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ECUADOR

MODERNIZATION AND RENEWAL PROGRAM FOR ECUADOR'S POWER SYSTEM

(EC-L1231)

LOAN PROPOSAL

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REQUIRED

1. Multiyear execution plan and annual work plan
2. Monitoring and evaluation plan
3. Environmental and social management report (ESMR)
4. Procurement plan

OPTIONAL

1. Economic analysis of the program
2. Program compliance with the Public Utilities Policy (document GN-2716-6)
3. Gender annex
4. Technical feasibility report
5. Environmental and social studies
6. Environmental and social analysis
7. Environmental and social management framework (ESMF) and environmental and social management plan (ESMP)
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ABBREVIATIONS

AIFk	Average interruption frequency per installed kilovolt-ampere
CHC	China Cofinancing Fund for Latin America and the Caribbean
EDC	Electric distribution company
ESMP	Environmental and social management plan
ESMR	Environmental and social management report
kVA	Kilovolt-ampere
MEER	Ministry of Electricity and Renewable Energy
MEF	Ministry of Economy and Finance
MERNNR	Ministry of Energy and Nonrenewable Natural Resources
MVA	Megavolt-ampere
PMU	Program management unit
SCADA	Supervisory Control and Data Acquisition
SNI	Sistema Nacional Interconectado [National Interconnected System]
TITk	Total interruption time per installed kilovolt-ampere

PROJECT SUMMARY
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<table>
<tr><th colspan="5">Financial Terms and Conditions</th></tr>
<tr><td colspan="3" rowspan="2">Borrower: Republic of Ecuador</td><td colspan="2">Flexible Financing Facility[a]</td></tr>
<tr><td>Amortization period:</td><td>25 years</td></tr>
<tr><td colspan="3" rowspan="2">Executing agency: Ministry of Energy and Nonrenewable Natural Resources (MERNNR)</td><td>Disbursement period:</td><td>5 years</td></tr>
<tr><td>Grace period:</td><td>7.5 years[b]</td></tr>
<tr><td>Source</td><td>Amount (US$)</td><td>%</td><td>Interest rate:</td><td>LIBOR-based</td></tr>
<tr><td rowspan="2">IDB (Ordinary Capital):</td><td rowspan="2">100,000,000</td><td rowspan="2">74</td><td>Credit fee:</td><td>[c]</td></tr>
<tr><td>Inspection and supervision fee:</td><td>[c]</td></tr>
<tr><td>Local:</td><td>35,000,000</td><td>26</td><td>Weighted average life (WAL):</td><td>15.07 years</td></tr>
<tr><td>Total:</td><td>135,000,000</td><td>100</td><td>Approval currency:</td><td>U.S. dollars (US$)</td></tr>
<tr><th colspan="5">Project at a Glance</th></tr>
<tr><td colspan="5">Project objective/description: To help modernize and improve the reliability and capacity of Ecuador's power system by (i) automating, renewing, and repowering electrical equipment in the National Transmission System and National Distribution System to make the National Interconnected System (SNI) more reliable; and (ii) strengthening the planning and management of the SNI to facilitate its capacity for expansion as well as improve the quality and reliability of service delivery.</td></tr>
<tr><td colspan="5">Special contractual conditions precedent to the first disbursement of the loan proceeds: (i) signature and entry into force of a subsidiary agreement between the Ministry of Economy and Finance (MEF) and the executing agency, indicating the period in which the proceeds from the loan and the local counterpart contribution will be recorded in the corresponding area for the program and transferred to the electric distribution companies (EDCs) and Transelectric and that they will be used pursuant to the agreed upon conditions and purposes; (ii) approval by the MEF of the contract guarantees and transfers (release) for the activities included in the initial procurement plan, including the relevant multiyear certifications; and (iii) approval and entry into force of the program Operations Manual, including the financial management procedures, and, as an annex thereto, the environmental and social management plans for the sample projects and the program's environmental and social management framework, in accordance with the terms and conditions previously agreed upon with the Bank (paragraph 3.3).
Special contractual conditions of execution: (i) prior to the use of the resources for Component 3, related to the institutional strengthening program for energy analysis and prospective studies, the executing agency will present, for the Bank's no objection, the investment plan and execution schedule, identifying the final scope of the activities to be performed; and (ii) prior to the transfer of the program resources from the executing agency to the EDCs and Transelectric, the recipients will have signed an interinstitutional agreement with the executing agency establishing the obligations of the parties under the program, including the obligation to carry out their respectively assigned activities under the loan contract and the program Operations Manual, as well as the obligation of the EDCs and Transelectric to open a special bank account solely for the loan proceeds and to submit any information required of them (paragraph 3.4).
In addition, see the special environmental and social contractual conditions in Annex B of the Environmental and Social Management Report (ESMR).</td></tr>
<tr><td colspan="5">Exceptions to Bank policies: None.</td></tr>
<tr><th colspan="5">Strategic Alignment</th></tr>
<tr><td colspan="2">Challenges:[d]</td><td>SI ☑</td><td>PI ☑</td><td>EI ☐</td></tr>
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</table>

[a] Under the Flexible Financing Facility (document FN-655-1), the borrower has the option of requesting changes to the amortization schedule, as well as currency and interest rate conversions. The Bank will take operational and risk management considerations into account when reviewing such requests.

[b] Under the flexible repayment options of the Flexible Financing Facility, changes to the grace period are permitted provided that they do not entail any extension of the original weighted average life of the loan or the last payment date as documented in the loan contract.

[c] The credit fee and inspection and supervision fee will be established periodically by the Board of Executive Directors as part of its review of the Bank's lending charges, in accordance with the applicable policies.

[d] SI (Social Inclusion and Equality); PI (Productivity and Innovation); and EI (Economic Integration).

[e] GD (Gender Equality and Diversity); CC (Climate Change and Environmental Sustainability); and IC (Institutional Capacity and Rule of Law).

I. DESCRIPTION AND RESULTS MONITORING

A. Background, problems to be addressed, and rationale

1.1 The Ecuadorian government has undertaken an ambitious transformation of the country's electricity subsector. As a result, over the past 10 years and with an estimated investment of more than US$11 billion, a subsector characterized by infrastructure deficits and organizational inefficiency has developed into an operationally robust, self-sufficient, and stable system. This has allowed the government to focus its activities on sustainable service delivery at high levels of quality and coverage.

1.2 The advances achieved in the last decade were primarily due to the effective and timely execution of the Electricity Master Plan,[1] the main planning tool of the electricity subsector. The Electricity Master Plan is periodically updated and consists of the following operational instruments, all of which require mandatory compliance: (i) generation expansion plan; (ii) transmission expansion plan; and (iii) distribution expansion plan. The Electricity Master Plan is aligned with the goals set forth in the Intended Nationally Determined Contribution under the Paris Agreement, aimed at increasing the share of renewable energy sources in the country's power generation matrix and replacing the use of liquefied petroleum gas in the residential sector.

1.3 The cornerstone for the subsector's renewal was the implementation of the power generation plan, which prioritized the development of generation projects using natural resources. This doubled the installed capacity for renewable electricity output, predominantly through hydroelectric projects, raising renewable power generation from 58.2% of the total in 2007 to 85.5% of the total in 2017, and diversifying the risk of a lack of electricity supply due to drought by building hydropower plants in hydrologically complementary basins and watersheds.

1.4 Works identified in the power transmission plan and power distribution plan were implemented for timely and efficient evacuation of the energy generated in the new hydropower plants. These works were designed to strengthen the National Interconnected System (SNI),[2] incorporating new projects and works that have made it possible to expand the National Transmission System and improve the system's topology, boosting its operational efficiency. This included: (i) improving the service quality indicators, namely average interruption frequency per installed kilovolt-ampere (AIFk), which went from 18.00 faults/year in 2011 to 5.09 faults/year in 2017, and total interruption time per installed kilovolt-ampere (TITk), which went from 19.25 hours/year to 5.01 hours/year over the same period, reinforcing system reliability and stability; (ii) reducing the electricity loss rate in the National Distribution System from 21.4% in 2007 to 11.7% in 2017; and (iii) increasing the nationwide electrification rate to 97.33% as of December 2017.

1.5 As part of the execution of the projects identified in the Electricity Master Plan and aimed at covering the demand for electricity in the short and medium term,

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[1] The most recent version of the Electricity Master Plan was published in May 2017 and covers the period 2016-2025. An update is currently being prepared and is scheduled to be published in the third quarter of 2018.

[2] The SNI is comprised of: (i) the National Transmission System, which falls under the responsibility of the CELEC-EP Transelectric business unit; and (ii) the National Distribution System, which is operated by ten electric distribution companies (EDCs).

investments in the SNI since 2007 have made it possible to expand the power system through the implementation of new infrastructure works, which include: (i) adding 1,985 kilometers (km) of transmission lines, 678 km of subtransmission lines, and close to 20,000 km of distribution lines; (ii) boosting installed transformer capacity in power substations from 7,047 megavolt-amperes (MVA) to 14,698 MVA in the National Transmission System and from 5,035 MVA to 7,270 MVA in the National Distribution System; and (iii) adding more than 1.55 million new users throughout the country.

1.6 **Problems to be addressed.** Despite the works carried out by the Ecuadorian government in the last decade, there are persistent lags in the implementation of investments in transmission and distribution infrastructure, specifically, in two areas that have the potential to significantly jeopardize the ability to maintain the current quality and continuity of electricity service:[3] (i) modernization of the National Distribution System; and (ii) repowering of equipment that has reached the end of its useful life and/or exceeded its design capacity.

