



Technical Requirements for Renewable Energy Power System

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1. Introduction

- 1.1. This document aims to provide the technical requirements for renewable energy power system (the **REPS**) connected to the 220/380 V low-voltage electricity supply network operated by HK Electric (the **Grid**).
- 1.2. This document is only applicable to inverter-based REPS of aggregated power rating up to 1,000 kW. For inverter-based REPS other than the above rating or non-inverter-based REPS, the applicant should provide the proposed installation arrangement for HK Electric's consideration as soon as possible in the planning stage.
- 1.3. The declared limits of the supply voltage and frequency of the Grid under normal conditions are 220/380 V \pm 6% and 50 Hz \pm 2%, respectively. The REPS shall be compatible with the HK Electric's supply system.
- 1.4. The installation shall also comply with HK Electric's Supply Rules, and Guide to Connection of Supply (GCS), the latest edition of Code of Practice for the Electricity (Wiring) Regulations, EMSD's Technical Guidelines on Grid Connection of Renewable Energy Power Systems and relevant guidance notes, and relevant Government Ordinances.
- 1.5. This document shall not be construed as a part of terms and conditions of the supply agreement.
- 1.6. If there is any inconsistency or ambiguity between this document and GCS, this document will prevail.
- 1.7. If there is any inconsistency or ambiguity between the English and Chinese versions, the English version shall prevail.

2. Safety Requirements

- 2.1. The REPS shall be designed with an "anti-islanding" function to automatically disconnect the REPS from the Grid in the event of de-energisation of the Grid. The time delay for the automatic disconnection of the REPS shall not exceed 2 seconds. In case of failure of the anti-islanding function of the REPS, there will be a safety hazard for personnel working on the "de-energised" circuit. Operational procedures or other means shall be adopted to ensure all REPS connected to the "de-energised" circuit are disconnected before work.

- 2.2. Proper warning labels shall be displayed at all electrical equipment with dual power supply sources. Typical examples of warning labels are shown in the appendix of the Commissioning Report for Renewable Energy Power System (Sample).
- 2.3. An up-to-date single-line electrical diagram (showing clearly the connection arrangements via the electricity account meter to the HK Electric's supply point with Supply Number) shall be displayed in prominent positions at different appropriate locations to facilitate responsible personnel to properly shut down the grid connection arrangement under normal and emergency conditions.
- 2.4. A Registered Electrical Worker shall be designated by the Customer to communicate directly with HK Electric under normal and emergency operations.

3. Protection Requirements

- 3.1. Technical assessment shall be carried out by the Customer's Registered Electrical Contractor (REC) or Registered Electrical Worker (REW) to ensure that all the electrical equipment in the customer installations and the Grid are safe to operate in the new fault level with the grid connection of the REPS and to avoid improper operations of protective devices during fault conditions and under all possible operation conditions. The new fault level shall not exceed 40 kA.
- 3.2. The REPS shall be equipped with an appropriate earthing system so as to ensure the operation safety of the worker and the installations. The REPS shall still have an effective earthing system even when the REPS is disconnected from the Grid.
- 3.3. A synchronisation check function shall be installed at the REPS such that voltage fluctuation at the connection point of the Grid during synchronisation operation of the REPS shall be limited to below 3%.
- 3.4. The REPS shall be equipped with proper protection facilities to protect it against transient abnormalities (e.g. supply interruption, voltage fluctuation, frequency fluctuation and voltage dip) that may originate from the customer installations and the Grid.
- 3.5. When sustained voltage and frequency fluctuations are detected, the protection facilities of the REPS shall be able to disconnect the REPS from the Grid with a time delay according to Table 1 below.

| Table 1 | |
|--|---------------------------|
| Voltage (measured at the connection point of the Grid) | Maximum trip time* |
| $V < 50 \%$ | 0.1 s |
| $50 \% \leq V < 85 \%$ | 2 s |
| $85 \% \leq V \leq 110 \%$ | Continuous operation |
| $110 \% < V < 135 \%$ | 2 s |
| $V \geq 135 \%$ | 0.05 s |
| Frequency (measured at the connection point of the Grid) | Maximum trip time* |
| $f < 49 \text{ Hz}$ | 0.2 s |
| $f > 51 \text{ Hz}$ | 0.2 s |
| <p>* The REPS does not have to cease to energize if the voltage returns to normal continuous operation conditions within the specified trip time. The owner or registered electrical contractor of the REPS shall arrange to design the protection settings of the REPS taking into consideration its ride-through capability under abnormal voltage and frequency conditions.</p> | |

- 3.6. In the event of automatic disconnection of the REPS due to fluctuation in voltage, frequency or anti-islanding operation, the REPS can be re-connected to the Grid only after the Grid has resumed to normal conditions continuously for at least 5 minutes.

4. Power Quality Requirements

- 4.1. The power output of REPS to the Grid shall not be less than 0.85 power factor lagging.
- 4.2. The total harmonic current distortion of the REPS output shall not exceed 5 % at the output of the REPS.
- 4.3. Direct Current (DC) shall be prevented from flowing into the Grid so as to avoid voltage distortion and adverse impacts to other electrical equipment. An isolation transformer shall be installed in the REPS to limit the DC current flowing into the Grid to below 0.5% of the rated inverter output.
- 4.4. After the connection of the REPS to the Grid, the voltage fluctuation at the connection point of the Grid due to the output power of the REPS shall not exceed 1%.

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- 4.5. For connection of 1-phase REPS to the Grid, the maximum rated output current shall not exceed 60 A. For REPS with rated output power greater than 13.2 kVA, the REPS shall be connected to the Grid in 3-phase arrangement.
- 4.6. The negative phase sequence voltage at the supply point shall not exceed 1.3% of the positive sequence voltage in a 3-phase supply system.

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