

# Technical Requirements of Grid Connection of Renewable Energy System

11/2018

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# RES - System Overview

## *Type of RES*

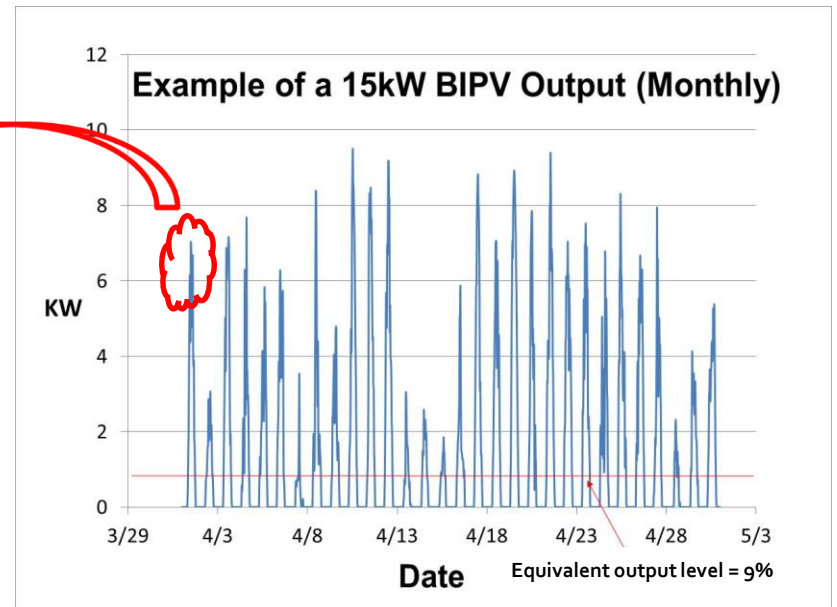
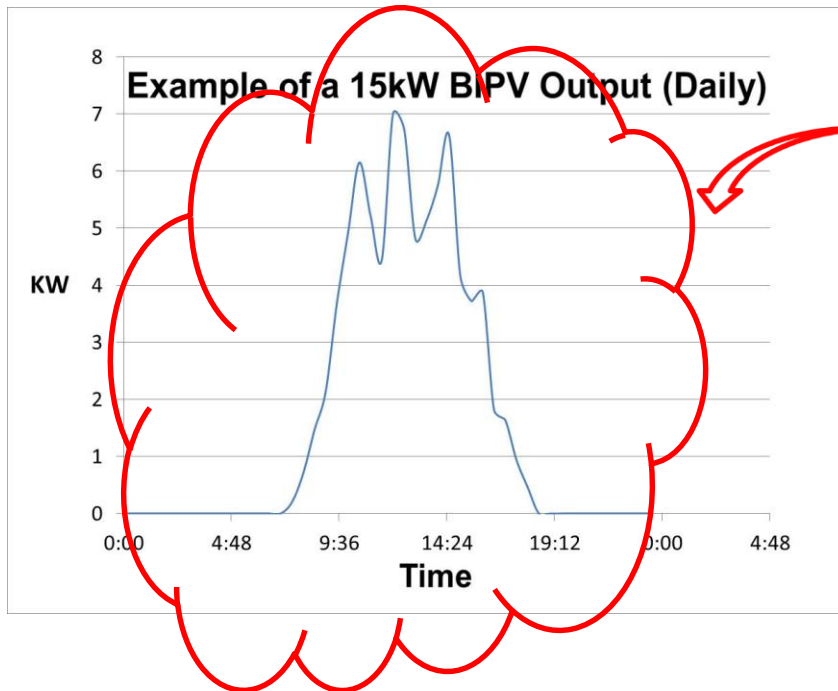
- **Solar energy**
  - **Wind energy**
  - *Hydro energy*
  - *Geothermal energy*
  - *Tidal energy*
  - *Biomass energy*
  - *Energy from waste*
- Eligible to join Feed-in Tariff Scheme