1.7 By modernizing power systems, including through automation, their operational efficiency can be boosted since, in addition to facilitating the maneuverability of operations, modernization reduces both the scope and the time needed to restore service in the event of a failure, thereby helping to improve the indicators of service quality.[4] According to the current needs of the Ecuadorian system, modernization of the National Distribution System involves, among other things, automating the power substations and feeders by: (i) integrating protection and segmentation equipment into the Supervisory Control and Data Acquisition (SCADA) system; (ii) installing automatic reconnection equipment, also known as reclosers, in feeders to interrupt momentary faults and protect circuits; and (iii) remotely monitoring substation transformers.

1.8 In this regard, the Electricity Master Plan 2016-2025 identifies significant gaps in the modernization of the distribution segment. Specifically, it is estimated that only 1% of the feeders and 80% of the substations in the National Distribution System were automated as of 2016. To achieve the goal of having 43% of all feeders automated by 2025 and 100% of all substations automated by 2020, an average of US$30 million per year will be required over the next seven years to cover these and other investments in the National Distribution System.[5]

1.9 At the same time, the SNI includes various pieces of equipment, such as transformers, switches, disconnectors, and power lines, whether for transmission, subtransmission, or distribution, that have reached or are about to reach the end of

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[3] In Paraguay, for example, a rise in demand, seasonal overloads, and peak-hour overloads have aggravated the transmission system faults. Jiménez, Serebrisky, and Mercado (2014). IDB. Power lost: Sizing electricity losses in transmission and distribution systems in Latin America and the Caribbean.

[4] The modernization and automation of power systems are basic elements for improving system reliability effectively and at a low cost. As a conceptual reference, see Pai and Kopte (2015). A Study on Power System Automation. Department of Electrical Engineering, Sadar Patel College of Engineering, Mumbai, India. By way of experience, one example is the case of Chile, which between 2014 and 2016 reduced the frequency and duration of interruptions per number of users by 8.8% and 8% respectively as a result of projects aimed at introducing network segmentation and automation equipment. See ENEL Distribución Chile Sustainability Report 2016.

[5] Electricity Master Plan 2016-2025, Chapter 6, Distribution Expansion and Improvement. MEER 2017.

their useful life.[6] This is primarily the case with the older transmission and distribution systems, which date from the 1970s and 1980s and have been subject to adequate maintenance plans to ensure their operational continuity. For example, the transformer in the Esmeraldas transmission substation became operational in 1981 and reached the end of its useful life in 2011. Due to the large number of projects with these characteristics, the Electricity Master Plan 2016-2025 envisages the need to move forward with the National Transmission System Asset Renewal Program, which for the next five years will require an estimated budget of US$81.3 million.[7]

1.10 In addition to useful-life considerations, some equipment is either overloaded or approaching its operational design limits. This is due to a number of factors, including: (i) the growth in demand for electric energy, which has risen at an annual rate of 4.8% since 2007; (ii) the entry into commercial operation of the new hydropower plants (paragraph 1.3), leading to a redistribution of the energy flows through the various points of the SNI as a result of changes in the dispatch dynamics at the old thermal plants;[8] and (iii) recent natural events,[9] which have given rise to the need to reconfigure the topology of certain SNI subsystems both to restore service expeditiously in the affected areas and to improve system maneuverability.

1.11 As a result, feeders and transformation equipment at substations have high loadability levels.[10] In 2017, 24% of the transformers in the National Transmission System had a loadability level of more than 80%. With regard to the National Distribution System, a recent diagnostic assessment of current demand at the electric utility CNEL EP El Oro, which accounts for approximately 10% of nationwide users, shows that 40% of the 25 transformers at the substations in the utility's area of concession exceed a 90% loadability level. This includes three transformers that are operating at more than 100% of their rated capacity.[11] Other examples in the National Distribution System include the main transformer at the La Maná substation, whose loadability level is currently 90%, and the transformer at the Esmeralda substation, which in addition to having been in operation for more than 35 years, will exceed 95% loadability in the next 3 years.

1.12 Currently in the SNI, some substation equipment is very close to its operational limits for ensuring the reliability and protection of the associated equipment. This creates the need to replace and repower equipment such as transformers and electrical conductors to adapt to current operating conditions, while at the same time seeking to boost transformer, transmission, and distribution capacity in the substations.

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6 In Ecuador, according to Executive Decree 2713 of 2002, average useful life is estimated at 45 years for transmission lines and 30 years for substations.

7 Electricity Master Plan 2016-2025, Chapter 5, Transmission Expansion. MEER 2017.

8 For example, in the Guayaquil area, the influx of energy from the new hydropower plants has made it necessary to reduce the dispatch levels at neighboring thermal power plants, requiring an expansion of certain substations to unload the transmission lines in their area of influence.

9 The eruption of the Cotopaxi volcano in 2015 and the earthquake in Ecuador's coastal area in 2016.

10 The loadability of electrical equipment is the ratio of maximum operation demand to rated capacity.

11 Measured during the transformers' operation with natural cooling. To operate beyond their rated capacity, the transformers need to work with forced cooling to more efficiently dissipate internal heat.

1.13 Continuing to operate in the aforementioned conditions will mean limiting service quality and reducing the useful life of the equipment.[12] In turn, this will tend to increase the likelihood of faults, favoring the development of reliability problems and reducing the operational efficiency of the system as a whole,[13] with the added consequence of hindering the ability to properly manage the power system and expand service coverage to new users.

1.14 This is evident, for example, in the results of the short-term power flow analysis performed for the Posorja transmission substation, which estimates that 32,588 consumers will depend on it in 2020 and whose main transformer is not only currently functioning at maximum capacity but has been in operation for 30 years.[14] In addition, the analysis shows that, with the current configuration, the ability to meet demand will reach its limit in 2021, precluding the connection of additional users to the system (when under normal conditions) and leaving Posorja without electricity service (when under fault conditions).

1.15 The overload on feeders that form a radial network, which are generally located outside urban areas, affects the quality of service to end users since the saturation of lines and/or transformers creates more service interruptions. The Ecuadorian government's policy for distribution network repowering projects is to survey demand in the project's area of influence before the design of the works in order to quantify existing customers and residents who have no service. Based on this census, the repowering projects favor the addition of new customers, including those located in low-income rural and periurban areas.

1.16 **Institutional restructuring of the energy sector.** In April 2018, the president of Ecuador presented the Economic Program for Fiscal Stabilization and Productive Reactivation, which contains pillars and measures aimed, among other things, at reducing public expenditure through actions such as the administrative restructuring of certain governmental institutions. Implementing the mandate to merge the institutions in the energy and mining sectors, Executive Decree 399 of 15 May 2018 created the Ministry of Energy and Nonrenewable Natural Resources (MERNNR) by merging the following institutions: (i) Ministry of Hydrocarbons; (ii) Ministry of Electricity and Renewable Energy (MEER); (iii) Ministry of Mining; and (iv) Hydrocarbons Secretariat. The creation of the MERNNR is not expected to affect the arrangements, competencies, and responsibilities presently in place for executing Bank-financed loans, including the proposed operation. Along these lines, the Ecuadorian government has requested the Bank's assistance in moving forward with the institutional merger process. Accordingly, using technical cooperation resources, a consulting firm will be engaged to help the Ecuadorian government identify the optimal structure for the energy and mining sector's new institutional

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12 Operating transformers beyond their rated capacity tends to raise internal operating temperatures, thereby reducing the useful life of the equipment. Cajamarca et al. (2010). Cargabilidad en Transformadores de Potencia, Incidencia en la Vida Útil, Pérdidas de Energía y Condiciones Operativas. Salesian Polytechnic University. Ecuador.

13 See, for example: Shahidehpour, M.; and Marwali, M. (2000). Maintenance Scheduling in Restructured Power Systems. Fu, Weihui. Iowa State University (2000). Risk Assessment and Optimization for Electric Power Systems.

14 As a temporary emergency measure, a mobile substation has been added to the Posorja substation so that the two sets of transformer equipment can together cover current demand. In addition, the mobile substation serves as a mitigator in the event of a fault in the main transformer.

framework. It is estimated that the process will be completed in the second half of 2018.

1.17 The new organizational arrangement envisages reinforcing the energy and mining policy role of the new MERNNR as well as the areas of authority and responsibility set out in the legal framework for the electricity, hydrocarbons, and mining subsectors. This will strengthen the institutional structure and make the execution of administrative and operational processes more efficient, while also improving interinstitutional coordination. In this regard, with a view to ensuring the continuity of advances made in the electricity subsector in the last decade, it is important to reinforce the MERNNR in its planning role so that the comprehensive planning processes in the energy sector take into account the vision, objectives, strategies, and actions of the new apex agency and consider the appropriate instruments for developing prospective analysis methods for the sector based on the current legal framework, including a socioeconomic and gender approach.

1.18 **Gender considerations.** Globally, women occupy just 5% of executive positions in the energy and public services sector and just 13% of senior management teams have female representation. Ecuador is not an exception, as women comprise merely 28% of the country's employees in the electricity, gas, and water sectors,[15] evidencing women's limited participation in high-productivity sectors such as electricity, gas, and mining.[16] Studies conducted in Ecuador show that, on average, women earn a lower income than men, and, in addition, their income has declined by 14.4%.[17] Despite gender parity in ministerial positions in the Ecuadorian government, the situation is different in other public service positions: for example, women account for 29% of the public electricity sector (see gender annex).[18] The evidence supports the argument that employing more women in the sector would enhance business performance. For example, studies conducted by McKinsey at universities and industries in various countries shows a direct correlation between women in the boardroom and better financial performance.

