Technical Requirements of Grid Connection of Renewable Energy System

May 2019

Remarks:
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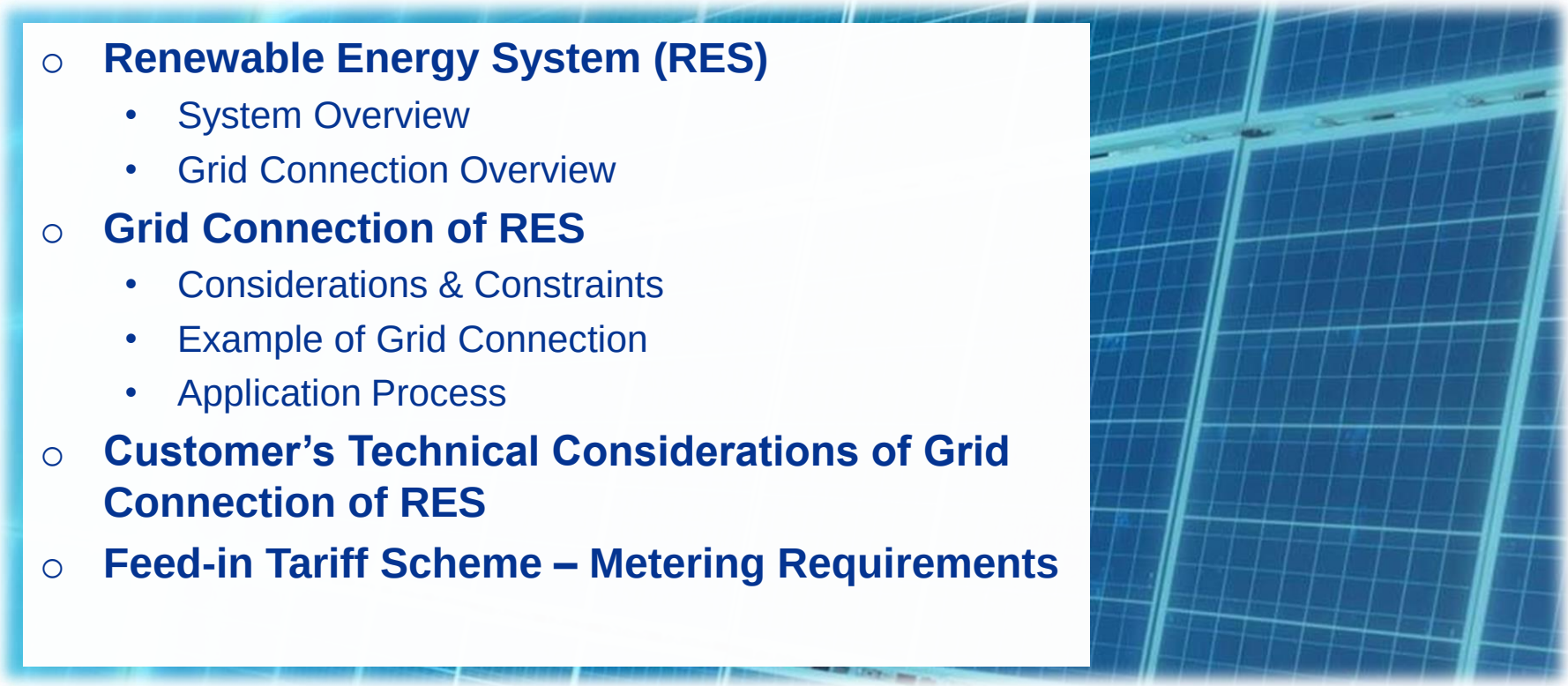
Contents



