e-MOBILITY INDONESIA

Photo by www.gogoro.com

Overview
Jan 2023

www.elisabetebelaunde.com

Contents

Photo by Adrian Pranata on Unsplash

1 Indonesia Transportation Market

Indonesia, as the world's fourth-most populous country with a population of ~280m people, has a large vehicle market compared with other ASEAN countries.

- **Mobility in Indonesian archipelago is dominated by road transport** (90% of the passenger and freight transport)
- **Two-wheelers (motorcycles and scooters) are the dominant mode of road transport in Indonesia** (~75% of all vehicles)

Indonesia is the world's third-largest two-wheeler market.

- Indonesia had about **15.7 million passenger cars and 115 million motorcycles on its roads in 2020** *(source BPS)*
- There was an **average total domestic sales of ~1 million cars and ~6.5 million two-wheelers** per year.
- **Indonesia is still in the early stages of the transition to electric mobility,** despite some regulations and incentives for EV having been set in place by the Government.
- Until 2022, there are just **25,782 E2W & E3W / 7,679 E4W / 58 E-Bus on the road in Indonesia** *(source IESR Report 2022)*

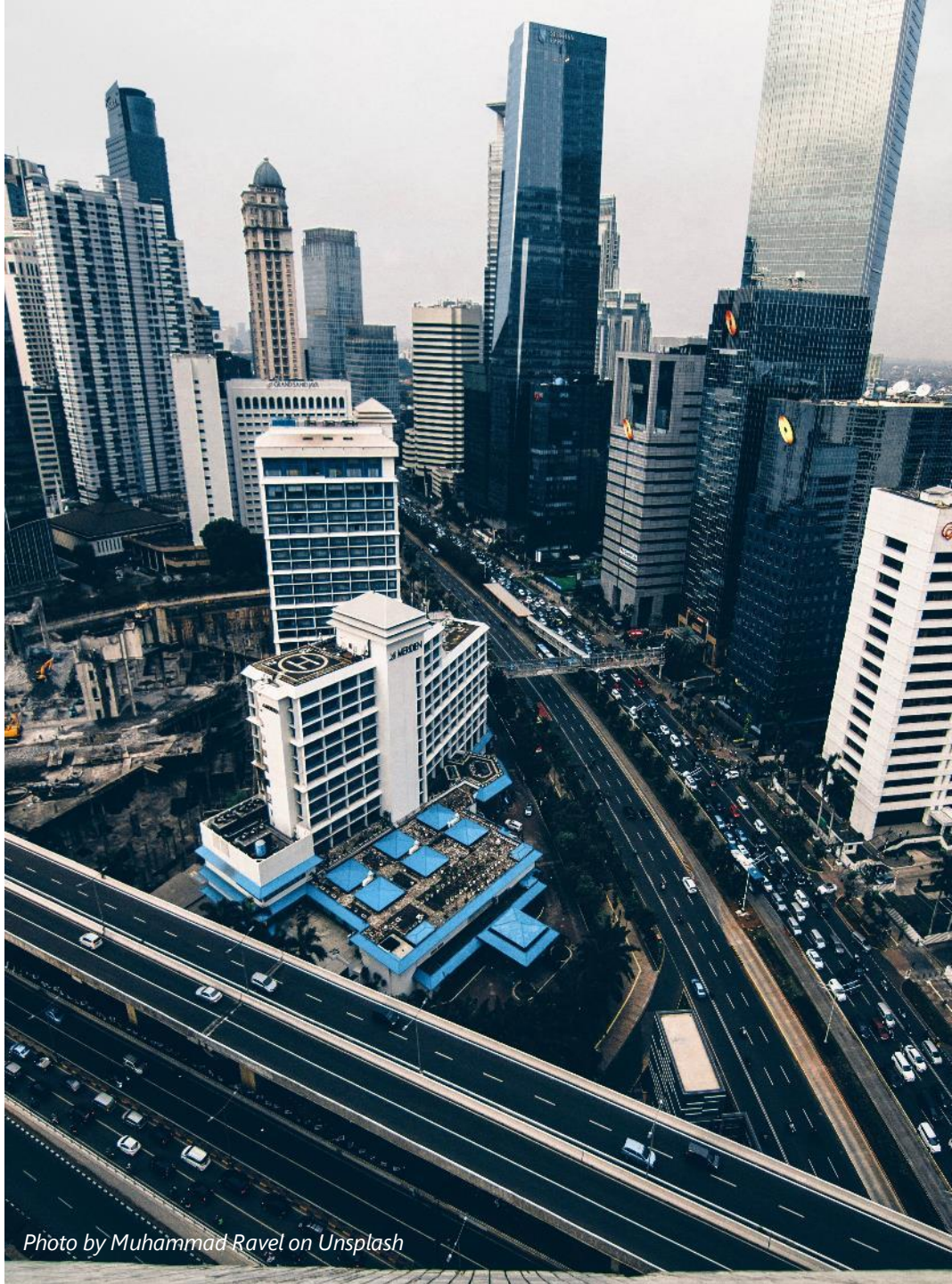


Photo by Muhammad Ravel on Unsplash

2 Why e-Mobility in Indonesia

Indonesia, as a G20 country and emerging market with great economic potential, faces important air pollution and climate challenges:

- **Transportation is a leading cause of air pollution and emissions** in Indonesian cities (~70% of pollution)
- **Transportation contributed to a quarter** (~27%) **of Indonesia's energy-related GHG emissions in 2020** (mostly ~90% from road transport)

- The electrification of the transport sector offers great potential **to reduce air pollution and GHG emissions** **when accompanied by a clean energy transition.**
- **Electric Vehicles (EVs) improve people's quality of life** by not emitting toxic gases and improved air quality, and by **reduced noise pollution.**
- **Indonesia has pledged its commitment** to **achieve 23% of renewable energy share by 2025** **(KEN-National Energy Policy)** and to **reduce its GHG emissions by 31.2%** **(unconditional) and 43.2% (conditional) by 2030** relative to business-as-usual (BAU) baseline as stated in its **Nationally Determined Contribution (NDC) as part of the 2015 Paris Agreement**
- Indonesia's long-term goal is to achieve **net-zero carbon emissions by 2060 or sooner.**
- As the top three contributor to energy sector emissions, **decarbonization of the transportation sector** **makes the EV uptake therefore crucial for Indonesia to reach its net-zero emission (NZE) goal.**

