17 - 18 October 2023 / Addis Ababa, Ethiopia

IMPROVING VEHICLES TO IMPROVE LIFE

- ECA - The challenge of E-vehicles
- CITA - RAG Africa Conference

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SESSION 1

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The e-vehicles in Africa: market and challenges

Placide Badji, ECA

ideas for a prosperous Africa

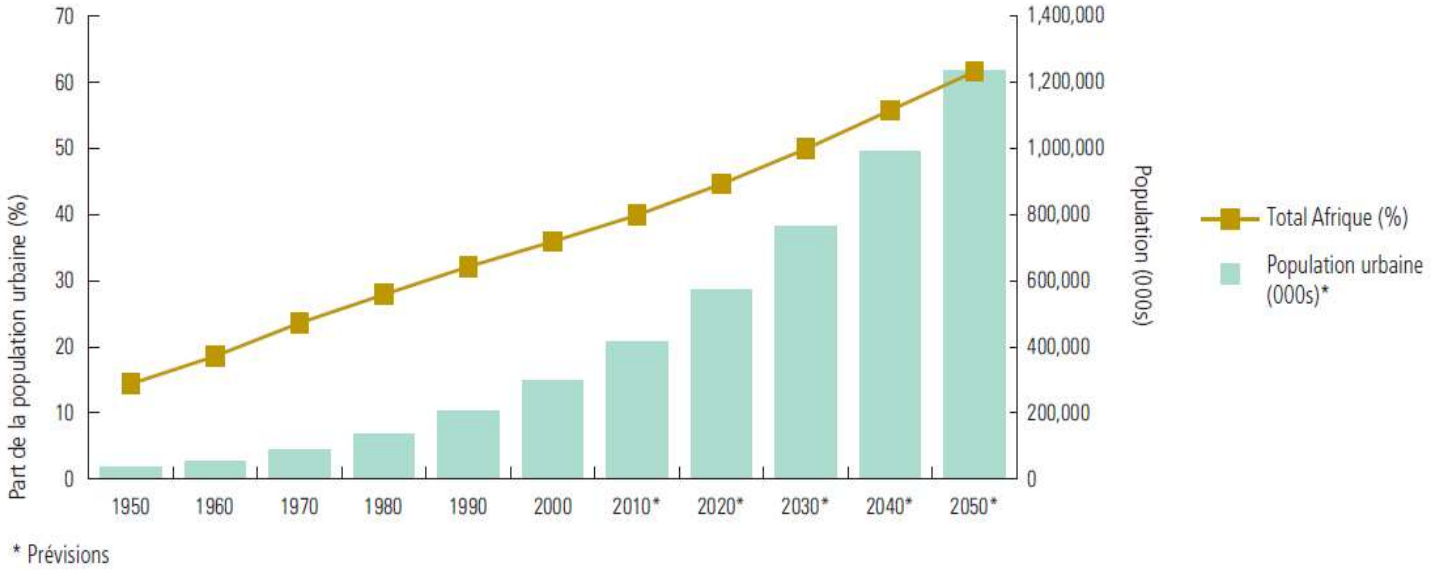
Addis Ababa, 18/09/2023

Context

- Rapid urbanization, increasing incomes, and the rise of a middle class: Urban areas contained **472 million people in 2018**, and will double over the next 25 years (Center for Strategic and International Studies, 2018)

- Africa's middle class has tripled over the last 30 years. The current trajectory suggests that the African **middle class will grow to 1.1 billion (42%) in 2060** (Deloitte, 2013)

- AfCFTA requires over **2 million trucks by 2030** (ECA, 2022)



The vehicle parc is expected to grow from 25 million vehicles to an estimated 58 million by 2040, driven by urbanization and rising incomes

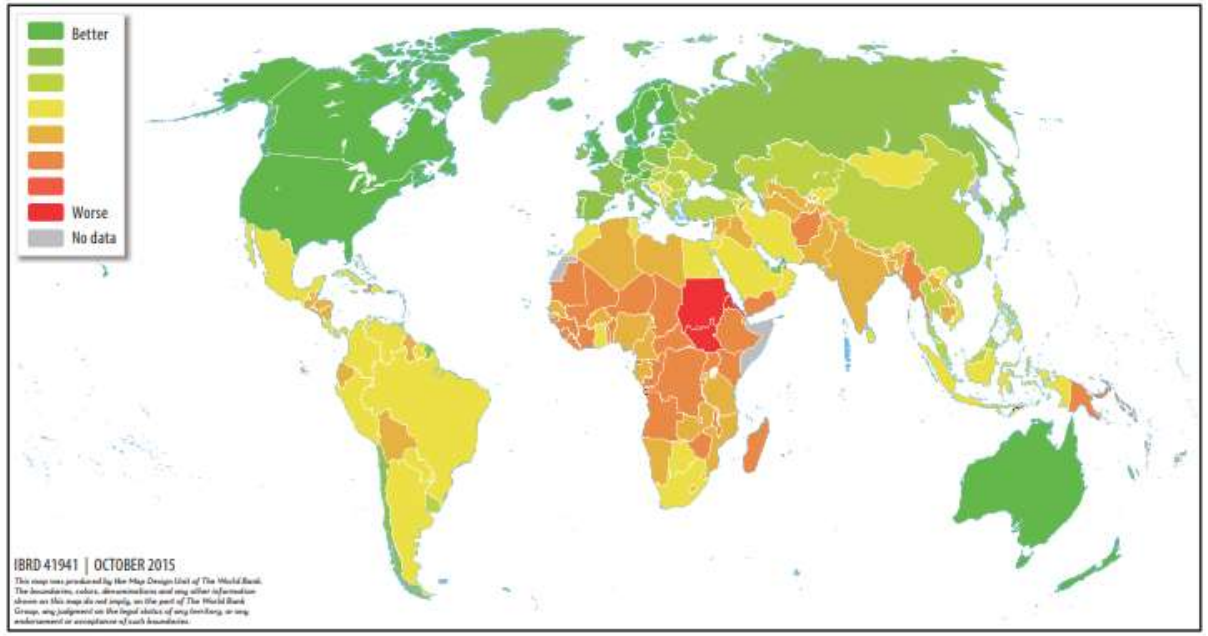
Transport and global climate challenge

- Transport enables development, but causes traffic congestion, pollution, noise, and road accidents.

- The contribution of the transport sector to increasing greenhouse gas emissions (GHG) and fossil fuel consumption have been at the center of global discussions on climate change.

