CORRIGENDUM -2 TO NOTICE INVITING TENDER (NIT) Dated 17th September 2025

(Tender Ref No: 4100053363/CC26ADO016 - OLA for 2 years for Procurement of Chargers PAN India.)

CORRIGENDUM -2

Contents of Corrigendum – 2 are as follows:

1) Extension in Bid submission date
2) Reply to Prebid Queries
3) Annexure1 to Annexure 24

1) Extension in Bid submission date

Vide this corrigendum, Bid Submission date stands revised as below

		Earlier Schedule	Revised Schedule
(e)	Last date and time of receipt of Bids	06.10.2025 up to 15:00 Hrs.	10.10.2025 up to 21:00 Hrs.
(f)	Date & Time of opening of Price of qualified bids	Will be notified to the successful bidders through our website / e-mail.	Will be notified to the successful bidders through our website / e-mail.

2) Reply to Prebid Queries

Reply to Prebid Queries are as follows-

Reply to Prebid Queries - 4100049556/CC26ADO010 - OLA for 2 years for Procurement of Chargers PAN India.

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
1	2	3	4	5
1	Annexure-IX/Techincal Specification (upgradable 60kW to 120kW) /Page no 49	Standout features: Multi language support	English only	In accordance with the Technical Specifications, the requirements shall be determined based on the proposed location/region
2	Annexure-IX/Techincal Specification (upgradable 60kW to 120kW) /Page no 44	Voltage Range: . Undervoltage is 295V (-20V) with recovery at 295V	Under voltage limit is 320 V	Bidders to adhere to the Technical Specifications
3	Annexure-V/Techincal Specification 7.4kW AC Public Charger /Page no 42	Meter class:Certification: Certified class 0.5	Meter Class 0.2	Ok
4	Annexure-IX/Techincal Specification (upgradable 60kW to 120kW) /Page no 46	Altitude:3500 meters	Upto 2000 meters	OK
5	Annexure-IX/Techincal Specification (upgradable 60kW to 120kW) /Page no 47	Life of cycles for connector: 20k operations	as per current product avsupto 10k operations	OK
6	Annexure-IX/Techincal Specification (upgradable 60kW to 120kW) /Page no 51	IP 55	IP55 with rain/shower	Accepted
7	Annexure-XI/Techincal Specification 180kW /Page no 109/Annexure X/Techincal Specification 60kW-Page no 96	SIM network strength detection and modification on CMS is available.	Not applicable	Bidders to adhere to the Technical Specifications
8	Annexure-XII/Techincal Specification 240kW /Page no 122	After 3 consecutive wrong password attempts, a 30-minute wait is enforced	can be done , it might create problems for customer	OK . Will Review and adopt as per business need
9	Annexure-XII/Techincal Specification 240kW /Page no 124	Ring Net Support: Allows on-site integration between two chargers to boost the total output power.	Future Development	OK. Pl refer Annexure_11 for reference.
10	Annexure-XII/Techincal Specification 240kW /Page no 125	Gun complete control with the remote monitoring system's real-time charger visibility	Please elaborate	Pl Refer Annexure_1
11	Annexure VII:- Noise Level	Mandatory <65 dB in all directions @1m distance	Will Confirm Later	Bidders to adhere to the Technical Specifications
12	Annexure IX:- Noise Level	Mandatory <65 dB in all directions @1m distance	Will Confirm Later	Bidders to adhere to the Technical Specifications
13	Annexure X:- Noise Level	Mandatory <65 dB in all directions @1m distance	Will Confirm Later	Bidders to adhere to the Technical Specifications
14	Annexure XI:- Noise Level	Mandatory <65 dB in all directions @1m distance	Will Confirm Later	Bidders to adhere to the Technical Specifications
15	Annexure XII:- Noise Level	Mandatory <65 dB in all directions @1m distance	Will Confirm Later	Bidders to adhere to the Technical Specifications
16	Annexure VIII:-Output Current	200 A	125A Each Gun	Bidders to adhere to the Technical Specifications
17	Annexure IX:-Output Current	250 A	200A	Bidders to adhere to the Technical Specifications
18	Annexure XII:- Output Current	400A (250A per Gun for continuous rating)	Complied (200A Continous on Each Gun)	Bidders to adhere to the Technical Specifications
19	Annexure VIII:- Display		7'' TFT LCD Touch Screen	Bidders to adhere to the Technical Specifications

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
20	Annexure IX:- Display	Color LCD touch screen – 10" and greater (screen with dark mode for better visibility during day time) and compatibility to run Ads or commercials may be checked.	7" TFT LCD Touch Screen	Bidders to adhere to the Technical Specifications
21	Annexure X:- Display		7" TFT LCD Touch Screen	Bidders to adhere to the Technical Specifications
22	Annexure XI:- Display		7"/ 10" TFT LCD Touch Screen	Bidders to adhere to the Technical Specifications
23	Annexure XII:- Display		7"/ 10" TFT LCD Touch Screen	Bidders to adhere to the Technical Specifications
24	Annexure VII:- Electrical Safety: Surge Protection	25 kA	Type 2 (Due to compact design Type 2 can be installed)	Bidders to adhere to the Technical Specifications
25	Annexure VII:- SPD	Class B IEC 61643-11:2011 (Type-1+2)	Type 2(Due to compact design Type 2 can be installed)	Bidders to adhere to the Technical Specifications
26	Annexure VII:- Charging Connector	CCS type 2 connector must have replaceable silver plated power contact with mating frame.	Fixed Contacts	Bidders to adhere to the Technical Specifications
27	Annexure VII:- Charger Gun	DC gun output is adjustable and replaceable with contact.	Fixed Contacts	Bidders to adhere to the Technical Specifications
28	Annexure VIII:-Standout features Requirement	Standby Power Consumption-≤ 50 W	<90Watt	Test report to be submitted
29	Annexure IX:- Standout features Requirement	Standby Power Consumption-≤ 80 W	<90Watt	Test report to be submitted
30	Annexure X:- Standout features Requirement			
31	Annexure XI:- Standout features Requirement			
32	Annexure XII:- Standout features Requirement			
33	Voltage Range	415 V AC (Charger nominal voltage is 415V. Overvoltage is 475V (+20V), with recovery at 475V. Undervoltage is 295V (-20V) with recovery at 295V	415 (330 to 465)Vac	Bidders to adhere to the Technical Specifications
34	Earthing System	TN-S, TN-C, TN-C-S and IT	Complied (TN-C & TN-C-S not recommended)	Refer Annexure-2
35	Efficiency	>95%	>95% (Peak)	Bidders to adhere to the Technical Specifications
36	Cable Length	Min 6 meter & above	Complied (End to End)	Bidders to adhere to the Technical Specifications
37	Installation Type	Floor mounted and / Stool mounting as per requirement. Suitable pedestal to be provided in case of floor mounted installation as per (Manufacturing as per IEC 62208 and mechanical impact resistance as per IEC 62262; sheet steel (Industrial grade- Grade D) as per IS 513:Corrosion protection of C4M (3-layer coating) , colour to be approved by TPEVCSL project Manager)	Complied C4M (2Layer Coating))	Bidders to adhere to the Technical Specifications

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38	Enclosure	Manufacturing as per IEC 62208 and mechanical impact resistance as per IEC 62262; sheet steel (Industrial grade Grade D) as per IS 513:Corrosion protection of C4M (3-layer coating) and The enclosure of electric vehicle supply equipment shall be made of fire retardant material with self-extinguishing property and free from halogen	Complied (C4M (2Layer Coating))	Bidders to adhere to the Technical Specifications
39	Heat Dissipation	Bidder should submit heat loss calculation and Air flow calculation	Noted (Will share it later)	Bidders to adhere to the Technical Specifications
40	Display	Color LCD touch screen – 10" and greater (screen with dark mode for better visibility during day time) and compatibility to run Ads or commercials may be checked.	7'' TFT LCD Touch Screen	Bidders to adhere to the Technical Specifications
41	Indications	Indications may be provided amber, green and res LEDs / key operated interlocks	Red,Green,Blue with Pad lock type key lock	Bidders to adhere to the Technical Specifications
42	Altitude	3500 Mtrs above sea level	Upto 2000Mtr.	OK
43	Life Cycles for Connector	Minimum 20K operations	>10K	OK
44	Communication	Ethernet || Cellular (3G/ 4G/ 5G)	Ethernet, 4G	Bidders to adhere to the Technical Specifications
45	Online tracking through Web portal & Mobile App	Required	In CMS Scope	Bidders to adhere to the Technical Specifications
46	Electrical Safety: Surge Protection	25 kA	Type 2	Bidders to adhere to the Technical Specifications
47	SPD	Class B IEC 61643-11:2011 (Type-1+2)	Type 2	Bidders to adhere to the Technical Specifications
48	Safety Parameters	Over current, under voltage, over voltage, Residual current, Surge protection, Short circuit, Earth fault at input and output, Input phase reversal, Prevention of vehicle movement during charging, Emergency shutdown with alarm, Over temperature, Insulation fault, Protection against electric shock	Complied (Input Phase Reversal: Not required,Charger can work on any phase sequence Prevention of vehicle movement during charging: EV responsible for the locking control of CCs 2 Gun)	Bidders to adhere to the Technical Specifications
49	Earthing	As per IS 732/IEC 60364-5-54	In System Installer Scope	Charger Panel Earthing to be complied as per Latest IEC / IS
50	Power Supply Cable	As per IEC 62893-1	Complied (As per IEC 62893-4-1)	Ok
51	Over temperature protection (Derating/Shutdown)	Mandatory. Charger & rectifier derating starts at 55 °C and cut-off is 70 °C. and Gun temperature derating & cut-off temperature is 90°C	Complied (Charger Start Derates:->50Deg C)	Bidders to adhere to the Technical Specifications

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52	Under Voltage Shutdown Voltage	Undervoltage is 295V (-20V) with recovery at 295V	330Vac	Bidders to adhere to the Technical Specifications
53	Over Voltage Shutdown Voltage	Overvoltage is 475V (+20V), with recovery at 475V	465Vac	Bidders to adhere to the Technical Specifications
54	Insulation Resistance	As per IEC 61851-1/ >1 G Ohm	Complied (As per IEC 61851-1)	Bidders to adhere to the Technical Specifications
55	Energy Calculation Function	Required	Noted (Will share it later)	Test report to be submitted
56	Diagnostic Function/Data monitoring	as per list attached	Pls Share a Format	FAT reports already shared
57	Alarm/Fault condition standard as per TPC need	as per list attached	Pls Share a Format	Error code list already shared
58	Automatic Software update over net	Required	Complied for Network Connected Board	Refer Annexure-4
59	Network interface	Mandatory-Ethernet, Wi-Fi, 4G,	Ethernet, 4G	Bidders to adhere to the Technical Specifications
60		Provisional Upgrade to 5G	Will Confirm Later	Bidders to adhere to the Technical Specifications
61	Standout features Requirement	Remote Monitoring System (RMS)	CMS Scope	Refer Annexure_10
62		Multi language support	English (Pls Specify regional Language)	In accordance with the Technical Specifications, the requirements shall be determined based on the proposed location/region
63		Chargers are compatible with Plug & charge /Ensure ISO 15118-2 and TLS 1.2 encryption	Auto Charge via MAC address	OK
64	Charging Connector Mating Cycles	20K minimum	>10K	OK
65	Charge Option	Auto Charge, Mode Selection (Time/Power/SoC)	Complied, Mode Selection in scope of CMS	Bidders to adhere to the Technical Specifications
66	Dimension (L x D x H) for Power cabinet and Dispenser	New Product hence Bidder should submit GAD for finalization to TPC team	Noted (Share it later(Stand alone Product))	As per the Technical Specifications requirements, reports must be submitted along with the bid.
67	Charging Cable length	6 meter and above	Complied (End to End)	Ok
68	Operating Temperature	-5°C to 60°C	-25°C to 55°C (Above 50 Deg Derating Starts)	Bidders to adhere to the Technical Specifications
69	Storage Temperature	-20°C to 85°C	-25°C to 70°C	Annexure-5
70	Green Lamp	Blinking – Charging in progress	Blue	Bidders to adhere to the Technical Specifications
71		Continuous ON – Charging completed	Blue	Bidders to adhere to the Technical Specifications
72	Individual Dispenser /each gun and each session energy measurement facility along with mentioned payment option	Compatible for billing and payment transactions Can be integrated with different modes of payment (mobile app based, card based,QR based etc.)	CMS Scope	As per Technical Spcification requirements, the supplied charger will support all listed payment modes.
73	AIS-138 (part2)	Safety Function Verification	ARAI IS 17017 Series	Bidders to adhere to the Technical Specifications
74	IEC-61851-23/24	23-Electric vehicle requirements for Requirements only to on-board circuits with the conductive connection to an AC/DC supply 24-DC electric vehicle charging station	ARAI IS 17017 Series	Test report to be submitted

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75	IEC-62196-3	Plugs, socket, outlets, vehicle connector and vehicle inlets	ARAI IS 17017 Series	Test report to be submitted
76	DIN 70121	Digital communication between a d.c. EV charging station and an electric vehicle	ARAI IS 17017 Series	Test report to be submitted
77	IEC-61851-1	General requirements for Electric vehicle conductive charging system	ARAI IS 17017 Series	Test report to be submitted
78	IEC- 60068-2	Enviornmental testing	ARAI IS 17017 Series	Test report to be submitted
79		Remote Monitoring System (RMS)	CMS Scope	Refer Annexture 10
80		Multi language support	Complied (Pls Specify regional Language)	As per the Technical Specifications, based on the proposed location/region
81		Chargers are compatible with Plug & charge	Auto Charge via MAC address	Ok
82		Remote Monitoring System (RMS) is available.	CMS Scope	Refer Annexture 10
83		SIM network strength detection and modification on CMS is available.	Need Clarity	TPEVCSL has requested the Signal Strength Error Codes
84		Power output modes: Intelligent, Priority, and Single Mode.	Need Clarity	Refer Annexure-6
85		Strong User and password length	Pls Specify Purpose	Bidders to adhere to the Technical Specifications
86	Standout features Requirement	Usernames and passwords now support alphabets, numbers, and special characters.	Pls Specify Purpose	Bidders to adhere to the Technical Specifications
87		Reset option is available on-screen.	Complied (Password Protected controlled via CMS)	As per the Technical Specifications, both Manual and CMS should be available
88		After 3 consecutive wrong password attempts, a 30- minute wait is enforced.	Need Clarity	Will Review and adopt as per business need
89		Data transfer packet for VIN/MAC ID with connector ID option is required	Pls Share a Format	Refer Anneture B-PDU Format
90		User and manufacturer password configuration keys is required	Need More Clarity	Refer Annexure-7
91		URL/ID single manufacturer key is required	Need a Clarity	Refer Annexure-8
92		TATA front logo is required	Need a Clarity	As per the Technical Specifications, only the TATA logo is required on the Charger HMI screen
93		Color of Panel:Main housing: RAL 9006, Roof & Base: RAL 9017	RAL9016 Main Housing RAL 7021 Roof & Base	Bidders to adhere to the Technical Specifications
94		High Efficiency: System efficiency of >95%, resulting in a lower total cost of ownership and reduced energy waste.	Complied Peak	Bidders to adhere to the Technical Specifications
95		Robust Operating Range: Designed to operate in a wide temperature range, with intelligent de-rating beyond 55°C to maintain reliability	Complied (Derating above 50Deg C)	Bidders to adhere to the Technical Specifications
96		Smart Multi-Stack charging profiles: Enables intelligent charging management across multiple EVs with advanced stack-level coordination.	CMS Scope	Refer Annexure-9

