



Firming Solar Generation with Energy Storage System for CRESS Participations

**CRESS TOWNHALL
4th February 2025**

Content of Presentation

- Direct Connection: Possible connection configuration of GEP, BESS
- Fulfilling Firming requirement: BESS Sizing
 - Firm and Non-Firm Output
- Operation of GEP, BESS: Normal and Emergency
- GSO Technical documents

Roles of GSO

CRESS Guideline:

- Manages the dispatch of the energy produced from the GEP and any storage system associated with the RED
- Ensures the security of the Electricity Supply Network as a whole
- Manages the testing and commissioning of these assets as required under the Grid Code and other relevant guidelines related to the operation of these generating or storage modules.

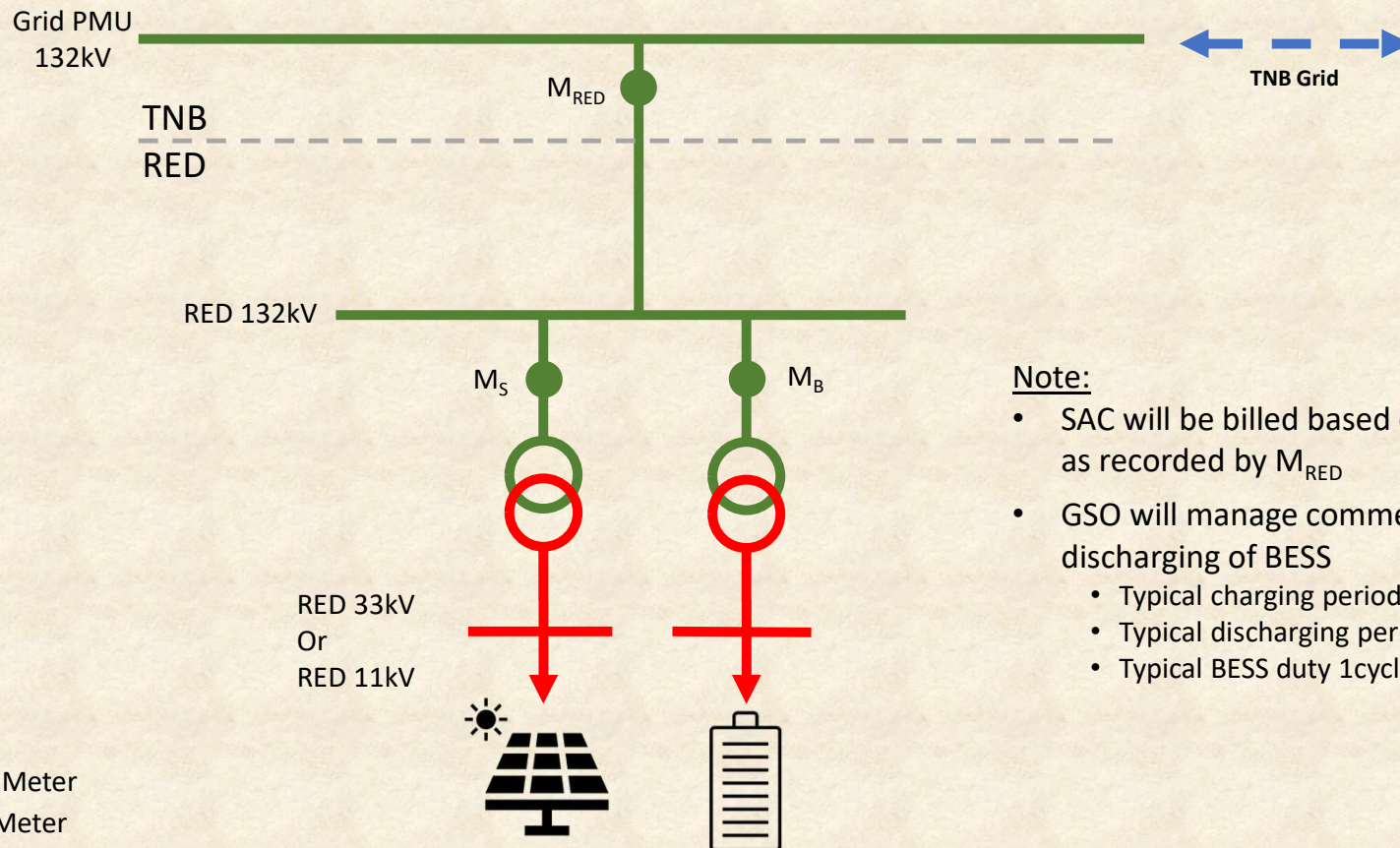
Grid Code for Peninsular Malaysia says, GSO is responsible towards:

- The preservation or restoration of the Grid System integrity;
- The compliance of the Users with obligations imposed by their Licences or the Grid Code;
- The avoidance of the breakdown, separation, islanding, collapse or blackout of the whole or parts of the Grid System;
- The fulfilment of safety requirements under all circumstances and at all times; or
- The prevention of damage to the Plant and Apparatus or the environment



GEP/BESS Direct Connection

Configuration A: Solar + BESS Co-located



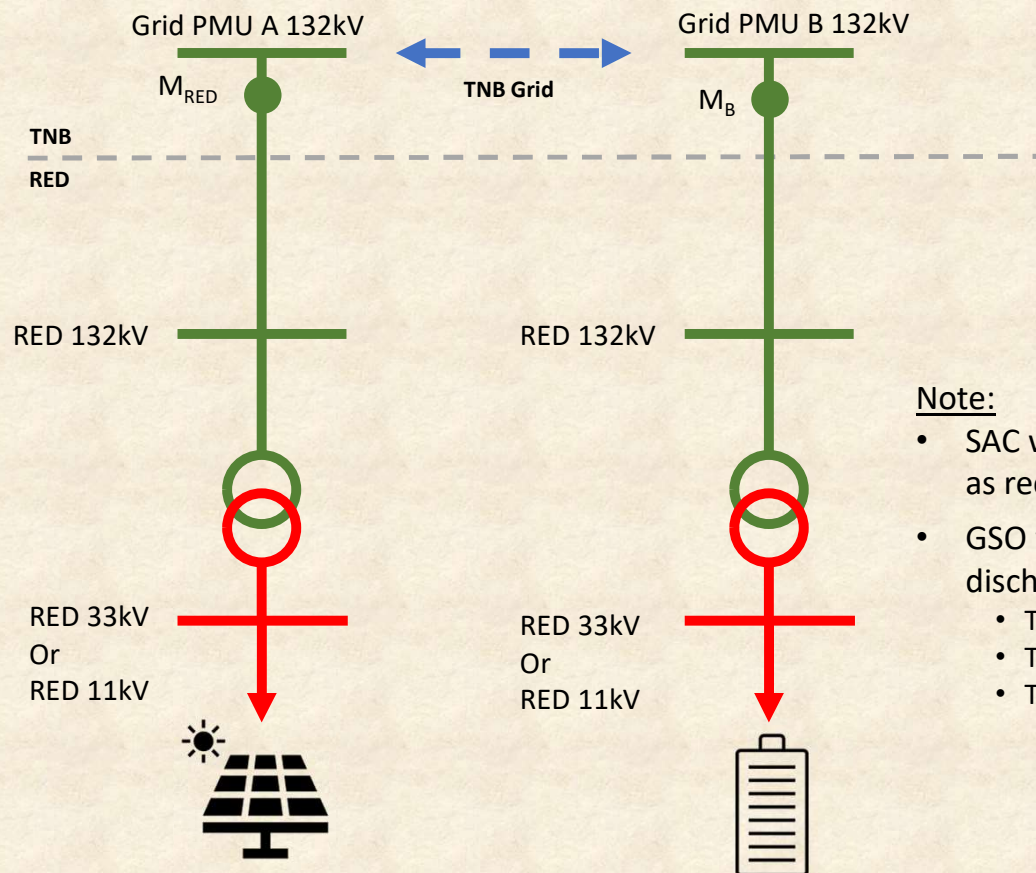
Note:

- SAC will be billed based on export energy delivered as recorded by M_{RED}
- GSO will manage commencement of charging and discharging of BESS
 - Typical charging period between 9am to 5pm
 - Typical discharging period 5pm to midnight
 - Typical BESS duty 1cycle/day

M_{RED} - RED Meter
 M_B - BESS Meter
 M_S - Solar Meter

Configuration B: Solar + BESS non co-located#

(#RED shall own both GEP and BESS)



Note:

- SAC will be billed based on export energy delivered as recorded by M_{RED}
- GSO will manage commencement of charging and discharging of BESS
 - Typical charging period between 9am to 5pm
 - Typical discharging period 5pm to midnight
 - Typical BESS duty 1cycle/day

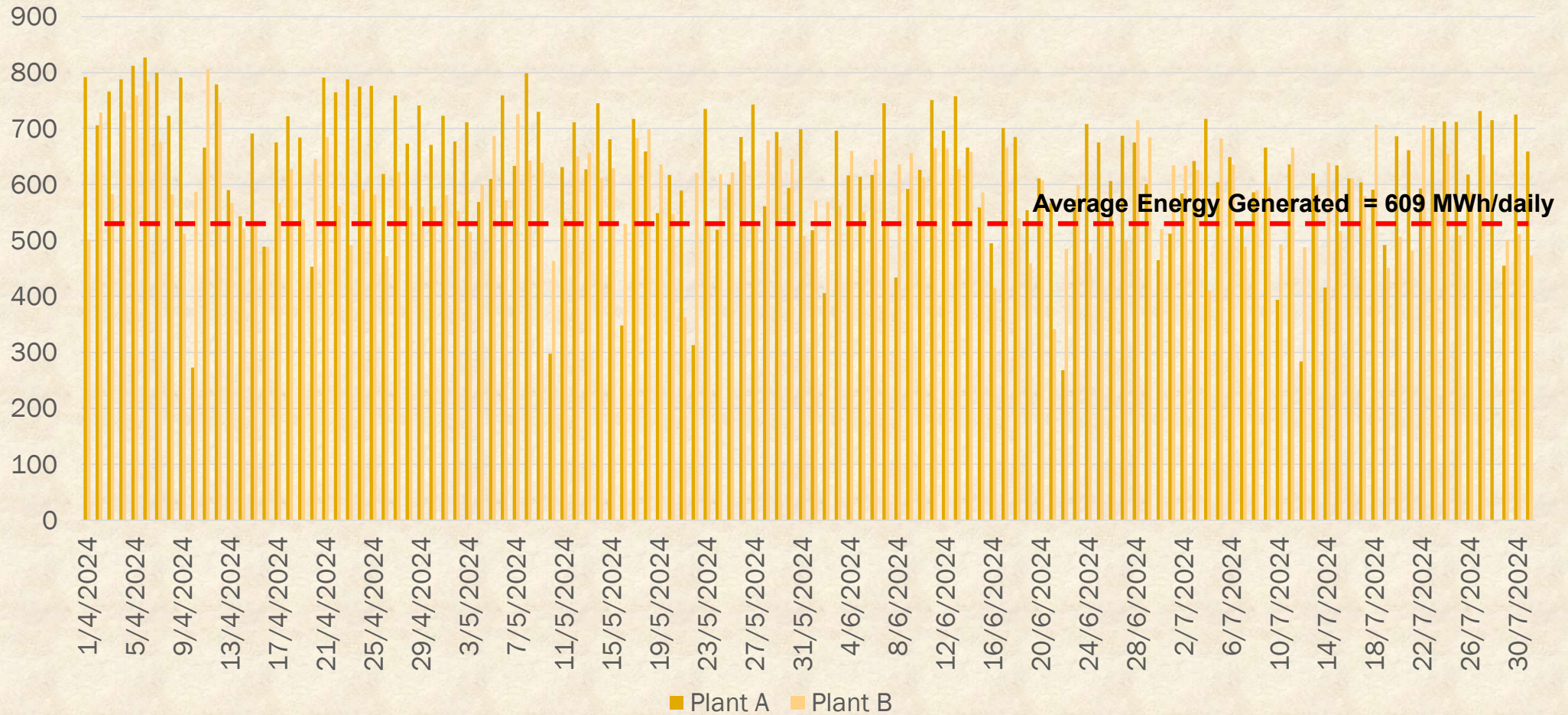
M_{RED} - RED Meter

M_B - BESS Meter

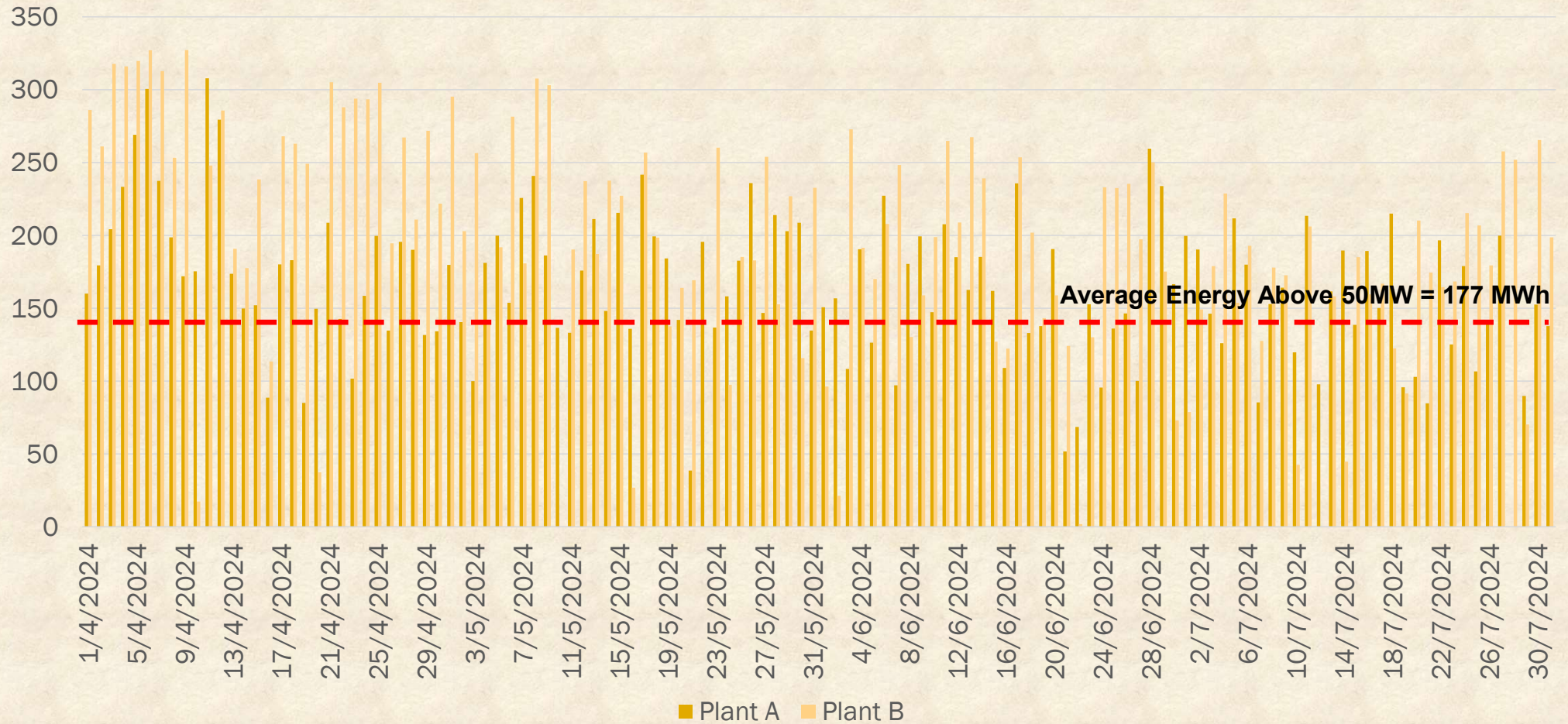
Firming Using Energy Storage e.g. BESS

- CRESS Guideline 8.14 (a)
 - The energy storage capacity (MW) shall not be less than fifty percent (50%) of the GEP registered capacity or the tested capacity prior to commercial operations whichever is lower, for four (4) consecutive hours and dispatchable by GSO as per system requirement