# RES - System Overview

## Characteristics of electricity generated from RES:

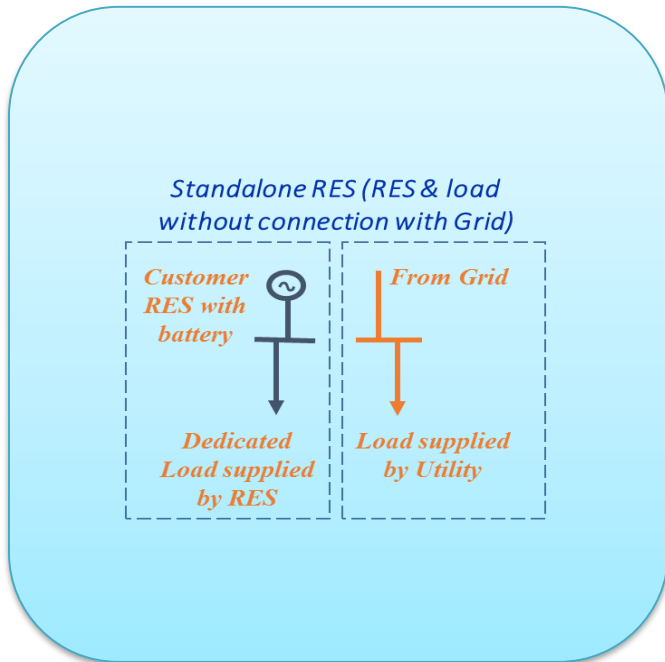
- *Intermittent*
- *Unstable & irregular*



# RES - Grid Connection Overview

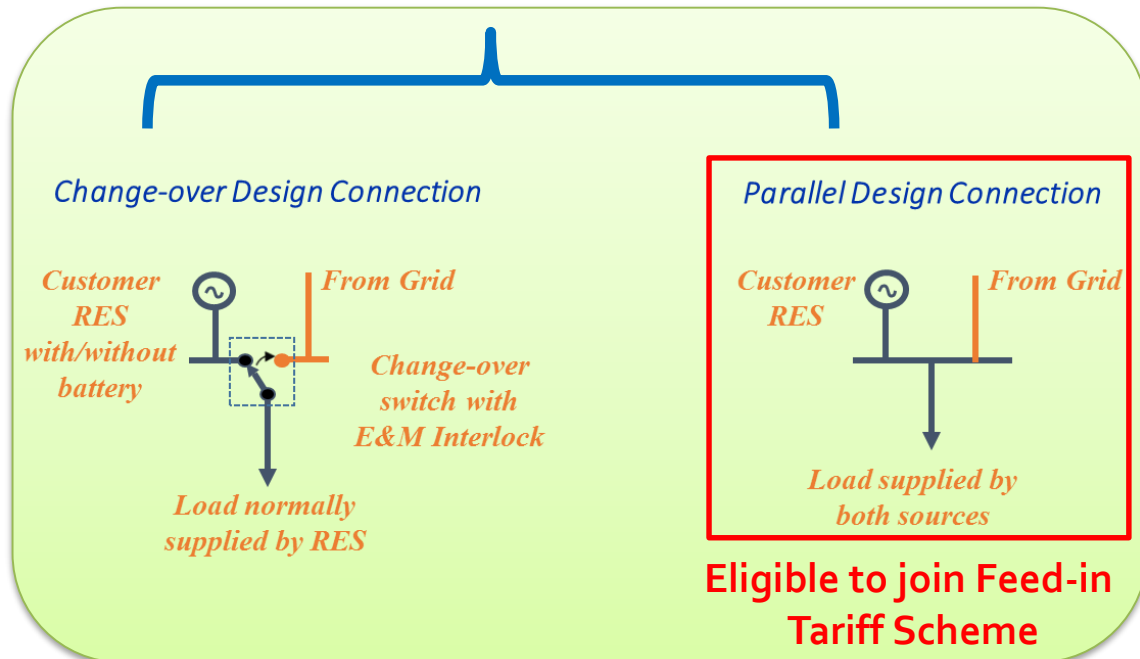
## Standalone RES:

- Supply a dedicated load
- Totally isolated to utility's grid
- No Standby supply from utility



## Grid connected RES:

- Standby supply from utility
  - Change-over Design Connection
  - Parallel Design Connection



