

TC Document

I. Basic Information for TC

▪ Country/Region:	Ecuador/CAN
▪ TC Name:	Analysis for the Implementation of the Smart Grid Program in Ecuador
▪ TC Number:	EC-T1279
▪ Associated Loan/Guarantee Name:	n/a
▪ Associated Loan/Guarantee Number:	n/a
▪ Team Leader/Members:	Jesus Alberto Tejeda Ricardez (ENE/CEC) Arnaldo Vieira de Carvalho (INE/ENE) Paola Méndez (INE/ENE) Alberto Levy (ENE/CAR) Lumas Kendrick (ENE/CJA) Carlos Jacome (ENE/CHO) Sergio Ballón (INE/ENE) Yolanda Valle (INE/ENE) Gumersindo Velázquez (FMP/CEC) Gustavo Palmerio (FMP/CEC) Javier Bedoya (LEG/SGO)
▪ Date of TC Abstract authorization:	September 12 th , 2013
▪ Beneficiary	<i>Ministerio de Electricidad y Energía Renovable (MEER)</i>
▪ Executing Agency and contact name	The Energy Division (INE/ENE)
▪ Donors providing funding:	IDB-Knowledge Partnership Korea Fund for Technology and Innovation (KPK) ¹ US\$450,000
▪ Local counterpart	US\$250,000 ²
▪ Disbursement period (which includes Execution period):	18 months
▪ Required start date:	December 2013
▪ Types of consultants:	Firm and individual consultants
▪ Prepared by Unit:	The Energy Division (INE/ENE)
▪ Unit of Disbursement Responsibility:	CEC
▪ TC Included in Country Strategy (y/n):	Yes
▪ TC included in CPD (y/n):	
▪ GCI-9 Sector Priority:	Infrastructure for competitiveness and social welfare, protect the environment, respond to climate change and enhance food security

II. Objectives and Justification of the TC (estimated length: 1 page)

¹ See Donor Approval Letter [IDBDOCS-#38055912-Donor Approval Notice - Memo](#)

² Korea EXIMBank-Korean Sharing Program (KSP) is financing US\$250,000 non-reimbursable.

- 2.1 A Smart Grid (SG) is an upgraded electricity network that can intelligently integrate the actions for all users connected to it (producers, consumers), in order to ensure economically efficient, sustainable power systems with low losses and high levels of quality and security of supply and safety.³ A SG introduces Information and Communication Technologies (ICT) tools in the field of electric power systems and promotes innovation in the management of the electricity grid.
- 2.2 **Benefits of SG.** By allowing bidirectional data and information flow, SG (i) enables active participation of consumers and therefore promotes the introduction of Energy Efficiency (EE) measures at the demand side; (ii) SG is also necessary when large and intermittent energy packets are introduced to the network. This is the case of Renewable Energy (RE) and Distributed Generation (DG); (iii) SG also may improve grid stability and security since it allow a better response to system disturbances and enables new products, services and markets around the evolved electricity sector. By enabling network optimization, SG can contribute as well to reduce technical and non-technical losses⁴.
- 2.3 Implementing SG measures requires update and new infrastructure in order to allow the communication in real time among three levels (i) Generation (ii) Transmission-Distribution and (iii) the end user. For the operation of the systems is required an Asset Management System (AMS), which include: (i) integrated and adapted Supervisory Control and Data Acquisition (SCADA)⁵; (ii) Outage Management Systems - Mobile Workforce Management (OMS-MWM); and (iii) Distribution Management Systems (DMS). These measures will be the first step under the Roadmap because such measures do not require the behavioral change of customers while enhancing EE through optimized control and management of the power grid.
- 2.4 At the transmission level technologies such as synchronized Phasor Measurement Units (PMU) and Wide Area Monitoring Systems (WAMS) are required to ensure synchronization. One key component of SG is the Advance Metering Infrastructure (AMI) which comprises three key elements (a) Smart Meters (SG), (b) Meter communication infrastructure⁶ and (c) Data management. The installation of SM is an important step in the deployment of SG, since they provide utilities with a secure two-way flow of data.
- 2.5 In January 2013, the Government of Ecuador (GoE) launched the Roadmap for the Ecuadorian Smart Grid Program⁷ (REDIE, for its acronym is Spanish). REDIE has three phases covering the period 2013-2030. Following the Ministerial Agreement N301 an Executive Committee was created for the execution of the REDIE project. The Executive Committee is chaired by the *Ministry of Electricity and Renewable Energy* (MEER, for its acronym in Spanish) and its members are public institutions of the sector represented by the National Regulatory Body, the National Dispatch Centre and representative from the Electricity Distribution Companies.

³ Smart Grids European Technology Platform (ETP). Strategic deployment document. www.SmartGrids.org/APRIL2010.pdf

⁴ Technical losses are those related to transformer losses, resistance losses on power networks, etc. Non-technical losses are occurred by mistakes, human errors, malfunctions of management systems, etc.

⁵ SCADA is a software application program for process control, the gathering of data in real time from remote locations in order to control equipment and conditions. SCADA is used in power plants as well as in oil and gas refining, telecommunications, transportation, and water and waste control.

⁶ Methods to transmit data such as Power Line Communication (PLC), General Packet Radio Service (GPRS) or Broadband over Power Line (BPL)

⁷ *Programa de Redes Inteligentes del Ecuador REDIE - Mapa de Ruta 2013.* Ministerio de Electricidad y Energía Renovable (MEER), Consejo Nacional de Electricidad (CONELEC), Corporación Eléctrica de Ecuador (CELEC EP), Centro Nacional de Control de Energía (CENACE).

