



# Diesel & Motor Engineering PLC

**COMMENTS ON THE REGULATION OF ELECTRIC VEHICLE CHARGING  
STATIONS**

# Overview

- **INTRODUCTION TO CHARGING STANDARDS**
- **TECHNICAL STANDARDS (AND REGIONAL STANDARDS)**
- **TECHNICAL AND SAFETY GUIDELINES**
- **DETERMINING END-USER TARIFFS**

# Types of EV charging

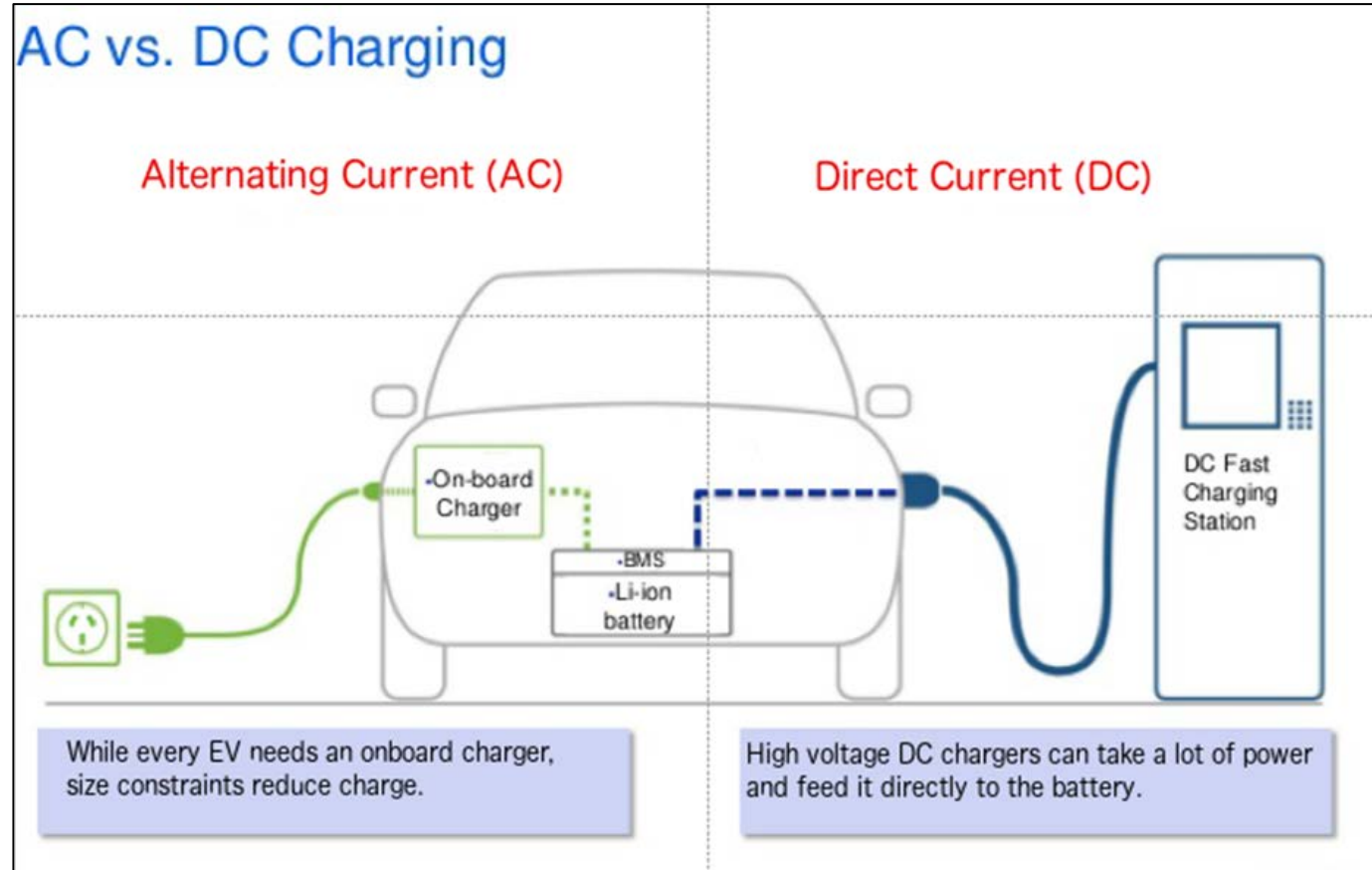
Mode 1: Cable



Mode 2: Cable + Control Unit



Mode 3: Dedicated EVSE



# Types of EV charging

Mode 1: Cable



Mode 2: Cable + Control Unit



Mode 3: Dedicated EVSE



## AC vs. DC Charging

### Alternating Current (AC)

- Cheaper
- Can be used in residences
- Minimal installation required

### Direct Current (DC)

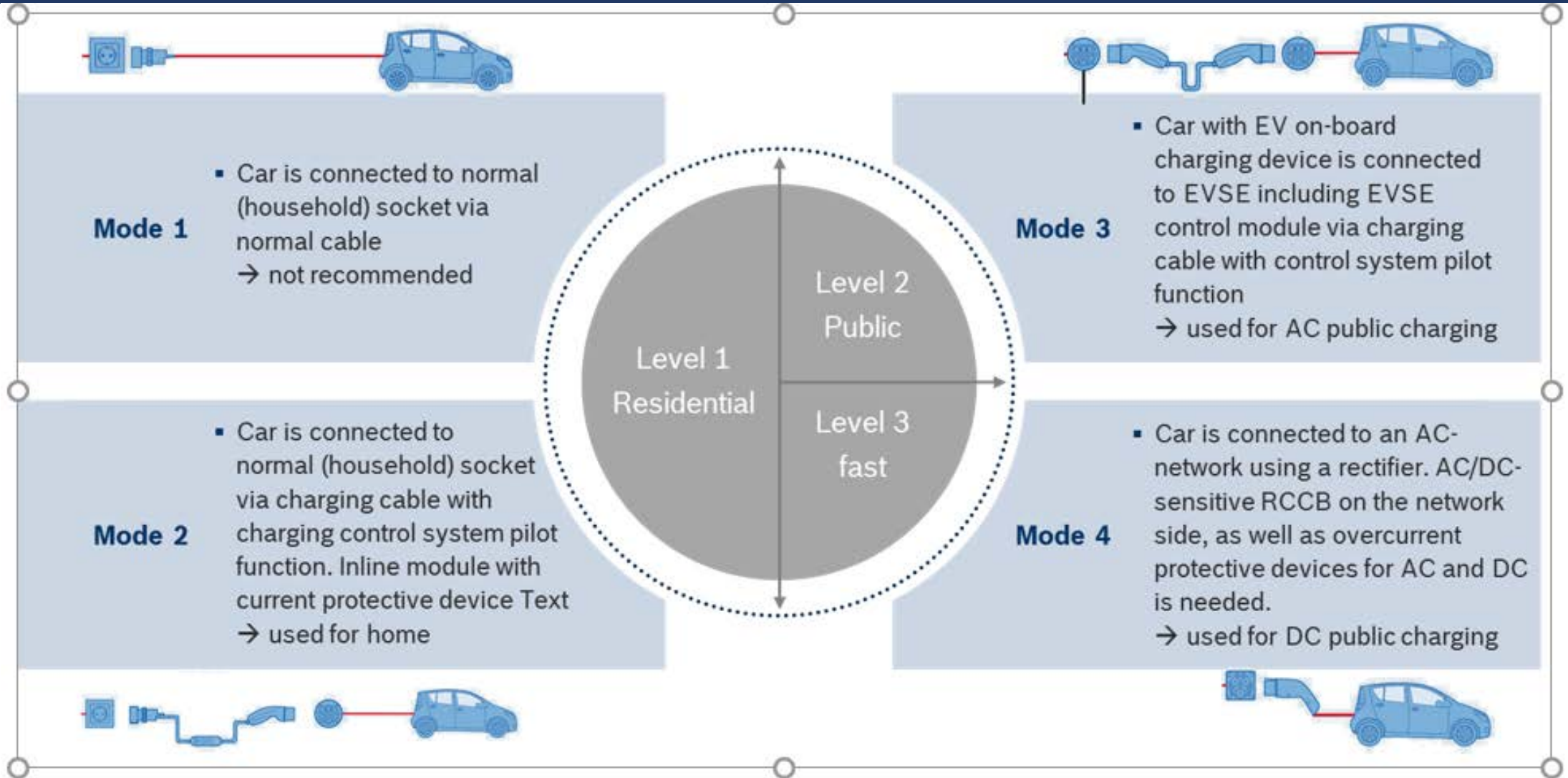
- Quick charging time

- Slower charging times
- Numerous connector types

- Can only be used in public spaces (high power)
- Extremely expensive











# Modes of EV Charging





# Types of connectors

	<b>Type 1</b> SAE J1772 Single-phase Standard in USA	<b>Type 2</b> Mennekes Single- or three-phase Germany	<b>Type 3</b> SCAME Three-phase Italy and France	<b>GB/T 20234</b> Single-phase Standard in China	<b>CHAdeMO</b> DC- Standard in Japan