RES - System Overview

Type of RES

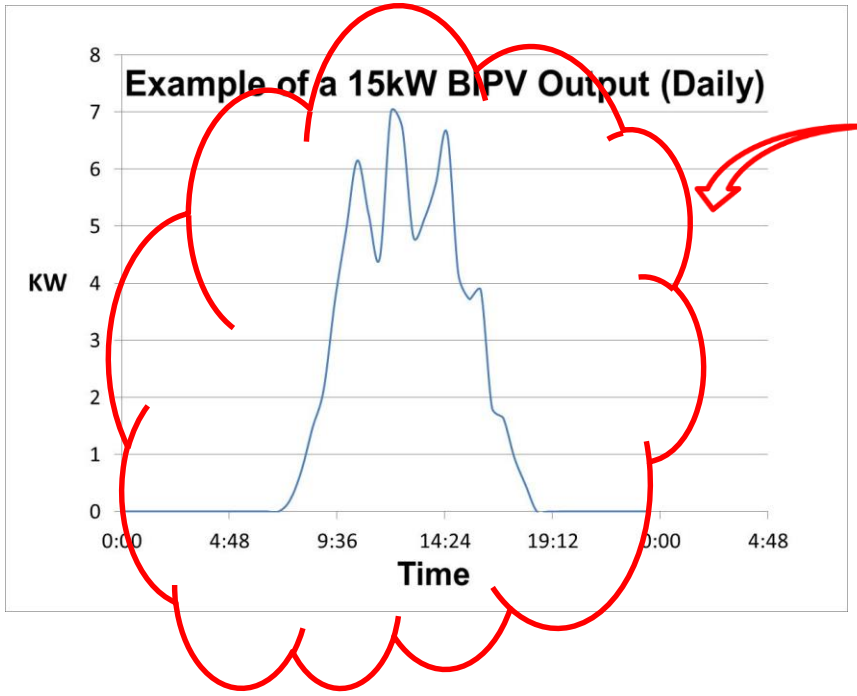
- *Solar energy*
- *Wind energy*
- *Hydro energy*
- *Geothermal energy*
- *Tidal energy*
- *Biomass energy*
- *Energy from waste*

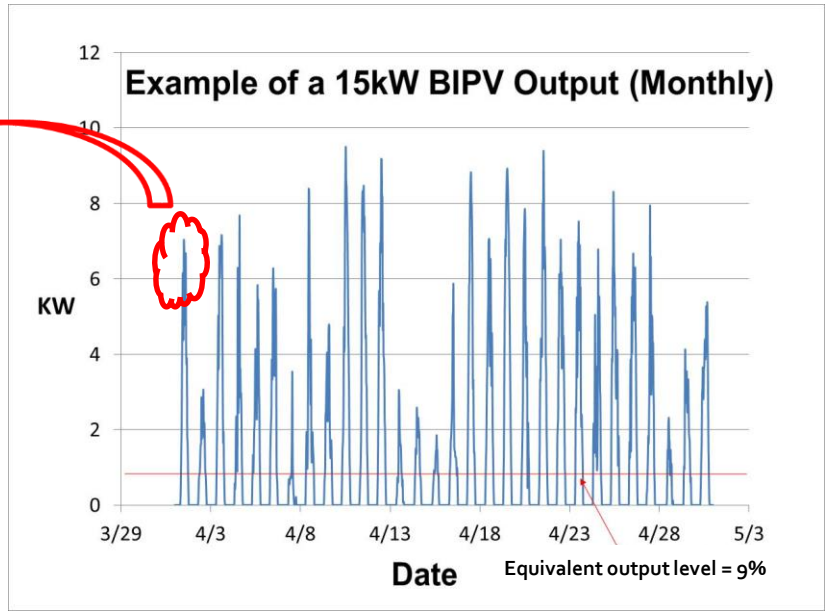
Eligible to join Feed-in Tariff Scheme

RES - System Overview

Characteristics of electricity generated from RES:

- ***Intermittent***
- ***Unstable & irregular***

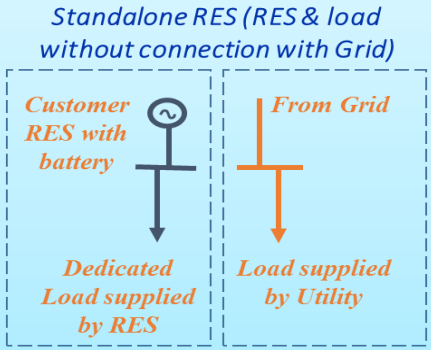




RES - Grid Connection Overview

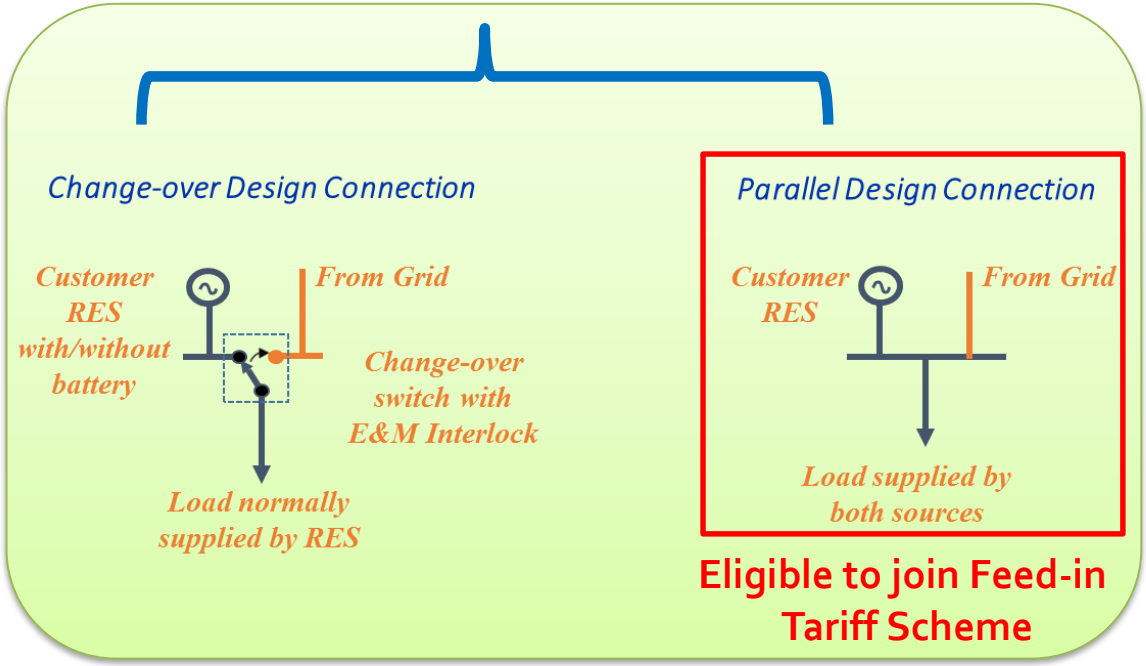
Standalone RES:

- ***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***



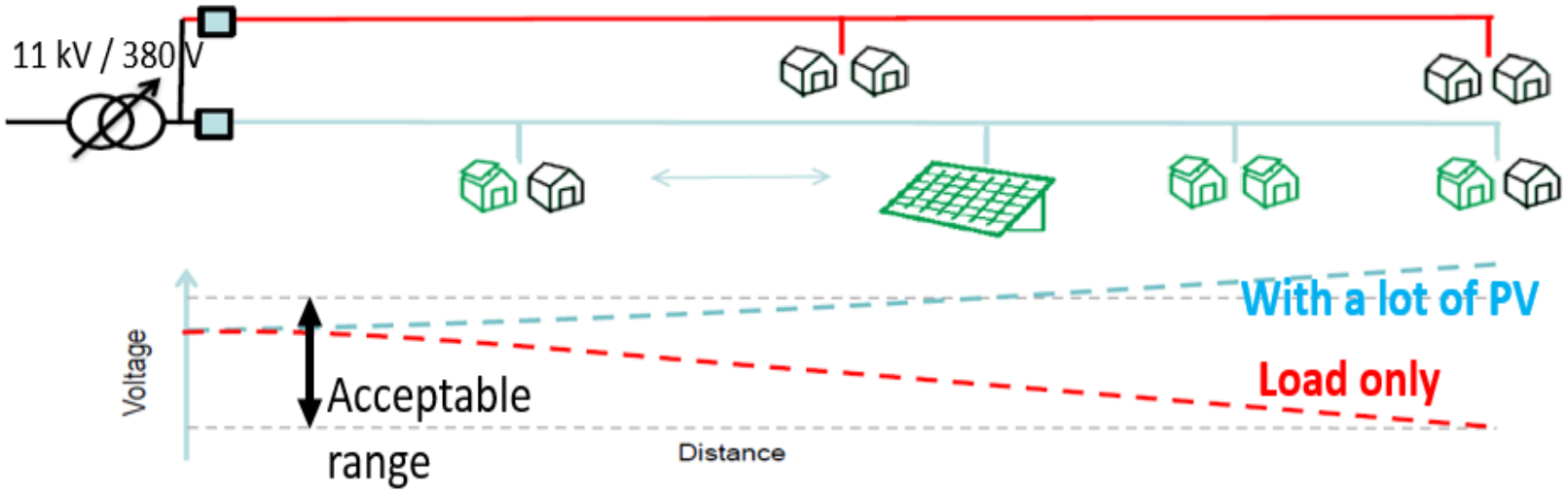
Utility needs to know the impact on the power system