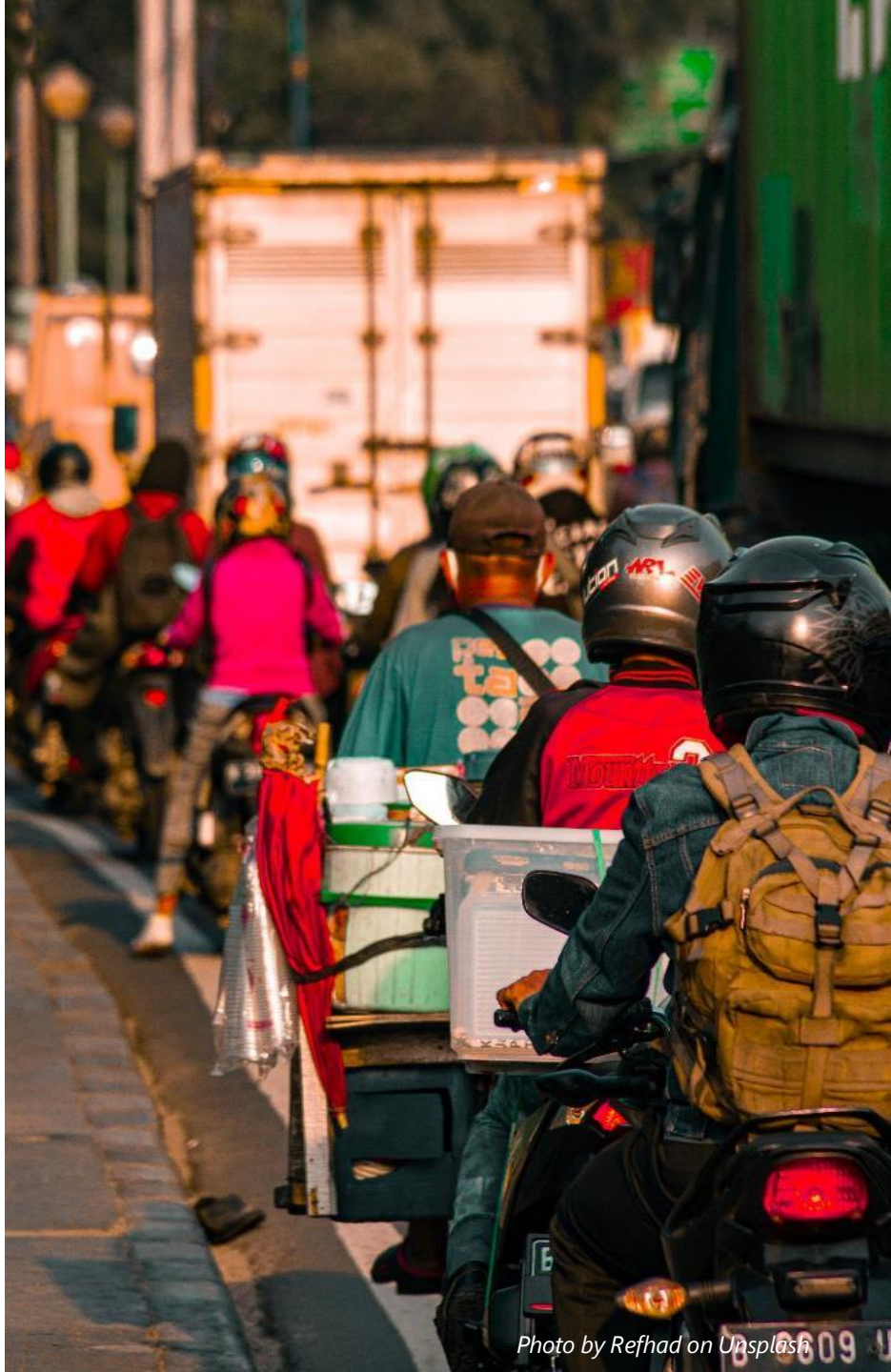


Photo by Refhad on Unsplash

3 e-Mobility Solutions

- **E-mobility (electromobility) is the collective term for means of transportation** (Road Transport, Rail Transport, Water Transport and Air Transport) **that are partially or fully powered by electricity.**
- **Electric Vehicles (EVs)** are therefore present in all transport modes and vehicle categories: **Ground Vehicles, Airborne EVs and Seaborne EVs.**
- **Road transportation** is the focus of this presentation:

e-scooters & push-scooters

E2W: electric 2-wheelers vehicles

- E-bikes (electric bicycles)
- E-scooters
- E-motorcycles (>500W engine)

E3W: electric 3-wheelers vehicles

- Electric Motorized Tricycles

E4W: electric 4-wheelers vehicles (LDV)

- E-cars (electric passenger cars)

Heavy-duty Vehicles (HDV)

- E-Trucks
- E-Bus

Image source www.e-amrit.niti.gov.in

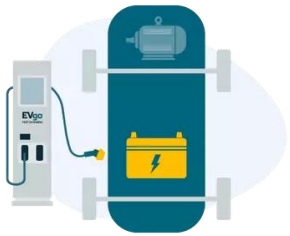
Note: In this presentation the term "electric two-wheelers (E2W)" applies to electric scooters and electric motorcycles

Photo source Alamy

4 Definition & Main Types of EVs

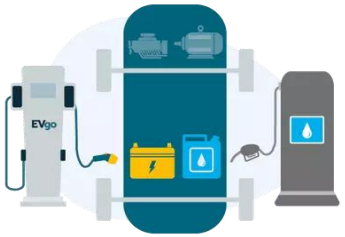
Electric Vehicles (Evs) can be either partially or fully powered by electricity from a battery.

"Plug-in" EVs (PEVs) need external charging source from the grid to recharge de batteries: BEVs and PHEVs.