<b>AC</b>	 <ul style="list-style-type: none"> <li>&gt; Only AC charging</li> <li>&gt; Still used in US, "de facto standard" in Japan</li> </ul> <p>120V, 12A, 1.4kW 120V, 16A, 1.92kW 240V, 32A, 7.68kW 240V, 80A, 19.2kW</p>	 <ul style="list-style-type: none"> <li>&gt; Only AC charging</li> <li>&gt; Still used in Europe, but not a standard any more</li> </ul> <p>240V, 16A, 3.7kW 400V, 32A, 22kW 400V, 63A, 43.5kW</p>	 <ul style="list-style-type: none"> <li>&gt; Only AC charging</li> <li>&gt; Still used in Italy and France, not a standard any more</li> </ul> <p>400V, max.32A, max.22kW</p>		
<b>DC (+ AC)</b>	 <p>AC: 120V, 16A, 1.92kW AC: 240V, 32A, 7.68kW DC: 200-500V, 60-200A, 50kW</p> <p><b>Combined Charging System (CCS) Combo 1</b></p> <ul style="list-style-type: none"> <li>&gt; Combined charging (AC and DC)</li> <li>&gt; Standard in USA since 2013</li> <li>&gt; Communication using PLC and IP</li> <li>&gt; PWM pilot control via voltage detection</li> </ul>	 <p>AC: 240V, 16A, 3.7kW AC: 400V, 32A, 24kW DC: max. 600V, 125A, max. 50kW</p> <p><b>Combined Charging System (CCS) Combo 2</b></p> <ul style="list-style-type: none"> <li>&gt; Combined charging (AC and DC)</li> <li>&gt; Standard in European Union (EU) since 2013</li> <li>&gt; Communication using PLC and IP</li> <li>&gt; PWM pilot control via voltage detection</li> </ul>		 <ul style="list-style-type: none"> <li>&gt; Combined charging (AC and DC)</li> <li>&gt; Not compatible to any other plug</li> <li>&gt; Communication using CAN BUS and CAN</li> <li>&gt; PWM pilot control via current detection</li> </ul> <p>AC: 250V, 16A, kW AC: 250V, 32A, kW DC: max. 600V, 125A, 50kW</p>	 <p>50-500V, max. 125A, max. 50kW</p> <ul style="list-style-type: none"> <li>&gt; Only DC charging</li> <li>&gt; "de facto standard" for fast charging</li> <li>&gt; Widely used in Japan (1,967), Europe (1,117) and USA (592)</li> <li>&gt; Communication using CAN</li> </ul>