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

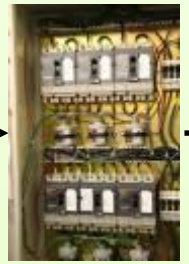
  - ***Violation of upper voltage limit stipulated by the Supply Rules***
  - ***Voltage rise limit could be a concern for limiting the capacity of RES grid connection***



Grid Connection of RES - Example

Solar Panel

DC Panel



Inverter with built-in Isolation Transformer

Utility Supply

LV board

4-P lockable Isolator

Switch with OCEF protection

Remarks: Utility will install Meter for RES

Customer load

When RES is connected to grid, reliable supply from grid will be available to back up insufficient generation of RES

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

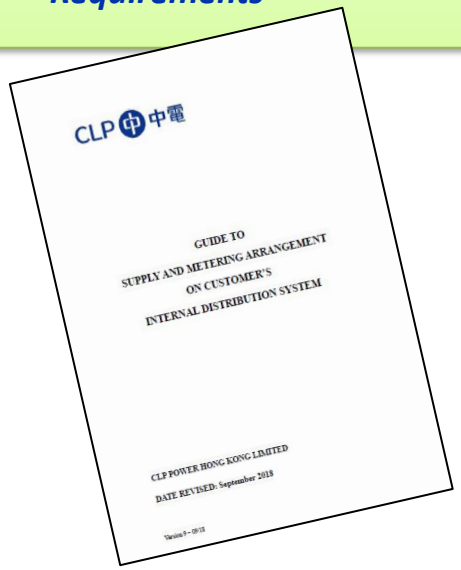
EMSD:
Guidance Notes for Solar Photovoltaic (PV) System Installation

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***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GUIDE TO
SUPPLY AND METERING ARRANGEMENT
ON CUSTOMER'S
INTERNAL DISTRIBUTION SYSTEM