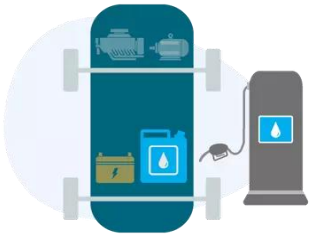
Battery-electric vehicles (BEVs):

- ✓ **Fully electric** vehicle
- ✓ Powered by an electric motor that uses energy stored in a **battery (28-100kWh)**
- ✓ Battery charged by plugging in to an electric power source
- ✓ The **EV battery uses Direct Current (DC) voltage** and is usually a lithium-based technology.
- ✓ Typical travel ranges **200 to 500 km on a single charge**
- ✓ **Zero emissions**



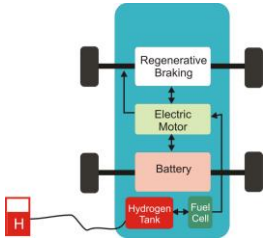
Plug-in hybrid electric vehicles (PHEVs):

- ✓ Powered **by both internal combustion engine and electric motor** that uses energy stored in a battery (smaller than BEVs)
- ✓ Battery charged by plugging in to an electric power source, through "regenerative braking" and by the combustion engine
- ✓ Battery allows to travel on **pure-electric mode for 20-50 km**
- ✓ **Lower emissions** (electric mode)



"Hybrid" electric vehicles (**HEVs**):

- ✓ Powered **by both internal combustion engine and electric motor** that uses energy stored in a battery
- ✓ Battery charged by "regenerative braking" and the internal engine
- ✓ No capability to charge the battery from an external source

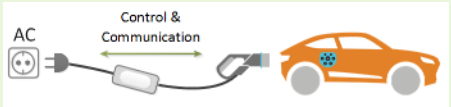
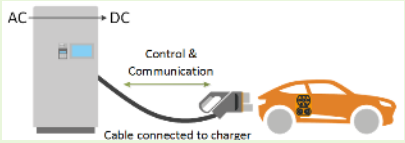


Fuel Cell Vehicle (FCEV):

- ✓ A fuel-cell electric vehicle **converts the chemical energy from a fuel, such as hydrogen, into electricity**
- ✓ This charges the battery that will power the electric motor
- ✓ Residue is just water

Source www.evgo.com

5 EVs Charging Modes

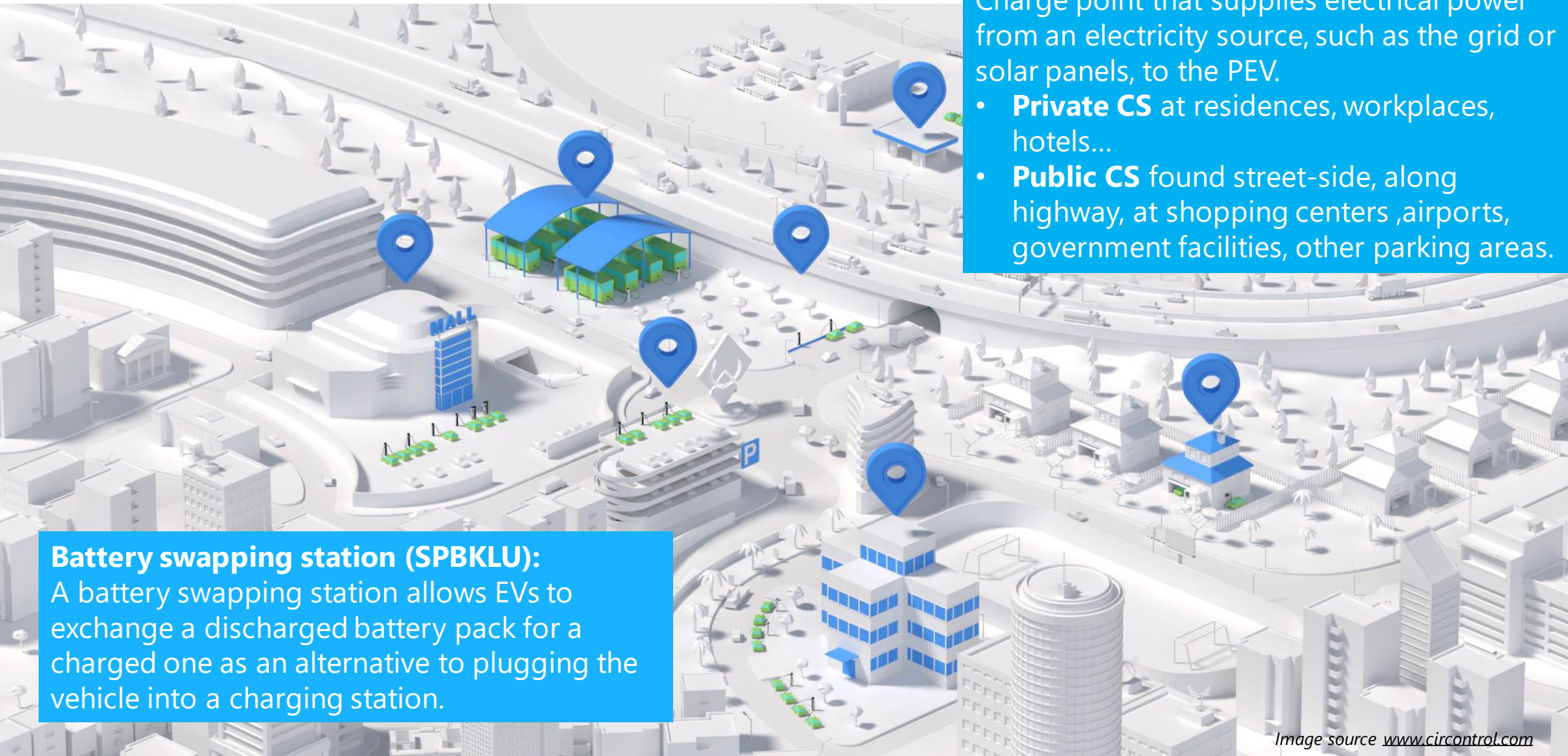
		Public Charging Infrastructure	
MODE 1	**MODE 2**	**MODE 3**	**MODE 4 (Fast Charge)**
			
