational decisions.

Component 1: Expanding Energy and Digital Access (US$130m)

36. This component is designed to mobilize significant investments of private capital to improve access to energy and ICT in underserved areas, thereby supporting efforts to improve service delivery and bridge the urban-rural divide. Increasing access to energy services is considered crucial for socio-economic development in Madagascar, especially in rural areas. Likewise, bringing more Malagasies online, by increasing internet access, would help in laying the foundations for reaping the digital dividends associated with greater technology adoption, for instance in services like online education, remote medical care, mobile money, digital delivery of government services etc. The philosophy of Private Capital Mobilization (PCM) and Private Capital Enabling (PCE) is consistent with the World Bank Group's approach to Green, Resilient and Inclusive Development (GRID).

Subcomponent 1.1: Hybridization and digitization of isolated grids

37. This subcomponent will support the hybridization of part of the 95 isolated grids currently operated by JIRAMA while some generation assets are managed by private sector. The total generation capacity of the 95 isolated grids is 116.MW, mainly thermal-based (diesel and heavy fuel): (i) generation assets of 38 isolated grids are managed by JIRAMA with a total capacity of 6.3MW; (ii) generation assets of 42 isolated grids are privately managed with a capacity of 48.2MW; and (iii) the generation assets of the remaining 15 isolated grids are jointly managed by JIRAMA and private sector with a total of 62.1MW. Generation costs for these isolated grids are extremely high putting addition burden on JIRAMA's financial situation. The isolated grids will be hybridized through the installation of a renewable power generation source (likely solar PV) and a battery backup at the selected sites, as well as, where appropriate, the upgrade and extension of the distribution networks and service drops. This is expected to improve the performance and reliability of the existing systems,

reduce the overall levelized cost of energy (by reducing dependence on expensive diesel fuel), expand access to surrounding households as feasible, reduce the environmental impacts, and increase the sustainability of the systems. A set of 45 sub-projects was already prepared by JIRAMA for a potential IPP tender in 2018 and further assessed during the preparation of the SREP Investment Plan, but never funded. Hybridizations of 19 isolated grids managed by the private sector are already underway. During preparation, the sub-projects will be reviewed and prioritized according to their technical, economic, social and environmental feasibility. For the completely publicly operated isolated grids, generation assets will be hybridized based on EPC contracts with extended operation and maintenance services provided by the contractor. During preparation, the team will explore opportunities for hybridizing the 23 remaining privately operated generation assets. Once the hybridizations have been carried out, network extension and densification operations would increase access to electricity.

38. The hybridization will be combined with the deployment of smart grid technologies that can better manage future growth in renewable energy supply through digitization. Smart metering, smart street lighting, distribution automation, and support for more advanced supervisory control and data acquisition (SCADA) will be considered, and the subcomponent will also include TA to support data analytics for more efficient (and greener) grid management. Benefits from modernizing the grid include improved operational efficiency (reduced losses, lower energy consumption, amongst others), reduced peak demand, improved service reliability, ability to accommodate distributed generating resources without adversely impacting overall power quality, improved asset utilization and workforce productivity improvement.

Subcomponent 1.2: Deployment of digital infrastructure in rural areas

39. This subcomponent aims to boost broadband connectivity and significantly reduce the digital divide through rural connectivity schemes. In addition to the measures to increase sector competitiveness and private network investment through regulatory and other 'soft' mechanisms (see Component 3), there is a need for more direct interventions to create incentives for the private sector to deploy infrastructure and close the digital divide between urban and rural populations, and this requires some level of public subsidy, leveraging funds from this project as well as from the FDTIC.

40. The scheme will extend data-enabled (4G or higher) network coverage to un- or under-served areas in targeted rural areas, with incentives to encourage private sector deployment of mobile broadband infrastructure and services. It will be informed by a mapping and feasibility study to identify priority coverage areas and explore how best to leverage public financing to crowd in the private sector to expand last-mile coverage. The project will seek to promote the most cost-effective connectivity options in different regions, with the private sector taking the lead. Possible options to propel last-mile infrastructure upgrades or investment in new greenfield sites include the use of public-private partnerships (PPPs) with competitive awards of subsidies to private actors (e.g., through least-cost subsidy "reverse auctions") to incentivize private sector financing and construction/upgrading of infrastructure. Under such a mechanism, the public authority, which might be the FDTIC or a local community office, will entrust one or several private sector partners with the construction, ownership, operation, and maintenance of the infrastructure, in return for a capital subsidy paid to the private sector operator or partnership. In principle, the public subsidy would apply only to the initial