- 2.6 REDIE Program objectives are (i) to increase the efficiency in the value chain, with emphasis on reducing energy losses and encouraging a more efficient energy consumption (ii) to adopt new technologies, with a high benefit-cost ratio, in order to optimize the power system operation, (iii) to provide reliable supply of electricity with high quality to meet the demand at a reasonable cost, (iv) to strengthen human resources in order to string along with the innovation processes, organization and development of the electricity sector and (v) to maximize the use of the electrical infrastructure management.
- 2.7 As part of the REDIE program, the National Dispatch Centre (CENACE, for its acronym in Spanish) has been conducting the WAMS project since 2010. WAMS aims to improve the reliability of system operation mainly by installing the PMU⁸ at long-distance transmission lines and analyzing the remotely acquired data through optical communication network. This infrastructure in addition to new regulations for the efficient operation of the transmission and distribution systems is necessary to secure a more efficient dispatch of new power generation with renewables and to maximize the benefits of the regional electrical integration⁹.
- 2.8 In the last few years, Ecuador has experienced the use of isolated metering programs in which different meters (Elster, Itron, Landys and GE) have been installed to improve billing accuracy as well as collection rates. These meters also contribute to the reduction of non-electricity losses. Nevertheless, data is collected using different systems. These systems have communication problems and the protocols to enable interoperability are not in place. On the other hand, Ecuador has approved regulations to promote the deployment of Non-Conventional Renewable Energy (NCRE), such as wind and solar, which is highly variable and intermittent.
- 2.9 The implementation of a SGP would improve data monitoring, communication between customer and the network, and the adequate integration and dispatch of NCRE. With the implementation of SGP, PPU will have the instruments to optimize the use of its assets. Operation would be optimized by obtaining information in real time, allowing the detection of any equipment failure in the very moment that the equipment requires maintenance. In addition, it is expected to improve system security, minimizing outages episodes when facing challenges of ageing infrastructure, variable generation, among others. The operating policies of the control centers will be established as part of this Technical Cooperation (TC), as well as the adequate team for the operation of each center.
- 2.10 The Government of Korea (GoK) has shown interest in supporting the implementation of the SGP in Ecuador through the Knowledge Sharing Program (KSP). As knowledge sharing in the context of development cooperation becomes important in fostering ownership among developing countries and strengthening their capacities for development, the GoK has offered to share its experience in rapid economic development and innovative technologies to Ecuador through the KSP. The KSP is expected to co-finance this TC and pursue collaboration with the Inter-American Development Bank (IDB) by bringing together Korea's advanced technologies in ICT and SG, and the IDB's extensive expertise in the development of Ecuador. Considering its capacity on the cutting-edge of Smart Grid Technologies (SGT)

⁸ PMU measures voltages and currents at principle intersecting locations (critical substations) on a power grid and can output accurately time-stamped voltage and current phasors.

⁹ Technical Cooperation- RG-T2056-Support to the Andean Electric Interconnection Studies. Investment Loan-EC-L1117-Strengthening of the National Transmission Network.

and large-scale test bed in Jeju Island, GoK is expected to generate synergy through this joint consulting TC.

- 2.11 The GoE launched in April 24, 2007 the Initiative Cero Fossil Fuel for the Galapagos. The National Initiative is implemented by MEER and executed directly by the Galapagos power utility – ELECGALAPAGOS, State owned company. The GoE has already shown its capability to operate, administrate and maintain the existing clean energy supply and cutting edge technologies¹⁰ in the Islands. The GoE has decided to make Galapagos a technological showcase in order to send the message to the society that it is possible to protect the environment and promote sustainable growth by using clean and safer technologies. The main outcomes of this TC will be used to guide the implementation of a smart grid showcase in Galapagos by the GoE.
- 2.12 **Legal framework of the electricity sector.** The current Ecuadorian legislation of the electricity sector is based on the Constituent Mandate 15 from 2008; the Electricity Law (LRSE, for its acronym in Spanish) from 1996, and reforms of the Public Utility Act from 2009¹¹ and 2010.
- 2.13 **Institutional framework of the electricity sector.** The MEER is the head of the energy sector and the National Regulatory Council (CONELEC, for its acronym in Spanish) fulfills the role of regulating and monitoring the supply of electricity, subject to the National Development Plan (NDP). Ten Distribution Companies are responsible for the distribution and commercialization of the electricity throughout the country.
- 2.14 The CENACE was created in 1996 and is defined as a non-profit corporation; whose members include all companies in generation, transmission, distributions and large consumers. CENACE's Board of Directors is chaired by the Minister of Energy, as delegate of the Ecuadorian Presidency. The main function of CENACE is to secure real time dispatch of electricity through the operation of the Energy Management System (EMS).
- 2.15 The Technical Cooperation (TC) is framed in the dialogue area of energy, and the SGP is embedded in the strategy to promote a long-term sustainable energy framework that facilitates adequate energy supply, and secure reliable access to electricity, as included in IDB Country Strategy (CS) with Ecuador 2012-2017 (GN-2680). The TC will directly contribute to achieve the indicators of the CS by supporting the (i) diversification of the energy national matrix and (ii) the increase of Energy Efficiency (EE) at national level.
- 2.16 The TC is aligned with IDB's institutional priorities outlined in the Ninth General Capital Increase (GCI-9), which considers as priority areas: (i) infrastructure for competitiveness and social welfare, as the TC seeks to assess the benefits and necessary infrastructure for the implementation of the SGP in Ecuador; and (ii) protecting the environment and responding to climate change by promoting the effective integration of RE and the efficient use of energy. This TC is also aligned with the strategic goal of supporting less developed and small countries.

III. Description of activities/components and budget (estimated length: 1-2 pages)

¹⁰ San Cristobal Island implemented the first national 2.4 MW wind project with 35% wind energy penetration in 2007. Currently a high complex wind (2.25 MW)/ PV (1.5 MW)/ thermal power project integrating Baltra and Santa Cruz Islands is been built. This project will integrate industrial energy storage system aiming at least 50% renewable energy penetration in 2015

¹¹ The LRSE defines objectives in terms of generation, transmission, and distribution of electricity. The Public Companies Act contains aspects related to the organization and management of public companies, including those that form part of strategic sectors.

