Technical Proposal for Grid Connected Solar EV Charging Station

BHARAT HEAVY ELECTRICLS LIMITED

In this proposal, it is planned to establish 18 kWp (3 + 5 + 10 kwp) solar based charging station for EVs. The proposed scheme is shown in fig-1. It consists of four solar PV strings, four string inverters, four battery banks, and six charging posts. It is designed to cater the power requirement of six cars.

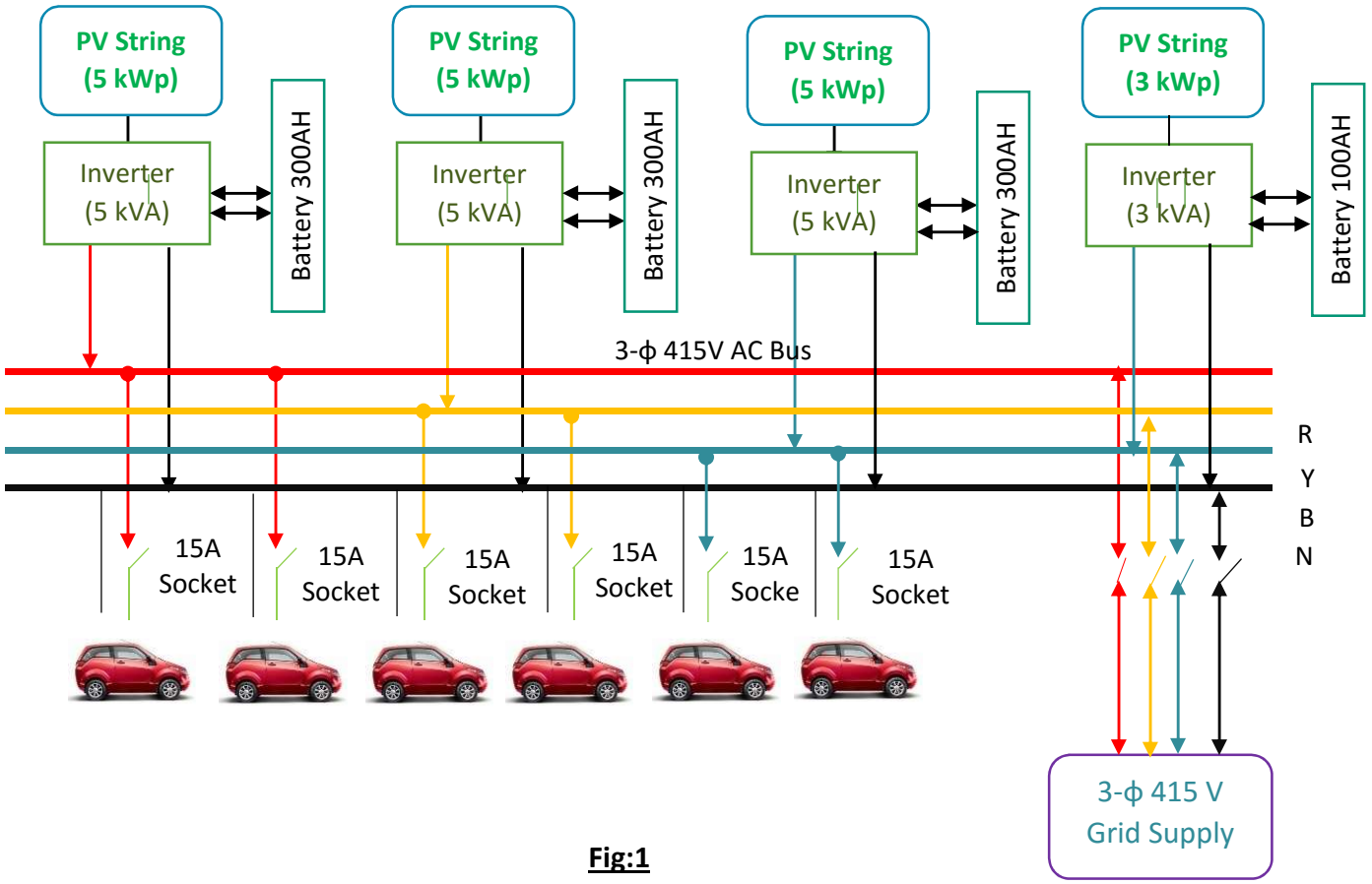

Fig:1

The Solar PV strings will be made from BHEL make LF24270 PV modules whose details are given Table-1. Details of vehicle considered is given in Table-2.

