Electric Vehicles Sector Development in Kenya

MA Insights meeting - Key learnings

2024

Information provided in this report is fact-based market analysis and should not be construed as legal advice

PRELIMINARY DRAFT

Manufacturing Africa supported the Kenyan E-Mobility taskforce for 5 weeks to assess potential governmental initiatives for the EV sector

The objective of the E-mobility Taskforce is **developing a National Electric Mobility Policy to create an enabling** environment for adoption of electric vehicles in Kenya

Manufacturing Africa's project support focused on **benchmarking global initiatives and laying out options** for further consideration

The team **benchmarked initiatives** from selected countries with high **market maturity**, **regulatory activity** and **regional diversity**

+8
Countries benchmarked

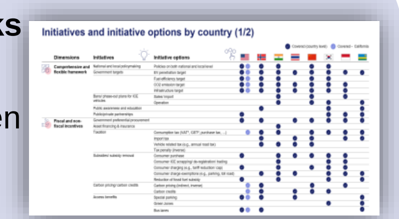
+300
governmental Initiatives researched

~5
Databases from EV sector development analyzed

+10
Interviews with global experts

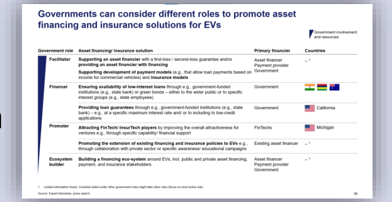
Global benchmarks

Understanding of main initiatives taken worldwide for EV sector

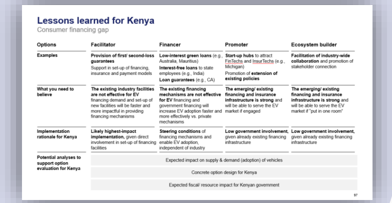


Implementation approaches

Understanding main global trends of specific initatives



Context and lessons learned for Kenya and possible areas for further analysis



Global comparison indicated that countries are leveraging 25 initiatives along 6 dimensions to establish the EV sector

Initiatives including proposals, ambitions, legislations, and targets

Dimension
x Initiative

Comprehensive & flexible framework

1 National & local policymaking
2 Government targets
3 Bans/ phase-out plans for ICE vehicles
4 Public awareness & education
5 Public / private partnerships

Fiscal & non-fiscal incentives

6 Government preferential procurement
7 Asset financing & insurance
8 Taxation
9 Subsidies/ subsidy removal
10 Carbon pricing/ carbon credits
11 Access benefits

Local manufacturing/ assembly & infra. capacity

12 Local manufacturing requirements
13 Local manufacturing incentives
14 Local enablers
15 Energy infrastructure
16 Charging infrastructure

Quality & assurance

17 Technical standards, incl. interoperability
18 Safety standards
19 ESG standards
20 End-of-life/ E-waste standards

Licensing & registration

21 Registration benefits
22 Registration criteria
23 License benefits

Monitoring & evaluation

24 Stakeholder engagement across value chain
25 Evaluation agency

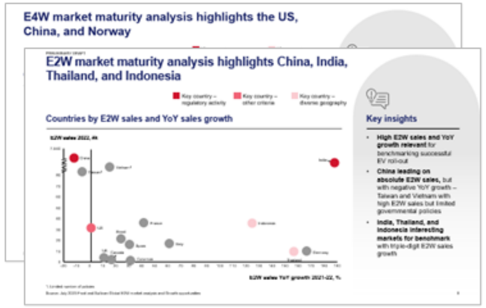
To better understand policy choices made globally, we selected countries to benchmark based on market maturity & regulatory activity

Process for country prioritization

Key criteria

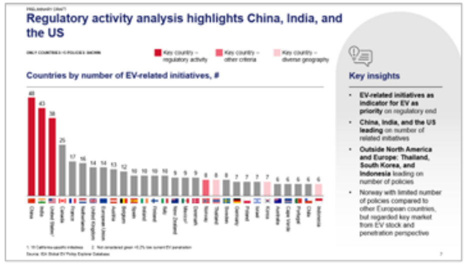
- **EV market maturity,** e.g., EV penetration
- **Regulatory activity**, e.g., through EV-related legislation
- **Regional diversity** (e.g., incl. countries from North America, Europe, Asia, and Africa)

Sources of input



Market maturity
E4W # total sales and % stock penetration by country

E2W # total sales and % YoY sales growth by country



Regulatory activity
EV-related initiatives by country (e.g., legislations, targets, ambitions, proposals)

Supported by qualitative expert insights

Countries proposed for comprehensive deep-dive

Advanced EV markets[1]

US (California)
China
Norway

Emerging EV markets[1]

India
Indonesia
South Korea
Thailand
Rwanda

Countries for targeted deep-dive[2]

United Kingdom
Chile

1. Based on EV roll-out (total stock and penetration)
2. For selected initiatives/dimensions

Common initiatives have been observed in the development of the EV sector across countries

Takeaways on eight benchmarked countries

Dimensions	Key takeaways
Comprehensive and flexible framework	• **National initiatives complemented by local/regional initiatives** in the majority of countries • **Extensive implementation of government targets across countries**, particularly on EV penetration, CO_2 emissions, and infrastructure
Fiscal and non-fiscal incentives	• **All countries with at least one taxation scheme and one subsidy** for end-consumers • **Majority of countries with at least one access benefit for end-consumers** with special parking being the most common • **Government preferential procurement** in the majority of countries
Local manufacturing / infrastructure capacity	• Local manufacturing supported in all countries through **either incentives (e.g., taxation) or requirements (e.g., local production share restriction)** • **At least one local business enabler** by country; research centers/ incubators most prominent • **At least one infrastructure initiative** by country; charging infrastructure initiatives present in the majority of benchmarked countries
Quality standards and assurance	• **Implementation of technical standards in all countries;** safety and end-of-life/ e-waste standards in most countries – with greater emphasis on advanced EV markets/ criteria for batteries
Licensing and registration	• Not observed in all countries; when applied; **registration fee benefit** most prominent
Monitoring and evaluation	• Not observed in all countries; when applied, establishing an **evaluation agency** most prominent

Source: IEA Global EV Policy Explorer Database, expert interviews, press search,

Initiatives by deep-dive countries (5/28)

This is example of 3 initiatives deep dives across four countries. Similar analysis were performed for 25 initiatives across the selected 8 countries

Initiatives	Initiative options				
6 **Government preferential procurement**	Government preferential procurement	✓ National: By 2027: 100% LDV government fleet to be ZEV By 2035: aspirations for 100% M/HDV procurement to be ZEV	✓ By 2022: 100% LDV government procurement to be ZEV By 2025: 100% bus procurement to be ZEV		✓ By 2030: 100% government agencies and public fleets to be ZEV
7 **Asset financing & insurance**	Asset financing & insurance			✓ 100% interest free loan to state employees for EV purchase (Uttar Pradesh policy, 2018)	
8 **Taxation**	Consumption tax	✓ California: tax credit of 750-7,500 USD for EV purchase	✓ Purchase tax exemption (0%) – from 2023 onwards: some weight-based taxation introduced again VAT exemption (0%) – from 2023, 25% VAT on the purchase price above 500K NOK (~47K USD)	✓ GST reduction: 5% flat vs. 28-50% for ICE Tax rebates: up to 2.1K USD on interest paid on loans	
	Import tax		✓ Import tax exemption (0%)		✓ Import duty exemption (0%) on charging equipment

Source: IEA Global EV Policy Explorer Database, expert interviews, press search,

There are key elements to consider around the Kenyan context to advance the sector

Further assessment based on E-mobility taskforce priorities

NON -EXHAUSTIVE

2W-driven market
~50% of vehicle park are 2Ws & emerging innovative 2W community

Above-usual vehicle strain
High usage, high loading (passenger & cargo), varying road conditions

Import-driven used 4W market
~80%+ of 4Ws are used second hand, imported under tariffs

Green energy infrastructure
High green energy share - but limited distribution/ grid unreliability and need for extra capacity

Gender & diversity focus
Key value for Kenya on the forefront inclusivity

Consumer financing gap
Requirement for vehicle financing mechanisms

Vehicle affordability gap
Current discrepancy of ICE vs. EV prices

Public infrastructure gap
Need for public charging (limited at-home)

Potential for domestic manufacturing/ assembly
Today, assembly focus and nascent manufacturing; potential for FDI

Fiscal capacity
Government budget constraints; revenue implications of existing ICE/ fossil policies

Source: Shell foundation, expert interviews

We evaluated key initiatives based on priorities for the E-mobility taskforce

Example outlined next

Kenyan context elements	Related initiatives for deep-dive[1]
Import-driven used 4W market	3 Bans/ phase-out plans for ICE vehicles
Consumer financing gap	7 Asset financing & insurance
Vehicle affordability gap	8 9 Taxation & Subsidies/ subsidy removal[1]
Public infrastructure gap	16 Charging infrastructure 17 Technical standards: standardization/interoperability
Potential for domestic manufacturing/assembly	12 13 Local manufacturing requirements & incentives[1] 14 Local enablers: re-skilling & up-skilling programs 20 End-of-life/ E-waste standards
Fiscal capacity	*Assessment as further deep dive on following discussions[2]*

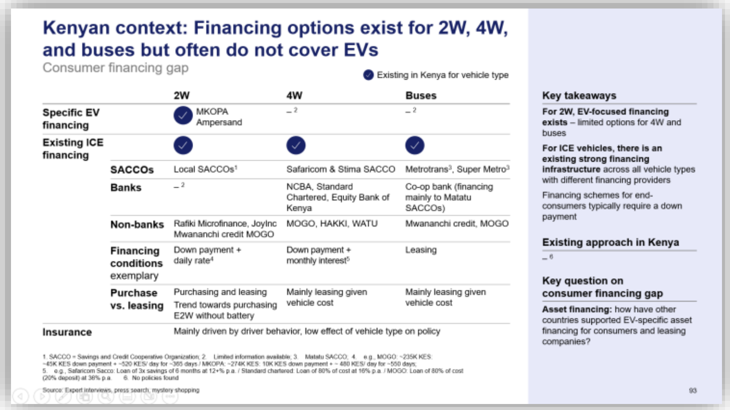
For each initiative, we assessed:

- Kenyan context, e.g., main opportunities, drivers of gaps
- Main implementation approaches taken by other countries
- Deep-dive on country examples and specific actions
- Lesson learned for Kenya

1. During deep dives, the emphasis was on exploring various strategies and approaches that have been employed to address the key context, rather than covering every possible initiative option
2. Assessment not included in the scope of this present report

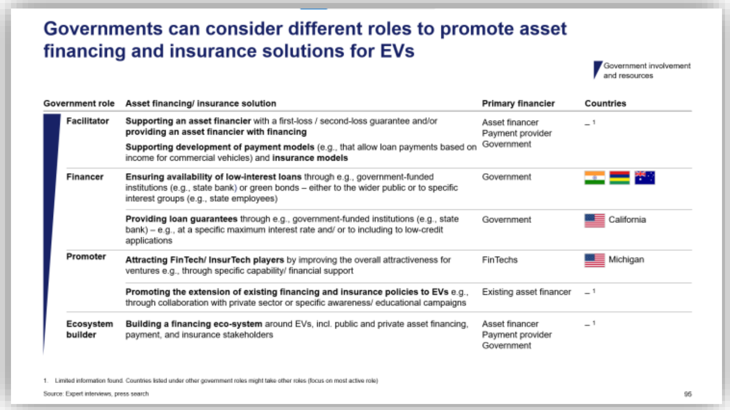
For each initiative for deep dive, we assessed Kenyan context, main approaches taken by other countries and lessons learned for Kenya

Kenyan context



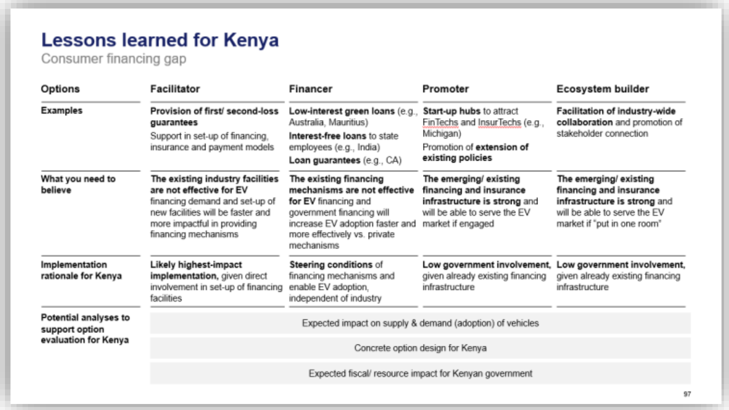
- Which **challenges/opportunities** the Kenyan data point out on this initiative?
- What are the **Kenyan policies** that are already in place?
- What are the **main questions important** to considerate to Kenya on this initiative?

Implementation approaches



- What are the **different roles/approaches** taken by government on this initiative?
- Which countries decided for what **approaches**?
- What are **useful examples of approaches** that clarify the role taken by government?

Lessons learned for Kenya



- What do you **need to believe to decide** on each approach?
- What would be the specific **rationale to implement** that approach in Kenya?
- What analysis is **needed to support the implementation** decision for Kenya?

Kenyan context: Financing options exist for 2W, 4W, and buses but often do not cover EVs

This is an example of consumer financing gap initiative. Similar analysis were performed for all prioritized initiatives

Consumer financing gap

✓ Existing in Kenya for vehicle type

		2W	4W	Buses
Specific EV financing		✓ MKOPA Ampersand	– [2]	– [2]
Existing ICE financing		✓	✓	✓
	SACCOs	Local SACCOs[1]	Safaricom & Stima SACCO	Metrotrans[3], Super Metro[3]
	Banks	– [2]	NCBA, Standard Chartered, Equity Bank of Kenya	Co-op bank (financing mainly to Matatu SACCOs)
	Non-banks	Rafiki Microfinance, JoyInc Mwananchi credit MOGO	MOGO, HAKKI, WATU	Mwananchi credit, MOGO
	Financing conditions exemplary	Down payment + daily rate[4]	Down payment + monthly interest[5]	Leasing
	Purchase vs. leasing	Purchasing and leasing Trend towards purchasing E2W without battery	Mainly leasing given vehicle cost	Mainly leasing given vehicle cost
Insurance		Mainly driven by driver behavior, low effect of vehicle type on policy		

1. SACCO = Savings and Credit Cooperative Organization; 2. Limited information available; 3. Matatu SACCO; 4. e.g., MOGO: ~235K KES: ~45K KES down payment + ~520 KES/ day for ~365 days / MKOPA: ~274K KES: 10K KES down payment + ~ 480 KES/ day for ~550 days;
5. e.g., Safaricom Sacco: Loan of 3x savings of 6 months at 12+% p.a. / Standard chartered: Loan of 80% of cost at 16% p.a. / MOGO: Loan of 80% of cost (20% deposit) at 36% p.a. 6. Range of income based on vehicle leasing/ ownership and rural/ urban areas 7. No policies found

Source: Expert interviews, press search, mystery shopping

Key takeaways

For 2W, EV-focused financing exists – limited options for 4W and buses

For ICE vehicles, there is an existing strong financing infrastructure across all vehicle types with different financing providers

Financing schemes for end-consumers typically require a down payment

Vehicle cost is significant to taxi drivers (e.g., compared to average income of ~200-400 USD/ month for Uber and Boda Boda drivers)[6]

Existing approach in Kenya

– [7]

Key question on consumer financing gap

Asset financing: how have other countries supported EV-specific asset financing for consumers and leasing companies?

