ELECTRICITY CONTROL BOARD

ELECTRIC VEHICLES CHARGING INFRASTRUCTURE (EVs-CI) REGULATORY FRAMEWORK INCLUDING ADOPTION OF INTERNATIONAL EV STANDARDS

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Signed:

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Evangelina Nailenge
Board Chairperson

Date: 21/10/2024

FOREWORD

The Electricity Control Board (ECB) is the statutory electricity regulator with the core responsibility of exercising control over the Namibian Electricity Supply Industry (ESI) through regulation of electricity generation, transmission, distribution, supply, use, import and export, electricity tariffs and quality of supply and service. To keep up with the pace of technological advancement, the ECB recognises the need to maintain balance between fostering innovation, protecting consumers and addressing the potential unintended consequences of disruption in the industry.

In terms of Section 3.1 of the Electricity Act, (Act 4 of 2007), the preeminent issue is how to protect citizens and ensure fair markets while allowing innovation and businesses to flourish. With the ongoing noticeable global transition towards the use of Electric Vehicles (EVs), it is imperative to establish a regulatory framework to enable the ECB to effectively exercise, monitor, and enforce regulatory oversight of the infrastructure for charging EVs.

This document provides guidelines and regulations for owning, installing, operating, and managing EV charging stations and related equipment, including the provision of electricity for the charging infrastructure, pricing, and resale mechanisms. In addition, it makes recommendations for relevant international EV standards that can be adopted for the local market to complement existing Namibian ESI regulatory instruments.

This document is named the “Electric Vehicles Charging Infrastructure Regulatory Framework”, developed by the ECB, in consultation with the key industry stakeholders, and with the assistance of the Voltgate Engineering team (appointed as the project’s consultant). The document is subject to continuous review and updates as deemed necessary.

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LIST OF ACRONYMS

A	Amperes
AC	Alternating Current
BEV	Battery Electric Vehicles
CCS	Combined Charging System
CHAdeMO	CHArge de MOve
CPO	Charge-Point Operators
CRAN	Communications Regulatory Authority of Namibia
DB	Distribution Board
DC	Direct Current
DERs	Distributed Energy Resources
DSO	Distribution System Operators
ECB	Electricity Control Board
EG	Embedded Generation
EL	Earth Leakage
EMC	Electro Magnetic Compatibility
EMSPs	e-Mobility Service Providers
ESI	Electricity Supply Industry
EV-CI	Electric Vehicles Charging Infrastructure
EVGI	EV Grid Integration
EV	Electric Vehicle
EVs	Electric Vehicles
EVSE	Electric Vehicle Supply Equipment
HEVs	Hybrid Electric Vehicles
ICE	Internal Combustion Engine
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organisation for Standardisation
kW	kilowatt
kWh	kilowatt-hour
MSP	Mobility Service Providers
PHEV	Plug-In Hybrid Electric Vehicles
RES	Renewable Energy Sources
SAE	Society of Automotive Engineers
SANS	South African National Standards
ToU	Time-of-Use
V	Volts
V2G	Vehicle-to-Grid
VGI	Vehicle-Grid-Integration

1. INTRODUCTION

1.1. RATIONALE

The global trend towards sustainable transportation is evident in the rising adoption of Electric Vehicles (EVs), driven by their environmental benefits and ongoing technological advancements. This surge is particularly notable in leading EV markets, where policy commitments have been made to gradually phase out Internal Combustion Engine (ICE) vehicles over the next decade. Consequently, the seamless integration of EVs into daily lives necessitates a rapid and robust deployment of EV charging infrastructure across various settings, including residential, commercial, and public locations.

In anticipating the future increase in EVs uptake in the Namibian market, integration of EV charging infrastructure into the electric grid poses new challenges in terms of grid stability, quality of supply and load management. Hence, there is a need for a regulatory framework that establishes fundamental principles governing the ownership, installation, and management of EV charging stations. It should be noted that the charging stations, charging points, cables, connectors, and related accessories are components of the Electrical Vehicle Supply Equipment (EVSE). It is thus crucial for EV owners and operators to have a good understanding of the different types and operation of EVSE to ensure they select the appropriate equipment and engage competent persons/contractors for proper installation. Furthermore, while residential charging is likely to be the preferred option, it is essential to have EVSE at commercial and public sites to facilitate extended EV driving ranges and ensure convenience. Therefore, all installations should adhere to common industry practice and comply with existing Electricity Supply Industry (ESI) regulations.

Considering the above, this framework introduces basic principles and requirements for installing and operating EVSE. It also serves as an informative resource for stakeholders within the Namibian ESI. Where required, this document should be read with prescribed existing ESI regulations and international standards.

1.2. OBJECTIVES

The goal of this framework is to establish basic principles and minimum regulatory requirements that govern the ownership, installation, and management of EV charging infrastructure in Namibia.

Specifically, the focus areas of the framework are:

a) To establish basic principles of charging an Electric Vehicle (EV);
b) To specify conditions to install and operate one or more Electrical Vehicle Supply Equipment (EVSE);
c) To specify conditions to connect the EVSE to an electrical supply;
d) To provide guidance to EVSE operators to effectively plan and operate publicly operated EVSE;
e) To establish mechanisms for pricing the EV charging service;
f) To provide minimum requirements for managing power quality of supply at EV charging points;
g) To recommend relevant international EV standards for local ESI adoption; and
h) To sets out the role and responsibilities of key players involved in the charging of an EV.

1.3. SCOPE

1.3.1. INCLUSIONS

The provisions of this regulatory framework are applicable to:

a) Both AC and DC EVSE, with a rated supply voltage of up to 1 000 V AC or up to 1 500 V DC and a rated output voltage of up to 1 000 V AC or up to 1 500 V DC.
b) Charging equipment for recharging electric vehicles, including Battery Electric Vehicles (BEV) and Plug-in Hybrid Electric Vehicles (PHEV).
c) Both on-board and off-board EV charging equipment.
d) EV charging points with an output power above the standard household socket-outlet of 16 A, 230 V AC (about 3.7 kW).

1.3.2. EXCLUSIONS

The regulatory framework is not applicable to:

a) Other electric vehicle than fully or partially battery electric vehicle that needs to be charged directly by the grid, for example, hydrogen-powered fuel cell vehicles.
b) Electric vehicles themselves, including their design, construction, operation, maintenance, and safety measures.
c) All components outside the EVSE, including batteries in the EVs and energy storage components supporting the EVs charging infrastructure (e.g. those that are part of the PV system).
d) Maintenance of the components and equipment forming the EVs charging infrastructure.
e) Battery swapping.
f) The specific methods and techniques used in demand/load management of EVSEs.

Note to entry (b): EV manufacturers are required to adhere to safe engineering practices and stringent international standards governing EVs manufacturing. EV owners and drivers are responsible to adhere to their vehicle's manufacturer's instruction regarding safe operation and maintenance.

Note to entry (d): EVs charging infrastructure should be considered as any other electrical installation and should be maintained and operated according to the manufacturer's instructions and existing industry practices.

2. NORMATIVE REFERENCES

Where required, this document should be read with regulatory instruments listed below. For dated references, only the cited edition applies. For undated references, the latest edition, including any amendments, shall apply.

2.1.1. NAMIBIAN REFERENCED REGULATORY INSTRUMENTS

a) The Electricity Act 2007 (Act No.4 of 2007)

b) The Distribution Grid Code, 2018

c) Namibia Electricity Safety Code (NESC), 2009

d) The Net Metering Rules

e) The Technical Rules

f) The Economic Rules

g) The Draft Embedded Generation Standards

h) The Draft Connection Code

i) The Rules Relating to Redistribution and Resale of Electricity

j) The National Connection Charge Policy

k) The Namibian Electrical Installation Regulations, 2021

l) The Namibian Occupational Health and Safety (Act No. 11 of 2007)

m) Rules Relating to Redistribution and Resale of Electricity, 2021

n) NAMS/ESI 002: Ed. 1.0 04-2021: Namibia Electricity Supply Industry: Distribution Infrastructure Standards

o) NAMS/ESI 01:04-2021: Namibia Electricity Supply Industry: Quality of Supply Standard (QoSS)

p) NAMS/ESI LVEIWS 001: Ed 1.0 04-2021: Namibia Electricity Supply Industry: Low Voltage Electrical Installation Wiring Standard (LVEIWS)

Note to entry (g) and (h): These regulations are still in draft format and subject to change. When gazetted, the latest edition shall apply.
Note to entry (j): The National Connection Charge Policy (NCCP) is under review, with the aim of converting it to a code, and therefore subject to change. When the revision is enacted, it shall replace the current NCCP and therefore takes precedence.

2.1.2. INTERNATIONAL REFERENCED STANDARDS

a)	IEC 61851:	- Electric vehicle conductive charging system.
b)	IEC 62196:	- Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles.
c)	IEC 60364-7-722:2018:	- Low-voltage electrical installations - Requirements for special installations or locations - Supplies for electric vehicles.
d)	IEEE 1547:2018:	- IEEE standard for interconnection and interoperability of distributed energy resources with associated electric power systems interfaces.
e)	SAE J2894/1_201901	- Power Quality Requirements for Plug-In Electric Vehicle Chargers
f)	NRS 048-2-1:2007:	- Voltage characteristics, compatibility levels, limits, and assessment methods.
g)	IEC TS 62898-1: 2017/AMD1: 2023	- Microgrids – Part 1: Guidelines for microgrid project planning and specification

3. TERMS AND DEFINITIONS

For the purpose of this document, the following terms and definitions apply. In addition, a word, or an expression to which a meaning has been assigned in the Electricity Act No.4 of 2007 has that meaning unless the context otherwise indicates.

Note 1 to entry: Where the terms "voltage" and "current" are used, they imply root mean square (RMS) values, unless otherwise specified.

3.1. **ad hoc price** means the price charged by the operator of a public charging point to an end user for recharging an electric vehicle (EV) on an ad hoc basis (i.e. without prior contractual agreement).

3.2. **authorised** means authorised by the relevant Regulatory Body.

3.3. **battery electric vehicle (BEV)** means an electric vehicle that runs exclusively on the electric motor with no secondary source of propulsion.

3.4. **bi-directional charging** means a smart recharging operation where the direction of the electricity flow can be reversed, allowing electricity flow from the battery to the charging point it is connected to (e.g. in the case of vehicle-to-grid (V2G) technology).

3.5. **cable assembly** means a flexible cable or cord fitted with a standard plug or EV plug and/or a vehicle connector that is used to establish the connection between the EV and the supply network or an EV charging station.

Note 1 to entry: A cable assembly can be detachable or be a part of the EV or part of the EV charging station.
Note 2 to entry: A cable assembly can include one or more cables, with or without a fixed jacket, which can be in a flexible tube, conduit or wire way.

3.6. **certificate of compliance (CoC)** means a certificate that is issued by a registered and competent person in respect of a successful electrical installation or part of an electrical installation, in accordance with the NAMS/ESI LVEIWS 001: Ed 1.0 04-2021 and the Namibian Electrical Installation Regulations, 2021: Section 11 or equivalent recognised regulation such as SANS 10142.

3.7. **CHAdeMO** means a charging protocol and associated connector standard primarily used to deliver high-power direct current (DC) to enable rapid charging for compatible electric vehicles. This standard was developed by the CHAdeMO Association in Japan, and it is characterised by its distinctive connector design, featuring large pins and a locking mechanism.

3.8. **charge point operator (CPO)** means a legal entity that provides EV charging services to EV end-users through public charging points, usually in exchange for a fee. The CPO is usually responsible for the installation, operation, and management of one or more public charging points.

3.9. **charging** means all functions necessary to condition voltage and/or current provided by the alterative current (AC) or direct current (DC) supply network to ensure the supply of electric energy to the recharge an EV.

3.10. **charging mode** means a method for connection of an EV to the supply network to supply energy to the vehicle.

3.11. **charging point** means a supply interface that can be used to recharge one EV at a time.

3.12. **charging pool** means one or more charging stations at a specific location.

3.13. **charging station** means a stand-alone or wall-mounted charging unit, consisting of one or more charging points, used to recharge a compatible EV. The charging station is typically designed to provide functionalities such as verification of connection with the EV, continuous monitoring of protective conductor, energisation, and de-energisation of the supply, and determining the EV battery charging rate.

a. AC EV charging station means an EV charging station that supplies alternating current to an EV.
b. DC EV charging station means an EV charging station that supplies direct current to an EV.

3.14. **competent person** means a person certified in writing by an approved competent authority as having sufficient knowledge and skills of the NAMS/ESI LVEIWS 001: Ed 1.0 04-2021, and the Namibian Electrical Installation Regulations, or equivalent regulations recognised by the Distribution Licensee and accepted by the Board (e.g. SANS 10142), and who is deemed competent to perform low voltage electrical installation, testing, inspection, and issuing of certificate of compliance (CoC). Electrical contractors registered with various Distribution Licensee to perform low voltage electrical installations are also considered competent to perform EVSE installations, testing, and inspection, as determined by their level of certification.

3.15. **connector** means the physical interface between the charging point and the EV through which the electric energy is exchanged.

3.16. **contract-based payment** means a payment for a charging service from the end user to a CPO or a mobility service provider (MSP) based on a contract concluded between the end user and the CPO/MSP.

3.17. **control pilot circuit** means circuit designed for the transmission of signals or communication between the EV and the EV supply equipment.
Note 1: for Mode 2 the control pilot circuit is between the EV and the ICCB or IC-CPD.

3.18. **control pilot conductor** means an insulated conductor incorporated in a cable assembly, which, together with the protective conductor, is part of the control pilot circuit.

3.19. **digitally-connected charging point** means a charging point that can send and receive information in real time, communicate bi-directionally with the electricity grid and the electric vehicle, and that can be remotely monitored and controlled, including to start and stop the recharging session and to measure electricity flows.

3.20. **distribution licensee** means an entity licensed to supply electricity to end consumers. In this context they may include Regional Electricity Distributors (REDs), municipalities, local authorities, and energy suppliers undertaking redistribution of electricity, and responsible for the planning, operation, and optimisation of their electric energy distribution system.

3.21. **distribution** means the conveyance of electricity by means of a distribution system, which consists wholly or mainly of medium and low voltage networks, to a customer.

3.22. **distribution network** means the network owned and operated by a distribution licensee (DSO).