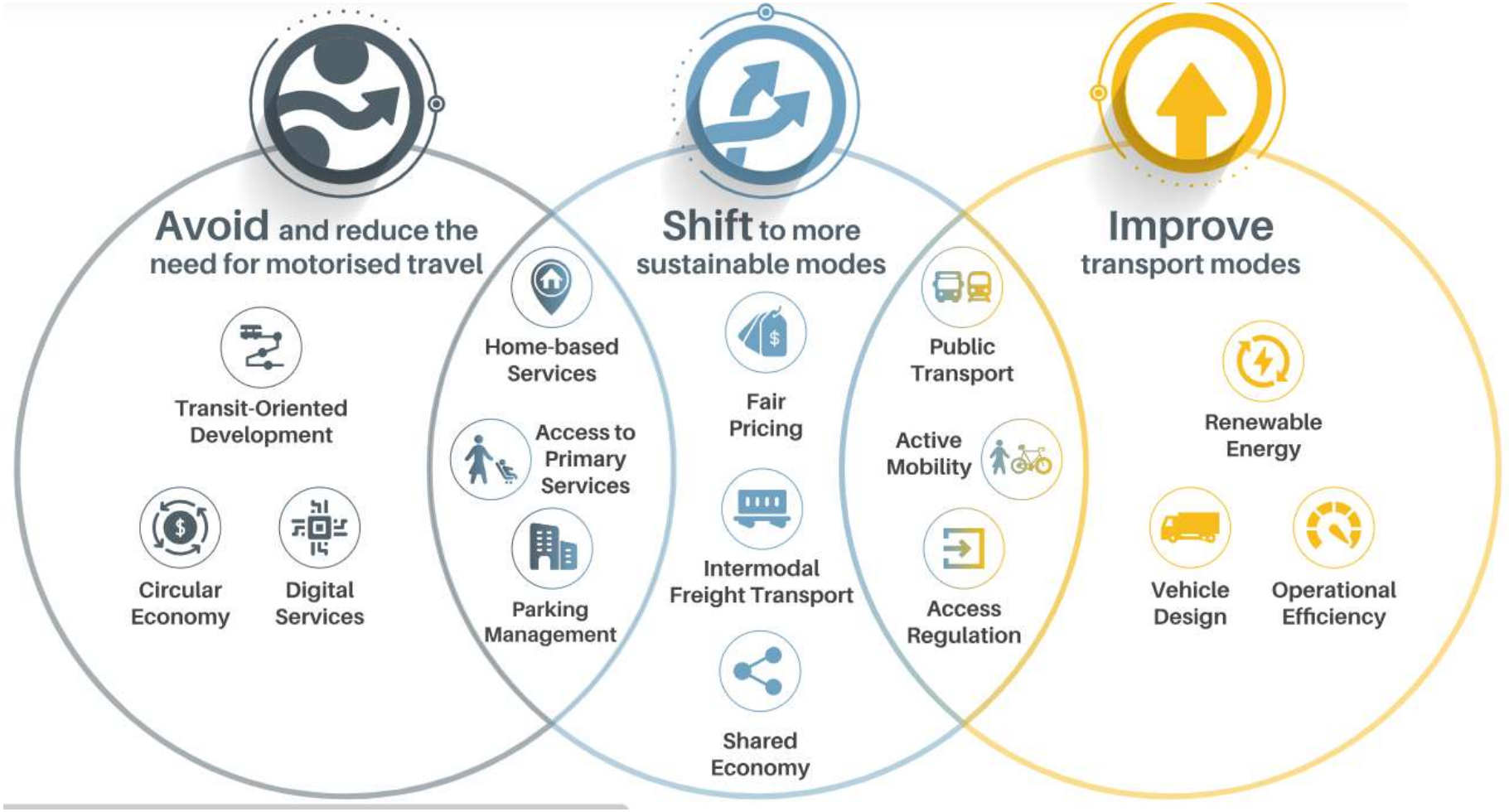
- Air pollution was responsible for approximately **1.1 million deaths in Africa in 2019**, making it the second leading cause of death in the continent (Shindell et al., 2022)

Vulnerability to the risks of Climate Change and other global Challenges



Source: University of notre dame global adaptation index (nd-gain)

Avoid-Shift-Improve Framework



- A transition to e-mobility currently will reduce vehicle emissions by 50% in Africa.