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97	Additional Key Features:	Advanced Remote Monitoring System (RMS) Functionality: Comprehensive Remote Monitoring System for real-time diagnostics, data logging, and fault management with functionality of rule engine for customization	CMS Scope	Refer Annexure_10
98		Ring Net Support: Allows on-site integration between two chargers to boost the total output power.	Not Supported	Refer Annexure_11
99		User-Friendly Interface: Equipped with a 10-inch touchscreen, offering an intuitive and responsive user experience. With optional multi-lingual support.	7'' TFT LCD Touch Screen with English language (Pls Specify multi language)	Bidders to adhere to the Technical Specifications
100		Quick Deployment: Engineered for easy transportation and fast installation, reducing site setup times and costs	Project team will confirm	Internally to be coordinated by Charger OEM
101		Smart Power sharing linking standalone chargers into one synchronized system	Need Clarity	Annexure_12
102		Enables flexible multi- vehicle charging dynamically adjusting for high traffic locations	Need Clarity	Annexure_13
103		Allows different billing rates or power limits based on time of day or by customer group	CMS Scope	Annexure_23
104		Supports to enable multiple business models for CPOs for revenue maximization	CMS Scope	Annexure_14
105		Provides the ability for CPOs to define multiple active charging profiles supporting dynamic prioritization of rules	Need More Clarity	Annexure_15
106		Showcase promotions, pricing, or vibrant, brand tailored ads, all effortlessly managed remotely	Need Clarity	Annexure_16
107		Boost your market presence and engage with users by making your brand shine.	Need Clarity	Annexure_17
108		Enhance station visibility and foster customer loyalty	Need Clarity	Annexure_18
109		Simplify charging with advanced connector holsters featuring integrated placement sensing	Need Clarity	Annexure_19
110		Gun complete control with the remote monitoring system's real-time charger visibility	Need Clarity	Annexure_1
111	Special Conditions of Contract Page.151 Clause no 5. CONTRACT PERFORMANCE BANK GUARANTEE (CPBG)	Vendor shall submit an unconditional and irrevocable Contract Performance Bank Guarantee (CPBG) cum Performance Bank Guarantee (PBG) for a value equal to 5% of the total OLA value. Such CPBG shall be valid till the expiry of Warranty/Defects Liability Period with a further claim period of 6 months. Warranty period to be considered for CPBG is the highest warranty period applicable for the chargers in the OLA.	Contract Performance Bank Guarantee (CPBG) cum Performance Bank Guarantee (PBG) for a value equal to 5% of the alloted OLA value of the project.	Deviation not accepted. All terms and Conditions shall be as per the tender document

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112	Special Conditions of Contract Page.151 Clause no 6. TERMS OF PAYMENT	Payment terms for chargers shall be as follows: 1) AC chargers (3.3 kW, 7.4 kW, 10 kW, 11 kW & 22 kW) a. 60% of supply portion on supply of charger at stores/site. b. Remaining 40% in equal installments during the warranty period of 5 years. 2) CCS chargers 30 kW, 60 kW, up to 120 kW a. 65% of supply portion on supply of charger at stores/site b. Remaining 35% in equal installments during the warranty period of 7 years. 3) CCS chargers 180 kW & 240 kW a. 64% of supply portion on supply of charger at stores/site b. Remaining 36% in equal installments during the warranty period of 12 years.	The CPBG will be submitted as per tender demand which shall cover the risk over entire agreed warranty period. Hence request you to release the 100% Payment against the GRN of the material.	Deviation not accepted. All terms and Conditions shall be as per the tender document
113	1.7 / (Page no 8)	Commercial Capability	a.Consider and allow the average revenue of parent group companies as there are a common owner ship of bidder and other group companies by Parent Company and the average annual turnover of last 3 years is also met and proves the financial capability of the parent group very well. We can also provide CA certificate for the same.	All terms and Conditions shall be as per the tender document
114	1.7 / (Page no 8)	Commercial Capability	a.Consider and allow the average revenue of parent group companies as there are a common owner ship of bidder and other group companies by Parent Company and the average annual turnover of last 3 years is also met and proves the financial capability of the parent group very well. We can also provide CA certificate for the same.	All terms and Conditions shall be as per the tender document
115	Bid Guarantee Fee/EMD	Bid Guarantee Fee/EMD	Any Relaxations for MSME's/Start Up's?	All the bidders will have the submit Tender Fee/EMD as per the tender documents
116	Commercial Capability	Bidder shall have an average annual turnover not less than Rs. 5 cr for last three financial years	Any Relaxations for MSME's/Start Up's?	All terms and conditions and qualification requirements shall be as per the tender document
117	Annexure - II Technical Specifications	BILL OF MATERIAL OF CHARHER	Any reputed make apart from mentioned make is eligibile for electrical switchgear?	Pl submit the make /Model (Origin of Material)-

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118	Annexure - II Technical Specifications	30kW/40 KWCHARGING MODULE	Kindly state the qualification criteria for Make In India power module. Is global CE certificate accepted?	OK.Accepted
119	Annexure - II Technical Specifications	Charging Gun CableCCS2-1000V,200A/250A/275A	ARAI certified charging gun cable from other make is acceptable?	Yes, accepted. Please submit the test certificate and make & model with BID
120	Annexure - II Technical Specifications	E/F RELAY 230V AC10mA-30A	Is product from similar make acceptable?	Yes, accepted.Please submit the test certificate and make & model with BID
121	Annexure - II Technical Specifications	Phase Failure Relay	Is product from similar make acceptable?	Yes, accepted. Please submit the test certificate and make & model with BID
122	Annexure-V-Technical Specification - 7.4 KW AC Public Charger	Temperature Sensor	If not available what deviation is acceptable?	It is mandatory.
123	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Display	Is Android LCD acceptable if ads to be displayed?	Bidders to adhere to the Technical Specifications
124	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Standout features Requirement	Please mention the server for hosting Remote Monitoring System data or OEM cloud server is acceptable?	In accordance with the Technical Specifications. Yes,OEM cloud server is acceptable
125	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	User Interface & Control Display	Please explain in detail for the functionality of Auxilary Voltage Mode selection from HMI?	Bidders to adhere to the Technical Specifications
126	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Emergency Switch For System shutdown in emergency	Please explain in detail for the functionality of Emergency Switch For System shutdown in emergency from HMI? A separate STOP button is to be dispalyed in HMI pages? Please elaborate on which page it should be displayed?	Bidders to adhere to the Technical Specifications
127	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Power output modes: Intelligent, Priority, and SingleMode.	Please elaborate on Power outpute modes mentioned in Standout features? Is the selection to be done via HMI? What is the criteria of functionality for mentioned modes?	Annexure-6
128	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Additional Key Features-Ring Net Support: Allows on-site integration betweentwo chargers to boost the total output power.	Please elaborate as mentioned in Additional feature?	Annexure-11
129	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Additional Key Features- The brain behind the charger, flexibly managing everyfunction with precision	Please elaborate as mentioned in Additional feature?	Annexure-20
130	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Dynamically balances power, runs real-time diagnostics, and adapts any scenario	Please elaborate as mentioned in Additional feature?	Annexure-21
131	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Smart Power sharing linking standalone chargers into one synchronized system	Please elaborate as mentioned in Additional feature?	Annexure_12
132	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Enables flexible multi- vehicle charging dynamically adjusting for high traffic locations	Please elaborate as mentioned in Additional feature?	Annexure_13

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133	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Reduced operational costs, requirement of external equipment for managing power facto	Please elaborate as mentioned in Additional feature?	Annexure-22
134	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Allows different billing rates or power limits based on time of day or by customer group	Please elaborate as mentioned in Additional feature?	Annexure_23
135	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Supports to enable multiple business models for CPOs for revenue maximization	Please elaborate as mentioned in Additional feature?	Annexure_14
136	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Provides the ability for CPOs to define multiple active charging profiles supporting dynamic prioritization of rules	Please elaborate as mentioned in Additional feature?	Annexure_15
137	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Captivate every user with dynamic screensaver	Please elaborate as mentioned in Additional feature as there is no mention of internet connectivity for HMI? Also please state the internet connectivity modes of the HMI in this case.	Annexure_24
138	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Simplify charging with advanced connector holsters featuring integrated placement sensing	Please elaborate as mentioned in Additional feature?	Annexure_19
139	Annexure-IX-CCS Type2- 60 KW(Upgradable 60 KW to 120 KW)	Gun complete control with the remote monitoring system's real-time charger visibility	Please elaborate as mentioned in Additional feature?	Annexure_1
140	Annexure-VI- Technical Specification - AC Type2 11KW/22KW Public	Output Current - 32A scalable to 16A,20A, 25A, 32A	Only possible in case of 22 kW charger.	OK
141	Annexure-VII- CCS 2 -30kW	Load Sharing Facility(Dynamic Load Sharing)	Please elaborate as the output power is restricted to 60A as mentioned before?	For the 30 kW charger with a single gun, load sharing is not required
142	Annexure-VII- CCS 2 -30kW	Display- Color LCD touch screen – 7" and greater (screen with darkmode for better visibility during day time) andcompatibility to run Ads or commercials may be checked	Is android LCD acceptable if ads to be displayed?	Bidders to adhere to the Technical Specifications
143	Annexure VIII- General Conditions of Contract	3- Packing Details	Damaged goods will be replaced on provision of post unloading images. If damage is found on improper unloading then please state the criteria/conditions for rectification?	Bidders to adhere to the Technical Specifications
144	Annexure VIII- General Conditions of Contract	4-Transportation and Unloading at Site	The rejected material will be accepted on provision of proper images/videos of unloading before removal of packing material	Bidders to adhere to the Technical Specifications
145	Annexure VIII- General Conditions of Contract	6- Payment Terms	Please state the provision of payment for registered MSMEs as per The MSME Act,2006	All terms and conditions shall be as per the tender document
146	SPECIAL CONDITIONS OF CONTRACT	6 TERMS OF PAYMENT	Please explain which payment terms are applicable?	Payment terms as per the Special Terms and Conditions shall be applicable

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
147	Warranty / Defect Liability Period	AC Chargers (3.3 kW, 7.4 kW, 10 kW, 11 kW & 22 kW): 5-year warranty CCS Chargers (30 kW, 60 kW, up to 120 kW): 7-year warranty CCS Chargers (180 kW & 240 kW): 12-year warranty	We request to consider 2 years standard warranty followed up by AMC for all the chargers	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
148	Contract Performance Bank Guarantee (CPBG)	Vendor to submit CPBG cum PBG equal to 5% of total OLA value. Valid till expiry of warranty/defect liability period + 6 months claim period.	We request to remove this clause or We request for 2 separate BGs. 1- Supply- to be valid till warranty period 2- Separate for AMCs- as AMC period will be 5/7/12 years	Deviation not acepted. All terms and conditions shall be as per the tender document
149	Terms of Payment	AC Chargers: 60% on supply, 40% in equal installments over 5 years CCS Chargers (up to 120 kW): 65% on supply, 35% over 7 years CCS Chargers (180 & 240 kW): 64% on supply, 36% over 12 yearsCredit period: 60 days (non-MSME), 45 days (MSME) after invoice acceptance.	90% on supply within 45 days and 10% on comissionng within 45 days. if commisiong is delayed by 30 days, payment should be immediately released.	Deviation not acepted. All terms and conditions shall be as per the tender document
150	1.7 Qualification Criteria	The bidder should have installed following no. of chargers, in last 3 years in India	Can previous supply of 7.4 KW Chargers experience be considered for 3.3 KW as the device is same and output be configured.	OK. Supply experience of higher capacity chargers of a particular type can be submitted for qualification in a lower capacity charger
151	1.7 Qualification Criteria	The bidder should have installed following no. of chargers, in last 3 years in India	Can there be exception for particular Model (120 KW & 180 KW) as our previous supply was majority for 60 & 240 KW	OK. Supply experience of higher capacity chargers of a particular type can be submitted for qualification in a lower capacity charger
152			1. Needs more clarification of technical side as most of specification are similar of both non OCPP & OCPP.	Bidders to adhere to the Technical Specifications
153		2.On Operation cycle Operating Life of charger - Min 60,000 hours/ 10 years	Need Clarification	Bidders to adhere to the Technical Specifications
154		2.On Operation cycle Life Cycles for Connector - Minimum 20K operations	Need Clarification	10K Minimum maximum upto 20K
155		3.On over load protection Short Circuit, OL , OL >18A	Yes, But need confirmation to set the limit to either 15A or 18A	OL Setting -18A,same to Review as per site requirement.
156			6.Clarity of Factory license and ARAI.	Testing facility and ARAI is Mandatory requirement.
157	Clause 3 & Sub Clause 3.3 (Page No 11)	Bid Prices	Unit Price of EV Chargers shall be inclusive of Freight Charges, Packing Charges, Installation & Commissioing charges. Please confirm	Unit Price of EV Chargers shall be inclusive of Freight Charges, Packing Charges.
158			Whether we can quote extra years of warranty inclusive with the charger's price. Please confirm.	Bidders to adhere to the Technical Specifications