3.23. **earth leakage current** means the current that flows to earth in an electrically undamaged circuit.

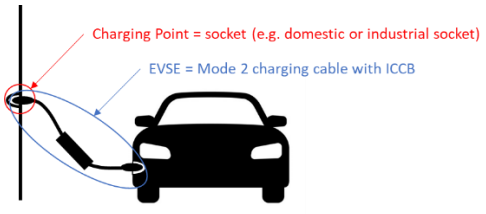
3.24. **earth leakage protection** means form of protection in which an earth leakage unit is used.

3.25. **earth leakage Unit (EL)** means device that can detect the flow of a specified or predetermined current from a circuit to earth and of disconnecting, automatically and reliably, the affected circuit within a specified time when such current exceeds the specified or pre-determined value.

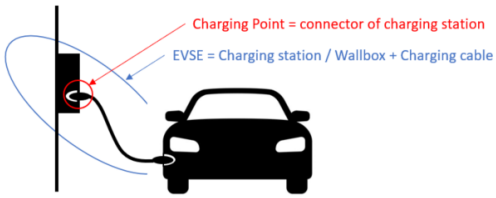
3.26. **electric vehicle (EV)** means any vehicle that runs on an electric motor, either exclusively or in combination with another source of propulsion system, intended primarily for use on public roads.
Note 1 to entry: In this document, these terms refer only to those vehicles that can be charged from an external electrical source.

3.27. **electric vehicle supply equipment (EVSE)** means a combination of all equipment, providing dedicated functions to transfer electric energy from the source of electricity supply to the electric vehicle for the purpose of charging. A Mode-2 charging cable is technically an EVSE.

a. AC EVSE means an EV supply equipment that supplies alternating current to an EV.
b. DC EVSE means an EV supply equipment that supplies direct current to an EV.



Mode 2 Charging



Mode 3 / Mode 4 Charging

3.28. **electrical installation** means the entire electrical installation on a customer's premises, including all material, equipment, and appliances used or intended to be used for or in connection with the provision of electricity from a point of control to a point of consumption, by definition includes only up to the supply terminal of appliances (i.e. EVSE) anywhere on the premises.

3.29. **end user** means a person who receives electricity from a CPO for the purpose of recharging an electric vehicle (e.g. an EV end user or EV driver).

3.30. **e-roaming or roaming** means the exchange of data and payments between the operator of a charging point and a mobility service provider from which an end user purchases a charging service.

3.31. **e-roaming platform** means a platform connecting market actors, notably mobility service providers and operators of recharging points, to enable the provision of services between them, including e-roaming.

3.32. **EV charging infrastructure** means a network of physical components and technologies collectively designed to facilitate the recharging of electric vehicles.

3.33. **EV charging system** means complete system including the EV supply equipment and the EV functions that are required to supply electric energy to an EV for the purpose of charging.

3.34. **EV grid integration** means direct or indirect integration of electric vehicles into an existing electrical grid infrastructure to deliver energy from the EV back into the grid.

3.35. **EV owner** means party who will specify, use and/or operate the EV supply equipment, or someone acting on their behalf.

3.36. **EV plug** means specific plug intended to be used as part of EV supply equipment.
EXAMPLE: the plugs defined in the IEC 62196 series.

3.37. **EV socket-outlet** means specific power outlet intended to be used as part of EV supply equipment.
EXAMPLE: the socket-outlet defined in the IEC 62196 series.

3.38. **EV end user or EV driver** is an individual or entity who directly utilises an electric vehicle for transportation purposes, and may require to a charging service from time to time.

3.39. **in-cable control box (ICCB)** means device incorporated in the Mode 2 cable assembly, which performs control functions and safety functions.

3.40. **in-cable control-and protection device (IC-CPD)** means Mode 2 cable assembly that complies with IEC 62752.

3.41. **installation electrician** means a person who has been registered as an installation electrician in terms of the NAMS/ESI LVEIWS 001: Ed 1.0 04-2021 standard or equivalent regulations accepted by the Distribution Licensee, for the verification, testing, and inspection of electrical installation work, including installations of different EVSEs.

3.42. **isolation** means a function intended to de-energise, for reasons of safety, all or a discrete section of the electrical installation by separating the electrical installation or section from every source of electric energy.

3.43. **leakage current** means electric current in an unwanted conductive path under normal operating conditions.

3.44. **local authority** represents the Distribution Licensee, energy supplier, municipality or town council overseeing the distribution network where the off-grid EVSE is installed.

3.45. **mobility service provider (MSP)**, also known as an e-mobility service provider (eMSP) means a legal entity that provides services, in return for remuneration, to an end user, including the selling of charging services.

3.46. **plug-in hybrid vehicle (PHEV)** means an electric vehicle with a conventional internal combustion engine combined with an electric propulsion system which can be recharged from an external electric power source.

3.47. **power output** means the theoretical maximum power, expressed in kW, that a charging point, station or pool, or a shore-side electricity supply installation can provide to vehicles or vessels connected to that charging point, station, pool, or installation.

3.48. **premises** means place such as a site, building or structure, whether stationary or mobile, that can be electrically wired.

3.49. **private charging point** means a charging point which is located at a site or premises that is limited to a certain end-user group such as occupants of a residential premises, workplaces, or a hotel facility.

3.50. **protective conductor** means conductor provided for purposes of safety, for example protection against electric shock.

EXAMPLE: Examples of a protective conductor include a protective bonding conductor, protective earthing conductor and an earthing conductor when used for protection against electric shock.

3.51. **protective device** means unit that comprises of one or more fuses or circuit-breakers.

3.52. **public charging point** means a charging point which is located at a site or premises that are open for EV recharging by the general public, irrespective of whether the charging point is located on public or private property. For example, EV charging points located at shopping malls, along the highways, and installed at existing fuels service stations.

3.53. **quick Response code' (QR code)** means an ISO/IEC 18004:2015-compliant encoding and visualisation of data.

3.54. **recharge on an ad hoc basis** means a charging service purchased by an end user without the need for that end user to register, conclude a written agreement or enter into a commercial relationship with the operator of that charging point that goes beyond the mere purchase of the charging service.

3.55. **rechargeable energy storage system (RESS)** means a system that stores energy for delivery of electric energy, and which is rechargeable.

3.56. **charging service** means the activity or process of recharging an electric vehicle. For instance, many mobility service providers offer mobile apps that allow users to find charging stations, register, recharge, and pay for the service.

3.57. **recharging session** means the full process of recharging a vehicle at a public charging point from the moment the vehicle is connected to the moment the vehicle is disconnected.

3.58. **redistributor** means a registered business entity or non-profit organisation undertaking redistribution of electricity.

3.59. **registered person** means a person registered in terms of the NAMS/ESI LVEIWS 001: Ed 1.0 04-2021 or Electrical Installation Regulations, as an installation electrician, an electrical tester for single phase, , or a master installation electrician, as the case may be.

3.60. **residual current device (RCD)** means a mechanical switching device designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the residual current attains a given value under specified conditions.

Note 1 to entry: A residual current device can be a combination of various separate elements designed to detect and evaluate the residual current and to make and break current.

3.61. **smart recharging** means a recharging session in which the intensity of electricity delivered to the battery is adjusted in real-time, based on information received through electronic communication.

3.62. **socket-outlet** means an accessory having socket-contacts designed to engage with the contacts of a plug and having terminals for the connection of cables or cords.

3.63. **standard plug and socket-outlet** means a plug and socket-outlet which meets the requirements of any IEC and/or any national standard that provides interchangeability by standard sheets, excluding the specific EV accessories as defined in the IEC 62196 series.

3.64. **supply network** means any source of electric energy (e.g. mains or electric grid, distributed energy resources (DER), battery bank, PV installation, generator, etc.).

3.65. **the Board** means the Electricity Control Board.

3.66. **vehicle connector** means an electric vehicle connector part of a vehicle coupler integral with or intended to be attached to the cable assembly.

3.67. **vehicle inlet** means an electric vehicle inlet part of a vehicle coupler incorporated in or fixed to the electric vehicle.

4. TECHNOLOGICAL CONSIDERATIONS REQUIREMENTS

4.1. EV CHARGING ECOSYSTEM

The EV charging ecosystem consists of interconnected entities which play different roles in providing EV charging services. It includes everything from energy supply to the EV that consumes the produced energy. Within this ecosystem lies the charging infrastructure, comprising of charging stations, cables, connectors, accessories, the people, and companies involved in EV recharging and the communication protocols that connects them all. Together, these components form a dynamic ecosystem that continually adapts to emerging technologies and business models. Modern EV charging stations integrates renewable energy sources, advanced technologies like Internet-of-Things (IoT) and cloud connectivity, and supports Vehicle-to-Grid (V2G) applications for smart grid management.

As illustrated in Figure 1, the EV charging ecosystem usually involves seven (7) distinct entities with specific roles, as described below. Generally, when the CPO also acts as an eMSP/MSP and EVSE Owner at the same time, the Roaming Hub is not needed.

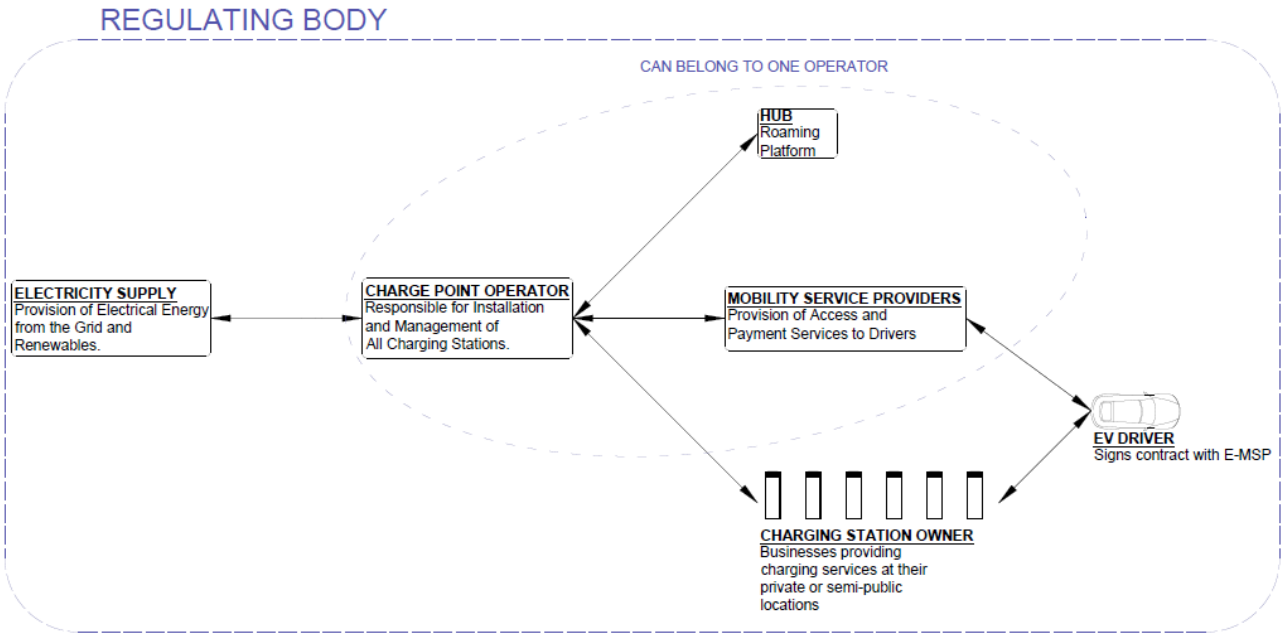


Figure 1: Main actors of the EV charging ecosystem.

Functions of distinct actors of the EV charging ecosystem:

a) **Energy Supply:** This refers to utilities and distribution licensees that supply electricity to power EVSE and manage the energy demand associated with charging infrastructure.

b) **Charge Point Operators (CPOs):** This refers to entities who are responsible for installing, operating, and maintaining publicly accessible charging stations, enabling EV users to recharge their vehicles. The CPO determines the price for charging services at its charging stations towards end customers and the eMSP.

c) **E-Mobility Service Provider (eMSPs):** Also known as MPS, refers to entities that make it easy for people to charge their EVs by offering comprehensive services that enable users to conveniently use different charging stations operated by different CPOs. Their services include issuing charging cards, offering apps for locating and navigating to charging points, managing, and expanding roaming networks, handling billing and invoicing, customer management and setting pricing for recharging sessions towards their end customers.

d) **Roaming Hub:** This refers to entities that enable seamless access to charging infrastructure by enabling interoperability between different CPOs.

e) **EVSE/Charging Station Owner:** This refers to individuals and businesses who purchase and install EVSE for private and/or commercial use.

f) **EV Driver:** This refers to individuals who use electric vehicles for different needs.

g) **Regulating Body:** This refers to a statutory regulatory body, in this case, the Electricity Control Board (ECB), who formulate and enforce regulations governing the EV charging infrastructure.

4.2. REQUIREMENTS FOR THE CHARGE POINT OPERATOR (CPO)

In this document, it is assumed that the CPO can include the roles of the eMSP/MSP, and EVSE owner. It is further assumed that the CPO is a business entity that provides EV charging services through public charging points, in exchange for a fee. Therefore, individuals or organisations interested in becoming CPOs should consider the following requirements:

a) **Legal entity:** The CPO shall be a legally recognised non-profit or business entity such as a corporation, partnership, public company, or sole proprietorship.

b) **Infrastructure:** The CPO should have access to the necessary infrastructure to install, operate and maintain public EV charging points. This may involve securing suitable locations, obtaining permits for installation, and ensuring reliable power supply.

c) **Registration:** The CPO shall obtain permission and register with the Distribution Licensee, within their area of operation, prior to installing and operating public charging points.

d) **Permits:** Where necessary, CPOs may need to obtain permit from relevant Authorities such as a local municipality or town council, to be able to install and operate charging points for street charging.

e) **Network connectivity:** CPOs may need to establish network connectivity for their charging stations to manage operations, monitor usage and provide payment processing capabilities.

f) **Payment systems:** CPOs may need to implement payment systems to enable users to pay for charging services. This may involve setting up billing systems, accepting various payment methods, and complying with regulations related to pricing transparency.

g) **Accessibility:** Charging stations must be accessible to the public or to specific user groups, depending on the CPO's business model and any applicable regulations.

h) **Insurance:** CPOs may need to obtain liability insurance to protect against potential accidents or damages associated with operating charging stations.

i) **Interoperability:** CPOs shall ensure interoperability between their charging stations and those operated by other CPOs, enabling EV drivers to use different networks seamlessly.

j) **Environmental considerations:** CPOs may need to adhere to environmental standards and regulations and implement measures to minimise the environmental impact of their operations (e.g. when excavation is required to setup charging stations).

k) **Compliance:** CPOs must comply with all relevant laws, regulations, and standards governing EV charging infrastructure, including safety, accessibility, and environmental regulations.