Asset financing & insurances conditions are similar for EVs vs. ICE vehicles

This is an example of consumer financing gap initiative. Similar analysis were performed for all prioritized initiatives

Impact on financing/ insurance policy

	ICE	EV
Asset financing – purchase	+ **Similar asset financing schemes** vs. EVs but likely lower overall cost given on average lower vehicle prices	– **Similar asset financing schemes** vs. ICEs but likely higher overall cost given on average higher vehicle prices
Asset financing – leasing	+ **Clarity on residual vehicle value** – easier pricing of leasing schemes	? **Uncertain residual/ resale value** e.g., battery value driven by material supply constraints vs. technological advancements
Insurance	+ **Similar insurance policies to EVs,** but typically lower premiums given on average lower vehicle prices ↔ **Likely higher maintenance service needs** due to more technical components to potentially break down	– **Similar insurance policies to ICEs,** but typically higher premiums due to on average higher vehicle price/ risks through battery fire hazards ↔ **Likely lower maintenance service needs but at higher cost** (i.e., more specialized capabilities required) + **Potential for behaviour-based insurance** due to IoT component deployment in EVs

Source: Expert interviews, press search

Key takeaways

Overall, there are no main differences between financing and insurance policies for EVs vs. ICE vehicles

Purchase financing policies for end-consumers are only impacted on cost by vehicle type, while leasing is subject to some uncertainty around the residual value of EVs

Insurance policies are similar but at on average higher cost for EVs, given higher vehicle price

Governments can consider different roles to promote asset financing and insurance solutions for EVs

This is an example of consumer financing gap initiative. Similar analysis were performed for all prioritized initiatives

High

Government involvement and resources

Low

Government role	Asset financing/ insurance solution	Primary financier	Countries
Facilitator	**Supporting an asset financier** with a first-loss / second-loss guarantee and/or **providing an asset financier with financing** **Supporting development of payment models** (e.g., that allow loan payments based on income for commercial vehicles) and **insurance models**	Asset financer Payment provider Government	–[1]
Financer	**Ensuring availability of low-interest loans** through e.g., government-funded institutions (e.g., state bank) or green bonds – either to the wider public or to specific interest groups (e.g., state employees)	Government	
	Providing loan guarantees through e.g., government-funded institutions (e.g., state bank) – e.g., at a specific maximum interest rate and/ or to including to low-credit applications	Government	California
Promoter	**Attracting FinTech/ InsurTech players** by improving the overall attractiveness for ventures e.g., through specific capability/ financial support	FinTechs	Michigan
	Promoting the extension of existing financing and insurance policies to EVs e.g., through collaboration with private sector or specific awareness/ educational campaigns	Existing asset financer	–[1]
Ecosystem builder	**Building a financing eco-system** around EVs, incl. public and private asset financing, payment, and insurance stakeholders	Asset financer Payment provider Government	–[1]

1. Limited information found. Countries listed under other government roles might take other roles (focus on most active role)

Source: Expert interviews, press search

Most governments have adopted a “financer” role to increase adoption of EV

This is an example of consumer financing gap initiative. Similar analysis were performed for all prioritized initiatives

Promoter

Michigan

- **Entrepreneurial hubs across the State to support small businesses** and provide comprehensive resources
- 75Mn USD support for “Small Business Smart Zones and Business Accelerators initiative”

Financer

Low-interest loan

Australia

- **Interest rate reduction for “green car loans”** (vs. ICE loans) provided in a financing agreement **by Taurus Motor Finance & the Government-owned bank Clean Energy Finance Corporate** as part of Electric Car Discount bill
- **Commitment of 20.5Mn AUD (~13.5Mn USD) in investment** to support discounted loans totaling 100Mn AUD (~65Mn USD)
- **Consumer savings estimated at 1.3K AUD (~850 USD)** over 7-year period on loan of 48K AUD (~31K USD)
- Eligibility for all BEVs & plug-in hybrid vehicles <90K AUD (~59K USD)

Mauritius

- **Low-interest “green” loans by the Development Bank of Mauritius for the purchase of EVs by taxi and van operators** to remove the upfront investment barrier
- **Concessionary interest rate of 0.5% annually** for max. 3Mn RS (~68K USD), repayable over a period of 7 years
- **Planned extension to corporate fleets** after proof of concept with taxis

India

- **100% interest free loans offered to state employees** under for the purchase of EVs in the state under the Haryana Policy

Loan guarantee

California

- **Loan guarantees** offered by State of California as part of Clean Vehicle Assistance Program and **provided by Beneficial State Bank**
- **Max. guaranteed interest rate of 8%** for qualified clean vehicle grant recipients; with possible qualification for low- or no-credit applicants

Financers or promoters are most common roles taken by governments of countries addressing the consumer financing gap

Source: Press search

Lessons learned for Kenya: Consumer financing gap

This is an example of consumer financing gap initiative. Similar analysis were performed for all prioritized initiatives

Asset financing & insurance

Reasons to address: Financing schemes improve consumer ability to afford the upfront cost of the vehicle and increase EV adoption

Options	Facilitator	Financer	Promoter	Ecosystem builder
Examples	**Provision of first/ second-loss guarantees** Support in set-up of financing, insurance and payment models	**Low-interest green loans** (e.g., Australia, Mauritius) **Interest-free loans** to state employees (e.g., India) **Loan guarantees** (e.g., CA)	**Start-up hubs** to attract FinTechs and InsurTechs (e.g., Michigan) Promotion of **extension of existing policies**	**Facilitation of industry-wide collaboration** and promotion of stakeholder connection
What you need to believe	**The existing industry facilities are not effective for EV** financing demand and set-up of new facilities will be faster and more impactful in providing financing mechanisms	**The existing financing mechanisms are not effective for EV** financing and government financing will increase EV adoption faster and more effectively vs. private mechanisms	**The emerging/ existing financing and insurance infrastructure is strong** and will be able to serve the EV market if engaged	**The emerging/ existing financing and insurance infrastructure is strong** and will be able to serve the EV market if "put in one room"
Implementation rationale for Kenya	**High importance of topic requires direct involvement (incl. resources) and overseeing** through set-up of financing facilities	**Direct influence on financing conditions (incl. resource implication)** but no requirement for setting up new facilities	**Lower government involvement** and resources but support for start-ups to leverage potential and support local innovation	**Low government involvement,** and resources given already existing financing infrastructure

Potential analyses to support option evaluation for Kenya

- Expected impact on supply & demand (adoption) of vehicles
- Concrete option design for Kenya
- Expected fiscal/ resource impact for Kenyan government

Next steps for Kenyan E-Mobility Taskforce

Taskforce incorporate priorities into policy suggestions

Taskforce review priorities on electric vehicles and discuss otential opportunities for Kenya with the whole group of E-mobility taskforce members

Evaluate next steps to complement policy framework

Asses needed activities to define and incorporate policies for EV in Kenya (e.g public submissions)

Discuss findings with other local stakeholders

Review findings of work with other local stakeholders important to EV development

Backup

Key learnings

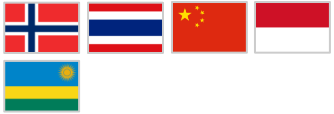
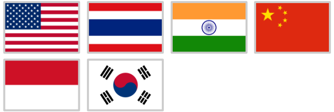
What we learned	What worked well/ *what to be aware of*	What we can do to be more effective going forward
Align on scope early on	Early check-ins and adhoc meetings were critical to align on trigger topics “Excitement” triggers topics were identified and reviewed periodically with team to determine impact on scope	Test periodically what the end deliverable look like especially “excitement” triggers topics on what the end deliverable looks like with senior clients
Improve client involvement/ engagement during working sessions	Weekly working sessions to review progress and cocreate solutions All client requests addressed and played back for their final address *Weekly working sessions requires active client involvement to ensure co-creation*	Assign content related responsibilities to clients to help improve engagements during working sessions
Involve all Taskforce members in conversations early on	Workshop is set at the end of the study to take all Taskforce members through report and get their inputs *Late involvement of all taskforce members may result in “late” inputs causing delays or missteps*	Account for lead time required for crystallisation of inputs received from workshops. Set mid study workshops to align on progress and receive timely inputs
Involve senior leadership	SteerCo updates and other adhoc meetings for output requiring broader alignment *Senior clients to create sufficient time for output aliment and provide critical inputs when needed*	Understand upfront any program or other macro environment driven limitations on time availabilities from all senior leadership stakeholders

F: Executive summary: Prioritized initiatives (1/5)

	Kenyan context	Implementation approaches used by governments	Examples of countries	Considerations for Kenya
3 Bans/ phase-out plans for ICE vehicles	**80% of parc is used ICE vehicles imports** **Petroleum import bill rose to KES 628.4 billion in 2022 up from KES 348.3 Billion in 2021** **~90% green energy generation capacity**	ICE ban No ICE bans – EV targets and technical restrictions		**Implementation will vary depending on** • **Demand adoption:** With comparable total costs of ownership for ICE and EVs, and subsequent sufficient adoption, an ICE ban will not disrupt a country's mobility. • **Vehicle supply:** Vehicle availability will provide options for an ICE transition • **Charging infrastructure availability:** Charging availability will reduce charging anxiety among consumers and boost EV adoption
7 Asset financing & insurance	**Existing strong financing infrastructure for ICE vehicles** **EV-focused financing existing for E2W** but limited for 4W and buses **Different financing providers** (e.g., banks, SACCOs) **Vehicle cost significant** e.g., to taxi drivers	**Facilitator:** direct involvement through set-up of facilities **Financer:** direct involvement through provision of e.g., loans **Promoter: I**ndustry player attraction/ policy extension promotion **Ecosystem builder:** facilitation of industry-wide collab.		**Implementation will vary depending on** • **Extent of Government role** (e.g., active direct involvement vs. more passive, indirect involvement) • **Resources & budget availability** (e.g., capacity to provide financing vs. stakeholder engagement role) • **Strength of existing industry to cover EV requirements** (e.g., effectiveness of financing scheme)

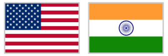
Source: Expert interviews, press search

F: Executive summary: Prioritized initiatives (2/5)

	Kenyan context	Implementation approaches used by governments	Examples of countries	Considerations for Kenya
8 9 Taxation & subsidies/ subsidy removal	**Off-the-road vehicle cost for E4W vehicle in Kenya is higher** vs. new and used ICE vehicles **For 2W, vehicle price gap relates to E2W incl. battery** – but 5-year total cost of ownership is similar for ICE 2W vs. E2W	**Value added tax:** Reduction of or exemption from taxes		**Implementation will vary depending on** • **Importance of visibility to consumers** as accelerator of EV adoption • **Importance of supporting upfront costs vs. operation** of EV vehicles as accelerator of EV adoption • **Resources & budget availability,** i.e., magnitude of support provided • **Required dependencies for implementation** (e.g., independent decision-making vs. cross-country collaboration) • **Available scope for implementation** (e.g., measures already in place limiting actionability vs. range of options)
		Import tax: Reduction of or exemption from taxes		
		Vehicle-related tax: Reduction of or exemption from taxes		
		Upfront lump sum: financial contribution to EV purchase		
		Scrap reward: financial contribution to EV purchase upon scrapping of ICE		
		Charge exemption: Reduction of or exemption from charges		
		Tariff reduction: Reduction of or exemption from charges		

Source: Expert interviews, press search

F: Executive summary: Prioritized initiatives (3/5)

	Kenyan context	Implementation approaches used by governments	Examples of countries	Considerations for Kenya
16 Charging Infrastructure	Currently **<25 privately-funded E4W charging stations** located at JKIA airport, shopping centres, existing petrol stations and offices Currently, **~10Mn KES** planned for infrastructure development	Public Funded		**Implementation will vary depending on** • **Capital requirements** and **risk appetite** in nationwide deployment • **Potential revenues** from tariffs/ fees charged at stations • **Efficiency** of synergies between government and private sector • **Potential impact** on EV adoption
		Private funded		
		Public-private funded		
17 Technical standards: interoperability	**Today, limited number of EVs & EV charging points** **Variety of connector types:** mostly Type1/ Type 2; some CHAdeMO and CCS2 **E2W battery charging/ swapping** e.g., by Ampersand, Roam Kenya, ARC Ride	**Mandatory prescriptions:** specific standardization requirements		**Implementation will vary depending on** • **Importance of charging convenience to consumers** as accelerator of EV adoption • **Importance of EV vehicle variety in the market** as accelerator of EV adoption (i.e., limitations through connector standardization) • **Ability to incentivize charging operators** to set up infrastructure under specific prescriptions or guidelines
		Guidelines: more flexible ranges of options and targets (no specific prescription)		
		No regulation		

Source: Expert interviews, press search

F: Executive summary: Prioritized initiatives (4/5)

	Kenyan context	Implementation approaches used by governments	Examples of countries	Considerations for Kenya
12 13 Local manufacturing requirements & incentives	Local assembly of 4Ws is small representing ~10% of annual registered 4Ws while 2Ws local assembly is significant with share of >90% of registered 2Ws ~7 major assemblers	Non battery components incentives		**Implementation will vary depending on:** • **Local manufacturing/assembling capacity** (e.g., capacity existing local assembly players) • **Sourcing raw materials competitively** (e.g., battery or components raw materials) • **Resources and budget availability** (i.e., magnitude of subsidies/tax incentives given) • **Expected demand** for non-battery components, batteries and fully built EVs
		Battery components incentives		
		Incentives across EV production value chain		
14 Local enablers: re-skilling & up-skilling program	There were 3000 people employed on ICE assembly lines in Kenya in 2017 There are shifts coming in skills needed in the EV ecosystem and the current ICE vehicle industry workforce will need to be upskilled accordingly	**Hire foreign talent**		**Implementation will vary depending on:** • **Expected EV adoption (penetration rate):** Skills will be needed to service the existent EVs and infrastructure set up • **Local EV manufacturing needs:** A ramp up of local manufacturing/assembly will require skilled workers at assembly lines/factories
		Acqui-hire: Acquire company with required skills		
		Utilize training centers		
		Boost STEM education		
		OEM upskilling: OEMs launch training programs for their workforce		

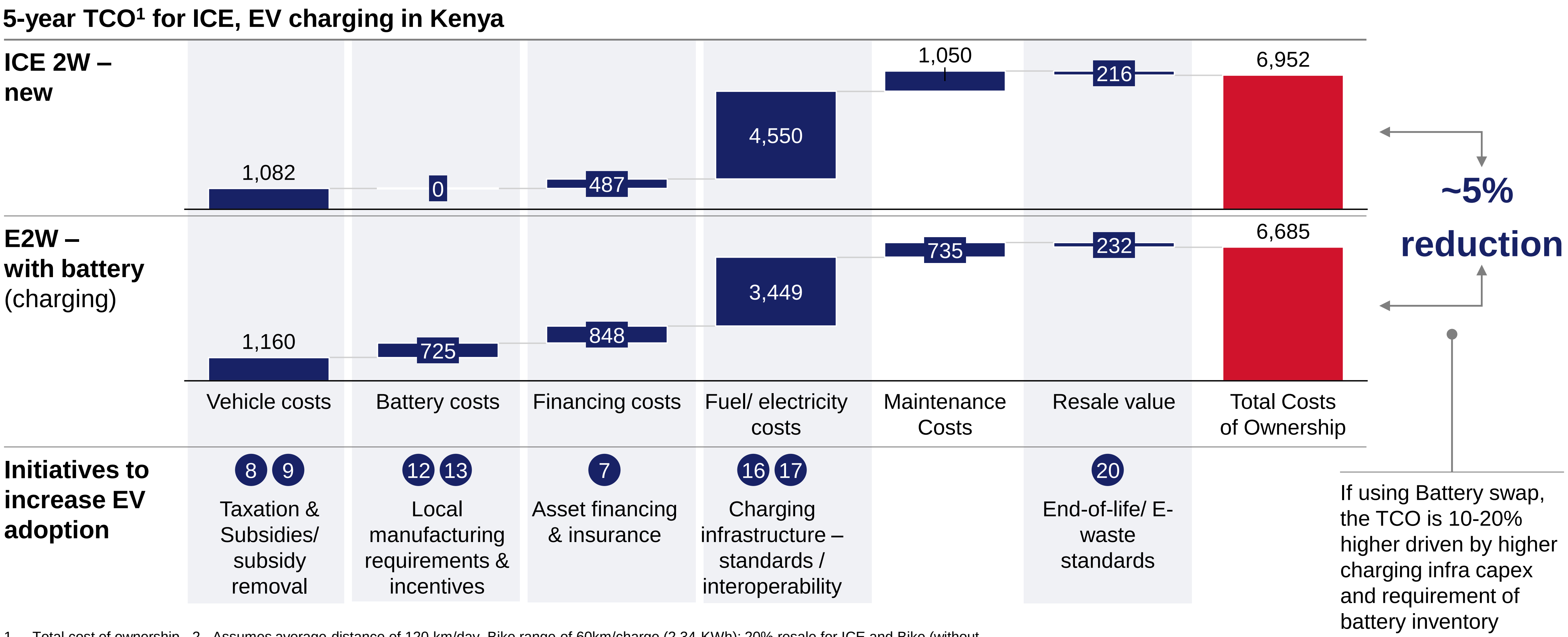
Source: Expert interviews, press search

F: Executive summary: Prioritized initiatives (5/5)