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
	Special Conditions of Contract - Clause 4 (Page No 150)	Warranty / Defect Liability Period		
159		AC chargers (3.3 kW, 7.4 kW, 10 kW, 11 kW & 22 kW) - Complete 5-year warranty	Warranty terms shall be 2 years from the date of Supply or date of installation, whichever is earlier and Balance Years AMC after Warranty period. Please confirm	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
160		CCS chargers 30 kW, 60 kW, up to 120 kW - Complete 7-year warranty	Warranty terms shall be 2 years from the date of Supply or date of installation, whichever is earlier and Balance Years AMC after Warranty period. Please confirm	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
161		CCS chargers 180 kW & 240 kW - Complete 12-year warranty	Warranty terms shall be 2 years from the date of Supply or date of installation, whichever is earlier and Balance Years AMC after Warranty period. Please confirm	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
	Special Conditions of Contract - Clause 6(Page No 150)	**Terms of Payment**		
162		1) AC chargers (3.3 kW, 7.4 kW, 10 kW, 11 kW & 22 kW) a. 60% of supply portion on supply of charger at stores/site. b. Remaining 40% in equal installments during the warranty period of 5 years.	Payment terms as 90% at the time of supply of material at Stores/Sites and balance 10% as a Bank Gurantee valid till the warranty period. Please Confirm	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
163		2) CCS chargers 30 kW, 60 kW, up to 120 kW a. 65% of supply portion on supply of charger at stores/site b. Remaining 35% in equal installments during the warranty period of 7 years.	Payment terms as 90% at the time of supply of material at Stores/Sites and balance 10% as a Bank Gurantee valid till the warranty period. Please Confirm	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
164		3) CCS chargers 180 kW & 240 kW a. 64% of supply portion on supply of charger at stores/site b. Remaining 36% in equal installments during the warranty period of 12 years.	Payment terms as 90% at the time of supply of material at Stores/Sites and balance 10% as a Bank Gurantee valid till the warranty period. Please Confirm	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
	Special Conditions of Contract - Clause 8(Page No 150)	**Delivery Schedule:**		
165		AC chargers (3.3 kW, 7.4 kW, 10 kW, 11 kW & 22 kW) – within 2 weeks from the date of P.O.	Material readiness shall be 7 - 8 weeks from Manufacturing clearance/ CAT-1 Drawings and clear Purchase Order	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
166		CCS chargers 30 kW, 60 kW, up to 120 kW – within 3 weeks from the date of P.O.	Material readiness shall be 7 - 8 weeks from Manufacturing clearance/ CAT-1 Drawings and clear Purchase Order	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
167		CCS chargers 180 kW & 240 kW – within 4 Weeks from the date of P.O.	Material readiness shall be 7 - 8 weeks from Manufacturing clearance/ CAT-1 Drawings and clear Purchase Order	Deviation not accepted. Bidders to abide by all terms and conditions as per the tender document
	3.3KW Charger			
	Power Input			
168	Rated Voltage	230VAC	Yes	OK
169	Nominal Input Voltage Range	1Ø, 230V AC (+15% and -15%) as per IS 12360	Yes	OK
170	Rated Frequency	50Hz	Yes	OK
171	Frequency Range	50Hz ± 3% (IS 12360)	Yes	OK
172	Rated Current	16 A max (Output current limit configurable 6A to 16A, through OCPP remotely)	Yes	OK
173	Rated Power	3.3 KW	Yes	OK
174	Input Supply	1-Phase, 3 Wire AC (1Ph+Neutral+Earth)	Yes	OK
175	Power factor	>0.95	Yes	OK
176	Input Supply Failure Backup	NA	NA	OK
	Power Output			
177	Number of outputs	1	Yes	OK
178	Output Socket	3 Pin Domestic Socket (Line, Neutral, Earth), IS 1293:2019/IEC 60884-1:2013	Yes	OK
179	Output Current	One vehicle charging at 16A output current	Yes	OK
180	Output Power	3.3 KW	Yes	OK
181	Efficiency	>99%	Yes	OK
182	Limiting Output Current	Circuit breaker for outlet limited to 15A, reset to resume operation	Yes	OK
	Environmental Paramerts			
183	Ambient temperature Range	(-10)°C to 60°C	(-10)°C to 60°C	OK
184	Ambient Humidity	5% to 95%	Yes	OK
185	Ambient Pressure	70kpa to 106 kpa	Yes	OK
186	Storage Temperature	0 to 60°C	Yes	OK
187	Noise Level	Mandatory <65 dB in all directions @1m distance	NA	Bidders to adhere to the Technical Specifications
188	Altitude	2000 meters or above	Yes	OK
	User Interface & Control Display			
189	RFID reader specs	ISO 14443 A/B. (complies with part 1 to 4)	NA	Bidders to adhere to the Technical Specifications
190	User Authentication	Through RFID Smart Card or Smart Key	NA	Bidders to adhere to the Technical Specifications
191	Emergency stop switch	Mushroom type push button with locking in red colour	Yes	OK
192	Visual LED Indicators	Error, input supply, charge process indications	Yes	OK
193	Display	Optional	NA	OK
194	Support language	English	Yes	OK
195	Operating Life of charger	Min 60,000 hours/10 years	TBD	Bidders to adhere to the Technical Specifications
196	Life Cycles for Connector	Minimum 20,000 operations	3,600	**10K Minimum maximum upto 20K**
197	Data Storage	Mandatory (min 1 month capacity)	Yes	OK
198	Display Messages	Optional	Available	OK
	Mechanical Parameters			
199	Mechanical Stability/Weight	20J (5 kg at 0.4 m)	Yes	OK
200	Mounting	Wall mount / Pole mount	Yes	OK

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
201	Cooling	Air/forced air cooling or liquid cooling (IEC 61851-1 Annex D)	Air	Bidders to adhere to the Technical Specifications
	Communication Parameters			
202	Communication/interface with EVSE central SRV	NA		Query Not Clear
	Certification			
203	ARAI Certification	Mandatory	Yes	OK
204	IP Certification	IP 65 or greater (IEC/IS 60529)	IP 56	Bidders to adhere to the Technical Specifications
205	Meter Class		Class 1 (On Board)	Bidders to adhere to the Technical Specifications
206	EMI/EMC for EVSE	Compliance as per IEC 61851-21-2 if no ARAI	AIS 138	In accordance with the Technical Specifications and Mandatory ARAI certificate
207	Standard	IEC61851, IEC62196, IEC62763, ISO15118/DIN70121, IS 17017	Yes	Bidders to adhere to the Technical Specifications
	Protection & Safety			
208	Electrical Safety General	OV, UV, OC, Miss Ground, Short, Ins fault, E-Stop, Shock, earth fault, phase reversal	OV, UV, OC, Miss Ground, Short, Ins fault, E-Stop, Shock	Bidders to adhere to the Technical Specifications
209	Earthing	IS 732/IEC 60364-5-54	Yes	Bidders to adhere to the Technical Specifications
210	Charger Enclosure	Fire-retardant, self-extinguishing, halogen-free material	Metal enclosure	Bidders to adhere to the Technical Specifications
211	Power Supply Cable	IEC 62893-1	Yes	Bidders to adhere to the Technical Specifications
212	Residual Current Device	≤30 mA/Type A with IS732-2018	Yes	OK
213	Short Circuit, OL	>18A	Yes	OK
214	Over Voltage	>270V, auto recovery	Yes	OK
215	Under Voltage	<185V, auto recovery	Yes	OK
216	Surge Protection	AIS 138/IS 17017, IEC 61643-11	Yes	OK
217	Earth Leakage	>30mA	Yes	OK
218	Temperature Sensor	Power Line shutdown above 60°C	Yes-Configurable	OK
219	Insulation Type	Basic/Reinforced/Double (Bidder to specify)	Basic	Bidders to adhere to the Technical Specifications
220	Insulation Resistance	IEC 61851-1 / >7 MΩ	Yes	OK
221	Harmonics Protection level	Harmonics (IEC 61000) limited to 5%(THD)	NA	Bidders to adhere to the Technical Specifications
222	Earth Absence	AIS 138/IS 17017	Yes	OK
223	Protection against electric shock	AIS 138/IS 17017	Yes	OK
224	Protect against direct contact (live parts)	AIS 138/IS 17017	Yes	OK
225	Warranty	Complete 5-year warranty	1 year + CMC	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
	7.4 KW Home Charger			
	Power Input			
226	Rated Voltage	230VAC	Yes	OK
227	Nominal Input Voltage Range	1Ø, 230V AC (+15% and -15%) as per IS 12360	Yes	OK
228	Rated Frequency	50Hz	Yes	OK
229	Frequency Range	50Hz ± 3% (IS 12360)	Yes	OK
230	Rated Current	32 A max; Output current limit configurable from 6A to 32A (via OCPP remotely)	Yes	OK

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
231	Rated Power	7.4 KW	Yes	OK
232	Input Supply	1-Phase, 3 Wire AC system (1Ph+Neutral+Earth)	Yes	OK
	Power Output			
233	Power Factor	>0.95	Yes	OK
234	Input Supply Failure Backup	NA	NA	Bidders to adhere to the Technical Specifications
235	Number of Outputs	1	Yes	Bidders to adhere to the Technical Specifications
236	Output Gun Type	IEC 62196 Type 2 AC	Yes	Bidders to adhere to the Technical Specifications
237	Output Current	One vehicle charging at 32A max output current	Yes	Bidders to adhere to the Technical Specifications
238	Output Power	7.4 KW	Yes	Bidders to adhere to the Technical Specifications
239	Efficiency	>99%	Yes	Bidders to adhere to the Technical Specifications
240	Limiting Output Current	Circuit for outlet limited to 32A; should be reset to resume operations	Yes	Bidders to adhere to the Technical Specifications
	Environmental Paramerts			
241	Ambient Temperature Range	(-10)°C to 60°C	Yes	OK
242	Ambient Humidity	5% to 95%	Yes	OK
243	Ambient Pressure	70kpa to 106 kpa	Yes	OK
244	Storage Temperature	0 to 60°C	Yes	OK
245	Noise Level	Mandatory <65 dB in all directions @1m	Yes	OK
246	Altitude	2000 meters or above	Yes	OK
	User Interface & Control Display			
247	RFID Reader Specs	ISO 14443 A/B, parts 1-4 compliant	Yes	OK
248	User Authentication	Through RFID Smart Card or smart Key	Mobile APP, RFID (Optional)	Bidders to adhere to the Technical Specifications
249	Emergency Stop Switch	Mushroom type push button, locking, red colour	Yes	OK
250	Visual LED Indicators	Error, input supply, charge process indications	Yes	OK
251	Display	Optional	Yes, available in the Pro variant	Bidders to adhere to the Technical Specifications
252	Support Language	English	Yes	Bidders to adhere to the Technical Specifications
253	Operating Life	Min 60,000 hours/10 years	TBD	Bidders to adhere to the Technical Specifications
254	Life Cycle for Connector	Minimum 20,000 operations	10,000	Bidders to adhere to the Technical Specifications
255	Data Storage	Mandatory (min 1 month)	TBD	Bidders to adhere to the Technical Specifications
256	Display Messages	NA	TBD	Bidders to adhere to the Technical Specifications
	Mechanical Parameters			
257	Mechanical Weight/Stability	8.5 KG; IK08 as per IEC62262	TBD	Bidders to adhere to the Technical Specifications
258	Cable Length	5 meters	Yes	Bidders to adhere to the Technical Specifications
259	Mounting	Wall mount / Pole mount	Yes	Bidders to adhere to the Technical Specifications

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
260	Cooling	Air cooled	Yes (natural- no exrternal fans)	Bidders to adhere to the Technical Specifications
261	Communication with Server	NA	NA	Bidders to adhere to the Technical Specifications
	Certification			
262	ARAI Certification	Mandatory	Yes	Bidders to adhere to the Technical Specifications
263	IP Certification	IP65 or greater (IEC/IS 60529)	IP 56	Bidders to adhere to the Technical Specifications
264	Meter Class	NA	Class A	Bidders to adhere to the Technical Specifications
265	EMI/EMC	IEC 61851-21-2 if no ARAI	Yes	Bidders to adhere to the Technical Specifications
266	Standard	IEC61851, IEC62196, IEC62763, ISO15118, DIN70121, IS 17017	Yes	Bidders to adhere to the Technical Specifications
	Protection & Safety			
267	Electrical Safety (general)	OV, UV, OC, missing ground, short, insulation, E-Stop, over-temp, shock, etc.	Yes	Bidders to adhere to the Technical Specifications
268	Earthing	IS 732/IEC 60364-5-54	Yes	Bidders to adhere to the Technical Specifications
269	Enclosure	Fire-retardant, self-extinguishing, halogen-free	ABS enclosure	Bidders to adhere to the Technical Specifications
270	Power Cable	IEC 62893-1	Yes	Bidders to adhere to the Technical Specifications
271	RCD	≤30mA/Type A as per IS732-2018	Yes	Bidders to adhere to the Technical Specifications
272	Short Circuit, OL	>32A	Yes	Bidders to adhere to the Technical Specifications
273	Over Voltage	>270V, auto-recovery	Yes	Bidders to adhere to the Technical Specifications
274	Under Voltage	<185V, auto-recovery	Yes	Bidders to adhere to the Technical Specifications
275	Surge Protection	AIS 138/IS 17017, IEC 61643-11	Yes	Bidders to adhere to the Technical Specifications
276	Earth Leakage	>30mA	Yes	Bidders to adhere to the Technical Specifications
277	Temperature Sensor	Shutdown above 60°C	Yes	Bidders to adhere to the Technical Specifications
278	Insulation Type	Basic/Reinforced/Double (bidder to specify)		Bidders to adhere to the Technical Specifications
279	Insulation Resistance	As per IEC 61851-1, >7 Mega Ohm	Yes	Bidders to adhere to the Technical Specifications
280	Harmonics	≤5% THD per IEC 61000	Yes	Bidders to adhere to the Technical Specifications
281	Earth Absence / Shock / Contact	AIS 138/IS 17017 (for shock, direct contact, etc.)	Yes	Bidders to adhere to the Technical Specifications
282	Warranty	Complete 5-year warranty	1 year + CMC	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
	7.4 KW Public Charger			
	Power Input			
283	Rated Voltage	230VAC	Yes	Bidders to adhere to the Technical Specifications