- 3.1 **Component I. Power Sector Analysis.** As a baseline study, Component I will analyze the status of the power sector in Ecuador including the Galapagos Island *vis-à-vis* the implementation of the SGP. It will provide analysis on the conditions for the implementation of the SGP including, *inter-alia*: (i) market conditions; (ii) regulations; (iii) local capacities; (iv) technological options; and (v) recommendations on regulatory framework necessary for the implementation of the SGP. On a technical basis, the analysis will also review equipment compatibility, communication systems and protocol used of current systems, among others. This component will also provide a review of best practices in Smart Grid in other countries including Korea.
- 3.2 **Component II. Implementation Plan of the Smart Grid Program.** Based on the analysis results from Component I, the implementation plan of the SGP will be outlined. This implementation will specifically focus on the Phase 1 of the SGP, which comprise the period of 2013-2017 when the fundamental infrastructure required for SG will be analyzed and proposed. The plan will address all aspects from distributed generation and transmission, to distribution and end-user side, as indicated in the Roadmap, including the required technology and infrastructure, such as AMS, AMI, Distribution Automation, Home Area Network and Electric Vehicles, the media and communication protocol standards applicable, and the plan of pilot programs and expansions. Considering the current status, the plan will employ step-by-step approaches to introduce from the most essential and feasible technology to more advanced ones, aiming at achieving the objectives of Phase 1, as stated in the Roadmap. The Plan will include the implementation of the SGP in Galapagos Island. The TC will be consistent with the Roadmap and will take into account current experience toward the use of SG in Ecuador.
- 3.3 KSP is financing the activities of Components I and II and the outputs of those activities will be the base for the development of Components III, IV and V. Therefore those outputs will be delivered before the execution of Components III, IV and V (See aide memoire of studies for Component I and II currently in execution *IDBDOCS-#38260357-Aide Memoire_estudio de redes inteligentes*) .
- 3.4 **Component III. Financial and Economic Analysis of the Smart Grid Program.** Component III will conduct financial and economic analysis for the proposed implementation plan designed in Component II, through an economic extrapolation and cost/benefit analysis. Component III includes the following activities: (i) determine the cost (including CAPEX and OPEX) and the benefits to implement the plan in Component II, according to the timetable to introduce each proposed technology, in order to show decision makers if there are advantages for introducing SG in Ecuador, considering different scenarios for energy demand, economic and regulatory aspects; (ii) calculate the Net Present Value (NPV), and the financial and economic rates of return of the proposed implementation plan; (iii) carry out sensitivity analysis on the major cost factors; and (iv) propose financing alternatives for its deployment. The output of Component III will be a high level cost estimate and cost/benefit analysis of the project for three different scenarios. The expected result of Component III is the adoption of an economic model to analyze the required infrastructure for the introduction of SGP throughout the country and in the Galapagos Island.
- 3.5 **Component IV. Proposal for the Development of the Asset Management System (AMS).** The objective of Component IV is to develop a proposal for the infrastructure development and the AMS, including SCADA, OMS-MWM and DMS, in order to enable effective planning and integrated programming of physical resources throughout the life cycle of the grid. The

specification, design and construction of the assets, its operations and its maintenance during its life cycle should be incorporated. The proposal should be closely aligned with the national plan to establish control centers at different supervision levels and the Roadmap. The output of Component IV will be a proposal for the AMS, which contains a specific and detailed development plan to be implemented immediately.

- 3.6 **Component V. Capacity Building and Dissemination.** The objective of Component V is to provide training to GoE's staff (MEER, CONELEC, CENACE, CELEC EP and Distribution Companies staffs) in the implementation and operation of the SGP. System operators' staff will be trained in traditional issues (e.g. power system control) and emerging issues (e.g. electricity market and regulation). Experience and lessons learned in operating the AMS will be also transferred for helping draft operating policies for control centers and the Terms of Reference (ToR) for the selection. As part of the products, a technical note with the results of the consultancy will be prepared and edited for publication. At the end of the TC, one regional seminar will be organized to share the results of this joint consulting program of the IDB and the KSP with local and regional stakeholders.

Indicative Results Matrix

Component	Product	Base Line (2013)	Goal (2015)
Component I	Power Sector Assessment and Report on SG best practices	0	1
Component II	Implementation plan and timetable for adopting SG	0	1
Component III	Economic and Financial Assessment of SG Plan	0	1
Component IV	AMS Proposal	0	1
Component V	Regional SG Seminar	0	1
	Publication (Technical Note)	0	1

Indicative Budget

Component	IDB	KSP ¹²¹³	Total Funding
Component I. Power Sector Analysis	-	100,000	100,000
Component II. Implementation Plan of the Smart Grid Program	-	100,000	100,000
Component III. Financial and Economic Analysis of the Smart Grid Program	100,000	-	100,000
Component IV. Proposal for the Development of the Asset Management System	120,000	-	120,000
Component V. Capacity Building and Dissemination	100,000	30,000	130,000
Contingencies	30,000	20,000	50,000
Project Management	100,000	-	100,000
TOTAL	450,000	250,000	700,000

IV. Executing agency and execution structure (estimated length: 1 page)

¹² The Korea EXIMbank will be in charge of the management of the joint consulting project in close collaboration with the IDB and the GoE. The selection and engagement of consultants will be carried out in line with the agreement on the Terms of Reference for KSP consultants among the Korea EXIMbank, the IDB, and the GoE. See Aide Memoire [IDBDOCS-#38260357-Aide Memoire ESTUDIO DE REDES INTELIGENTES](#) and Project Concept Note [IDBDOCS-#38260329-PCP IDB Ecuador SmartGrid KSP](#)

¹³ Activities being funded and developed according to the scope of the MOU on the Knowledge-Sharing Program ("KSP"), signed on March 27, 2011 between the Inter-American Development Bank ("IDB") and the Ministry of Strategy and Finance of Korea ("MoSF").

- 4.1 According to the Operational Guidelines for Technical Cooperation Products (GN-2629-1), the IDB is allowed to execute on behalf of the beneficiary TC which are either Operational Support or Client Services. The Executing Agency will be the Inter-American Development Bank through the Energy Division (INE/ENE)¹⁴. The execution by the IDB will mitigate the risk identified and described in section V.
- 4.2 IDB Energy specialist in the Country Office (CEC/ENE) as well as IDB energy specialists based on Headquarters (INE/ENE) will participate and coordinate all the execution activities through (i) review of all products and (ii) periodic visits to MEER. In order to ensure the coordination among stakeholders (KSP, MEER, CENACE, CONELEC, CEPEC EP and Distribution Companies) and the execution of this TC in a timely manner, a Project Manager will be hired as part of the TC.
- 4.3 The team will follow the “Policies for the Selection and Contracting of Consultants Financed by the Inter-American Development Bank” (GN-2350-9) and the Policies for the Procurement of Goods and Works financed by the Inter-American Development Bank (GN-2349-9). For Component I and II, the IDB in coordination with KSP, will draft the Terms of Reference (ToR) for the selection of the consulting services. According to the Operational Guidelines for the Technical Cooperation Products (GN-2629-1), the Bank will not contract works under this TC.
- 4.4 **Auditing and financial Management.** This TC will be executed by INE/ENE. The financial responsibility of these resources management rests within IDB and no auditing process is foreseen.