	Kenyan context	Implementation approaches used by governments	Examples of countries	Considerations for Kenya
20 End-of-life (EoL)/ E-waste standards	**Kenya has waste management act** but it does **not directly regulate EoL**. **EoL management is still nascent** as there is no sufficient old batteries requiring recycling. Currently, ~4 countries have some EoL policies	No policies Battery sourcing policies Policies across battery lifecycle	   	**Implementation will vary depending on** • **Perceived importance of EoL management** given its still nascent globally, and its **complementary advantages to country's waste management services** • **Perceived importance of battery safety standards** • **Perceived importance of battery cost competitiveness in the market** (i.e., allowing many OEMs to enter the market even those with little incentives to recycle)

Source: Expert interviews, press search

Kenyan context: E2W today have similar TCO as ICE; further reduction in TCO would be needed for steep increase in adoption[1]



1. Total cost of ownership 2. Assumes average distance of 120 km/day, Bike range of 60km/charge (2.34 KWh); 20% resale for ICE and Bike (without Battery) 3. Assumes fuel price of 1.3USD/l for ICE, Charging fee of 0.32 USD/ h and 2x charging

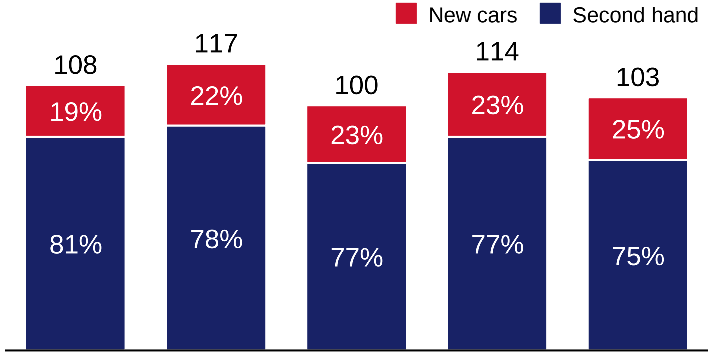
Source: Press and OEM websites research

Import-driven used 4W market

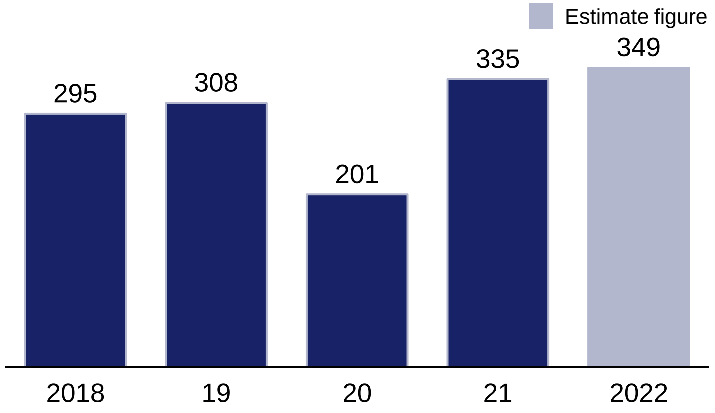
3 Bans/ phase-out plans for ICE vehicles

Kenyan context: Phase out of ICE vehicles as one option to help meet country's decarbonization goals

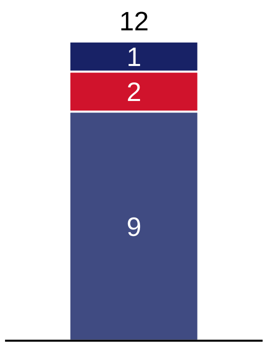
4W Vehicles registered in Kenya, 000s



Petroleum products imports to Kenya, Bn



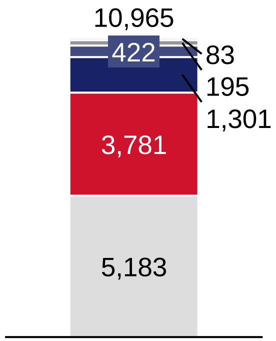
Kenya's transport sector emissions 2020, "MtCO2e"



On average, **ICE 4W** and **2W** contributed to **~75%** and **~17%** of the transport sector's emissions **respectively[1]**

With **Kenya's decarbonization target of 2050**, vehicle emissions reduction will be a crucial lever in country emissions reduction, as **transport contributes ~11%** of Kenya's carbon emissions today

Kenya's electricity generation in 2021, "GWh"



Kenya's **energy demand for 2021 was 9565.4 GWh**, indicating a surplus production

Kenya also **produced 88% of its electricity from renewable sources** in 2021

1. Assumption: Vehicle parc of 3.9m in 2020; 50% cars and50% motorcycles. An average car emits 4.6 tCO2e annually, while an average motorcycle emits 0.81tCO2e annually

Source: Climate Analytics, Kenya bureau of Statistics, Environmental protection agency, CleanTechnica

Key takeaways

Kenya's vehicle park is on the rise, with **~80% of 4W being imports** and 2W being locally assembled

With the increasing petroleum import bill and consequent emissions, a transition to EV will help reduce the oil imports and emissions

There is a **~90% local capacity for renewable energy generation**

Existing approach in Kenya

ICE ban in Kenya: no ban or ban proposal planned. Net zero pledged for 2050

Government EV targets: No government EV targets set

Technical restrictions: Age restriction in place for imports of ICE cars only (8 years)

Key questions on Import driven used 4w market

What were the main elements that made countries adopt ICE bans?

What are indirect ways of promoting gradual phase outs? What are the tradeoffs?

What to consider when thinking of different ways for ICE – EV transition?

ICE phase outs have been conducted in different ways by countries: by applying direct bans or creating indirect restrictions

NON-EXHAUSTIVE

	ICE ban		No ICE ban	
Implementation examples[3]	**Policy**	**Proposal**	**Govt EV targets**	**Technical restrictions**
Description	Enforced in law end of sale, importation or operation of ICE vehicles, with penalties on non-compliance	Government preference on EV adoption but no law enforcement on end of ICE sale, imports or operation	Government EV penetration targets help communicate overall direction to citizens	Age and emissions restriction help governments regulate quality of ICE vehicles and introduce EV options
Key levers	**Last mile EV adoption**; the markets is mature enough for the ban to act as a last-mile enabler **Target achievement lever:** ICE bans can help achieve ambitious EV penetration and climate goals **Predictability:** official communication for local stakeholders (E.g manufacturers) be able to plan their ICE phase-out	**Regulation complexity:** proposals can be easier than policy bans to implement **Policy anticipation:** Proposals can be a precursor to enforced policies **Awareness:** statement of the need for transitioning to sustainable forms of transportation can encouraged public discussion	**Specific automotive industry impact:** targets allow to incentivize specific elements/enablers of the EV industry **Flexibility:** target can provide more flexibility to review goals than bans as the market evolve **Predictability:** official communication for local stakeholders (e.g manufacturers) to be able to plan their ICE phase-out	**Precision:** description of the specific technical elements needed on ICE to ensure safety while transitioning to EV **Implementation complexity:** OEMs may require time and significant investment to shift to EV manufacturing
Country examples	Norway will completely phase out sales of ICE vehicles by 2025, with EVs making up 80% vehicle sales in 2022	China propose a ban of ICE sales by 2030, and will likely enforce this in its tier 1 cities	30% of motorcycles, 8% of passenger vehicles, 20% of buses, and 25% of minibuses to be electric	By 2030: 33.1km/L for passenger cars and 17.3km/L for light trucks

1. Off-the-road price: Final price that consumer pays for a new car, coupled with import, excise and value added taxes
2. TCO - total cost of ownership
3. Other policies are in place to adopt phase out of ICE without bans. These are the most typical ones that countries rely hugely on to make the transition

Source: Expert interviews, press search

Supply and demand factors are important when assessing ICE ban/phase-out readiness for countries

Key factors for ICE ban/ phase out assessment

ICE bans/phase-outs impact a country's mobility, and some considerations are made when **assessing a country's ICE phasing out options**

Demand adoption	Total cost of ownership difference for ICE and EV vehicles EV adoption maturity
Vehicle supply	Sufficient supply of EVs/ICE alternatives Availability of EV-purchase financing
Charging infrastructure availability	Sufficient supply of charging stations Optimally located throughout the country

Different regions are approaching ICE phase-outs/bans in different ways, given the factors aforementioned

The EU in March stepped back on a law banning the sale of petrol and diesel cars from 2035

Main reasons were:

- E-fuels as **a fit alternative to diesel** and petroleum
- **Unpreparedness of the automotive industry**, which forms a significant part of the EU economy
- **Cost affordability** of the EV alternatives to ICE vehicles

Chinese policy makers may start launching ICE banning policies only after EV penetration is expected to reach 50%

Key criteria elements on ICE banning readiness are:

- **EV penetration levels**
- **Sufficient charging facilities**
- **Cities with local EV manufacturers**
- **Focus areas of anti-pollution initiatives**

Cities that led EV preferential policies are expected to introduce the bans earlier, *e.g., Beijing, Guangzhou, Shanghai*

Source: Expert insights

Lessons learned for Kenya: Import-driven used 4W market

ICE bans/phase-outs

Reasons to address: phase-out mechanisms allow countries to communicate market about their EV transition intention, accelerate/prepare for it

	ICE ban	No ICE ban	
Options	**Policy/Proposal**	**Government EV targets**	**Technical restrictions**
Examples	End the sale of combustion engine cars by a specific year End the importation of combustion engine cars by a specific year Enforced laws with punishable consequences	A % EV penetration by a specific year, target public charging stations by a specific year, a % of car sales to be electric by a specific year Government targets set against specific EV measures	Target km/L for combustion engines, imports of cars with a specific age Restrictions set on vehicle performance measures
What you need to believe	Enforced ICE bans are a needed lever to achieve EV penetration and climate goals, including last-mile EV adoption goals. Other policies may contribute to increasing the use EV , but a complete transition to EVs can only be achieved through the implementation of an ICE ban	EV targets are effective to communicate direction of the sector and increase it adoption over time while not imposing economic and infrastructure risks while the market evolves	Technical restrictions do not need significant investment to meet With stricter technical restrictions, a shift to EVs will become apparent for OEMs
Implementation rationale for Kenya	An ICE ban is considered a faster shift to Kenya's mobility, in order to not be an ICE dump destination while other countries transition to EV mobility	EV targets would communicate to importers and the public of the anticipated direction to electric mobility preparing to the shift, without compromising affordability of cars in short term	Restrictions address the most pressing concerns in Kenya (car import quality, pollution) and shift the import market to EVs without compromising the affordability of cars in the short term
Potential analyses to support option evaluation for Kenya	Expected impact on supply & demand (adoption) of vehicles Expected EV vs second hand ICE import affordability Concrete option design for Kenya		

Consumer financing gap

7 Asset financing & insurance

Kenyan context: Financing options exist for 2W, 4W, and buses but often do not cover EVs

Consumer financing gap

✓ Existing in Kenya for vehicle type

		2W	4W	Buses
Specific EV financing		✓ MKOPA Ampersand	– [2]	– [2]
Existing ICE financing		✓	✓	✓
	SACCOs	Local SACCOs[1]	Safaricom & Stima SACCO	Metrotrans[3], Super Metro[3]
	Banks	– [2]	NCBA, Standard Chartered, Equity Bank of Kenya	Co-op bank (financing mainly to Matatu SACCOs)
	Non-banks	Rafiki Microfinance, JoyInc Mwananchi credit MOGO	MOGO, HAKKI, WATU	Mwananchi credit, MOGO
	Financing conditions exemplary	Down payment + daily rate[4]	Down payment + monthly interest[5]	Leasing
	Purchase vs. leasing	Purchasing and leasing Trend towards purchasing E2W without battery	Mainly leasing given vehicle cost	Mainly leasing given vehicle cost
Insurance		Mainly driven by driver behavior, low effect of vehicle type on policy		

1. SACCO = Savings and Credit Cooperative Organization; 2. Limited information available; 3. Matatu SACCO; 4. e.g., MOGO: ~235K KES: ~45K KES down payment + ~520 KES/ day for ~365 days / MKOPA: ~274K KES: 10K KES down payment + ~ 480 KES/ day for ~550 days;
5. e.g., Safaricom Sacco: Loan of 3x savings of 6 months at 12+% p.a. / Standard chartered: Loan of 80% of cost at 16% p.a. / MOGO: Loan of 80% of cost (20% deposit) at 36% p.a. 6. Range of income based on vehicle leasing/ ownership and rural/ urban areas 7. No policies found

Source: Expert interviews, press search, mystery shopping

Key takeaways

For 2W, EV-focused financing exists – limited options for 4W and buses

For ICE vehicles, there is an existing strong financing infrastructure across all vehicle types with different financing providers

Financing schemes for end-consumers typically require a down payment

Vehicle cost is significant to taxi drivers (e.g., compared to average income of ~200-400 USD/ month for Uber and Boda Boda drivers)[6]

Existing approach in Kenya

– [7]

Key question on consumer financing gap

Asset financing: how have other countries supported EV-specific asset financing for consumers and leasing companies?

