Asia-Pacific Economic Cooperation

Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

International Copper Association
Copper Alliance

EWG 03 2020A – Progress Update

- **Project Title:** EWG 03 2020A – Integrating Electrical Vehicles and Solar Rooftop PV in Electricity Distribution Systems with Continued Performance of Distribution Transformers

- **Rationale:** Increased EV charging stations and solar rooftop PV connected to the grid affect the performance of DTs and stability of the grid

- **Objectives:**
  1. Describe and quantify the problems
  2. Propose technical and policy solutions to mitigate the problems
- Co-sponsor economies : USA, The Philippines, Hong-Kong, China, Chinese Taipei, Chile

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- **Activities:**
  - Data Collection
  - Load and Impact Analysis
  - Review of International and APEC Experience
  - Preparation of Technical and Policy Recommendation Report
  - Organization of Workshop
- **Methodology:**
  - Data collection through internet research and survey questionnaires
  - Load and impact analysis
  - Formation of international experts committee to formulate recommendations

Contractor:

IIEC
International Institute for Energy Conservation

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Key Findings on PV&EV Impacts

- PVs and EVs can negatively affect the grid stability and power quality due to the intermittent nature of PV energy and uncertainty of EV load.
- Possible Impacts of Solar PV and EV on Distribution Networks and Distribution Transformers include:

Technology	Possible Impacts on Distribution Network	Possible Impacts on Distribution Transformer
Solar PV	• increased spinning reserve at the generation level • less stable system arising from the inability to support system frequency management • voltage change/ voltage stability • decrease in daytime loading • line overloading • power quality issues • system loss • reverse power flows	• transformer overloading • power quality issues • voltage change
EV	• voltage drop, deviation, and instability • overloading of lines • system instability • harmonics and system losses • short-circuit currents are higher	• accelerated aging • overheating • Overloading

Key Findings on PV&EV Impacts

- Most utilities in APEC have employed grid codes and other means to manage adverse impacts from the intermittent nature of PV energy and uncertainty of EV load.
  - However, most of them focus on imposing requirements on PV generation and EV load (e.g., solar inverter and EV charger specifications), and utilization of smart grid technologies rather than developing new specifications for network components.
- Utilities have opted for a more comprehensive approach (beyond DT specifications) on mitigating impacts of solar PVs and EVs. - Grid codes with stringent requirements on solar inverters and EV chargers, and load managements.
- Extensive review of research works found that:
  - Trend of DT life will generally improve with PV penetration until power flow reversals.
  - Coordinated operation of the PVs and EVs can negate the issues arising due to individual integration of PVs and EVs.

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GENERAL INFORMATION CIRCULAR

APEC Workshop on

"Integrating Electrical Vehicles and Solar Rooftop PV in Electricity Distribution Systems with Continued Performance of Distribution Transformers"

(EWG 03 2020A)

22nd April 2022

Virtual Workshop