V. Major issues (estimated length: 1 page)

- 5.1 **Technological Complexity:** The TC finances studies to guide the implementation of Ecuadorian SGP. Due to the priority of SGP in the agenda of the sector, the main risk associated is the timely delivery and the quality of the outcomes of the studies financed. This risk will be mitigated with the adequate selection of the consulting services and the selection of an experienced local consultant to support review of deliverables by the SGP team and the Bank.
- 5.2 **Coordination risk:** The implementation of this TC requires a strong coordination with local and national authorities. The INE/ENE execution will allow to ensure the coordination of all stakeholders and to ensure regional dissemination of products and lessons learned.

VI. Exceptions to Bank policy

- 6.1 No exceptions to Bank policy are foreseen.

VII. Environmental and Social Strategy

- 7.1 The TC does not have associated social and environmental risks. This TC has been classified as “C”. See [IDBDOCS-#38197193-EC-T1279 SSF](#) & [IDBDOCS-#38197188-EC-T1279 SPF](#)

Required Annexes:

- GoE Request [Carta solicitud de apoyo CT Redes inteligentes \(#37816286\)](#)
- Terms of Reference [IDBDOCS-#38218898-EC-T1279 TOR SmartGrid](#)

¹⁴ On May 7th 2013 the GoE requested the IDB support for the implementation of the REDIE Program. The GoE has requested the IDB to be the executing agency and a letter of non-objection is under preparation and should be received shortly. The IDB will not start the execution of this CT unless such letter has been provided.

- Procurement Plan [IDBDOCS-#38260375-EC-T1279 Procurement Plan vfinal post QRR](#)



Oficio Nro. MEER-SDCE-2013-0298-OF

Quito, D.M., 07 de mayo de 2013

Asunto: Solicitud de Cooperación Técnica No Reembolsable â Estudios para la identificación de mejores prácticas en la operación de redes eléctricas en Ecuador, bajo el concepto de Redes Inteligentes

Sr.

Morgan Doyle

Representante

BID - BANCO INTERAMERICANO DE DESARROLLO

En su Despacho

Con el fin de avanzar en la implementación del Programa Redes Inteligentes Ecuador (REDIE) publicado recientemente por el Gobierno de Ecuador, el Ministerio de Electricidad y Energía Renovable (MEER), en conocimiento del interés del Banco Inter Americano de Desarrollo (BID) en apoyar la implementación de mejores prácticas en la operación de redes eléctricas en Latinoamérica bajo el mismo concepto (*Smart Grid, por su nombre en inglés*), me permito solicitar el apoyo de la Institución que usted representa, a través de una cooperación técnica no reembolsable.

Esta cooperación permitirá llevar a cabo estudios que en función de las mejores prácticas internacionales, contribuyan, entre otros, a:

1. Analizar las condiciones actuales del sistema eléctrico según los objetivos del Programa REDIE;reparación de la estrategia para la implementación de la primera fase del Programa REDIE.
2. Desarrollo de una propuesta para implementación del AMS (Asset Management System) y que facilite el planeamiento integral de la red;
3. Desarrollo de la hoja de ruta para la implementación de un ERP (Enterprise Resource Planning)
4. Desarrollo de la hoja de ruta para la implementación de una AMI (Advanced Metering Infrastructure)
5. Capacitación de funcionarios públicos en la implementación del Programa REDIE.

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Oficio Nro. MEER-SDCE-2013-0298-OF

Quito, D.M., 07 de mayo de 2013

El MEER agradece al Señor Representante por su aporte con las gestiones necesarias para contar con el apoyo del BID en esta iniciativa, la misma que redundará en un aumento de la calidad del servicio eléctrico para todos los clientes del sector eléctrico ecuatoriano.

Con sentimiento de consideración.

Atentamente,

Ing. Geovanny Pardo Salazar

**SUBSECRETARIO DE DISTRIBUCIÓN Y COMERCIALIZACIÓN
DE ENERGÍA**

Copia:

Señora Economista

Gabriela Rosero Moncayo

Secretaria Técnica de Cooperación Internacional

SECRETARÍA TÉCNICA DE COOPERACIÓN INTERNACIONAL

Señor

Leandro Alves

Jefe de División de Energía

BANCO INTERAMERICANO DE DESARROLLO

meme

Analysis for the Implementation of the Smart Grid Program in Ecuador
Financial, Economic and AMS Assessment
TOR I
EC-T1279

A. Background

- 1.1 A Smart Grid (SG) is an upgraded electricity network that can intelligently integrate the actions for all users connected to it (producers, consumers), in order to ensure economically efficient, sustainable power systems with low losses and high levels of quality and security of supply and safety.¹ A SG introduces Information and Communication Technologies (ICT) tools in the field of electric power systems and promotes innovation in the management of the electricity grid.
- 1.2 **Benefits of SG.** By allowing bidirectional data and information flow, SG (i) enables active participation of consumers and therefore promotes the introduction of Energy Efficiency (EE) measures at the demand side; (ii) SG is also necessary when large and intermittent energy packets are introduced to the network. This is the case of Renewable Energy (RE) and Distributed Generation (DG); (iii) SG also may improve grid stability and security since it allow a better response to system disturbances and enables new products, services and markets around the evolved electricity sector. By enabling network optimization, SG can contribute as well to reduce technical and non-technical losses².
- 1.3 In January 2013, the Government of Ecuador (GoE) launched the Roadmap for the Ecuadorian Smart Grid Program³ (REDIE, for its acronym is Spanish). REDIE has three phases covering the period 2013-2030. Following the Ministerial Agreement N301 an Executive Committee was created for the execution of the REDIE project. The Executive Committee is chaired by the Ministry of Electricity and Renewable Energy (MEER, for its acronym in Spanish) and its members are public institutions of the sector represented by the National Regulatory Body, the National Dispatch Centre and representative from the Electricity Distribution Companies.
- 1.4 REDIE Program objectives are (i) to increase the efficiency in the value chain, with emphasis on reducing energy losses and encouraging a more efficient energy consumption (ii) to adopt new technologies, with a high benefit-cost ratio, in order to optimize the power system operation, (iii) to provide reliable supply of electricity with high quality to meet the demand at a reasonable cost, (iv) to strengthen human resources in order to string along with the innovation processes, organization and development of

¹ Smart Grids European Technology Platform (ETP). Strategic deployment document. www.SmartGrids_APRIL2010.pdf

² Technical losses are those related to transformer losses, resistance losses on power networks, etc. Non-technical losses are occurred by mistakes, human errors, malfunctions of management systems, etc.