CLP POWER HONG KONG LIMITED
DATE REVISED: September 2018


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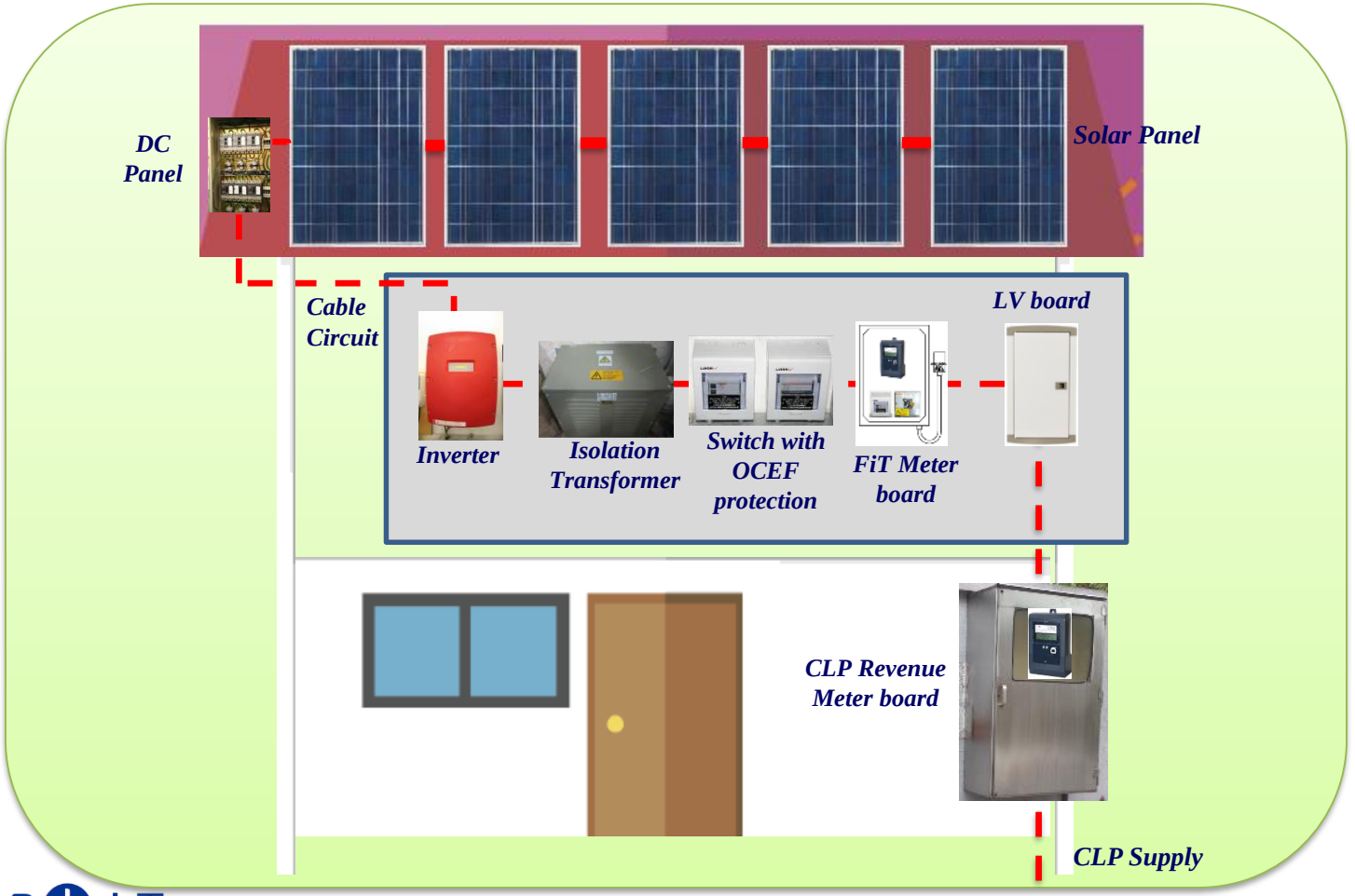
Feed-in Tariff Scheme
Standard Metering Requirements

CLP POWER HONG KONG LIMITED
Date Revised: April 2018

Customer's Technical Considerations of Grid Connection of RES

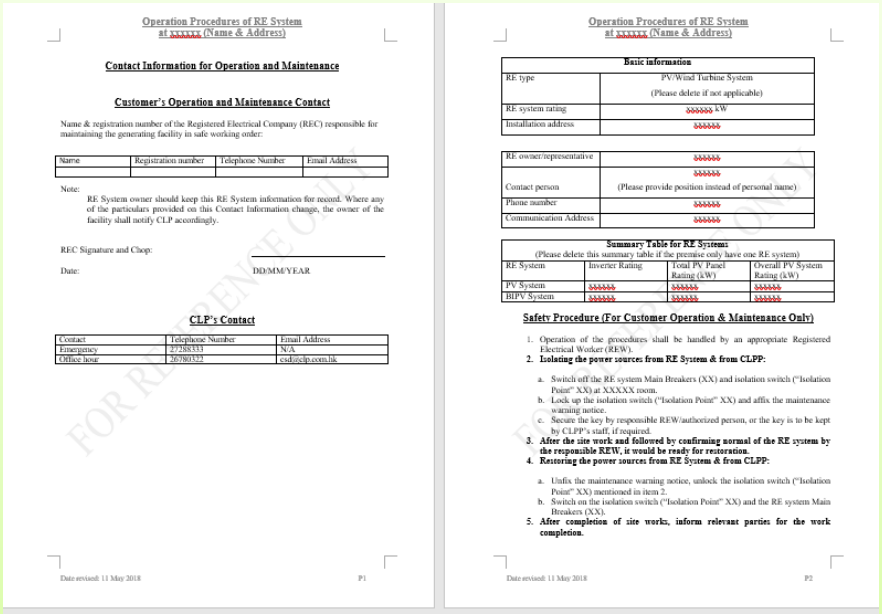
- ***RES Connected to Grid***



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)