• **AC charging (slow),** mono phase • Direct connection from the vehicle to the grid • Non-dedicated socket (**Schuko**-Standard power outlet) • No communication, no protective measures (used for e-scooters, e-bikes..) • **Max. 3,7kW** • Imax per phase=16A	• **AC charging (slow),** mono phase • Direct connection from the vehicle to the grid • Non-dedicated socket (**Schuko**-Standard power outlet) • Cable with communications, charge monitoring and protection • **Max. 3,7kW** • Imax per phase=32A	• **AC charging (slow or semi-fast)**, mono or three-phase • Direct connection from the vehicle to the grid, through an external charger **(SAVE or "WALLBOX"** with **connectors Type 1 (Yazaki) or Type 2 (Mennekes)** • Dedicated cable with communications, control and protection in charging station • **Max 7,4 kW (mono-phase) and 44kW (three-phase)**	• **DC Charging** (with Inverter AC/DC) • Indirect connection from the vehicle to the grid, through an external charger (**SAVE with CCS Combo or CHAdeMO Connectors**) • Dedicated cable with communication, control and protection included in charging station • **20 to +50kW**

Images source www.ocw.tudelft.nl

6 EVs Charging Infrastructure

Charging Stations CS (SPKLU):
Charge point that supplies electrical power from an electricity source, such as the grid or solar panels, to the PEV.

- **Private CS** at residences, workplaces, hotels…
- **Public CS** found street-side, along highway, at shopping centers ,airports, government facilities, other parking areas.



Battery swapping station (SPBKLU):
A battery swapping station allows EVs to exchange a discharged battery pack for a charged one as an alternative to plugging the vehicle into a charging station.

Image source www.circontrol.com

Photo by Chuttersnap on Unsplash

7 Indonesia e-Mobility Targets

Document	Target	Year
General Plan for Energy (under review)	**PR No. 22/2017 on General Energy Plan**: uptake targets of 2,200 EVs and hybrid cars (no specification regarding type of hybrid) and 2.1 million electric two-wheeler by 2025.	2017
C40 Fossil Fuel Free Street Declaration	**Jakarta City commitments to accelerate the transition to EVs:** C40 Fossil Fuel Free Street Declaration to procure only zero-emission buses by 2025 and committing to electrify 100% of the TransJakarta fleet by 2030.	2019
Minister of Industry Regulation No. 27/2020 EV Roadmap	**Battery Electric Vehicle Industry Roadmap 2020–2030** • Planned local production capacity of more than 600,000 units of four-wheeled BEV and 2.45 million units of two-wheeled EV annually by 2030. • The Indonesian government has set the target to produce 80% of components domestically by 2030 for electric cars (E4W) and by 2026 for electric motorcycles (E2W). • Low Carbon Emission Vehicle (LCEV), which includes hybrid vehicles, PHEV, BEV, and FCEV to reach at least 20% of annual domestic vehicle production by 2025 and 30% in 2035.	2020
National Energy Grand Strategy (GSEN) Ministry of Energy and Mineral Resources (MEMR) (under review)	**GSEN Roadmap for 2020–2040**. It includes plans to reduce fuel imports and promote EV development. EV uptake targets in the strategy are: • **2,195,000 of electric cars LDVs by 2030 (cumulative number)** • **13,000,000 of electric motorcycles by 2030 (cumulative number)** • It is expected to replace fuel consumption by around 77,000 barrels per day, thus reducing GHG emissions of 7.23 million tonnes of CO2e. • **GSEN has set 100% target of renewables portion in the energy mix by 2060 (Rev 2022)**	2020
Presidential Instruction No. 7/2022	**Presidential Instruction No. 7/2022 on EV Adoption for Government Official Vehicles**. By 2030, the government is expected to have 132,983 e-cars and 398,530 e-motorcycles for its operational needs.	2022

8 Indonesia e-Mobility Policies and Regulations

Type	Document	Year
Main EV Regulation	**Presidential Regulation (PR) No.55/2019** on **Acceleration of the Battery-Based Electric Motor Vehicle (BEVs) Program for Road Transportation**	2019
Regulation for charging stations	**Regulation of Minister of Energy and Mineral Resources (MEMR) No. 13/2020** on **the Provision of Electric Charging Infrastructure for Battery Electric Vehicle** (with a plan for PLN to add up to 24,720 recharging stations in the next 10 years). Standardization of charging plugs and electricity tariff policy for public electric vehicle charging station and public electric battery vehicle replacement.	2020
Ministry of Transport	• **MoT Regulation No. 44/2020**: EV testing and certification process • **MoT Reg. No. 45/2020**: Regulates special vehicle with electrical motor including safety requirement, riding behaviour, and vehicle lane. • **MoT Reg. No. 65/2020**: Legitimize the conversion of 2W to E2W, and regulates the component of conversion vehicle, requirement to convert to conversion shop for Small Medium Enterprises (SME) workshop, along with safety requirements and administration process • **MoT Reg. No. 15/2022**: Conversion of Motor Vehicles Other Than Motorcycles with Combustion Engine to BEV • **MoI Reg. No. 6/2022**: Technical requirements and Local Content Requirement (LCR) Guideline	2020
Implementing Regulations	**Minister of Industry (MoI) Regulation No.28/2020** on "Completely Knocked Down and Incompletely Knocked Down BEV". **Minister of Industry Regulation No. 27/2020** on "Specification, Roadmap for Development and Calculation of Local Content (Tingkat Komponen Dalam Negeri – TKDN) for BEV".	2020
Indonesian National Standardization Agency - BSN	**BSN has issued 34 Indonesian National Standards (SNI) related to the safety of electric vehicles (EVs), 71 SNIs on renewable energy sources as it is an integral part of the electromobility ecosystem** (ex. SNI ISO 50001 on an Energy Management System), **new SNIs for the battery component of BEVs** (SNI IEC 62660-part 1-3, SNI 8871:2019, SNI 8872:2019, SNI 8927:2020, SNI 8928:2020)	2019-2020

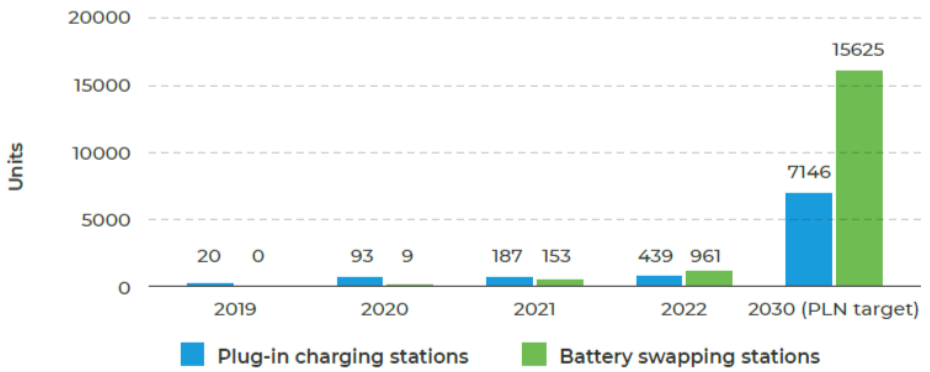
Photo by Metro Rakyat

9 Status Charging Infrastructure in Indonesia

Regulated by MEMR No. 13/2020 for the provision of BEV charging infrastructure, stipulating the types of charging infrastructure, the licensing requirements and safety standards, and the tariff to be imposed.