³ *Programa de Redes Inteligentes del Ecuador REDIE - Mapa de Ruta 2013. Ministerio de Electricidad y Energía Renovable (MEER), Consejo Nacional de Electricidad (CONELEC), Corporación Eléctrica de Ecuador (CELEC EP), Centro Nacional de Control de Energía (CENACE).*

the electricity sector and (v) to maximize the use of the electrical infrastructure management.

- 1.5 The Government of Korea (GoK) has shown interest in supporting the implementation of the SGP in Ecuador through the Knowledge Sharing Program (KSP). As knowledge sharing in the context of development cooperation becomes important in fostering ownership among developing countries and strengthening their capacities for development, the GoK has offered to share its experience in rapid economic development and innovative technologies to Ecuador through the KSP. The KSP is expected to co-finance this TC and pursue collaboration with the IDB by bringing together Korea's advanced technologies in ICT and SG, and the IDB's extensive expertise in the development of Ecuador, through a consultancy currently underway.
- 1.6 The TC EC-T1279 is designed to support the GoE in their efforts to introduce SG technologies in Ecuador by assessing the technical options, the regulation and norms as well as by assessing the infrastructure requirements.

B. Objective

- 1.7 The objective of this consultancy is to support the implementation of the REDIE Program in Ecuador. This TC will perform a cost-benefit analysis in order to estimate economic and financial indicators arising from the implementation plan. Additionally, the project will provide a detailed proposal to immediately execute the development of the Asset Management System (AMS) as the first step of the implementation plan. This consultancy should lay down a robust foundation toward the implementation of the Smart Grid Program in Ecuador, and in particular, will address the particular case of Galapagos.

C. Outputs and Activities

- 1.8 The following outputs/activities are expected from this consultancy (i) Financial and economic analysis of the SGP, and (ii) Proposal for the development of the asset management system (AMS).
- 1.9 **Financial and Economic Analysis of the SGP.** The main activities to be developed are (i) Financial and economic analysis for the proposed implementation plan of the SGP through an economic extrapolation and cost/benefit analysis will be conducted.
- 1.10 The following activities will be included: (i) determine the economic and financial costs (including CAPEX and OPEX) and the economic and financial benefits to implement the plan to be defined by the KSP consultancy. (ii) This assessment should consider different scenarios regarding economic and regulatory aspects (energy prices, costs fluctuations, energy demand scenarios, among others); (iii) calculate the NPV, and the financial and economic rates of return of the proposed implementation plan; and (iv) propose financing alternatives for its deployment. The output of this activity will be a high level cost estimate and a cost/benefit analysis of the project for three different scenarios. The expected result of this assessment is the adoption of an economic model to analyze the required infrastructure for the SGP. This analysis will be done considering Galapagos Island as a possible pilot for the SG program.

- 1.11 **Proposal for the Development of the Asset Management System.** The objective of this activity is to develop the proposal for the development of the operation management capacity and the AMS including SCADA/OMS-MWM/DMS, in order to enable effective planning and integrated programming of physical resources throughout the life cycle of the grid. The specification for the design and construction of the assets, its operations and its maintenance during its life cycle should be incorporated. The proposal should be closely aligned with the national plan to establish control centers at different supervision levels and the Roadmap of the Ecuadorian Smart Grid Program. The output of this activity will be a proposal for the AMS, which contains a specific and detailed development plan to be implemented immediately in Ecuador and in Galapagos Island.

D. Products and Timeline

13. This consultancy will be implemented during June 2014 to March 2015. The proposed implementation schedule and milestones are as follows:

Activities (Milestone)	Date
Kick off workshop	June 2014
Preliminary report – Activity 1	September 2014
Preliminary report – Activity 2	October 2014
Final Report – Activities 1 & 2	January 2015
Dissemination seminar	March 2015

E. Schedule of Payments

- 15% upon Contract signature
- 15% upon accepted Preliminary Report Activity 1
- 15% upon accepted Preliminary Report Activity 2
- 30% upon accepted Final report
- 15% upon Final Presentation.

F. Coordination

- *Team Leader or Coordinator: Jesus Tejada (jesust@iadb.org)*
- *Department/Division: INE/ENE*

G. Consultancy Requirements

- The Consultancy will be performed by a firm
- Contract Duration : June 2014 – March 2015
- Place(s) of work: Based in the Firm Headquarter, with several missions to Ecuador when necessary

H. Qualifications

- Extensive experience and proven track records in SG technologies, extensively from designing policies and regulatory frameworks to implementing technological applications in practice.
- Experience of participation in Jeju Island Smart Grid Test Bed will be highly preferred.
- Capacity and prior experience in conducting financial and economic analysis will be desirable.
- Excellent communication skills in both English and Spanish required.

Payment and Conditions of Employment: If the work will be carried out at Bank headquarters in Washington D.C. Remuneration will be determined in accordance with Bank regulations and criteria. The Bank will additionally contribute toward travel and moving expenses, if applicable. If a candidate is not a citizen or resident of the United States, the Bank will apply for a G-IV visa from the consulate of the United States in the candidate's country of origin. If a candidate cannot obtain a visa to work at the IDB the contractual offer will be rescinded.