Table-1

Peak Power	300W
Open Circuit Volatge	44V
Short Circuit Current	8.8A
Volatge at MPP	36V
Current at MPP	8.34A
Length	2m
Breadth	1m

Table-2

S.No	Type of Vehicle	Battery Bank capacity	Charging time in Hrs	Power
1	Four wheeler (Eg: Mahindra Reva…etc)	48V, 300Ah	6	2800 W

From the above details, each module can give peak a power of 300 Wp at MPP voltage of 36 V and MPP current of 8.34 A. The inverter converts dc power into ac power at 1-ph 240 V and synchronized to grid. The inverter will be having the efficiency of 96% at full load rating with the built-in MPPT feature to harvest maximum power available from solar panels at any instant.

Power lines are drawn from 1-ϕ 240V AC bus and are terminated through IEC 60309 female connectors. A cable with IEC 60309 male connector at charging post and standard 15 A female connector on the vehicle side will provided to provide flexibility for charging. The charging station will be provided with a total battery back-up of 48 kWh to facilitate the EV charging in case of non-availability of both solar and grid power. If PV array generates more power than required by the electric vehicles and the battery is fully charged, then the surplus power will be exported to the grid.

The EV Charging station will be protected from the following protections:

a) Ground fault
b) AC over current protection from inverter side
c) Over current protection on each charging point
d) DC over voltage
e) AC over voltage

Proposed Layout - Facing towards west:

In this layout PV modules are mounted on a roof facing toward west in continues manner. Front view and top view of the charging stations are shown in fig-2 and fig-3 respectively. These PV modules are arranged in 13 columns with each column consisting of five PV modules. The distance between adjacent supporting poles is 5.2 m which can accommodate two vehicles.

a) Dimensions of the layout - 26x5 m2
b) Inclination angle – 5 degrees towards west