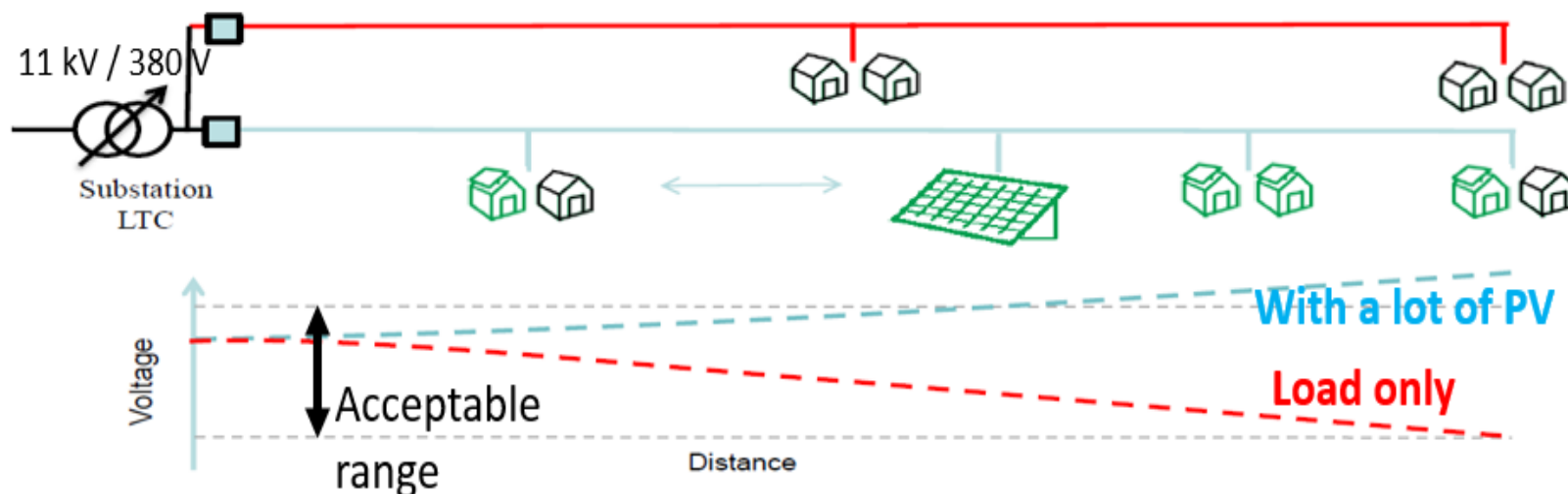
Utility needs to know the impact to power system