4.3. TYPES OF ELECTRIC VEHICLES

An electric vehicle (EV) refers to types of automobiles powered by electric motors and associated power electronics, which rely fully or partially on electrical energy stored in rechargeable batteries. Periodic recharging of batteries necessitates connection to an electrical supply through an on-board or off-board charging system.

In this document, two types of EVs are considered, namely, the Battery Electric Vehicle (BEV) and the Plug-in Hybrid Electric Vehicles (PHEV). The EVs basic structure are illustrated in Figure 2 and compared in Table 1.

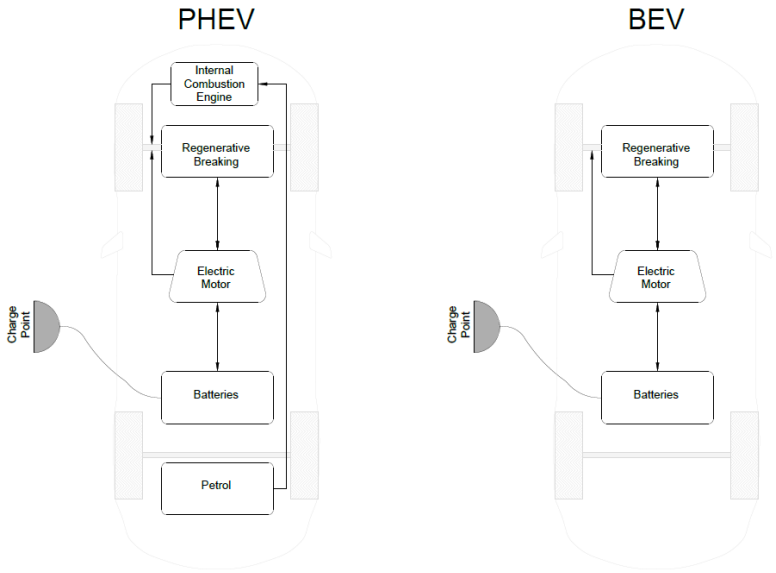


Figure 2: Essential components of PHEV and BEV.

Table 1: Comparing BEV and PHEV.

Criteria	Battery Electric Vehicle (BEV)	Plug-in Hybrid Electric Vehicle (PHEV)
Source of energy	Battery	Battery & Fossil fuel
Powertrain drive	Electric motor	Electric motor & ICE
Requires external source for batteries recharging?	Yes, plugged-in	Yes, plugged-in
Battery capacity	Large-capacity	Medium-capacity

4.4. EV CHARGING EQUIPMENT

EV recharging occurs via an electric vehicle supply equipment (EVSE), which is commonly referred to as charging stations. Technically, an EVSE encompasses a charger with one or more charging points, charging cables and connectors, a display screen, and a series of coloured lights to indicate charging status. Additionally, it may include an electronic payment system, an energy meter and internet or wireless communication capabilities.

This document focuses on conductive charging, which can be broadly classified into on-board charging and off-board charging, as illustrated in Figure 3. On-board chargers are integrated within the EV and responsible for converting AC power from the electrical socket-outlet into DC power in order to charge the EV battery. Conversely, off-board chargers internally convert AC power to DC power and then deliver it to the vehicle to charge the battery directly.

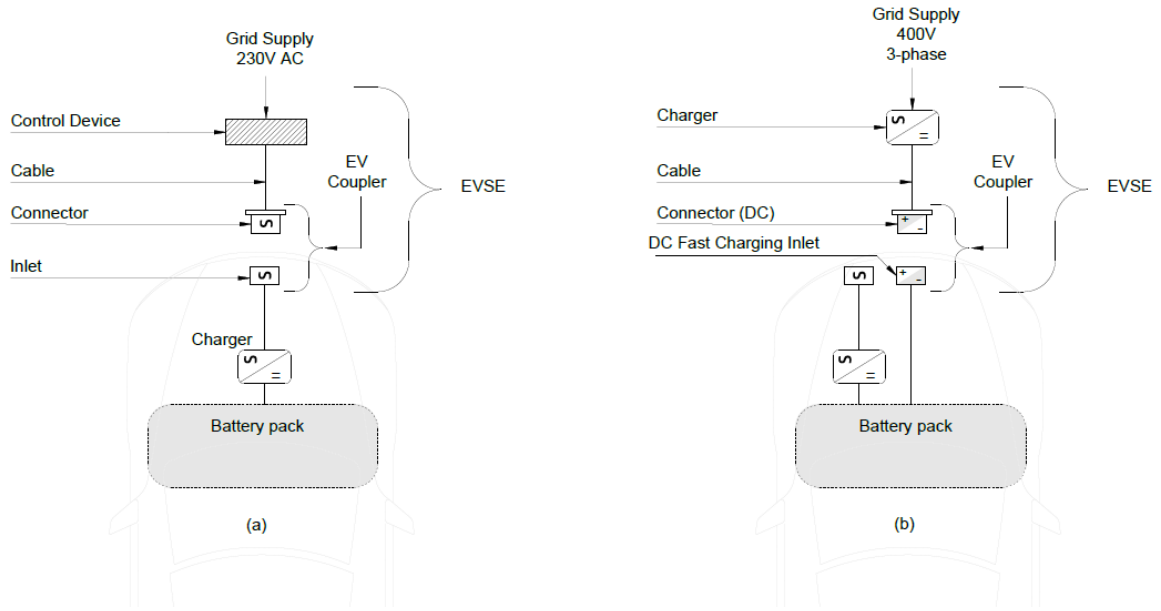


Figure 3: (a) On-board EV charging and (b) off-board EV charging.

4.5. EV CHARGING MODES

A charging mode refers to a method of connecting an EV to the supply network to transfer energy to the vehicle's battery storage. This document prescribes four charging modes, described by the IEC 61851, which specifies the requirements for EV conductive charging systems.

a) **Mode-1:** This refers to the basic level of charging where the EV is connected directly to a standard household power socket outlet. The outlet typically supply power at 230 V AC with a maximum current rating of 16 A, resulting in a power output of approximately 3.7 kilowatts (kW). Mode 1 is commonly used for topping up the vehicle's battery over an extended period, such as overnight charging or when faster charging options, such as public charging stations are not available.

   For this mode, an EVSE is made up of the charging cable and the socket outlet (which becomes the charging point), as illustrated in Figure 4. Since the charging cable lacks built-in safety features and control mechanisms, this type of charging increases the risk of electrical hazards, such as overheating, short circuits, or electrical fires, and it is usually not recommended.

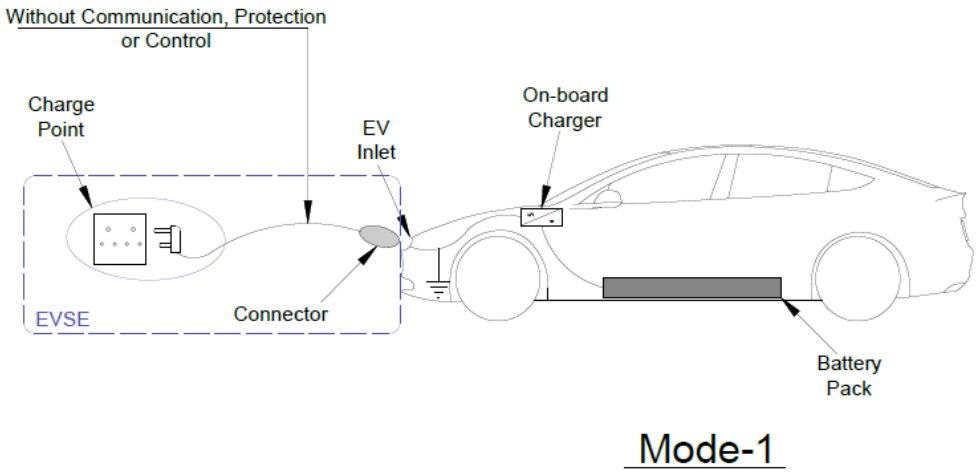


Figure 4: Mode-1 charging.

b) **Mode-2:** Similar to Mode-1, this type of charging involves connecting the EV to a standard household or industrial power socket outlet, but using a portable charging cable with an integrated control and safety mechanism. For a single-phase outlet supplying power of 230 volts AC at a maximum current rating of 16 amps, the resulting power output is approximately 3.7 kilowatts (kW). For a three-phase outlet supplying power of 230 volts AC at a maximum current rating of 32 amps, the resulting power output is approximately 22 kilowatts (kW).

Mode 2 is commonly used for home charging when dedicated charging stations are not available or for occasional charging needs while traveling. The In-Cable Communication and Protection Device (IC-CPD) or In-Cable Control Box (ICCB) in the charging cables help manage the charging process and provide additional protection against potential electrical hazards. An EVSE in this mode is made up of the charging point (socket) and the charging cable with ICCB or IC-CPD.

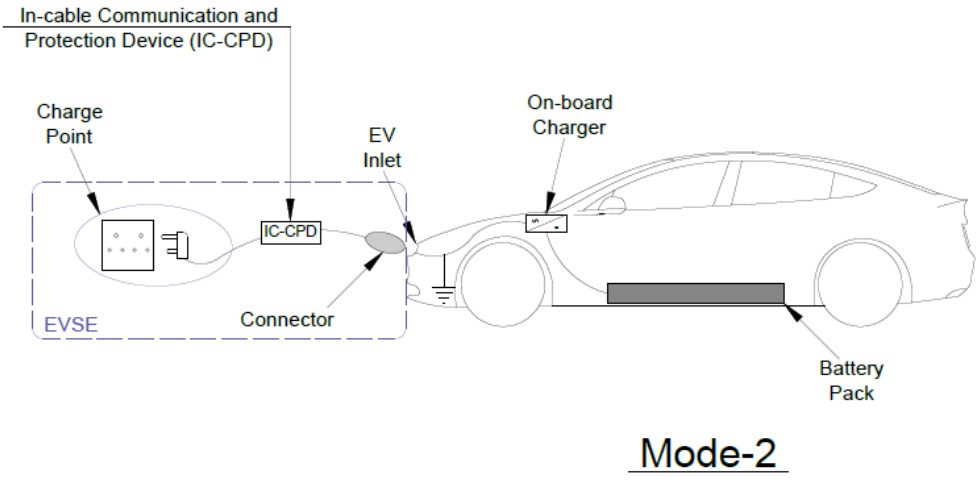


Figure 5: Mode-2 charging.

c) **Mode-3:** This type of charging utilises an on-board charger to supply AC current to an EV through a dedicated stand-alone fixture or wall mounted charging station, equipped with one or more charging points. The charging stations can vary in power output, with options ranging from 3.7 kW to around 22 kW. The charging cable allows communication between the charging station and the EV's on-board charger, providing functionalities such as verification of connection with the EV, continuous monitoring of protective conductor, energisation and de-energisation of the supply and determining the charging rate. Mode-3 charging is suitable home charging (wall-box), workplace charging and any other use case where the vehicle can charge for several hours. Mode-3 charging utilises standardised connectors, such as Type 2 which ensure compatibility between the charging station and the EV, and therefore allows for interoperability and ease of use across different EV models. The charging station, charging points and charging cables makes up an EVSE.

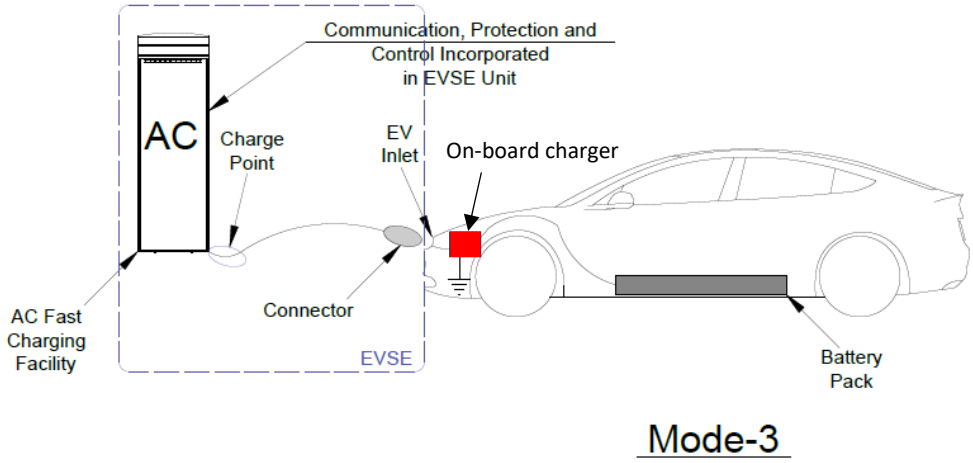


Figure 6: Mode-3 charging.

d) **Mode-4:** Also known as DC fast charging, utilises an off-board charger to supply DC current directly to the EV battery. Like in Mode-3, the charging equipment usually takes the form of either charging posts or wall-mounted units. In Mode-4, the off-board charger within the charging station converts the AC supply to DC supply, which directly charges the EV battery. Due to their high-power requirements (usually above 50 kW), such charging equipment are not suitable for domestic installations and thus solely used for public charging requiring rapid charging. Their installation usually requires high-power electrical infrastructure capable of providing the required voltage and current capacity to enable fast charging.