- **Plug-in charging station business is dominated by PLN** (PT Perusahaan Listrik Negara), the state-owned electricity distributor**, who owns 52% of the charging stations in Indonesia (**224 stations in 135 locations in 2022). Supported by battery charging application named **Charge.IN**
- **However, in Jakarta private sector players** have more charging stations than PLN.
- **PLN has developed a road map for the installation of 7,149 charging stations by 2030** with emphasis on private cars and motorcycles.
- **Pertamina**, the state-owned oil and gas distributor, is planning to add charging stations to its petrol stations.
- **The Government has set a target for the number of public charging stations for EVs (SPKLU)** under the National Grand Strategy for Energy. The goal is to achieve 6,318 SPKLU units by 2025, rising to 31,859 units by 2030.
- **Type 2 charging connector with lower capacity power (<22 kW**) is still the dominant type (SPKLU).
- **From the investment point of view, the battery-swapping station is a very** attractive option for E2W.

Charging infrastructure implementation yearly and 2030 target



Source: DGE (2020), CNN (2022), PLN (2022)

Charging infrastructure operators, charging types and station units in Jakarta areas (2022)

Private	AC Type 2 7-11 kW	81
	AC Type 2 22 kW	17
	DC CHAdeMO 60 W	2
	DC CCS/CCS2 50-60 kW	6
PLN	AC Type 2 7 kW	6
	AC Type 2 22-50 kW	37
	DC CHAdeMO 24-30 kW	5
	DC CHAdeMO >50 kW	7
	DC CCS 2 24-30 kW	5
	DC CCS 2 >50 kW	7
Pertamina	AC Type 2	5
	DC CCS	4
	DC CHAdeMO	3

Source: PLN (2022), Pertamina (2022), EVCuzz (2022), Starvo (2022), Hyundai (2022)

Source "IESR-Indonesia Energy Transition Outlook 2023"

Hello Indonesia.

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10 Indonesia EV Market

EV annual adoption status

Year	E2W & E3W	E4W	E-bus
2019	1,300	40	0
2020	2,047	229	0
2021	5,748	2,012	30
2022	25,782	7,679	58
2030 (NDC & private target)	13 million	2 million	10,000
2030 (IESR Target)	110 million	3 million	2,4 million

Source "IESR-Indonesia Energy Transition Outlook 2023"

EVs by category available for sale in the Indonesian Market as of November 2020

Type	Brand	Domestic/ Foreign	Model: Battery Capacity and Specification	Note
Passenger vehicle	BYD	Foreign	E6: 75 kWh	Taxi/ by Bluebird group
	Hyundai	Foreign	Ioniq: 38.3 kWh	Taxi/ by Grab Indonesia
	Tesla	Foreign	X 75D: 75 kWh	Taxi/ by Bluebird group
	BMW	Foreign	I3: 42.4 kWh	I3 model is offered
	Mitsubishi	Foreign	Outlander PHEV: 13.8 kWh, 2360 cc	Offer Outlander PHEV
Bus	Mobil Anak Bangsa (MAB)	Domestic	City bus: 12 m, 315.85 kWh Inter-city bus: 12 m, 315.85 kWh	In production
	BYD	Foreign	K9: 12 m, 324 kWh C6: 7.4 m, 135 kWh	No production yet Prototype
	Skywell	Foreign	NJL612BEV: 12 m, 258 kWh	Prototype (no production yet)
	Inka	Domestic	E-Inobus: 8 m, 143 kWh	Prototype (no production yet)
	Higher	Foreign	Higher bus: 8 m, 385 kWh	Prototype (no production yet)
Two- /three-wheeler	Viar	Domestic	Q1: 2 kWh	In production
	Gesit	Domestic	Gesits: 1.98 kWh	In production
	Selis	Domestic	Eagle Prix: 0.96 kWh Agats: 1.4 kWh Balis: 2.7 kWh Jalak Pro: 1.2 kWh E-max: 1.2 kWh	In production
	MIGO	Domestic	ECGO 2: 1.4 kWh	In production
	United	Domestic	T1800: 1.68 kWh	In production
	Tomara (e3Ws)	Domestic	Semar: 1.9 kWh	In production
	ECGO	Foreign	ECGO Bike-2: 1.25 kWh	In production
	Volta	Domestic	Volta 100: 0.4 kWh Volta 202/203/301/302: 0.6 kWh Volta 501 (e3Ws): 3.5 kWh	In production
	Unity	Foreign	Unity Scoopy: 0.6 kWh	In production
	Electro (MAB)	Domestic (MAB)	ML 01: 3.4 kWh	In production
	Sunrace	Domestic	Jupiter: 1.4 kWh F1: 1.4 kWh Stylish: 0.6 kWh & 0.9 kWh	In production
	Artas	Foreign		In production
	Gelis (e3Ws)	Domestic	Cargo: 3 kWh	In production
	Benelli	Foreign	Divo: 1.56 kWh	In production
	Keeway	Foreign	E-Zi: 1.2 kWh	In production
	Kymco	Foreign	Nice 100 EV: 1.5 kWh	In production

Source "ICCT Working Paper 2021-36"

11 Initiatives Local Mobility in Indonesia

May 2019

- **Indonesia's biggest taxi operator "Blue Bird Group" launched first fleet of electric taxis** by using China's BYD as well as Tesla cars in Jakarta and Bali.

