

MEMORANDUM OF UNDERSTANDING
between the
MINISTERIO DE ELECTRICIDAD Y ENERGIA RENOVABLE DEL
ECUADOR
and the
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
POWER & ENERGY SOCIETY

This Memorandum of Understanding ("MOU") is entered into by and between the Ministerio de Electricidad y Energía Renovable del Ecuador (MEER) and the Institute of Electrical and Electronics Engineers Power & Energy Society (IEEE PES), on behalf of the Institute of Electrical and Electronics Engineers Incorporated (IEEE), hereinafter "the Parties".

IEEE is a not-for-profit organization that engages in scientific and educational activities directed toward advancement of the theory and practice of electrical, electronics, communications and computer engineering.

MEER was created by Executive Decree No. 475 on July 9, 2007, published in Official Record No. 132 on July 23, 2007, in which the Ministry of Energy and Mines was split into the Ministries of Mines and Oil and the Ministry of Electricity and Renewable Energy (MEER). MEER is the governing body of the electricity sector, and of the renewable and nuclear energy in Ecuador. It is responsible for meeting the country's electricity needs, through the formulation of relevant regulations, development plans and sectorial policies for the efficient use of its resources, ensuring that electricity provision responds to the principles of obligation, generality, uniformity, efficiency, responsibility, universality, accessibility, regularity, continuity and quality, establishing mechanisms of energy efficiency, social participation and environmental protection, managed by its specialized and high performance human resources.

I. Purpose

The purpose of this MOU is to facilitate interactions between MEER and IEEE on matters of mutual interest pertaining to the electricity system. Through this MOU, the Parties seek to more effectively align their efforts to address reliability and resiliency challenges due to significant changes in energy supply, energy transfer, demand, and technology.

Technology changes, including the growth in renewable generating resources, distributed energy resources, electric vehicles, and energy storage, among others, provide new opportunities for improving the efficiency and reliability of the bulk power system. Increasing power transfers in the region through future building of transmission power lines with Bolivia, Chile, Colombia, and Peru will grow the need to address system reliability and resiliency issues, as well as to improve grid codes.

As new technologies are developed, they will require careful examination to understand

their impacts, requirements, and potential benefits for integration into the electric energy system. Recognizing the mutual interest in mobilizing the technical community to address these challenges pertaining to the reliable, resilient, and efficient operation of the electric transmission system, MEER and IEEE are formalizing this understanding for the purpose of facilitating dialogue and coordinating activities leading to the implementation of effective strategies for enduring responsibilities of both organizations. This purpose statement is not exhaustive and MEER and IEEE may decide to cooperate in other areas of mutual interest.

Cooperation between the MEER and IEEE under this MOU may include but is not limited to the following objectives:

1. Sharing technical needs and addressing challenges for infrastructure planning, modeling, system operations, and cyber/physical security;
2. Identifying existing and emerging technological requirements and needs and approaches for addressing them; and
3. Developing, disseminating, and sharing information related to the planning, operation, and maintenance of electricity systems and their component parts.

II. Coordination

IEEE PES will act as the IEEE lead organization and will consult within other divisions of IEEE as necessary.

Through this MOU, the Parties agree to work together to advance the objectives stated above and will develop an implementation plan to accomplish them. An initial draft implementation plan is incorporated as an addendum under this MOU.

III. Terms and Termination

This MOU shall remain in effect for three (3) years or until terminated by either party upon written notice to the other party. Parties should endeavor to give sixty (60) days prior written notice of such termination.

This MOU in no way restricts either of the Parties from participating in any activity with other public or private agencies, organizations or individuals.

This MOU is neither a fiscal nor a funds obligation document. Nothing in this MOU authorizes or is intended to obligate the Parties to expend, exchange, or reimburse funds, services, or supplies, or transfer or receive anything of value.

This MOU is not legally enforceable and shall not be construed to create any legal obligation on the part of either Party, including that of a federal contractor. This MOU shall not be construed to provide a private right or cause of action for or by any person or entity.