# Grid Connection of RES - Considerations & Constraints

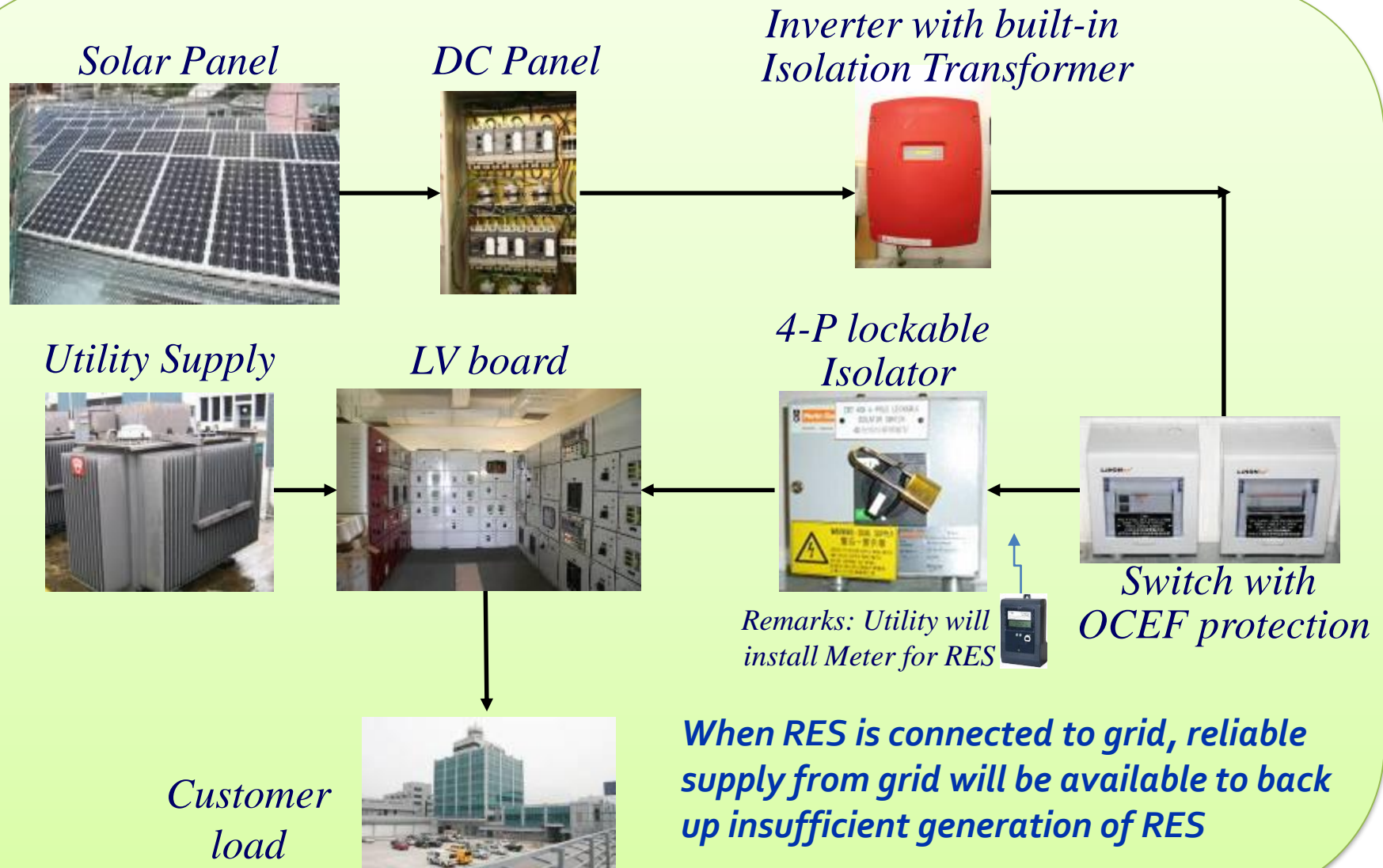
- *Reserve sufficient supply capacity to back up RES*
- *Capability of existing supply network for RES exporting power*

*Example: Voltage rise due to excessive power exporting from RES to utility's distribution grid at network remote end*

- *Violation of upper voltage limit stipulated by the Supply Rules*
- *Voltage rise limit could be a concern for limiting the capacity of RES grid connection*



# Grid Connection of RES - Example



# Grid Connection of RES - Application Process

## Step 1:



Submit Application and Required Documents

## Step 2:



Technical Assessment, System Test and Installation before  
CLP Smart Meter Installation

## Step 3:



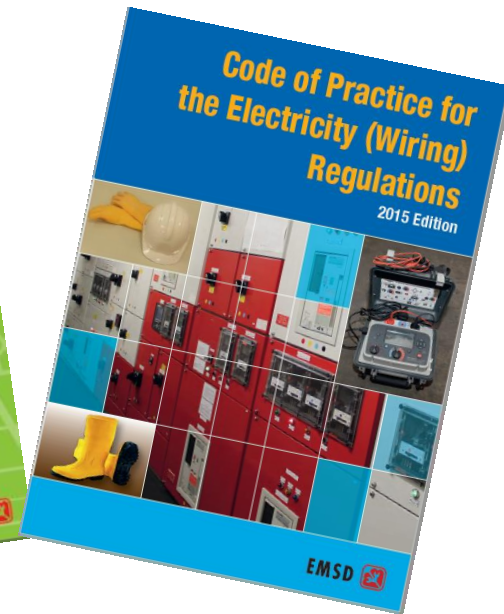
Completion and Grid Connection



# Customer's Technical Considerations of Grid Connection of RES

## ○ *Related Statutory Electricity Ordinances & Guidelines*

- **Cap. 406 of Electricity Ordinance**
- **EMSD:**
  - *Technical Guidelines on Grid Connection of Renewable Energy Power Systems (2016 Edition)*
  - *Code of Practice for the Electricity (Wiring) Regulations (2015 Edition)*