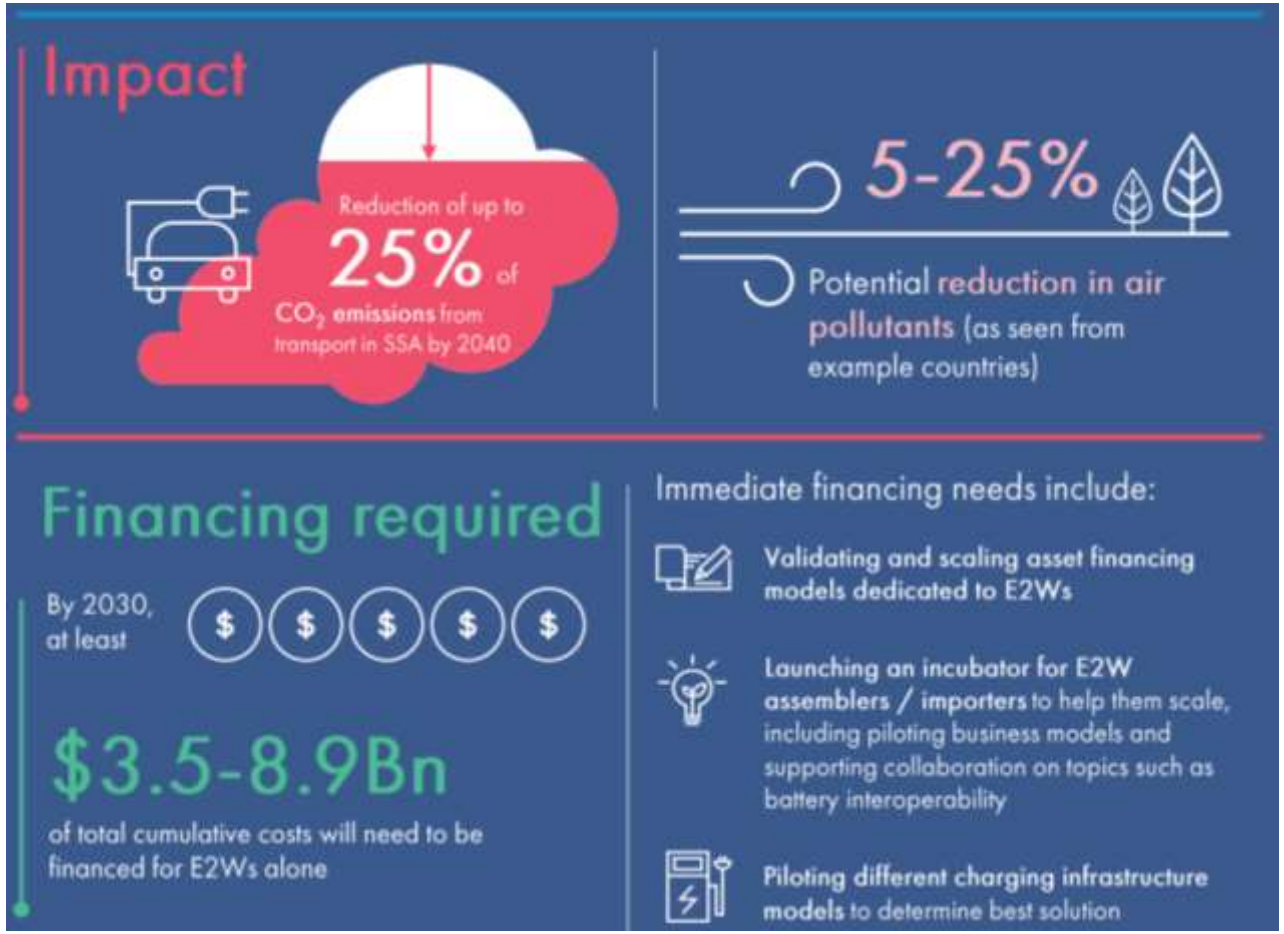
Source: SLoCaT, 2018

Electric vehicles in Africa today

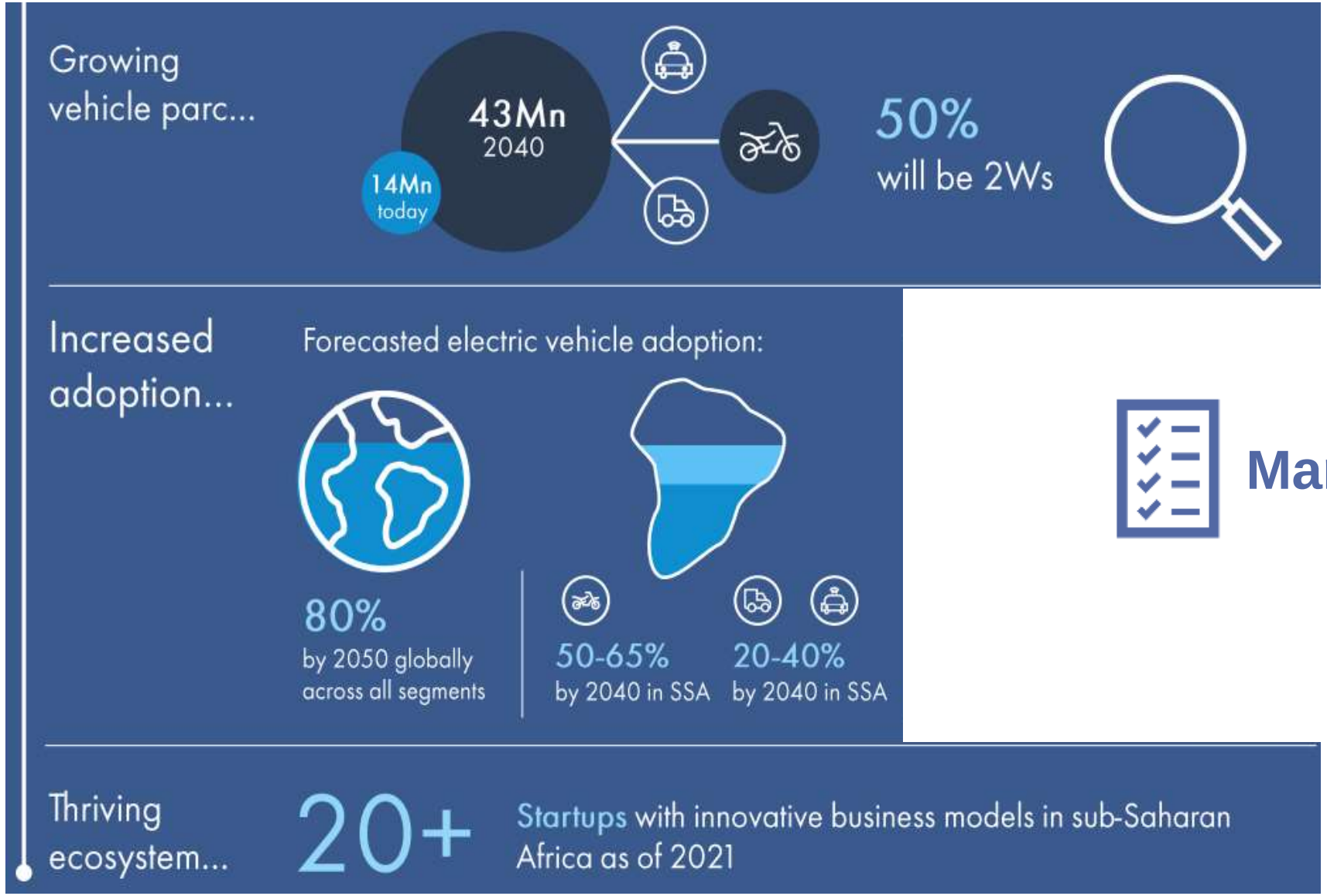
- Some governments in sub-Saharan Africa have started to announce electrification targets for vehicles and incentives for EV adoption—such as Rwanda's (*duty-free or reduced import rates for electric vehicles and related parts. The growth of an EV startup ecosystem is also contributing to these efforts*).

- A growing start-up ecosystem for EVs, focusing particularly on electric two-wheelers, is emerging in the region.

- McKinsey estimates that as of the end of 2021, there were more than 20 start-ups in the ecosystem EV, which combined raised over $25 million in funding that year.



Source: Shell Foundation, 2022

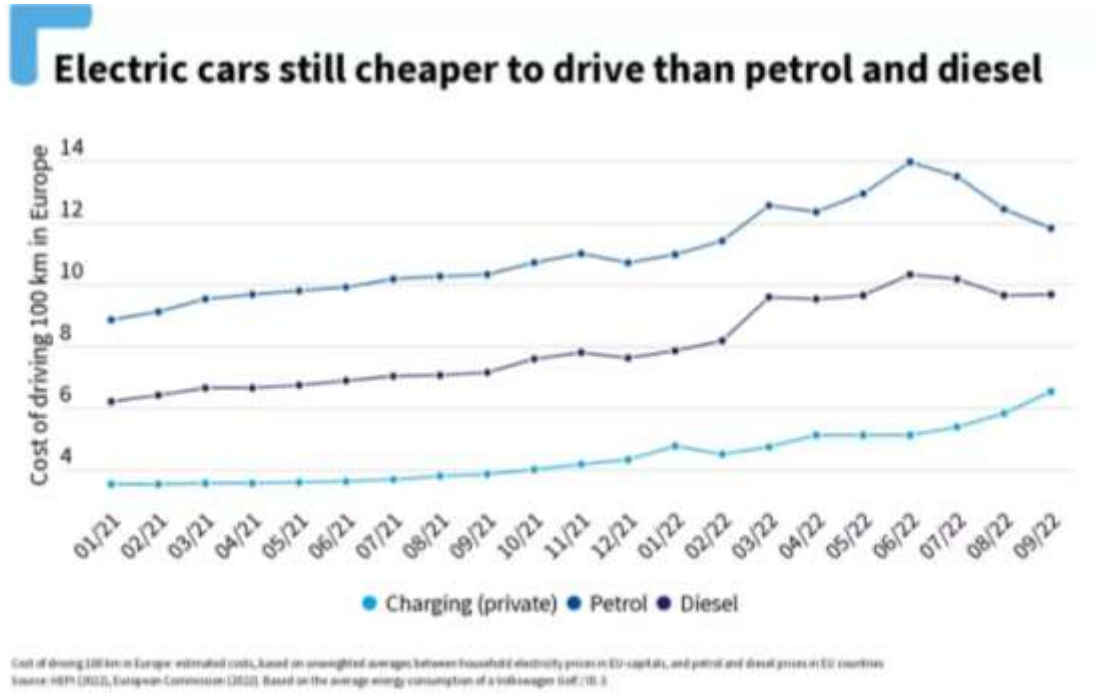


Market outlook

Source: Shell Foundation, 2022

Are E-Vehicles the most economical option?