Contact Information for Operation and Maintenance

Customer's Operation and Maintenance Contact

Name & 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/YEAR

CLP's Contact

Contact	Telephone Number	Email Address
Emergency	27288333	N/A
Office hour	26780322	csd@clp.com.hk

Date revised: 11 May 2018 P1

Operation Procedures of RE System
at xxxxxx (Name & Address)

Basic information	
RE type	PV/Wind Turbine System (Please delete if not applicable)
RE system rating	xxxxxx kW
Installation address	xxxxxx

RE owner/representative	xxxxxx
Contact person	xxxxxx (Please provide position instead of personal name)
Phone number	xxxxxx
Communication Address	xxxxxx

Summary Table for RE Systems
(Please delete this summary table if the premise only have one RE system)

RE System	Inverter Rating	Total PV Panel Rating (kW)	Overall PV System Rating (kW)
PV System	xxxxxx	xxxxxx	xxxxxx
BIPV System	xxxxxx	xxxxxx	xxxxxx

Safety Procedure (For Customer Operation & Maintenance Only)

1. Operation of the groceedures 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 restoration.**
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 works, inform relevant parties for the work completion.**

Date revised: 11 May 2018 P2

Operation Procedures

Customer's Technical Considerations of Grid Connection of RES

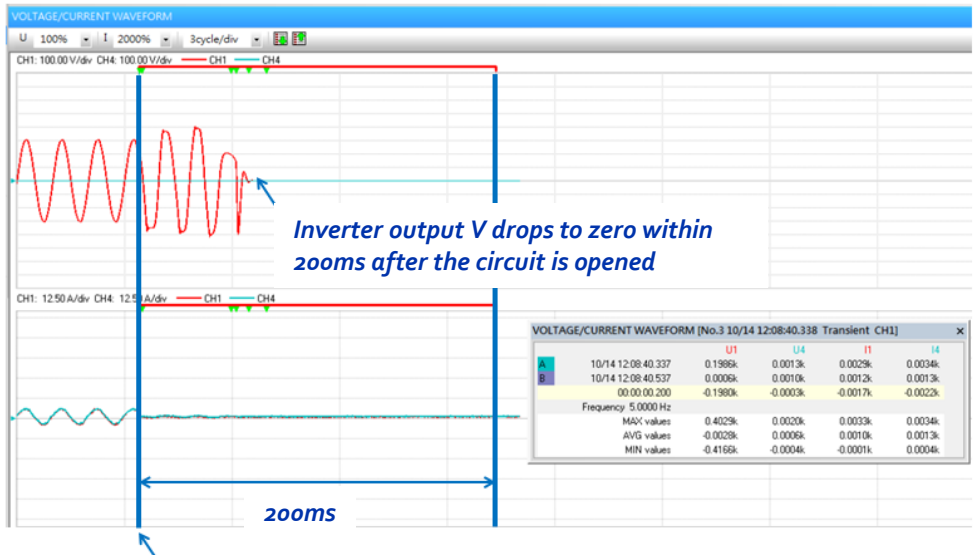
- ***Safety Considerations***
  - ***Warning Labels***