Jan 2020

- SE Asian ride-hailing firm **GRAB and South Korean automaker Hyundai launched GrabCar Elektrik** service in Jakarta.
- GRAB is investing in deploying charging stations, battery swapping stations and e-bikes with PLN and Pertamina (deployed over 8,500 EVs across Indonesia).

Feb 2021

- Private energy company "**Medco Power" signed MoUs with PLN and GRAB** to support the Government's program to **accelerate the growth of EVs and new renewable energy in Indonesia**

Apr 2021

- **DAMRI E-Bus Project: ADB in partnership with Indonesia State-owned bus operator DAMRI** to provide **50 battery electric buses** and **39 fast charging stations** in Greater Jakarta area.

Nov 2021

- **Partnership between GOJEK** (SE Asia's leading mobile on-demand services platform) **and GOGORO** (Global technology leader in battery swapping ecosystems) **and PERTAMINA,** investing in EV: **Gogoro Smartscooter and GoStation battery swapping stations located** at Pertamina gas stations and pilot scheme in Jakarta.

Mar 2022

- Land transit operator for the Greater Jakarta Area, **TransJakarta, in partnership with Vektr Mobiliti Indonesia (VKTR)** and Chinese automaker BYD Auto plans to **operate at least 100 e-buses by 2025, targeting 100% e-bus in 2030**.

May 2022

- **Indonesian Government partnership with World Bank** for creating **"Electric Mobility Roadmap for the Indonesian Mass Transit Program"** to promote the **deployment of e-buses in Bandung and Medan** as pilot project.

- **Rent e-bike services:** Ex. Viar Vrent www.vrent.id, www.e-viar.com, www.migo-ebike.com…

12 Initiatives Local Manufacturing in Indonesia

- **Mar 2021** • **Indonesia Battery Corporation IBC**, electric battery holding company formed by four state-owned companies (Pertamina, PLN, Mind.Id and ANTAM), with an investment of USD 17 billion until 2030 **aims to build 140 GWh of battery capacity by 2030** (50 GWh for export)
- **Jul 2021** • **MoU signed between the Indonesia Ministry of Investment and "Hyundai Motor Company"** for an **EV battery factory with a capacity of 10 GWh,** and price tag of USD 1.1 billion
- **Feb 2022** • **"PT Vektr Mobiliti Indonesia" (VKTR)** to manufacture **electric buses (e-buses)** in collaboration with local carrosserie manufacturer "Tri Sakti" and top Chinese EV producer "BYD Auto".
- **Mar 2022** • **"PT Hyundai Motor Manufacturing Indonesia"** launched the first BEV made in Indonesia **Hyundai IONIQ 5**, for domestic and export.
- **Apr 2022** • China's battery giant "**Contemporary Amperex Technology" (CATL) joint investment** $5.97 billion with state-owned **Indonesian nickel miner "Aneka Tambang" and IBC** plans will cover an **end-to-end lithium battery supply chain.**
- **Jun 2022** • **South Korea's "LG Energy Solution" (LGES) launched nickel processing plants in Indonesia,** part of the company's $9.8 billion investment in the country to produce EV batteries.
- **Jul 2022** • **"Toyota Indonesia"** plans to invest ~USD1.8 Billion in the country over the next 5 years to produce **new generation electric vehicles.**
- **Sep 2022** • **Taiwanese Tech-group "Foxconn"** stablished Joint Venture with **Indonesia coal miner "Indika Energy"** with plans to **manufacture batteries and EVs in Indonesia**
- **Jan 2023** • **Partnership between state-owned mining holding "MIND ID" and China's CATL** on the development of the **lithium battery ecosystem in Indonesia**, with the aim to **produce the first lithium battery in 2025**

13 BALI e-Mobility Pilot Case

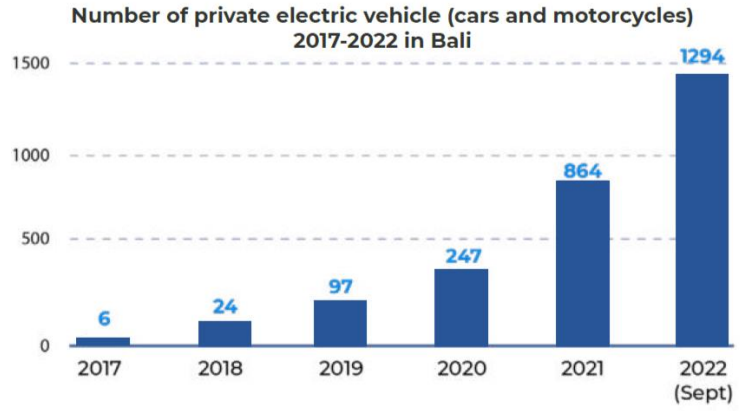
Bali is planning to deploy E-bus in its National Strategic Tourism Areas (KSPN). Bali is first province in Indonesia to issue a regulation on EVs, which has seen a 150% increase in EVs adoption in 2020, with a further 250% increase in 2021

Type	Bali Regulations - Documents	Launched
RUED Regional energy planning	**Local Government Regulation No. 9/2020 about the RUED**, in which the province of Bali has set a target of 11.15% renewable energy mix by 2025. However, Bali only had 1.29% of renewable energy share in its energy mix in 2021	2020
Regulation EV related	**Governor Regulation No. 48/2019 about the Use of Battery-based EVs**, which sets the commitment to build a healthy ecosystem for EVs and results in the increasing number of EVs in Bali. There are fiscal and non-fiscal incentives to accelerate the use of battery-based EVs	2019
Regulation EV related	**Governor Instruction No. 11/DISHUB/2021 about the Procurement of Battery-based within the Provincial Government of Bali.** Instruct Government Agencies, Area Management Authorities, SOE/LOE and Public Transportation Companies to gradually use battery-based EVs.	2021

- **EVs in Bali are ~6% of the total number of EVs** in Indonesia (2022)
- Bali has **21 charging stations, 6 public battery exchange stations, and ~100 battery swap places**, owned by Indonesian SOEs and companies.
- The increase in the number of EVs, infrastructure, and services shows that the **presence of local regulations encourages the investment in the EV ecosystem**.