- Electric vehicles have the lowest operating expenses.
- Low energy consumption. Over 77% of the grid electricity is converted to power at the wheels in EVs. Only about 12 percent to 30 percent of the energy in gasoline is converted to power at the wheels in standard automobiles.
- Despite their typically higher purchase price, EVs are ultimately more cost-effective than gasoline or diesel engines over time.
- Depend on: cheap charging, tax breaks, government subsidies, longer lifespan, and a decent infrastructure for EV in your area.



Recharging an EV at home or at the office is still much cheaper than refuelling at the pump, according to T&E's calculations. - Courtesy Transport & Environment

https://www.fueleconomy.gov/feg/evtech.shtml

Market outlook

From the supply chain perspective

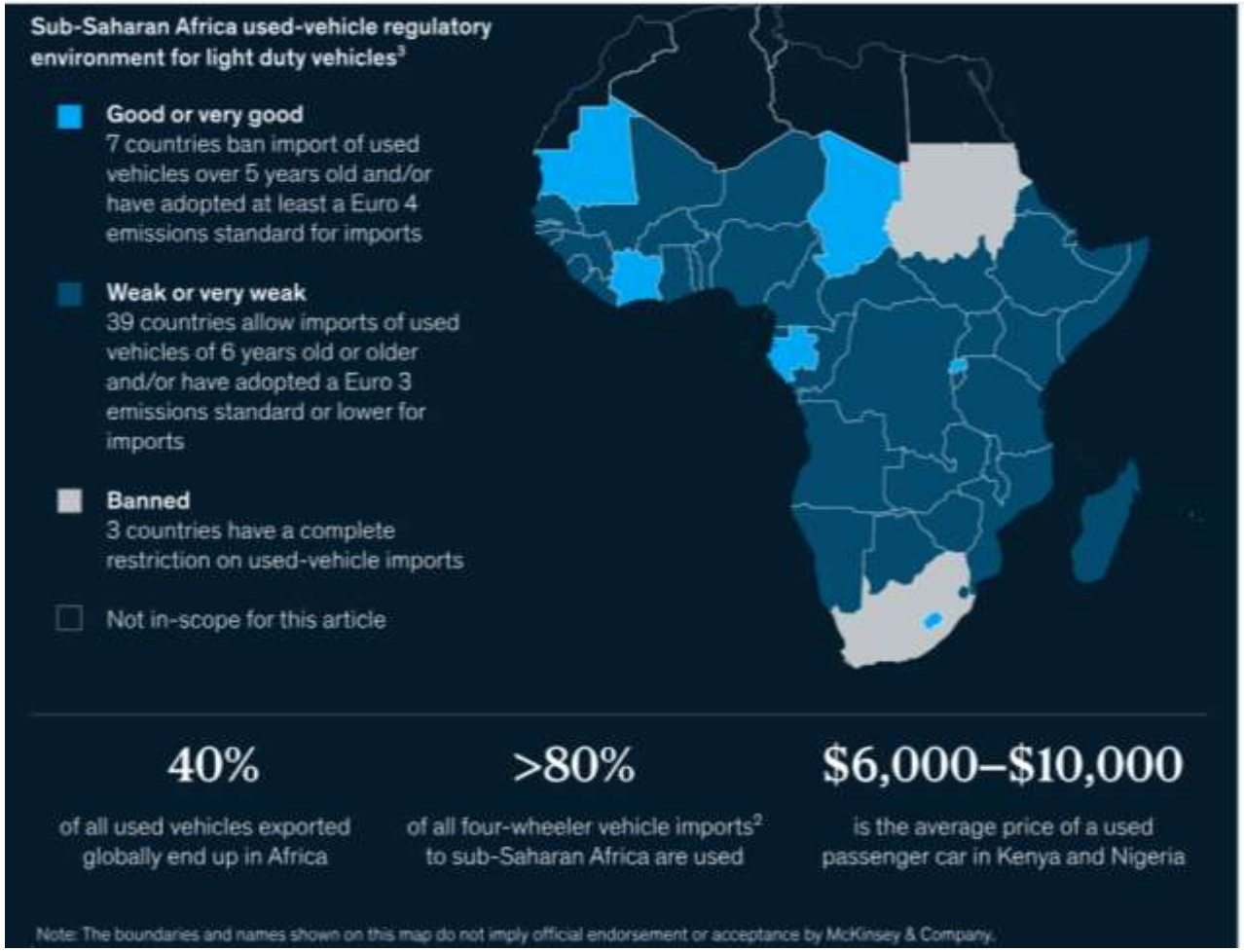
Africa's focus

Mining	Metals	Precursor Production	Cell Production	Cell Assembling	Electric Vehicles
Lithium, Nickel, Cobalt	Smelt and refine	Precursor	Cells	Battery	
ALBEMARLE CORPORATION, GLENCORE, NORNICKEL, VALE	BHP, 华友钴业 HUAYOU COBALT, JINCHUAN 金川, TQC TIANQI LITHIUM	JM Johnson Matthey, SUMITOMO METAL MINING CO., LTD.	umicore, BASF We create chemistry	CATL, LG Chem, Panasonic, SAMSUNG SDI	RENAULT, TESLA
Market Value by 2025	$11b →	$44b →	$271b →	$387b →	$1.18t → $7t+