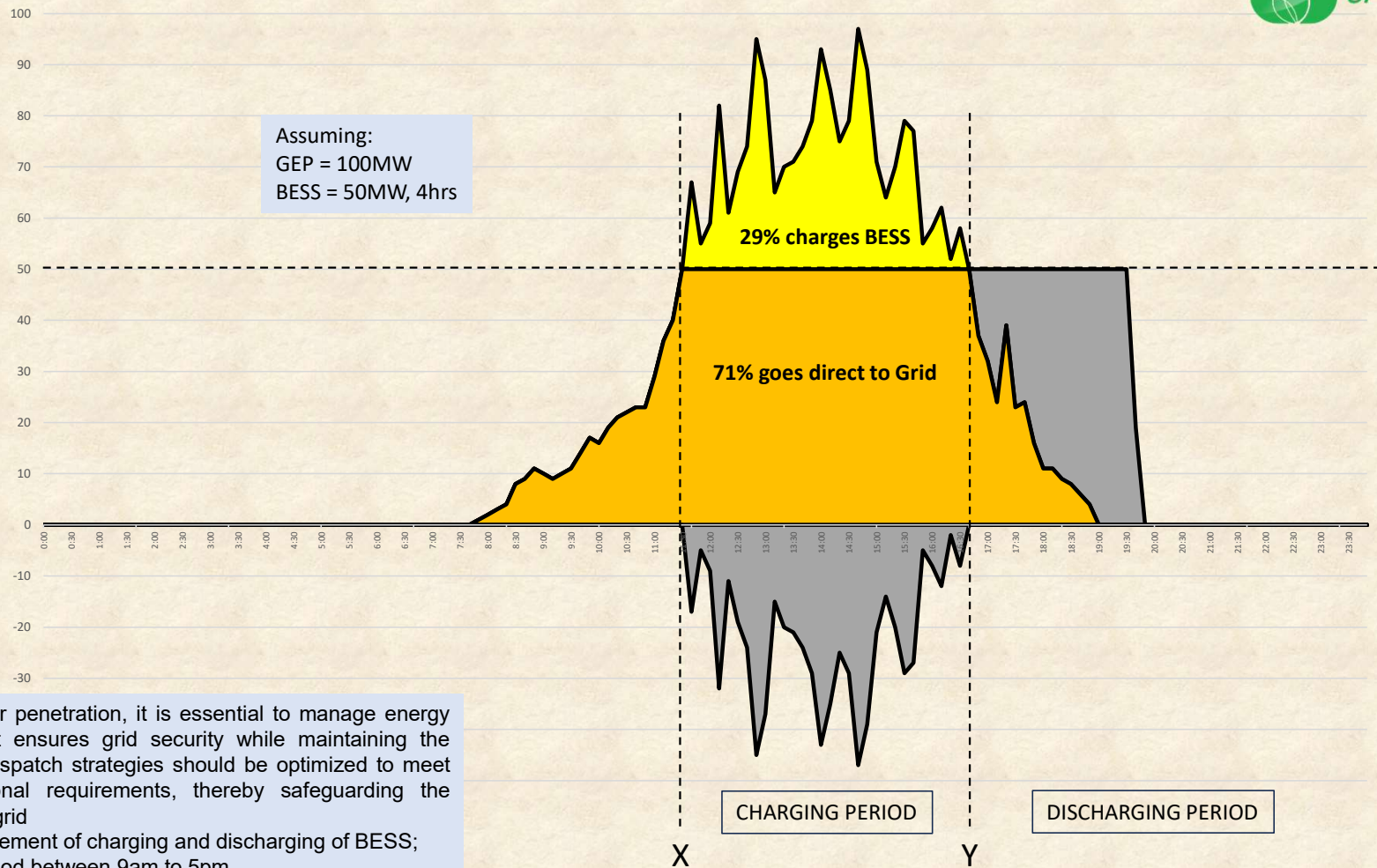
Historical Daily Generation for 100 MW LSS



Historical Energy Exported above 50 MW (50% of registered LSS capacity)