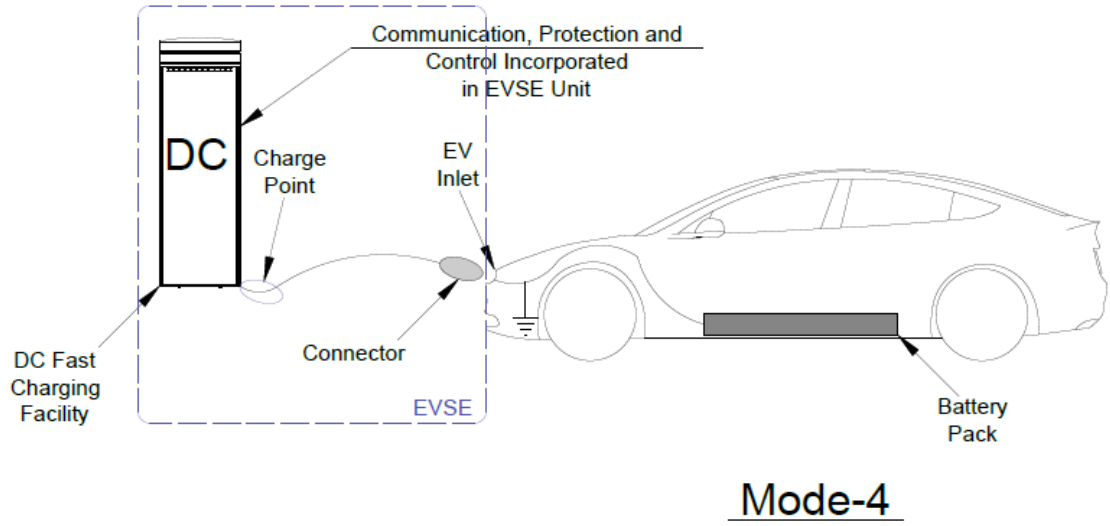
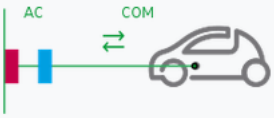
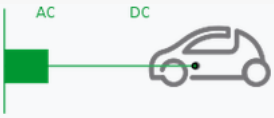


Figure 7: Mode-4 charging.

A summary of the described charging modes is given in Table 2.

Table 2: Charging modes prescribed by IEC 61851-1.

Mode	Diagram	Limits				Supply & Interface	Application
		Phases	Current	Voltage	Power		
1	 EV connected directly to AC grid	1ϕ 3 ϕ	16 A 16 A	230 V 400 V	≈ 3.7 kW ≈ 11 kW or ≈ 22 kW	AC, dedicated (household socket)	- Slow AC charging - Suitable for electric bikes & scooters
2	 EV connected to AC grid through cable incorporating RCD protection	1ϕ 3 ϕ	16 A 32 A	230 V 400 V	≈ 3.7 kW ≈ 22 kW	AC, dedicated (household socket)	- Slow AC charging - Suitable for private AC charger installation.
3	 EVSE connected to AC grid, supplies EV using tethered cable or socket-outlet with bidirectional communication	1ϕ 3 ϕ	32 A 32 A	230 V 400 V	≈ 7 kW ≈ 22 kW	AC, dedicated (IEC 62196 Type 2, CCS connector)	- Slow and fast AC charging - Suitable for public AC charger installation.
4	 EVSE rectifies AC grid & supplies DC power to EV using tethered cable with bidirectional communication	-	> 50 A	200 V – 1000 V	50 kW – 350 kW	DC, dedicated (IEC 62196 Type 2, CCS, or CHAdeMO connector))	- Fast DC charging - Suitable for public DC charger installation.

Note 1: 1ϕ – single-phase supply.
Note 2: 3 ϕ – three-phase supply.
Note 3: Dedicated means the EVSE shall be supplied by a dedicated circuit that supplies no other loads.
Source: Table adapted from [1]

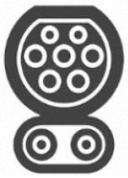
[1] https://en.wikipedia.org/wiki/IEC_61851

4.6. EV CHARGING CONNECTORS

This document supports the use of charging connectors and inlets prescribed by any of these standards: IEC 62196 (Type-2), Combined Charging System 2 (CCS2) and CHAdeMO. The three standards are briefly described below, and the respective connectors are shown in Table 3.

- **IEC 62196** defines the fundamental requirements for plugs, socket-outlets, vehicle connectors, vehicle inlets and cable assemblies intended for use in the conductive charging of EVs in accordance with IEC 61851.
- **CCS2** builds upon the IEC 62196 by integrating additional features tailored for high-power DC fast charging and advanced communication protocols aimed at providing a unified charging solution for EVs. CCS2 includes communication protocols for bidirectional power transfer enabling features like Vehicle-to-Grid (V2G) and smart charging capabilities.
- **CHAdeMO** is a Japanese fast-charging protocol and connector standard primarily used for EVs high-power DC charging. It features a unique connector design and communication protocol facilitating interoperability among charging stations and EVs equipped with CHAdeMO-compatible charging ports.

Table 3: Charging connectors and inlets, in accordance with IEC 62196, CCS2 and CHAdeMO standards.

Standard	Use	Connector
IEC 62196 (Type-2)	Can support AC charging (<= 22 kW). Widely used in Europe, Africa, and Asia.	
Combined Charging System 2 (CCS2)	Can support EV charging through either AC charging using IEC 62196 Type 2 connector or through fast DC charging. CCS2 is becoming the most widely used connector, globally.	
CHAdeMO	Used exclusively for fast DC charging. Widely used in Japan and Africa (mainly for older EV models).	

4.7. EV GRID INTEGRATION

4.7.1. GRID IMPACT

When an EV is drawing power directly or indirectly from the grid, it should be treated as a normal residential or industrial electric load, depending on the applicable charging mode. However, when an EV is required to supply power back to the grid, as employed by V2G technologies, it functions as a Distributed Energy Resource (DER). Since there are no standards yet established for V2Gx, the grid interconnection standards and regulations established for DERs, and embedded generations (EGs) extend to EVs. In the case when an EV act as a DER, and in the absence of a gazetted Namibian standard on EGs, use of international standards such as IEEE 1547, IEC 61727 or VDE-AR-N 4105 should be employed.

Increase in EV charging and discharging may cause operational challenges when EVs integrates with the grid, directly or through respective charging stations. For instance, distribution feeders are typically designed based on residential loads, so integrating EV charging—potentially doubling each household's power demand—could considerably strain the distribution system. With unregulated basic charging methods, the distribution network could face congestion problems, increased losses, and potential voltage or power quality issues, especially with higher EV adoption rates. Therefore, unless specifically stated in this framework, existing Namibian regulations established in dealing with grid impacts affecting the capacity limits of different grid components, and those affecting the power quality for end users or the grid, should apply.

4.7.2. DEMAND MANAGEMENT

Demand management in EV charging refers to strategies and technologies used to optimise the use of electrical grid resources and EV charging infrastructure. As EV adoption continues to grow, managing the impact of charging on the grid becomes increasingly important to ensure reliability, stability, and cost-effectiveness of electricity supply. Methods and strategies employed in demand management ranges from peak shaving, load balancing, demand response programs, integrating renewable energy and energy storage systems, and optimisation efforts aimed at enhancing the overall efficiency of EV charging infrastructure.

Since demand management is often considered an activity occurring “behind the meter”, the approaches and techniques used should be determined by the consumer or stipulated in the agreement between the consumer and the Distribution Licensee.

4.7.3. VEHICLE-TO-GRID (V2G) TECHNOLOGY

Vehicle-to-Grid (V2G) technology is a pioneering innovation in the realm of EVs and energy management, enabling EVs to both draw power from the grid for charging and return electricity back to the grid when needed. This bidirectional energy flow transforms EVs into distributed energy resources, capable of supporting grid stability by supplying surplus energy stored in their batteries during peak demand periods. This capability not only enhances grid reliability and resilience but also facilitates the integration of renewable energy sources by storing excess renewable energy in EV batteries and dispatching it back to the grid when required.

Different types of V2G technologies include:

- **Unidirectional V2G (V1G)**: This type allows EVs to charge from the grid and discharge power back to the grid, in a unidirectional manner. Essentially, alternating between grid-to-vehicle (G2V) and vehicle-to-grid (V2G) flow, as needed.
- **Bidirectional V2G (V2G):** This is the most advanced form of V2G, where electric vehicles are equipped with bidirectional charging technology, thereby allowing EVs to charge from the grid and to discharge electricity back to the grid at times of high demand or to provide ancillary services.
- **Vehicle-to-Home (V2H):** While not strictly V2G, V2H allows EVs to power homes directly using their stored energy. EVs equipped with V2H capabilities can act as mobile power sources during power outages or peak demand periods, providing backup electricity to homes
- **Vehicle-to-Building (V2B):** Similar to V2H, V2B involves using EVs to supply power to buildings or commercial facilities.
- **Vehicle-to-Grid-to-Vehicle (V2G2V):** This concept enables EVs to supply electricity to the grid and allow for direct sharing of energy between multiple EVs.

Generally, V2G systems could offer financial incentives to EV owners and operators, enabling them to earn money from stored energy, offset electricity costs, and potentially generate extra income by participating in demand response programs As EV adoption continues to rise globally, V2G is increasingly seen as a valuable tool for grid stabilisation and optimisation. Although still at an infant stage, pilot projects and commercial deployments have demonstrated V2G's potential to provide grid services such as frequency regulation, peak shaving, and demand response, thereby enhancing grid reliability and stability.

4.8. EV COMMUNICATION STANDARDS

Effective communication among various components and actors of the EV charging ecosystem is crucial for controlling and protecting EV users, EVSE, for correct billing and enabling interoperability, among others. Different communication protocols have been developed for each layer of communication, such as sharing information between EV and EVSE, EVSE and CPO, CPO and MSP, and CPO with DSO, each with its own set of functionalities. The communication protocols commonly used in communication devices and platforms between different entities of the EV ecosystem are illustrated in Figure 8. This document list standards and protocols that are widely used in the EV charging industry. Unless one is involved in manufacturing of these devices and platforms, the information given in this section is solely meant to guide CPOs and system integrators on standards and protocols currently supported by industry.

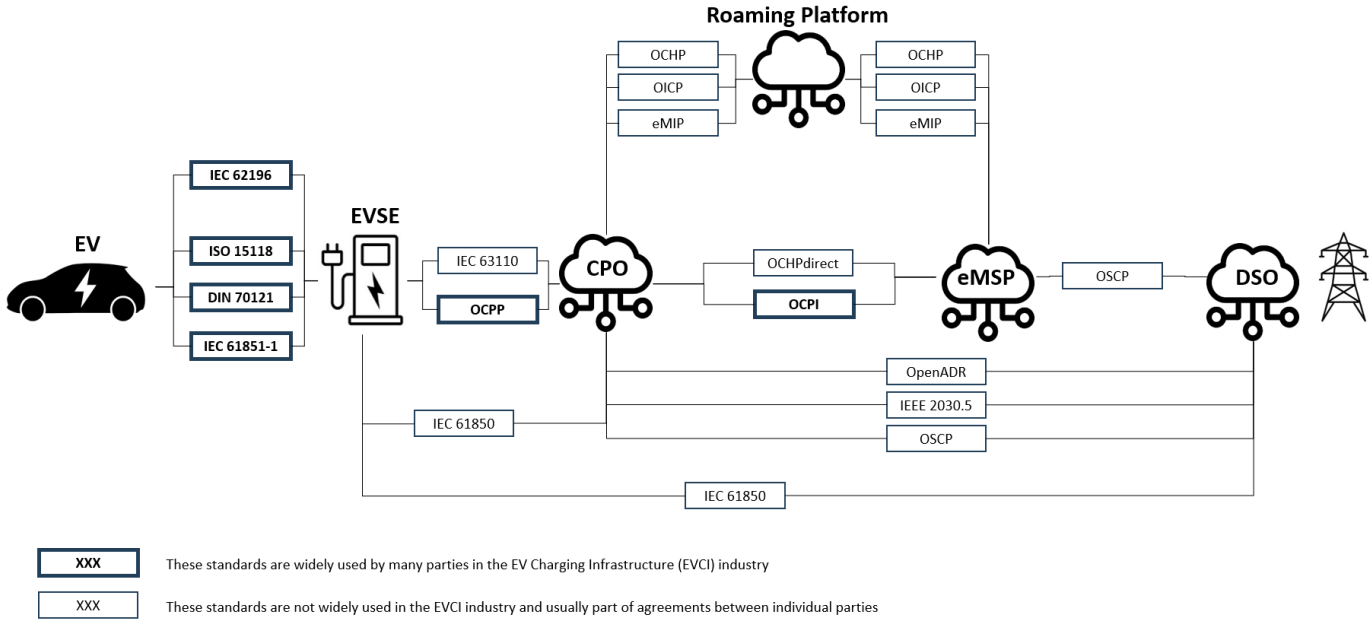


Figure 8: Communication protocols used between entities in the EV ecosystem.

5. REGULATIONS AND GOVERNANCE

Parties wishing to carry out the EV charging service(s), through one or more Electric Vehicle Supply Equipment (EVSE) installed in any premises, including residential, commercial, industrial, or public facilities, shall comply with the provisions outlined in this section.

In this section, certain provisions are included for compliance, information, or guidance. For requirements in which case the word “shall” or “must” is used, no deviation is permitted if compliance with the said regulation is to be claimed. The word “may’’ indicates a permissible action, and the word “should” indicate recommendations or guidelines only. The word “can’’ is used to indicate a possible action.

5.1. REGISTRATION, ROLES, AND RESPONSIBILITIES

5.1.1. REGISTRATION

a) Any EV charging point and EVSE installation that requires an electrical supply above the capacity of a standard household socket-outlet of 16 A, 230 V AC (about 3.7 kW) shall be registered with the respective Distribution Licensee prior to the start of any associated work or services.

NOTE to entry (a): The above requirement is meant to prevent connections of mobile Mode 2 charging cables to industrial socket-outlet rated at 32 A, 230 V AC, without informing the supplying Licensee. This is considered a high-powered load and could significantly impact the grid during peak-demand times.

b) All eligible EV charging points and EVSE installations shall be registered with the relevant Distribution Licensee using the standard form in **Annexure E**.

c) Provision of the EV charging service does not require obtaining an operating license from the Board, but any work or services related to this activity shall be registered with the respective Distribution Licensee before commencement.

d) All public charging points shall only be operated by a registered Charge Point Operators (CPO) or e-Mobility Service Provider (eMSP), irrespective of the charging mode employed.

e) The CPO or eMSP does not require an operating license from the Board, but shall be registered with the respective Distribution Licensee.

f) Registration of a CPO or eMSP shall be in two parts:

   i. The CPO or eMSP shall be a legally recognised business entity or a non-profit organisation registered in accordance with the applicable laws of Namibia.

   ii. The CPO or eMSP shall also register with the relevant Distribution Licensee, using the standard form in **Annexure E**.