This MOU does not imply endorsement by either party of the other organization, its products or its services.

MEER-IEEE PES MOU Implementation Plan

Objective:

Pursuant to a Memorandum of Understanding (MOU), the Ministerio de Electricidad y Energía Renovable del Ecuador (MEER) and the Institute of Electrical and Electronics Engineers Power & Energy Society (IEEE PES), have agreed to coordinate activities to address opportunities for electrical system to address society energy needs, as well as reliability and resiliency challenges due to significant changes in energy supply, demand, and technology. This draft implementation plan outlines the approach and content for the coordinated effort.

Organization and Process:

MEER and IEEE PES will plan and execute the objectives set forth in the MOU. The MEER and IEEE PES will meet annually to review progress and to revise the implementation plan, as well as to monitor progress against stated objectives. The implementation plan will be updated annually to identify possible new projects to help accomplish the planned objectives.

Designated points-of-contact will serve as liaisons between the respective organizations and they will ensure the effective coordination of activities.

The currently designated lead officers and points-of-contact are:

For MEER:

Lead Officer: Medardo Cadena

Point-of-Contact:

For IEEE:

Lead Officer: Damir Novosel

Point-of-Contact: Jaime Cepeda

Proposed Technical Topics:

A proposed set of technical topics on which MEER and IEEE PES will coordinate is provided below. These topics may be modified as a result of the review of the lead officers or for other appropriate reasons. The proposed topics for coordination are:

1. Grid Reliability and Resilience:

- a. Integrated asset management, including infrastructure upgrades needed to address aging infrastructure, hardening (related to weather, physical, and cyber-attacks), and system reliability and resilience.
- b. Evaluate electric grid-related elements, activities, and conditions that may impact the electric system (such as fuel constraints, generation and

transmission siting and permitting, changing resource mix and integration of renewable energy, electrical storage, electrical transportation, etc.) and cost-recovery options for potential solutions;

- c. Evaluate next generation sensors and energy management systems (EMS) and distribution management systems (DMS) methods and tools to secure the electric system, including cyber facilities, against potential vulnerabilities.
- d. Identify electric system operations and planning emerging needs and regulatory/legislative actions;

2. Ancillary Services (e.g., regulation, voltage support, frequency response):

- a. Operating characteristics and capabilities of ancillary services
- b. New types of ancillary services and requirements
- c. Methods and tools to analyze potential impact on grid reliability

3. Electric System Efficiency:

- a. Seams (inter-regional coordination)
- b. Transmission and distribution supply functions
- c. Energy efficiency
- d. Grid codes

4. Application of Technology (e.g., energy storage technology, distributed energy resources, aggregation, intersection of operational and information technology, electrical transportation, and power electronics):

- a. Performance characteristics and limits
- b. Advanced control and interoperability requirements
- c. Methods and tools to permit valuation and cost/benefit analysis
- d. Disruptive effects.

Proposed Engagement Activities:

MEER:

1. Promote and support IEEE PES membership for its engineers and technologists
2. Participating in power engineering, technology education, and professional training programs offered by PES
3. Participating in IEEE webinars and providing newsletter articles and presentations on topics related to energy infrastructure
4. Attending and participating in IEEE PES conferences and workshops.
5. Participating in IEEE PES technical committees as appropriate, including committees that develop IEEE Standards (e.g. Standard IEEE1547) relevant to the

objectives of the MOU

IEEE:

1. Providing presentations and tutorials to MEER on priority topics
2. Participating in selected MEER technical conferences and workshops related to energy infrastructure
3. Utilizing PES publications, panels, sessions, conferences, and other media platforms to address MEER's outreach in energy infrastructure, reliability, and energy markets
4. Supporting resolution of MEER's technical challenges with PES technical community input and guidance

Caveats: Nothing in this implementation plan should be deemed binding on the parties or obligate the parties to expend funds.