Asset financing & insurances conditions are similar for EVs vs. ICE vehicles

● Impact on financing/ insurance policy

		ICE		EV
Asset financing – purchase	+	**Similar asset financing schemes** vs. EVs but likely lower overall cost given on average lower vehicle prices	–	**Similar asset financing schemes** vs. ICEs but likely higher overall cost given on average higher vehicle prices
Asset financing – leasing	+	**Clarity on residual vehicle value** – easier pricing of leasing schemes	?	**Uncertain residual/ resale value** e.g., battery value driven by material supply constraints vs. technological advancements
Insurance	+	**Similar insurance policies to EVs,** but typically lower premiums given on average lower vehicle prices	–	**Similar insurance policies to ICEs,** but typically higher premiums due to on average higher vehicle price/ risks through battery fire hazards
	–	**Likely higher maintenance service needs** due to more technical components to potentially break down	+	**Likely lower maintenance service needs:** cumulatively lower cost over usage period but potentially higher cost per maintenance due to i.e., more specialized capabilities required
			+	**Potential for behaviour-based insurance** due to IoT component deployment in EVs

Key takeaways

Overall, there are no main differences between financing and insurance policies for EVs vs. ICE vehicles

Purchase financing policies for end-consumers are only impacted on cost by vehicle type, while leasing is subject to some uncertainty around the residual value of EVs

Insurance policies are similar but at on average higher cost for EVs, given higher vehicle price

Source: Expert interviews, press search

Governments can consider different roles to promote asset financing and insurance solutions for EVs

High

Government involvement and resources

Low

Government role	Asset financing/ insurance solution	Primary financier	Countries
Facilitator	**Supporting an asset financier** with a first-loss / second-loss guarantee and/or **providing an asset financier with financing** **Supporting development of payment models** (e.g., that allow loan payments based on income for commercial vehicles) and **insurance models**	Asset financer Payment provider Government	– [1]
Financer	**Ensuring availability of low-interest loans** through e.g., government-funded institutions (e.g., state bank) or green bonds – either to the wider public or to specific interest groups (e.g., state employees)	Government	
	Providing loan guarantees through e.g., government-funded institutions (e.g., state bank) – e.g., at a specific maximum interest rate and/ or to including to low-credit applications	Government	California
Promoter	**Attracting FinTech/ InsurTech players** by improving the overall attractiveness for ventures e.g., through specific capability/ financial support	FinTechs	Michigan
	Promoting the extension of existing financing and insurance policies to EVs e.g., through collaboration with private sector or specific awareness/ educational campaigns	Existing asset financer	– [1]
Ecosystem builder	**Building a financing eco-system** around EVs, incl. public and private asset financing, payment, and insurance stakeholders	Asset financer Payment provider Government	– [1]

1. Limited information found. Countries listed under other government roles might take other roles (focus on most active role)

Source: Expert interviews, press search

Most governments have adopted a "financer" role to increase adoption of EV

Promoter

Michigan

- **Entrepreneurial hubs across the State to support small businesses** and provide comprehensive resources
- 75Mn USD support for "Small Business Smart Zones and Business Accelerators initiative"

Financer

Low-interest loan

Australia

- **Interest rate reduction for "green car loans"** (vs. ICE loans) provided in a financing agreement **by Taurus Motor Finance & the Government-owned bank Clean Energy Finance Corporate** as part of Electric Car Discount bill
- **Commitment of 20.5Mn AUD (~13.5Mn USD) in investment** to support discounted loans totaling 100Mn AUD (~65Mn USD)
- **Consumer savings estimated at 1.3K AUD (~850 USD)** over 7-year period on loan of 48K AUD (~31K USD)
- Eligibility for all BEVs & plug-in hybrid vehicles <90K AUD (~59K USD)

Mauritius

- **Low-interest "green" loans by the Development Bank of Mauritius for the purchase of EVs by taxi and van operators** to remove the upfront investment barrier
- **Concessionary interest rate of 0.5% annually** for max. 3Mn RS (~68K USD), repayable over a period of 7 years
- **Planned extension to corporate fleets** after proof of concept with taxis

India

- **100% interest free loans offered to state employees** under for the purchase of EVs in the state under the Haryana Policy

Loan guarantee

California

- **Loan guarantees** offered by State of California as part of Clean Vehicle Assistance Program and **provided by Beneficial State Bank**
- **Max. guaranteed interest rate of 8%** for qualified clean vehicle grant recipients; with possible qualification for low- or no-credit applicants

Financers or promoters are most common roles taken by governments of countries addressing the consumer financing gap

Source: Press search

Lessons learned for Kenya: Consumer financing gap

Asset financing & insurance

Reasons to address: Financing schemes improve consumer ability to afford the upfront cost of the vehicle and increase EV adoption

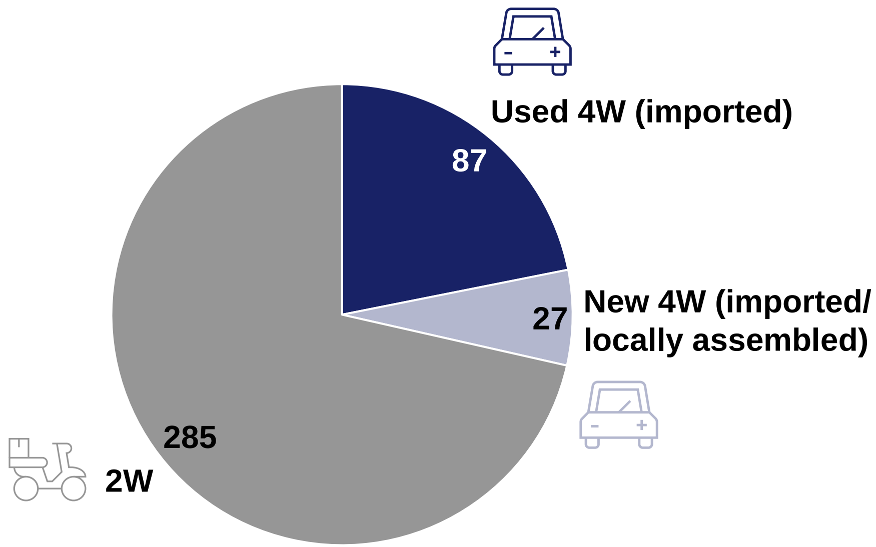
Options	Facilitator	Financer	Promoter	Ecosystem builder
Examples	**Provision of first/ second-loss guarantees** Support in set-up of financing, insurance and payment models	**Low-interest green loans** (e.g., Australia, Mauritius) **Interest-free loans** to state employees (e.g., India) **Loan guarantees** (e.g., CA)	**Start-up hubs** to attract FinTechs and InsurTechs (e.g., Michigan) Promotion of **extension of existing policies**	**Facilitation of industry-wide collaboration** and promotion of stakeholder connection
What you need to believe	**The existing industry facilities are not effective for EV** financing demand and set-up of new facilities will be faster and more impactful in providing financing mechanisms	**The existing financing mechanisms are not effective for EV** financing and government financing will increase EV adoption faster and more effectively vs. private mechanisms	**The emerging/ existing financing and insurance infrastructure is strong** and will be able to serve the EV market if engaged	**The emerging/ existing financing and insurance infrastructure is strong** and will be able to serve the EV market if "put in one room"
Implementation rationale for Kenya	**High importance of topic requires direct involvement (incl. resources) and overseeing** through set-up of financing facilities	**Direct influence on financing conditions (incl. resource implication)** but no requirement for setting up new facilities	**Lower government involvement** and resources but support for start-ups to leverage potential and support local innovation	**Low government involvement,** and resources given already existing financing infrastructure
Potential analyses to support option evaluation for Kenya	Expected impact on supply & demand (adoption) of vehicles Concrete option design for Kenya Expected fiscal/ resource impact for Kenyan government			

Vehicle affordability

3 **Taxation & Subsidies/ subsidy removal**

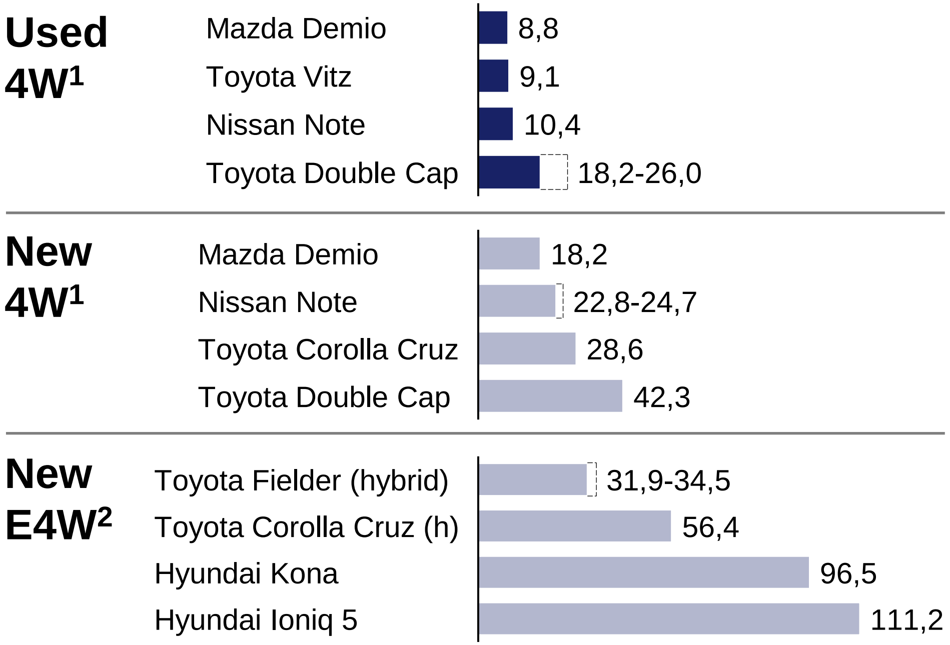
Kenyan context: Off the road vehicle cost for E4W vehicles in Kenya is higher vs. new and used ICE vehicles, creating significant gap to bridge

Number of vehicles registered, 2021, # K



Used 4W account for >75% of total 4W registered and ~25% of total vehicles registered in Kenya

4W off the road vehicle cost, 2023, USD K



Cost for used ICE is ~55% lower[3] than for new ICE

Cost for new ICE is ~60% lower[3] than for new ICE vehicle

Given significant price gap between used ICE and new ICE/ new EV, regulatory and policy support from the government would likely not suffice to increase adoption of E4W

For initial focus, E2W with smaller gap could be prioritized to increase affordability

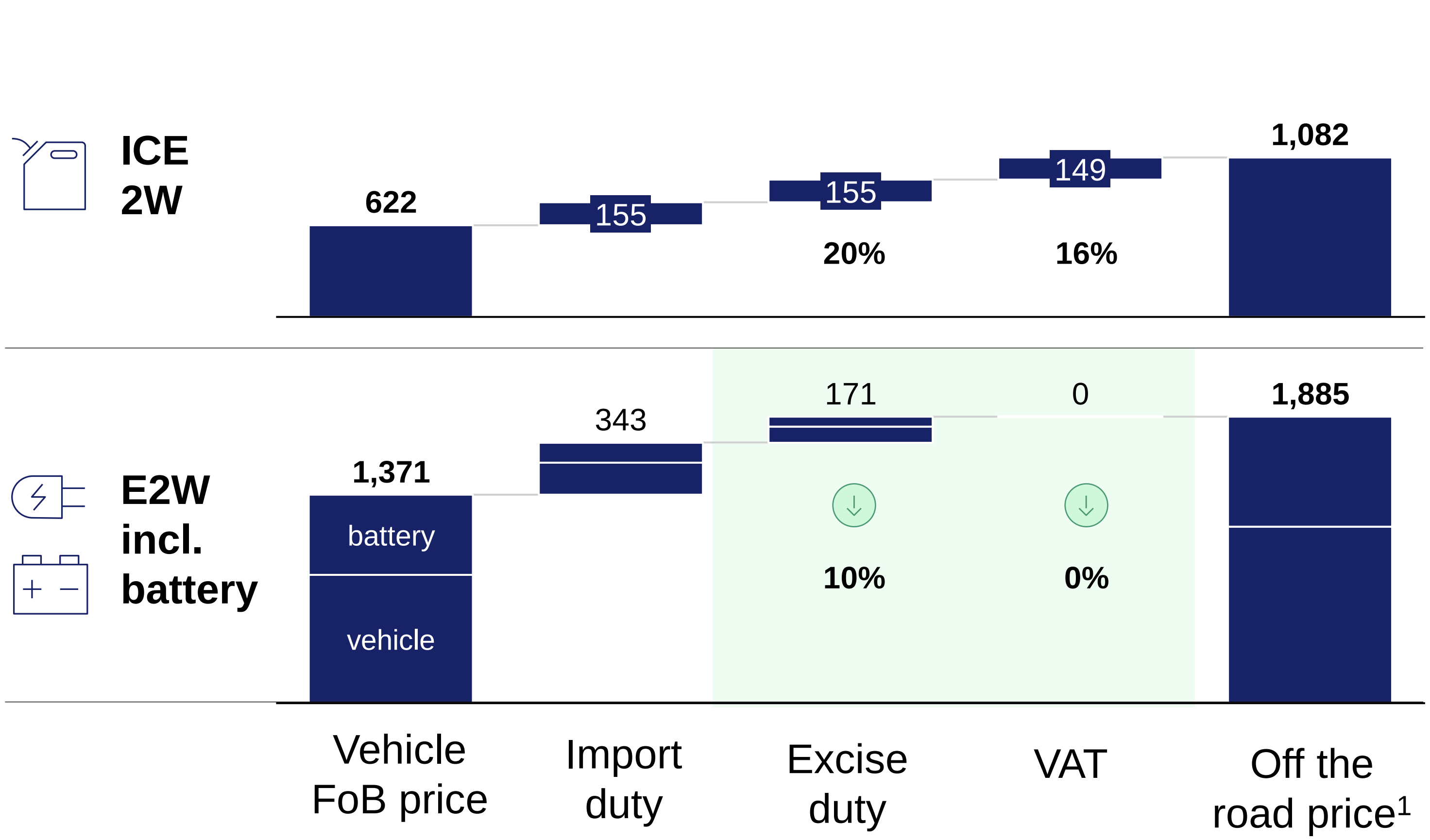
1. Based on common vehicles in Kenya 2. Based on availability in Kenya 3. Average of prices

Source: Kenya Bureau of Statistics, Mystery shopping, company websites

Vehicle prices reflect current taxation, incl. E2W excise duty reduction & VAT exemption

Adjusted tax rate in favor of EV

2W price comparison[2], USD



1. Incl. main elements, excl. e.g., railway development levy or import declaration fee
2. Based on average prices obtained for ICE (different Bajaj and TVS models) and EVs (Roam Air, Kiri), details in backup

Source: Kenya Revenue Authority, Mystery shopping, company websites

Key takeaways

There is still a gap on ICE vs. E2W with battery, despite reduction in excise duty and VAT exemption

Import duty is set on East African Community level and adjustment would require cross-country collaboration

Battery cost developments expected to further decrease gap

Existing approach in Kenya

Tax reductions
Import duty: n/a – set on East African Community level
Excise duty: reduction for EVs (10% vs. 20%)
VAT: exemption for E2W, Li-ion batteries

Tariff reductions: Kenyan power with "e-mobility" tariff below regular domestic tariff (peak/ off-peak)

Key question to answer on vehicle affordability gap

Taxation & subsidies/ subsidy removal: how have other countries improved vehicle affordability for consumers by bridging the price gap between ICE vs. EV vehicles – esp. for 2-wheelers?

Battery swapping: How did other countries leverage potential consumer cost advantage of battery swapping?