   Note to entry (f), (i): As stated in 5.1.3 (b), registration of a Distribution Licensee acting as a CPO, shall be approved by the Board, by submitting the same form in **Annexure E**, and any additional information that the Board shall request.

g) The Distribution Licensee shall evaluate each application prior to registering eligible EV charging points to be installed in any premises within their area of operation (i.e. all EVSEs to be connected to their distribution network).

   i. If the premises or site has adequate electrical capacity and protection for the planned EVSE installation. The applicant needs only to submit the form in **Annexure E** and attach relevant electrical diagrams for EVSE installation (e.g. single-line electrical diagrams showing the EVSEs layout and designs), before it is registered with the Distribution Licensee.

   ii. If additional supply capacity is required, the applicant shall first apply to the relevant Distribution Licensee for the extra capacity. Since each Distribution Licenses has its unique procedure, the applicant shall familiarise himself/herself with procedures for requesting for new or additional supply capacity

   Once sufficient capacity is availed, the applicant shall then submit the form in **Annexure E** together with relevant electrical diagrams for EVSE installations, for registration with the respective Distribution Licensee.

   iii. The Distribution Licensee shall appoint a registered competent person who shall be inspect, verify, test, and certify the EVSE installation in line with NAMS/ESI LVEIWS 001: Ed 1.0 04-2021: Section 7, and the Namibian Electrical Installation Regulations, Section 9 and 11.

   Note to entry (g), (i) and (ii): The information in **Annexure E** is meant to capture all EVSEs connected to the Distribution Licensee's network. The Board reserves the rights to request such EVSE statistics from the Distribution Licensee.

h) If the EVSE owner or operator is generates their own power to supply their EV charging points, partially or fully, with on-site generation capacities up to 500 kVA, the interconnection and operation of such net-metered installation shall comply with Section 3 to 6 of the prevailing Net-Metering Rules. For on-site generation capacities exceeding 500 kVA, a generation license shall be required as guided by the Guidelines for License Applications.

i) The installation electrician and inspector overseeing any EVSE installation (for private or public use) shall be a competent person certified in accordance with NAMS/ESI LVEIWS 001: Ed 1.0 04-2021 and the Namibian Electrical Installation Regulations or equivalent regulations accepted by the respective Distribution Licensee.

5.1.2. ROLES AND RESPONSIBILITIES

a) In-line with Section 4.1, the roles and responsibilities of the core players in the EV charging ecosystems shall be as follows:

   i. The Distribution Licensee is a licensed utility or energy supplier responsible for supplying electricity to power EVSEs and manage the energy demand associated with charging infrastructure.

   ii. The Charging Point Operators (CPOs) is responsible for operating one or more public charging points. His/her role includes ownership, installation, maintenance, and operation of these charging points. The CPO determines the price for charging services at his/her charging points either directly

towards end customers via direct payment or indirectly via the eMSPs on a business-to-business basis.

iii. The e-Mobility Service Provider (eMSP) is responsible for commercial management of public charging points. He/she typically provides a comprehensive suite of charging services to customers including access to public charging stations of one or more CPO, payment services, mobile apps to find charging points, among others.

iv. The Roaming Hub serves as an intermediary connecting multiple CPOs to multiple eMSPs, and thus enabling EV end-users to use a single charge card or customer account across various CPO networks.

v. The roles of an eMSP, Roaming Hub, and CPO do not need to be carried out separately. When the CPO also acts as an eMSP, the Roaming Hub is not required.

b) The CPO should meet the criteria recommended under Section 4.2. These include, among others, access to necessary electrical infrastructure, network connectivity, payment system, accessibility, insurance, interoperability, and environmental consideration.

c) The CPO shall be responsible for the safe design, installation, maintenance, and operation of its charging points and ensuring that the uptime of their services fully meet the needs of end users.

d) The CPO shall be considered as the final consumer of the energy supplied by the Distribution Licensee. The CPO providing charging services to EV drivers shall therefore be considered as a service and not as sales of energy.

e) When a CPO engages a third party to assist in carrying out EV charging services on its behalf, such operator shall select a competent party or parties that are able to carry out this activity in accordance with applicable laws and regulations.

f) Approval granted to EVSE owners and operators to install or operate any charging point shall not constitute exemption from complying with any related laws or regulations and it is therefore their responsibility to ensure they comply with all necessary legal requirements stipulated in any relevant laws or regulations. These include, among others, environmental, health and safety regulations and approved municipal zoning requirements.

g) All parties in the EV charging ecosystem shall comply with all applicable Namibian Electricity Supply Industry (ESI) laws, regulations, technical standards and codes and any amendments to them, as well as any other relevant requirements approved by any other competent authority.

h) The Board is responsible for regulating the installation, operation, and management of all EV charging infrastructure in the country, and the energy tariff applied to the energy supplied by the Distribution Licensee for EV charging.

i) The Board shall gather and monitor EV price statistics from CPOs and eMSPs to observe the local market trend, and shall reserves the rights to specify the maximum capping on the service fee that the CPO or eMSP can charge, to protect consumers from price gouging and other unfair market practices.

5.1.3. DISTRIBUTION LICENSEES OPERATING EV CHARGING POINTS

a) Distribution Licensees are permitted to install and operate EV charging points for both private and public use. All EVSE installations shall comply with relevant safety, technical, and regulatory standards as required by non-Licensees.

b) When a Distribution Licensee wish to operate public charging points, their registration as a CPO shall be approved by the Board using the same form in **Appendix E**.

c) Distribution Licensees shall ring-fence their EV charging operations from their core electricity distribution business, ensuring that separate accounting and operational records are maintained for their EV charging infrastructure. This is to prevent cross-subsidisation and ensure a competitive market.

d) Distribution Licensees shall grant other CPOs and eMSPs fair and non-discriminatory access to their electricity grid.

e) Distribution Licensees shall declare any potential conflicts of interest between their core business and their participation in the EV charging market, to prevent possible unbiased decision-making.

5.2. PRE-INSTALLATION CONSIDERATIONS

5.2.1. SELECTION OF EVSE PRODUCTS

a) EVSE owners and operators should consult with EVSE product manufacturer's manuals/instruction for the recommended installation procedures.

b) The EVSE shall be marked with intended use (i.e. electrical vehicle charging).

c) For Mode 2 charging, preferences should be given to EVSE that employs in-built control and safety mechanism for protection against potential electrical hazards.

d) The EVSE shall be complaint with the standards adopted for the local market.

e) The EVSE and associated infrastructure should be designed to withstand extreme weather conditions, such as high winds heavy rain, or extreme heat. This includes the use of weather-resistant materials and protective enclosures for critical components.

5.2.2. SELECTION OF THE EVSE LOCATION/PREMISES

a) The EVSE can be installed at various locations including residential, commercial, industrial, and public premises. The location and capabilities of the EVSE should match the needs of the EV drivers.

b) The selected EVSE location for public use should be convenient, highly visible, and easily accessible to a large number of EV drivers.

c) To enable charging in residential premises, EV owners may install residential EVSE in a suitable location within the boundaries of their premises. Suitable locations are garages and parking bays.

d) Selecting an appropriate site for EVSE installation requires consideration of a combination of factors. While every site is unique and EVSE owners or operators have different priorities, the criteria below should provide guidance when assessing the potential location.

A. Electricity capacity

i. Proximity to an existing power source or where a power source can be set up.

ii. Capacity of existing infrastructure.

iii. The expected effect on the power load density (kW/m^2).

iv. The expected number of EVSE and their configurations (e.g. charging mode and number of charging points), including potential future expansion;

v. When installing the EVSE, a separate and dedicated circuit with means of isolating the supply is required, as specified in Section 5.3.3 and 5.3.4. This can be added to an existing distribution board (DB) or planned for in new constructions.

vi. EVSE is considered as a continuous load and, therefore, the existing DB should have enough spare capacity to accommodate the additional EVSE load.

vii. Distribution Licensees have the responsibility of ensuring capacity availability. In addition to ensuring safety of the EVSE installation, utilities are concerned with overloading local transformers. EVSE above 3.7 kW shall therefore be registered with the Distribution Licensees to enable them to plan for neighbourhood power needs.

viii. Use of on-site renewable energy sources with energy storage should be considered, to supplement grid electricity for EV charging and to assist with managing grid peak load.

B. Network and communication

i. Access to a telecommunication network for internet access, if required by the EVSE control.

ii. The EVSE communications shall be in compliance with the applicable laws and regulations by the Communications Regulatory Authority of Namibia (CRAN).

C. Other considerations

i. Availability of lighting and security for the convenience and safety of EV drivers.

ii. The expected number of EV drivers and the potential traffic around the EVSE.

iii. Expectation of future expansion including the facility's electrical capacity.

iv. The expected time each EV driver will spend at this location.

v. The potential vehicle traffic around the EVSE location. EV drivers stopping for charging their car should not cause an obstruction to traffic movement.

vi. Protection against traffic collision from moving vehicles.

vii. The EVSE deployed in remote or isolated areas should be equipped with security cameras and lighting to ensure user safety and deter vandalism or theft considering the fact that in remote areas, security becomes even more critical due to the lack of regular monitoring.

5.2.3. APPROVAL FROM RELEVANT AUTHORITIES

a) The installation of EVSE should comply with relevant building design standards, urban streets design guidelines and applicable jurisdictional regulations.

b) EVSE owners and operators should prepare and submit all relevant design documents of the EVSE installation for approval by relevant authorities such as the Distribution Licensees, Town Councils, Municipalities and Communication companies.

c) The relevant authority shall review the design documents of EVSE installation and, if satisfied, approve the design for implementation.

d) Where additional capacity is required, any directly attributable costs of network upgrade or additional capacity needed to connect the EVSE are allocated to the EVSE owner. The costs that may need to be recovered by the Distribution Licensee should be in accordance with Section 8 of the current Namibian National Connection Charge Policy (NCCP) or the equivalent section of the revised Code that replaces the current NCCP, once enacted.

e) The EVSE owners and operators should consult with relevant authority to be informed of the procedures to follow when seeking a new or additional electrical connection.

f) The Distribution Licensee should not be allowed to reject an application to install charging points if the applicant provides the Licensee with the option of limiting the load of the charging points in a charging pool to a maximum of 3.7 kW via remote control interface. The specific technical solution for this remote-control interface has to be agreed on between the Licensee and the applicant.

5.2.4. INSTALLATION OF THE EVSE

a) Owners and operators of the EVSE should be fully aware of such equipment and its operational methods in order to select suitably competent person to install it correctly.

b) Owners and operators of the EVSE should consult with the Distribution Licensee for the registered competent person (e.g. installation electrician or electrical contractor) to install the EVSE at the selected site.

c) The EVSE installation is permitted if the selected premises or site has adequate electrical capacity and protection for the planned installation. If additional capacity is needed, the EVSE owner or operator shall submit an application to the relevant Distribution Licensee for the extra capacity.

d) Details of the EVSE installation shall be carried out in accordance with Section 5.3 of this document.

5.3. EVSE INSTALLATION REQUIREMENTS

The EVSE installation is considered as a low-voltage installation, and therefore shall be carried out in accordance with the following regulations, in addition to the NAMS/ESI LVEIWS 001 Ed 1.0 04-2021, and any other applicable regulations in the Namibian Electricity Supply Industry (ESI).

Note 1 to entry: refer to **Annexure B** for typical AC EVSE electrical installation in residential premises.
Note 2 to entry: refer to **Annexure C** for typical AC EVSE electrical installation in public/ non-residential premises.

5.3.1. THE EVSE CIRCUIT

a) All EVSE eligible for registration shall be supplied by a dedicated circuit that supplies no other loads except ventilation equipment intended for use with the EVSE, if required. More than one EVSE can be supplied by the same supply circuit, provided that the combined power demand of the equipment does not exceed the rating of the supply circuit.

b) EVSE is classified as a high-power load, necessitating the installation of a dedicated supply circuit to minimise safety risks and assist with peak load management, especially when multiple charging points are present.

c) The cables supplying EVSE shall be mechanically protected by means of metal sheath/armour or installed inside a rigid steel conduit, plastic or PVC conduit and as per the NAMS/ESI LVEIWS 001 Ed 1.0 04-2021: Section 6.9.3.3.

d) Each EVSE circuit shall be sized to carry the rated current of the EVSE and with limited voltage drop as required by the NAMS/ESI LVEIWS 001 Ed 1.0 04-2021: Section 4.2.3, the NAMS/ESI 01:04-2021: Section 3.1.1, and in-line with the instructions of the EV charging equipment manufacturer.

e) If the circuit supplies more than one EV charging point, then no diversity shall be applicable. The use of a diversity factor may be applicable for a dedicated distribution circuit supplying multiple EVSE charging points if the load control is available.

f) An extension cord unit, irrespective of its rating, shall not be used with the EV charging cable assembly. The circuit must comply to (a), (b), (c) and (d) above.

g) The EVSE circuit and its associated socket-outlet shall be clearly labelled for EVSE charging only.

5.3.2. SOCKETS

a) A single socket-outlet shall be used to charge only one EV at a time. No extension cable of multi-plugs shall be used to connect multiple EV charging points on a single socket-outlet, irrespective of its rated capacity.

b) An EVSE socket shall be installed such that the main operating controls and any socket-outlet are between 0.6m and 1.2m above ground.

c) EV manufacturers' instructions should be followed when determining the type of socket-outlet to be installed in residential premises. The socked must comply with the NAMS/ESI LVEIWS 001 Ed 1.0 04-2021: Section 3.178.

Note to entry (b): The specified high is to ensure that the sockets are within arm's reach and to make sure that people in wheelchairs can use it comfortably.

5.3.3. ISOLATION AND SWITCHING

a) A means of isolating the supply to the EVSE circuit shall be provided in accordance with NAMS/ESI LVEIWS 001 Ed 1.0 04-2021: Section 5.4.5 and the Namibia Electricity Safety Code (NESC).

b) The isolating device shall be capable of being locked in the open position and located in a position that is readily accessible for maintenance purposes and shall be suitably identified by marking and/or labelling and in accordance with the NAMS/ESI LVEIWS 001 Ed 1.0 04-2021 and the NESC.

c) Where an emergency switch is provided, it shall be located in a position that is readily accessible and shall be suitably identified by marking and/or labelling and shall disconnect all live conductors including the neutral.