capital expenditure (CAPEX) investment required for the capital investment.[22] Digital infrastructure would typically comprise relatively small cell towers[23], close to villages or serving dispersed population centers. The cell towers would house mobile broadband base stations providing fourth generation (4G) or, later, 5G services. Ideally, the towers would be connected to the backbone network by fiber optic cable, but this is unlikely to be viable in rural areas, so instead a mix of microwave or even satellite would be used for backhaul. Areas where there is currently no telecom and energy coverage (i.e., "greenfield" sites) will be targeted, while at a later stage, public subsidy interventions may be considered to assist operators in upgrading existing 2G cellular sites to 4G+ (i.e., "brownfield" sites). Only green energy solutions (solar or wind power and battery storage) will be used to power mobile networks and options will be explored for co-deployment of mini grids to power both towers and local communities simultaneously (See Subcomponent 1.3).

41. The modality to be used to implement the scheme will require some additional considerations to be explored further during project preparation. For instance, it may be appropriate to use disbursement conditions around this category of expenditure. An obvious disbursement condition would be the completion of the Open Access PPP manual that would guide the allocation of subsidies, but disbursement conditions may be extended to cover policy and regulatory issues, to ensure that the government has made progress in implementing certain of the reforms presented under Component 3 (e.g., open access or improved governance of the FDTIC). In addition, there would need to be mechanisms in place to ensure that access to infrastructure built with public funds is provided to all market players on the basis of open access, non-discriminatory conditions of service provision, and with fair pricing (with adjustments over time), which could include national roaming agreements[24]. Other features that could be included in the design include the adoption of suitable procurement approaches to determine how best to incentivize private sector investment, including the use of interactive auction platforms to optimize the best value in competitive bidding processes, and the use of geographical lots to ensure that not all contracts are going to the same actors. Competitive award processes may also be run in phases to ensure a learning from one phase to the next.

Subcomponent 1.3: Greenfield renewable energy mini grids

42. This subcomponent will finance the roll-out of mini-grids with local LV networks and powered by appropriate renewable energy resources (solar photovoltaic in combination with battery or hydro-electric), implemented through private sector led approaches based on a pipeline of pre-identified sites leveraging geospatial planning. In line with the goals and ambitions of the Government, the subcomponent will support

[22] However, an implicit subsidy to operation expenditure (OPEX) may be applied, for instance through the use of *Pay or Play* mechanisms that allow an operator to reduce its contribution to the FDTIC, or other indirect forms of subsidy, such as a waiver of spectrum fees or local taxes on revenues generated in the areas designated as uneconomic.

[23] An alternative approach would be to use very tall towers (~250m) covering much larger areas of up to 40 km radius. So-called "SuperCell" technology is still largely experimental and is appropriate for relatively flat terrain with dispersed rural populations. The tall tower could be substituted by a tethered balloon, a drone or a constellation of low-earth orbit satellites. The feasibility of such innovative technological approaches may be considered, but it is thought unlikely to be economic in rural Madagascar.

[24] Under "national roaming agreements", the operator that won the subsidy may be given an initial period of exclusive service provision (say for 2-3 years) but thereafter must offer service to other operators without a requirement to pay roaming charges and/or must allow other operators to use the cell tower to accommodate their own base stations. In circumstances where the subsidy is won by a cell tower operator, rather than an operator directly, this may be the natural outcome.

demonstration of private sector-led approaches to leverage local and international private sector financing for mini-grid scale-up. The bidders will bid based on a minimum CAPEX subsidy or a fixed per-household subsidy amount needed to meet the difference between the developer's cost of system installation and O&M and the tariffs that can be charged based on consumers' affordability at the selected sites. Sites will be prioritized according to a set of economic parameters, including total population, population density, local demand profile (number of schools, health centers, households, SMEs) and potential for productive uses, such as agricultural and industrial demand centers. The investments will also incorporate productive uses programs to stimulate rural economic growth alongside the delivery of first-time electricity services in the targeted geographical areas. The World Bank has financed feasibility studies for 10 mini-hydroelectric sites through the ESOGIP project. One of the main conclusions was that the profitability of those projects cannot be ensured without subsidies on the CAPEX. DECIM project would study best business models to improve the financial viability of these projects. In addition, the project could study the possibility of setting up credit lines, notably through a window at the level of the OMDF, allowing the financing of mini grids. Concrete actions on gender equality will also be taken under this component focused on enhancing productive uses of energy for women-led businesses and closing gaps in opportunities for employment for women in the mini-grid sector.