1.19 Significant gender gaps continue to exist in Ecuador, primarily in connection with economic contributions and opportunities for women.[19] However, the Ecuadorian government has taken steps toward closing these gaps, as set out in the National Development Plan 2017-2021, *Plan Toda Una Vida*, which, among other things, aims to boost gender equality by working to close pay gaps between women and men. In particular, in the electricity subsector, the program EC-L1223 Support for the Advancement of the Energy Matrix Transition in Ecuador, approved in 2017, provides financing to initiate activities to promote gender equality, including: (i) an institutional, gender-based diagnostic assessment of the electricity subsector and the generation, transmission, and distribution segments, identifying the levels of female and male labor participation, primarily in technical and leadership positions, including an analysis of the specific areas of training and degrees required and the skills needed to expand the various employment positions in the subsector, as well as an analysis of the barriers limiting the participation of both men and women and

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15 IDB Labor Markets and Social Security Information System (2014).

16 CepalStats, 2014.

17 National Employment, Unemployment, and Underemployment Survey. INEC.

18 Data provided by the MEER for the ministry and electric distribution companies in 2016.

19 The female economic participation rate is 52%, compared with 82% for men, and women earn 59% of men's wages and fill just 31% of senior management positions. World Economic Forum, 2016.

the potential areas of intervention to eliminate these barriers; (ii) a gender strategy, based on the results of the diagnostic assessment, that will identify the proper and appropriate activities, taking cultural, educational and social considerations into account; and (iii) a gender action plan, which will include specific actions to strengthen gender equality in the planning, generation, and project and policy management areas. Under this loan, the Bank will finance implementation of the first stage of the action plan (paragraph 1.36).

1.20 **The Bank's experience in Ecuador.** The Bank has supported investments in Ecuador's electricity subsector through the approval of 10 investment loans and a policy-based loan totaling US$1.6577 billion since 2010, with other multilateral agencies joining the effort under the Bank's leadership. This financing has primarily focused on (i) improving operational efficiency; (ii) expanding the SNI and boosting its reliability; (iii) moving forward on the implementation of energy efficiency; and (iv) reducing the gap in access to electricity coverage. The current portfolio consists of: (i) investment loans EC-L1128 and EC-L1136, about to close;[20] (ii) operations EC-L1117, EC-L1147, EC-L1160, and EC-L1219, currently in execution;[21] and (iii) loan EC-L1223, recently approved and pending eligibility.[22]

1.21 Complementarily, nonreimbursable financing[23] has made it possible to design plans and policies aimed at modernizing and expanding the power system as well as strengthening the companies and institutions in the subsector, supporting areas such as: (i) regional integration; (ii) modernization of the National Distribution System; (iii) reduction of electricity losses; (iv) replacement of fossil fuels with renewable resources; (v) strengthening of geothermal energy capabilities; (vi) reinforcement of electricity distribution company capabilities; (vii) strengthening of the institutional and regulatory framework; (viii) sustainability of rural electrification; and (ix) diversification of financing sources for the electricity subsector. As a result, the Bank has positioned itself as an important strategic partner for the Ecuadorian government in the electricity subsector, both in terms of investment financing and in terms of knowledge generation and institutional strengthening.

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20 (i) EC-L1128 (US$30 million), aimed at helping to improve access to electricity service at periurban and rural households, whose financial closing took place in June 2018; and (ii) EC-L-1136 (US$170 million in Ordinary Capital and US$50 million from the China Cofinancing Fund for Latin America and the Caribbean (CHC)), aimed at strengthening the National Distribution System to support the provision of quality electricity service, whose financial closing is expected to take place in October 2018.

21 (i) EC-L1117 (US$150 million), which helps to improve the National Transmission System, ensuring the nationwide provision of energy and regional trade: 70% physical progress and 62% financial progress; (ii) EC-L1147 (US$50 million in Ordinary Capital and US$30 million from CHC), which is aimed at continuing to reinforce the National Distribution System, facilitating the energy matrix transition: 85% physical progress and 61% financial progress; (iii) EC-L1160 (US$118 million in Ordinary Capital and US$25 million from the Korean Infrastructure Fund), which supports the advancement of the energy matrix transition: 76% physical progress and 63% financial progress; and (iv) EC-L1219 (US$60 million), aimed at improving service through reconstruction of the electricity infrastructure in provinces affected by the 2015 earthquake: 10% physical progress and 50% financial progress.

22 EC-L1223 (US$150 million). Its objective is to support the Investment Plan for the Energy Matrix Transition, by expanding, strengthening, and improving the operational efficiency of the power system. This loan operation was approved in October 2017 and the signing of the loan contract is expected to take place in the third quarter of 2018.

23 Since 2010 the Bank has financed 11 technical cooperation operations in various areas of the energy sector for a total amount of approximately US$4 million. Of these, ATN/OC-15601-EC, ATN/OC-15142-EC, ATN/OC-15608-EC, and GRT/FM-13784-EC are currently in execution.

1.22 The Bank's experience in the electricity subsector over the last eight years has enabled the MEER, as the executing agency for the portfolio, to learn and apply Bank policies and procedures as well as implement best practices in the project due diligence process, while internally adopting these procedures and practices both in the preparation of operations and during the execution stage. This has allowed the electricity subsector to move forward on: (i) the use of project sustainability methodologies; (ii) the use of information and project management systems; and (iii) systematic monitoring during execution. The Bank's track record in Ecuador's electricity subsector has made it possible to deepen coordination with the executing agency, thus contributing to a noteworthy pace of execution.

1.23 In its design, the program incorporates lessons learned from operations executed both in Ecuador and in the region, including: (i) preparing the operation in close collaboration with the executing agency; (ii) selecting the portfolio of projects to be financed based on prioritization criteria, including financial, socioenvironmental, and technical sustainability (paragraph 2.1); (iii) including activities aimed at ongoing strengthening of the executing agency; and (iv) using improved technical specifications for resilient infrastructure in the construction of power projects.

1.24 **The Bank's country strategy with Ecuador 2018-2021 (document GN-2924).** In the context of the Bank's country strategy, the electricity subsector investments included in this operation contribute to the strategic objective of moving forward with the Ecuadorian energy reform and are aligned with the following priority areas: (i) institutional strengthening; and (ii) access to quality public services. Specifically, the program contributes to the following proposed actions identified in the country strategy, which support: (i) the investments needed to move forward with the energy reform; (ii) the State modernization process, prioritizing initiatives that generate efficiencies; and (iii) enhanced wellbeing of the rural population through the provision of public goods and services. The operation is included in the 2018 Operational Program Report (document GN-2915).

1.25 **Strategic alignment.** The program is consistent with the Update to the Institutional Strategy 2010-2020 (document AB-3008) and is aligned with the following development challenges: (i) social inclusion and equality, by improving infrastructure to supply electricity to low-income rural and periurban populations; and (ii) productivity and innovation, by fostering increased use of digital technologies to enhance the output of power systems, with a focus on the National Distribution System. It is also aligned with the crosscutting areas of: (i) gender and diversity, by seeking to encourage greater female participation in the electricity subsector through the implementation of the first stage of the Gender Action Plan; (ii) climate change and environmental sustainability,[24] by including projects to improve environmental waste management by utility companies in the subsector, including the waste generated by this operation; and (iii) institutional capacity, by strengthening the planning and operational management capabilities of the electricity subsector. The program is aligned with the Corporate Results Framework 2016-2019 (document GN-2727-6) through the main indicator "Government agencies benefited by projects that strengthen technological and managerial tools to improve public service delivery" and the auxiliary indicators: (i) electricity transmission and distribution lines

[24] Alignment with the crosscutting area of "climate change and environmental sustainability" is specific to the area of environmental sustainability and, therefore, does not contribute to the climate financing target according to the joint methodology of the multilateral development banks for tracking climate finance. For further details, see section 3.1.3 of the technical feasibility report.

installed or upgraded; and (ii) number of households with new or improved access to electricity supply. Similarly, the program is aligned with the priority areas of the Sustainable Infrastructure for Competitiveness and Inclusive Growth Strategy (document GN-2710-5), by financing the modernization, reinforcement, and repowering of the power transmission and distribution infrastructure and thereby helping to meet projected demand and deliver quality electricity services that promote sustainable and inclusive growth. The program is consistent with the Energy Sector Framework (document GN-2830-3), supporting universal and sustainable access to electricity service in rural and periurban areas by repowering distribution networks that enable new users to connect to the system. In addition, the program promotes strengthening actions for the energy sector's institutions in the planning and operational management areas. The program is consistent with the Climate Change Sector Framework (document GN-2835-3) by implementing smart systems for electric power distribution that promote resilient operation of the National Distribution System, and by helping to boost the use of renewable energy sources.