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
284	Nominal Input Voltage Range	1Ø, 230V AC (+15% and -15%) as per IS 12360	Yes	Bidders to adhere to the Technical Specifications
285	Rated Frequency	50Hz	Yes	Bidders to adhere to the Technical Specifications
286	Frequency Range	50Hz ± 3% (IS 12360)	Yes	Bidders to adhere to the Technical Specifications
287	Rated Current	32A max; Output current limit configurable 6A–32A via OCPP	Yes	Bidders to adhere to the Technical Specifications
288	Rated Power	7.4 KW	Yes	Bidders to adhere to the Technical Specifications
289	Input Supply	1-Phase, 3 Wire (1Ph+Neutral+Earth)	Yes	Bidders to adhere to the Technical Specifications
	Power Output			
290	Power factor	>0.95	Yes	Bidders to adhere to the Technical Specifications
291	Input Supply Failure Backup	Battery backup 10–15 mins (control/billing); IS 16270/9000	No Battery backup, billing data will be synced	Bidders to adhere to the Technical Specifications
292	Number of outputs	1	Yes	Bidders to adhere to the Technical Specifications
293	Output Gun Type	IEC 62196 Type 2 AC	Yes	Bidders to adhere to the Technical Specifications
294	Output Current	One vehicle charging at 32A max	Yes	Bidders to adhere to the Technical Specifications
295	Output Power	7.4 KW	Yes	Bidders to adhere to the Technical Specifications
296	Efficiency	>99%	Yes	Bidders to adhere to the Technical Specifications
297	Limiting Output Current	Circuit for outlet limited to 32A, reset to resume operation	Yes	Bidders to adhere to the Technical Specifications
	Environmental Paramerts			
298	Ambient Temperature Range	(-10)°C to 60°C	Yes	Bidders to adhere to the Technical Specifications
299	Ambient Humidity	5% to 95%	Yes	Bidders to adhere to the Technical Specifications
300	Ambient Pressure	70kpa to 106 kpa	Yes	Bidders to adhere to the Technical Specifications
301	Storage Temperature	0 to 60°C	Yes	Bidders to adhere to the Technical Specifications
302	Noise Level	<65 dB in all directions @1m	Yes	Bidders to adhere to the Technical Specifications
303	Altitude	2000 meters or above	Yes	Bidders to adhere to the Technical Specifications
	User Interface & Control Display			
304	RFID Reader specs	ISO 14443 A/B. Complying to part 1 to part 4	Yes	Bidders to adhere to the Technical Specifications
305	User Authentication	Mobile app, QR code, OTP	Yes	Bidders to adhere to the Technical Specifications
306	Emergency stop switch	Mushroom type push button, locking, red colour	Yes	Bidders to adhere to the Technical Specifications
307	Visual LED Indicators	Error, input supply, charge process	Yes	Bidders to adhere to the Technical Specifications
308	Display	1.8-inch TFT color LCD (min)	4.3 inch TFT display	Bidders to adhere to the Technical Specifications

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
309	Support language	English	Yes	Bidders to adhere to the Technical Specifications
310	Operating Life of charger	Min 60,000 hours/10 years	TBD	Bidders to adhere to the Technical Specifications
311	Life Cycles for Connector	Minimum 20K operations	10,000	OK
312	Data Storage	Mandatory (min 1 month)	Yes	Bidders to adhere to the Technical Specifications
313	Display Messages	Display plug-in/out/idle; metering info; failure sent to CMS	Yes	Bidders to adhere to the Technical Specifications
	Mechanical Parameters			
312	Mechanical Stability/Weight	8.5 KG; IK08 per IEC62262	Yes	Bidders to adhere to the Technical Specifications
313	Length of charging cable	5 meter	Yes	Bidders to adhere to the Technical Specifications
314	Mounting	Wall mount / Pole mount	Yes	Bidders to adhere to the Technical Specifications
315	Cooling	Air cooled	Yes	Bidders to adhere to the Technical Specifications
316	Communication w/Server/Metering	OCPP v1.6, upgradable; 2G/4G/5G, Class 1 Responsive Metering	Yes	Bidders to adhere to the Technical Specifications
	Certification			
317	Certification	ARAI Certification Mandatory	Yes	Bidders to adhere to the Technical Specifications
318	IP Certification	IP65 or greater as per IEC/IS 60529	IP 56	Bidders to adhere to the Technical Specifications
319	Meter Class	Certified Class 0.5	Yes	Bidders to adhere to the Technical Specifications
320	EMI/EMC for EVSE	IEC 61851-21-2 if no ARAI cert	Yes	Bidders to adhere to the Technical Specifications
321	Standard	IEC61851, IEC62196, IEC62763, ISO15118/DIN70121, IS 17017	Yes	Bidders to adhere to the Technical Specifications
	Protection & Safety			
322	Electrical Safety General	OV, UV, OC, missing ground, insulation fault, E-Stop, etc.	Yes	Bidders to adhere to the Technical Specifications
323	Earthing	IS 732/IEC 60364-5-54	Yes	Bidders to adhere to the Technical Specifications
324	Enclosure	Fire-retardant, self-extinguishing, halogen-free	ABS enclosure	Bidders to adhere to the Technical Specifications
325	Power Supply Cable	IEC 62893-1	Yes	Bidders to adhere to the Technical Specifications
326	RCD	≤30 mA/Type A w/ IS732-2018	Yes	Bidders to adhere to the Technical Specifications
327	Short Circuit, OL	>32A	Yes	Bidders to adhere to the Technical Specifications
328	Over Voltage	>270V, auto-recovery	Yes	Bidders to adhere to the Technical Specifications
329	Under Voltage	<185V, auto-recovery	Yes	Bidders to adhere to the Technical Specifications
330	Surge Protection	AIS 138/IS 17017, IEC 61643-11	Yes	Bidders to adhere to the Technical Specifications
331	Earth Leakage	>30mA	Yes	Bidders to adhere to the Technical Specifications
332	Temperature Sensor	Shutdown above 60°C	Yes	Bidders to adhere to the Technical Specifications

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
333	Insulation Type	Basic/Reinforced/Double - specify	Basic	Bidders to adhere to the Technical Specifications
334	Insulation Resistance	As per IEC 61851-1/>7 Mega Ohm	Yes	Bidders to adhere to the Technical Specifications
335	Harmonics Protection level	≤5%(THD) per IEC 61000	Yes	Bidders to adhere to the Technical Specifications
336	Earth Absence/Direct Contact/Shock	AIS 138/IS 17017	Yes	Bidders to adhere to the Technical Specifications
337	Warranty	Complete 5-year warranty	1 year + CMC	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document
	CCS 2 60 KW			
338	Input Supply	415VAC, 3PNPE, 50Hz	Yes	Bidders to adhere to the Technical Specifications
339	Voltage Range	415V AC nominal; Overvoltage: 475V (+20V), Undervoltage: 295V (-20V), auto recovery	Yes	Bidders to adhere to the Technical Specifications
340	Rated Frequency	50Hz	Yes	Bidders to adhere to the Technical Specifications
341	Frequency Range	50Hz ± 3%	Yes	Bidders to adhere to the Technical Specifications
342	Rated Current	125A	Yes	Bidders to adhere to the Technical Specifications
343	Input Power	93A, 75kVA	Yes	Bidders to adhere to the Technical Specifications
344	Power Factor	>0.95	Yes	Bidders to adhere to the Technical Specifications
345	Metering	Non-revenue grade meter; min. 1% accuracy for Input AC & Output DC	Yes	Bidders to adhere to the Technical Specifications
346	Earthing System	TN-S, TN-C, TN-C-S, IT	TN-S	Bidders to adhere to the Technical Specifications
347	Standards	IEC61851, IEC62196, IEC62763, ISO15118, DIN70121, IS17017	Yes	Bidders to adhere to the Technical Specifications
348	Number of Outputs	Single/double vehicle IEC-62196 Type 2 combo connector	Double	Bidders to adhere to the Technical Specifications
349	Output Power	60kW	Yes	Bidders to adhere to the Technical Specifications
350	Output Voltage	200–1000V DC	Yes	Bidders to adhere to the Technical Specifications
351	Output Current	200A	Yes	Bidders to adhere to the Technical Specifications
352	Efficiency	≥95%	Yes	Bidders to adhere to the Technical Specifications
353	DC Power Rating	60kW	Yes	Bidders to adhere to the Technical Specifications
354	Output Plug	CCS2	Yes	Bidders to adhere to the Technical Specifications
355	Cable Length	≥6 meters	Yes	Bidders to adhere to the Technical Specifications
356	Installation Type	Indoor/Outdoor; Floor/stool mounted	Indoor/Outdoor	Bidders to adhere to the Technical Specifications
357	AC & DC Energy Meter Provision	AC Energy meter (Input); DC Energy meter for each gun	Combined meter for both the guns (AC side is an add-on)	Bidders to adhere to the Technical Specifications

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
358	Meter Calibration Certificate	To be submitted	Yes	Bidders to adhere to the Technical Specifications
359	Number of Plug/Gun	2 Guns (IS-17017; must be ARAI-tested for Indian atmosphere)	Yes	Bidders to adhere to the Technical Specifications
360	Certification	ARAI Certification Mandatory	Yes	Bidders to adhere to the Technical Specifications
361	Plug-in Charging Facility	Mandatory	Yes	Bidders to adhere to the Technical Specifications
362	Dynamic Load Sharing	Mandatory	Yes	Bidders to adhere to the Technical Specifications
363	Power Consumption (ideal)	Module enters sleep mode when not charging	Yes	Bidders to adhere to the Technical Specifications
364	Auxiliary Supply	24V DC or 12V DC	12V DC	Bidders to adhere to the Technical Specifications
365	IP Protection Degree	IP55 or greater	IP 54	Bidders to adhere to the Technical Specifications
366	Cooling Type	Forced air or liquid (bidder to specify; IEC 61851-1 Annex D compliance)	Forced air cooling	Bidders to adhere to the Technical Specifications
367	Storage Temperature	0–60°C	Yes	Bidders to adhere to the Technical Specifications
368	Ambient Pressure	70–106 kPa	Yes	Bidders to adhere to the Technical Specifications
369	Altitude	Up to 3500m above sea level	Yes	Bidders to adhere to the Technical Specifications
370	Emergency Stop Button	Mandatory	Yes	Bidders to adhere to the Technical Specifications
371	Data Storage	Minimum 1 month; remote diagnostics, OTA firmware updates, TLS encryption (OCPP 1.6J/2.0.1)	Yes	Bidders to adhere to the Technical Specifications
372	User Recognition	RFID card, Mobile app, QR code (No OTP default authentication)	Yes	Bidders to adhere to the Technical Specifications
373	Operating Life	≥60,000 hours / 10 years	TBD	Bidders to adhere to the Technical Specifications
374	Connector Mating Cycles	≥20,000 cycles	TBD	Bidders to adhere to the Technical Specifications
375	Display	≥10-inch LCD touchscreen; Dark mode for day compatibility	7 inch touch TFT display	Bidders to adhere to the Technical Specifications
376	Visual Indicators	Input supply, charge process, error indications	Yes	Bidders to adhere to the Technical Specifications
377	Mechanical Ingress Protection	IP55 or above (Optional IP65)	IP 54	Bidders to adhere to the Technical Specifications
378	Mounting Arrangement	Floor mounted, stool mounting	Floor mounted	Bidders to adhere to the Technical Specifications
379	Permissible Surface Temperatures	IEC 61851-1	Yes	Bidders to adhere to the Technical Specifications
380	Protection Against Electric Shock	IS17017-1	Yes	Bidders to adhere to the Technical Specifications
381	Residual Current Device	≤30mA, Type A, IS732-2018	Yes	Bidders to adhere to the Technical Specifications
382	Power Supply Cable	IEC 62893-1	NA	Bidders to adhere to the Technical Specifications
383	Charger Gun	Replaceable contacts; screen replacement capability	Yes	Bidders to adhere to the Technical Specifications

Sr. No.	Detailed Reference to concerned Document . Please specify Document No / Clause No / Page No	Description as per Bid Document	Query / Clarification / Deviation	Tata Power Response
384	Surge Protection	25kA SPD Class B, IEC61643-11:2011 Type 12	Yes	Bidders to adhere to the Technical Specifications
385	Harmonics Protection	≤5% THD (IEC 61000)	Yes	Bidders to adhere to the Technical Specifications
386	Over Temperature Protection	Derating starts at 55°C, shutdown at 70°C, Gun cutoff at 90°C	Yes	Bidders to adhere to the Technical Specifications
387	Over/Under Voltage Protection	Overvoltage: 475V (+20V), Undervoltage: 295V (-20V), auto recovery	Yes	Bidders to adhere to the Technical Specifications
388	Ground Fault Protection	IS17017-1	Yes	Bidders to adhere to the Technical Specifications
389	Reverse Polarity Protection	Mandatory (bidder to provide specs)	Yes	Bidders to adhere to the Technical Specifications
390	Alarm & Diagnostic Function	Standard as per TPC, OCPP 1.6J Status Notification	Yes	Bidders to adhere to the Technical Specifications
391	Automatic Software Update	Required	Yes	Bidders to adhere to the Technical Specifications
392	Remote Monitoring System (RMS)	Comprehensive RMS; data logging, fault mgmt, diagnostics	Yes	Bidders to adhere to the Technical Specifications
393	Multi-language Support	Yes	Yes	Bidders to adhere to the Technical Specifications
394	Payment System	Billing and payment transaction compatibility	Yes	Bidders to adhere to the Technical Specifications
395	Warranty	Complete 7-year warranty	1 year + CMC	Deviation not acepted. Bidders to abide by all terms and conditions as per the tender document

Annexure_1 Gun remote monitoring system

Key features of the system

- **Remote monitoring and control:** Operators can manage every aspect of a charging station from a central system, including starting, stopping, and resetting sessions from a distance.

- **Real-time visibility of chargers and "guns":** The system provides live updates on the status of each charging gun, showing whether it is in use, available, or malfunctioning. This real-time data helps reduce operational downtime and enhances the user experience.

- **Optimal efficiency and management:** Remote oversight allows for intelligent load management, which optimizes power distribution across multiple charging stations to prevent overloading and maximize efficiency.

- **Instant diagnostics:** The system can run remote diagnostics and perform pre-emptive maintenance checks. Operators are alerted to issues like "gun tripping" (a charging interruption) before users even report a problem.

- **Advanced data analytics:** Operators can track energy usage and gather insights into charging behavior, which can be used to optimize pricing strategies and business operations.

- **OCPP compliance:** Many modern systems use the Open Charge Point Protocol (OCPP) to enable seamless remote monitoring and network management.