Consanguinity: Individuals with relatives working for the IDB within, and including the fourth degree of consanguinity and the second degree of affinity are not eligible for employment as staff, consultants, or contractors through firms or agencies. Candidates must be citizens of a member country of the Inter-American Development Bank

Other: Only include details of work activities. No individual information such as name/address, etc. Do not include budget or fees as these are not part of the terms of reference. No titles, leadership roles, or supervision are permitted for contractual

Analysis for the Implementation of the Smart Grid Program in Ecuador
Project Manager
TOR 2
EC-T1279

I. Background

- 1.12 A Smart Grid (SG) is an upgraded electricity network that can intelligently integrate the actions for all users connected to it (producers, consumers), in order to ensure economically efficient, sustainable power systems with low losses and high levels of quality and security of supply and safety.⁴ A SG introduces Information and Communication Technologies (ICT) tools in the field of electric power systems and promotes innovation in the management of the electricity grid.
- 1.13 **Benefits of SG.** By allowing bidirectional data and information flow, SG (i) enables active participation of consumers and therefore promotes the introduction of Energy Efficiency (EE) measures at the demand side; (ii) SG is also necessary when large and intermittent energy packets are introduced to the network. This is the case of Renewable Energy (RE) and Distributed Generation (DG); (iii) SG also may improve grid stability and security since it allow a better response to system disturbances and enables new products, services and markets around the evolved electricity sector. By enabling network optimization, SG can contribute as well to reduce technical and non-technical losses⁵.
- 1.14 In January 2013, the Government of Ecuador (GoE) launched the Roadmap for the Ecuadorian Smart Grid Program⁶ (REDIE, for its acronym is Spanish). REDIE has three phases covering the period 2013-2030. Following the Ministerial Agreement N301 an Executive Committee was created for the execution of the REDIE project. The Executive Committee is chaired by the Ministry of Electricity and Renewable Energy (MEER, for its acronym in Spanish) and its members are public institutions of the sector represented by the National Regulatory Body, the National Dispatch Centre and representative from the Electricity Distribution Companies.
- 1.15 REDIE Program objectives are (i) to increase the efficiency in the value chain, with emphasis on reducing energy losses and encouraging a more efficient energy consumption (ii) to adopt new technologies, with a high benefit-cost ratio, in order to optimize the power system operation, (iii) to provide reliable supply of electricity with high quality to meet the demand at a reasonable cost, (iv) to strengthen human resources in order to string along with the innovation processes, organization and development of

⁴ Smart Grids European Technology Platform (ETP). Strategic deployment document. www.SmartGrids_APRIL2010.pdf

⁵ Technical losses are those related to transformer losses, resistance losses on power networks, etc. Non-technical losses are occurred by mistakes, human errors, malfunctions of management systems, etc.

⁶ *Programa de Redes Inteligentes del Ecuador REDIE - Mapa de Ruta 2013. Ministerio de Electricidad y Energía Renovable (MEER), Consejo Nacional de Electricidad (CONELEC), Corporación Eléctrica de Ecuador (CELEC EP), Centro Nacional de Control de Energía (CENACE).*

the electricity sector and (v) to maximize the use of the electrical infrastructure management.

- 1.16 The Government of Korea (GoK) has shown interest in supporting the implementation of the SGP in Ecuador through the Knowledge Sharing Program (KSP). As knowledge sharing in the context of development cooperation becomes important in fostering ownership among developing countries and strengthening their capacities for development, the GoK has offered to share its experience in rapid economic development and innovative technologies to Ecuador through the KSP. The KSP is expected to co-finance this TC and pursue collaboration with the IDB by bringing together Korea's advanced technologies in ICT and SG, and the IDB's extensive expertise in the development of Ecuador, through a consultancy currently underway.
- 1.17 The TC EC-T1279 is designed to support the GoE in their efforts to introduce SG technologies in Ecuador by assessing the technical options, the regulation and norms as well as by assessing the infrastructure requirements.

J. Objective

- 1.18 The objective of this consultancy is to coordinate and supervise all activities related to the execution of this TC and the timely coordination with activities to be developed under the KSP Consultancy

K. Outputs and Activities

- 1.19 The following outputs/activities are expected from this consultancy:
- (i) **Coordination.** The consultant will be charge with the coordination of all activities of this TC with local stakeholders (MEER, CONELEC, CENANE, ect). The consultant will be the IDB liaison for all matters regarding the KSP consultancy and should ensure the coordination of activities and outputs.
 - (ii) **Technical Supervision.** The consultant will be responsible for the technical and economic review of all products to be developed under the EC-T1279. He/She will as well review and comment if necessary products and results of the KSP Consultancy in order to ensure technical coherence between products.
 - (iii) **Dissemination Activities.** The consultant will design and implement several dissemination activities for increasing the visibility of the products to be developed under EC-T1279.

L. Timeline and Schedule of Payments.

- 1.20 This consultancy will be implemented during January 2014 to March 2015. The payments will be done on a monthly basis.

M. Coordination

- *Team Leader or Coordinator:* Jesus Tejeda (jesust@iadb.org)

- *Department/Division: INE/ENE*

N. Consultancy Requirements

- The Consultancy will be performed by a individual consultant.
- Contract Duration : January 2014 – March 2015
- Place(s) of work: Based in consultant location, with at least 3 missions to Ecuador.

O. Qualifications

- Electrical or Industrial Engineer with extensive experience in supervision and management of energy projects (technical assistant, investment grants, etc) in Latin America and the Caribbean. MSC in Economics or Financial highly desirable.
- Extensive Experience in the Ecuadorian energy sector.
- Experience on SG programs is highly desirable.
- Capacity and prior experience in conducting financial and economic analysis will be desirable.
- Excellent communication skills in both English and Spanish required.

Payment and Conditions of Employment: If the work will be carried out at Bank headquarters in Washington D.C. Remuneration will be determined in accordance with Bank regulations and criteria. The Bank will additionally contribute toward travel and moving expenses, if applicable. If a candidate is not a citizen or resident of the United States, the Bank will apply for a G-IV visa from the consulate of the United States in the candidate's country of origin. If a candidate cannot obtain a visa to work at the IDB the contractual offer will be rescinded.