**New**

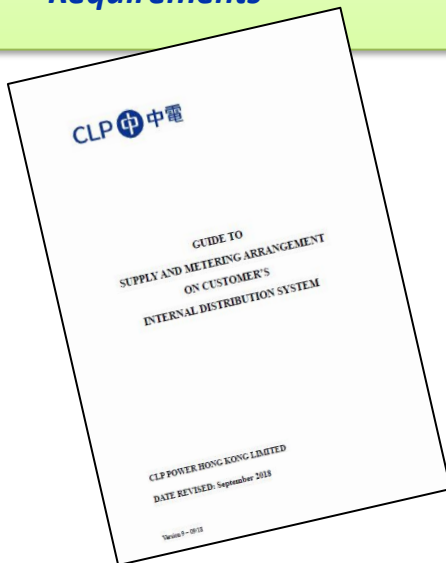
**EMSD:**  
**Guidance Notes for Solar Photovoltaic (PV) System Installation**

# Customer's Technical Considerations of Grid Connection of RES

## ○ *Related Statutory Electricity Ordinances & Guidelines*

**CLP:**

- *Supply Rules*
- *Guide to Supply and Metering Arrangement on Customer's Internal Distribution System*
- *Feed-in Tariff Scheme Standard Metering Requirements*



# Customer's Technical Considerations of Grid Connection of RES

- *RES Connected to Grid*



# Customer's Technical Considerations of Grid Connection of RES

## ○ Safety Considerations

- Operation Procedures
- Lockable Isolation Switch



**Lockable  
Isolation Switch**

Operation Procedures of RE System at xxxxxx (Name & Address)			
<b>Contact Information for Operation and Maintenance</b>			
<b>Customer's Operation and Maintenance Contact</b>			
Name and registration number of the Registered Electrical Company (REC) responsible for maintaining the generating facility in safe working order:			
Name	Registration number	Telephone Number	Email Address
Note: RE System owner should keep this RE System information for record. Where any of the particulars provided on this Contact Information change, the owner of the facility shall notify CLP accordingly.			
REC Signature and Chop: _____			
Date: DD/MM/YYYY			
<b>CLP's Contact</b>			
Contact	Telephone Number	Email Address	
Emergency	27788333	N/A	
Office hour	24/7	clp@clp.com.hk	
Date revised: 13 May 2018			

Operation Procedures of RE System at xxxxxx (Name & Address)			
<b>Basic information</b>			
RE type	PV/Wind Turbine System (Please delete if not applicable)		
RE system rating	555555 kW		
Installer address	555555		
RE owner/representative	555555		
Contact person	(Please provide position instead of personal name)		
Phone number	555555		
Communication Address	555555		
<b>Summary Table for RE Systems</b> (Please delete this summary table if the premise only have one RE system)			
RE System	Inverter Rating	Total PV Feed-in Rating (kW)	Overall PV System Rating (kW)
PV System	555555	555555	555555
Bi-PV System	555555	555555	555555
<b>Safety Procedure (For Customer Operation &amp; Maintenance Only)</b>			
1. Operation of the procedures shall be handled by an appropriate Registered Electrical Worker (REW).			
2. Isolating the power sources from RE System & from CLPP:			
a. Switch off the RE system Main Breakers (XX) and isolation switch ("Isolation Point" XX) at XXXXX room.			
b. Lock up the isolation switch ("Isolation Point" XX) and affix the maintenance warning notice.			
c. Secure the key by responsible REW/authorized person, or the key is to be kept by CLPP's staff, if required.			
3. After the site work and followed by confirming normal of the RE system by the responsible REW, it would be ready for reconnection.			
4. Restoring the power sources from RE System & from CLPP:			
a. Unfix the maintenance warning notice, unlock the isolation switch ("Isolation Point" XX) mentioned in item 2.			
b. Switch on the isolation switch ("Isolation Point" XX) and the RE system Main Breakers (XX).			
5. After completion of site work, inform relevant parties for the work completion.			
Date revised: 13 May 2018			