Benefits for charge point operators

- **Increased uptime:** By remotely monitoring and diagnosing issues, operators can significantly reduce the time a charger is out of service, leading to greater reliability.

- **Improved user experience:** Real-time visibility allows operators to guide drivers to available chargers and resolve charging issues quickly.

- **Operational efficiency:** The ability to manage multiple chargers from a single system reduces the need for on-site staff and streamlines logistics.

- **Enhanced security:** Continuous monitoring of charging stations contributes to overall site security by detecting unauthorized access or other suspicious activity.

Annexure_2_Earthing system

TN-S, TN-C, TN-C-S, and IT are international standards for electrical earthing systems, distinguishing themselves by how the neutral (N) and protective earth (PE) conductors are arranged. In the **TN-S** system, N and PE conductors remain separate throughout the system. The **TN-C** system combines them into a single PEN (protective earth neutral) conductor from the source to the consumer. **TN-C-S** is a hybrid where the PEN conductor is used from the source, but the N and PE conductors are separated within the building's wiring. The **IT** system isolates the power source from the earth, either completely or through a high-impedance connection.

TN-S (Terra-Neutral-Separate)

- **Conductor Arrangement:** A separate protective earth (PE) conductor runs alongside the neutral (N) conductor from the transformer to the final device.
- **Characteristics:** Offers lower risk of electrical interference and provides a high degree of safety.
- **Cost:** Generally more expensive due to the extra conductor.

TN-C (Terra-Neutral-Combined)

- **Conductor Arrangement:** The neutral (N) and protective earth (PE) conductors are combined into a single PEN conductor from the source all the way to the consuming device.
- **Characteristics:** Cost-effective and simple to install but poses higher safety risks due to the combined conductor.

TN-C-S (Terra-Neutral-Combined-Separate)

- **Conductor Arrangement:** The neutral and protective conductors are combined as a PEN conductor from the power source up to the user's main distribution board (or building entry). After the distribution board, they are separated into independent N and PE conductors.
- **Characteristics:** It is a hybrid system that offers a balance between the cost-efficiency of TN-C and the safety of TN-S.

IT (Isolation-Terra)

- **Conductor Arrangement:** The primary power source is either completely isolated (ungrounded) or connected to earth via a high-impedance device.
- **Characteristics:** Highly effective in preventing potential damage from fault currents because they don't immediately trigger a protective action.
- **Application:** Often used in critical installations such as hospitals and industrial facilities, where uninterrupted power and fault tolerance are essential.

Annexure_3_Insulation 1 Mega oham

As per IEC 61851-1, an insulation resistance value of "> 1 GΩ" means there is exceptionally high electrical isolation, which indicates excellent safety
. This value is significantly higher than the minimum requirements and is a measure of the effectiveness of the insulation in preventing the flow of unwanted current.
Breakdown of the value

- **GΩ (Gigaohm):** A gigaohm is one billion (10910 to the nineth power109) ohms. Standard electrical insulation tests often require minimum values in the megaohm (MΩ) range.
- **> 1 GΩ:** This indicates that the measured resistance is greater than one billion ohms, which is an extremely high level of resistance. A high resistance value signifies very low leakage current, meaning the electrical insulation is in a near-perfect state.

Context in EV charging

For electric vehicle (EV) charging stations and their components, IEC 61851-1 sets the general requirements for electrical safety. An insulation resistance test is a standard safety procedure performed on this equipment.
The test measures the resistance between:

- Live electrical components and the protective earth (chassis).
- Different live electrical circuits.

The purpose is to ensure that the insulation reliably separates all live parts from the user and from the vehicle's body.
Significance of a high reading
While standards for EV chargers often specify minimum requirements in the MΩ range (e.g., >1 MΩ or >7 MΩ, depending on the equipment class), a result of "> 1 GΩ" is considered a superior safety measure for several reasons:

- **Initial quality:** A high initial reading indicates excellent manufacturing quality and pristine insulation materials.
- **Long-term reliability:** Good initial insulation means the equipment is more resilient to degradation over time from factors like heat, moisture, and vibration.
- **Safety margin:** A GΩ-level reading provides a large safety margin, minimizing the risk of electric shock and ground faults.
- **Component health:** A consistent, high insulation reading over time confirms the healthy state of the electrical components, cables, and connectors.

Annexure-4 Automatic Software update over net

Automatic software updates for electric vehicle (EV) chargers are a standard feature known as Over-the-Air (OTA) updates. This process allows charging station providers and manufacturers to wirelessly deliver new software and firmware, just like updates for a smartphone or laptop.

How automatic updates work

Automatic updates on an EV charger are managed through a centralized system that controls a fleet of chargers.

- **Central management system (CMS):** A charge point operator (CPO) uses a CMS to manage their network of chargers.
- **Connectivity:** The charger connects to the CMS over the internet using Wi-Fi, Ethernet, or a cellular network.
- **OCPP:** Communication between the charger and CMS is standardized by the Open Charge Point Protocol (OCPP). This protocol has included standard procedures for remote firmware updates since version 1.6.
- **Update process:** The CMS sends a secure update package to the charger, often at a scheduled time to minimize disruption. The charger downloads the update and installs it, typically followed by a reboot.

Key benefits of OTA updates:

- **Enhanced security:** Wireless updates allow providers to quickly deploy security patches to protect against cyber threats across the entire charging network.
- **Cost efficiency:** Remote updates save the significant labor and travel costs associated with sending technicians to physically service chargers.
- **Improved reliability:** Glitches or software bugs can be fixed quickly without taking the charger offline for an extended period, which increases uptime and customer satisfaction.
- **Future-proofing:** As charging technology and communication protocols evolve, new standards (such as Plug and Charge) can be added to older chargers through software updates.
- **Added features:** Manufacturers can release new features or performance enhancements, such as optimizing charging algorithms for better efficiency, to all chargers on the network.

Important considerations and challenges:

While highly beneficial, automatic software updates require careful implementation.

- **Security and authentication:** The update process must be secure to prevent the installation of malicious software. Secure communication protocols like TLS and digital signatures are used to verify that updates are from a trusted source.
- **Network reliability:** Chargers in areas with poor internet connectivity may struggle to download or install updates reliably. The system must include retry logic or "store-and-forward" mechanisms to handle these situations.
- **Testing and rollback:** Updates should be thoroughly tested in a controlled environment before being deployed widely. A rollback mechanism should be in place to revert to a previous software version in case an update fails.
- **User communication:** For home chargers, the system should be able to notify the user of an upcoming update and allow it to be scheduled for a convenient time.

Annexure_5 Storage Temperature

The "Storage Temperature" function of an EV charger refers to its **thermal management system's ability to withstand and operate within specified temperature extremes when not in use**. This function is a critical part of the charger's overall design, ensuring its longevity, safety, and reliability. While operating temperature focuses on managing heat during active charging, the storage temperature function addresses the passive, long-term environmental durability of the equipment. For example, a Victron Energy EV charger lists a storage temperature range of -40∘C negative 40 space raised to the composed with power cap C−40∘C to +80∘C positive 80 space raised to the composed with power cap C +80∘C , much wider than its operating range of -25∘C negative 25 space raised to the composed with power cap C−25∘C to +50∘C positive 50 space raised to the composed with power cap C +50∘C

Key functions of the EV charger's storage temperature capabilities include:

- **Protection of sensitive components**. An EV charger contains sophisticated power electronics, control circuitry, and communication interfaces. Storing or operating the unit outside its specified temperature range can cause stress, damage, or degradation to these components over time.
- **Safety**. Extreme temperatures, both hot and cold, can create safety risks. For instance, very low temperatures can make charging cables stiff and brittle, while extreme heat can increase fire risk. A charger with a robust storage temperature function is built with fire-retardant materials to prevent hazards.
- **Prevention of physical damage**. For outdoor charging stations, a wide storage temperature range ensures the structural integrity of the weatherproof enclosure, cables, and connectors. This protects the internal components from environmental damage, such as water ingress from rain and snow.
- **Reliability**. By being able to endure environmental temperature swings, the charger's readiness is maintained, preventing malfunctions or failures when it's put back into service. A durable storage design ensures the charger is available for use without performance issues caused by prolonged exposure to harsh weather.

Factors influencing storage temperature design

To meet storage temperature requirements, manufacturers implement several design features:
- **Material selection**: Components are made from materials that maintain their properties across a wide temperature range. This includes specialized metals, plastics, and insulation that resist becoming brittle in the cold or soft in the heat.
- **Enclosure design**: The housing for outdoor chargers is engineered to protect against temperature extremes and moisture. This can include specialized ventilation systems and sealed compartments to prevent condensation.
- **Sensor integration**: Thermal sensors can monitor the temperature of internal components, even when the charger is off. While active thermal management systems (like cooling fans) may not run during storage, the system can record data to assess if temperature limits were exceeded.

A charger that can withstand a broad storage temperature range is more versatile and can be installed in a wider variety of climates without concern for long-term

Annexure_6_Power output modes Intelligent, Priority, and Single Mode

Intelligent, Priority, and Single Mode describe power management strategies in electric vehicles (EVs), especially plug-in hybrids (PHEVs), which can use both a battery and a gas engine. They control how the vehicle utilizes its power sources to optimize for factors like efficiency, performance, or battery preservation.

1. Intelligent mode

Intelligent mode automatically and seamlessly switches between power sources to achieve the most efficient or powerful performance for the given driving conditions. It is the default mode in most hybrid systems, managing the vehicle's dual power sources for maximum benefit.

- **How it works:** An intelligent control unit (ECU) assesses real-time factors such as vehicle speed, battery state of charge (SoC), throttle input, and road conditions. It then decides whether to use the electric motor, the combustion engine, or both.

- **Key features:**

    o **Maximizes efficiency:** For example, it will use only the electric motor during low-speed city driving, where a gas engine is least efficient.

    o **Boosts performance:** When rapid acceleration is needed, it engages both the electric motor and the combustion engine for maximum power.

    o **Quiet operation:** The system prioritizes the silent, all-electric mode whenever possible, like when starting from a standstill.

    o **Charges on the go:** It uses the engine as a generator to recharge the battery at higher cruising speeds or through regenerative braking.

2. Priority (EV) mode

Priority mode—often labeled as "EV Mode" or "EV Priority"—forces the vehicle to run on pure electric power for as long as possible. This mode is most commonly found in plug-in hybrid EVs (PHEVs).

- **How it works:** The driver manually engages this mode, which instructs the vehicle to prioritize the electric motor and delay engaging the gas engine. It is typically intended for low-speed, short-distance driving and has specific operational limits.

- **Key features:**

    o **Zero emissions:** The vehicle produces no tailpipe emissions when driving in this mode.

- o **Silent motoring:** The quiet operation is ideal for residential areas or enclosed spaces like parking garages.

- o **Preserves gas:** It allows drivers to save gasoline for highway driving, where the combustion engine is most efficient, or to use the electric range for city errands.

- **Conditions and limitations:**

  - o **Battery state of charge:** This mode requires a sufficient battery charge to activate.

  - o **Speed and distance:** It generally only functions at low speeds and for a limited distance, as the gas engine will engage if the driver accelerates too aggressively or exceeds a certain speed.

3. Single mode (EV or Power)

In a hybrid or PHEV, "Single Mode" is not a standard term but can refer to either a pure EV mode (as described above) or a performance-focused "Power Mode". In a pure battery electric vehicle (BEV), the "single mode" is the default operation, using only electric power.

- **Single mode (in a BEV):**

  - o A pure BEV operates in a single, electric-only power mode by default.

  - o Power output can still be adjusted through selectable driving modes like "Eco," "Normal," and "Sport" that change the throttle response and power delivery.

- **Single (Power) mode (in a hybrid):**

  - o **Focus on performance:** This mode prioritizes acceleration and throttle response over fuel efficiency.

  - o **Higher power demand:** It makes it easier to access the engine's and motor's full power for spirited driving or merging onto a highway.※

Annexure_7_User and manufacturer password

For a new electric vehicle (EV) Human-Machine Interface (HMI), the implementation of user and manufacturer password configuration requires a multi-layered security approach. This is necessary to protect the vehicle's systems from unauthorized access while allowing different levels of control for users and technicians.

Security levels and access control

A robust EV HMI uses a tiered security model to define access.

- **Manufacturer/OEM level:** This is the highest access level, typically reserved for vehicle diagnostics, software updates, and deep system configuration. A manufacturer password or secure key protects access to these critical systems, ensuring that only authorized service technicians can make changes.

- **Dealer/technician level:** A separate layer can grant access to the manufacturer's authorized service centers. It can allow for software upgrades and diagnostics, but may be more restricted than the highest OEM level.

- **User/driver level:** This is the lowest access level, covering functions the driver can customize. The user is provided with a unique password, PIN, or biometric option to access personal preferences like infotainment settings, navigation history, and specific driving modes. This prevents other individuals from tampering with a user's personalized data.

Configuration keys and implementation

Manufacturer configuration key

The manufacturer key is a secure authentication method that is never intended to be changed by the end-user. It can be implemented using a combination of hardware and software security measures.

- **Secure Hardware Module (HSM):** A Hardware Security Module can be used to securely store and manage the manufacturer's cryptographic keys and credentials.

- **Digital certificate:** A cryptographic certificate stored in the HSM can be used to authenticate the vehicle to the OEM's diagnostic tools and backend servers.

- **Secure bootloader:** This ensures that only manufacturer-signed software can be loaded on startup, protecting the system from malware.

- **Secure software updates:** All over-the-air (OTA) updates for the EV's HMI software must be digitally signed by the manufacturer. The HMI should verify this signature before installing any update to prevent malicious firmware from being sideloaded.

User password configuration

A user's authentication method is designed for ease of use while still providing strong security for personal data.

- **PIN/Password protection:** The HMI software provides a feature to set and manage a user PIN or password for controlling specific, sensitive functions, such as vehicle controls or in-car payment features.

- **Biometric authentication:** Modern HMIs increasingly incorporate biometric technology, such as facial or fingerprint recognition, for user authentication. Biometrics offer a high level of security and convenience by eliminating the need to remember passwords.

- **User management tables:** The HMI's editing software includes a user administration feature to define different user levels and assign unique credentials. This allows different drivers to have personalized profiles with unique access permissions.

Best practices and cybersecurity

To secure password configurations in an EV HMI, best practices must be followed.

- **Strong password policy:** Enforce policies for user passwords, including minimum length and the use of numbers and symbols.