Consanguinity: Individuals with relatives working for the IDB within, and including the fourth degree of consanguinity and the second degree of affinity are not eligible for employment as staff, consultants, or contractors through firms or agencies. Candidates must be citizens of a member country of the Inter-American Development Bank

Other: Only include details of work activities. No individual information such as name/address, etc. Do not include budget or fees as these are not part of the terms of reference. No titles, leadership roles, or supervision are permitted for contractual

Project: Analysis for the Implementation of the Smart Grid Program in Ecuador
Project Number EC-T1279
Period comprised in this Procurement Plan: From 01/01/2014 to 31/06/2015

Ref. No. ¹	Description of and category of procurement contract	Estimated cost in (US\$ thousand)	Procure-ment method ²	Review (ex-ante or ex-post)	Source of financing and percentage		Prequali-fication ³ (Yes/No)	Estimated Dates		Status ⁴ (pending, in process, awarded, cancelled)	Comments
					IDB %	Local / Other %		Publication of specific procurement notice	Completion of contract		
1	CONSULTING SERVICES	450,000									
	SG Consulting Firm (Proposal SG development Plan)	100,000	DC	ex-ante	100%	0%	No	1rd Quarter 2014		Pending	
	Project Manager	100,000	QCII	ex-ante	100%	0%	No	1rd Quarter 2014		Pending	
	Edit and Design Consultant	20,000	PC	ex-ante	100%	0%	No	1rd Quarter 2015		Pending	
2	SERVICES										
	Seminar Services	50,000	PC	ex-ante	100%	0%	No	1rd Quarter 2015		Pending	
	Trainning Services	100,000									
	Publication Services	30,000	PC	ex-ante	100%	0%	No	1rd Quarter 2015		Pending	
	Translations Services	20,000									
	Contingencies	30,000									
¹ If there are a number of similar individual contracts to be executed in different places or at different times, these can be grouped together under a single heading, with an explanation in the comments column, indicating the average individual amount and the period during which the contracts would be executed. For example: an education project that includes school construction might include an item labeled “School Construction” for an estimated cost of US\$20 million and an explanation under the Comments column such as this: “This item encompasses some 200 contracts for school construction averaging US\$100,000 each, to be awarded individually by the participating municipal governments over a three-year period between January 2006 and December 2008.”											
² Goods and Works: ICB: International competitive bidding; LIB: limited international bidding; NCB: national competitive bidding; PC: price comparison; DC: direct contracting; FA: force account; PSA: Procurement through specialized agencies; PAs: Procurement agents; IA: Inspection agents; PLFI: Procurement in loans to financial intermediaries; BOO/BOT/BOOT: Build, own, operate/build, operate, transfer/build, own, operate, transfer; PBP: Performance-based procurement; PLGB: Procurement under loans guaranteed by the Bank; PCP: Community participation procurement; Consulting Firms: QCBS: Quality- and cost-based selection; QBS: Quality-based selection; FBS: Selection under a fixed budget; LCS: Least-cost selection; CQS: Selection based on the consultants' qualifications; SSS: Single-source selection; Individual Consultants: QCNI: Selection based on comparison of qualifications of national individual consultants; QCII: Selection based on comparison of qualifications of international individual consultants.											
³ Applicable only to Goods and Works in case the new Policies apply. In the case of previous Policies, it is applicable to Goods, Works and Consulting Services.											
⁴ Column “Status” will be used for retroactive procurement and when updating the procurement plan.											

SAFEGUARD POLICY FILTER REPORT

PROJECT DETAILS	
IDB Sector	ENERGY-ENERGY EFFICIENCY AND RENEWABLE ENERGY IN END USE
Type of Operation	Technical Cooperation
Additional Operation Details	
Investment Checklist	Infrastructure Power Transmission
Team Leader	Tejeda Ricardez, Jesus Alberto (JESUST@iadb.org)
Project Title	Analysis and recommendations for the successful implementation of the Smart Grid
Project Number	EC-T1279
Safeguard Screening Assessor(s)	Mendez Muñoz, Paola A. (paolame@IADB.ORG)
Assessment Date	2013-10-28

SAFEGUARD POLICY FILTER RESULTS		
Type of Operation	Technical Cooperation	
Safeguard Policy Items Identified (Yes)	Operation for which (Type 1) disaster risk is most likely to be low .	(B.01) Disaster Risk Management Policy– OP-704
	The Bank will make available to the public the relevant Project documents.	(B.01) Access to Information Policy– OP-102
	The operation is in compliance with environmental, specific women's rights, gender, and indigenous laws and regulations of the country where the operation is being implemented (including national obligations established under ratified Multilateral Environmental Agreements).	(B.02)
	The operation (including associated facilities) is screened and classified according to their potential environmental impacts.	(B.03)
	The Bank will monitor the executing agency/borrower's compliance with all safeguard requirements stipulated in the loan agreement and project operating or credit regulations.	(B.07)
	Suitable safeguard provisions for procurement of goods and services in Bank	(B.17)

	financed projects may be incorporated into project-specific loan agreements, operating regulations and bidding documents, as appropriate, to ensure environmentally responsible procurement.	
Potential Safeguard Policy Items(?)	No potential issues identified	
Recommended Action:	Operation has triggered 1 or more Policy Directives; please refer to appropriate Directive(s). Complete Project Classification Tool. Submit Safeguard Policy Filter Report, PP (or equivalent) and Safeguard Screening Form to ESR.	
Additional Comments:		

ASSESSOR DETAILS	
Name of person who completed screening:	Mendez Muñoz, Paola A. (paolame@IADB.ORG)
Title:	
Date:	2013-10-28

SAFEGUARD SCREENING FORM

PROJECT DETAILS	
IDB Sector	ENERGY-ENERGY EFFICIENCY AND RENEWABLE ENERGY IN END USE
Type of Operation	Technical Cooperation
Additional Operation Details	
Country	ECUADOR
Project Status	
Investment Checklist	Infrastructure Power Transmission
Team Leader	Tejeda Ricardez, Jesus Alberto (JESUST@iadb.org)
Project Title	Analysis and recommendations for the successful implementation of the Smart Grid
Project Number	EC-T1279
Safeguard Screening Assessor(s)	Mendez Muñoz, Paola A. (paolame@IADB.ORG)
Assessment Date	2013-10-28

PROJECT CLASSIFICATION SUMMARY		
Project Category: C	Override Rating:	Override Justification:
		Comments:
Conditions/ Recommendations	<ul style="list-style-type: none"> No environmental assessment studies or consultations are required for Category "C" operations. Some Category "C" operations may require specific safeguard or monitoring requirements (Policy Directive B.3).Where relevant, these operations will establish safeguard, or monitoring requirements to address environmental and other risks (social, disaster, cultural, health and safety etc.). The Project Team must send the PP (or equivalent) containing the Environmental and Social Strategy (the requirements for an ESS are described in the Environment Policy Guideline: Directive B.3) as well as the Safeguard Policy Filter and Safeguard Screening Form Reports. 	