Kwasi Ampofo / Bloomberg

Challenges in electric mobility transition in Africa

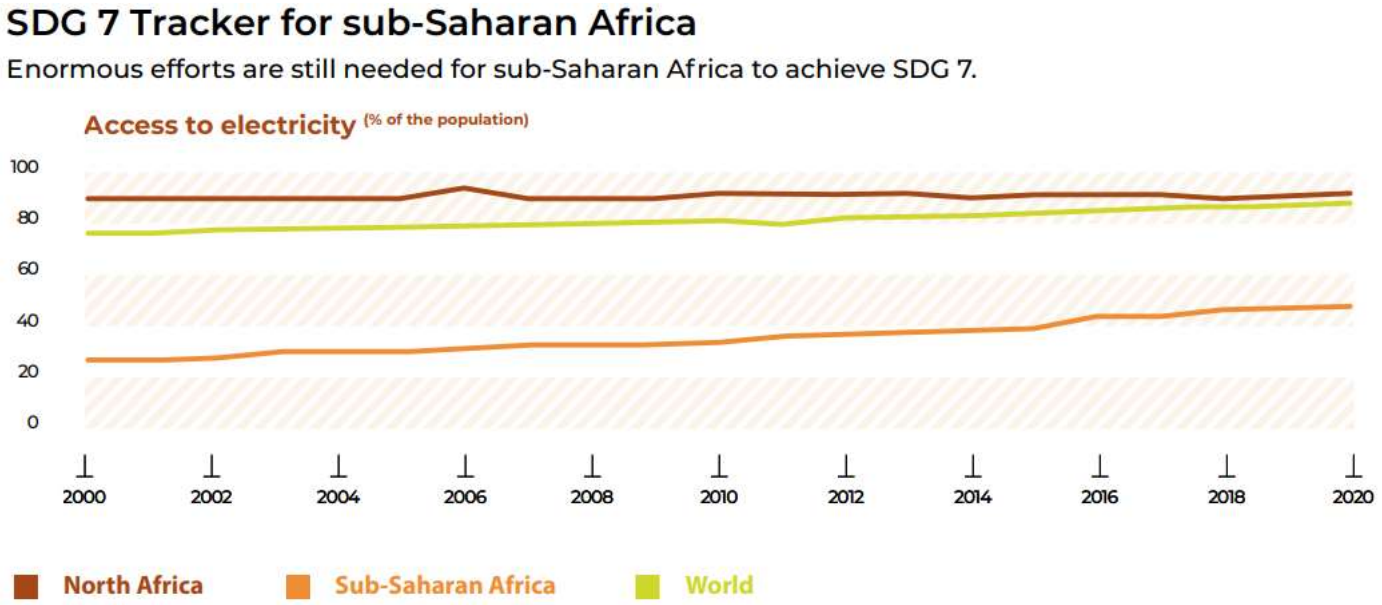
- Used vehicles



- Uganda: 95% of fleet consists of relatively inexpensive used vehicles imported from Asia
- Ethiopia: used cars constitute 85% of vehicle fleet
  - Country imported 135,457 vehicles in 2019, 30,834 more vehicles than in 2018.
  - Average age of imported vehicle rose from 15.5 years in 2000 to about 20 years in 2016 (> 25 %)

Challenges in electric mobility transition in Africa

- Unreliable electricity supply,
- Unavailability of energy
- Availability of charging infrastructures ??



Source: RES4AFRICA, 2023

- 51.5% of people in Sub-Saharan Africa have access to electricity.
- The 2020 System Average Interruption Disruption Index (SAIDI) for **sub-Saharan Africa was 39.30 versus 0.87 for OECD** high-income countries.

ECA is engaged

- ECA constructed/installed electric charging stations in its premises and gives priority to the purchase of EVs. Important to notice that at the headquarter/Addis-Ababa, 100% of the electricity is renewable, clean.

- ECA is also committed for the local manufacture of batteries for E-vehicles in Zambia and DRC in the frame of the African Continental Free Trade Area (AfCFTA)

Opportunities

- **The market of cars in Africa is constantly growing**

- **Africa has the resources to become a renewable powerhouse**. The solar capacity potential is estimated at 10 TW, hydro energy at about 350 GW, wind at 110 GW, and geothermal resources at 15 GW. It has the potential to generate up to 24,000 TWh of electricity each year – 90% of the world's electricity production in 2018 – and 26 times that currently generated by the continent (AfDB, 2018)

- **Critical minerals, such as lithium, cobalt, platinum, and rare earth elements**, are becoming increasingly vital to meet the rising global demand for batteries, solar panels, wind generators, etc.

- **The African Continental Free Trade Area (AfCFTA)** represents an opportunity to promote production and related value chains

- **The existence of legal instruments, continental agreements and programmes on transport** (SAATM, TAH, African Maritime Transport Charter, PIDA, African railway network, Corridor authorities, etc.) constitutes an opportunity

Table: Major sources of raw materials for batteries and fuel cells

Raw materials	Source countries
Cobalt	Australia; Canada; Congo, Dem. Rep.; Cuba; Philippines; Russian Federation
Copper	Australia; Chile; China; Congo, Dem. Rep.; Peru; United States
Graphite	Brazil; China; Türkiye
Lithium	Argentina; Australia; Bolivia; Chile; China; Russian Federation; United States; Zimbabwe
Manganese	Australia; Brazil; South Africa; Ukraine
Nickel	Australia; Brazil; Canada; China; Cuba; Indonesia; New Caledonia; Philippines; Russian Federation
Platinum	Russian Federation; South Africa; Zimbabwe

Sources: NOW 2020a; USGS 2021.

Recommendations

- Innovating local production and supply chains
- Consider regulatory mechanisms
- Finance assets, assemblers, and infrastructure
- Produce guidelines on vehicle inspection and explore all specific aspects related to safety in the safe system perspective.
- EVs alone are not enough for sustainable transport: need of combination with mass transit, active mobility, clean energy, etc
- Set harmonised standards for the continent in the frame of the AfCFTA

Thank you !

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SESSION 2

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Arne Willerlev

TÜV Rheinland Group

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UNECA CONTINENTAL WORKSHOP ON E-VEHICLES INSPECTION

Ensuring lifetime compliance of EVs with Safety and Sustainability Requirements

October 18th, 2023

Arne Willerslev-Legrand | Chair – Taskforce Electric Vehicles
Arne.Willerslev@tuv.com

Goals of this presentation

- Share some background and context on why we believe PTI needs to be adapted for EVs
- Present excerpts from the Task Force recommendations
- Provide an outlook on next steps

Ensuring EV compliance with safety and environmental regulations while keeping economic burden at a manageable level for all stakeholders is key

Situation

EV adoption is growing considerably due to:

- Regulatory moves
- Advances in technology
- Changing consumer behavior

Complication

- Ensuring the safe use of EVs and a proven positive impact on avoiding emissions is an enabler of EV adoption rather than a roadblock
- Current PTI criteria do not yet sufficiently address the specifics of EVs
- “Budgetary” restrictions in terms of monetary and time aspects

Recommendation

Elaborate a set of recommendations which at the same time:

- Ensure vehicle safety and environmental performance compliance over the entire vehicle life
- Consider cost/benefit and convenience aspects from a user perspective
- Keep investment for PTI service providers – and thus the cost to those who pay for or fund PTI – at manageable level

CITA EV Task Force has developed a set of recommendations along four subgroups and defined prerequisites for an effective PTI adaption

Subgroups

General safety

Electrical safety inspection (electric elements and resistance / isolation)

Rechargeable energy storage system and battery management system

Electric energy consumption

Prerequisites

- A mandate for relevant items to become part of the type approval requirements
- Open access to relevant OEM data for PTI organizations in a legally standardized form, in a centralized way and on a non-discriminatory basis
- Relevant equipment needs to be available at the place where PTI is conducted and inspectors must be appropriately trained for HSE purposes and in order to achieve consistent outcomes

Recommendations (1/2)

General Safety

- Only specially trained PTI inspectors should be testing EVs
- Ensure presence of relevant labels and shields
- Visual inspection of high and low voltage wiring
- Brake testing: Ensure mechanical brakes are being tested
- Check “active driving possible mode” and “state of drive indicator”
- Check acoustic vehicle alerting system