1.26 **Public Utilities Policy (document GN-2716-6)**. The program is consistent with the pillars of the Public Utilities Policy, meeting the conditions of: (i) financial sustainability, based on: (a) a sustained reduction in power generation costs;[25] (b) a reduction in electricity losses;[26] (c) modernization of the operating systems; and (d) inclusion of the operating and maintenance costs of the projects forming part of the program in the budget of the companies responsible for their operation; and (ii) economic evaluation, since the portfolio of projects to be financed is selected based on a rigorous financial and technical feasibility analysis. The subsector is consistent with the principles of support for basic needs, transparency, financial sustainability, and an appropriate institutional structure by clearly defining and operating under the following criteria: (i) division of roles between the MERNNR as lead agency, the regulator, and the generation, transmission, and distribution companies; (ii) openness to private sector participation in power generation; and (iii) rate adjustments to ensure operation and maintenance of the system, and contributions by the Ecuadorian government to ensure expansion of the subsector (see Public Utilities Policy annex).

1.27 **Innovation and digitization.** Digital technologies are evolving at an exponential rate, transforming and revolutionizing the energy sector. These technologies are configured to make power systems more interconnected, efficient, reliable, sustainable, and smarter. For the electricity subsector, digitization is an opportunity to significantly improve demand flexibility, integration of variable renewable energy, smart demand, and distributed power generation. The program will promote increased use of digital technologies to improve the performance of power systems, with an emphasis on the National Distribution System (paragraph 1.29), with a view to making service delivery more efficient.

B. Objectives, components, and cost

1.28 **Objective.** The general objective of the program is to help modernize and improve the reliability and capacity of Ecuador's power system by (i) automating, renewing, and repowering electrical equipment in the National Transmission System and

[25] Between 2007 and 2016, the average cost of energy purchased by the EDCs went from US$0.0655 per kilowatt-hour (kWh) to US$0.0496 per kWh. This downward trend is expected to continue for 2017.

[26] The reduction in electricity losses over the last decade has meant a cumulative savings of approximately US$1.200 billion.

National Distribution System to make the National Interconnected System (SNI) more reliable; and (ii) strengthening the planning and management of the SNI to facilitate its capacity for expansion as well as improve the quality and reliability of service delivery. The proposed components are:

1.29 **Component 1. Modernization of operation and management of the National Distribution System (US$23.09 million).** This component will finance the implementation of projects that help automate the National Distribution System in terms of both subtransmission and distribution, including technological measures aimed at boosting the digitization of the National Distribution System, expanding real-time control over the electrical equipment to address emergencies during the system's operation as well as to perform comprehensive system management.

1.30 For subtransmission, the modernization projects include: (i) improvement of fiber-optic communication links in substations to enable communication with the control center and optimize operation through the SCADA system; (ii) replacement of metering, control, and protection consoles at substations; and (iii) remote monitoring of transformers through the installation of equipment to determine electrical and physical parameters for monitoring from the SCADA system.

1.31 For distribution, the modernization projects include: (i) integration of existing reclosers and communication infrastructure into the SCADA system; (ii) automation and modernization of feeders by introducing telemanaged disconnectors and reclosers, voltage regulators, switches, and automated protection equipment; and (iii) implementation of signal concentrator devices for automated distribution equipment.

1.32 **Component 2. Renewal and repowering of electricity subsector assets (US$72.35 million).** The works to be financed under this component include projects that help to improve the reliability and capacity of the SNI by incorporating additional firm power transformation and transmission capacity into both the National Transmission System and the National Distribution System.

1.33 Subcomponent 2.1, Renewal of the National Transmission System, includes the repowering of transmission infrastructure, including: (i) increase in line and transformer bays at substations so as to improve both power flow transmission capacity and system maneuverability; and (ii) replacement of electrical equipment, such as transformers and electrical protection equipment at substations, to boost transformer capacity.

1.34 Subcomponent 2.2, Renewal of the National Distribution System, will finance the following works: (i) repowering of subtransmission substations, including adding line and transformer bays and replacing power transformers and associated protection equipment; (ii) repowering of primary feeders, including replacement of poles, lines, transformers, and ancillary equipment; and (iii) renewing and repowering distribution networks and transformer stations by replacing poles, conductors, and insulators as well as metering and control equipment, including connecting new users to the system.

1.35 **Component 3. Institutional strengthening for operational management of the electricity subsector (US$3.56 million).** This component will include the financing of activities aimed at supporting environmental management and improved SNI planning and management capacity on the part of the MERNNR and the electric distribution companies (EDCs) and their business units.

1.36 This component will finance: (i) projects to reinforce environmental waste management by four EDCs on the coast, including the installation and/or reinforcement of infrastructure and equipment to support the work in the environmental and social management areas so as to improve the loading, unloading, transfer, testing, and temporary storage of decommissioned equipment, including those financed by this operation; (ii) development of a program for institutional strengthening of the MERNNR with a view to boosting the ministry's sector planning capacity through the assessment and development of prospective energy analysis methods, including the procurement of software for energy and electrical studies, technical assistance to develop comprehensive planning methodologies for proper updating of the Electricity Master Plan, and comprehensive design of electric systems at both the technical and socioenvironmental levels, so as to move forward on the merger of the energy and mining sectors; and (iii) implementation of the activities included in the first stage of the Gender Action Plan,[27] with a view to advancing gender equality in the electricity subsector, including actions such as: (a) implementation of human resource monitoring and evaluation processes and mechanisms; (b) communication, awareness raising, and promotion campaigns aimed particularly at women to encourage the submission of applications to fill vacant positions in the electricity subsector; (c) design of work modalities, mentoring and sponsorship programs, and professional development and training programs; and (d) educational campaigns at the primary, secondary, and university levels to promote women's interest in pursuing subsector-related studies.

1.37 **Program administration (US$1 million).** In addition, the program will finance the administrative costs associated with the program management unit (PMU), as well as program evaluations and audits.

1.38 **Cost and financing.** The estimated cost of the program is US$135 million, of which US$100 million will be financed by the Bank with Ordinary Capital resources and approximately US$35 million will be contributed by the local counterpart (see Table 1. Program costs).

[27] The activities to be financed by this operation will be contingent on approval of the Gender Action Plan, which is expected to be developed in 2019 with financing under contract 4343/OC-EC.

Table 1. Program costs (US$)

Components	Financing		
	IDB (Ordinary Capital)	Local counterpart	Total
Component 1. Modernization of operation and management of the National Distribution System	**23,090,000**	**2,770,847**	**25,860,847**
Subtransmission modernization projects	2,973,000	356,767	3,329,767
Distribution modernization projects	20,117,000	2,414,080	22,531,080
Component 2. Renewal and repowering of electricity subsector assets	**72,348,000**	**31,681,713**	**104,029,713**
2.1 Renewal of the National Transmission System			
Transmission projects	44,500,000	28,339,992	72,839,992
2.2 Renewal of the National Distribution System			
Subtransmission projects	13,714,000	1,645,628	15,359,628
Distribution projects	14,134,000	1,696,093	15,830,093
Component 3. Institutional strengthening for operational management of the electricity subsector	**3,562,000**	**427,440**	**3,989,440**
Reinforcement of environmental waste management	979,000	117,480	1,096,480
Institutional strengthening for prospective energy analysis	2,383,000	285,960	2,668,960
Gender action plan for the electricity subsector	200,000	24,000	224,000
Program administration	**1,000,000**	**120,000**	**1,120,000**
Program management unit	660,000	79,200	739,200
Financial audits	150,000	18,000	168,000
Midterm and final evaluations	190,000	22,800	212,800
Total	**100,000,000**	**35,000,000**	**135,000,000**

C. Key results indicators

1.39 The program has a results matrix describing the outputs, outcomes, and impacts associated with program objectives and components. The implementation of the program is expected to lead to an operational improvement of the National Distribution System by helping to reduce the AIFk and TITk indices by 0.81 and 0.79 respectively. The outcomes of execution of the works to be financed are as follows: (i) increase in effective transformer capacity in the National Transmission System through the inclusion of an additional 707 firm MVA; (ii) 40,557 customers with access to new or upgraded electricity service; and (iii) improvement of 755 km of distribution lines. The monitoring and evaluation plan describes the links between the expected outputs, outcomes, and impacts, the evidence regarding the effectiveness of similar interventions, and the evaluation plan for this operation.

1.40 Since the projects will be carried out at various key points throughout the SNI, all electricity service customers in Ecuador are program beneficiaries and will have higher service quality. With regard to connecting new customers to the system, approximately 6,125 households will benefit as part of the implementation of distribution network repowering projects. These households are located in low-income rural and periurban areas that currently lack electricity supply.

1.41 **Economic analysis.** An analysis showing the economic feasibility of the investments was conducted for a representative sample[28] of the program's infrastructure investment components, and the results are shown for components 1 and 2 as well as for the program as a whole. The economic analysis of each component, with a 12% discount rate, yielded the following values for the economic internal rate of return (EIRR) and the economic net present value (ENPV): (i) Component 2: EIRR=13.5%; ENPV=US$1.8 million; and (ii) Component 2: EIRR=33.0%; ENPV=US$1.623 billion. The overall analysis of the program yielded an EIRR of 32.3% and an ENPV of US$1.625 billion. A sensitivity analysis was performed in which variability of +/-15% was applied to the study's main parameters, including: (i) average energy sale price; (ii) investment; and (iii) growth in demand. The program's economic analysis link presents the assumptions, scenarios, and findings of the analysis.