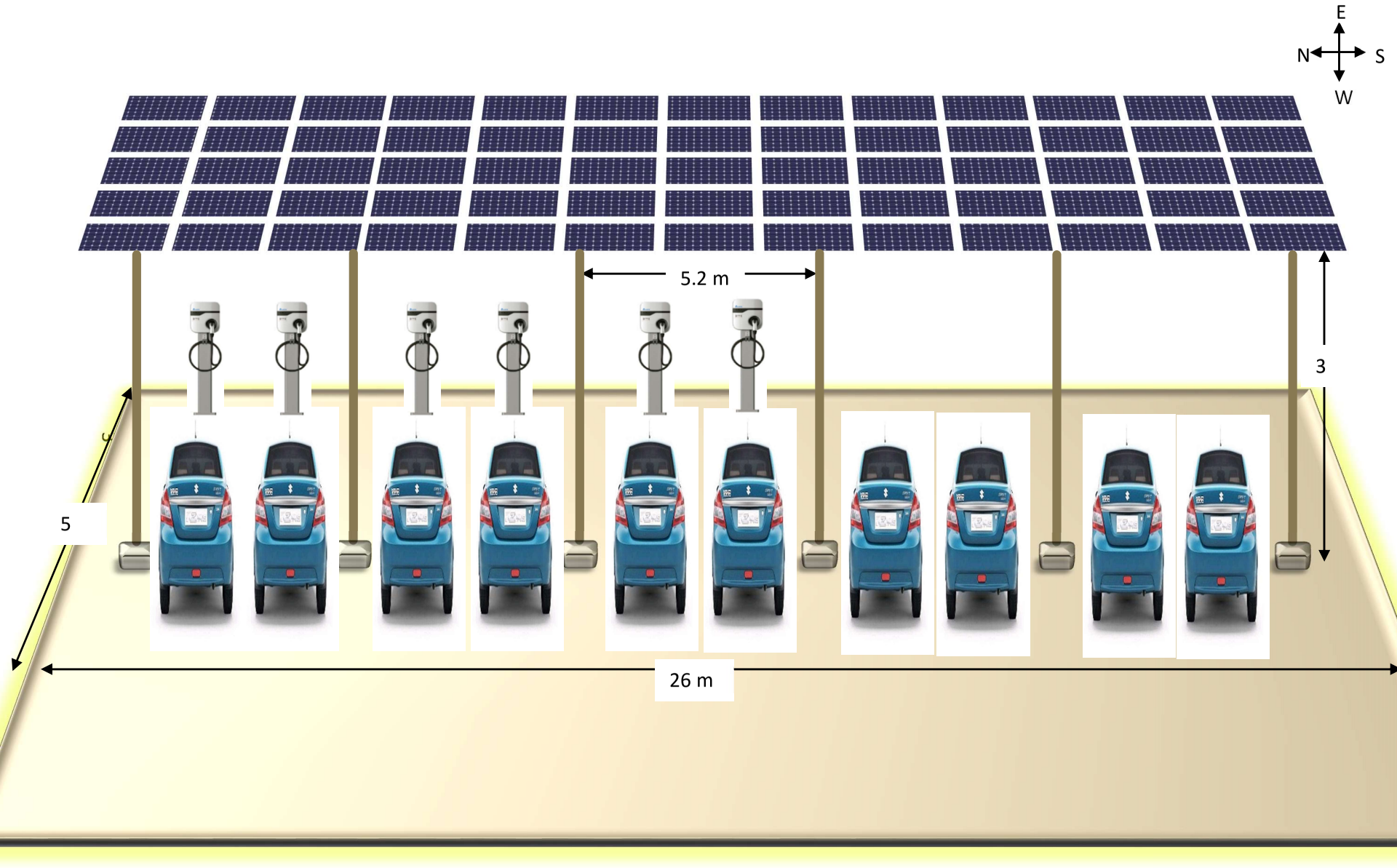

Fig-2 Front View of Solar EV Charging Station

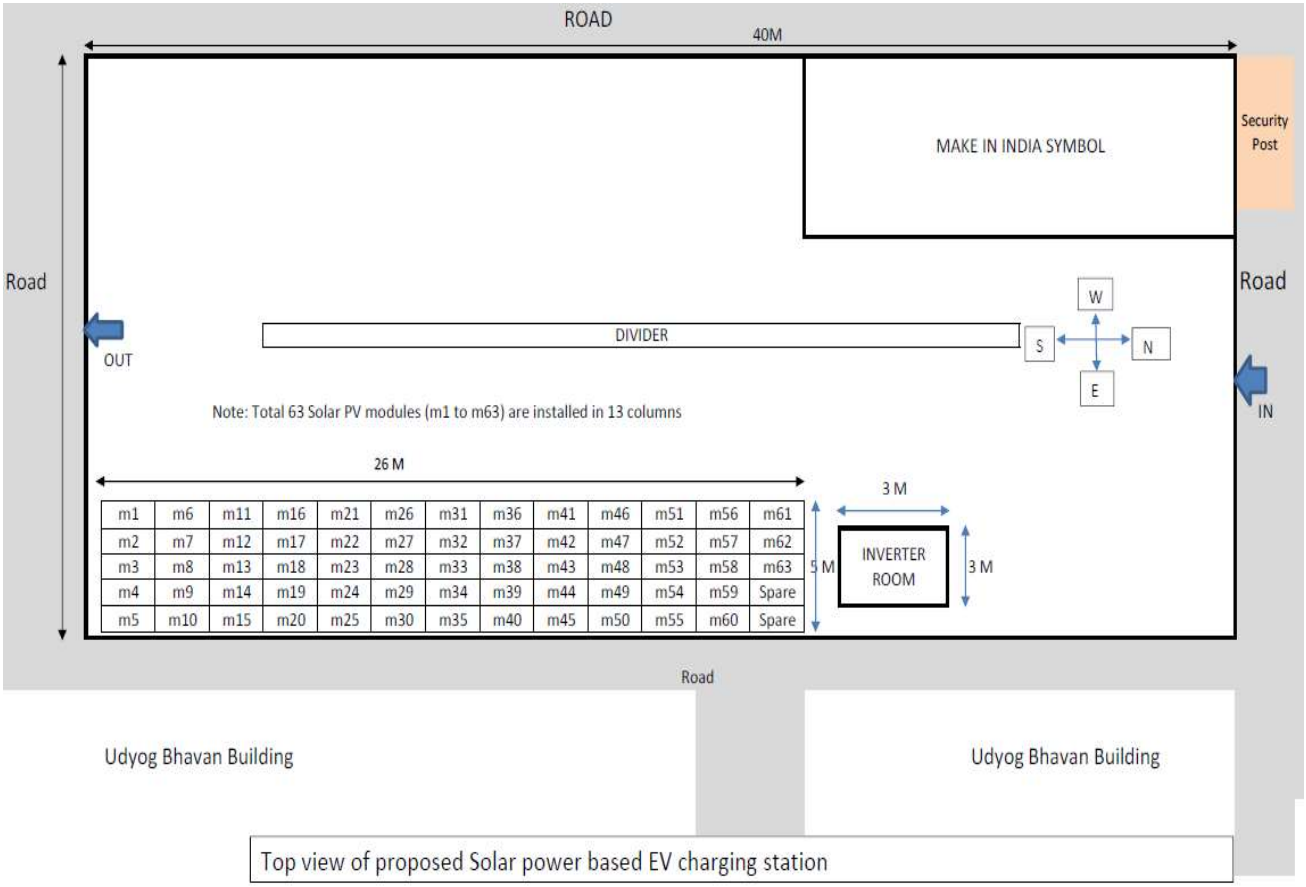

Fig:3

Module interconnections:-

Solar charging station consists of 63 PV modules which are divided into four groups namely group A, B, C and D.

a) Group-A consists of 18 modules (m1 to m18) connected in series.
b) Group-B consists of 18 modules (m19 to m36) connected in series.
c) Group-C consists of 18 modules (m37 to m54) connected in series.
d) Group-D consists of 9 modules (m55 to m63) connected in series.

PV module connections shall be done with the help of interconnecting cables which will be supplied along with PV modules. The output of group-A, group-B and group-C will be fed to three 5 kW inverters and the output of group-D will be fed to a 3 kW inverter.

Inverter room consists of 3No.s of 300Ah battery bank, 1No. of 100Ah batter bank, 3No.s of 5KW inverter panels, 1 No. of 3KW inverter panel and 1 No. of AC distribution box as shown in fig-4.