Electrical Safety Inspections

Visual inspections need to be supported by further measures:*

- Reading OBD information from all safety relevant control units
- Verifying the electric safety by measurements
- Verification of the vehicle inlet charging connection
- Ensuring right equipotential bonding of the vehicle
- Verification of the isolation resistance between the vehicle and HV components
- Charging cable test

* UNECE Rule 4 only defines visual inspections

Recommendations (2/2)

Rechargeable energy storage system and battery management system

- Vehicle charging immobilization interlock
- Charging communication test
- Charging test

Additional recommendation:

- OBD connection to verify information with focus on safety and efficiency
- Regulated and standardized data access to inspect safety relevant state and sub-functions of the battery system, e.g. malfunctions, failure modes, soft- and hardware versions

Electric energy consumption

- Regenerative braking is environmentally relevant and should be inspected in PTI including a short test drive where possible
- Drive efficiency and energy consumption should be inspected using the vehicle interface because failures and wrong software may lead to an environmental non-compliance

Next steps

- The EV White Paper and its practical recommendations has been published and well received. Freely available on the CITA homepage: CITA_WP_BEV_REV1_15062023_FINAL.pdf (citainsp.org)
- Practical EV PTI testing is being carried out in several places, demonstrating the feasibility of the approach
- Legislation updates must be seen through: new technologies cannot be tested with old tools!

Thank you for your attention!

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Dagnachew Alemu

Ministry of Transport and Logistic, Ethiopia

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MINISTRY OF TRANSPORT AND LOGISTICS OF ETHIOPIA

Electric Vehicle Technic Inspection Experience andTrends in Ethiopia

October 2023

Presented By:Dagnachew Alemu

Senior Expert Automotive Development

BG

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MINISTRY OF TRANSPORT AND LOGISTICS

Topics

1. Introduction
2. Background
3. Objective
4. Ethiopian Experience on Electric Vehicle Inspection
5. Vehicle Inspection Process in Ethiopia
6. Required Documents to Obtain Vehicle Ownership Certificate and License Plate in Ethiopia
7. Conculusion

የትራንስፖርት እና ሎጂስቲክስ ሚኒስቴር
MINISTRY OF TRANSPORT AND LOGISTICS

Introduction

In Ethiopia, fuel imports account for approximately $4 billion annually. On a global scale, the manufacturing and utilization of electric vehicles (EVs) are experiencing significant growth, driven by governments' implementation of stricter environmental protection directives. Ethiopia, with its abundant electric power resources and attractive incentives, holds immense potential for the electric vehicle sector.

Electric vehicles (EVs) are gaining popularity worldwide due to their environmental benefits and potential to reduce dependence on fossil fuels. As a result, many countries are adopting policies and regulations to promote the use of EVs. However, ensuring the safety and reliability of these vehicles is crucial for their successful integration into the transportation system. This presentation aims to shed light on Ethiopia's experience in implementing technical inspections for electric vehicles.

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Background

Ethiopia, like many other countries, recognizes the importance of transitioning to sustainable transportation systems. In recent years, the government has taken significant steps to promote the adoption of electric vehicles. These efforts include providing incentives for EV purchases, establishing charging infrastructure, and implementing policies to support the growth of the EV market.

However, as the number of electric vehicles on Ethiopian roads increases, it becomes imperative to ensure that these vehicles meet the necessary safety and technical standards. Technical inspections play a vital role in this regard, as they help identify any potential issues or defects that may compromise the safety and performance of EVs.

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Objective

The objective of this presentation is to present and discuss Ethiopia's experience with electric vehicle technical inspections.

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Ethiopia's Experience on ElectricVehicle Technical Inspection

In Ethiopia, mostly vehicle registered in Addis Ababa followed by Oromia.
Annual vehicle inspection is mandatory in Ethiopia. Vehicle inspection covered by private persons or companies. 80% inspection center has one line. Vehicle inspection equipment will be brake tester, sideslip tester, suspension tester, headlight tester, All equipment will integrate together to print one report

Electric Vehicle Inspection Process in Ethiopia

Electric vehicle (EV) are more reliable than conventional vehicle using internal combustion Engine(ICE) as there are fewer moving parts.Vehicle technical inspection in Ethiopia is required for both roadworthiness certification and repairs. All vehicles, including electric vehicles, undergo annual technical inspections to assess the technical systems, ,

1

Emerging Stage

Since the electric vehicle is new to Ethiopia, the technical inspection experiences for electric vehicles is also at an emerging stage.

2

Rules and Regulations

The Ministry of Transport and Logistics of Ethiopia has developed appropriate rules and regulations to be followed for inspecting electric vehicles.

3

Inspection Experience

To obtain roadworthiness and register your vehicle has undergonel inspection stages

Types of Vehicle Technical Inspections in Ethiopia

According to Proclamation No. 681/2010ratified by the House Representive forVehicle identification,inspectionand registration there are Four types of Vehicle inspections

1. **Compliance Checking with Country's Rules and Regulations:**

The first type of vehicle technical inspection in Ethiopia involves a thorough examination of compliance with the country's rules and regulations. This inspection ensures that vehicles adhere to the prescribed standards and guidelines set by the authorities.

2. **Vehicle Ownership Registration Inspection:**

The second type of inspection focuses on verifying the ownership registration of vehicles. This inspection ensures that the vehicle's ownership details are accurately recorded and legally documented.

3. **Roadworthiness Certificate Inspection:**

The third type of inspection is the roadworthiness certificate inspection. This inspection assesses the overall condition of the vehicle, including its mechanical components, safety features, and general fitness for road usage. A roadworthiness certificate is issued to vehicles that meet the required standards and are deemed safe for operation on public roads.

By conducting these comprehensive vehicle technical inspections, Ethiopia aims to enhance road safety, ensure compliance with regulations, and promote a reliable and efficient transportation system.

4. **random spot inspection of freight and public transport vehicles**

Four types of vehicle inspection institute in Ethiopia

Level One (Small) Vehicle Inspection Institute" is an institution that verifies the technical proficiency of two- and three-wheel vehicles and vehicles with a total weight of up to 450 kg and issues a certificate of vehicle technical proficiency

. "**Level two (light) vehicle inspection institute**" means an institute that verifies the technical qualification of vehicles with a total weight of 450 to 3,500 kg and issues a vehicle technical qualification certificate.

"Level Three (Medium) Vehicle Inspection Institute" means an institution that verifies the technical efficiency of vehicles with a total weight of 450 kg to 7,500 kg and issues a certificate of vehicle technical efficiency.

"Level Four (High) Vehicle Inspection Institute" means vehicles with a total weight of more than 450 kg, as well as motor tractors, semi-trailers and heavy trucks and trailers, which have been inspected and tested for their technical ability.

Vehicle Inspection Process in Ethiopia

stage 1

Visual check:

- Vehicle identity number
- Light equipment (head lamp stoplamp, front and rear lamp,direction indictor,etc)
- body condition
- wheel and tyre
- General items (high voltage cable,cable harnness,horn,windscreen,safety devices etc

Stage 2

- Brake Test:Determines the efficiency of brakes.
- The brake tester is used to measure brake performance, efficiency and drag force.