5.3.4. PROTECTION

a) The EVSE installation should comply with IEC 60364-7-722 protection requirements, which requires the following three (3) electrical safety measures to address EVSE installations.

   i. Short-circuits and overloads protection

   ii. Protection for electric shocks and risks of electrocution

   iii. Overvoltage protection

b) In addition to IEC 60364-7-722 requirements:

   i. The EVSE and its associated accessories shall be selected and installed to ensure the risk of overloads and short-circuits are minimised.

   ii. Each EVSE supplying circuitry shall be individually protected against fault currents by suitably rated overcurrent protective devices and in accordance with the applicable standards. Use of RCD Type B

is recommended to protect the EVSE circuit against AC and DC residual currents, as illustrated in single-line diagram in **Annexure D**.

iii. Protection for electrical shock shall be provided by automatic disconnection of supply or electrical separation as provided for in the NAMS/ESI LVEIWS 001 Ed 1.0 04-2021: Section 5.4.5 and the NESC.

c) Every EVSE circuit shall be individually protected by an appropriate Residual Current Device (RCD) /Earth Leakage (EL) unit. The use of RCDs with a rated residual operating current not exceeding 30 mA, is recognised in AC systems as additional protection in the event of failure of the provision for basic protection and/or the provision for fault protection or carelessness by users. [NAMS/ESI LVEIWS 001 Ed 1.0 04-2021: Clause 4.1.2.7]

5.3.5. INSPECTION, TESTING, CERTIFICATION, AND COMMISSIONING

a) Before energising, the EVSE installation shall be inspected, tested, verified, and certified by a competent person, that the installation complies with applicable regulations of this framework, including the manufacturer's instructions, and all applicable regulations of the NAMS/ESI LVEIWS 001 Ed 1.0 04-2021.

b) The Distribution Licensee shall appoint a registered competent person to inspect the EVSE installation before it is energised. A certificate-of-compliance (CoC), accompanied by a test report in the format approved by the Distribution Licensee, shall be issued in respect of a compliant EVSE installation.

c) Periodic inspections and testing shall be carried out in accordance with the NAMS/ESI LVEIWS 001 Ed 1.0 04-2021: Section 7.3, and in-line with the manufacturer recommendations.

Note: Refer to **Annexure A** for a typical EVSE connection process flowchart.

5.3.6. LABELLING AND EVSE SIGNAGE REQUIREMENTS

a) All labelling and identification requirements for the EVSE installation shall be as per NAMS/ESI LVEIWS 001: Ed 1.0 04-2021: Section 4.1.10, 5.3.2, and 5.7.4.

b) All labels must be written in English, clear, easily visible and affixed to remain legible for as long as the enclosure is in use.

c) In public spaces, clear and visible directional signage indicating the presence of a charging point is recommended to direct EV drivers to designated parking spaces with charging points.

d) Signage for public charging points should use recognisable EV charging symbols. If applicable, signage indicating accessibility features for disabled users should be included.

e) There should be clear instructions on how to use the charging station including any necessary steps for initiating charging, payment methods, pricing, and safety precautions.

f) Contact details for assistance or support, such as a customer service helpline or website, in case users encounter any issues or require further information, should be provided.

g) The EVSE should be equipped with fire extinguishers and clear emergency procedures including safety signage and user instructions to comply with the fire safety measures and guide users on safe operation, including emergency shut-off procedures and contact information for support.

5.3.7. REQUIREMENTS FOR EV CHARGING CONNECTORS

a) The Alternating Current (AC) EVSE charging point shall be equipped, for interoperability purposes, with at least one EV connector of Type 2 as described in standard IEC 62196-2.

b) The Direct Current (DC) EVSE charging point shall be equipped, for interoperability purposes, with at least one connector of the combined charging system 'Combo 2' or CCS 2 as described in IEC 62196-3 standard. Additionally, a DC charging pool offering several DC charging points should provide at least one CHAdeMO connector.

5.3.8. ACCESSIBILITY

a) Transport infrastructure should allow seamless mobility and accessibility for all users including older persons, persons with reduced mobility and persons with disabilities.

b) The location of all EVSE, as well as the EVSE themselves, should be designed in such a way that they are accessible and user-friendly to the public as possible, in particular, to older persons, to persons with reduced mobility and to persons with disabilities.

c) In principle, operators of publicly accessible EVSE should provide sufficient space around the parking place, ensuring that the charging station is not installed on a curbed surface, ensuring that the buttons or screen of the recharging station are at an appropriate height and the weight of the charging cables is such that persons with limited strength can handle them with ease. In addition, the user interface of the related charging stations should be accessible.

5.4. EVSE OPERATION REQUIREMENTS

5.4.1. TECHNICAL OPERATIONS

A. Charging Modes

This refers to an operating mode in which energy is transferred from a power source to the EV's battery storage. The EV charging modes shall be in accordance with the IEC 61851-1, as described in Section 4.5 of this document.

B. Power Quality Requirements

a) The power quality requirements for EVSE should be as per the IEC 61851-1, SAE J2894 and NAMS/ESI 01: 04-2021 Namibia Electricity Supply Industry: QoSS. These standards provide recommendations for Quality of Supply that enable equipment manufacturers, vehicle manufacturers and electrical companies to make

informed decisions regarding the appropriate power quality of the supply. Therefore, the Distribution Licensees and other participants shall comply with national and international standards regarding the parameters listed below:

i. Voltage harmonics and inter-harmonics
ii. Voltage flicker
iii. Voltage unbalance
iv. Voltage dips
v. Power interruptions
vi. Voltage regulation
vii. Voltage surges and switching disturbances.

b) According to SAE J2894 standard, the minimum recommended values for the total power factor of Mode-2, Mode-3, and DC charging systems are 95%. These values are for operation at the maximum output power of the charger. Maintaining the power factor above 95% is important for two main reasons:

i. To minimize reactive line currents and harmonics in the main frequency line. This is crucial because the available power is limited by the line current controlled by the protective circuit breaker and limited by the line capacity. Minimising reactive currents and harmonic currents, the available line current for power transmission is maximised.

ii. Minimising reactive currents and harmonics reduces the heat generated in the conductors to deliver the specified power. This possibility optimises infrastructures and may eliminate the need for service upgrades when installing electric vehicle battery chargers.

c) The voltage drop at the power terminals of the EVSE shall be within the appropriate limits as required by NAMS/ESI 01-04 – 2021, Section 3.1.2 or applicable international codes and guidelines recommended by EVSE manufacturers.

d) To minimise the adverse effects of excessive harmonic current in an AC line, it is recommended that the total harmonic distortion of current produced by the EVSE at full rated power, as measured by a resistive load, shall be in accordance with NRS 048-2, Section 4.2.5.

e) Where a three-phase supply is used to supply single-phase loads, the circuits shall be so arranged that the total load is, as nearly as is practicable, balanced between the phases of the supply.

5.4.2. OFF-GRID EVSE INSTALLATION

a) Similar to EVSE supplied via grid-connection, EVSE supplied via off-grid connections shall be registered with the relevant Distribution Licensee, as stipulated under Section 5.1.1 of this document. The regulations for EVSE installations in Section 5.3 of this document shall also applies for off-grid EVSEs.

b) EVSE in off-grid remote areas shall comply with the standards of islanded microgrids such as IEEE 1547 and IEC 62898.

c) EVSE in off-grid remote areas may be equipped with adequate renewable energy sources and battery energy storage systems.

d) EVSE operating in off-grid remote areas shall have adequate backup power systems, such as onsite battery storage or backup generators, to ensure uninterrupted charging services during extended periods of renewable energy scarcity or inclement weather conditions. The backup power systems should be regularly maintained and tested to guarantee reliability.

e) While also recommended for grid-connected EVSEs, the EVSEs in off-grid shall incorporate remote monitoring and maintenance capabilities to enable real-time monitoring of system performance, fault detection, and troubleshooting. Remote access to charging station data including energy consumption, battery status and equipment health should be facilitated to ensure timely intervention and preventive maintenance.

5.4.3. RENEWABLE ENERGY GENERATION AND ENERGY STORAGE

a) EVSEs are permitted to integrate on-site renewable energy sources such as solar power, to supplement grid electricity for EV charging, subject to compliance with the Namibian embedded generation standards. A generation license shall be required for on-site generation capacities exceeding 500 kVA.

b) EVSE owners and operators generating their own renewable energy, of up to 500 kVA, shall be eligible for net-metering, allowing excess energy produced to offset the cost of EV charging, in accordance with Section 3 to 6 of the prevailing Net-Metering Rules.

c) Energy storage systems such as batteries, located behind-the-meter, can be utilised to store renewable energy for later use in EV charging or to participate in net-metering programs when there is excess generation.

d) EVSE should be equipped with a sufficient battery storage capacity to store surplus energy generated from renewable sources. The storage capacity should be able to accommodate variations in renewable energy generation and ensure continuous availability of power for EV charging, especially during periods of low renewable energy production.

e) All electrical components, including charging systems, renewable energy sources, and battery storage, shall be properly grounded and insulated to minimize risk to users and equipment. This includes compliance with international and local electrical safety standards.

f) Renewable energy generation and energy storage systems should undergo periodic inspection and certification to ensure continued compliance with safety and operational standards. Authorities may require certification from accredited agencies to ensure ongoing compliance.

g) Distribution Licensees, CPOs and local communities should collaborate to raise awareness about the benefits of renewable energy integration and EV adoption, such as through public outreach programs, educational initiatives, and community engagement activities. This is highly recommended for off-grid EVSEs where awareness is mostly lacking.

h) EVSE within a specific distribution network may integrate a minimum percentage of renewable energy sources (RES), such as solar or wind power, to reduce reliance on fossil fuels and enhance the power grid efficiency. The minimum percentage shall be determined by relevant policies of the Ministry of Mines and Energy (MME) and reviewed periodically based on technological advancements and energy availability.

i) The MME may incentivise EV owners and operators to install RES through different measures such as through the Solar Revolving Fund, among other.

j) EVSE, including those in off-grid remote areas, shall comply with standardised interconnection protocols to facilitate seamless integration with the existing grid infrastructure or microgrid systems. Compatibility with local grid specifications and communication protocols should be ensured to enable efficient energy exchange and grid stability.

k) EVSE in both on-grid and off-grid locations should be equipped with smart charging systems to enable the incorporation of demand response capabilities to manage energy demand during peak periods and optimise resource utilisation. Automated demand response systems should be implemented to adjust charging rates or schedules based on grid conditions, renewable energy availability, and user preferences.

5.4.4. VEHICLE-TO-GRID (V2G) REQUIREMENTS

a) The V2G should comply with the national and international standards and regulations regarding power plants embedded in distribution networks. The IEEE 1547, IEC 61851, and the Nambian Embedded Generation (EG) standard are recommended.

b) The EVSE charging point should be equipped with a bidirectional charging and metering equipment and should be controlled via a central system like an Energy Management System (EMS).

c) It should be possible to charge and discharge within the same transaction.

d) Unbalanced phase supply should be avoided, for example by means of phase shifting.

e) The supplied energy from and charged energy to the vehicle should be measured on different registers of MID-certified energy meters. Both registers should be readable via a central system/back-end.

f) The V2G system is equipped with means to automatically disconnect from the grid during a power outage (anti-islanding). To do so, at least voltage and frequency should be monitored. It is allowed to use relays in the EVSE for the disconnection.

g) The EVSE should be equipped with an indicator that shows the current state of the system. There should be a separate indication between charging and discharging mode. If the indicator is a coloured LED, the shown colour for discharging is different from the already used standard colours for charging infrastructure (for example: charging = blue, discharging is flashing blue or white).

h) The communication between EVSE and EV for bidirectional charging should comply with prevailing standard or de facto standard such as CCS2, CHAdeMO or ISO/IEC 15118-20.

i) For V2G applications the communication between EVSE and the central system (back end) should comply with the OCPP 2.0 (or higher) specification. Note that the required messages for bidirectional charging are not part of the specification yet. A draft is available via the Open Charge Alliance.

j) Client and Contractor should sign an agreement on data-sharing. The data to be provided consists of at least:

   i. Real time CDR's
   ii. Meter-readings (every quarter of an hour), including current and voltage per phase.
   iii. Location data of the charging points

5.5. PRICING AND PAYMENT REQUIREMENTS

5.5.1. GENERAL

a) The CPOs, eMSPs and private premises (e.g. hotels and lodges) offering EV charging services shall provide clear and transparent pricing information to consumers, including any applicable energy tariff, levies, and fees, and therefore ensuring that consumers are fully informed of charging costs.

b) The electricity supplied to the EVSE shall be monitored and billed by the supplying Distribution Licensee through the supplied energy meter. At this stage, the energy tariff charged during an EV recharging session shall be in accordance with the type of premises in which the EVSE is connected to.

c) The tariff rate related to the energy transferred between the Distribution Licensee's network and the EVSE shall be regulated by the Board, and in accordance with the Board's Schedule of Approved Tariff for the type of premises where the recharging of an EV takes place.

d) Consumers, including CPOs/eMSPs shall familiarise themselves with the Board's approved energy tariffs of the supplying Licensee.

e) The Board may consider, as an incentive, a special/bespoke EV energy tariff that provides discounted rates for EV charging, to promote EV adoption, but subject to regular review.

f) The special/bespoke EV energy tariff may be applicable generally or can be applied to an identified category or categories of CPOs/eMSPs or circumstances.

g) Where necessary, the Distribution Licensee may offer Time-of-Use (TOU) pricing plans for EV charging services, providing lower rates for EV charging during off-peak hours to encourage load balancing and efficient grid use. Installation of smart meters may be required to enable TOU pricing and detailed consumption monitoring, and subject to an agreement between the Licensee and consumer.