II. Financing Structure and Main Risks

A. Financing instruments

2.1 This program is structured as a multiple works investment loan, since the projects are physically similar, but independent from one another. The projects in the sample account for 30% of the budget to be financed with proceeds from the loan and are representative of the works to be financed by the program. The projects in the sample include transmission and subtransmission substations, distribution network repowering projects, and National Distribution System automation works. They meet the following eligibility criteria: (i) they are included in the transmission or distribution expansion plan; (ii) they contribute to reinforcement and repowering of the National Transmission System and National Distribution System; (iii) they contribute to improving electricity service quality; (iv) they are viable according to the economic evaluation and financially sustainable, ensuring that sufficient resources will be received to cover the financial costs of operation and maintenance; and (v) they are not category "A" operations under the environmental and social classification. Of the 163 works included in the operation, more than 70% have the necessary designs and background for preparing the bidding documents, so the works are estimated to begin within the first three years of execution (see technical feasibility report), due to the sequencing of the works and the planning for when they will come on line based on demand growth estimates. Program resources will be disbursed as follows:

Table 2. Disbursement projection (US$ thousands)

Source	Budget	2019	2020	2021	2022	2023
IDB (Ordinary Capital)	US$100,000	33,278	37,951	26,816	1,457	498
Total	**US$100,000**	**33,278**	**37,951**	**26,816**	**4,457**	**498**
%	**100**	**33.3**	**37.9**	**26.8**	**1.5**	**0.5**

B. Environmental and social risks

2.2 Based on the project information provided by the executing agency for the representative sample, the adverse social and environmental impacts from

[28] The projects included in the economic analysis total about US$68 million, or 68% of the total program amount.

implementing the works are expected to be of medium magnitude, localized, and reversible, for which there are effective control and mitigation measures. Accordingly, this program is classified as a category "B" operation under the Bank's Operational Policy OP-703.

2.3 The majority of the projects will be implemented in areas where work has already been done and where the rights-of-way are in place. The Salitral substation project requires the procurement of an adjoining parcel of land owned by a government entity. There are no identified impacts associated with physical displacements or adverse economic effects. The potential adverse socioenvironmental impacts would primarily be during the construction phase within the substations and arising from distribution works and, to a lesser extent, during their operation. Care will be taken to ensure the proper handling and final disposal of polychlorinated biphenyls resulting from the disassembly of old transformer equipment.

2.4 As of this date, environmental and social studies have been prepared for four projects in the sample (Salitral, Taday, La Maná, and Puerto Ayora), as well as a strategic environmental and social analysis, including the environmental and social management plans (ESMP). In addition, since this is a multiple works program, an environmental and social management framework (ESMF) was prepared so that any future projects comply with the Bank's environmental and social provisions.

2.5 Public consultation events were conducted for the following projects in the sample: an event for the Salitral substation, an event for the Taday substation, and event for the La Maná substation, three events for the Galápagos repowering projects, and four events for the Cotopaxi projects. The public consultation reports, environmental and social studies, environmental and social analysis, and environmental and social management framework have been posted on the Bank's website in accordance with the Bank's Access to Information Policy (OP-102) and Environment and Safeguards Compliance Policy (OP-703).

2.6 The environmental risk, identified as medium, refers to varying waste management and handling capacities at the electric distribution companies (EDCs). This risk will be mitigated by including resources for institutional strengthening for environmental waste management as part of Component 3 of the program.

2.7 In addition, the program will finance the first stage of the Gender Action Plan, helping to close the gender gap in the electricity subsector (paragraph 1.36). With regard to natural disaster risks, the operation was classified as having moderate risk to ensure that the projects include robust contingency plans.

C. Risks and other key issues

2.8 **Financial risk.** There is a high risk that if the Ministry of Economy and Finance (MEF) fails to transfer the resources for program execution to the executing agency in timely fashion, the executing agency would be unable to transfer the resources to the EDCs and Transelectric on schedule, thereby delaying the start of the works and the delivery of the final outputs. To mitigate this risk, the subsidiary agreement between the MEF and the executing agency, as well as the interinstitutional agreements (to be included in the program Operations Manual) between the executing agency, the EDCs, and Transelectric, should stipulate that transfers of proceeds from both the loan and the local counterpart contribution are to be made within a timeframe to be set in the subsidiary agreement, once the request for the corresponding transfer has been received by the MEF.

2.9 **Public management and governance.** There is a medium risk that any delays in the MEF approval process for works contracts will lead to project execution delays. To mitigate this risk, early approval will be sought from the MEF for the program contract guarantees by including this as a contractual condition precedent to the first disbursement.

2.10 **Sustainability.** The investments to be financed are sustainable in the medium and long term because the projects included in the program are prioritized in the sector expansion plans and will be part of the respective electric companies' assets once the works are completed (paragraph 3.1). Operating and maintenance costs will be included in those entities' budgets, and the executing agency will submit the annual maintenance plan to the Bank.

III. IMPLEMENTATION AND MANAGEMENT PLAN

A. Summary of implementation arrangements

3.1 The executing agency is the Ministry of Energy and Nonrenewable Natural Resources (MERNNR), as the subsector's lead agency (paragraph 1.16). It will follow the arrangements presently in place for programs, whereby execution is coordinated centrally by the program management unit (PMU), which will be based at the MERNNR and will have a general coordinator, a procurement specialist, a financial specialist, an environmental management and occupational health and safety specialist, and a social sector specialist, paid for out of loan proceeds. The PMU will supervise program activities, which will be executed directly by Transelectric and the EDCs, which will receive transfers of financial resources for this purpose. Transelectric and the EDCs have work teams made up of technical, socioenvironmental, financial, procurement, and legal managers, who will supervise and report to the PMU on implementation of the activities, as follows: (i) Transelectric, for the works in Component 2.1; and (ii) the EDCs, for the works in Component 1 and Subcomponent 2.2. For execution of Component 3 activities, the PMU will coordinate with the power distribution and marketing divisions of the MERNNR and the unit in charge of energy planning and prospective analysis. The proposed arrangement facilitates optimal execution, as evidenced by the progress being made in the portfolio currently in execution (paragraph 1.20).

3.2 The roles and responsibilities of Transelectric and the EDCs in the execution of program works will be set out in the interinstitutional agreements between the aforementioned entities and the executing agency (paragraph 3.4). These roles and responsibilities will include carrying out the precontractual and contractual processes, including preparation of the bidding documents, contractual management, reports on technical and socioenvironmental progress in the works, bank reports and reconciliation statements, and any information required by the executing agency for the reports on program execution.

3.3 **Special contractual conditions precedent to the first disbursement of the loan proceeds:** Execution of the following activities **will be part of the special contractual conditions precedent to the first disbursement of the loan proceeds and will require the no objection of the Bank: (i) signature and entry into force of a subsidiary agreement between the MEF and the executing agency, indicating the timeframe in which the proceeds from the loan and the local counterpart contribution will be recorded in the corresponding area for the program and transferred to the EDCs and Transelectric and that they will**

be used pursuant to the agreed upon conditions and purposes, in order to establish the legal nexus between the two institutions for the timely transfer and appropriate use of program resources**; (ii) approval by the MEF of the contract guarantees and transfers (release) for the activities included in the initial** procurement plan**, including the relevant multiyear certifications**, to streamline and ensure effective execution of the program within the established timeframe; **and (iii) approval and entry into force of the program Operations Manual, including the financial management procedures, and, as an annex thereto, the environmental and social management plans for the sample projects and the program's environmental and social management framework, on the terms and conditions previously agreed upon with the Bank,** so as to establish the guidelines and procedures for the executing agency to follow for successful program execution.

3.4 **Special contractual conditions of execution:** The following will be conditions of execution: (i) prior to use of the resources for Component 3, related to the institutional strengthening program for energy analysis and prospective studies, the executing agency will present, for the Bank's no objection, the investment plan and execution schedule, identifying the final scope of the activities to be performed, which will be defined in accordance with the update to the Electricity Master Plan (see footnote 1); and (ii) prior to the transfer of the program resources from the executing agency to the EDCs and Transelectric, the recipients will have signed an interinstitutional agreement with the executing agency establishing the obligations of the parties under the program, including the obligation to carry out their respectively assigned activities under the loan contract and the program Operations Manual, as well as the obligation of the EDCs and Transelectric to open a special bank account solely for the loan proceeds and to submit any information required of them, in order to have mechanisms in place that promote timely execution of the operation and make it easier to manage and track resources as they are received and used by the executing agency.

3.5 **Procurement plan and procurement policies.** A procurement plan was agreed upon and will be updated annually, in conjunction with the annual evaluations and before the end of each calendar year or as needed during program execution. The Procurement Plan Execution System (SEPA) will be used for this purpose. Goods, works, and consulting services will be procured in accordance with the Policies for the Procurement of Goods and Works Financed by the IDB (document GN-2349-9) and the Policies for the Selection and Contracting of Consultants Financed by the IDB (document GN-2350-9), respectively. In addition, the country procurement system may be used in Bank-financed projects. This would apply for the following types of contract: (i) provision of goods and nonconsulting services; (ii) construction of works for an estimated cost of less than the Bank's threshold for Ecuador for international competitive bidding; and (iii) consulting services by firms for amounts below the threshold for an international shortlist.

3.6 **Disbursements and advances of funds.** Disbursements will be made through advances of funds, in accordance with the program's estimated liquidity needs derived from the annual work plan and the procurement plan. The programming of cash needs will have a rolling 12-month horizon, and the advances will cover liquidity needs for up to nine months of execution, which includes the estimated timeframe for EDC and Transelectric reports to the executing agency.