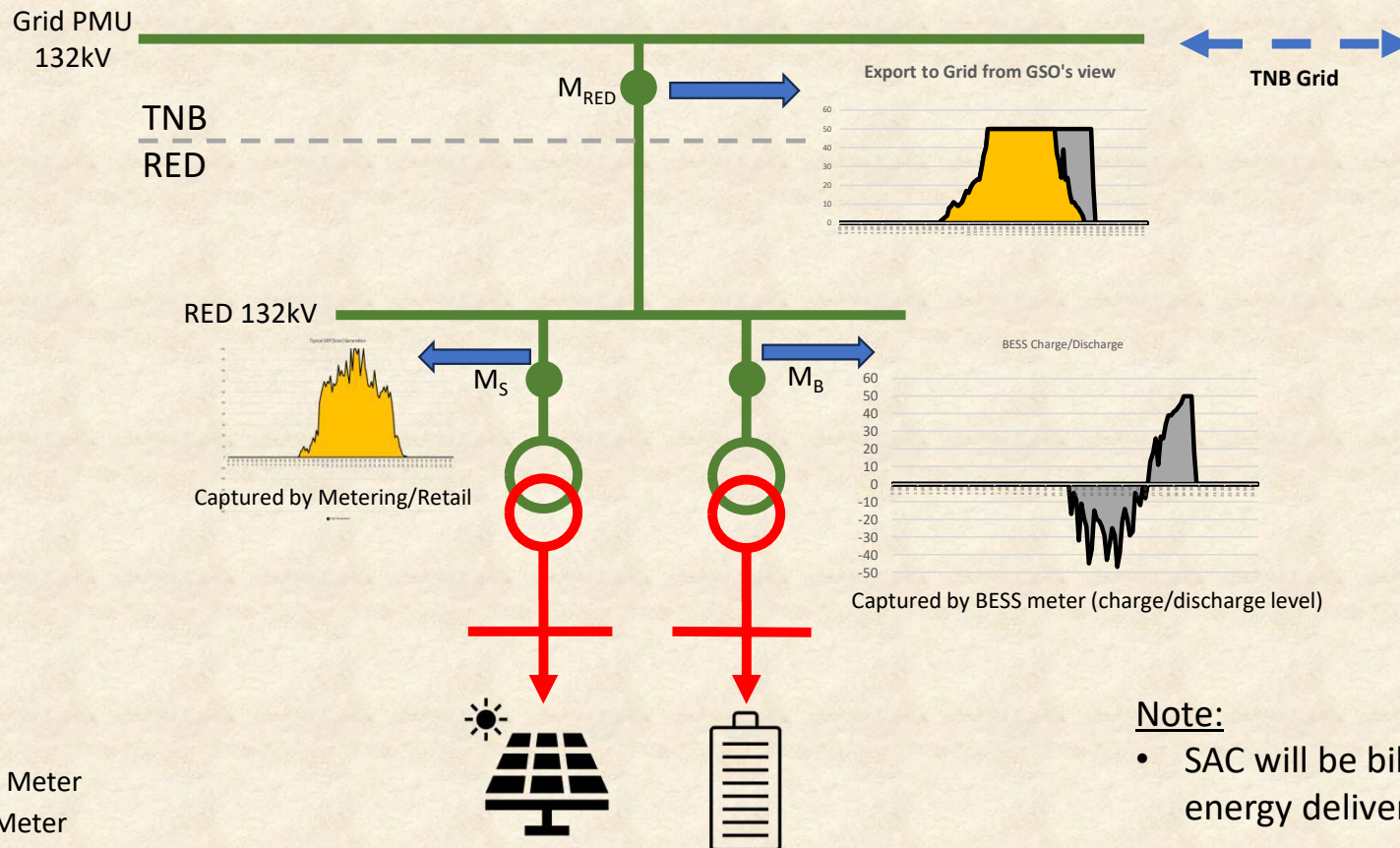


Typical GEP (Solar) Generation



- During periods of high solar penetration, it is essential to manage energy dispatch in a manner that ensures grid security while maintaining the necessary grid flexibility. Dispatch strategies should be optimized to meet all reliability and operational requirements, thereby safeguarding the stability and integrity of the grid
- GSO will manage commencement of charging and discharging of BESS;
 - Typical charging period between 9am to 5pm
 - Typical discharging period 5pm to midnight
 - Typical BESS duty 1cycle/day

GEP/BESS Captured Output



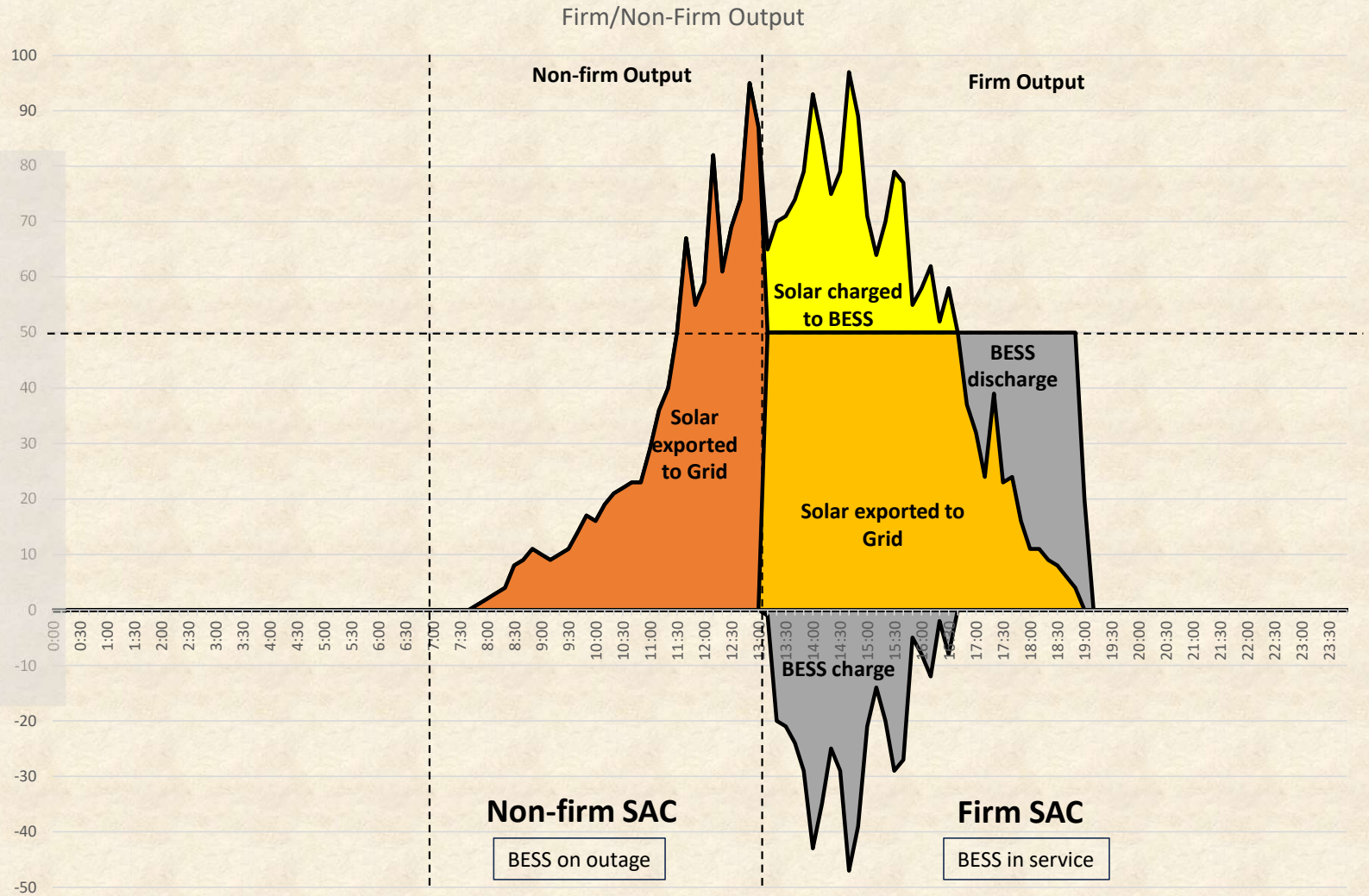
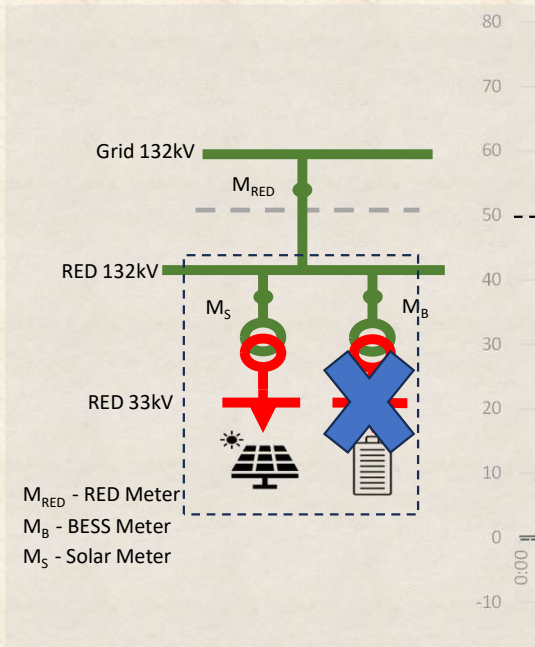
M_{RED} - RED Meter
 M_B - BESS Meter
 M_S - Solar Meter