## Operation Procedures

# Customer's Technical Considerations of Grid Connection of RES

## ○ *Safety Considerations*

- *Warning Labels*



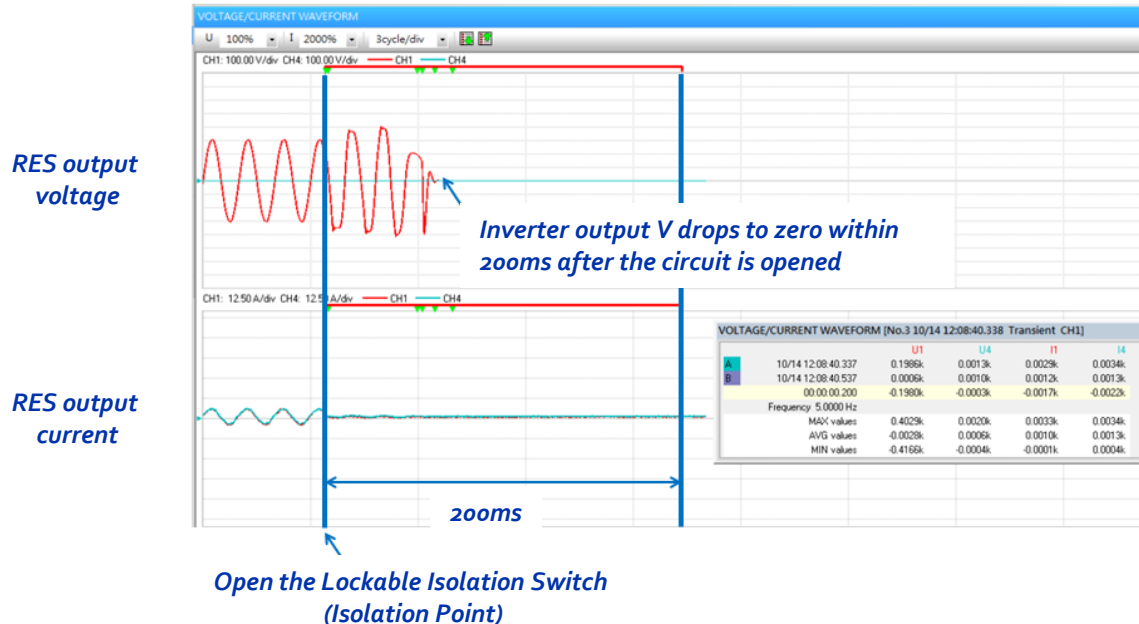
*DC Warning Label*



*AC Dual-Source Warning Label*

# Customer's Technical Considerations of Grid Connection of RES

- **Anti-Islanding**
  - **Loss-Of-Main Supply Test**



# Customer's Technical Considerations of Grid Connection of RES

- **Equipment Protection**
  - **Fault Current Protection**
  - **2-P or 4-P Circuit Breaker or Isolator**
  - **Fault Current Contributed by RES**



**Fault Current Protection**



**4-P Circuit Breaker**

# Customer's Technical Considerations of Grid Connection of RES

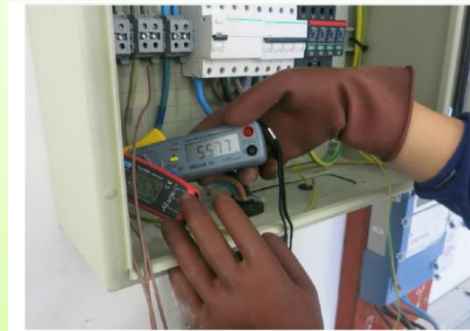
## ○ *Power Quality*

- *Voltage*
- *Frequency*
- *Power Factor*
- *Total Harmonic Distortion (Current)*
- *Restrict DC content flowing into the AC side*

*(Isolation transformer shall be used at the inverter output side to limit the DC)*