SOE/LOE: State-Owned Enterprise/Local-Owned Enterprise

Source www.iesr.org



Source: IESR Analysis from Data Number of Registered EV in Bali's Department of Transportation, (2022)

Photo by Henry & Co on Unsplash

14 Challenges for EV adoption in Indonesia

- **Policy Challenges** due to **limited Government incentives and supporting policies**, and complex regulatory landscape with transport policy divided between local and central Government.
- **High cost of EVs and high electricity tariffs:** **Low price competitiveness of EVs** versus traditional mobility options as diesel is publicly subsidized in Indonesia.
- **Limited charging infrastructure:**
  - **Long charging times or uncertainty around charging locations and availability** can create a psychological problem for consumers to adopt EV ("**range anxiety**").
  - **Lack of a harmonized information portal** on charging stations or battery swap stations
- **High carbon intensity of Indonesia's electricity system and integration of EVs:**
  - **High grid emission factor (~ 0.8 kgCO2/kWh)** as ~60% of Indonesia's electricity generation comes from fossil fuel (mostly coal, and diesel), compromising the GHG reduction impact of e-mobility.
  - **Grid not ready yet to generate the extra power required**, especially from renewable sources, and grid instability issues.
- **Lack of Public Awareness,** lack of consumer knowledge with regards the options and benefits of e-mobility:
  - **Lack of motivation and trust** in investing in this new technology.
  - Concerns about electrocution risks during floods, which are frequent in an island-nation, and lack of repair service for EVs
- **Product availability / Local content requirements:** **Limited selection in the model and supply of EVs,** and limited supply chain for batteries and EV components due to the requirement for components to be domestically sourced.
- **Technology Challenges** due to the **shortage of local skilled workers** in the field of maintenance and repair of e-mobility.
- **Socio-economic Challenges** related to **stablished interests and livelihoods that might be compromised** with new e-mobility options.
- **Environmental concerns** regarding the highly polluting and carbon-intensive nickel mining and processing industry in Indonesia.

Sources www.cp.catapult.org.uk, www.iesr.org and www.theicct.org

15 Recommendations
for Indonesian Government to develop EV Ecosystem (I)

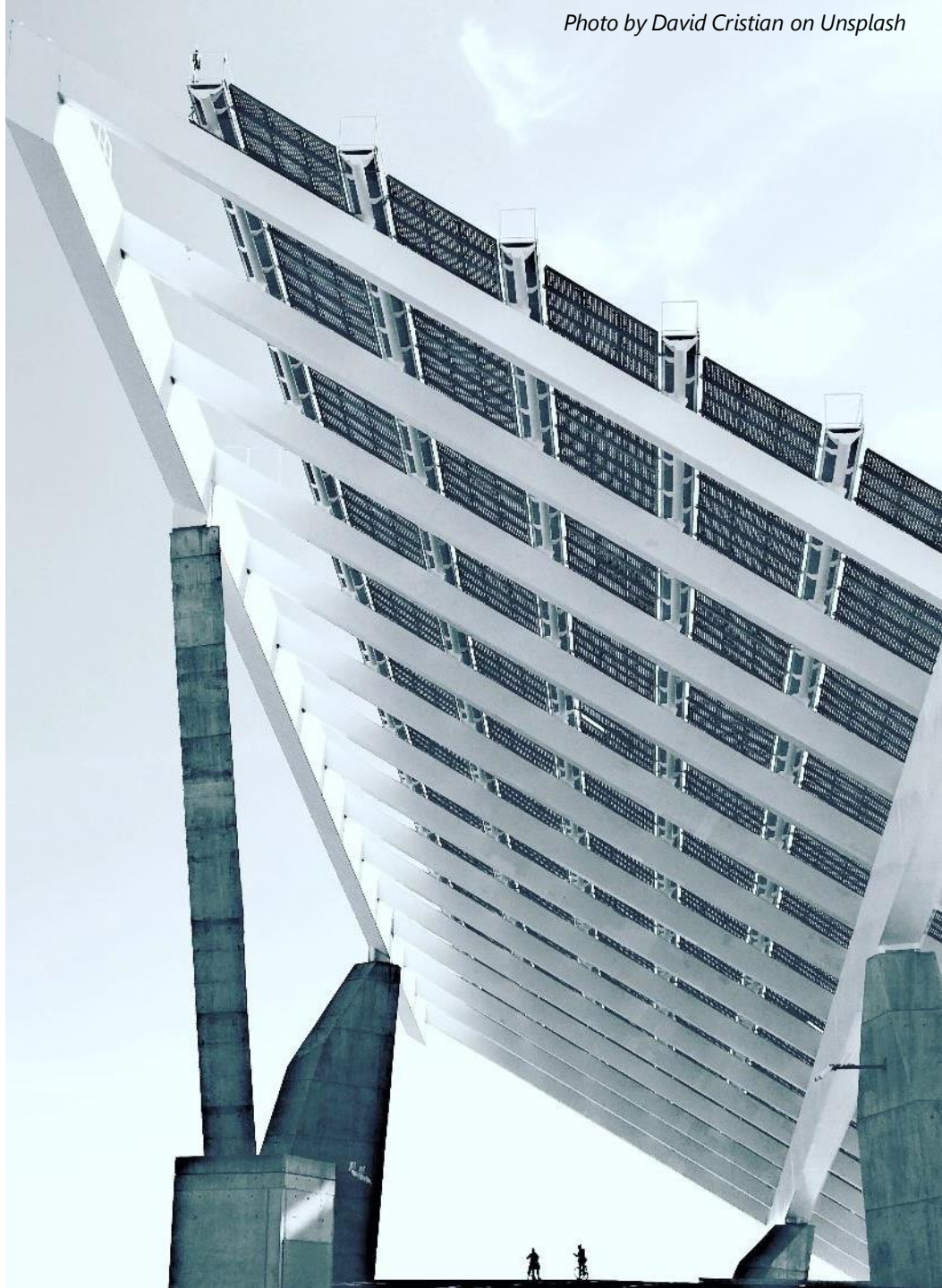
a) Development of regulatory and fiscal policies:

- Align the **national EV adoption targets** and make them binding and develop an **integrated roadmap for the transition to EVs**
- **Implement fiscal** (e.g. tax exemptions, registration taxes, import duties, subsidies) **and non-fiscal incentives** (e.g. access to special lanes, road toll exemptions, free parking, access to low emission zones) to make EV prices more competitive.
- **Create an initial market through public procurement of EVs** such as for public buses and official vehicles for government officials.
- **Implement policies to limit the sales of fossil fuel vehicles** (e.g. increase fuel price, fuel economy standard, conventional vehicles sales quota)

b) Decarbonise the grid before transitioning to EVs / Strengthen the charging infrastructure:

- First priority decarbonising the power sector **through increasing renewable energy** and reducing coal consumption in electricity generation.
- Introduce **electricity tariffs for peak and off-peak periods** to encourage charging at times that suit the electricity generation/supply profile.
- Develop a **massive public charging infrastructure network** (SPKLU and SPBKLU) through a mandate from Government entities along with both public and private investment, as well as the preparation of home charging infrastructure.
- **Support PLN to address the issues** like high investment costs for charging stations, especially DC fast charge, **the absence of standards** for charging station operations, **lack of land availability** in strategic locations and **untested business** models for charging/battery swap stations.