43. Where feasible, digital infrastructure (under Subcomponent 1.2) and the mini grids may be deployed in tandem. For instance, the mini-grids would be co-located with the cell towers, with the idea that the towers would serve as the anchor tenant for the mini-grid. During preparation, the team will conduct preparatory studies to evaluate the feasibility of a joint approach, including investigation of likely private sector partnerships arrangements, for instance between energy specialists and cellular operators, or between commercial and community institutions as well as a strategy for supporting joint deployment of energy and infrastructure in rural areas. The use of thematic lots to ensure coordination between award of energy supply subsidies and cellular service subsidies could be considered. In other words, a single bidding process with multiple lots would be used to encourage bidding partnerships that bring together both energy and digital service providers.

44. Sites for Subcomponents 1.2 and 1.3 will be prioritized according to a set of economic parameters, including total population, population density, current coverage of energy and digital services, local demand profile (number of schools, health centers, households, SMEs) and potential for productive uses, such as agricultural and industrial demand centers. An initial screening as part of the geospatial assessment financed by the World Bank in 2021 has demonstrated potential for the rollout of approximately 146 hydro and 3819 solar PV mini grids (ranging between 52-125 MW and 152-430 MW, respectively). Experience and lessons of the existing 145 mini grids managed by ADER will also be taken into consideration. During preparation, the team will carefully assess the potential implementation arrangements including identification of the contracting agency for the mini-grid tenders.

Component 2: Enhancing Energy and Digital Inclusion (US$85m)

45. This component aims to accelerate uptake by addressing demand-side barriers that hamper digital and energy access, so as to increase digital inclusion of underserved communities, while maximizing synergies between the two sectors. Supply-side interventions and network infrastructure alone will not drive broadband to scale. The creation and boost of demand for broadband services and products are equally crucial to increase

usage and expand socio-economic benefits. Interventions will improve access to affordable ICT devices bundled with off-grid electricity solutions, which can help move users over to mobile broadband networks. This sub-component will also boost the digital literacy of the Malagasy consumer base to enable basic usage of smart mobile devices, digital applications, PAYGO solutions for energy services and help tackle Madagascar's basic digital skills gap. The proposed interventions will seek to close spatial- and gender-related gaps to actively support greater inclusion. Particular attention will be given to ensuring that the most impoverished communities, in remote areas, are prioritized, as well as persons with disabilities and other and marginalized groups. The target areas for this subcomponent would be those areas where infrastructure has been deployed under Component 1, as well as areas already covered by telecommunication services but where adoption of services is low (e.g., peri-urban areas/secondary cities where the usage gap is high).

Subcomponent 2.1: Off-grid solar and digital devices for underserved communities and marginalized groups

46. This activity aims to accelerate uptake by addressing demand-side barriers that hamper digital and energy access, while maximizing synergies between the two sectors. Particular attention will be given to ensuring that the most impoverished communities, in remote areas, are prioritized, including women, the elderly, persons with disabilities and other marginalized groups. This subcomponent will promote access to ICT devices bundled with off-grid electricity solutions (e.g., solar lamps paid for using mobile money credit, solar chargers for mobile phones). The objective here is address access to finance and other constraints preventing the accelerated growth of the digital device and off-grid solar markets in Madagascar, including the need for tenor-matched working capital, PAYGO (that is, lease-to-own or rental) cost recovery support, support for expanding customer engagement and distribution footprints, and limited affordability given low purchasing power.

47. The LEAD project has already set up the Off-grid Market Development Fund (OMDF) which supports a series of financial mechanisms targeting the most critical enterprise development bottlenecks identified through the off-grid market assessment, and which enable OGS companies and MFIs to extend credit and sell OGS products to households and micro, small, and medium enterprises. However, the OMDF has not reached the most remote areas in Madagascar due to affordability constraints.

48. The subcomponent will expand the OMDF by adding financing windows (such as results-based financing, end consumer subsidies and others) targeted at the poorest consumers outside of main and isolated grid areas and including an appliance window focusing on financing end-user appliances with specific focus on ICT devices (laptops, tablets, smartphones). This could involve, for instance, creating a window for enabling scale-up of ICT devices and Off-Grid Solar (OGS) product sales on a PAYGO basis, and an additional window for results-based financing to distributors for the sale of devices/products in remote areas. During project preparation, the team will review how OMDF was able to support PAYG providers, understand limitations and consider inclusion of specific incentive schemes, e.g., through RBF. In addition, the OMDF eligibility criteria will be reviewed to understand how non-OGS companies, e.g., telecommunication operators interested in offering financing schemes for OGS (e.g., Orange, Telma) could be included. The team will also

explore whether to expand ownership of smart devices through subsidies and/or innovative asset-financing and guarantee schemes to facilitate the purchase of ICT devices by lower-income households[25].