There are different options for bridging the "affordability gap" between electric and ICE vehicle purchase prices

Options for bridging the affordability gap

- Purchase support
- Operation support
- (partially) implemented by Kenya

Taxation benefits

Value-added tax

Reduction or exemption of VAT to be paid on electric vehicles and/ or components

+ High impact, high visibility, centralized implementation

− High fiscal impact

Import tax

Reduction or exemption of import duty to be paid on electric vehicles and/or components

+ High impact, high visibility, centralized implementation

− High fiscal impact, applies only to imported vehicles

Vehicle-related tax

Reduction or exemption of vehicle-related taxes (e.g., road tax, vessel tax) for electric vehicles

+ Low-medium fiscal impact

− Local implementation, requires vehicle-related taxes, EV operation already less costly vs. ICE

Grants & subsidies

Upfront lump sum

Lump sum payment for purchase of electric vehicles

+ High impact, high visibility, centralized implementation

− High fiscal impact

Scrap reward

Cash reward or discount on purchase of EV upon scrapping of ICE vehicle

+ Faster transition to EV (e.g., earlier adoption)

− Local implementation

Charge exemption

Reduction or exemption of charges to be paid (e.g., toll roads, parking charges)

+ Low-medium fiscal impact

− High-effort implementation, potentially limited opportunities (e.g., privatized parking), EV operation already less costly vs. ICE

Tariff reduction

Discounts or price caps for charging tariffs in public and/ or residential charging (e.g., peak/ off-peak)

+ Support of grid stability, high visibility

− EV operation already less costly vs. ICE

Note: Kenyan regulation incl. Excise duty: reduction for EVs (10% vs. 20%); VAT: exemption for E2W, Li-ion batteries; Kenyan power with "e-mobility" tariff below regular domestic tariff (peak/ off-peak)
Source: Expert interviews, press search

Lessons learned for Kenya: Vehicle affordability gap

Taxation & Subsidies/ subsidy removal

Purchase support
Operation support

Reasons to address: Taxation/ subsidies contribute to affordability of EV's upfront costs and operations, esp. vs. ICE vehicles, increasing EV adoption

Options	Value-added tax / Import tax	Vehicle-related tax	Upfront lump sum / Scrap reward	Charge exemption	Tariff reduction
Examples	**Reduction of or exemption from taxes** (VAT, import tax) for EV purchase	**Reduction of or exemption from taxes** for EVs (e.g., annual road tax)	**Financial contribution to EV purchase** (e.g., upfront lump sum, cash reward upon ICE scrapping)	**Reduction of or exemption from charges,** e.g., parking, toll roads	**Discounts or price caps on charging tariffs** e.g., peak/ off-peak
What you need to believe	**High upfront costs will prevent EV adoption and roll-out** – decreasing cost will incentivize purchase	**Continuous cost savings on vehicle operation contribute** to EV rollout	**High upfront costs will prevent EV adoption and roll-out** – decreasing cost will incentivize purchase **Available resources** from e.g., former ICE promotion	**Continuous cost savings on vehicle operation are effective** to incentivize EV rollout	**Continuous cost savings on vehicle operation are effective** to incentivize EV rollout
Implementation rationale for Kenya	**High impact and visibility for upfront cost reduction** through import duty (given limited scope due to existing VAT and excise reductions) – but cross-country dependency (EAC)	**Further upfront cost decrease in addition to existing tax reductions** – but limited scope given few vehicle-related taxes (e.g., railway development levy)	**High impact and visibility** – given limited scope from taxation levers (already implemented)	**Removal of pain point in urban areas with crowded parking** (esp. 4W, limited paid parking for 2W)**;** limited toll roads	**High visibility** and support of grid stability through off-peak tariffs
Potential analyses to support option evaluation for Kenya	Expected impact on supply & demand (adoption) of vehicles Concrete option design for Kenya Expected fiscal/ resource impact for Kenyan government				

Public Infrastructure Gap

Kenyan context: There is a significant charging infrastructure gap to supply EVs

Public infrastructure gap

Kenyan road transport ecosystem today

	ICE Vehicles	EVs
Vehicles	**~4.3Mn** registered non-EV vehicles; ~50% 2W[1]	**<2.5K** registered Evs; ~70% E2W[2]
Charging stations	**~4.2K** petrol stations	**<25** E4W charging stations[3] (mostly Type1/ Type 2; some CHAdeMO and CCS2) Currently, <0.05 public charging points per E4W (vs. world average of ~0.1)[4]
Battery	n/a	E2W battery charging and swapping stations e.g., Ampersand, Roam Kenya, ARC Ride Bus charging e.g., BasiGo

1. Based on 2021 CEIC figure; 2. EV numbers based on new vehicle registrations in the years 2017-2023; 3. based on Electromaps 4. IEA, typically, multiple charging points per charging station (>=2)

Source: IEA Global EV Outlook 2023, press search

Key takeaways

Currently, road transport ecosystem dominated by ICE vehicles (<0.1% of vehicles electric)

To reach world average, Kenya would require ~6K public charging points for E4W by end of 2024 to supply ~200.000 electric vehicles (announced target)**,** assuming share of ~30% EW4

Existing approach in Kenya

Country target of 1K charging stations by 2027 (700 in urban areas, 300 along highways)

~10Mn KES dedicated by Kenya Power to increase charging points; KenGen to set up 30 electric vehicle charging stations

Charging/ swapping station operators to display prices & to provide **one or more chargers from a selection of connectors for 4W, e.g., Type 2/ CCS/ ChHAdeMO** (Energy and Petroleum Regulatory Authority)

Key questions to answer on public infrastructure gap

Charging infrastructure: how have other countries supported the roll-out of a charging infrastructure? Which stakeholders were involved?

Interoperability & standardization: How have other countries ensured the useability of charging stations for as many vehicles as possible (maximized charging station network efficiency)?

Public Infrastructure Gap

16 **Charging infrastructure**

Three main mechanisms have been used to fund EV charging infrastructure

	Key elements	Public-funded	Private-funded	Public-private funding
Consumer	**Speed of penetration**	Public procurement processes may be extended causing **delayed deployment**	Private players may deploy infrastructure **faster** to **minimize payback period**	Delayed government processes may be **offset by efficient private systems**
Consumer	**Charging Fees**	The government may **charge higher** fees due to **first-mover advantage** and **convenience offering**	Private players may **charge less** to **drive utilization**	Public-private partnerships may charge **lower fees** due to **government subsidies**
Consumer	**User tracking**	Public-funded stations may have **limited tracking** and records	Private stations may achieve **higher degree of tracking** by **controlled access**	Stations may have **limited tracking** and records
Consumer	**Distribution/ Accessibility**	Public-funded infrastructure can achieve **greater coverage** and **accessibility** across locations	Chargers may have **limited accessibility** due to installation in residences, offices or malls	**Prioritization** of locations can achieve **greatest impact**
Developer	**Maintenance requirements**	Chargers may need **more maintenance** due to **higher frequency of use**	Chargers may need **less maintenance** due to **lower frequency of use**	Chargers may need **more maintenance** due to **higher frequency of use**
Developer	**Set up cost**	Set up costs may be **lower** due to **government purchasing economies**	Private investors may incur **higher costs** due to **free market** dynamics	Public-private partnerships may incur **lower costs** due to **government subsidies**
Developer	**Planning horizon**	Public chargers typically have **>10 years** payback period	Most private chargers expect a **5-6 year** payback period	Investments may a **>8 year payback period** due to **subsidies**
Developer	**Power output**	Output may be limited to **Level 2 charging (240V)**, which may **limit utilization rate**	**All charging levels** can be achieved (upto 480V), **increasing utilization** rate	**All charging levels** can be achieved (upto 480V), **increasing utilization** rate
	Country examples			

Key takeaways

- **Public stations** may require more maintenance and suffer high downtime due to high frequency of usage
- **Private charging stations** may require the highest set up costs due to free market dynamics; however, they can lead to faster adoption
- **Public-private funding** can bear lower set up costs due to subsidies and provide high accessibility for variety of EVs

Kenya has allocated 10Mn Ksh to develop a nationwide public charging network through collaboration between Kenya Power, KenGen and private players, with new buildings required to incorporate charging stations

Source: Expert interviews, press search

Different countries have used multiple strategies to address key elements of EV charging infrastructure

	Selected elements	China – Public funding	US – Private funding	Norway – Public private funding
Consumer	Penetration	China has developed **>1.7Mn public charging stations** through the State Grid Corporation of China with **>50% CAGR** in **number of stations** from 2014-2021	**Tesla** has built **>19k stations**, while **Electrify America** has **859 stations** and **Evgo** has **850 stations**	**>25k public stations**; more than **82%** of EV users **charge at home**
	Charging Fees	**0.14-0.28 USD per kWh** at **public** stations, while **private** charging costs up to **0.14 USD per kWh (half)**	**0.11 USD per kWh** for **home** charging, while **0.17 USD per kWh** at **public** chargers	Charging at **private-funded chargers** costs **3-4 times** as much as **public-private-funded chargers**
	Accessibility	EV users rely on **public chargers** as most urban residents do not have home garages/ private parking; most provinces have **>10k public charging stations**	EV users rely on the **~20k private-funded commercial networks**, mainly Tesla and Electrify America with **>12 states** having **>1k public charging stations**	**Most** EV users rely on **home chargers** despite **>20k public chargers**
Developer	Set up cost	**Public** stations cost **~4k USD**, while **private** stations cost **~5.5k USD** Equipment accounts for about one-third of the total cost of a charger station. The rest is made to secure the land and grid capacity, and on construction works	Average cost to install an EV charger in a **home** is **923 USD**, while **commercial chargers** cost from **1k - 12k USD** depending on output	**Housing associations** can apply for grants of up to **50% of the cost** of buying and installing **communal chargers** ~460 USD grant per charging point, ~4,600 USD grant per housing association
	Power output	Most public chargers are **Level 1 chargers**, i.e. AC chargers rated **7 kW** **(88%** of charger stock) and DC chargers between **60 kW – 150 kW**	**2%** of charger ports are **level 1 chargers**, **79.5%** are **Level 2 chargers** and **18.5%** are **level 3 chargers**	**Most** chargers are **Level 1 home chargers**

Source: Expert interviews, Norwegian EV Association, Electrify America, press search

There are different possible approaches to public-private funded charging infrastructure

	Public incentives	Public private partnerships (PPP)		
	Government subsidies	**Joint ventures**	**Special Purpose Vehicle**	**Concession Agreement**
Description	Funds channeled directly from government to qualified private players	Existing government utilities partner with private players to deploy infrastructure	Special independent organizations formed to oversee infrastructure development	Long-term contracts between government and approved private players to provide certain services
Examples of country implementation	**Grants**: ~460 USD grant per charging point, ~4,600 USD grant per housing association **Rent**: No rent on land issued by government for charging infrastructure **Subsidy:** MHI has sanctioned ~51.5Mn USD as a capital subsidy to three Oil Marketing Companies for the set up of 7,432 charging stations	The EV Association, an NGO, is responsible for the ongoing management of NOBIL and works with national and local authorities to promote the use of electric cars Indonesia’s appointed state-owned power company PLN[1] to establish the EV charging infrastructure, spending ~1Bn USD by 2030	ENOVA was formed in 2001 with the purpose to transition to green energy. Enova's work is funded by the Energy Fund and is governed according to principles of goal attainment and performance targets Joint Office of Energy and Transportation was formed to support the deployment of zero-emission, convenient, accessible, and equitable transportation infrastructure	Private partners are required to design and install EV charging infrastructure to the government authority’s technical specifications for hardware and software; government authorities monitor and oversee the private partners, who are responsible for operation and maintenance of EV charging infrastructure
Tradeoffs	Subsidies may promote organic infrastructure development, but may also see slow penetration	Joint ventures may achieve faster deployment by leveraging existing synergies but may have high capital requirements	Special Purpose Vehicles may benefit from efficiency, but low utilization may slow growth	Private partners may be incen-tivized to provide quality services but may also be disinclined to repair chargers in low-demand and monopoly markets

Other nascent options: 1: **Corporate Social Responsibility** – India has a proposal for private companies to use the 2% mandated CSR fund towards infrastructure development. 2: **Community-Based Organizations** – some neighborhoods in America pool funds and deploy infrastructure that serves the neighborhoods

1. Perusahaan Listrik Negara

Source: Expert interviews, press search

Main market drivers are needed to attract private funding for charging infrastructure

Main drivers		Critical factors	electrify america (US)	Voltron — Formerly EVCuzz Charging Network (Indonesia)	DELTA (Thailand)
Utilization	**Market maturity**	High EV penetration and stock can provide increased charging events compared to low stock markets	**E4W stock**: >2.9m **E4W penetration:** ~1% (EV sales share ~8%)	**E4W stock**: ~28k (2022)	**EV fleet:** ~100k **EV penetration:** 8.7% in 2023
	Network	Multiple charging stations located in dense and frequented destinations can provide more convenience	3,830 chargers in 859 stations Highways, shopping malls, offices	~150 stations Offices, malls, highways and residential areas	<1500 stations** Communities, commercial buildings, charging stations, and highway service areas
	Vehicle category served	Stations that serve multiple categories can offset low utilization by one category	E4W, E2W[1]	E4W	E4W, E3W, E2W
	Charging speeds	Level 3 chargers typically record more charging events in a day compared to Level 2 chargers	Level 2, Level 3 – upto 480V	Level 2, Level 3	Level 2, Level 3
	Reliability	Higher uptime can reduce range anxiety and encourage charging at public stations	Required to achieve 97% uptime	minimum of 5 DC fast chargers to minimize wait times	Modular charging system provides protection against downtime
Payback period		Lower payback periods can allow faster scaling and growth	Expected ~10 year	Expected ~6-10 year	Expected ~8-10 year
Integratation of value chain		Opportunities for value chain integration can drive greater economies for companies	EVCI HW > **Solution provider** > **Energy whole-sale** > **CPO** > **Roam-ing & energy mgmt** > **EMSP** High value chain integration	**EVCI HW** > **Solution provider** > Energy whole-sale > **CPO** > **Roam-ing & energy mgmt** > EMSP Moderate value chain integration	**EVCI HW** > **Solution provider** > Energy whole-sale > CPO > Roam-ing & energy mgmt > EMSP Low value chain integration

1. Electrify America has partnered with Harley Davidson for their Livewire charging system, offering up to 25kW

Source: Electrify America, Delta Electronics India, Voltron, press search

Government funding
Public-private funding
Private funding

Lessons learned for Kenya:Public Infrastructure Gap

Charging Infrastructure Funding

Reasons to address : EV charging infrastructure reduces range anxiety and encourages adoption of multiple EV types, fastening transition from ICE vehicles

Options	Government roll out	Government subsidies	Joint ventures	Special Purpose Vehicle	Concession Agreement	Private development
Examples	Direct **government procurement** and operation of infrastructure along major highways and malls	**Grants to private developers, rent exemptions** on land for development, tax reductions/ exemptions on imports of charging equipment	**National utilities and local governments working together with private players** in a share-split model to develop infrastructure in certain regions	**Government setting up an independent body to oversee development** and operation of infrastructure	**Long-term contract giving exclusive rights** and targets to a private developer	**Development by multiple private players** in different regions/ segments
What you need to believe	**Strong market signal** and **regional leader role** could **drive market maturity** and **attract investment**	Subsidies could encourage **organic infrastructure development** driven by demand, with limited government risk	Government **procurement economies** and **private sector efficiency** could offer **lower upfront costs** for government	Existing private market **interest**, with **extensive knowledge and capabilities** could offer **efficient development** and operations	Potential **assurance of infrastructure** provision and **innovation** Government could bear **less proportion of risk**	**Strong EV policy** and existing market **success factors** could attract private players and **encourage competition**, driving down charging fees
Implementation rationale for Kenya	**Early government development** could plug infrastructure gap (5k charging points by end of 2024)	**Subsidies could support growth of existing developers a**nd attract potential investors	**Different local county governments** could collaborate with local private players to deploy infrastructure across each county, achieving faster penetration and national coverage	**The government could achieve transition to convenient**, accessible, and equitable green transportation through collaboration with existing stakeholders with required skills	The government could regulate **technical standards and specifications for hardware and software** components while monitoring the private partners	Government could incur **low fiscal and risk impact as private players** fund development

Potential analyses to support option evaluation for Kenya

- Critical mass/number of chargers required to sustain organic sector growth
- Potential fiscal/resource requirements for national infrastructure roll out
- Potential utilization and revenues from charging stations
- Projected impact on EV adoption/penetration and international investment

Public Infrastructure Gap

17 **Technical standards: standardization/interoperability**

Interoperability refers to smooth and streamlined vehicle operations through charging accessibility

Elements of interoperability

Deep dive next

A Charging levels & connector compatibility

- **Electric vehicle suitability** for e.g.,. Level 2 vs. Level 3 charging
- **Charging station/ vehicle compatibility given different connector types** e.g., CCS, CHAdeMO (i.e., compatible with Level 3 only)
- Availability of adapters for different connector standards

B Software system and technology

- **Software systems to track vehicle diagnostics**, driver behavior, maintenance needs, and integration with third-party tools (e.g., maintenance)
- **Telematics data**, incl. battery usage, energy consumption, charging status

C Charging station/ battery swap network & availability

- **Charging station networks with different protocols** (e.g., OCPP) causing users to require multiple personal accounts
- Exclusivity of specific charging stations (e.g., Tesla)
- **For 2W, different battery dimensions across bike types** with need for specific battery swapping

D Payments

- **Payment processes**, e.g., credit card swipe capability vs. authentication through a mobile application
- Partially addressed through communication protocols

Source: press search, expert input

A: Variety of charging connectors are used globally for 2W and 4W – with different regulation by countries