Sources www.cp.catapult.org.uk, www.iesr.org, www.theicct.org



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15 Recommendations
for Indonesian Government to develop EV Ecosystem (II)

c) Expand EV model availability and supply:

- **Encourage production to** increase EV models quantity & availability
- **Develop roadmap for the implementation of Indonesian standards** and technical regulations and their harmonization with international standards
- **Make use of and develop international standards** so products are internationally compatible and can easily be integrated into global value and supply chains while ensure their quality and safety.

d) Increase public/consumer awareness and acceptance:

- **Promote EVs as environmentally friendly vehicles** and educate consumers on the benefits and incentives of purchasing EVs.
- Establish a **platform for knowledge sharing**, organize outreach campaigns, stablish pilot projects at the local level.

e) Develop the supply chain for batteries and EV components:

- **Impose technology transfer** in collaboration with the international EVs and battery manufacturers.
- **Increase investment** in EVs domestic industrial and supply chain development
- **Develop local battery industry** to reduce the price of EVs as it is also to pursue the fulfillment of local content requirements (TKDN)
- Establish governance aspects for **battery waste treatment/recycling industry.**

Sources www.cp.catapult.org.uk, www.iesr.org and www.theicct.org

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16 Opportunities provided by e-Mobility in Indonesia

Economic growth & job creation potential	The electrification of the transportation sector provides huge potential for the development of a **high-tech and high-skilled national industry around e-mobility**, widely expected to create millions of jobs.
Key route to achieving net zero target	**As Indonesia has committed to reducing GHG emissions** in line with its membership in the 2015 Paris Agreement.
Link the renewable power and low-carbon transport sectors	**EVs present a viable opportunity to introduce much higher shares of renewables into the overall power generation mix**. To date, the renewable energy (RE) share in the power generation mix in Indonesia is 12.8%, with 8.52 MW of installed capacity.
Support VRE (variable renewable energy) integration	**Increasing power system flexibility by somehow synchronizing the charging of EVs with electricity demand**. EVs may also be used to supply electricity to the grid under the new vehicle-to-grid (V2G) concept. EVs would even support the development of smart grid systems and large energy storage solutions
Become key supplier for EV battery manufacturing sector	**Indonesia, the world's largest producer of nickel with 22% of the world's reserves**, an essential component in EVs batteries**, intends to become a global hub for producing and exporting EVs by developing a domestic battery industry and EV manufacturing capacity.**
Increase market resilience and growth	Indonesia to move from a net importer of fossil fuels and e-mobility supply chain parts and solutions, **to a leading hub of development and deployment**, and then to a regional and global powerhouse of exports.
Increase EV public transport	Increase public transport solutions like **e-buses, similar to TransJakarta and DAMRI pilot projects.**
Promote Green Tourism	EVs can be seen as a way **to boost green credentials**, helping to attract environmentally conscious tourists.
Battery waste treatment	Promote the development and establishment of a **battery waste treatment and recycling industry**
No one is left behind	**Most vulnerable sectors could be included and benefit from special e-mobility programs** (e.g. waste pickers, mobile food stalls and sellers…)

Sources www.cp.catapult.org.uk, www.iesr.org and www.theicct.org

Photo by Michael Fousert on Unsplash

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Annex 2 Key Stakeholders for EV development

Stakeholders	Role/Function
Ministry of Industry (MoI)	Coordinates and synchronizes the formulation, and execution of ministerial policy in industry. Develops technical specification and roadmap for development and calculation of local content for battery electric vehicles and regulations concerning completely knock down and incompletely knocked down imports.
Ministry of Finance (MoF)	Prepare state budgeting, including for road and public transport infrastructure. Formulate and set up carbon tax and fiscal policies, incorporate EVs into the procurement catalogue for operational vehicles of various government agencies.
Ministry of Energy and Mineral Resource (MEMR)	Develop energy planning and supply, including for the transport sector. In charge of charging infrastructure development; regulate electricity price; overall energy management, including to assure that renewable energy targets are achieved.
State Owned Electric Company (PLN)	Develop charging infrastructure for EV. PLN (PT Perusahaan Listrik Negara): The state-owned electricity distributor is overseeing EV rollout projects, signing memorandums of understanding (MoUs) with automobile and energy companies to build cars and support charging infrastructure.
Agency for Technology Assessment and Application (BPPT)	Lead the assessment of various innovative technologies related to EV supporting infrastructure
Ministry of Environment and Forestry (MoEF)	Prepare national policy for pollution control and environmental impact management of transport sector Issue regulations governing vehicle and power plant emission standards; monitor the environmental impact of used battery recycling
Ministry of Transport (MoT)	Construct national transport policy and manage public transport infrastructure operation Issue vehicle type approval, regulate periodic inspection and maintenance requirements, certify retrofit of conventional engine into electric
Associations of vehicle industries	Four-wheeler manufacturer association (GAIKINDO) and two-wheeler manufacturer association (AISI) advocate for the interests of the auto industry
Ministry of Trade	Responsible for ensuring local domestic components, TKDN (Tingkat Komponen Dalam Negeri) Provide import duty incentives
Local governments	Develop initiatives to promote the uptake of EVs within their jurisdictions
Civil society, university research centers and development partners	Collaborate with the government to support all dimensions relevant to the uptake of EVs
Automotive industry	Manufacture and distribute EVs to end users

Sources www.iesr.org and www.theicct.org

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