Subcomponent 2.2: Digital literacy and awareness

49. This subcomponent will aim to accelerate broadband uptake by improving digital awareness, literacy and skills. Digital literacy courses will be provided for the general population – with an emphasis on young people and marginalized groups (such as women and girls, the elderly, the disabled). Training courses will be designed to enhance basic digital literacy capabilities to enable beneficiaries to confidently "get connected" and gain entry-level user skills allowing them to access digitally enabled services and take advantage of digital technologies. The following design features will be considered for inclusion: (i) specific modules on financial inclusion and PAYGO models for energy services and workplace or commerce use cases; (ii) a focus on task-based learning and the use of applications relevant to end-users; (iii) training for potential "digital ambassadors" who can impart digital skills and raise awareness at the community level; and (iv) leveraging the scheme as a platform for creating job opportunities for digital-savvy young people. Courses will be delivered in local languages, and curricula and approaches tailored to distinct user groups. A gender-sensitive approach will be applied to ensure accessibility and relevance to women. Likewise, considerations will also be made to support learning needs for elderly persons and persons with disabilities.

50. The training program will be complemented by a national awareness-raising campaign that will be deployed to enhance awareness about digital services and the opportunities they enable and build trust in digital services. Attractive, language-specific content tailored to rural communities will be developed as well as an awareness program tailored to women to increase access to information and combat social norms and cultural barriers that prevent them from using digital tools.

Subcomponent 2.3: Off-grid solar and broadband connectivity for public institutions, including schools and health centers

51. Under this subcomponent, provision of OGS and broadband connectivity services will be targeted for specific clients within unconnected/underserved municipalities, such as schools, health centers, post offices, and other public service points. A study and pilot on broadband connectivity for municipalities will be carried out as part of PRODIGY and will be scaled-up under this project. In addition, the project will build on the experiences during LEAD in providing lighting, refrigeration, sterilization, and other services through OGS. Indeed, through LEAD, 500 health centers are being electrified. This experience allowed the teams to develop an organized approach to deploying off-grid solutions from a logistical perspective. Also, a customer base has been developed and can be used for the deployment of other access solutions, for example the Internet. This experience also made it possible to address the problem of operation and maintenance which will be reviewed during the preparation of the Project. The objective is to improve local capacity for digital public service delivery. This will be conducted through a competitive, market-based approach, whereby the Government is purchasing digital connectivity and OGS, under long-term supply agreements. The advanced bulk purchase of capacity and/or services contract for internet connectivity and enterprise services, and energy services would be carried out for specific clients, as mentioned above, but will benefit from aggregation of demand to achieve the best possible value. On the digital side, this will also include support for upgrading local area networks to reliably

[25] The activity will be informed by an ongoing global study on device affordability and a related pilot program in a number of African countries funded by the Digital Development Partnership (DDP) Trust Fund.

connect end-users and network maintenance training to technical personnel at connected institutions. Those public institutions that serve the largest number of inhabitants and thus have the highest suppressed energy and broadband demand will be prioritized, as well as those with the lowest likelihood of receiving grid or mini-grid connections in the medium to long term.

52. To further help connect the unconnected, the project will also support public access through the expansion of last-mile connectivity for community access points. The project will finance the advanced bulk purchase of connectivity services that will be outsourced to the private sector and the financing of devices (e.g., laptops). Citizens will equally benefit from publicly funded WIFI hotspots and charging points at connected locations to stimulate internet usage. Emphasis will be placed on simplicity of execution, low costs, sustainability and locally driven design, with the development of a business model so that facilities and equipment can be maintained, and operational costs covered, e.g., by partnering with local private sector actors, by working with local champions or digital ambassadors, by charging for specific services, such a phone charging or delivery specialized technical training courses etc.

53. Long-term services contracts are expected to support the business case for private sector investment in infrastructure needed to provide the required services to public institutions while also lowering the costs and risks of providing those services. Interventions are expected to further incentivize private sector network investment, as the public institutions will serve as anchor customers for wider geographical service provision. In particular, it is expected that the private sector will invest in new/upgraded middle mile backbone links and access networks in areas throughout the country where it does not yet currently exist. Thus, public subsidies targeted at specific community institutions benefit the network and its users as a whole.