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

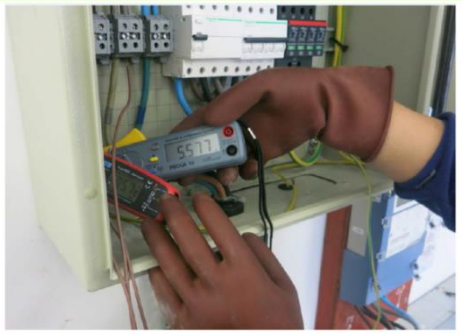
4-P Circuit Breaker

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

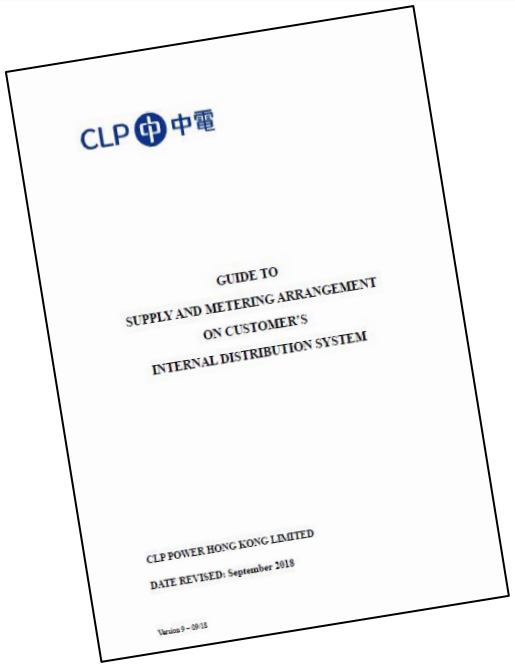
Isolation transformer

Customer's Technical Considerations of Grid Connection of RES

- ***Revenue Meter & FiT Meter Location***

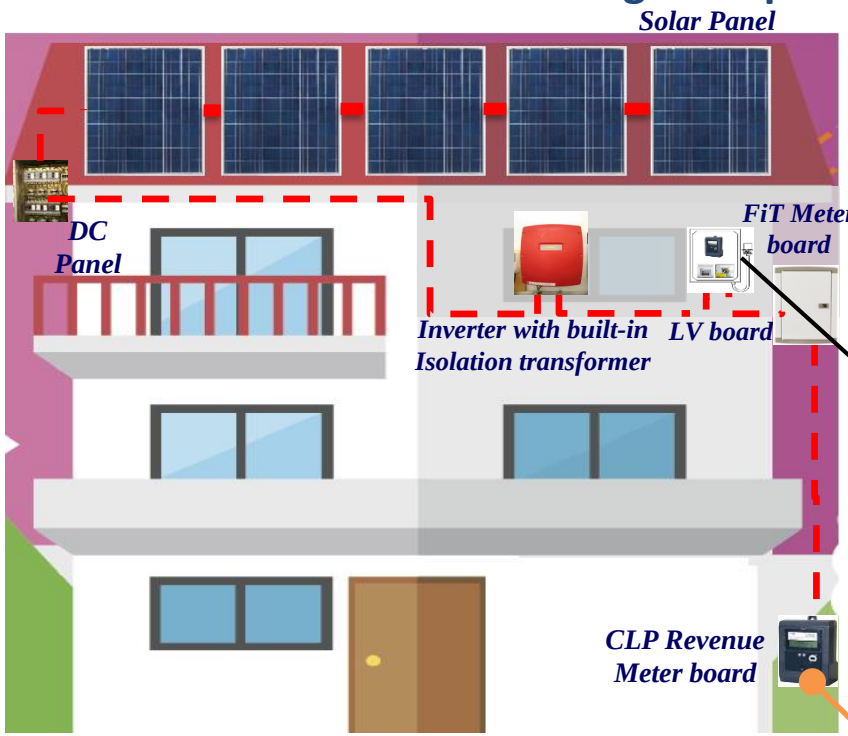
CLP:

- ***Feed-in Tariff Scheme Standard Metering Requirements***



Feed-in Tariff Scheme – Metering Requirements

Feed-in Tariff Scheme Metering Example

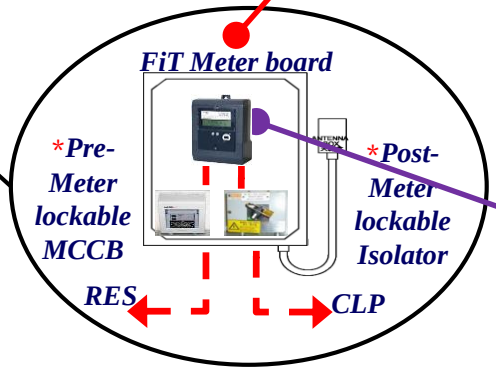


* 2-P (1 Ø) or 4-P (3-Ø) Circuit Breaker /Isolation Switch

FiT Meter board

Ideal Location

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



FiT Meter

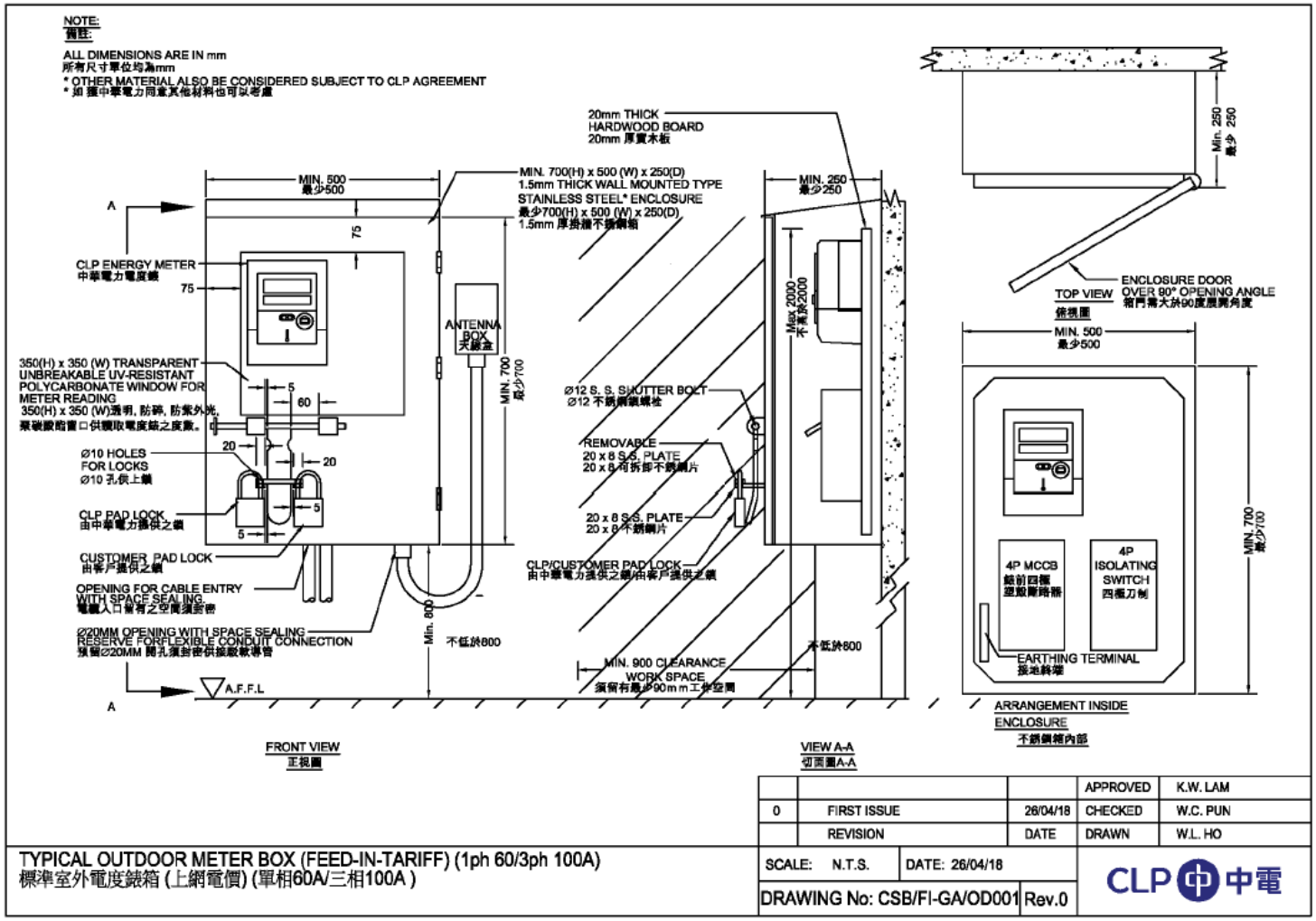
- Determine the amount of electricity generated by the RES
- To be installed inside an existing switch room or meter box (or location agreed by CLP)
- Equipped with automatic reading function
- Communication for FiT meter will be supplied by CLP (Only applied to ≤ 60 Ampere (Single-Phase) or ≤ 100 Ampere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



			APPROVED	K.W. LAM
0	FIRST ISSUE	26/04/18	CHECKED	W.C. PUN
	REVISION	DATE	DRAWN	W.L. HO

TYPICAL OUTDOOR METER BOX (FEED-IN-TARIFF) (1ph 60/3ph 100A)
標準室外電度錶箱 (上網電價) (單相60A/三相100A)

SCALE: N.T.S. DATE: 26/04/18

DRAWING No: CSB/FI-GA/OD001 Rev.0

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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*