3.7 **Retroactive financing and recognition of expenditures.** The Bank may retroactively finance, from the loan proceeds, up to US$20 million (20% of the financing from the Ordinary Capital), and recognize, against the local contribution, up to US$7 million (20% of the local contribution), for eligible expenditures incurred by the executing agency prior to the loan approval date corresponding to payments for advance contracting on project works, provided requirements substantially similar to those in the loan contract have been met. Such expenditures must have been made on or after 6 April 2018 (date of approval of the project profile), but in no case will they include expenditures incurred more than 18 months prior to the loan approval date.

3.8 **Audits.** External auditing services for the program will be provided by a firm of external auditors acceptable to the Bank, to be hired using loan proceeds and based on terms of reference agreed upon between the Bank and the executing agency.

B. Summary of results monitoring arrangements

3.9 **Monitoring arrangements.** The Bank will conduct semiannual technical visits to the executing agency to review progress on the works and make any adjustments stemming from execution. Annual fiduciary supervision visits will be conducted. External accounting and operational audits are planned to validate use of the loan proceeds and the internal operating controls and processes. Semiannual status reports on execution will be sent to the Bank, including the technical and financial status of the program, as well as the monitoring and progress report (see the monitoring and evaluation plan).

3.10 **Program evaluation arrangements.** Program evaluations include a midterm and a final evaluation, financed with loan proceeds. The midterm evaluation will be commissioned by the executing agency a maximum of 30 months after the entry into force of the loan contract. The final evaluation will be commissioned by the executing agency when the last disbursement of loan proceeds is requested. The final evaluation will determine the level of fulfillment of the targets in the Results Matrix and will be presented before the financial closing of the operation. The terms of reference for the midterm and final evaluations will have the Bank's no objection. The executing agency will submit the semiannual and annual reports in accordance with the program's monitoring and evaluation plan.

Development Effectiveness Matrix		
Summary		
I. Corporate and Country Priorities		
1. IDB Development Objectives	Yes	
Development Challenges & Cross-cutting Themes	-Social Inclusion and Equality -Productivity and Innovation -Gender Equality and Diversity -Climate Change and Environmental Sustainability -Institutional Capacity and the Rule of Law	
Country Development Results Indicators	-Government agencies benefited by projects that strengthen technological and managerial tools to improve public service delivery (#)* -Households with new or improved access to electricity supply (#)* -Electricity transmission and distribution lines installed or upgraded (km)*	
2. Country Development Objectives	Yes	
Country Strategy Results Matrix	GN-2924	To advance in the Ecuadorian energy reform.
Country Program Results Matrix	GN-2915	The intervention is included in the 2018 Operational Program.
Relevance of this project to country development challenges (If not aligned to country strategy or country program)		
II. Development Outcomes - Evaluability		Evaluable
3. Evidence-based Assessment & Solution	7.7	
3.1 Program Diagnosis	3.0	
3.2 Proposed Interventions or Solutions	1.7	
3.3 Results Matrix Quality	3.0	
4. Ex ante Economic Analysis	10.0	
4.1 Program has an ERR/NPV, or key outcomes identified for CEA	3.0	
4.2 Identified and Quantified Benefits and Costs	3.0	
4.3 Reasonable Assumptions	1.0	
4.4 Sensitivity Analysis	2.0	
4.5 Consistency with results matrix	1.0	
5. Monitoring and Evaluation	8.5	
5.1 Monitoring Mechanisms	2.5	
5.2 Evaluation Plan	6.0	
III. Risks & Mitigation Monitoring Matrix		
Overall risks rate = magnitude of risks*likelihood	Medium	
Identified risks have been rated for magnitude and likelihood	Yes	
Mitigation measures have been identified for major risks	Yes	
Mitigation measures have indicators for tracking their implementation	Yes	
Environmental & social risk classification	B	
IV. IDB´s Role - Additionality		
The project relies on the use of country systems		
Fiduciary (VPC/FMP Criteria)	Yes	Financial Management: Budget, Treasury, Accounting and Reporting. Procurement: Information System, National Public Bidding.
Non-Fiduciary		
The IDB's involvement promotes additional improvements of the intended beneficiaries and/or public sector entity in the following dimensions:		
Additional (to project preparation) technical assistance was provided to the public sector entity prior to approval to increase the likelihood of success of the project		

Note: (*) Indicates contribution to the corresponding CRF's Country Development Results Indicator.

The objective of this operation is to contribute to the modernization and improvement of the reliability and capacity of the Ecuadorian electrical system, through: (i) the automation, renovation and repowering of electrical equipment in the National Transmission System (NTS) and the National System of Distribution (NSD), which allows to increase the reliability of the National Interconnected System (NIS); and (ii) strengthening the planning and management of the NIS to facilitate its capacity for expansion, as well as improving the quality and reliability of service provision.

The documentation is well structured-a good summary of the achievements of the sector in the last ten years is provided, and two main challenges of the sector are identified and quantified. Specifically, two areas that have the potential to generate risks to maintain the current quality and continuity of the electric service provision are identified: 1) modernization of the National Distribution System; and 2) renovation of equipment that has fulfilled its useful life or exceeded its design capacity.

The program is structured as an investment loan for multiple works, given that the projects to be financed are physically similar, but independent of each other. The projects in the sample constitute 30% of the budget to be financed with financing resources and are representative of the works to be financed by the program. The proposed solution is clearly linked to the problems and challenges identified. The results matrix (RM) reflects the objectives of the project and shows a clear vertical logic for each of the three components. The impact indicators are derived from the ex ante economic analysis and the lower level indicators reflect the design of the three components. The RM includes SMART indicators at the level of products, outcomes, and impacts, with their respective baseline values, targets, and means to collect the information.

The economic analysis is based on a representative sample of 68% of the program amount, which is based on a cost-benefit exercise. The main benefits are in terms of reducing electricity losses and improving the reliability of the service. The results of the integral analysis show an internal rate of return (IRR) of 32.3% and a net present value (NPV) of US $ 1,625 million. A sensitivity analysis is performed under alternative scenarios modifying the main variables that can affect costs and benefits. The conservative scenario finds an IRR of 28.1%, with a NPV of US $ 1,238 million.

The monitoring and evaluation plan proposes an evaluation using an ex post cost-benefit economic analysis which is complemented with a reflexive evaluation (Before-After), which is appropriate given the nature of this intervention.

The risks identified in the risk matrix seem reasonable and are classified as Medium risk (1) and High (1). Risks include mitigation actions and compliance indicators.

RESULTS MATRIX

Program objective:	To help modernize and improve the reliability and capacity of Ecuador's power system by (i) automating, renewing, and repowering electrical equipment in the National Transmission System and National Distribution System to make the National Interconnected System (SNI) more reliable; and (ii) strengthening the planning and management of the SNI to facilitate its capacity for expansion as well as improve the quality and reliability of service delivery.

EXPECTED IMPACT

Expected impact	Indicators	Unit of measure	Baseline		Targets		Means of verification
			Value	Year	Value	Year	
Increase in the reliability of the National Distribution System through improvement of the overall indicators of distribution quality	AIFk, average interruption frequency per kVA. TITk, total interruption time per kVA.	Faults/year Hours/year	5.09 5.01	2017	4.28 4.22	2023	Statistical report by the electricity subsector's lead agency

EXPECTED OUTCOMES

Expected outcomes	Indicator	Unit of measure	Baseline		Intermediate		Targets		Means of verification	Observations
			Value	Year	Value	Year	Value	Year		
Component 2. Renewal and repowering of electricity subsector assets										
Increase in firm transformer capacity in the National Transmission System	Additional firm megavolt-amperes (MVA)	MVA	0	2017	92	2021	707	2023	Program status report	The calculation methodology is established in the monitoring and evaluation plan.
Increase in electricity coverage	Households with access to new or improved electricity service in the program's area of influence	Households	0	2017	40,557	2021	40,557	2023	Program status report	Only the direct connections that benefit from the program are counted. This indicator contributes to the Corporate Results Framework.
Improvement of the national electricity infrastructure	Power distribution lines (improved)	km	0	2017	755	2021	755	2023	Program status report	The calculation methodology is established in the monitoring and evaluation plan. This indicator contributes to the Corporate Results Framework.

OUTPUTS

Outputs	Estimated cost (US$)	Unit of measure	Baseline 2017	Years					Final target	Means of verification
				2019	2020	2021	2022	2023		
Component 1. Modernization of operation and management of the National Distribution System	**23,090,000**									
1.1. Subtransmission modernization projects energized	2,973,000	Number of projects	0	-	-	4	1	-	5	Project status report
1.2. Distribution modernization projects energized	20,117,000	Number of projects	0	-	15	53	-	-	68	
Component 2: Renewal and repowering of electricity subsector assets	**72,348,000**									
Subcomponent 2.1. Renewal of the National Transmission System	**44,500,000**									
2.1.1. Transmission repowering projects energized	44,500,000	Number of projects	0	-	0	3	2	1	6	Project status report
2.1.1.1 Expansion of Taday substation	4,132,791	%(*)	0	50	40	10	-	-	100	
2.1.1.2 Expansion of Durán substation	797,446	%(*)	0	50	40	10	-	-	100	
2.1.1.3 Expansion of Posorja substation	3,055,000	%(*)	0	30	40	20	10	-	100	
2.1.1.4 Expansion of Esmeraldas substation	3,085,000	%(*)	0	30	60	10	-	-	100	
2.1.1.5 Expansion of Esclusas substation	10,224,177	%(*)	0	30	40	20	10	-	100	
2.1.1.6 Expansion of Salitral substation	23,205,586	%(*)	0	30	40	10	10	10	100	
Subcomponent 2.2. Renewal of the National Distribution System	**27,848,000**									
2.2.1. Subtransmission repowering projects energized	13,714,000	Number of projects	0	-	-	14	-	-	14	Project status report
2.2.2. Distribution repowering projects energized	14,134,000	Number of projects	0	14	36	16	-	-	66	
Component 3. Institutional strengthening for operational management of the electricity subsector	**3,562,000**									
3.1. Electricity companies reinforced in environmental waste management	979,000	Number of companies	0	-	4	-	-	-	4	Project status report
3.2. Prospective Energy Studies and Analysis Unit strengthened	2,383,000	Number of units	0	-	-	-	-	1	1	
3.3. Gender Action Plan for the Electricity Sector implemented	200,000	Action plan implemented	0	-	-	-	-	1	1	

(*) Progress in % for substations includes the following stages: studies and designs (5%); precontractual (5%); supplies, equipment, and materials (40%); civil works (20%); electromechanical works (20%); testing and energization (10%). Reference: Electricity Regulation and Control Agency reporting blueprint.