Component 3: Supporting the Enabling Environment for Digital and Energy (US$25m)

Subcomponent 3.1: Support for digital sector reforms

54. This subcomponent will support the adoption and implementation of fast-tracked, deep reforms in the digital sector. Liberalization of digital infrastructure combined with independent and effective sector regulation is the starting point for inclusive telecommunications and internet access. They are needed to allow private sector players to compete on a level playing field to provide high quality access at the best price, and to encourage investment in digital infrastructure. This involves both improving the legal and regulatory framework and strengthening the capacity and independence of the regulator to implement effective regulation. In addition, the FDTIC can be an effective tool to improve digital access and adoption, but only if its governance and performance are improved. Overall, this subcomponent will seek to establish an enabling environment conducive to the development of a more competitive and dynamic telecom/broadband market, offering both extensive network coverage and the provision of affordable, high-quality commercial services, in support of universal digital access goals. This would complement and eventually supersede support currently provided under the PRODIGY project. Interventions may include:

a) **TA to support the revision of the legal and regulatory framework** with a focus on (i) removing constraints and exclusivities on the construction and commercialization of digital infrastructure, most notably the fiber optic backbone, to ensure that all operators have equal rights across the value chain;

(ii) addressing in the legal and regulatory framework issues of competition, Significant Market Power (SMP) and open access to guarantee open and competitive access to infrastructure and fair wholesale tariffs; (iii) revising the licensing framework and removing barriers to entry for additional players in specialized market segments, such as facility-based internet service providers; (iv) promoting national roaming agreements to stimulate more efficient investment in underserved areas; and (v) strengthening customer protection and promotion of user interests.

b) **TA to strengthen ARCEP**, so that the regulator is better resourced and is armed with effective enforcement powers – with an emphasis on (i) definition of SMP in specific market segments; (ii) the regulation of wholesale rates and conditions, where justified, including an assessment of upstream wholesale markets and wholesale prices, ensuring non-discriminatory access to network infrastructure and interconnection services; (iii) enhanced and modernized spectrum allocation and management; (iv) monitoring of operator obligations (coverage, quality of service); and (iv) enhanced market analysis capabilities, including data collection and information dissemination.

c) **TA to strengthen FDTIC**, so that the Fund can truly play its role in expanding access to ICT, with a focus on (i) ensuring the transparency of financial statements and developing appropriate accountability procedures for allocating, managing, and reporting on the use of universal access funds; (ii) developing more substantial incentives for efficient deployment and/or innovation, for example through a Pay-or-Play mechanism, whereby operators can decide to provide either financial contributions to the fund or in-kind contributions by implementing projects in commercially unattractive areas, thus reducing the risk that funds levied through the FDTIC will not be disbursed; (iii) revising the FDTIC's mandate to focus on increasing digital inclusion.

d) **An options and impact assessment of policy and regulatory strategies to improve digital device affordability**. The TA would look into sector taxation, but also at other options, such as development of a secondhand market and local assembly of mobile phone kits that could be exempted from excise taxes.

e) **TA to promote the pooling and sharing of infrastructure across sectors** to reduce deployment costs across the technical value chain, to optimize investment, especially in rural areas, and to enable access to other the telecom infrastructure of other utilities.

Note: Data protection/privacy and cybersecurity aspects are covered under PRODIGY.

Subcomponent 3.2: Support for energy sector reform

55. This activity will finance targeted reform support for advancing the energy reform program, including technical assistance to JIRAMA to assist the utility's path towards financial and operational performance improvement and strengthening the other sectoral institutions. The reforms in the energy sector relate essentially to the revision of the texts in force which should give more comfort to private sector investments in all activities in the sector and in particular in activities which affect both the energy sector and that of telecommunications. As such, actions are planned at the level of each institution.

a) TA to support the Ministry of Energy:

- TAs will be conducted to set a moratorium for new PPAs that are outside the LCDP. Indeed, to allow a coherent development of the sector, the LCDP and the geospatial analysis have clearly defined the projects to be launched. It is important to stick to the plan.

- Reforms relating to the improvement of the governance of JIRAMA will be carried out by the supervisory authority, in particular governance options of the company (affermage, management contracts, …)
- Similarly, a strategic reflection will be launched by the Ministry to give the regulator and the rural electrification agency an effective place in the sector. A development plan for these institutions is essential

b) TA to support JIRAMA

- Several areas of reform have been identified within the framework of the project. Revision of JIRAMA's connection policy, currently focused on social connection to extend to classic connection
- Options assessment and TA to enable JIRAMA to better manage and commercialize its fiber network on a wholesale, open-access basis to support the lower-cost deployment of broadband services and last-mile infrastructure throughout the country, to create incentives and to generate additional revenue for JIRAMA, including considerations for changes to the legal and regulatory framework needed to allow this.
- Technical support for renewable energy IPPs: Support could include: (i) preparation of standardized bidding documents and power purchase agreements; (ii) grid integration studies; (iii) transaction advisory services; (iv) studies to identify risk mitigating instruments; etc;
- Increase hydroelectric production by ensuring (i) the maintenance and general overhaul of existing hydroelectric plants (Andekaleka, Mandraka, Antelomita...), and (ii) the regularization of contracts for new plants such as Mahitsy.
- Put in place a moratorium on hiring at JIRAMA (outside dedicated "YP" program on Engineering and commercial services)
- Support self-production of energy in partnership with the private sector to develop renewable energies and accelerate the hybridization of isolated grids. (Including Scaling solar)

c) **TA to support ADER**

A study can be conducted to analyze financing options for rural electrification operators, including through the establishment of credit lines or performance-based financing. Other studies could be conducted such as: transaction advisory for mini grids; Support for productive uses of energy; Capacity building for planning and data collection.

d) **TA for the R (ARELEC) ;**

The structure has a significant need for capacity building: Pricing on wholesale & retail markets; mechanisms for indexation & adjustment of tariffs; formalized mechanism for processing regulatory information between the Regulator and JIRAMA; Development of Tariff Approval tools.

Subcomponent 3.3. Enabling environment for enhanced climate change adaptation and mitigation

56. Both the energy sector and the digital sector are major generators of greenhouse gases (GHG), but equally they can be part of the solution for climate change adaptation and mitigation. Renewable energy sources can significantly help to reduce GHG emissions and achieve climate protection. Likewise, greater use of digital technologies can substitute for the physical movement of people and goods, hence reducing GHG

emissions. In addition, transitioning towards economy-wide digital transformation will be a key driver of improved resilience and adaptation through enhanced and uninterrupted access to basic services and public assistance in times of emergencies, continuity of critical communications and commerce and supporting a transition away from natural resource intensive and climatically vulnerable sources of growth and job creation. This subcomponent will thus place an emphasis on investments in climate-smart infrastructure and capacity building that help increase response capacity and reduce Madagascar's climate footprint. Interventions may include:

a) **TA to streamline the inclusion of resilience of infrastructure in emergency situations and GoM's responsiveness capacities**. This may be done through better integration of climate data and risk analysis into digital and energy infrastructure planning and deployment. For energy and digital infrastructure, such as cell towers, the development and implementation of climate-related standards will increase its robustness and redundancy.
b) **TA to finalize standards for climate-resilient energy and digital infrastructure**. A first draft to a policy guideline to incorporate relevant international standards into domestic regulation had been started in 2017, but further work is required to finalise and implement this.
c) **TA to help relevant authorities draft technical and design specifications for the tenders under the project that factor in climate data, climate-induced risks, and resilience measures.** Bidders will be required to have protocols to ensure infrastructure robustness and a contingency plan in the event of a flood or storm.
d) **TA to support the development of a Green ICT strategy** to (i) minimize the climate and environmental impact of ICTs, e.g., such as through green data centers; and (ii) leverage digital technologies to reduce the climate and environmental impact of the overall economy, and to enhance resilience to health and climate related shocks.

Component 4: Project Management and Implementation Support (US$10m)

57. The Component will support project management and implementation functions and strengthen the GoM's coordination and management capacity. This includes operating and staff costs of the planned project implementation unit (PIU) and the recruitment of expert consultants in key areas, such as project management, procurement, and financial management (FM), environmental and social (E&S) management, as well as technical specialists relevant to the various project components. It will also include support for inter-ministerial and stakeholder coordination efforts, to be conducted through a project steering committee (PSC) as well as citizen engagement and communications. This component will also include a number of TAs targeted at filling knowledge gaps (surveys, market and impact assessments, options analyses) in support of implementation of investment components, e.g., a demand-side survey on the barriers to digital adoption.

Component 5: Contingent Emergency Response Component (US$0 million: to be capitalized in the event of an emergency)

58. The objective of this component is to support the GoM's response in an eligible emergency. The component will be governed by paragraph 12 of the World Bank Policy on *Investment Project Financing (Rapid Response to Crises and Emergencies)*. If an eligible emergency is being declared, the GoM may request the World Bank to reallocate project funds to support the response effort. The component would be capitalized by drawing

on unused (or uncommitted funds) under Components 1 to 4. The component could also be utilized for processing additional financing should funding for this become available due to an eligible emergency.