# Overview of connector types

Output Type	Plug Type	Power supply	Rated voltage	Rated current	Rated power	Avg. Charging Time	Suitable for Sri Lanka?
AC	Type 1	Single Phase	120V	12A	1.4kW	16-18 hrs	N
				16A	1.9kW	12-14hrs	N
			240V	32A	7.7kW	3-4 hrs	N
				80A	19kW	1-2hrs	N
	Type 2	Single Phase	240V	16A	3.7kW	6-8 hrs	Y
			400V	32A	22kW	1-2 hrs	Y
		Three Phase		63A	40kW	20-30 mins	Y
	Type 3	Three Phase	400V	32A	22kW	1-2 hrs	Y
DC	Type 4		max 500V	max 125A	50kW	15-25 mins	Y

# Determining standards

- **MAIN STANDARDS SET BY:**
  - **INTERNATIONAL ELECTRO-TECHNICAL COMMISSION (IEC)**
  - **SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)**
- **CONNECTOR TYPES SET BY IEC 62196.**
- **CONNECTOR TYPES VARY WITH REGION, AND MAINS VOLTAGE. E.G.**
  - **JAPAN UTILISES 110V**
    - **TYPE 1 AND TYPE 4 (CHADEMO) STANDARD**
      - **FOUND IN NISSAN LEAF, MITSUBISHI IMEV**



# Determining standards

1

- Assess specifications of local power grid

2

- Identify suitable standards that meet grid capabilities

3

- Set up EVCS to meet said standards

# Regional standards

Official standard, also used

de facto standard, also used

Country/Region	AC Charging	DC Charging
European Union	CCS 2, Type 2, Type 3	CCS 2, Type 4
United States	CCS 1, Type 1	CCS 1, Type 4
China	GB/T	GB/T
Singapore	Type 2 (moving from Type 1)	CCS 2 (moving from Type 4)
Japan	Type 1	Type 4
Australia	Type 2, Type 1	Type 4
Malaysia	Type 1	No DC Charging
Thailand	Type 1	Type 4

# Technical/Safety guidelines

- ELECTRIC VEHICLE SERVICE EQUIPMENT (EVSE) SHOULD BE **PROTECTED FROM DUST AND WATER** (IPX3 FOR INDOORS AND IPX4 FOR OUTDOORS).
- EVSE SHOULD BE **TESTED FOR COMPLIANCE** AS PER IEC STANDARDS.
- DEVELOPMENT OF **TECHNICAL REFERENCE GUIDELINES** TO INSTALLATION OF EVSE IN SRI LANKA:
  - SRI LANKA ELECTRICITY ACT, NO. 20 OF 2009
  - SRI LANKA ELECTRICITY ACT (AMENDMENT), NO. 31 OF 2013
  - IEC 61851- *ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM*
  - IEC 62196 - *PLUGS, SOCKETS, VEHICLE CONNECTORS AND INLETS - CONDUCTIVE CHARGING OF EVS*
  - IEC 62262 - *DEGREES OF PROTECTION PROVIDED BY ENCLOSURES FOR ELECTRICAL EQUIPMENT (IK CODE)*
  - IEC 60529 - *DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP CODE)*

# Determining end user tariffs

- THERE IS **NO ONE-SIZE-FITS-ALL** POLICY.
- MOST FREQUENTLY USED PRICING STRATEGIES:
  - **ENERGY BASED** - HOW MANY KWH WAS CONSUMED.
  - **TIME BASED** - HOW LONG YOU WERE CHARGING.
  - **ENERGY-TIME** - HOW MANY KWH WAS CONSUMED DURING SPECIFIC TIME PERIOD OF THE DAY.
  - **FLAT FEE** - SUBSCRIPTION BASED CHARGING (REGARDLESS OF TIME OR ENERGY CONSUMED).
- DIFFERENT TYPES OF CHARGING BEHAVIOURS:
  - EMERGENCY CHARGING - ENERGY BASED + PREMIUM
  - OPPORTUNITY CHARGING - TIME BASED
  - FREQUENT CHARGING - FLAT FEE

Thank you