Charging speed	Level & Mode	Combined Charing System (CCS) US/Japan	Combined Charing System (CCS) EU	Bharat India	Guobiao (GB) China	CHAdeMO US/ Japan	Tesla Super Charger Exclusive[2]
Slow	**Level 1, AC** **Mode 2[1]**: Connection via standard. socket outlets with in-cable control box for safety/ communication; for non-compliant wiring risks behind socket wall e.g., temperature increase	**Type 1** 	Not included; in EU and China, household voltage starts from 220V.			Not applicable; DC (fast-charging) standard only	Not applicable; DC (fast-charging) standard only
	Level 2, AC **Mode 2 &** **Mode 3:** Connection via dedicated wall box with control pilot function/control equipment		**Type 2** 	**AC-001** 	**GB AC** 		
Fast	**DC** **Mode 4:** Connection via off-board charger with control pilot function; AC to DC conversion in charging station	**Combo 1** 	**Combo 2** 	**DC-001** 	**GB DC** 	**CHAdeMo** 	**Super-charger** 

For E2W, mainly slow chargers (slow wall-outlets) and OEM-specific connectors in use today

Country regulation approaches

Variety of global charging connector types increases difficulty to make charging stations available to as many vehicles as possible

Countries globally are taking different approaches to enable compatibility of charging stations with vehicles, e.g., by setting one or multiple standards

Adapter cables exist to bridge connectors to charging stations

1. Mode 1 eliminated in most countries due to high risks: Connection via standardised socket outlets; high risks of socket/ cable overheating
2. Tesla-exclusive in global countries

Note: Photos showing vehicle inlet
Source: Literature research, expert interviews

A: Induction charging provides an option to bypass connector standardization but requires high invest

NOT EXHAUSTIVE

EV inductive charging

Inductive "wireless" charging for EVs through **magnetic coil within a dedicated surface sending current** to a magnetic coil in the chassis

2 options for inductive EV charging:

Static: EV charging through installed wireless charging coil in specific static areas, e.g., at home or office

Dynamic: EV charging while "on the go", i.e., through charging coil built into e.g., roads or highways

Projects

First "e-road" in Gotland, Sweden – 1.6km between airport and town center of Visby, led by Electreon

First US "e-road" in Michigan - 1.6km in downtown Detroit, led by Electreon

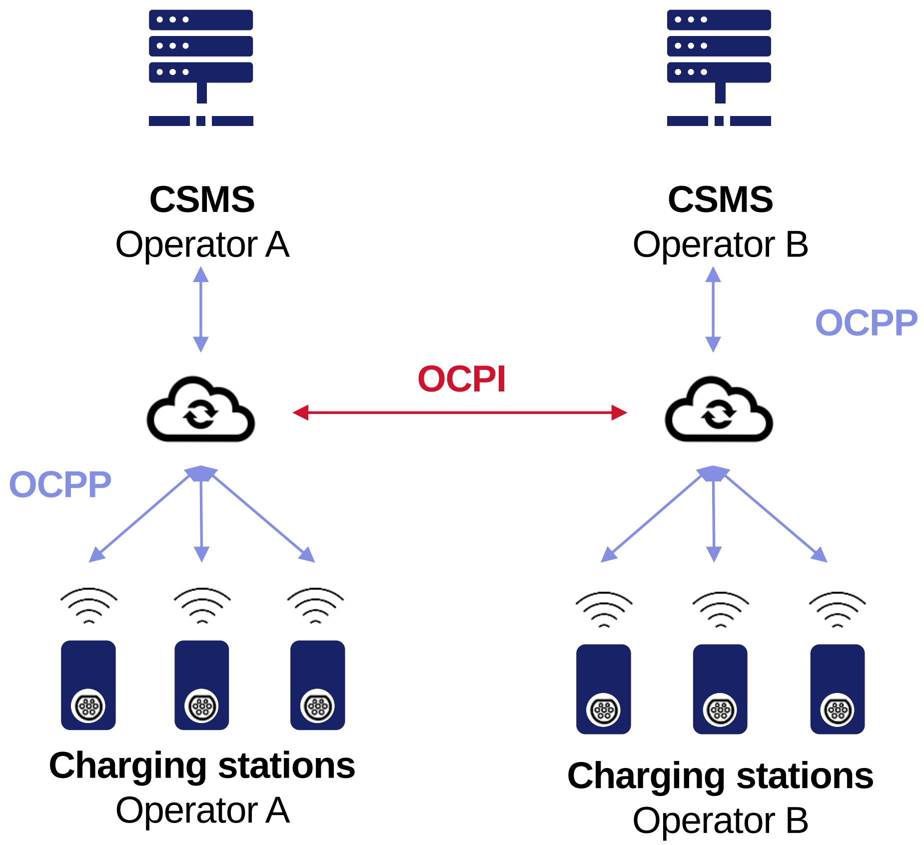
Considerations

+ **No connector requirements/** limited interoperability issues
+ EV **suitability for long-distance travel**
+ Decarbonization for heavy-duty vehicles
− **Significant cost**
− Currently, **limited supercharging-level** availability
− Currently, **limited field studies** and "real-world" roll-out

Source: VINCI, press search, electreon.com

C: Charging stations require protocols to enable charging

Communication protocol landscape



Key elements

Charging stations as physical interface, incl. connectors/ plugs for vehicle charging

Charging station management system (CSMS) owned by charging point operator as backend IT system to control multiple charging stations – performs multiple tasks, incl. charging authorization

Open Charge Point Protocol (OCPP) – open communication protocol, enables communication/ data transmission between charging stations and CSMS

Open Charge Point Interface (OCPI) – open communication protocol, enables communication between CSMS ("roaming")

- **Interoperability –** communication amonths different EV charging stations enables vehicle drivers to charge at increased number of stations without requirement for additional „personal accounts" with each operator („roaming")
- **Data management** – facilitation of backend communciation and measurement of relevant data (e.g., monitoring/ management of charge session, charge rates, energy demand management for load balancing of charging operators)

C: Battery swapping as relevant interoperability topic especially for E2W taxis given need for continuous „up-time" during the day

E2W charging options	**Upfront costs battery,** USD	**Charging cost,** USD/ kWh	**Suitability for taxi drivers** e.g., Boda Boda	**Trends**
Home charging	~725	~0.3-0.32	+ **Most economic charging** for many E2W vs. public charging − **Significant time required**, limiting „up-time" **Higher upfront cost** (~40% of BoM) Not every household with electricity access in some countries	Increased electricity access for households
Rapid charging	~725	~0.4-0.45	+ **Limited impact on „up-time"** − **Currently still explored** by OEMs without compromising safety and fire hazards Higher upfront vehicle cost (~40% of BoM)	**Exclusive fast-charging networks e.g.,** **Ather (India):** 150 fast-charging stations across India open for all E2W at zero cost **Ola (India):** Mission to build enough charging stations to provide virtually unlimited range; free charging at 200 hyperchargers
Battery swapping		~0.65-0.7	+ **No impact on „up-time"** **Lower upfront vehicle cost** − **Higher charging cost** **Batteries often tailored** to specific vehicle models with difficulty for agnostic swapping	**Partnerships/ initiatives for agnostic batteries,** e.g., **Gogoro** (Taiwan battery swapping): standardized batteries e.g., with Aeonmotor, eMOVING, eReady, PGO Scooters, Yadea, Yamaha, Awayspeed **Oyika** (Singapore/ Indonesia battery swapping): retrofitting of 2W to fit Oyika battery, e.g., work with Yadea, TailG **Thailand Battery Swapping platform:** project aiming for common battery pack standard across various lines of motorcycles and charging stations

Recharging is relevant especially for Kenyan taxi drivers (e.g., Boda Bodas):
Vehicle battery range of ~60-80km vs. average daily travel distance of ~60km (70km+ for ~25% of drivers)

Source: press search, company websites, model results, expert input

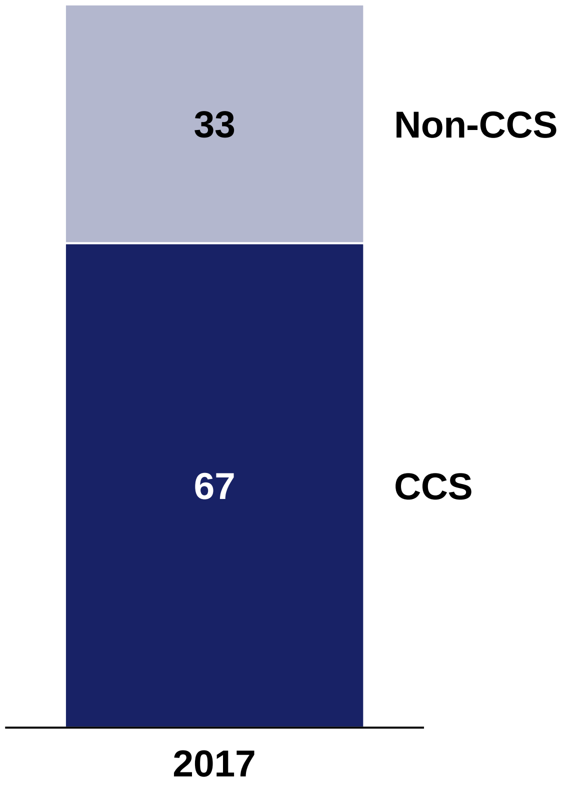
Countries globally are taking different approaches to enable interoperability

	Mandatory prescriptions	Guidelines	No regulation
Approach	**Prescribed implementation** for key elements for interoperability	**Provision of a range of options as implementation options for** key elements of interoperability Set targets to be met by charging station operators (but without specific required prescriptions)	**Key elements for interoperability set freely** by charging station operators
Example implemen-tation	For public charging stations e.g., specific mandatory • Specific connector type(s) • Specific battery dimensions • Communications protocols	For public charging stations e.g., • Range of possible connector type(s) of which at least one to be provided • Data sharing enablement • Communication protocol enablement (no specific)	No guidelines/ rules/ regulations for public charging stations
Example countries		  	– [1]

1. No countries identified across markets with relevant EV regulatory activity/ market maturity

Example: South Korea is enforcing one standard for EV chargers

Types of chargers in South Korea, %



European A.C. Phase (e.g., Renault Samsung SM3 Z.E.)

CHAdeMO (e.g., Kia Soul)

SAE Combined Charging System (e.g. Hyundai)

Connector standardization – target announced in Dec. 2017

The **South Korean Agency for Technology and Standards recommends CCS as connector for all future EVs** built in South Korea

Target standardization incl. charging infrastructure, E2W batteries, solid-state batteries and vehicle-to-grid technology

Drivers

- **Cheaper charging**[1] than other fast charging technology
- **Faster charging** – up to 350kW to 80% in <30 mins
- **High safety** – overvoltage protection, electrocution prevention, fixed charger orientation
- **Flexibility** – compatible with both AC and DC charging through same charging port
- Vehicle-to-grid capabilities
- Home installation possible

Challenges

- **Incompatibility** with older EV models
- **Complexity** of installation

Source: Press search

Example: India with multiple connectors for different vehicle types, but some guidelines in place

Charging standard landscape and regulation

Public charging stations / Private/ captive

Regulation	Heavy-duty	4W	2W & 3W	Private/ captive
By speed	Min. 2 chargers of 100kW+	*No regulation*	*No regulation*	*No regulation*
By connector	Global connector standards, e.g., **CCS**  **CHAdeMO** 	Global connector standards, e.g., **CCS**  **CHAdeMO**  **Fast AC Bharat** AC-001  **Fast DC Bharat** DC-001 	*No regulation* Most public chargers OEM-specific (e.g., OLA; Ather)  **Slow wall outlet** 5amp (Type D) or 15amp (Type M)	*No regulation*

Typically, connectors and vehicles compatible through adapter cable

General guidelines

Public charging operators required to enable monitoring for end-consumers on charging, payments and usage (e.g., in app or web portal) through tie-up with a Network Service Provider

Charging stations required to share charging data with State and Central Nodal agencies and Bureau of Energy Efficiency for monitoring and tracking purposes

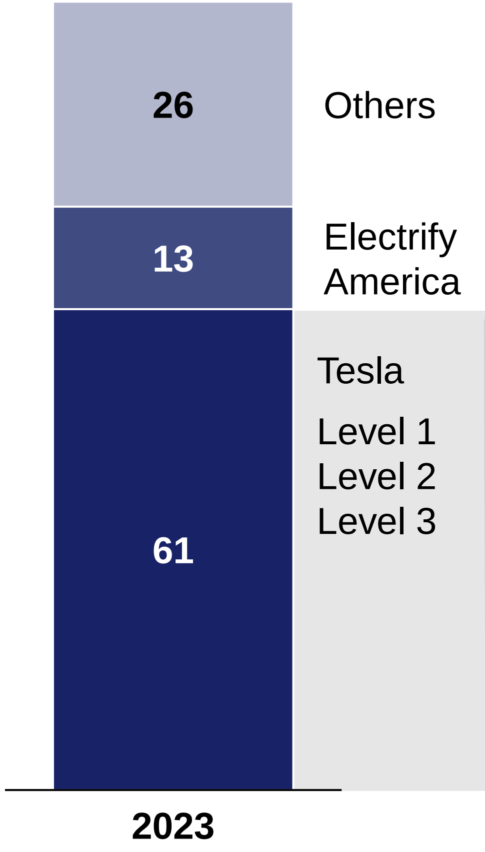
Standardization of OEM-specific charger connectors potentially on industry level (e.g., adapters or compatible meeting parts)

1. without communication function to the on-board charger of the EV

Source: Expert interviews, press search

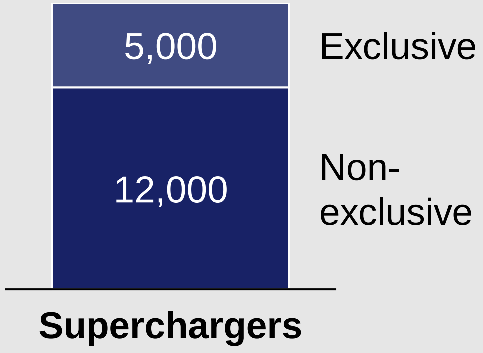
Example: The US is incentivising compatibility between EVs

Fast charger operators in the US, % market share



Tesla adapter cable[1] for Level 2 public charging stations enables charging with CCS[2] plug (most non-Tesla vehicles)

Level 3 superchargers:



1. Magic Dock 2. Combined Charging System 3. National Electric Vehicle Infrastructure

Source: Press search

Target: Connector standardization & compatibility

Requirements by the Federal Highway Administration

- Consistent plugs and output
- Single identification system
- 97% uptime
- Future-compatible technology
- Data sharing
- National software platform

7.5Bn USD federal funding for EV charging infrastructure provided by NEVI[3]

30K Non-exclusive DC fast chargers to be built across US & Canada by 7 automakers starting 2024

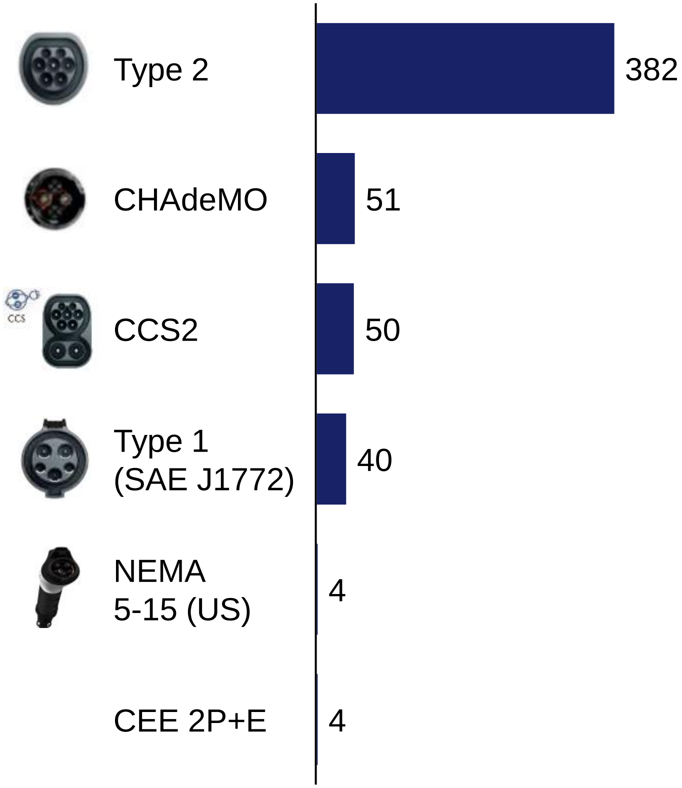
Challenges –

- Inconsistent charging speeds across models
- Higher charging fees for non-Tesla Evs
- Inconsistent software experience across models

Example: Chile has established rules to allow accessibility of charging infrastructure network

Charging types in Chile

EV Charging connectors by type, Chile, 2021



Requirements established by Chile

- **Equipped with at least 1 standardized connector** – stations are required to have at least 1 connector that complies with international standards (e.g., Type 2 (IEC 62196-2), CCS Combo 2(IEC 62196-3), CHAdeMO)
- **Real-time data sharing:** Charging stations must provide real-time data on public platforms or mobile apps on location, prices, type of charger/plugs and status of the charging stations
- **Support of communication protocols** – Stations are required to support communication between infrastructure and EVs (i.e., commonly used protocol is Open Charge Point Protocol)
- **Roaming agreements with other operators** to enable cross-network charging – allowing the users to access any station using a single authentication method and/or payment method

Chile Energy and Fuel regulator (SEC) mandated to maintain a database of public charging points – integration of points through app “EcoCarga” incl. location, charge status, prices connector type available, etc.

The new interoperability regulation will allow users to charge their vehicles at any charging point that meets the established standards and where the type of vehicle connector is available. In this sense, it should be noted that there are a variety

Luis Gutiérrez,
Director of Engineering,
Universidad Adolfo Ibanez

Source: Electromaps; International Council on Clean Transportation; Chile Electric Mobility Law; press search

Lessons learned for Kenya: Public Infrastructure Gap

Standardization/Interoperability

Reasons to address: Taking a decision on interoperability provides a reliable pathway for consumer EV purchases and charging operators (and OEMs), allowing for more predictability in EV infrastructure build-up and development

Options	Mandatory prescriptions	Guidelines	No regulation
Examples	**Specific connector type(s), battery dimensions, and/ or communications protocols mandatory** in public charging stations	**Provision of a range of options** (e.g., for connectors or battery types) and targets to be met by charging station operators (e.g., data sharing – but without specific required prescriptions)	**Connector types, battery dimensions and/ or communication protocols to be set freely** by charging station operators
What you need to believe	**Convenient charging options drive EV adoption** (i.e., no range anxiety by consumers) **OEMs will enter the market/ supply EVs even with set standards** (no “oligopoly” where OEMs have high price power) **Charging operators can be incentivized** to provide standardized equipment	A **sufficient number of vehicles complies** with range of options to satisfy customer demand **Charging operators can be incentivized** to comply with rules & guidelines	**Specific regulation will harm EV adoption more** (e.g., through OEM reluctance to enter the market) than charging inconvenience for consumers **Public charging will not be essential,** e.g., due to residential/ office charging as relevant charging option **Safety can be ensured**
Implementation rationale for Kenya	**Build-up of charging infrastructure from scratch** to allow for maximum consumer charging convenience efficiency	**Limited intervention to incentivize development of EV market, charging infrastructure, and vehicle variety** while providing consumers with some flexibility	**Current variety of EV vehicles/ connectors** in Kenya and required variety of charging options (also in the future)
Potential analyses to support option evaluation for Kenya	Expected impact on supply & demand (adoption) of vehicles Concrete option design for Kenya Expected fiscal/ resource impact for Kenyan government		

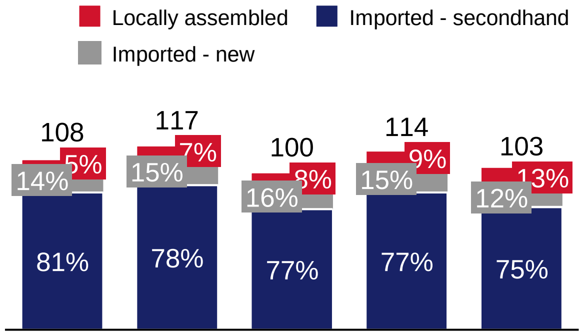
Potential for Local Manufacturing/ Assembly

Local manufacturing requirements & incentives

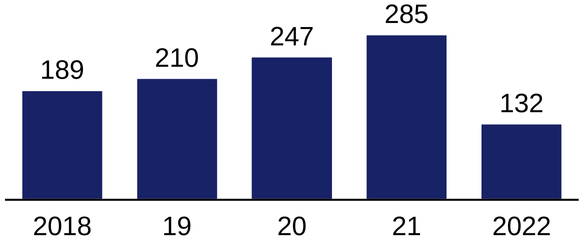
Kenyan context: country assembles significant number of 2Ws and ~10% of 4Ws

Local manufacturing/assembly

Annual number of 4Ws registered, 000s



Annual number of registred 2Ws, 000s



The number **of locally assesmbled 2Ws were the same as number** of of registered 2Ws for the years 2020 and 2021

Current automotive capacity

- **7** major local assemblers
- **~1600** Mechanics - Currently no special certification required to be an auto mechanic
- Technology Innovation Fund to acquire technologies

4Ws main assemblers

ICE

AVA Associated Vehicle Assemblers — Multibrand assembler for E4Ws and E2Ws (e.g., Volvo, Toyota, Bajaj etc.) Assembles 43% of vehicles assmbles in Kenya

ISUZU — Assembles E4Ws for Easten Africa market

EV

BASIGO — Locally assembles e-buses & has a target to produce 1,000 buses in the next 3 years

2Ws main assemblers

ICE

BAJAJ — Assembled by AVA and is the leading 2W assembler in the country

HONDA — Assemble 2Ws tailed to Kenyas customer needs

E2Ws

ROAM — Produces E2Ws tailored for the African terrain, with removable batteries and a portable charge

AMPERSAND — Produces E2Ws, offers financing and operates battery swap stations

1. Customs Bonded warehouse is a warehouse licensed by the Commissioner of Customs for the storage of goods imported into Kenya pending the payment of duties

Source: Kenya Bureau of Statistics; Motorcycle Assemblers Association of Kenya; press

Context summary

Kenya has no local automobile manufacturing, **only local assemblies**

There is a gap on local assembly of 4Ws as **~10% of annual registered 4Ws is locally assembeled**

ICE 2Ws local assembly is significant representing>90% of registered 2Ws indicating some potential to **locally assemble E2Ws and** opportunity to **locally produce E2W componets**

Existing approach in Kenya

- **Reduced import duty from 25% to 10%**
- **Exempted from excise duty**
- **Entrace of EV startups,** especially E2Ws producers

Key question to answer on local manufacturing

What are different paths to promote local manufacturing/assembly? Which one could be applicable to Kenya? (e.g., focus on 2Ws)

What are key elements required for local manufacturing/assembly?

How have other countries supported local manufacturing of auto esp. E2Ws?

Potential for Local Manufacturing/ Assembly

12 13 **Local manufacturing requirements & incentives**

PRELIMINARY DRAFT

There are key elements that majority of local manufacturing countries have in common

Key elements for local manufacturing

Examples follow

Efforts exist in Kenya's 2W local assembly sector

Low reliance | Accelerant | Critical unlock

	Elements needed for local manufacturing/assembly	Importance for local assembly	Description	Example
1	**Availability of resource-intensive commodities and processors**		**Raw materials** such as steel, aluminum, nickel (for batteries) coupled **with extraction/refining capabilities** are key for local manufacturing	China steel extraction and refining capabilities Indonesia Nickel reserves boost local manufacturing of batteries)
2	**Regional demand for autos**		Auto is a competitive market needing **regional customer base to boost sales**	Canadian automotive manufacturing is driven by exports, primarily to US. Canada consumes ~12%1 domestically of the vehicles it manufactures)
3	**Government support**		Government allows **ease of doing business and can build local demand and regional competitive advantage**	Indonesia is restricting imports of fully build autos (e.g., through import duty exemption on raw materials and no exemption on fully built autos)
4	**History of existing auto industry**		A rich history in auto manufacturing/ assembly **eases transition to EV by locally converting existing** ICEs and/or revamping their production lines to build EV	Due do Indonesia's significant 2Ws local assembly, its able to convert ICE 2Ws to E2Ws and government has given subsidy to accelerate conversion of ~200,000 ICE 2Ws
5	**Competitive technology**		Technology enables know-how to compete with overseas pears	Germany technology allows them to compete globally on quality, precision manufacturing and latest auto technology

Note: 2 >50% of vehicles in Kenyan roads are 2Ws: 3 Government support include Kenyan regulation incl. Excise duty: reduction for EVs (10% vs. 20%); VAT: exemption for E2W, Li-ion batteries: 4 Kenya has history of assembling 2Ws (~90% of annal registered 2Ws is locally assembled) with first assembled 2W in 1976

Source: Press search; Expert interviews

Countries have a variety of options to scale-up local manufacturing/ assembly

Proposed in public submissions | Example next | (partially) implemented by Kenya

Tax incentives

Import duty
Import duty exemption on incompletely knocked-down EV and raw materials
+ High impact, high visibility, centralized implementation
– High fiscal impact

VAT
VAT exemptions on raw materials, EV components and/or EV production machinery
+ High impact, high visibility, centralized implementation
– High fiscal impact

Corporate tax
Reduce corporate tax for local EV manufacturers/assemblers
Introduce tax holidays
+ High impact, high visibility, centralized implementation
– High fiscal impact

Local requirements

FDI restriction
Limits on foreign ownerships of EVs manufacturing company
No limits for class of EVs with strategic intend (e.g., E2Ws)
+ Low fiscal impact
– Displacement of local business if FDIs are not effectively managed

Production credits
Set local production credit (i.e., for every x ICEs produced, manufacturer/ assembler must produce y EVs)
+ Low fiscal impact, high impact on EVs produced
– Reduction of vehicles locally produced if OEMs do not meet EV quotes

Local content requireme-nts
Set percentage of local components used in the production (i.e., x % of components used in production must be sourced locally)
+ Low fiscal impact; develop linkages between EV sector and the rest of economy
– Potentially increases the price of EVs in short term

Manufacturing incentives

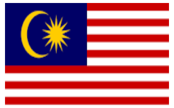
Subsidies
Provide subsidies to locally produce EVs, batteries or other components of EVs
+ High impact, high visibility, centralized implementation
– High fiscal impact

R&D promotion
Fund R&D and reform state research institutions to have/ increase capacity for EV R&D
+ High impact, high visibility
– High fiscal impact

Note: Kenyan regulation incl. Excise duty: reduction for EVs (10% vs. 20%); VAT: exemption for E2W, Li-ion batteries

Source: Expert interviews, press search

Different countries have used a variety of approaches to boost EV local component manufacturing

	 **Malaysia**	 **Indonesia**	 **Thailand**	 **India**
Approach	Tax incentives on non battery components	Tax incentives with large focus for EV battery production	Subsidy and tax incentives for EV and battery production	Subsidy across the value chain - local battery producers, local components producers and local EV producer
Rationale	No materials to locally manufacture battery	Availability of battery raw material – Nickel	Become regional hub for EVs	Enable existing capabilities for supply chain manufacturing
Examples of Incentives	From 2023-2027: **100% import duty exemption** on importation of EV components for local assembly **100% excise and sale tax exemption on locally** assembled CKD	**VAT exemption on battery raw** materials (e.g., nickel) and imported production equipment for battery and EV and components manufacturing **Ban export of Nickel**	From 2020-22: **full tax exemption on EV production**; 2% tax levy for 2023+ **90% reduction of import duties** for EV battery raw materials THB 24 Bn (~682 Mn USD) subsidy to produce battery cells	From 2022-2027: **PLI[1] scheme allocates INR ~26,000 Cr.** (~3.5 Bn USD) total budget for 13-18% cash back per vehicle for 4W EV OEMs From 2024:2029: PLI **also establishes a separate scheme for aiding local** Li-ion cell production in India, with an outlay of INR 18,000 Cr (~2.4 Bn USD

1. PLI = Production linked incentive

Source: IEA; Indian Venture and Alternate Capital Association; press search

Lessons learned for Kenya :Potential for Local Manufacturing/Assembly

Local manufacturing/assembly local requirements and incentives

Reasons to address : Local manufacturing/assembly could require choosing "where to focus" (e.g., focus on E2W) and leads to mitigation of jobs that could be lost as EV transition happens

NON EXHAUSTIVE

Options	Incentives on non battery components	Incentives on battery components	Incentives across the EV manufacturing/assembly value chain
Examples	**Import duty exemption** on EV components for local production (e.g., Malaysia, Thailand) **Excise and sale tax** exemption (e.g., Malaysia)	**Import exemptions** on battery raw materials (e.g., Indonesia, Thailand) **Subsidy for battery production** (e.g., Thailand, India)	**Corporate tax exemption/ reduction** for local producers **Subsidy for OEMs on locally produced EV** (e.g., Indonesia, Thailand)
What you need to believe	**Captive demand** to justify setting up local production of non-battery components Government's **local content requirements**	Ability to **source supplies of cost competitive** battery minerals/ components	**High demand to justify** end-to-end local EV production **Sufficient local** skills to produce EV competitively
Implementation rationale for Kenya	It could **require scaling/creating new manufacturing/assembly** lines for EV components, therefore a **new GDP opportunity**	New GDP opportunity requiring **setting up new production lines** as there is currently no local production capacity of batteries Become **regional battery hub producer** using African resources	**E2Ws: Scale up existing local assembly capacity**[1] to cover E2Ws **E4Ws:** Could **require creating new manufacturing/assembly** lines as current capacity is low Allows end-to-end steering of sector
Potential analyses to support option evaluation for Kenya	Quantify minimum market size needed to locally manufacture/assembles E4Ws/E2Ws Concrete option design for Kenya, (e.g., focus on components for E2Ws?) Expected fiscal/ resource impact for Kenyan government		

1. Kenya has significant locally assembly capacity for 2Ws, assembling >90% of annual registered 2Ws

Potential for Local Manufacturing/ Assembly

14 Local enablers: Skilling, re-skilling & up-skilling programs

There will be some change of skills in the transition to electric mobility

NON-EXHAUSTIVE

	ICE vehicle	Electric vehicle
Electrical engineering	Design and manufacture of **wiring, sensors, actuat**ors, etc. Development of control systems such as **Engine Control Units (ECUs)**	Designing, developing and testing the **electrical systems of EVs and EV servicing** **Charging station installation, connection to grid, energy storage solutions and station operation and maintenance**
Software engineering	Development of control systems that enable vehicle functions such as **stability control, infotainment system**, etc.	Developing EV software solutions including **energy management, thermal management, fault detection, smart control, driving assistance** etc. Developing **smart charging solutions**
Automotive engineering	**Chassis design, aerodynamics and ergonomics**, optimizing for efficiency and performance Design, development and testing of mechanical systems such as **engines, suspension, and transmission**	Designing, developing and testing parts that **support the movement and structure** of the entire vehicle
Chemical engineering	n/a	**Battery cell chemistry R&D**, **Battery lifecycle and recycling assessment**, manufacturing **process optimization**
Data Science	Business optimization algorithms, product development reliability assessment, marketing and sales customer optimization	Business **optimization algorithms**, product development **reliability assessment**, marketing and sales **customer optimization**, **Driving automation (self-driving)**

Key takeaway

Mechanical parts of the car have been partially replaced in the EV car by electrical components, giving more weight to the electrical skills needed in vehicle manufacturing

Batteries are a key power component for EVs, and with it **chemical engineering emerges as a key new skill** for the EV automotive industry

Previous areas with a smaller role in the ICE car are getting central roles in the EV such as software development and its energy management and smart charging skills

Source: Expert interviews, press search

There are different ways countries have tried to build local EV capabilities, driven by government and private sector

Options for skilling, upskilling and reskilling

Example ahead | Government | Private sector

Option	Description	Implementor
Hire foreign talent	Hire foreign talent to train local talent; accelerate their processes around work permits and accommodate foreign talent's requirements on salary, benefits, and working conditions These hires would be ideally made in a leadership/oversight role, to upskill local employees	Private sector; Govt can play an enabler role
Acqui-hire	Find companies that are software-led companies, which have collaboration and partnership opportunities and potentially acquire	Private sector; Govt can play an enabler role
Training centres	Utilize local R&D and training centers to train new generation workforce, and upskill and reskill the current workforce	Private sector; Government
STEM education	Boost STEM and software talent education through partnerships with universities, schools, technology partners, community colleges and learning platforms to create tailored training pathways	Private sector; Government
OEM upskilling	OEMs should come forth to help with formulation of the curriculum	Private sector; Govt can play an enabler role

Source: Expert Insights

Singapore established research center to spur local capability in manufacturing excellence by partnering with diverse stakeholders

NOT EXHAUSTIVE

The Advanced Remanufacturing and Technology Centre (ARTC) is the **leading public-private partnership research center in Southeast Asia**, serving as an innovation partner to leading companies and government institutes in their needs in **advanced manufacturing technologies, systems, and capabilities**

ARTC focuses on strategic manufacturing R&D themes…

Aspiring to make manufacturing smarter, greener, and more connected in the future

Advanced Manufacturing Process

Design with improved functionality

Advanced powder characterization methods

Surface integrity enhancement by physical / mechanical engineering

Autonomous Manufacturing

Intelligent inspection via optimized imaging systems

Design & simulation of robotic work

AR & VR manufacturing applications

Resilient Value Chain

Supply chain connectivity

Supply network configuration & simulation

Decision support system responding to risk & disruptions

Net Zero Manufacturing

Agile disassembly tech

Repair & regenerative tech

Smart energy, water, waste mgmt

…while delivering a holistic value proposition

Accelerate Technology Deployment

- **Develop new manufacturing tech and processes** at early stage
- **Enable supply chain collaborations** from research to tech deployment
- **Optimize manufacturing solutions** by integrating A*STAR capabilities

Best-In-Class Facilities for Research

- **Access to modern equipment and expertise** to support prototyping, testing and scale up to industrial production, de-risking investments
- **Attracting investments** into Singapore through branding under flagship programs

Training

- **Upskill existing workers and develop** future leaders in advanced manufacturing to compete globally
- **Secondment or ARTC researcher** (through T-UP program) enhances companies' competitiveness through technology upgrading

The platform partners with leaders across key industries…

Aerospace: BARNES, SAESL, ARCSTONE

FMCG/e-Comm: The Coca-Cola Company, Givaudan, P&G, DMG MORI

Energy: Shell, ABB, HALLIBURTON

Land Transport: Land Transport Authority, TYRIDA, Singapore Post, HYUNDAI, voestalpine

MedTech: IHI, SIEMENS, Singtel

…achieving impact and scale

>860 Industrial Projects Delivered

>300 Core Staff

>55 PhD Student, Interns & SGUnited Trainees

97 Industry Members with Global Presence

9 Core Technology Themes

6 Industrial Flagship Programs

Source: ARTC

Lessons learned for Kenya

Local capacity building: Skilling, upskilling and reskilling

Reasons to address this topic: Local capacity building is crucial to enable local manufacturing and assembly, and for the day-to-day operation of EVs in Kenya (EV servicing, charging station set up and servicing)

	Government as enabler			Government as implementor	
Options	**Hire foreign talent**	**Acqui-hire**	**OEM upskilling**	**STEM education**	**Training centres**
Examples (of governmental actions)	Accelerate **foreign hires' processes** in the EV industry e.g., work permits and benefits	Promote **acquisition law for EV and automotive** industry to promote acquisition activity	**Require and stablish guidelines for upskilling** programs from OEMs for their current workforce	Boost **STEM and software education** to create tailored training pathways	Partner **with OEMs to form a curriculum for skilling** for local training centers
What you need to believe	Top level **expertise hires** brought in would train junior colleagues, transferring knowledge	Acquisition would be a method to **acquire new talent needed** in EV related areas	OEMs need workforce, and upskilling their own **workforce would provide a competitive advantage without major finance impact**	**Boosting education systems would aid the coming workforce** develop skills needed in the EV sector	**Purposing training centers for upskilling** would give existing workforce skills to transition to the EV ecosystem
Implementation rationale for Kenya	Availability of **internationally-trained Kenyan experts** outside the country and existing EV startups with expert talent appetite	**Existing EV assembly** and manufacturing startups ecosystem **that require EV-related skills**	Opportunity of the ongoing EV policy work to also cover upskilling mandates and guidelines	Government can promote **STEM learning through existing initiatives** for the topic in the country	Existing **public and private Technical and Vocational Education and Training (TVET) centers** and act could support the EV sector
Potential analyses to support option evaluation for Kenya	Expected future demand of vehicles and respective workforce size needing skilling				
	Concrete option design for Kenya				

Potential for Local Manufacturing/ Assembly

20 **End-of-life/ E-waste standards**

Kenyan context: End-of-life management is still nascent globally, and Kenya policies do not directly cover it

Kenya has a Waste management act

- Act aims to **improve public health, reduce air pollution**, **make waste services effective**, **create jobs** and **encourage behaviour** changes when it comes to waste management
- The act aims to accomplish the above goals through multi-approach such as:
  - **Tax reform to incentivize private investment**
  - **Waste separation plan**
  - **Outlines public awareness programs**
  - **Establishes Waste Management Council**[1]

End-of-life management is still nascent

- Battery end-of-life management is **still nascent** with only EU, China, India and US having some policies
- **Kenya's market is still nascent as it does not** have EVs with batteries nearing end-of-life
- Currently, **Kenya do not directly regulate End-of-Life (EoL)** of battery/e-waste
- Currently, **only China and South Korea have capabilities recycle EV batteries**
  - EU sends battery waste to South Korea for recycling
- **EU and US are in pilot phases of creating** their own recycling plants

1. Central coordinating body for country's waste management

Source: Expert interviews: Press search

Key takeaways

EoL is still a nascent market as no sufficient batteries are there for to warrant set up local recycling plants

~4 jurisdictions have some EoL policies in place

Existing approach in Kenya

Kenya has waste management act but do not directly have EoL policies

Key question to answer on end-of-life management

What are the key aspects of end-of-life journey

What have countries done along end-of-life journey?

The value chain is still developing – governments are creating policies along the value chain

Deep dive next

NON EXHAUSTIVE

International | APAC | EU | North America | Served through partnerships

	Logistics			Dismantling and classification			Recycling			Active material production	
	Collect	Transport	Store	Test	Charac-terize	Separate / 2nd life	Shred (black mass)	Process	Refine	pCAM	CAM
Description	Used batteries need to be collected, transported and stored awaiting dismantling			Batteries are then tested and characterized depending on state of health			Batteries deemed for recycling are shredded into black mass then refined			Extraction of useful elements like cobalt and nickel	
What is needed	Logistics need to be done considering that batteries are regarded as hazardous			Does not require sophisticated technology			• Requires significant volume of black mass to be economically viable • Requires more complex hydrometallurgical process, and typically high separation costs[1]				

What countries are doing

- EU: OEMs must improve battery value chain traceability through a digital „battery passport“. Fines of up to 10,000 EUR/ battery in Germany, with other countries likely to follow suit
- China: Accountability measures determined via EPR[2] and traceability management (battery codification/passport)

Players

- Logistics & disassembly: REMONDIS (EU); suez, VEOLIA (International)
- Black mass producer: SungEel HiTech (APAC)
- Integrated processor-refiner: Huayou Cobalt, GEM (APAC); Cirba Solutions (North America)

Key takeaways

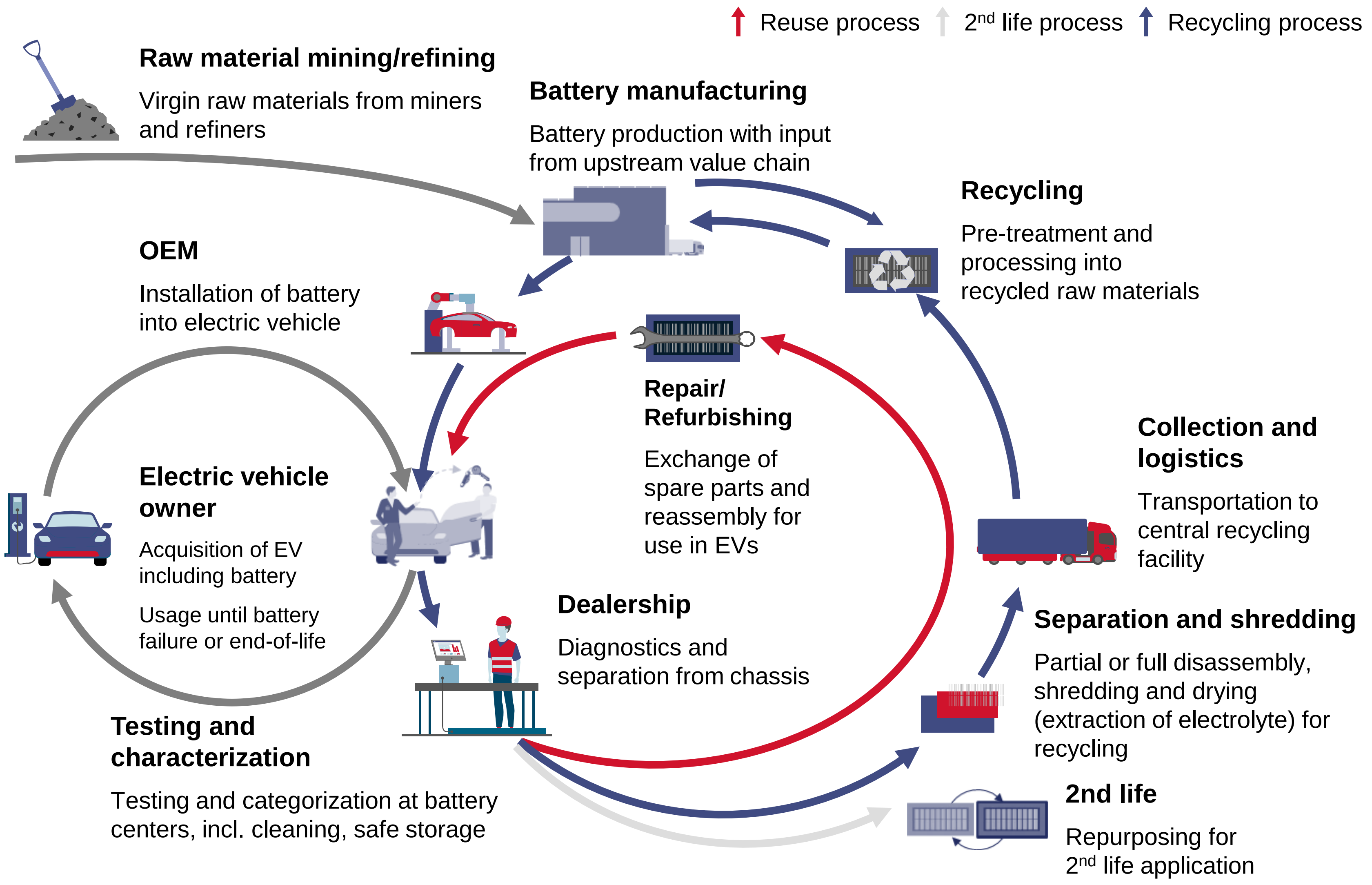
EU and China **requires OEM to be responsible** for the entire value chain though traceability

Given the nascent nature of the EV battery recycling market, participants are **still experimenting with diverse business model archetypes and determining "where to play"** in the value chain

1. Especially for Lithium iron phosphate battery
2. Extended producer responsibility

Source: Expert interviews, Markets & Markets, Battery Insights

Recycling is only one of many options in the end-of-life journey of batteries



Source: Experts interviews; Battery Insights

Key insights

Eventually, every battery will be **recycled**, and its **raw materials** will be **re-introduced** into the **battery value chain**

Batteries still have **high residual value** after they reach their end-of-life (EoL). This value can be captured through **multiple EoL pathways, of which one of them is recycling**

After separation, shredding and transporting black mass to recycling plants**, more complex hydrometallurgical process** is required to separate material and extract useful element

Countries have implemented policies along end-of-life journey, however there are trade offs of having less vs. more control

NON EXHAUSTIVE

No policies
on EoL Journey

Several polices
on EoL journey

No specific policies mandating original equipment manufacturers (OEMs) to be responsible for end-of-life batteries in the US

Consumers are usually expected to take care of the recycling

California is currently working to develop a policy **to ensure that 100% EV lithium-ion batteries** sold in the state are reused or recycled

OEM responsible for EoL battery collection, storage and setup of recycling network

Testing obligation of EoL batteries before feeding them into recycling chain

Storage and sorting requirements for disassembled products

Since 2018, all EV batteries are **given a unique ID to track them** throughout their lifecycle

OEM responsible for battery waste management (incl. EPR[2] and take-back obligation)

- Established Battery Passport and Electronic Information Exchange System to trace batteries

Materials recovery rate and recycled content

- By 2030, achieve material recovery rates of 95% for copper, nickel, and lead, and 70% for lithium and cobalt

Collection rates and recycling targets

- By 2028, 51% collection targets for light transport EV batteries and 61% by 2031
- By 2026, 65% recycling efficiency target for lithium-ion batteries and 70% by 2031

Battery green labeling and carbon footprint declaration

Trade-offs of less vs. more government policies on EoL journey

	Less policies	More policies
+	Attracts a variety of OEMs especially those with limited incentives to recycle their batteries	OEMs can capture remaining value contained in end-of-life batteries through reuse, second-life and recycling especially for NMC[1] batteries Supplements countries waste management services
−	Creates additional waste management risks especially for countries with weaker waste management services	LFP batteries generates significantly less recycling revenue compared to NMC[1] batteries and OEMs using LFP batteries may not enter jurisdictions where entire EoL journey is OEM's obligation

1. Nickel Manganese Cobalt (NMC). LFP batteries generate ~60% less recycling revenue compared to NMC ; 2. Extended producer responsibility

Source: Expert interviews; Press search

Lessons learned for Kenya

End-of-life/ E-waste standards

Reasons to address this topic: Although futuristic, EoL management (e-waste management) is important for individual's wellbeing and environment and could lead to recycling jobs

NON EXHAUSTIVE

Options	No policies	Policies on battery sourcing	Policies on battery sourcing and EoL journey / recycling
Examples	**No policies mandating** OEMs to be responsible for EoL batteries (e.g., USA)	**Batteries meeting set standards** allowed in the country (e.g., India[1])	**OEMs are fully responsible for entire life circle of battery** incl. recycling (e.g., EU and China)
What you need to believe	**Availability of cost competitive batteries** as any OEMs willing to enter the market can do so **Battery EoL is still nascent** (futuristic) and no sufficient old batteries to warrant EoL management	**Safety is important** and batteries need to meet certain standards Possibility of already enforcing **battery sourcing standards from early EV market maturity phase** helps compliance in long term	**Supplement** countries waste management resources Ensuring **EoL journey policies in early stage** is important otherwise is going to be hard
Implementation rationale for Kenya	**Limited battery raw materials** in the country could require attracting cost competitive batteries	**High importance of safety topic** requires direct involvement and overseeing battery sourcing	**Opportunity of the ongoing EV policy work to cover EoL;** policies will be already in place when enough batteries are available for EoL management

Potential analyses to support option evaluation for Kenya

- Expected impact of having EoL polices vs no policy on battery costs, supply and waste management
- Expected fiscal/ resource impact for Kenyan government

1. India is working on policy which covers EVs, portable, and industrial batteries. These rules require producers and importers to be accountable for the collection and recycling of batteries

Source: Expert interviews, press search