Beneficiaries/targeting:

59. The following beneficiaries will be targeted through the project interventions:

- **The project's main beneficiaries are households, SMEs, health centers and schools that currently have extremely limited access to affordable and reliable power sources and digital affordability and access. They will gain access through the project.** Beneficiaries will benefit directly from electricity access in their premises and indirectly through improved access to economic opportunities and public services that come with electrification. Likewise, the population residing in historically underserved areas, including lagging regions in the southern parts of the country, will have increased access to broadband networks and services through which to access digital communications and other digitally enabled services and livelihoods opportunities. Targeted individuals will also benefit from wider opportunities to access digital services through activities that promote digital access and inclusion. These include individuals accessing digital literacy training and receiving support to acquire an ICT device, and those residing near connectivity access points. Youth, women and girls, persons with disabilities and other marginalized and vulnerable groups are specifically targeted, with gender and location disaggregated data used to track progress.

- **The private sector will benefit significantly, both directly and indirectly from the project.**
  - On the energy side, under Components 1 and 2, contractors providing infrastructure services may qualify for additional contracts, while SMEs that receive grid connections will benefit from lower-cost electricity service (relative to diesel generators). Purveyors of the OGS systems for households, SMEs, and institutional applications will also be supported in a variety of ways, allowing them to grow their businesses. Meanwhile, off-grid SMEs could benefit from off-grid energy services that are both cheaper and more reliable than alternatives.
  - On the telecom side, targeted businesses will directly benefit, including telecommunications companies, IT services and equipment providers and digital skills providers contracted under various project activities. The telecommunications sector more broadly, including smaller local internet service providers (ISPs) will broadly benefit because the project will enable a reduction in the costs of network deployment and development of more competitive markets, and boosted consumer demand for broadband and other digital services.

60. While the project will have a national approach, some interventions will be more geographically focused and will involve prioritization of underserved areas. The selection of sites to be included in the project is a critical element in its success, and it will be important to develop an objective and easy to apply methodology to avoid the danger of selecting sites on the basis of political patronage. Some activities will require prioritization in areas with lower energy and digital connectivity and higher needs for interventions to address demand-side barriers, primarily located in lagging regions in the southern regions of the country (based on the mapping activities envisaged under the preparatory studies). Rural connectivity programs will target areas with market failures - where there are gaps in coverage, while digital inclusion programs (devices, digital skills) will also include poor secondary cities and peri-urban areas along growth corridors - where there is a large usage gap and a large concentration of poor people who could benefit from new economic opportunities through digital

technologies, i.e., areas that have a high potential to stimulate growth. Regardless of the geographical area, the project will seek to actively address the digital and energy inclusion of vulnerable or marginalized populations through proactive targeting of these groups and a granular approach to beneficiary selection, differentiated by region, which will be informed by a number of feasibility studies. The spatial targeting methodology will be based on geo-spatial analysis to identify key priority locations based on need/demand and impact potential to maximize the catalytic impact of investments. It will be aligned across certain activities (e.g., villages where schools could be connected under subcomponent 2.3 will be prioritized for the rural connectivity schemes under 1.2) where possible to maximize synergies.

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

Summary of Screening of Environmental and Social Risks and Impacts

The environmental and social risk classification (ESRC) is substantial. The relevant standards that have been identified via the environmental and social risk screening at concept stage of the project are: ESS1: Assessment and Management of Environmental and Social Risks and Impacts; ESS2:Labor and Working Conditions; ESS3: Resource Efficiency and Pollution Prevention and Management; ESS4: Community Health and Safety; ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement; ESS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources ESS8 Cultural Heritage; ESS10: Stakeholder Engagement and Information Disclosure.

Environmental risks and impacts. The Environmental Risk Rating has been determined as ?Substantial? mainly due to key environmental risks and impacts stemming from Component 1, that are associated with community health and safety risks, the transmission of communicable diseases such as COVID-19, environmental pollution risks are associated with transportation, installation, storage, operation, and disposal of solar panels. The civil works construction of local small-medium-infrastructure are associated with community health and safety concerns and other OHS related issues with the use of vehicles, construction equipment, and machinery to direct and indirect contracted workers. However, substantial impacts are expected such as: activities associated with ESS2 related to OHS for different types of workers, ESS3 related environmental pollution, ESS4 related community health and safety, as well as ESS6 related biodiversity loss, clearing of habitats, and potential damage to ecologically sensitive areas, natural and/or critical habitats, and ESS8 related potential damage to cultural heritage, not yet reported. In addition, it is noted a low institutional capacity of the Ministries stemming from the unfamiliarity with the new Environmental and Social Framework and the key environmental risks and impacts related to: (i) solid waste from the construction phase, (ii) management of waste of electrical and electronic equipment (WEEE) and hazardous waste including end-of-life batteries, (iii) community health and safety risk, (vi) noise and vibration caused by generators, and (vi) downstream impacts likely to be generated by TA activities
However, preliminary screening of the project shows that it does not include activities associated with potentially

significant and irreversible negative environmental risks and impacts through the implementation of established mitigation measures.

