TC ABSTRACT

I. Basic project data

▪ Country/Region:	Ecuador/CAN
▪ TC Name:	Analysis for the Implementation of the Smart Grid Program in Ecuador
▪ TC Number:	EC-T1279
▪ Team Leader/Members:	Jesus Alberto Tejeda Ricardez (ENE/CEC) Arnaldo Vieira de Carvalho (INE/ENE) Alberto Levy (ENE/CAR) Carlos Echeverría (INE/ENE) Yolanda Valle (INE/ENE) Javier Bedoya (LEG)
▪ Indicate if: Operational Support, Client Support, or Research & Dissemination.	Client Support
▪ If Operational Support TC, give number and name of Operation Supported by the TC:	n/a
▪ Reference to Request: (IDB docs #)	IDBDocs37816286
▪ Date of TC Abstract:	June 7, 2013
▪ Beneficiary (countries or entities which are the recipient of the technical assistance):	*Ministerio de Electricidad y Energía Renovable* (MEER)
▪ Executing Agency and contact name (Organization or entity responsible for executing the TC Program)	The Energy Division (INE/ENE)
▪ IDB Funding Requested:	US$450,000
▪ Local counterpart funding, if any:	US$250,000 (through the Korea Knowledge Sharing Program, KSP)
▪ Disbursement period (which includes execution period):	18 months
▪ Required start date:	August 2013
▪ Types of consultants (firm or individual consultants):	Firm and individual consultants
▪ Prepared by Unit:	The Energy Division (INE/ENE)
▪ Unit of Disbursement Responsibility:	CEC
▪ Included in Country Strategy (y/n); ▪ TC included in CPD (y/n):	Yes
▪ GCI-9 Sector Priority:	Infrastructure for competitiveness and social welfare, protect the environment, respond to climate change and enhance food security

II. Objective and Justification

In recent years, Smart Grids (SG), the convergence of a power grid with the application of Information and Communication Technologies (ICT) in the field of electric power systems, promotes innovation in the management of the electricity grid. Allowing bidirectional data and information flow, SG enables active participation of consumers and improvement of power

quality and Energy Efficiency (EE). Its faster response time to variations in large, stochastic energy packets introduced to the network permits the ever increasing presence of Renewable Energy (RE). SG also anticipates and responds to system disturbances and enables new products, services and markets around the evolved electricity sector.

In the last few years, Ecuador has experienced the use of isolated metering programs (Elster, Itron, Landys and GE), in which meters have been installed to improve collection rates and to reduce electricity losses, however, data is collected on separate systems. Both systems have communication problems and the protocols to enable interoperability are not in place. In addition, direct connections do not have metering systems and they are very difficult to access. On the other hand, Ecuador has been planning the introduction of Non-Conventional RE (NCRE), such as wind and solar, which is highly stochastic. Therefore, the implementation of a Smart Grid Program (SGP) is necessary to facilitate data monitoring, communication between customer and the network, and the adequate integration and dispatch of NCRE.

The Government of Ecuador (GoE) launched the Roadmap for the Ecuadorian Smart Grid Program [1] (Roadmap) in January of 2013. The Roadmap covers the period 2013-2030 for developing SG in Ecuador. It will support projects and initiatives to achieve objectives including: (i) EE in all stages of the value chain in the electricity industry; (ii) reliable public utility of electricity; and (iii) achievement of a more balanced energy exchange with its neighboring countries. The GoE will pursue the objectives through converging ICT with the power infrastructure and making real-time information exchange available.

Implementing SG measures and the Asset Management System (AMS), which include: (i) Supervisory Control and Data Acquisition (SCADA); (ii) Outage Management Systems - Mobile Workforce Management (OMS-MWM); and (iii) Distribution Management Systems (DMS), 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. In this direction, Ecuador is drafting policies, functions and strategies for the operation of its electricity distribution network, as reflected in the Roadmap. As part of the implementation of the SGP, Ecuador also considers Advanced Metering Infrastructure (AMI), bringing value to the Public Power Utility to enable more effective and intelligent operation of the grid.

The GoE is expecting that, with the implementation of SGP, the Public Power Utility will have the instruments to optimize the use of its assets. Operation would be optimized by obtaining information from the equipment to analyze the precise moment that the equipment requires maintenance. In addition, it is expected to improve system security, minimizing outages

[1] *Programa de Redes Inteligentes del Ecuador - 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).

episodes when facing challenges of ageing infrastructure, variable generation, among others. The GoE is expected to establish a National Control Center, five regional control centers and 20 Local Control Centers for the implementation of its SGP. 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.