*Voltage*



*Total Harmonic Distortion*



*Isolation transformer*



# Customer's Technical Considerations of Grid Connection of RES

## ○ *Revenue Meter & FiT Meter Location*

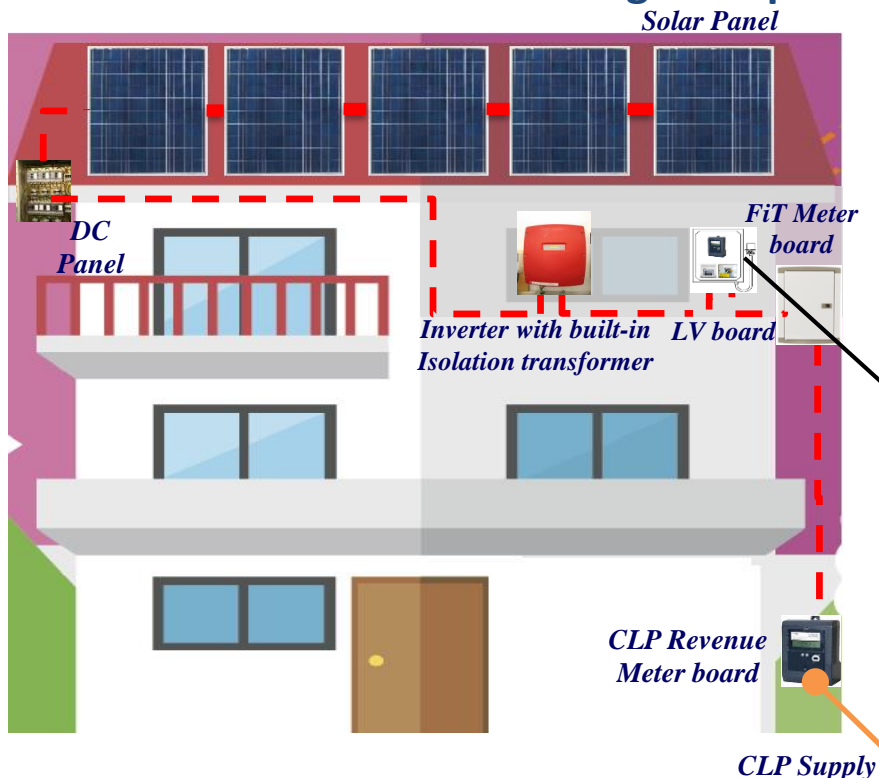
**CLP:**

- *Feed-in Tariff Scheme Standard Metering Requirements*



# Feed-in Tariff Scheme – Metering Requirements

## Feed-in Tariff Scheme Metering Example



\* 2-P (1 Ø) or 4-P (3-Ø) Circuit Breaker /Isolation Switch

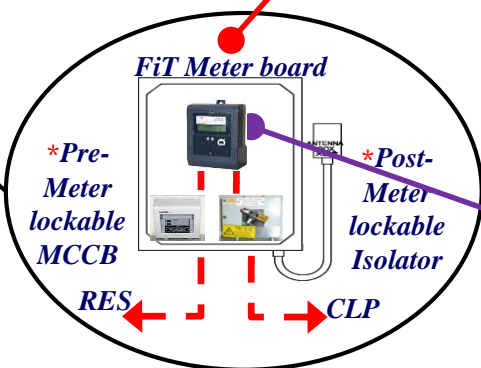
### FiT Meter board

#### Ideal Location

- Near CLP Supply Point
- Readily accessible by CLP's staff for regular check
- No potential safety hazards

### FiT Meter

- Determine the amount of electricity generated by the RES
- To be installed inside an existing switch room or meter box ( or location agreed by CLP)
- Equipped with automatic reading function
- Communication for FiT meter will be supplied by CLP (Only applied to ≤ 60 Ampere (Single-Phase) or ≤ 100 Ampere (Three-Phase))