Social risks and impacts. The social risk rating (SRR) for this project is considered to be substantial. The project activities will largely benefit the population as it aims to provide new and/or improved electricity and broadband services. Project interventions may include (i) several technical assistances to establish an enabling environment for improved digital access and maximizing synergies between energy and digital; (ii) public subsidy funds for private sector to co-deploy digital infrastructure and green energy solutions; (iii) Purchasing digital connectivity and energy services; and (iv) various capacity buildings activities. The anticipated social risks and impacts of the project are expected to be temporary and reversible. However, potential social risk identified at this stage relates to potential economic and physical displacement resulting from the component 1 which includes the construction/upgrading of digital infrastructure and installation of IT equipment to expand broadband connectivity to rural areas and e-waste management with associated potential civil works leading to safety and health hazards for workers and communities. Other main risks that may induce by the project activities are (i) the gaps between digitally included and excluded people are possibly widening for some groups such as poor or low-income household members, people with disabilities, elderly, people with lower education or no digital literacy, and herders living in remote areas. However, these can be mitigated through a robust and inclusive stakeholder engagement process which will be developed by the project and the TA interventions under component 1 and 2 which will help the vulnerable groups to ensure their equitable participation and that design training programs suit their needs; (ii) risks related to health and safety of workers to be hired by the project or the private operators; and (iii) labor influx risks including sexual exploitation and abuse/sexual harassment (SEA/SH) and exposure to COVID-19 induced by the civil works but also due to the hiring of many enumerators for the ICT household survey under component 1. Moreover, based on the available information at this stage, it is not certain that the future Project Management Unit (PMU) will have environmental and social risk management capacity especially on the ESF, but the project will ensure that the PMU will have environmental and social safeguard specialists and implement ongoing capacity building trainings for project staff.

Mitigation and risk management. To limit these risks, the project needs to develop and to disclose by appraisal (i) the Environmental and Social commitment plan (ESCP) which could be adjusted during the project life keeping with the evolution of environmental and social risk and impact; (ii) an inclusive stakeholder engagement plan (SEP) that will list the training sessions to be included in the capacity-building programs ; (iii) an Environmental and Social Management Framework (ESMF) given that the exact locations of the activities are not yet well identified, The ESMF will include: (i) Resource Efficiency & Pollution Prevention and Management Plan, water pollution, air pollution and others; (ii) Chance Finds Procedures; (iii) Environmental and Social Impact Assessment; (iv) Occupational Health and Safety Plan (including for COVID-19); (v) Community Health Plan (including for COVID 19) and an Electrical and Electronic Waste Management Plan (EEWMP) (iv) a Labor Management Procedures (LMP) which will be used to manage labor related risks.; (v) a Resettlement Framework (RF) to capture the scope of mitigation measure retaliated to involuntary resettlement; and (vii) an accessible grievance mechanism (GM).

Safeguard monitoring. The Monitoring and Evaluation (M&E) systems of the project will include monitoring of Environmental and Social (ESS) impacts and measures. The PIU as the implementing agency for the project, with the guidance of its environmental and social specialists and with support of World bank E&S team, will be responsible for the preparation of the relevant Environmental and Social Assessment documents, or other appropriate E&S tools. Monitoring checklists will be prepared based on mitigation plans.

Social inclusion, gender equality and citizen engagement. In accordance with corporate directives on citizen engagement (CE) in IPF projects, the project will emphasize approaches that maximize outreach and participation of communities and broader public awareness of project activities. In addition to at least one indicator monitoring progress on CE, the project

will also develop specific activities to solicit beneficiaries? feedback and maximize stakeholder engagement. To this end, specific activities will be outlined in the Stakeholder Engagement Plan (SEP). In accordance with the Environmental and Social Standard (NES10) and the guidelines for citizen involvement in projects throughout the preparation and implementation processes, the project will further promote citizen participation and the establishment of a process for processing community feedback. These aspects will be included in the Stakeholder engagement Plan (SEP), which will also include the establishment and operationalization of a project Grievance Redress Mechanism (GRM). The definition of specific related indicators will be identified during the design phase of the project. In addition, the project will develop and implement a robust Grievance Mechanism (GM) to ensure that any feedback will generate a timely and comprehensive response, and where needed, an acceptable resolution by the project.

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