FIDUCIARY AGREEMENTS AND REQUIREMENTS

Country:	Ecuador
Project number:	EC-L1231
Name:	Modernization and Renewal Program for Ecuador's Power System
Executing agency:	Ministry of Energy and Nonrenewable Natural Resources (MERNNR)
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I. SUMMARY

1.1 This document contains the fiduciary agreements on procurement and financial management for program execution, prepared on the basis of: (i) the fiduciary context of the country; (ii) a fiduciary risk evaluation; (iii) activities to supervise execution of loans 3087/OC-EC, 3167/OC-EC, 3187/OC-EC, 3188/CH-EC, 3494/OC-EC, 3494/CH-EC, 3710/OC-EC, and 3711-KI-EC; (iv) an institutional capacity assessment of MERNNR; and (v) input from meetings with the teams and entities involved in project execution.

II. FIDUCIARY CONTEXT OF THE COUNTRY

2.1 **Country procurement system.** The respective agreement was signed on 13 May 2014; the country system began to be used on 24 September 2014, and Resolution RE-SERCOP-2014-0000014 was published on 4 November 2014. Use of the system applies to the procurement of: (i) goods, nonconsulting services, and works for an estimated value below the Bank's threshold for international competitive bidding (ICB); and (ii) consulting services by firms for an estimated value of less than US$200,000, contracts for which the shortlist can be comprised entirely of national firms, in accordance with the Bank's policies for the selection and contracting of consultants.

2.2 **Financial management system.** Central government entities use the eSIGEF financial management system, which integrates the budget, accounting, and treasury processes. Government entities are subject to supervision and oversight by the Office of the Comptroller General of the State (CGE). Generally speaking, the financial management country systems have an adequate level of development, but, for execution of Bank-financed projects, they need to be supplemented as regards financial reporting with off-balance-sheet records and external auditing by auditing firms acceptable to the Bank. The government is currently implementing a new system to replace eSIGEF. This new system is expected to be in operation in 2019.

III. Fiduciary Context of the Executing Agency

3.1 The program executing agency is the Ministry of Energy and Nonrenewable Natural Resources (MERNNR), with the participation of the electricity distribution companies (EDCs) and Corporación Eléctrica del Ecuador, through Transelectric.

3.2 The MERNNR has been using the country procurement and financial management systems. Internal control of the Ministry is performed by the CGE, through its Internal Auditing Unit. With regard to information systems in support of financial management, the executing agency relies on the tool described in paragraph 3.3. Procurements are posted on the public procurement portal when country systems are used.

3.3 In addition, in April 2015, an analysis of the Project Management Information System (SIGPRO) yielded satisfactory results. That system focuses on systematizing the MERNNR's current project prioritization, monitoring, control, and settlement processes, and includes the lessons learned through execution of operation 2608/OC-EC, which has been completed.

3.4 The execution structure for this program is the same one successfully used in the operations mentioned in paragraph 1.1. As executing agency, the MERNNR has demonstrated that it keeps all activities documented, approved, and formalized through its information system and that is has staff who have been accumulating experience in the administration of financial management and procurement processes for Bank-financed operations. For this program, the MERNNR will have key support personnel exclusively dedicated to the program, including at least a coordinator, a financial specialist, and a procurement specialist. This team will report to senior management in order to be able to interact with all other participating institutional areas. Should the team be engaged for the aforementioned purposes, the contract may be funded using the Bank's loan proceeds. The program Operations Manual will establish the profiles of the individuals to be hired or appointed to carry out these tasks.

IV. Fiduciary Risk Evaluation and Mitigation Measures

4.1 The following was identified as a high risk: (i) if the Ministry of Economy and Finance (MEF) fails to transfer the resources for program execution to the executing agency in timely fashion, the executing agency would be unable to transfer the resources to the EDCs and Transelectric on schedule, thereby delaying the start of the works and the delivery of the final outputs. To mitigate this risk, the subsidiary agreement between the MEF and the executing agency, as well as the interinstitutional agreements, to be included in the program Operations Manual, between the executing agency, the EDCs, and Transelectric, should stipulate the timely transfer of the resources, once the disbursements in the form of advances of funds from the Bank have been received. These provisions have already been included both in the contractual conditions precedent to the first disbursement and in the special conditions of execution.

V. AGREEMENTS AND REQUIREMENTS FOR PROCUREMENT EXECUTION

5.1 **Procurement execution**. The initial procurement plan will be for the first 18 months. It will be updated annually or as needed during program execution. The procurement plan will be managed using the Procurement Plan Execution System (SEPA).

a. **Procurement of goods, works, and nonconsulting services (procurement policy, document GN-2349-9).** The threshold for use of international competitive bidding (ICB) will be set out for the MERNNR at www.iadb.org/procurement. Contracts for goods, works, and nonconsulting services generated under the program and subject to ICB will use the standard bidding documents issued by the Bank. Procurements subject to national competitive bidding (NCB) and shopping will use the documents agreed upon with the Bank.

b. **Selection and contracting of consultants.** For the selection and contracting of consulting services, any of the methods described in the Bank's policies (document GN-2350-9) may be used, provided the method has been identified in the procurement plan approved by the Bank. The threshold determining the makeup of the shortlist with international consultants will be posted for the program at www.iadb.org/procurement. Contracts for consulting services with firms generated under the program will use the standard request for proposals issued by the Bank.

c. **Selection of individual consultants**. In cases identified in the approved procurement plans, contracting of individual consultants will involve establishing a shortlist of qualified individuals, obtained through local or international expressions of interest, as the case may be, pursuant to document GN-2350-9, Section V, paragraphs 5.1 to 5.4.

d. **Training.** The procurement plan will list the procurements for the program components that involve training, which will be contracted as consulting or nonconsulting services.

e. **Use of the country procurement system.** The National Public Procurement System[1] will be used in Bank-financed projects for contracts for goods and nonconsulting services and for the construction of works that have an estimated cost of less than the Bank's threshold for Ecuador for ICB, and for consulting services for amounts below the threshold for an international shortlist.

f. **National preference**. Bids for goods originating in the borrowing country will have a margin of preference[2] on price equivalent to 15% in contracts subject to ICB.

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[1] If the Bank validates another system or subsystem, it will be applicable for the operation, as set forth in the loan contract.

[2] Policies for the Procurement of Goods and Works Financed by the IDB (document GN-2349-9) Appendix 2 and the loan contract; and the policies set forth in paragraph 1.16 of document GN-2349-9 and paragraph 1.23 of document GN-2350-9. The borrower shall prepare, and before loan negotiations present to the Bank for its approval, a procurement plan, acceptable to the Bank, for an initial period of at least 18 months.

g. **Retroactive financing and recognition of expenditures.** The Bank may retroactively finance, from the loan proceeds, up to US$20 million (20% of the financing from the Ordinary Capital), and recognize, against the local contribution, up to US$7 million (20% of the local contribution), for eligible expenditures incurred by the executing agency prior to the loan approval date corresponding to payments for advance contracting on project works, provided requirements substantially similar to those in the loan contract have been met. Such expenditures must have been made on or after 6 April 2018 (date of approval of the project profile), but in no case will they include expenditures incurred more than 18 months prior to the loan approval date.

Table V-1. Table of threshold amounts for ICB and international shortlist (US$)

Works			Goods			Consulting services	
ICB	National competitive bidding	Shopping	ICB	National competitive bidding	Shopping	Consulting services with international advertising	Shortlist 100% national
≥3,000,000	<3,000,000 ≥250,000	< 250,000	≥250,000	<250,000 ≥50,000	< 50,000	≥200,000	<200,000

5.2 The main procurements, being part of the Fiduciary Agreements and Requirements, are the responsibility of the procurement officer. The program's major procurements are to be prepared with the information generated for preparing the procurement plan, which is a joint effort by the procurement officer and the technical and procurement units of the lead institution for the program and the sector specialist, who ensures that procurements are on track to achieve the operation's outcomes and outputs. Once the loan is approved, the executing agency will be responsible for preparing the procurement plan,[3] and the procurement officer will provide and ensure that plans are adequate and of the expected quality in accordance with the procurement policies.

[3] See Guidelines for preparing and using the procurement plan[18].