5.5.2. PRIVATE CHARGING

a) When the recharging of an EV occurs at a residential or private premises (e.g. hotels, lodges, and workplaces), using either a standard 16A socket-outlet or a dedicated EVSE circuit, the EVSE shall be treated like any other household load. To that end, energy consumed through the EVSE shall be billed by the Distribution Licensee at the same tariff applicable to other loads within the same premises where the EVSE is installed; unless a specialised EV tariff is elected by the Board.

b) When private premises such as hotels, lodges, and workplaces provide EV charging for their guests and/or employees, they may offer these services either at cost or for free. If a service fee is to be charged, the service provider shall register as a CPO and shall adhere to relevant laws or regulations applicable to CPOs. However, registration as a CPO is not required when EV charging is provided for free or if the charges only cover the cost of electricity consumed during charging sessions.

c) If the owner of the residential or private premises benefits from a social energy tariff and has an EV charging installed on the premises, the owner shall notify the respective Distribution Licensee and the social energy tariff shall be removed to avoid cross-subsidisation.

d) EV charging provided at private premises for public use shall be classified as public charging, and shall comply with the relevant laws or regulations applicable to CPOs.

5.5.3. PUBLIC CHARGING

a) The CPO or eMSP shall be considered as the end consumer of the energy supplied by the Distribution Licensee. Consequently, EV drivers (customers) have the option to choose the CPO or eMSP that provides the most suitable offer for their individual circumstances.

b) The CPO or eMSP shall make the pricing information for their charging services (ad hoc or contractual services) clearly and easily available, with all its applicable price components, ensuring consumers are fully informed of charging costs prior to initiating a recharging session and to enable price comparison. The price should be communicated in a clearly structured manner to anticipate the total cost.

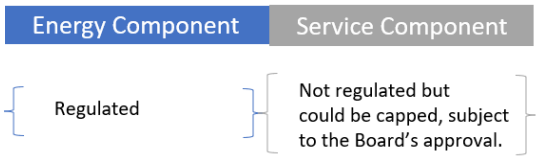
c) The total price to be paid for an EV charging service at a public charging point is that which is agreed upon between the EV end-user and the CPO/eMSP. As a rule, the total price should be composed of two price components:

   i. **The energy component:** This is related to the amount of energy (in kWh), that is effectively transferred from the supplying Licensee electrical network to the CPO's charging equipment during an EV recharging session. The maximum applicable energy tariff for CPO's connected to the

licensees grid will be in accordance with Rule 7(8) of Rules relating to Redistribution and Resale of Electricity: Electricity Act, 2007. However, the maximum applicable energy tariff for Off -Grid CPOs will be subjected to the Board's approval based on the licensed generation source.

ii. **The service component:** This is related to the service fee charged by the CPOs for the use of a charging point by EV end-users.

Note to entry (b): Illustrating the recommended price structure for public charging:



d) The CPO or eMSP shall have the discretion to set the price of a service component to support various business models for recharging services and ensure economic viability.

e) The CPO or eMSP shall have the freedom to design their price tags for their customers, by restructuring the pricing components described in (b) to fit their business models such as offering (i) free charging, (ii) flat-rate charging (fixed price regardless of actual consumption), (iii) discounted charging (e.g. customers of a shop/mall, discount on purchases, drivers of a certain vehicle).

Note to entry (e): The CPO or eMSP may re-structure the price as described in this example.

EXAMPLE: Assuming an approved energy tariff of N$ 3 per kWh (between the Licensee and CPO), 10 kWh of energy consumed by an EV in one hour, and 100 kWh of energy consumed by an EV in a month. The different pricing models could be accommodated as follows:

Pricing Model	Price Tag	Values of the Price Components
Free Charging	N$ 0	The CPO fully subsidizes customers for energy & service
Energy-Rate Charging	N$ 3 per kWh	The CPO only charged for energy & subsidizes the service
Flat-Rate Charging	N$ 50 per hour	N$ 30 charged for energy N$ 20 charged for service
Discounted Charging	N$ 40 per hour	N$ 30 charged for energy N$ 10 charged for service
Monthly Rate Charging (@ 100 kWh per month)	N$ 500 per month	N$ 300 charged for energy N$ 200 charged for service

f) The CPO/eMSP price should clearly show all components that apply, including but not limited to:

i. price per kWh;
ii. price per minute;
iii. price per session;
iv. an occupancy or blocking fee to discourage unnecessary long occupancy of the recharging point;

v. and any other applicable surcharges such as, a roaming fee, subscription fee, or a flat-rate session fee, which is invariable no matter how long the EV is connected to the recharging point or how much energy is consumed.

g) EV users should be able to recharge their EV on an ad-hoc basis, and pay easily and conveniently at all public charging points, without the need to enter into a contract with the CPO/eMSP.

h) If the price for the charging on an ad-hoc basis is provided on a dedicated platform beforehand such as on a webpage or mobile app, it should be clearly provided on the same platform as the one used for the payment of the session.

i) Operators of public charging points shall not discriminate, through the prices charged, between different end users or between different eMSP. However, the level of prices may be differentiated, but only if the differentiation is proportionate and objectively justified.

j) All public charging points should accept payment instruments that are widely used in the country. To that end, CPOs shall accept electronic payments at those points through terminals and devices used for payment services, including at least one of the following:

   i. payment card readers;

   ii. devices with a contactless functionality that is at least able to read payment cards;

   iii. devices using an internet connection and allowing for secure payment transactions such as those providing a Quick Response (QR) code.

k) A single payment terminal or device referred to in (i) may serve several public charging points within a charging pool.

5.6. ROAMING AND INTEROPERABILITY REQUIREMENTS

a) All public EV charging points shall adhere to interoperability standards, allowing EV end-users to access charging services regardless of their regular service provider, ensuring fair and consistent pricing across networks.

b) Regardless of the brand of their vehicle, EV end-users should be able to access and use publicly accessible charging stations in a user-friendly and non-discriminatory way.

c) Roaming is recommended for public charging points. Entities offering those new services, such as mobility service providers, should be able to operate under fair market conditions.

5.7. DATA REPORTING REQUIREMENTS

a) The Board reserve the rights to request from the operator(s) of public EV charging points, to report their pricing models, usage statistics, and operational costs for EV charging services, allowing for market monitoring and compliance with pricing regulations.

b) Operators of public charging points shall ensure the availability of static data and dynamic data concerning infrastructure operated by them, or services inherently linked to such infrastructure that they provide, or they outsource, at no cost. The following data types should be made available:

   a. static data for public charging points operated by them:

      i. geographic location of the recharging points,

      ii. number of connectors,

      iii. number of parking spaces for people with disabilities,

      iv. contact information of the owner and operator of the recharging station,

      v. operating hours;

   b. further static data for public charging points operated by them:

      i. ID codes, at least of the recharging point operator,

      ii. type of connector,

      iii. type of current (AC/DC),

      iv. maximum power output (kW) of the recharging station,

      v. maximum power output (kW) of the recharging point,

   c. dynamic data for public charging points operated by them:

      i. operational status (operational/out of order),

      ii. availability (in use/not in use),

      iii. ad hoc price,

      iv. electricity supplied is 100 % renewable (yes/no).

6. RECOMMENDED INTERNATIONAL EV STANDARDS

This section collates different international EV standards recommended to support the deployment of EV charging infrastructure in Namibia. They are categorised into (1) conductive charging, (2) connectors, (3) EVSE installation, (4) communication, and (5) EV grid integration standards.

Table 4: Recommended International EV standards on conductive charging system.

IEC 61851	This standard covers the mechanical, electrical, communications, EMC and performance requirements for EV supply equipment used to charge electric vehicles, including light electric vehicles. It consists of six (6) parts as described below.
IEC 61851-1:	General requirements.

IEC 61851-21-1:	Electric vehicle on-board charger EMC requirements for conductive connection to AC/DC supply. This part gives the general requirements that serve as a basis for all the subsequent standards in the series. It includes the requirements for AC EV supply equipment.
IEC 61851-21-2:	EMC requirements for off board electric vehicle charging systems. This part will cover all requirements for AC and DC EV supply equipment. EMC requirements for wireless power transfer systems (WPT) will not be included.
IEC 61851-23: 2014	DC electric vehicle charging station. This part covers the requirements for DC charging stations both permanently wired, and cable and plug connected.
IEC 61851-24: 2014	Digital communication between a DC EV charging station and an electric vehicle for control of DC charging. This part provides the requirements for communication between the vehicle and the DC charging stations of Part 23.
IEC 61851-25:	DC EV supply equipment where protection relies on electrical separation.
ISO 17409: 2020	A standard that specifies electric safety requirements for conductive connection of electrically propelled road vehicles to external electric circuits. External electric circuits include external electric power supplies and external electric loads. The standard provides requirements for the charging modes 2, 3, 4, as defined in IEC 61851-1, and reverse power transfer. For mode 4, it provides requirements regarding the connection to an isolated DC EV charging station according to IEC 61851-23.

Table 5: Recommended International EV standards on charging connectors.

IEC 62196 (all parts)	This standard specifies the requirements for plugs, socket-outlets, vehicle connectors, and vehicle inlets for conductive charging of electric vehicles. It sets the guidelines for charging connectors and sockets, ensuring interoperability and safety among electric vehicle charging systems.
Combined Charging System 2 (CCS2)	This is a fast-charging standard and connector protocol designed for electric vehicles, integrating both alternating current (AC) and direct current (DC) charging capabilities into a single, universal connector. It builds upon the IEC 62196 standard.
CHAdeMO	This is a fast-charging protocol and connector standard providing high-power direct current (DC) charging capabilities.

Table 6: Recommended International EV standards on EVSE installation.

IEC 60364-7-722	A standard that specifies requirements for the design and installation of electric vehicle charging installations. It covers aspects such as wiring, protection, and safety measures to ensure the proper and safe operation of charging infrastructure.

Table 7: Recommended International EV standards on communication.

ISO 15118	A high-level communication protocol standard between EV and EVSE defining a vehicle to grid (V2G) communication interface for bi-directional charging/discharging of electric vehicles, including smart charging features like Plug and Charge.
DIN 70121	A high-level communication protocol standard between EV and EVSE. It is predecessor of ISO 15118. It specifies technical parameters such as dimensions, electrical characteristics, and safety features to ensure compatibility and safe operation of charging equipment in Germany and beyond.
OCPP (Open Charge Point Protocol)	A communication protocol standard between EVSE and the Charge Point Operator's Management System (CPMS), facilitating interoperability and remote management of electric vehicle charging stations.
OCPI (Open Charge Point Interface)	A communication protocol standard between CPO and MSP for direct connection (not using a roaming platform).

Table 8: Recommended International EV standards on grid integration.

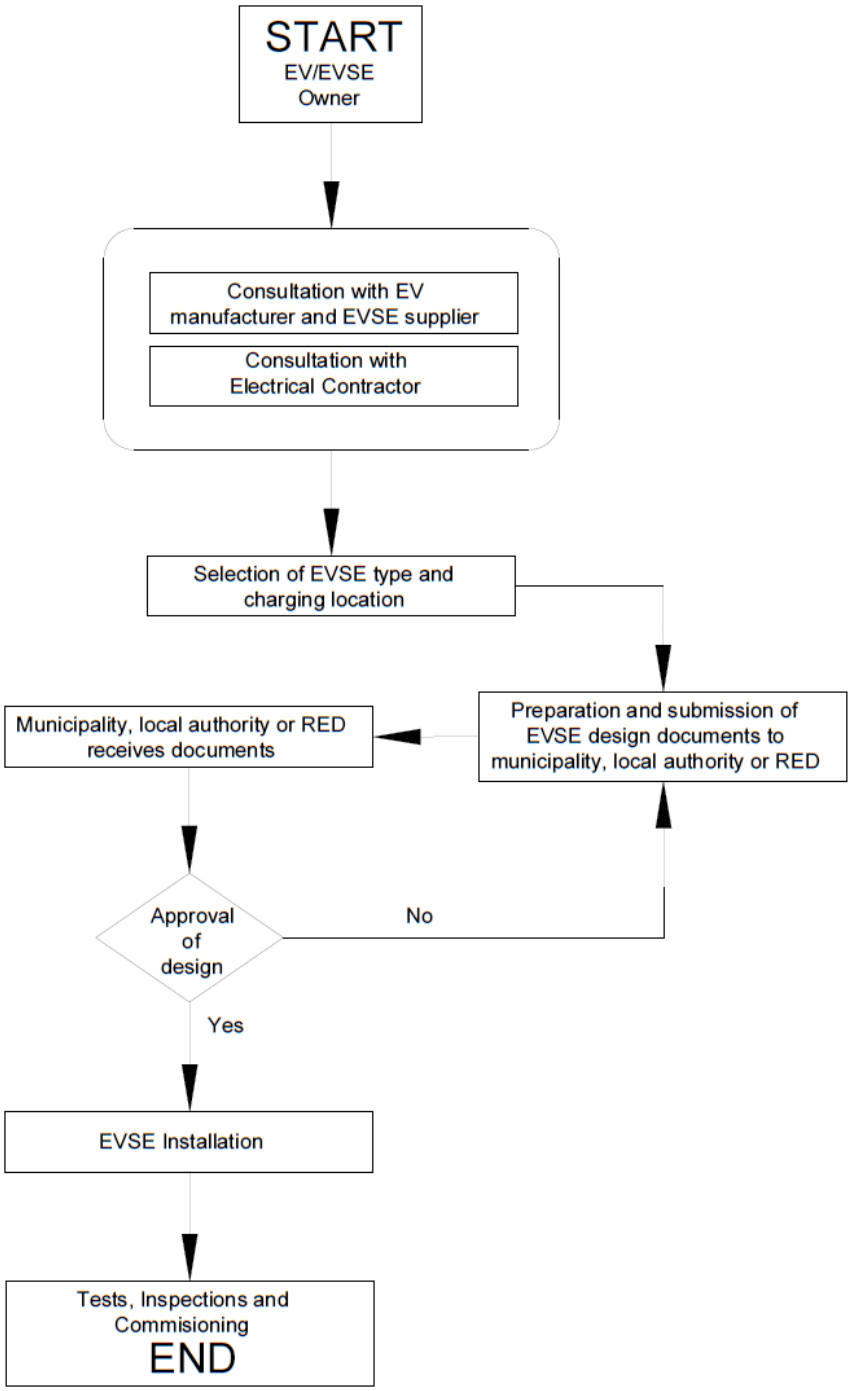
IEEE 1547	A standard that specifies the requirements for interconnecting distributed energy resources (DERs) with electric power systems. It ensures the safe, reliable, and efficient integration of DERs such as solar photovoltaic systems and wind turbines into the grid, addressing issues like voltage regulation and grid stability.
IEC 61727	A standard that outlines the procedures for assessing the compatibility of photovoltaic (PV) power systems with utility power grids. It provides guidelines for testing PV systems to ensure their safe and efficient integration into the electrical grid, addressing factors such as grid stability, voltage regulation, and power quality.
VDE-AR-N 4105	A comprehensive German standard for embedded generators connected to the low-voltage distribution network.