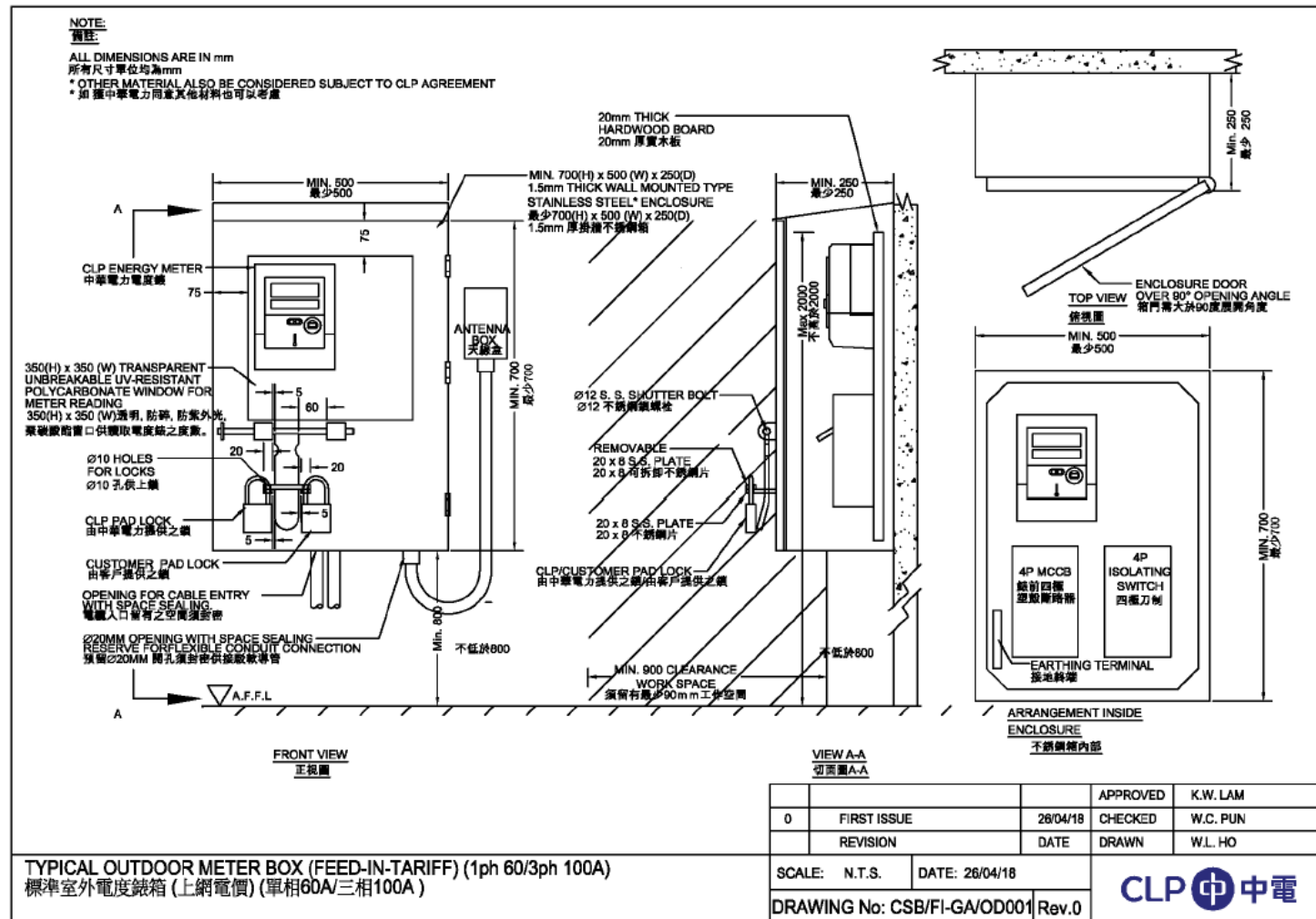


### Revenue Meter

- Record the amount of electricity used by the Customer
- Equipped with automatic reading function
- Bi-directional Meter (Single direction meter replaced with bi-directional meter)

# Feed-in Tariff Scheme – Metering Standard

## ○ Typical Outdoor Meter Box (Feed-In Tariff) (60A Single Phase or 100A Three Phase)



# Summary

## ○ **Power System Security**

- *To ensure power system security, application to utility is required for RES with **parallel design** or **change-over design** (using change-over device)*

## ○ **Power Quality**

- *RES is a **power source**, due considerations are required to ensure the power quality and reliability requirements of electricity supply in Hong Kong in addition to safety.*

## ○ **Regulations**

- *The RES **owner and REC/REW** should ensure that the RES complies with all prevailing statutory requirements and best practices*