- Test results are automatically registered. Test instructions and results are displayed on the overhead indicator board

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MINISTRY OF TRANSPORT AND LOGISTICS

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Stage 3

- Headlight Test:Determines proper alignment and focus of headlamps.
- The headlight aimer is used to measure the luminous intensity and the horizontal and vertical aim of each headlamp at high beam

Stage4

Under Carriage Check:Checks the condition of car parts and components.

Vehicle is driven over an inspection pit for visual checks on:

- Chassis
- High Voltage cables
- Suspension system
- Steering system
- Brake system

Required Documents to Obtain Vehicle Ownership Certificate and License Plate in Ethiopia

1. Vehicle Ownership Certificate: If the Vehicle Ownership Certificate includes a credit agreement with the debtor, please provide the Vehicle Inspection Certificate.
2. The Road Worthiness Certificate should be valid for 30 days for E.T License Plates and 20 days for A.A. License Plates, starting from the date of inspection.
3. The Inspection Certificate must be approved by two technicians and the technical head, who will sign the document
4. Include a photo print that shows the vehicle inspection procedures carried out at the inspection center.
5. Provide the names and sample signatures of the two technicians, along with their educational documents registered in the inspection system software.
6. Proof of third-party insurance coverage.
7. Road Fund Fee Certificate:
8. Renewed trade license or clearance document that is registered with the chassis and engine number of the vehicle.
9. If the vehicle was not inspected last year, there will be a punishment fee and other tax fees. However, if the vehicle has the disability duty-free right, please provide a letter from the relevant authority.

CONCLUSION

- Ethiopia has made significant progress in implementing technical inspections for electric vehicles. However, there are still several challenges that need to be addressed.
- One of the main obstacles is the lack of awareness,no regulation yet on electric vehicle inspection, skilled labor, and understanding among vehicle owners and operators regarding the importance of these inspections.
- To overcome these challenges and bridge the existing gap in the industry, it is crucial to develop a comprehensive training (capacity building) program for technicians at inspection centers. This program should provide