Table V-2. Main procurements

Activity	Procurement method	Estimated invitation date	Estimated amount (US$000)
1.- Works			
Construction of civil works, provision of materials and equipment, electromechanical assembly, testing and bringing on line the expansion of substations to 230/138/69 kV – six lots (see procurement plan).	ICB	Q1 2019	44,500
Construction of works for improvement of communication links, remodeling of metering, control, and protection consoles for substations, modernization of control centers for subtransmission and distribution systems, monitoring improvements for control of electrical parameters in power transformers, rehabilitation of distribution networks, and installation of meters in feeders and large consumers, among others (56 processes are envisaged; see procurement plan).	NCB	Q1 2019	46,879
2.- Goods			
Procurement of one mobile substation	ICB	Q1 2019	905
3.- Consulting services			
Contracting of individual consultants to oversee repowering, reinforcement, expansion, and improvement works related to substations, communication systems, reconnection equipment, feeders, distribution networks, etc. (54 processes are envisaged; see procurement plan).	3 CVs	Q1 2019	1,771

5.3 **Procurement supervision.** Contracts subject to ex post review by the Bank will conform to the provisions of Appendix 1 of the Policies; contracts for amounts equal to or greater than those indicated in Table VI-3 will be supervised ex ante. Ex post review missions by the Bank will be conducted at least once every 12 months. Ex post review reports will include at least one physical inspection visit, as appropriate.

Table V-3. Ex post review threshold (US$)

Works	Goods	Consulting services	Individual consultants
< 3,000,000	<250,000	< 200,000	< 50,000

Note: The threshold amounts established for ex post review apply based on the executing agency's fiduciary capacity for execution and may be modified by the Bank should that capacity change.

5.4 **Special provisions**. Measures to reduce the likelihood of corruption: The policies set forth in documents GN-2349-9 and GN-2350-9 relating to prohibited practices (list of companies and individuals ineligible to work with multilaterals) will apply.

5.5 **Records and files**. The executing agency will keep the records up to date and maintain procurement documentation organized in a single file; and the processes

financed from each of the sources under the program should be perfectly differentiated.

VI. Agreements and Requirements for Financial Management

6.1 **Programming and budget**. The Code on Planning and Public Finances is the legislation establishing the rules and regulations on programming, formulation, approval, execution, control, evaluation, and settlement of budgets. These general rules apply to execution of Bank-financed programs in Ecuador. The eSIGEF integrated system and the new one that the government is developing operationalize and standardize application of these general rules through the national public administration. The MERNNR will ensure, in a timely fashion, that the program's priority status is obtained and updated and that the program is included in the Annual Government Investment Plan, as well as handle the respective budget allocations for the program, obtain the necessary guarantees for contracting processes given the program execution timeframe, supervise budget execution through the respective systems, and continuously monitor the execution of resources by the EDCs and Transelectric.

6.2 **Accounting and information systems**. Program accounting will be performed through the eSIGEF system or the new system being developed by the government, once it is operational. All program commitments and payments will be recorded in this system, but off-balance-sheet records will be needed to make itemized entries by component and be able to generate the program's financial reports while the reliability of the new system and its reports is verified.

6.3 **Disbursements and cash flow**. In 2008, the Ecuadorian government installed the national treasury single account (TSAs) mechanism, which unified cash management at all central government entities.

6.4 Implementing this mechanism did not eliminate the Central Bank of Ecuador's (BCE) system of special accounts or special-purpose accounts for financing from multilateral loans. The program will have a special account at the BCE into which the loan proceeds will be disbursed. All program payments will be made through the eSIGEF system or the new system by debiting the TSA.

6.5 Similarly, each EDC and Transelectric, as the parties jointly responsible for execution of the program resources, will have a special bank account solely for the transfer and management of the resources to be received from the executing agency, in order to better track resources received from the executing agency during receipt and execution, and will be responsible for performing monthly bank reconciliations and attaching them to the reports to be periodically delivered to the executing agency.

6.6 The Bank will disburse the loan proceeds to the executing agency in the form of advances of funds based on the program's actual liquidity needs, including the payment commitments undertaken by the EDCs and Transelectric, pursuant to a detailed financial plan and cash flow statement reflecting the program's actual resource needs, for a period of up to nine months, which includes the estimated

timeframe for EDC and Transelectric reports to the executing agency. At the borrower's request, the Bank may also process direct payments to suppliers or reimbursements for expenditures.

6.7 In the event that the executing agency needs to disburse funds to the EDCs and Transelectric, it will do so in accordance with the actual liquidity needs of these companies, considering payment commitments to third parties and provided that the previous period's payments have been reported.

6.8 The rendering of accounts for advances will be done pursuant to OP-273-6. Once the executing agency has accounted for at least 80% of the balance of previous advances, a new disbursement may be made.

6.9 For expenditures incurred that are not considered eligible by the Bank, the IDB and the executing agency will determine whether to repay the Bank, replace them with other eligible program expenditures, or pay off the amounts in question.

6.10 The supporting documentation for payments made will be reviewed by the Bank and/or the external auditors following disbursement of the resources by the Bank and/or the external auditors.

6.11 **Internal control and internal auditing.** The Constitution of Ecuador provides that the CGE is responsible for running the public sector control system. As part of that sector, the executing agency has its own internal audit area that reports directly to the CGE; however, the Bank does not use its services, since that area's audit plans do not include reviewing the program. The program Operations Manual will include the main internal control processes needed to ensure that controls are functioning properly. During execution, the fiduciary team will assess compliance with and the quality of those processes.

6.12 **External control and reports**. Since the CGE does not currently have sufficient capacity for external control of projects financed with external loans, external auditing of the program will be performed by independent auditors acceptable to the Bank, in keeping with IDB requirements (OP-273-6). The auditing firm will be engaged by the executing agency based on terms of reference previously agreed upon with the Bank, and this engagement may be funded with the loan proceeds. During execution, the audited financial reports will be presented annually, within 120 days following the closing date of each fiscal year or the date of the last disbursement. The Bank may also request that the executing agency provide unaudited financial reports related to the program.

6.13 There is no national policy on public disclosure of audit reports; however, in keeping with the current access to information and information disclosure policy, the audited program reports are to be published in the Bank's systems.

Table VI-1. Supervision plan

Supervision activity	Supervision plan			
	Nature and scope	Frequency	Responsible party	
			Bank	Third party
Operational	Review of progress report	Semiannual	Project team	
	Portfolio review with the executing agency and MEF	In accordance with MEF requirements	Project team	MERNNR and MEF
Financial	Review of cash flow and disbursement execution schedule (including EDCs and Transelectric)	At the Bank's request, with each funds advance request, upon portfolio reviews or supervision visits	Project team	MERNNR
	Supervision visits to the executing agency, EDCs, and Transelectric	Annual	Fiduciary specialist	MERNNR, EDCs, and Transelectric
	Review of audited and unaudited financial reports	Annual	Fiduciary specialist and Project Team Leader	MERNNR
	Review of disbursement requests	Periodic	Fiduciary and sector team	
Procurement	Ex post review of procurement	In accordance with the supervision plan	Project Team Leader and fiduciary specialist	MERNNR and EDCs
	Ex ante review of procurement	In accordance with the procurement plan	Project Team Leader with support from procurement specialist	MERNNR
	Update of the procurement plan	Annual	Project Team Leader with support from procurement specialist	MERNNR
Compliance	Fulfillment of conditions precedent	One time	Project team	MERNNR
	Review of budget allocation	Annual	Project team	MERNNR
	Presentation of audited financial reports	Annual	Project Team Leader and fiduciary specialist	MERNNR/ Auditor

6.14 **Execution mechanism.** The executing agency is the MERNNR, as the subsector's lead agency. It will follow the arrangements presently in place for programs, whereby execution is coordinated centrally by the program management unit (PMU), which will be based at the MERNNR and will have a general coordinator, a procurement specialist, and a financial specialist, paid for out of loan proceeds. A detailed description is provided in section III-A-3.1 of the POD.

6.15 The main activities of the PMU include: (i) management of the loan proceeds and the fiduciary aspects (procurement and financial management); (ii) planning and execution of the loan, including preparing the annual work plans and monitoring and updating the procurement plan as well as continuously monitoring the execution of resources by the EDCs and Transelectric; (iii) coordination, management, and supervision of the activities associated with the procurement of goods, nonconsulting services, works, and consulting services by firms and individuals; (iv) supervision and monitoring of progress on program execution; (v) preparation of financial statements and disbursement requests; (vi) contracting of external auditing of the program's financial reports and their timely delivery; and (vii) monitoring of the subsidiary agreement and interinstitutional agreements, in addition to other activities to be described in the program Operations Manual.

6.16 The program Operations Manual will describe the program execution mechanism, the composition of the PMU, and the recording, communicating, resource execution monitoring, and reporting mechanisms that govern collaboration between the EDC contractors, Transelectric, and the MERNNR. See the procurement table.

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

PROPOSED RESOLUTION DE-__/18

Ecuador. Loan ____/OC-EC to the Republic of Ecuador
Modernization and Renewal Program
for Ecuador's Power System

The Board of Executive Directors

RESOLVES:

That the President of the Bank, or such representative as he shall designate, is authorized, in the name and on behalf of the Bank, to enter into such contract or contracts as may be necessary with the Republic of Ecuador, as borrower, for the purpose of granting it a financing to cooperate in the execution of the Modernization and Renewal Program for Ecuador's Power System. Such financing will be for the amount of up to US$100,000,000 from the resources of the Bank's Ordinary Capital, and will be subject to the Financial Terms and Conditions and the Special Contractual Conditions of the Project Summary of the Loan Proposal.

(Adopted on ___ _____ 2018)

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