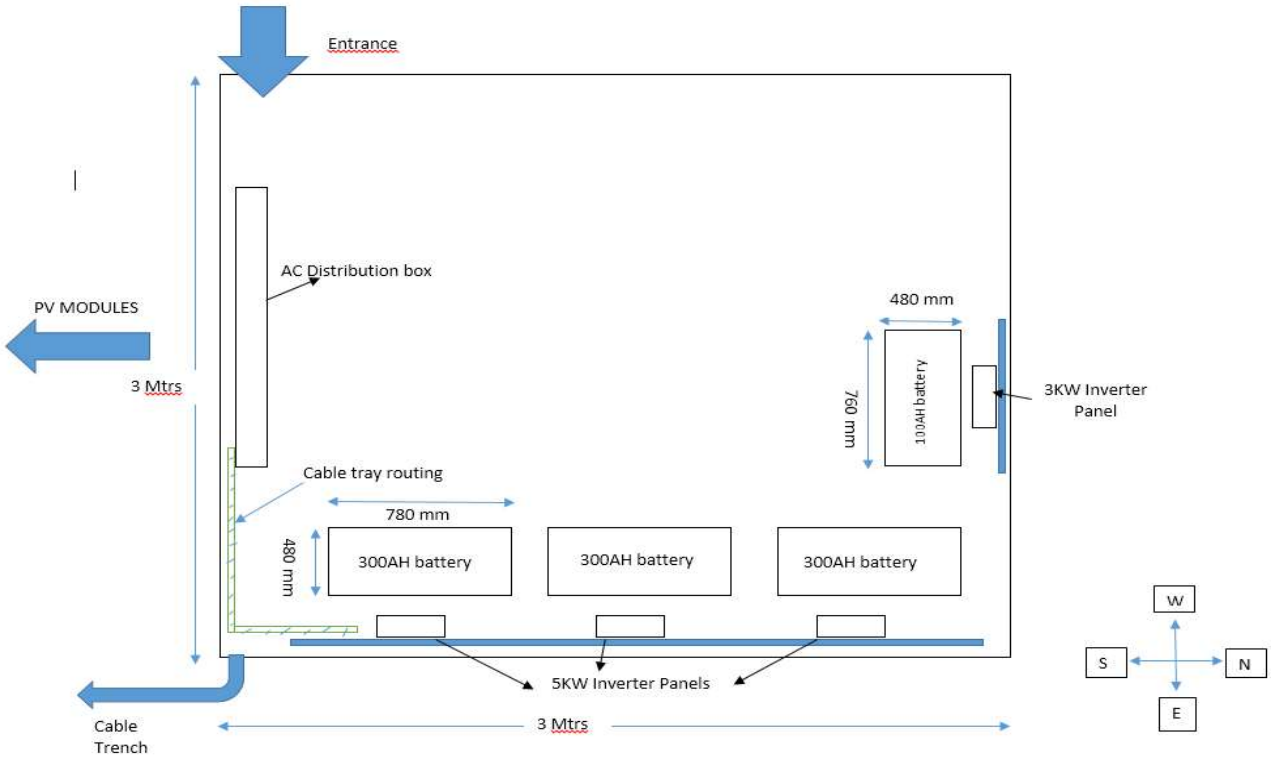

Fig-4 Top View of Inverter control Room

Details of cables used for interconnection of various sub-systems:

I. Connection from PV module to inverters:

a) Cabling shall be done from PV modules to Inverters with 1 core, 4sqmm Cu cable.

b) Cables from these four groups of PV modules will be routed through a cable tray of size 100mm along the vertical supporting structure close to the inverter room. These cables will be terminated at the inverter room through an underground cable trench of size 200mmx200mm.

c) Cable tray main routing and branch routing may vary as per site suitability.

II. Connection from inverters to battery bank:

a) Cabling shall be done from Inverters to battery banks with 1 core, 10sqmm Cu cable.

b) Cables from these four inverters to battery bank will be routed through a cable tray of size 50mm.

c) Cable tray branch routing shall be as per site suitability.

III. Connection from inverters to AC distribution box:

a) Cabling shall be done from Inverters to AC distribution box with 3 core, 6sqmm Cu cable.

b) Cables from these four inverters to AC distribution box will be routed through a cable tray of size 50mm.

c) Cable tray routing shall be as per site suitability.

IV. Connection from AC distribution box to existing utility grid :

a) Cabling shall be done from AC distribution box to existing utility grid with 3 core, 10 sqmm Cu cable.

b) Cables from these four inverters to existing grid will be routed through a cable tray of size 50mm.

c) Cable tray routing shall be as per site suitability.

V. Connection from AC distribution box to charging posts :

a) Cabling shall be done from AC distribution box to individual charging posts (6 nos) with 3 core, 4sqmm Cu cable.

b) The output AC cables from the distribution board will be terminated at the respective charging posts (6 nos) through the same underground cable trench.

c) Cable tray routing shall be as per site suitability.

Requirement from the GOI:

- 3-phase 415V, 32A, 50 Hz Grid supply
- Required statutory permissions.