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

The TC is framed in the dialogue area of energy, to create a long-term energy strategy that promotes a sustainable energy framework, facilitates adequate energy supply, and improves access to electric power, as established in the IDB Country Strategy with Ecuador 2012-2017 (GN-2680). The TC addresses the SG functionality required from the ICT and energy perspectives, thus providing important planning elements that are essential for any SG deployment. The TC is aligned with the IDB's institutional priorities as outlined in the Ninth General Capital Increase in Resources for the IDB Report (GCI-9), which considers as priority areas: (i) infrastructure for competitiveness and social welfare, as the Project seeks to assess the benefits and necessary infrastructure of SG in Ecuador; and (ii) protecting the environment, responding to climate change, RE, and enhancing food security by promoting an EE and the integration of RE and energy storage into the grid.

III. Description of activities

Component I. Power Sector Analysis. As a baseline study, Component I will analyze the status of the power sector in Ecuador *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.

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 recommended. 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 introduced. 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 TC will be consistent with the Roadmap and take into account currently existing systems and other SG projects in Ecuador. The output of Component II will be a document with the comprehensive implementation plan and timetable for adopting SGT in Ecuador for the Phase 1 of the Roadmap.

Component III. Financial and Economic Analysis of the Smart Grid Program. Component III will conduct financial and economic analysis for the proposed implementation plan of the SGP 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 about 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 SGP.

Component IV. Proposal for the Development of the Asset Management System. The objective of Component IV is to develop the proposal for the development of the operation management capacity 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.

Component V. Capacity Building and Dissemination. The objective of Component V is to provide training to GoE's staff in the implementation and operation of the SGP and to disseminate the outcome and lessons learned from this TC with other stakeholders in the region.

Experience and lessons in operating the AMS and hiring personnel dedicated to operate the AMS will be also transferred for helping draft operating policies for control centers and the Terms of Reference (ToR) for the selection. At the end of the TC, seminar(s) will be organized to share the results of this joint consulting program of the IDB and the KSP with other stakeholders. Since RE technologies are crucial to develop SG, Galápagos Island, where the GoE aims to fully convert the energy supply to RE including solar photovoltaic and biodiesel by 2020, can be a potential place for effective dissemination with relevant showcase in renewables.

IV. Budget and Schedule

Indicative Budget (US$)

Component	Duration (months)	IDB	KSP	Total Funding
Component I. Power Sector Analysis	5	-	100,000	100,000
Component II. Implementation Plan of the Smart Grid Program	5	-	100,000	100,000
Component III. Financial and Economic Analysis of the Smart Grid Program	5	100,000	-	100,000
Component IV. Proposal for the Development of the Asset Management System	5	100,000	-	100,000
Component V. Capacity Building and Dissemination	3	120,000	30,000	150,000
Contingencies	-	30,000	20,000	50,000
Project Management	18	100,000	-	100,000
TOTAL	18	**450,000**	**250,000**	**700,000**

V. Executing agency and execution structure

The Executing Agency will be the Inter-American Development Bank through the Energy Division (INE/ENE).

For Component I and II, which will be funded by the KSP, the Energy Division, in consultation with the GoK, will be responsible of hiring a consulting firm, through a competitive bidding process. Given the close linkage between components, Component III and IV are strongly required to have a compatibility and continuity with Component I and II, therefore, according to the "Policies for the Selection and Contracting of Consultants Financed by the Inter-American Development Bank" (GN-2350-9), it is in the best interest of the IDB to select the same consulting firm for Component III and IV. Component V, which is co-financed, will be discussed between IDB and KSP.

To ensure that the consulting firm from the competitive bidding, the IDB jointly with KSP, will draft the ToR which will be used for the selection of a consulting firm for Component I and II.

VI. Project Risks and issues

There are not major risks in the implementation of the TC. A Project Manager will be hired as part of the TC to execute the components in a timely manner.

VII. Environmental and Social Classification

This TC has been classified as "C". The TC does not have associated social and environmental risks as it is based on a set of consultancies and studies to improve corporate performance.

Vo.Bo. Original Signed
Leandro Alves,
Energy Division Chief