Table 9: Other General Recommended International EV standards.

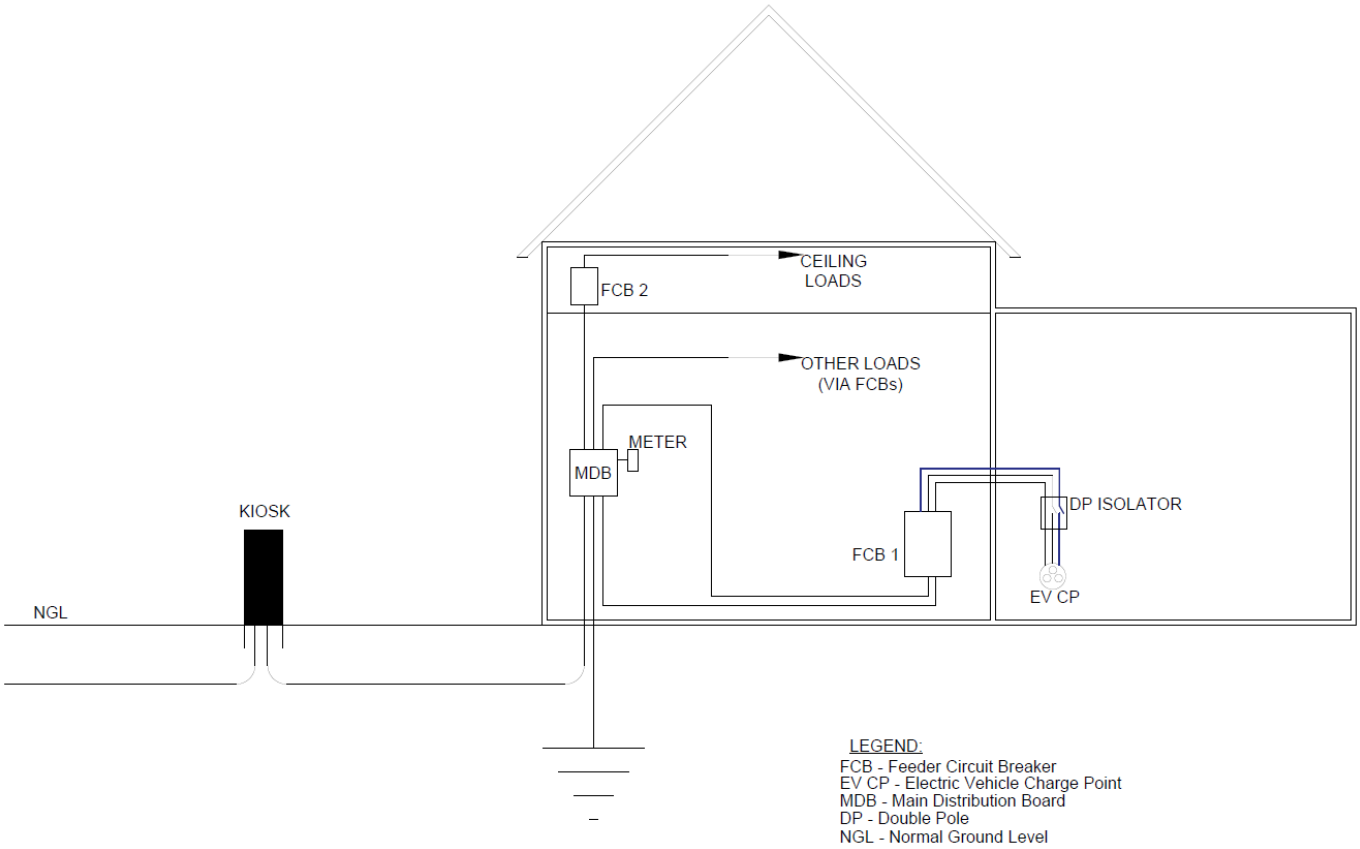
ISO 6469-2:2022	A standard that specifies requirements for operational safety specific to electrically propelled road vehicles, for the protection of persons inside and outside the vehicle. It includes operational safety requirements on (i) operation of auxiliary electric systems, and (ii) connection of the vehicles to an external electric circuit, which could support EVSE safety measures prescribed by IEC 61851.

7. ANNEXURES

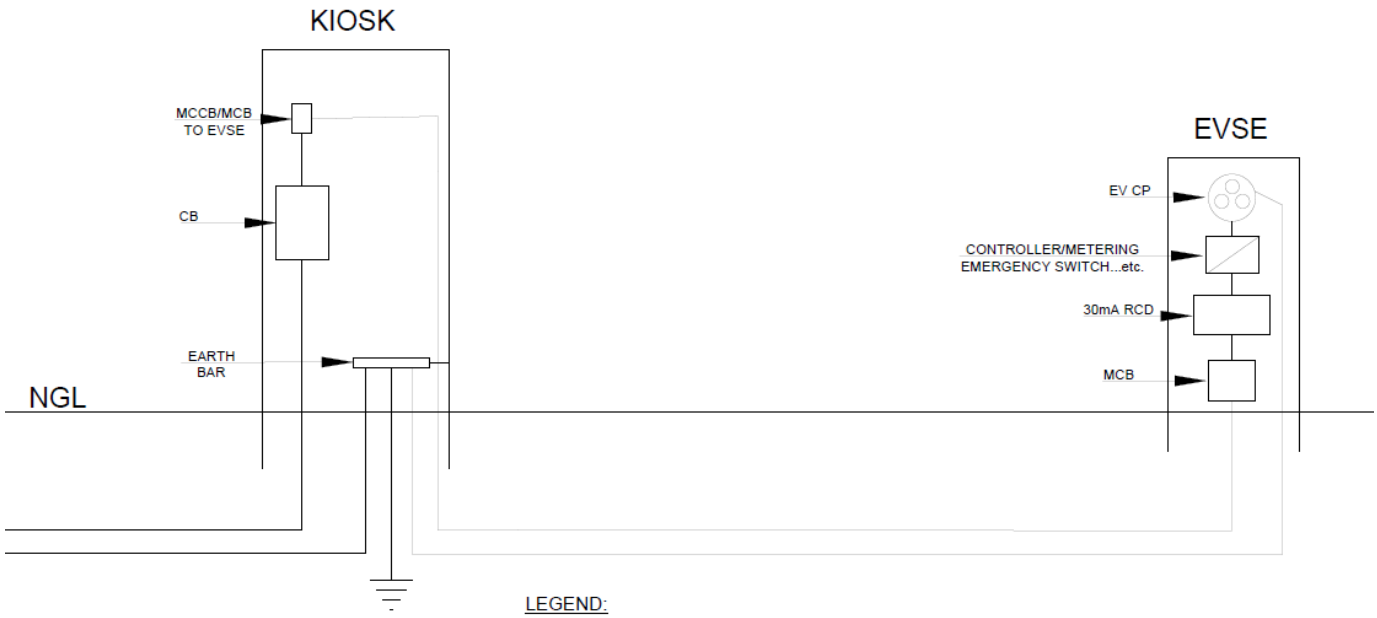
7.1. ANNEXURE A: GENERAL INSTALLATION PROCESS FOR AN EVSE IN A PUBLIC PREMISES



7.2. ANNEXURE B: TYPICAL AC EVSE ELECTRICAL INSTALLATION IN A RESIDENTIAL PREMISES



7.3. ANNEXURE C: TYPICAL AC EVSE ELECTRICAL INSTALLATION IN A PUBLIC PREMISES



LEGEND:

MCCB - Molded Case Circuit Breaker

MCB - Main Circuit Breaker

EVSE - Electric Vehicle Supply Equipment

CB - Circuit Breaker

EV CP - Electric Vehicle Charging Point

RCD - Residual Current Device

NGL - Normal Ground Level

7.4. ANNEXURE D: RECOMMENDED SINGLE-LINE DIAGRAM FOR PROTECTING EVSE CIRCUITS

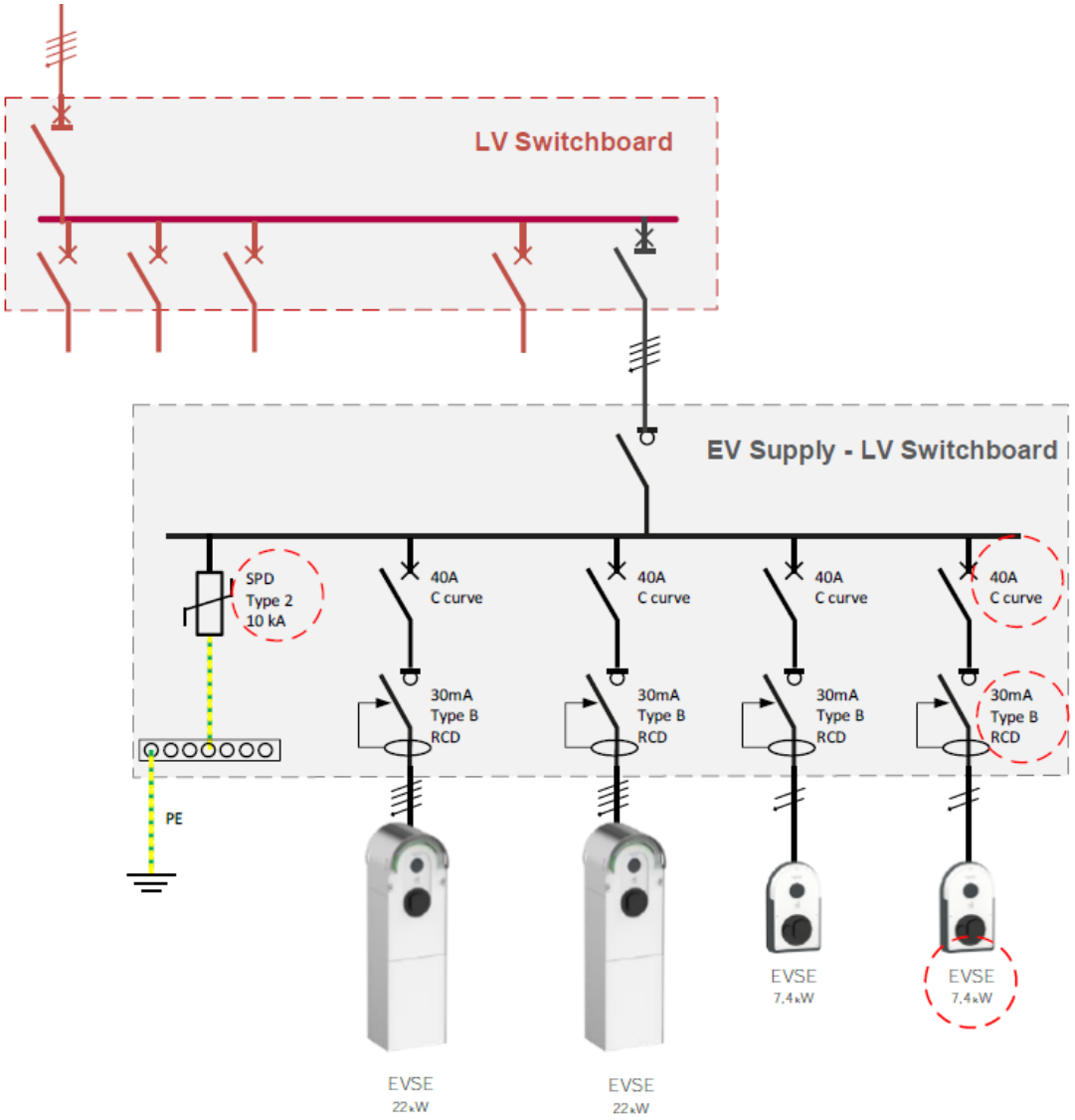


Image source:
Schneider Electric, 2021, Safety Measures for Electric Vehicle Charging (https://www.electrical-installation.org/enwiki/Electric_Vehicle_charging)

7.5. ANNEXURE E: STANDARD REGISTRATON FORM FOR EVSE ELECTRICAL INSTALLATION

DATE:

D	D	M	M	Y	Y	Y	Y

SECTION A: PARTICULARS OF THE APPLICANT		
Account Number with the Distributor:		
If the Applicant is an Individual:		
Full Name of the Applicant:		
Identity No.:		
If the Applicant is a Registered Entity:		
Company Name:		
Company Registration No.:		
Name of Contact Person:		
Contact Details		
Cell phone:		
Work:		
Email:		
Physical Address:		
Postal Address:		
Indicate whether the Applicant Currently Benefits from the Social Energy Tariff:	☐ Yes	☐ No
SECTION B: PARTICULARS OF THE EVSE INSTALLATION		
Type of EVSE Installation:	☐ New Installation	☐ To be Added to an Existing Installation
Physical Location of the EVSE:	Physical Address:	
	GPS Coordinates (preferably use decimal degrees): *(e.g. Lat: -22.5649, Long: 17.0842)*	
Total rated power output (kW) of **all** EVSE:		
Rated Voltage	Capacity (V):	☐AC ☐ DC
Rated Current	Capacity (A):	☐AC ☐ DC
Number of charging points:		

Maximum power output (kW) of each charging point:			
If load management is applied, please specify the total possible load limit (kW) to which the load is set:			
Type of connectors:			
Type of supply:	☐ On-Grid	☐ Net-Metered	☐ Off-Grid
Usage	☐ Private	☐ Public	☐ Semi-Public

SECTION D: INSTALLATION DETAILS	
1. Attach a SITE PLAN showing a scaled mapping of ERF boundaries; locations of the EVSE, metering equipment, and connection point to the distribution network.	☐
2. Attach a SINGLE LINE DIAGRAM showing the EVSE design including generator, meter, transformer, connection point, isolating devices, protection schemes.	☐
3. Attach any proof of network study and the feasibility study conducted (if applicable)	☐

SECTION E: DECLARATION

I hereby declare that the information provided by me is accurate and complete in all respects.

I shall at all times comply in every respect with the registration conditions as approved by the Distribution Licensees, from time to time.

Signed:

Full Name(s) of the Applicant:	Position:	Signature:

Date:
