BRPL Letter dt. 17th April, 2023

Objective: To measure the Renewable Purchase Obligation (RPO) for the Solar rooftop systems having battery installed on the DC side of the system.

The letter in in reference to DERC (Net Metering for Renewable Energy) Regulations, 2014 and DERC (Group Net Metering and Virtual Net Metering for Renewable Energy) Guidelines, 2019. These regulations provide the pathway for the installation of renewable energy system (RES) with battery energy storage system (BESS).

A consumer intends to couple its solar plant with BESS on the DC side. Key components of the intended system are (i) **solar meter** for the measurement of total solar generation to estimate discom's RPO and consumer's generation based incentive (GBI), and (ii) **separate backup wiring** to prevent battery power to flow into the grid when the grid is not supplying electricity.

One of the main issues in measurement of solar generation in case of hybrid inverter is the difficulty in capturing the generation from RES and BESS separately, thus making the estimation of discom's RPO separately.

Due to the identified issue, DERC is requested to estimate the solar energy generation based on the normative Capacity Utilisation Factor (CUF) of RES instead of using the solar meter.

The document can be accessed here.

CER Opinion

i. **Introduction:** The proposed configuration by BRPL provides for a bidirectional inverter wherein the battery can be charged both from the electricity generated from the PV panels or that imported from the distribution utility. The battery will thus be able to inject "non-green" electricity, which was drawn from the distribution utility, into the grid.

   This will lead to following issues-

   (i) This will make it difficult to estimate the proportion of green energy in the energy injected by a consumer under the prevailing net metering regulations.[1] It will be challenging to estimate the correct RPO met by the distribution utility.

   (ii) Under the proposed configuration, the battery may also be charged by drawing electricity from the distribution grid during the peak hours and discharged during the off-peak hours, thus further aggravating the peak load management of the distribution utility.

   (iii) Calculation of storage obligation

   The above problem can be addressed through the following proposed solutions:

[1] As per the existing DERC (Net Metering & Connectivity for Renewable Energy Sources) Regulations, 2014, two meters exist, one for the measurement of renewable energy generation (counted towards RPO compliance) known as "Renewable Energy Meter" to account for renewable energy generated to fulfil RPO and a "Net Meter" for consumer billing.

(i) Uni-directional inverter

(ii) Two bi-directional meters

(iii) ToD tariff mechanism

(iv) DC uni-directional meter

The Proposed System: The single line diagram of the proposed system in the BRPL letter is shown below:

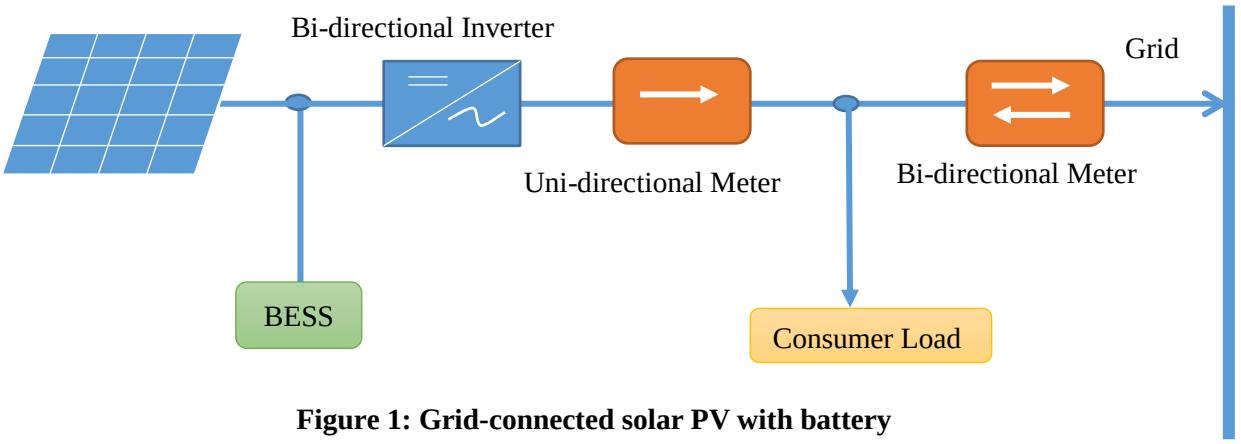

Figure 1: Grid-connected solar PV with battery

ii. **Suggestions for Alternate Arrangements:** Some of the alternate metering arrangements (changes w.r.t BRPL proposal highlighted in red curves) are discussed below:

Solution-I: Uni-directional inverter:

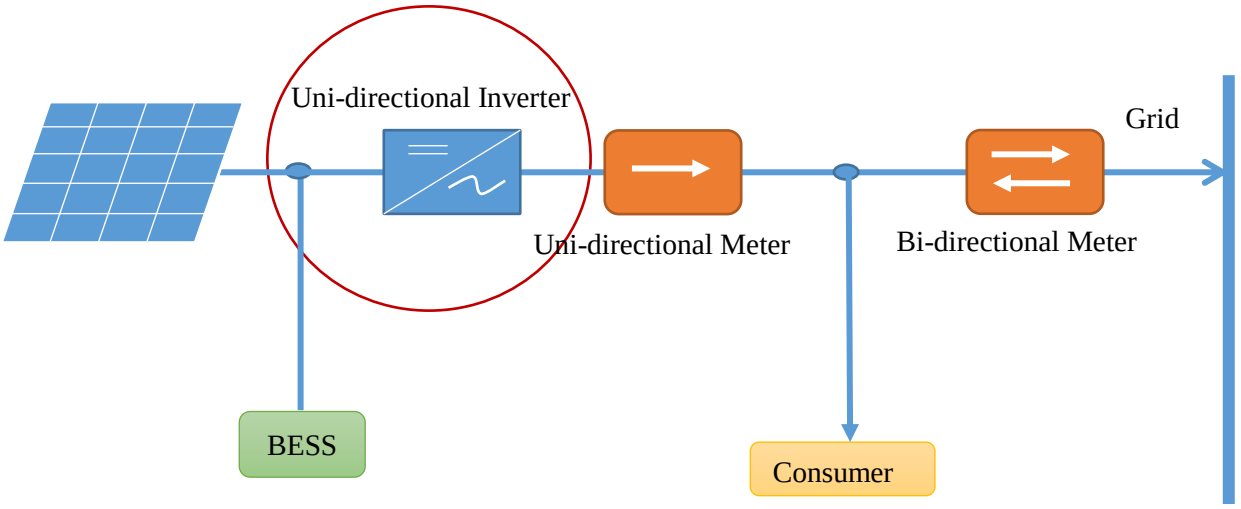

Figure 2: Arrangement with uni-directional inverter

Replacement of the bi-directional inverter along with the uni-directional inverter would obviate the possibility of grid power to charge the battery. The energy measured by the uni-directional meter will be green electricity (generated/stored at the site) and that will count towards the calculation of the RPO. **This solution will fix both the problems (i) and (ii) discussed above.**

Solution-II:

i. **Two bi-directional meters**

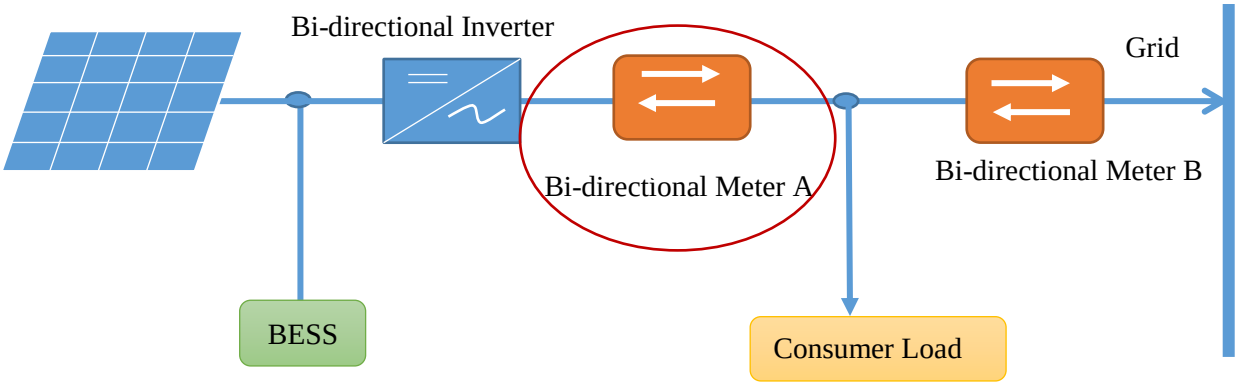

Figure 3: Arrangement with two bi-directional meters

The arrangement will consist of two bi-directional meters. One of the uni-directional meter would be replaced with the bi-directional one as per the submitted layout. The bi-directional Meter A measure the net green energy generated (including that stored) by the consumers system. The meter B would thus measure net green energy injected into the grid. However, there may be an uncertainty while accounting energy read by Meter A, whether it is from solar generation or from battery to the extent of battery capacity that can potentially be charged using electricity from the distribution system. The duration of such uncertainty can be up to 1 day equivalent of energy system considering that the battery is fully charged from solar on the last day of the previous financial year. This would have a miniscule effect only to the extent of RPO account for a given year but would not have impact when multiple years are taken together.

ii. **ToD Tariff Mechanism:**

The two bi-directional meters approach above can fix the problem of calculating the energy that will contribute towards the RPO, but will not address the problem (ii) as discussed in section 1.

The consumers of the category as mentioned in the BRPL letter must be provided the connection under ToD tariff mechanism. This will discourage drawl of electricity during the peak hours, thus helping to improve the peak load management of the distribution licensee.

Solution-III: Calculation of Energy Storage Obligation:

As per Ministry of Power (MoP), RPO as well as Energy Storage Obligation (ESO) has to be complied by every discom. In order to calculate the ESO from the proposed systems of the consumers, **either a normative approach to energy generation based approach is adopted, or a DC energy meter needs to be installed as suggested in diagram below**. In the case of the later, the ESO calculation would be relatively easier. However, this would require that the CEA (Operation and Installation of Meters) Regulations also include specifications for DC energy meters. As an alternative, the former solution can use normative energy generation from the solar panels and the energy drawn from solar+storage system through the unidirectional meter to estimate the ESO. This may pose several challenges as it would be difficult to set normative

generation to an estimation solar insolation at different sites with different technologies, performance and shading etc.

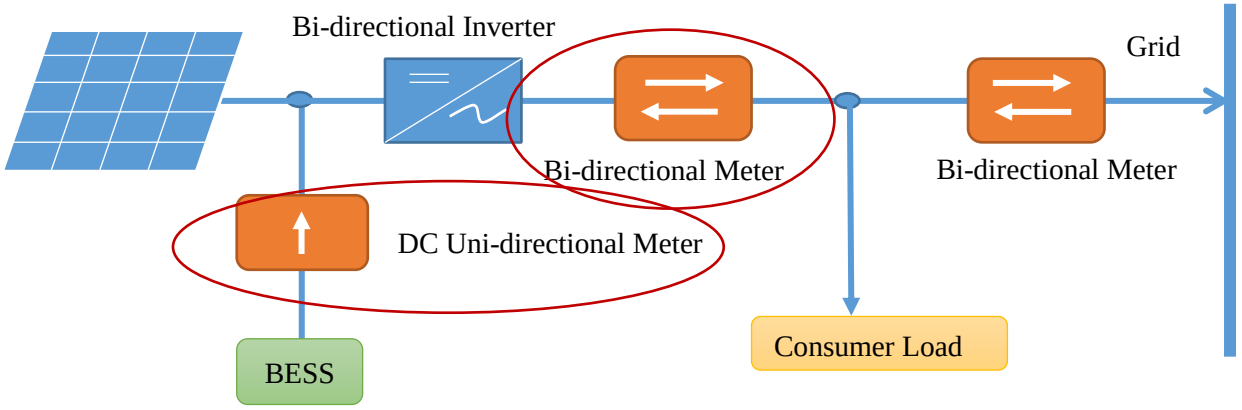

Figure 4: Metering Arrangement for Energy Storage Obligation

It is important to note that the ToD Tariff Mechanism could be implemented in the same way as explained for Solution II.

The table below summarises the proposed solutions to the issues with the BRPL proposed design:

Solution	Uni-directional Inverter	Bi-directional Inverter	Uni-directional Meter (Fig. 2)	Bi-directional Meter A (Fig. 3)	Bi-directional Meter B (Fig. 3)	ToD tariff	DC Uni-directional Meter (Fig. 4)
I	✓	×	✓	×	✓	×	×
II	×	✓	×	✓	✓	✓	×
III	×	✓	✓	✓	✓	✓	✓