- **Encryption:** The HMI should use encryption to protect sensitive data transmitted between the HMI, the vehicle's electronic control units, and backend services.

- **Audit logs:** Maintain an audit trail of all actions performed under manufacturer-level access to track system changes and detect unauthorized activity.

- **Regular updates:** Continuous software and firmware updates are essential to patch vulnerabilities and enhance security.

Annexure_8_URLID single manufacturer key

The concept of a "URL/ID single manufacturer key" in an EV's Human-Machine Interface (HMI) does not correspond to a standard technical term or a universal requirement. The search results suggest that this phrase is likely a misunderstanding of several distinct but related EV technology concepts, primarily involving cybersecurity, user authentication, and manufacturer-specific identifiers.

Here is a breakdown of the likely components of this misunderstanding:

1. Cybersecurity certificates and keys

Automotive cybersecurity regulations, such as the UN R155 standard, require vehicle manufacturers to secure the entire software and communication ecosystem, which includes the HMI. This process involves the use of cryptography with private keys and digital certificates.

- **Public Key Infrastructure (PKI):** EVs and charging stations use PKI to authenticate each other securely. This ensures that only authorized devices can communicate and prevents a range of cyberattacks.
- **Secure boot and updates:** Digital signatures, created using cryptographic keys, ensure that over-the-air (OTA) software updates are legitimate and have not been tampered with.

2. Digital keys for vehicle access

Automakers and the Car Connectivity Consortium (CCC) are developing digital key solutions for vehicle access.
- **Digital Key:** A smartphone or other device can function as a digital key to lock, unlock, and start a vehicle. This involves a secure digital ID that is unique to the user and their device.
- **Manufacturer-specific implementations:** Some automakers, like Hyundai with its Digital Key, develop their own proprietary digital key and sharing platforms.

3. Unique device identifiers and IDs

Electronic Control Units (ECUs) and HMI systems within a vehicle each have a unique identifier, or ID, to ensure proper communication on the in-vehicle network.
- **Forensic logging:** For cybersecurity, manufacturers are required to log data that can be used for forensic analysis following an attempted cyberattack. A unique device ID is critical for this logging.

4. OEM-specific software ecosystems

As vehicles become software-defined, manufacturers create unique in-vehicle platforms that feature personalized dashboards and integrated services. The HMI provides the user interface for this proprietary, brand-specific ecosystem. The "single manufacturer key" may be a misinterpretation of this unique, proprietary software environment, which is controlled entirely by the automaker.

Annexure_9_Smart Multi-Stack charging profiles

A Smart Multi-Stack charging profile refers to an intelligent system that manages and optimizes the charging of multiple electric vehicles (EVs) by coordinating power at the "stack" level. Instead of treating each EV as an independent charging event, this system groups charging posts into larger, coordinated units (stacks) to dynamically distribute power based on vehicle needs, energy costs, and grid availability.

This technology is critical for high-demand locations like fleet depots, apartment complexes, and public charging hubs, where many EVs need to charge simultaneously without overwhelming the local electrical infrastructure.

How multi-stack charging works

A smart multi-stack system coordinates power using a multi-layered, data-driven approach:

- **The stack:** At the physical level, a charging stack consists of multiple modular power units that are connected to an array of charging posts. This design allows the system to share power flexibly among all connected vehicles. In contrast, traditional systems use individual, self-contained chargers with a fixed power output.

- **Intelligent coordination:** A central, cloud-based Charging Station Management System (CSMS) continuously gathers data from the EVs and the grid to manage charging. It uses advanced algorithms to coordinate charging across the entire stack based on:

  - **Vehicle needs:** The system considers the battery's state of charge (SOC), vehicle type, and the driver's required departure time to prioritize charging sessions.

  - **Grid conditions:** It can adjust charging speeds based on real-time grid demand and capacity. For example, it will limit power during peak hours to avoid costly demand charges and grid stress.

  - **Energy costs:** The system can schedule charging during off-peak hours when electricity rates are lower, which saves money for both the site operator and the EV owners.

  - **Renewable energy:** It can integrate on-site energy sources, such as solar panels or battery storage, and prioritize charging when clean energy is most available.

Key features of a multi-stack system

- **Dynamic Load Balancing:** The system can automatically and evenly distribute the available power among all actively charging vehicles. If more EVs plug in, the power delivered to each car might be slightly reduced, but everyone continues charging simultaneously without overloading the electrical supply.

- **Charging Profiles:** The CSMS applies customized charging profiles to different groups of EVs. For example, a fleet depot might have a profile that prioritizes vehicles needed early in the morning, while a public garage might offer a cheaper, slower-charging profile overnight.

- **Power Sharing:** The modular design of the charging stack allows for efficient power pooling. For instance, if one EV is nearing a full charge and only needs low power, the system can redirect excess power to another vehicle that can still accept a fast charge, maximizing overall station efficiency.

- **Scalability and Redundancy:** Stacks are scalable because new power modules can be added easily to increase overall capacity as EV demand grows. The modular design also provides redundancy; if one power module fails, the others can continue to operate, ensuring charging services are not interrupted.

Benefits of multi-stack charging

- **Increased Charging Efficiency:** By intelligently distributing power, the system reduces waste and ensures the maximum use of available energy, leading to faster total charging times across the site.

- **Lower Costs:** Site operators can avoid expensive electrical infrastructure upgrades and high peak-demand utility charges by managing total power consumption.

- **Grid Stabilization:** The ability to shift and balance electrical load helps support the stability of the local and regional power grids.

- **Enhanced User Experience:** EV drivers benefit from optimized charging that meets their needs, such as ensuring their vehicle is fully charged by a specific time while charging at the lowest possible cost.

Annexure_10_RMS

A Remote Monitoring System (RMS) for Electric Vehicles (EVs) is a technology that collects and transmits real-time data about an EV's status and performance to a central server or user interface, enabling remote diagnostics, performance analysis, and alerts for potential issues. By leveraging sensors and wireless communication (like GSM/GPRS or the internet), the RMS helps monitor parameters such as battery health, energy consumption, and operational faults, ultimately improving the efficiency, maintenance, and user experience of electric vehicles and their associated infrastructure.

How it Works

1. **Data Collection:** Sensors and microcontrollers within the EV collect various operational parameters, such as battery voltage, current, temperature, and energy generation/consumption data.

2. **Data Transmission:** The collected data is sent wirelessly via a GSM/GPRS network or other internet-based communication technologies to a centralized server.

3. **Centralized Monitoring:** The server processes the data and makes it accessible through a user-friendly web interface or application, allowing users to view performance trends and receive alerts.

4. **Remote Control (Advanced Systems):** Some RMS systems may also offer remote control capabilities, allowing users to perform specific actions on the vehicle remotely.

Key Benefits for EVs

- **Improved Diagnostics & Fault Detection:**Identifies potential problems, such as hardware malfunctions or system errors, before they lead to downtime.
- **Performance Optimization:**Monitors energy generation and consumption to optimize usage and improve overall efficiency.
- **Enhanced Maintenance:**Provides valuable performance data to schedule proactive maintenance and reduce costly reactive repairs.
- **Better User Experience:**Offers users real-time insights into their vehicle's performance and allows for remote tracking and management.
- **Fleet Management:**Facilitates the management of large fleets of EVs by providing a centralized platform for monitoring and control.

Annexure_11_Ring Net System

A "ring net" in the context of electric vehicles (EVs) refers to a network communication or power distribution architecture designed to increase system reliability and fault tolerance. Instead of a single communication line (a bus topology) or a central hub (a star topology), a ring network connects components in a circular, closed loop.

The key benefit of a ring net is its redundancy, which is critical for safety and performance in modern, complex EVs.

Use cases of a ring net in EVs

1. Automotive Ethernet communication

In modern vehicles, particularly those with advanced driver-assistance systems (ADAS) and autonomous driving features, a high-speed and reliable network is essential. As an alternative to older network topologies, a ring-based Automotive Ethernet can be implemented with gateways, Electronic Control Units (ECUs), and other components connected in a loop.

- **Redundancy:** If the main communication path is severed due to a damaged cable, a dual-ring configuration allows data to travel in the opposite direction along the redundant ring.

- **Reliability:** This self-healing architecture ensures that critical vehicle systems—such as steering, braking, and infotainment—remain operational even if a single point of failure occurs.

- **Decentralized operation:** Since each ECU is connected to its two neighbors, no single central hub is required, which simplifies the design and reduces points of failure.

2. EV charging infrastructure

Research has been conducted on implementing ring networks in local charging infrastructures to balance the electrical load and integrate distributed energy resources like solar panels and battery storage.

- **Grid stabilization:** An AC ring main system connecting an EV charging station to prosumers (consumers who also produce power, e.g., with solar panels) can reduce the impact of high-demand EV charging on the main electrical grid.

- **Optimized energy flow:** This architecture, controlled by a centralized unit, can manage the energy flow to prioritize selling stored power back to charging stations during peak demand, ensuring the ring system does not draw excessive power from the main grid.

3. Power distribution in battery packs

While less common, the concept of a ring bus has been applied to power distribution systems for critical applications to maximize reliability and uptime. A similar approach could be explored in large EV battery packs to enhance power flow and fault tolerance. In a ring bus, power can be routed from multiple directions, ensuring that a fault in one section does not cause a total power outage.

Key differences in ring net applications

The term "ring net support" can apply differently depending on the system in question:

- **Automotive networks:** The focus is on secure, high-speed data communication with robust, fault-tolerant network topologies.

- **Charging networks:** The focus is on distributing electrical power efficiently and stabilizing the grid during high-demand EV charging.

- **Power electronics:** The focus is on reliable power distribution and preventing single points of failure, similar to its use in data centers and industrial systems.

Annexure_12_Smart Power sharing linking

A synchronized EV power-sharing system links standalone charging units into a smart network to optimize energy use and prevent grid overloads. This technology, known as dynamic load management (DLM), allows multiple electric vehicles (EVs) to charge efficiently without requiring costly electrical infrastructure upgrades.

How smart power sharing works

The system relies on cloud-based software, communication protocols like the Open Charge Point Protocol (OCPP), and real-time energy monitoring to function.

1. **Connectivity:** Standalone smart chargers are connected to a central, cloud-based platform via Wi-Fi, Ethernet, or cellular networks. The software monitors the total power consumption of the building or site in real-time.

2. **Dynamic load balancing:** When multiple EVs are plugged in, the system automatically distributes the available power among them. It allocates a maximum, flexible power budget for the charging stations. If the building's overall power draw increases (for example, when large appliances turn on), the system temporarily reduces the power sent to the EVs.

3. **Prioritization:** Operators can set rules for prioritizing charging. For instance, a system can be configured to either distribute power equally among all vehicles or prioritize those that have been charging the longest.

4. **Integration with renewables:** The network can be programmed to prioritize charging when local renewable energy, such as rooftop solar, is abundant. This reduces the reliance on grid power during peak hours.

5. **Billing and user management:** The platform handles billing and user authentication, allowing building owners or operators to monetize their charging stations. Drivers can use a mobile app or RFID card to start a session, and the system automatically tracks usage.

Benefits of synchronized EV charging

Implementing a smart, synchronized charging system provides advantages for EV owners, businesses, and the electrical grid.

For businesses and property owners**Avoids costly upgrades:** The system prevents exceeding the maximum power capacity of a site, eliminating the need for expensive electrical service upgrades to support multiple chargers.

- **Reduces energy costs:** By automatically scheduling charging during off-peak hours when electricity rates are lower, the system minimizes high demand charges.

- **Increases revenue:** A charging network can become a new revenue stream, with automated billing for charging sessions at commercial or public locations.

- **Enhances reliability:** By dynamically managing the load, the system reduces the risk of tripped circuits or power outages caused by sudden spikes in electricity demand.

For EV drivers

- **Convenient and reliable charging:** The system ensures a predictable and seamless charging experience, with mobile apps that can locate and reserve available chargers in advance.

- **Optimized charging speeds:** Dynamic load balancing ensures that all connected vehicles charge as fast as possible within the available power capacity.

- **Cost savings:** Drivers can save money by scheduling charging sessions during off-peak hours when electricity prices are lower.

Technologies supporting smart power sharing

Several technologies enable the development of a synchronized EV charging network.

- **Vehicle-to-everything (V2X):** The most advanced form of smart charging, V2X allows for bidirectional power flow between the EV and other entities, including the grid (V2G), a building (V2B), or a home (V2H). This turns EVs into a distributed energy storage resource that can stabilize the grid or provide backup power.

- **Open protocols:** Open standards like OCPP ensure that chargers and management software from different manufacturers can communicate with each other. This prevents vendor lock-in and enables scalable, interoperable networks.

- **Distributed architecture:** Instead of having a single, massive charger, a distributed system uses a central power unit to send electricity to multiple charging points. This allows for greater flexibility and scalability for large fleets or parking garages.

- **Distributed Energy Storage Systems (DESS):** Battery storage systems at charging sites can absorb excess renewable energy and release it during high-demand periods, further reducing stress on the grid.

Annexure_13_Enables flexible multi- vehicle

Enabling flexible multi-vehicle charging that dynamically adjusts for high-traffic locations in EVs is achieved through smart charging management systems. These platforms use dynamic load balancing and real-time data to optimize power distribution, prevent grid overloads, and improve the efficiency of charging infrastructure. This capability is crucial for commercial hubs, public charging stations, and fleet depots where demand fluctuates.

Key technologies and techniques include:

Dynamic Load Balancing (DLB)

Dynamic Load Balancing (DLB) is a software-based solution that automatically adjusts the power allocated to each charging station in real-time.

- **Optimal power distribution**: Rather than assigning a fixed amount of power to each charger, DLB systems measure the total energy consumption and the available capacity of the grid connection.

- **Maximized efficiency**: During periods of low demand, a charger can deliver a higher output to a single vehicle. When more vehicles plug in, the system dynamically redistributes power to ensure all vehicles charge as quickly as possible without exceeding the total capacity.

- **Priority charging**: Some DLB systems allow operators to set priorities based on a vehicle's needs or category, such as prioritizing a transit bus over a taxi or personal vehicle.

Smart charging management systems

These cloud-based software platforms manage all aspects of the charging process, from network operations to energy management.

- **Integration with the grid**: The system uses advanced algorithms and real-time data to optimize energy consumption based on grid constraints, energy pricing, and availability of renewable energy.

- **Remote management**: Operators can monitor charger utilization, diagnose issues, and perform software updates from a central platform. This is especially useful for managing a large network of chargers in different locations.