SUMMARY OF IMPACTS/RISKS AND POTENTIAL SOLUTIONS	
Identified Impacts/Risks	Potential Solutions

DISASTER RISK SUMMARY
Disaster Risk Category: Low

Disaster/ Recommendations	<ul style="list-style-type: none"> No specific Disaster Risk Management is required.
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ASSESSOR DETAILS	
Name of person who completed screening:	Mendez Muñoz, Paola A. (paolame@IADB.ORG)
Title:	
Date:	2013-10-28

ANÁLISIS PARA LA IMPLEMENTACIÓN DE UN PROGRAMA DE REDES INTELIGENTES EN ECUADOR II (EC-T1279)

REVISIÓN DE CALIDAD Y RIESGO (QRR) – INFORME DE RESULTADOS Y PROCEDIMIENTOS

Proceso QRR

Documento de referencia fue distribuido al QRR solicitando comentarios el día 11 de Noviembre de 2013. El documento fue enviado a: Morgan do Cuenin; Diego Sebastian Buchara; VPC-FMP; PDP-FM; Treasury Operations; Office of the Manager SPD; SPD-SDV; SPD-SMO; VPS CM; Janine Ferretti.

Envia a: Office of the Vice President, Sectors & Knowledge; Office of the Vice President for Countries; Vice Presidency for Finance and stration; Executive VicePresident; Office of the General Manager CAN; Office of the Manager - INE; ESRNET; Taekon Kim; GCM single w; Leandro Alves; Jesus Alberto Tejeda Ricardez; Arnaldo Vieira de Carvalho; Alberto Levy; Javier Bedoya; Sergio Ballon; Yolanda Valle ons Policy Commitee; Carlos Jacome y Paola Mendez.

mentarios recibidos, así como acciones posteriores, han sido documentados en este Informe de Resultados y Procedimiento. No se realizó u presencial.

ASUNTOS NO RESUELTOS

no

Comentarios

re/Dept.	Tema	Comentarios	Respuestas
	SINEA	<ul style="list-style-type: none"> Prever cómo esta CT puede responder también al pedido que hicieron las autoridades del SINEA en el marco del último Consejo de Ministros. 	<i>Se ha incorporado dicha solicitud. Ver Párrafo 4.3.</i>
	Contrataciones	<ul style="list-style-type: none"> No resulta evidente que la evaluación prevista en el componente III deba ser realizada por la misma firma coreana encargada de los productos de los componentes I y II, por lo tanto debería justificarse mejor la decisión, especialmente por parte del equipo fiduciario. Adicionalmente, en el párrafo 4.3 se indica que <i>“Component V, which is co-financed, will be discussed between IDB and KSP”</i>; qué es concretamente lo que se discutirá y por qué? 	<i>El Párrafo 4.3 ha sido actualizado.</i>
	Riesgos	<ul style="list-style-type: none"> No se identifican riesgos lo cual es llamativo dado que esta CT apoya la implementación de un plan de muy largo plazo, lo cual implica que puede verse sujeta a condiciones muy cambiantes. Adicionalmente, se da a entender que esta CT estaría apoyando la preparación de un proyecto específico para implementar el Smart Grid; qué ocurre si este proyecto no prospera? 	<i>La sección 5.1 fue modificada. Sin embargo, se aclara que la CT solo financia estudios y que los productos servirán de guía para la implementación del concepto redes inteligentes en el territorio continental y en Galápagos. La CT no financia equipos para pilotos.</i>
	Ejecución	<ul style="list-style-type: none"> Indicar el plazo de ejecución, y si efectivamente el GdE ya ha solicitado al Banco que sea el encargado de la ejecución (se indica que esto es posible desde el punto de vista de políticas, pero no que haya sido solicitado por el Gobierno). 	<i>El plazo de ejecución de esta TC es de 18 meses. Tal como mencionado en la carta anexa. Si bien el GdE ha expresado su acuerdo, se le ha solicitado una carta donde se confirme este acuerdo..</i>

	Otros	<ul style="list-style-type: none"> En el cuadro de costos revisar la líneas de los componentes III y IV, no cuadran los totales con el detalle por fuentes de financiamiento. 	<i>Cuadro de Costos revisados.</i>
	Executing Agency	<ul style="list-style-type: none"> In light of the criteria set forth in document GN-2629-1 (Appendix X), we recommend attaching to the TC document the communication by which the “Ministerio de Electricidad y Energía Renovable” requested the Bank to act as a Executing Agency. Based on that communication, we recommend adding to the document the corresponding justification as to why the Bank should execute the TC operation. Before any activity is undertaken in Ecuador, we recommend obtaining the corresponding non-objection letter from the government of Ecuador. 	<i>Se ha solicitado una carta al GdE donde confirme este acuerdo de ejecución. Sección sido ajustada para justificar este acuerdo.</i>

Selection and contracting of consulting services:	<ul style="list-style-type: none"> • According to paragraph 4.3 of the TC document it is implied that a consulting firm will be hired under single-source selection for components III and IV of this operation. In that sense, we recommend checking with FMP that the TC document includes all the required justification/documentation to process the single-source selection of that consulting firm, in light of the criteria set forth in paragraph 3.10 of Section III of the policy for the selection and contracting of consultants financed by the Bank (GN-2350-9) (exceptional cases in which single-source selection can be used). • Finally, take into consideration that the Bank should only contract consulting services; however, will not contract works or procure goods, in accordance with the Appendix X of the Operational Guidelines for Technical Cooperation Products (GN-2629-1). 	<i>El párrafo 4.3 ha sido actualizado.</i>
Local counterpart resources	<ul style="list-style-type: none"> • We recommend specifying in the TC document in what will the contribution consist (the document should specify if the contribution is in-kind). Additionally, we suggest obtaining a commitment from the “Knowledge Sharing Program” in order to secure their contribution. This commitments could be obtained through a communication/letter from this institution. 	<i>Se ha especificado la especie de recursos en de página n°10.</i>
Indicative Budget	<ul style="list-style-type: none"> • We recommend reviewing the Indicative Budget so as the total funding for components IV and V matches the sum of each financing source. 	<i>Cuadro de Costos ha sido revisado.</i>