Note:

- SAC will be billed based on export energy delivered as recorded by M_{RED}

Firming Using Energy Storage e.g. BESS

- CRESS Guideline 8.15
 - In the event where energy storage is unavailable due to planned or unplanned outage, RED shall be subject to non-firm SAC



Operation of GEP & BESS

- GSO is the responsible party to coordinate and operate all grid connected generating assets; which includes giving instruction to commence charging or discharging of the BESS to achieve the firming objective while at the same ensuring that GEP, BESS and other grid connected users can safely connect and operate in compliance to Grid Code and other regulatory requirements
- Depending on weather condition and solar irradiance on a particular day, the solar output more than 50% of GEP capacity, will be stored in BESS and discharged later to grid on the same day

Operation of GEP & BESS

- Under system emergency situation:
 - GEP or BESS or GEP & BESS will be directed by GSO to alter output level until emergency is restored
 - GEP part of full curtailment
 - BESS immediate charging or discharging

GRID CODE :Connection Code explains the responsibility of all the connected users

GCPM

Salient point

2 Objectives

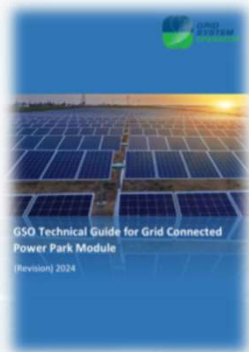
2.1 The objective of this CC is to ensure that by specifying minimum technical, design and operational criteria the basic rules for connection to the Transmission System and/or to a User's System are similar for all Users of an equivalent category and will enable the Grid Owner and GSO as well as the Users to comply with their statutory and Licence obligations.

2.2 No connection, existing, new, modified or to be modified shall impose unacceptable effects upon the Transmission System or on any User System nor will it be the cause of unacceptable effects by its connection to the Transmission System. In this respect unacceptable effects are all effects which cause the Grid Owner and GSO as well as any User to violate the Licence Standards and to become non-compliant with this Grid Code, statutory and Licence obligations.

- **To specify minimum technical, design, and operational criteria for connecting to the transmission system**

- **No connection, existing, new, modified or to be modified shall impose unacceptable effects upon the Transmission System or on any User system nor will it be the cause of unacceptable effects by its connection to the Transmission System.**

GSO Technical Guidelines for Solar and BESS



GSO Technical Guidelines for Grid Connected Power Park Module



Testing Guidelines for Grid-Connected Power Park Module



GSO Testing Guidelines for Battery Energy Storage System (BESS)



GSO EMS Interfacing, Testing and Commissioning Guidelines for CRESS



GSO SCADA Interfacing Guidelines



Thank You