- **Analytics and reporting**: The system collects and analyzes data on charging patterns and energy consumption, providing valuable insights for business decisions and future network expansion.

Integration with renewable energy

By integrating with renewable sources like solar panels and battery storage, charging sites can further optimize energy usage and reduce grid dependency during peak hours.

- **Cost savings**: Operators can schedule charging to occur during off-peak hours or when renewable energy generation is high, saving money and reducing grid stress.

- **Vehicle-to-Grid (V2G)**: Bidirectional charging technology allows EVs to return excess power from their batteries to the grid during high-demand periods. This helps stabilize the grid and can generate revenue for EV owners.

Real-time traffic and demand monitoring

By incorporating data from intelligent transport systems (ITS) and mobile applications, smart charging systems can adjust dynamically based on traffic conditions and user behavior.

- **Reduced congestion**: The system can direct drivers to less-congested charging stations, reducing waiting times in high-traffic areas.

- **Predictive insights**: AI and machine learning can analyze traffic patterns to predict charging needs, helping to manage demand more effectively.

In-motion charging

Also known as dynamic wireless charging, this emerging technology allows EVs to charge while driving over specially equipped road lanes. This would be particularly useful in high-traffic corridors to reduce range anxiety and the need for large batteries.

Annexure_14_Supports to enable multiple business

To maximize revenue, EV charging point operators (CPOs) must adopt a multi-faceted approach that moves beyond simple charging fees. The following are multiple business models and supporting strategies CPOs can use to create diverse revenue streams and maximize profitability.

Revenue models for charging

These models are built on how CPOs monetize the core service of charging EVs.

- **Pay-per-use:** A straightforward model where customers pay based on usage. CPOs can charge by the kilowatt-hour (kWh), per minute, or a flat fee per session. This model is ideal for high-traffic public areas where demand fluctuates.

- **Subscription or membership:** This model secures predictable, recurring revenue from frequent users like fleet drivers or daily commuters. Subscribers pay a recurring fee for benefits such as discounted charging rates, priority access, or the ability to reserve a charging slot.

- **Dynamic pricing:** Charging tariffs are adjusted based on demand and time of day, similar to surge pricing. Offering lower rates during off-peak hours and premium rates during high-demand windows can boost utilization and balance grid load.

- **Partnerships and revenue sharing:** CPOs can collaborate with property owners, commercial fleets, and e-mobility service providers. In a franchise model, the property owner provides the location while the CPO manages operations, and revenue is shared between both parties.

Value-added service models

To increase revenue per customer visit, CPOs can turn charging stations into multi-purpose hubs.

- **On-site retail and food:** Monetize the "dwell time" while drivers charge by offering convenience services like a café, vending machines, or partnering with a food truck.

- **Advertising and sponsorship:** Install digital screens or billboards at charging stations to sell ad space to brands. CPOs can also offer sponsorships to companies aligning with sustainable mobility.

- **Vehicle services:** Offer complementary services like car washes, tire checks, or detailing. These services leverage the time the vehicle is already parked.

- **Accessory sales:** Sell EV-related accessories like charging cables, adapters, and portable chargers through a kiosk or automated locker.

Technology and energy management models

Advanced technologies can create new revenue streams and increase efficiency.

- **Grid services (V2G and V2X):** Participate in grid flexibility markets by enabling Vehicle-to-Grid (V2G) technology. CPOs can receive incentives from utilities by managing load, stabilizing the grid, or selling stored power back during peak demand.

- **Smart charging and load balancing:** Use smart energy management systems to optimize energy draw and reduce operational costs, especially during peak pricing hours. Dynamic load balancing can distribute power across multiple chargers without expensive infrastructure upgrades.

- **Renewable energy integration:** Generate revenue by installing solar PV canopies over charging bays. This can reduce electricity costs, increase profit margins, and potentially generate tradable carbon credits.

- **Data monetization:** Anonymized and aggregated data on usage patterns can be valuable to market research firms, energy utilities, and urban planners. CPOs can create a new revenue stream by selling these insights.

Strategic partnership models

Partnerships allow CPOs to expand their network and service offerings without massive capital expenditure.

- **Fleet partnerships:** Work directly with corporate fleets, cab aggregators, and delivery companies to provide tailored subscription packages. These B2B contracts provide a consistent and predictable customer base.

- **OEM integration:** Partner with vehicle manufacturers to offer integrated charging solutions or bundled charging hardware with the purchase of an EV.

- **Real estate collaborations:** Partner with malls, commercial centers, residential complexes, and parking garages. This provides prime locations with built-in traffic in exchange for a revenue-sharing agreement.

How to execute a multiple business model strategy

To successfully combine these models, CPOs should:

- **Use a flexible platform:** Choose a hardware-agnostic management platform that can handle multiple billing engines and partner integrations.

- **Utilize data analytics:** Analyze usage data and market trends to make informed decisions on pricing, site selection, and service bundling.

- **Create strong partnerships:** Focus on strategic collaborations that expand market reach, increase utilization, and streamline operations.

- **Improve the customer experience:** Ensure a seamless and reliable charging experience by prioritizing uptime and offering excellent customer service. Happy, loyal customers lead to increased revenue through repeat business and word-of-mouth marketing.

Annexure_15_Provides the ability for CPOs

Charging Point Operators (CPOs) can enable multiple active charging profiles with dynamic prioritization through software solutions that implement the Open Charge Point Protocol (OCPP) and utilize dynamic load management (DLM). This allows CPOs to control how power is distributed among charging sessions based on a set of rules, enabling complex scheduling, grid optimization, and varied business models.

How multiple profiles and dynamic prioritization work

- **Charging profiles**: Using the OCPP standard, a CPO can send different charging profiles from their Central Management System (CMS) to a charging station (EVSE). A profile contains charging schedules and power limits, allowing the CPO to control charging behavior based on time, grid capacity, and user needs.

- **Profile stacking**: The key to dynamic prioritization is the ability to "stack" multiple charging profiles, with each profile assigned a different priority level. When an EV is charging, the charge point prioritizes the profile with the highest stack level, allowing CPOs to set default limits and then override them with more specific, high-priority rules.

- **Dynamic load management (DLM)**: DLM is the process of adjusting the power delivered to each charger in real-time, based on factors like site capacity, grid conditions, and user priorities. When new charging profiles are applied, the DLM system dynamically re-balances the power to all active charging sessions, ensuring the site never exceeds its maximum power limit.

Example of dynamic prioritization with stacked profiles

Consider a CPO that manages a fleet charging depot with a set total power capacity. They can define multiple active profiles to serve different business needs simultaneously:

1. **Lowest priority (TxDefaultProfile)**: A base profile is set for all new charging transactions. For instance, charging might be limited to a low rate of 10 kW per vehicle during the day to avoid high peak demand charges.

2. **Medium priority (Time-based)**: A higher-priority profile is stacked on top of the default profile to schedule cheaper, overnight charging. This profile allows for charging at a full 50 kW between 11 p.m. and 6 a.m., taking advantage of lower electricity rates.

3. **Highest priority (Urgent vehicle override)**: A specific, highest-priority profile is used for a particular vehicle that needs to be fully charged immediately for an urgent trip. The CPO can

activate this profile to override all other rules and ensure that this specific vehicle receives maximum power, even during peak times.

Benefits for CPOs

By implementing a system with multiple charging profiles and dynamic prioritization, CPOs can achieve several operational and financial benefits:

- **Operational optimization**: The system can intelligently balance the charging load across all chargers, preventing site overloads, grid instability, and costly energy spikes.

- **Cost reduction**: Dynamic load balancing and time-of-use pricing rules allow CPOs to reduce their electricity costs by scheduling heavy charging during off-peak, cheaper hours.

- **Increased revenue streams**: CPOs can create new pricing models based on a driver's willingness to pay for a higher charging priority, such as offering a premium service for faster charging.

- **Improved driver experience**: While prioritizing certain vehicles, the system still ensures that all active EVs receive some level of power, avoiding a frustrating "first come, first serve" scenario.

- **Scalability**: The system enables CPOs to add more chargers to a site without needing expensive and time-consuming electrical infrastructure upgrades.

Annexure_16_Showcase promotions, pricing

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Annexure_17_Boost your market presence

To boost your brand's market presence and engage with users in the EV sector, you must build trust, educate consumers, and demonstrate your unique value proposition. In a rapidly evolving and competitive market, a multi-channel digital marketing strategy is crucial for success.

Build brand authority and trust

- **Educate through content:** Many consumers still have misconceptions or anxieties about EVs concerning range, charging, and maintenance.

  o **Create blog posts and articles** on topics like the environmental benefits of EVs, battery maintenance tips, and guides for choosing the right EV.

  o **Produce engaging video content** with product demonstrations, customer testimonials, and behind-the-scenes footage to humanize your brand.

- **Leverage customer reviews and testimonials:** Authentic feedback from happy customers is a powerful tool for building credibility and confidence. Highlight positive reviews on your website and social media.

- **Invest in technical expertise:** Promote the certification and training of your service technicians, which helps build trust among potential buyers who may be concerned about EV servicing.

- **Provide transparent information:** Clearly communicate your pricing models for services and the cost-saving benefits of EVs, such as lower total cost of ownership compared to traditional cars.

Engage with users through interactive channels

- **Create a strong social media presence:** Identify the platforms your target audience uses and share a variety of content.

  o **Host live Q&A sessions** to address consumer concerns in real-time.

  o **Share interactive polls or quizzes** about EV knowledge to boost engagement.

  o **Encourage user-generated content** by asking customers to share their EV experiences.

- **Build a community:** Foster online communities on platforms like Facebook groups where owners can share their experiences, discuss new models, and address common questions. Respond quickly to their questions to build trust.

- **Use immersive technology:** For those who cannot test drive, virtual and augmented reality can provide an engaging experience. An AR mobile app could allow users to preview a model in their own parking space.

- **Launch targeted campaigns:** Use data to segment your audience and create personalized campaigns. For example, send personalized emails based on a user's location, interests, or online behavior.

Amplify reach and showcase innovation

- **Collaborate with influencers:** Partner with EV experts, green creators, or auto journalists whose values align with your brand. Authentic endorsements from credible figures can influence purchasing decisions and build trust.

- **Optimize for search (SEO):** Many consumers research online before buying. Ensure your website, including product pages and blog content, is optimized for search engines.

    o Conduct keyword research to understand the terms potential customers use.

    o Optimize for local search to help customers find your charging stations or physical locations.

- **Highlight sustainability:** Position your brand as an environmental leader. Create content and PR campaigns that showcase your commitment to sustainability and corporate social responsibility (CSR) initiatives.

- **Form strategic partnerships:** Collaborate with other brands that share your values, such as charging infrastructure providers or local businesses. Joint marketing campaigns can expand your reach and offer comprehensive solutions.

- **Offer interactive events:** Host test-drive camps, sponsor races, or run app-based treasure hunts. These events provide consumers with a direct, memorable experience with your brand.

Annexure_18_Enhance station visibility and foster

To enhance EV charging station visibility and foster customer loyalty, focus on strategic location planning, a superior customer experience, digital marketing, and robust loyalty programs. Since EV drivers are often "energy grazers" who charge while doing other things, the charging experience must be convenient and integrated into their daily routines.

Enhance station visibility

Effective visibility reduces range anxiety and attracts more customers.

- **Strategic site selection**: Place stations in high-traffic, convenient locations like shopping malls, office complexes, major highways, and near restaurants.

- **Clear signage and lighting**: Use large, well-lit signs to clearly direct drivers to charging spots, especially at night.

- **Digital discovery**: List your station on all major EV charging apps and platforms, such as Google Maps, PlugShare, and ChargePoint. Include real-time information on availability, charging power, and connector types.

- **Sustainability branding**: Highlight your commitment to sustainability by using green energy, like solar power, to attract eco-conscious drivers.

- **Local SEO and social media**: Optimize your online presence with local search engine optimization (SEO) and engage with users on social media to build community and amplify your brand.

- **Partnerships**: Partner with local businesses, hotels, or events to promote your charging stations. A coffee shop, for instance, could offer a promotion for customers who charge their vehicles.

Foster customer loyalty

Since there is currently very little brand loyalty in public EV charging, a strong customer experience is key to retention.

- **Implement a tiered loyalty program**: Reward frequent users with points, discounts, or free charging sessions. Use different tiers (Silver, Gold, Platinum) to gamify the experience and offer escalating perks.

- **Create a mobile app**: Develop a user-friendly app that integrates with the loyalty program and allows users to find stations, track charging status, make payments, and access exclusive promotions.

- **Offer tiered charging speeds**: Cater to different customer needs by providing a mix of fast DC chargers for quick stops and slower AC chargers for longer stays, such as at a mall or hotel.

- **Optimize the charging experience**: Ensure the entire process is seamless, from user-friendly payment options (app, RFID, tap-to-pay) to reliable and fast chargers. Provide real-time status updates to prevent customer frustration.

- **Provide valuable amenities**: Enhance the "dwell time" experience by offering comfortable waiting areas with Wi-Fi, seating, restrooms, and refreshments. This turns a charging session into a more enjoyable and productive stop.

- **Personalize the experience**: Use data from your app to offer personalized rewards and communications. For example, give bonus points for charging during off-peak hours or for using underutilized stations.

- **Provide excellent customer support**: Offer responsive and knowledgeable customer support through a helpline, live chat, or on-site staff to quickly resolve any issues.

- **Leverage cross-branding**: Partner with non-competitors to offer bundled perks. For example, EVgo and Cumberland Farms offer in-store promotions to drivers charging their vehicles.

Annexure_19_Simplify charging with advanced

To simplify electric vehicle (EV) charging, advanced connector holsters with integrated placement sensing use cameras or other sensors to guide drivers and automate charging once the connector is in the correct position. This technology is a step towards fully automated charging systems, which are especially useful for robotic charging and wireless charging applications.

Benefits of advanced connector holsters

Benefit	Description
Enhanced convenience	The system automatically initiates charging once the connector is properly docked, eliminating the need for manual confirmation through an app or a card. This hands-free experience is particularly beneficial in valet or autonomous driving scenarios.
Improved accuracy	Precision sensors ensure the connector is properly and securely seated before charging begins. This prevents faulty connections that can lead to charging interruptions or damage to the equipment.
Increased safety	By confirming correct placement, the system reduces the risk of incorrect handling, which can cause wear and tear on cables and increase electrical hazards. Some systems may even verify correct placement and then use a robotic arm to plug in the connector automatically, further increasing safety and precision.
Expanded accessibility	The guidance features assist drivers who may have difficulty with fine motor skills or those with physical disabilities, making the charging process more accessible to a wider user base.
Automated cable management	Some advanced systems can integrate with cable retraction mechanisms to automatically store and deploy the charging cable, preventing tangles and keeping the charging area tidy.

How placement sensing technology works

This technology simplifies the user experience in several ways, depending on the type of charging system.

For manual charging

1. **Vehicle parking:** The driver parks the vehicle near the charging station. Integrated cameras or sensors in the holster and charging pedestal help guide the driver to the correct parking position.

2. **Connector guidance:** When the driver removes the connector, visual or audio cues from the charging station can help guide them toward the vehicle's charging port.

3. **Holster detection:** The placement sensor in the holster detects that the connector has been successfully re-holstered. This action signals the system to end the session or prepare for the next user.

For automated and wireless charging

1. **Parking assistance:** Advanced vehicle-to-infrastructure (V2X) communication guides the vehicle to a precise parking position over a wireless charging pad.

2. **Sensor verification:** Integrated sensors, such as weight or thermal sensors, verify that the vehicle is correctly aligned and present.

3. **Automatic charging:** Once a correct position is confirmed, the system can automatically initiate wireless charging without any further human input. For conductive charging, a robotic arm can use visual sensors to guide the connector into the vehicle's charge port automatically.

4. **Completion and billing:** The system monitors the charge, stops automatically when complete, and handles billing for a completely seamless user experience.

Annexure_20_The brain behind the charger, flexibly managing every function with precision

The "brain" behind a smart EV charger is its integrated hardware and software system, which manages and optimizes the charging process with flexible, automated, and intelligent functions. This technology goes far beyond simply delivering electricity to a car.

The intelligent system's core functions

A smart charger's "brain" enables it to make real-time decisions by communicating with the electric vehicle (EV), the power grid, and the user via a cloud-based platform. Key functions include:

- **Dynamic load balancing:** Prevents circuit overloads by automatically adjusting the charging speed based on the overall power consumption of a building or location. For example, if you turn on other major appliances, the charger will temporarily slow down to prevent a fuse from blowing.

- **Time-of-use scheduling:** Coordinates charging with your electricity provider's energy pricing. The system can be programmed to automatically charge your EV during off-peak hours when electricity is cheaper, which can lead to significant cost savings.

- **Energy and resource optimization:** Works with renewable energy sources like solar panels. The charger can prioritize using excess solar power to charge your vehicle during the day and can even reduce the draw from the grid during periods of high demand.

- **Remote monitoring and control:** Allows users to manage charging sessions from anywhere using a mobile app. You can start or stop charging remotely, set timers, and receive real-time notifications on charging status.

- **Usage insights and reporting:** Tracks and records charging session data, including energy consumption, charging time, and cost. This allows drivers and business owners to better understand and manage their energy use.

How the system executes functions

A complex ecosystem of hardware, software, and communication protocols works together to execute these advanced features.

1. **Communication protocols:** Standards such as the Open Charge Point Protocol (OCPP) and ISO 15118 define how the charger, the vehicle, and the cloud-based management system communicate with one another.

    1. OCPP allows you to remotely control and monitor the charger.

2. ISO 15118 enables features like "Plug and Charge," which automatically authenticates and bills you just by plugging in the vehicle, with no app or RFID card required.

2. **Embedded hardware and firmware:** The charger's physical hardware contains sensors, connectivity modules, and microprocessors. The firmware on this hardware receives and executes commands from the cloud platform, constantly monitoring safety parameters and the charging cycle.

3. **Cloud-based software:** This central platform receives real-time data from the chargers. It runs algorithms to manage all charging events, optimize energy usage across an entire network of chargers (for businesses), and process billing.

4. **Flexible updates:** With internet connectivity, manufacturers can push over-the-air firmware updates to existing chargers. This allows new features and security patches to be added over time, making the technology future-proof without replacing the hardware.

Annexure_21_Dynamically balances power, runs real-time

The description refers to an Artificial Intelligence (AI)-driven **Energy Management System (EMS)** and **Battery Management System (BMS)** in electric vehicles (EVs). These systems utilize real-time data and AI algorithms to optimize power flow, perform advanced diagnostics, and adapt to changing conditions.

Here is a breakdown of the functionalities described:

Dynamically balances power

AI-driven EMS and BMS continuously manage and optimize the distribution of energy within the EV and with external systems.

- **Balancing internal power flow:** The system intelligently allocates power between the battery, motor, and auxiliary systems (e.g., climate control, infotainment) to maximize efficiency and extend range. For instance, AI might optimize regenerative braking to recover the maximum amount of kinetic energy and route it back to the battery.

- **Optimizing charging:** AI controls the charging and discharging process based on real-time factors such as grid demand, electricity prices, and the availability of renewable energy. This process, known as dynamic load balancing, ensures that EVs charge efficiently without overloading the electrical grid.

- **Integrating with smart grids (V2G):** Advanced systems can enable vehicle-to-grid (V2G) technology, allowing EVs to act as mobile power sources. During peak demand, the AI can discharge the battery back into the grid, helping to stabilize energy flow and potentially earning credits for the vehicle owner.

Runs real-time diagnostics

AI provides constant monitoring and predictive analysis to ensure the health, safety, and reliability of the EV's components.

- **Battery health and safety:** The AI-driven BMS uses continuous data analysis to predict the battery's state of health (SoH), state of charge (SoC), and remaining useful life (RUL). This provides drivers with more accurate range predictions and protects the battery from damage due to overcharging or overheating.

- **Predictive maintenance:** By analyzing sensor data and recognizing patterns, the system can identify potential component failures before they occur. This allows for proactive maintenance, reducing unexpected breakdowns and expensive repairs.

- **Early fault detection:** Real-time diagnostics detect anomalies, such as unusual voltage fluctuations or temperature spikes, to prevent minor issues from escalating into major safety hazards.

Adapts to any scenario

The AI systems can learn from diverse data sets and respond to a wide range of conditions, both internal and external to the vehicle.

- **Driver behavior:** AI algorithms can learn individual driving habits and preferences, from aggressive acceleration to a focus on maximizing range. It can then adapt power distribution and navigation to optimize for performance or efficiency accordingly.

- **Environmental conditions:** The system adapts to external factors such as traffic, weather, and road topography to optimize energy usage. For example, in cold weather, it can manage the battery's thermal system to mitigate the range-reducing effects of low temperatures.

- **Vehicle-to-everything (V2X) communication:** In the future, AI will integrate vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication to provide a comprehensive, adaptive ecosystem. This could allow for cooperative charging with other EVs and real-time responses to grid demands.

Annexure_22_Reduced operational costs, requirement of external

EV charging infrastructure often requires external equipment for power factor correction (PFC) to reduce operational costs. This is because the power electronics in EV chargers create a low power factor, which can lead to financial penalties from utility companies and increased energy losses.

Reduced operational costs

A low power factor leads to inefficient power usage, which translates to higher operational costs for EV charging stations. Utilities typically charge commercial customers based on both the amount of energy used (kilowatt-hours) and the maximum power demand (kilovolt-amperes).
Correcting a low power factor offers two primary benefits that lower operational costs:

- **Reduced electricity bills:** Improving the power factor means less total current is drawn from the grid to deliver the same amount of useful power. Since utility companies may apply penalties for a low power factor, correcting it reduces or eliminates these fees and lowers overall electricity costs.
- **Greater infrastructure capacity:** By reducing the total current, PFC allows for more electrical load to be added without upgrading existing transformers, cables, and switchgear. This defers costly infrastructure expansions and makes the charging station more efficient.

External equipment for power factor correction

The power factor issues from EV charging are addressed using external equipment, which is often a bank of capacitors or an active power filter installed at the charging station.

- **Capacitor banks:** For centralized PFC, capacitor banks are used to provide the reactive power needed to offset the inductive load from the chargers. Modern, automatically switched capacitor banks can adjust the capacitance in the system to ensure the correct amount of compensation.
- **Active power filters:** Advanced systems use active power filters, which can dynamically adjust to load changes and also mitigate harmonics. A 2025 study demonstrated an Internet of Things (IoT)-enabled system with nanostructured capacitors and machine learning that improved the power factor from 0.8 to over 0.98 in various load conditions, significantly reducing energy losses.

Importance in EV charging

Unlike simple household appliances, large-scale EV charging, especially fast-charging, can draw significant reactive power, which puts a strain on the electrical grid. The power electronics inside the chargers, particularly the rectifiers and inverters, are the source of this reactive power and harmonic distortion. Without correction, the cumulative effect of many charging stations can degrade the power quality of the local grid.

The requirement for external PFC equipment for EV charging highlights the need for robust energy management strategies as electric mobility expands. Deploying this equipment is a necessary investment to ensure grid stability, reduce energy waste, and lower the operating expenses of charging infrastructure.

Annexure_23_Allows different billing rates or power limits

Yes, electric vehicle (EV) charging systems and software allow for different billing rates and power limits based on the time of day, demand, and specific customer groups. This flexibility is a key strategy for managing grid load, optimizing revenue, and creating custom pricing plans for different users.

Billing rates and power limits by time of day

This approach is known as Time-of-Use (ToU) pricing, where electricity costs vary depending on the time and day.

- **Encourages off-peak charging:** Charging network operators offer lower rates during off-peak hours (e.g., late night) to incentivize EV drivers to charge when electricity demand is low. This helps prevent grid overload during peak times, such as when commuters return home in the evening.

- **Dynamic load balancing:** Smart charging management systems use software to communicate with the electrical grid and adjust charging rates in real-time based on grid conditions. This allows operators to redirect energy to where it's needed most, avoid grid overloads, and manage operational costs.

- **Variable power limits:** In addition to price, power output can be reduced during peak demand to balance the total load on the grid. For instance, a station might deliver slightly slower power during the evening rush to ensure the total energy draw stays within a safe limit.

Billing rates and power limits by customer group

Charging network software allows operators to create tailored pricing structures for different user groups to attract customers and manage access.

- **Employees:** A company can offer charging as a discounted or free amenity to its employees as a workplace perk.

- **Residents:** A multi-family apartment or housing association can provide exclusive, discounted charging rates to residents, often through a subscription plan, compared to a higher rate for visitors or the public.

- **VIP/Loyalty members:** Networks can reward frequent users with access to lower rates, priority access, or free charging as part of a loyalty program.

- **Fleet vehicles:** A fleet operator can use a dedicated rate plan to manage charging for its commercial fleet. This is especially useful for scheduling charges to minimize costs and ensure vehicles are ready for service.

- **Public vs. private users:** Operators can differentiate pricing for different classes of customers, such as charging a higher rate for the general public while offering a lower, incentivized rate for registered account holders.

How EV charging systems make this possible

These customized pricing and power strategies are enabled by sophisticated EV charging management systems (CMS). Key features include:

- **Software control:** Operators use software platforms to set and manage rates, power distribution, and access rules for individual chargers or entire stations.

- **User authentication:** Systems use apps, RFID cards, or secure credentials to identify users and apply the correct pricing and access tier.

- **Remote management:** Cloud-based software allows operators to make changes to pricing and power settings remotely, responding to real-time market conditions or business needs.

- **Hybrid pricing models:** The software can blend different billing methods, such as combining a per-kWh rate with time-based idle fees to encourage drivers to move their cars once charging is complete.

Annexure_24_Captivate every user with dynamic screensaver

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To captivate users with a dynamic screensaver in an EV, you can leverage advanced in-cabin sensors, AI, and generative art to create personalized, context-aware, and immersive visual experiences.

Dynamic screensaver concepts

1. Real-time journey visualization

Instead of a static image, the screensaver becomes an artistic, evolving reflection of the drive itself.

- **Data sources:** The vehicle's sensors, GPS, and external APIs can provide data on location, weather, and driving conditions.

- **Visual translation:** The system translates this data into a visual representation, such as:

    o **"Fluid road":** The road ahead is displayed as an abstract, colorful, and flowing animation, with shapes and hues changing based on the car's speed and surroundings.

    o **"Celestial cruise":** For night driving, the screensaver could display an animated star map or constellation that aligns with the car's direction, with stars and nebulae shifting based on the car's movement.

2. AI-driven generative art

Use AI to create completely unique, generative art pieces that respond to the cabin environment.

- **Data sources:** The system could monitor real-time data from interior microphones, biometric sensors, and occupant movement.

- **Visual translation:** The AI uses this data to generate bespoke artwork. For example:

    o **"Mood mural":** As passengers talk and laugh, the screensaver could display vibrant, abstract shapes that move and interact. If the driver is calm and focused, it may present a serene, minimalist animation.

    o **"Sonic sculpture":** The ambient sounds in the cabin could be turned into a screensaver that visualizes the sound waves as a shifting, 3D wireframe or particle simulation. The music's rhythm would directly influence the animation's pace.

3. Hyper-personalized media integration

The screensaver can transform into a curated, interactive digital art gallery based on each user's preferences.

- **Data sources:** User profiles, linked streaming services like Spotify or YouTube, and saved photos.

- **Visual translation:**

  o **"Memory lane mosaic":** The screensaver could cycle through a family's favorite vacation photos, subtly animated to bring them to life. The system could pull location metadata to create a screensaver that displays photos from the exact road trip you're currently on.

  o **"Audio art":** The screensaver could display dynamic album art for the current song playing. The visuals could be a unique, animated interpretation of the music rather than just a static image.

Implementation and user experience

- **Customization:** Allow for a high degree of personalization. Users should be able to create and save different screensaver "themes" for various occasions, such as a calming theme for morning commutes and an energetic one for road trips.

- **Contextual awareness:** Ensure the system is smart and unobtrusive. In autonomous or assisted-driving modes, the screensaver can be more prominent. However, while the driver is actively engaged, the display must prioritize driving information. The screensaver should subtly fade or adapt to a minimalist view to minimize distraction.

- **Seamless cross-device integration:** The screensaver should work seamlessly across devices. A user might start creating a generative screensaver on their smartphone and have it ready to display the next time they enter their EV.

- **Accessibility:** Consider different user needs. For visually impaired users, the "screensaver" could be an ambient audio experience. For users with motion sensitivity, there should be options for less-intense visual effects

Rest all details remain same as per the NIT published on 17th September 2025 for this tender.

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