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UNECA CONTINENTAL WORKSHOP ON E-VEHICLES INSPECTION

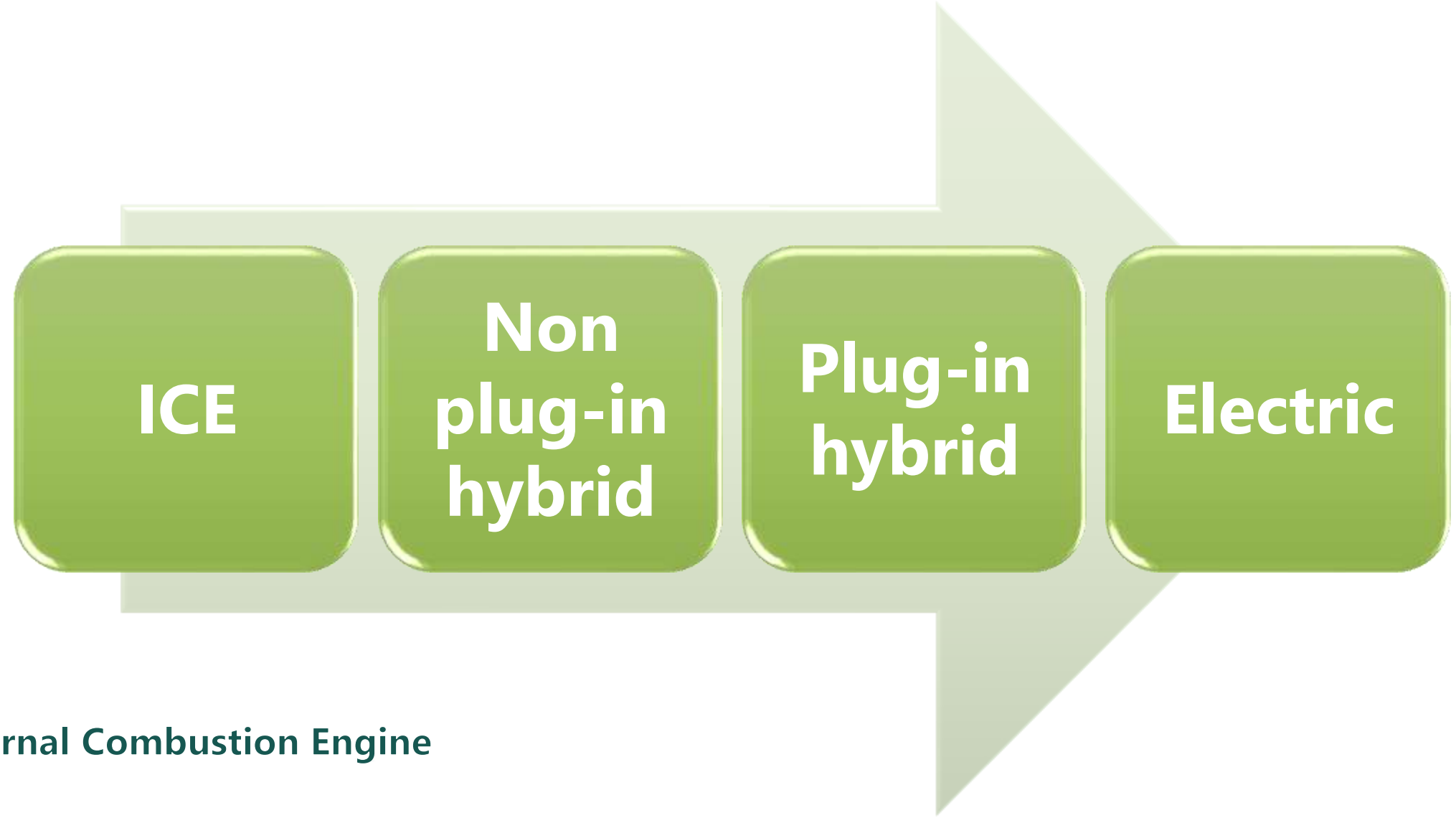
The challenges of e-vehicles

October 18th, 2023

Eduard Fernández |Executive Director | e.fernandez@citainsp.org

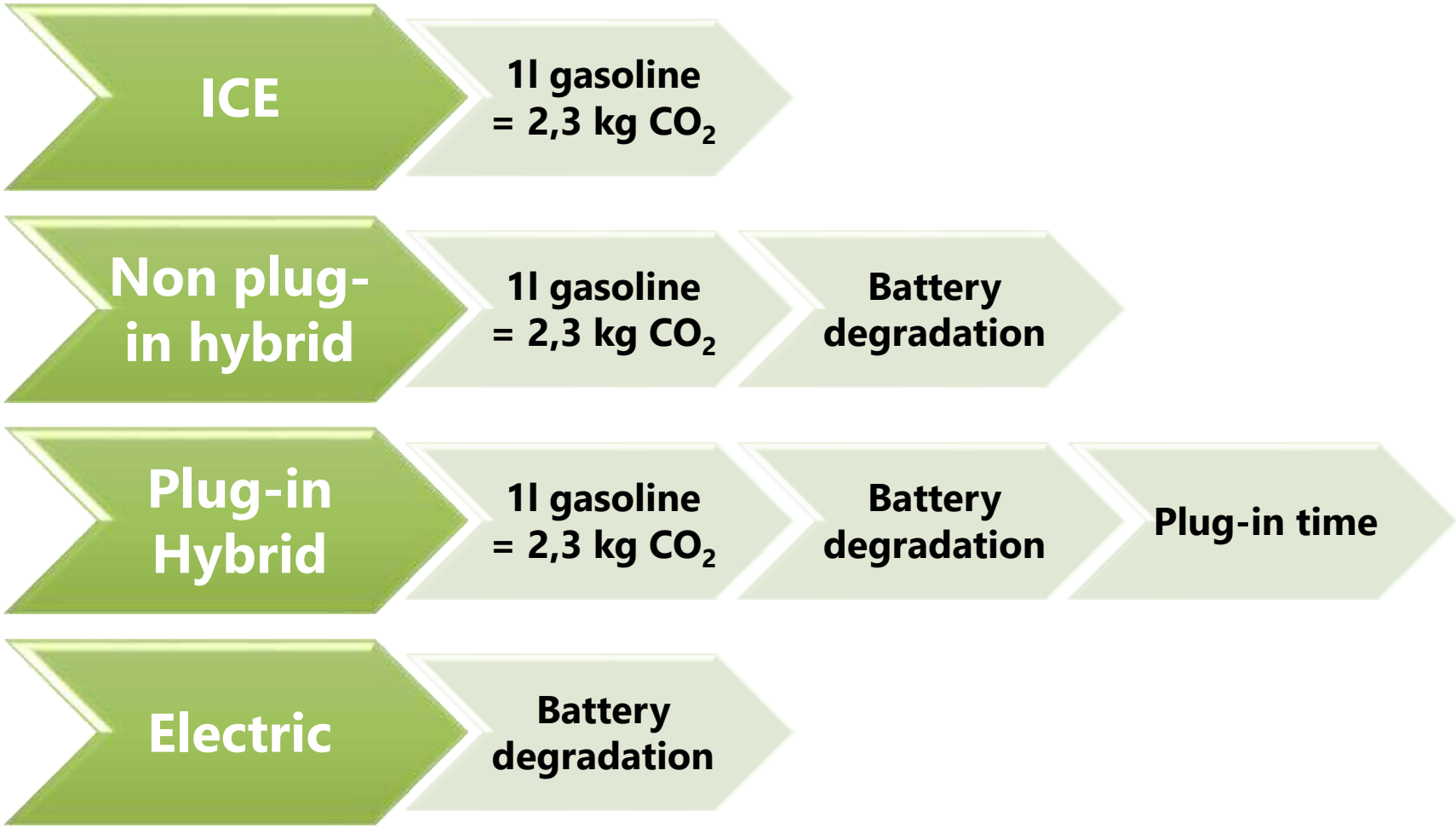
Whereas this presentation highlights the challenges, electrification is the way forward for road transport

Challenge 1: shifting technologies



ICE: Internal Combustion Engine

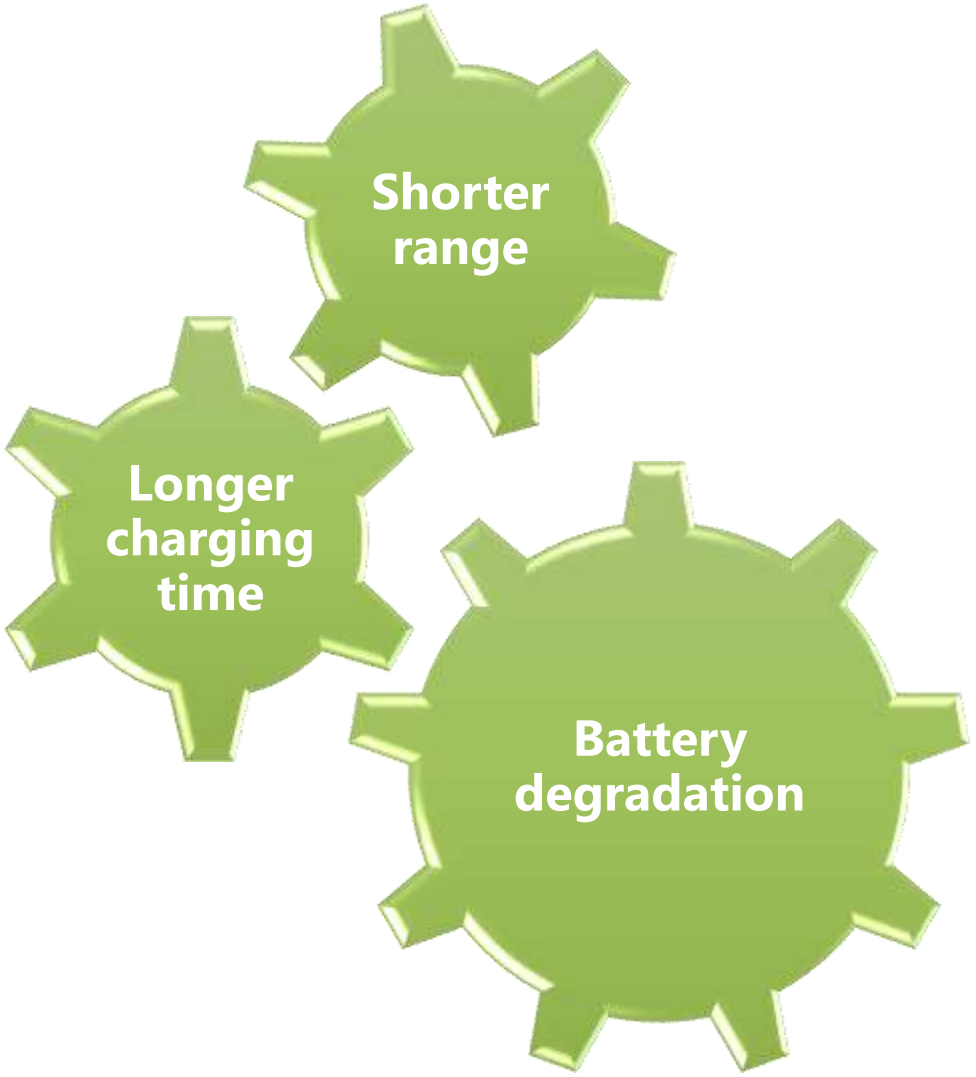
Challenge 1: shifting technologies



Challenge 1: shifting technologies

A hybrid vehicle with worn or empty batteries is an ICE vehicle drawing x hundred kg of useless weight

Challenge 1: shifting technologies



Tampering temptation

Fire hazard

Challenge 2: indicators

- ✓ Fuel consumption = GHG emission ► theory and reality not always matching
- ✓ WLTP cycle: fuel consumption data refers to the first 100 km. Does it properly represent plug-in hybrid vehicles?
- ✓ Battery range ► theory and reality not always matching
- ✓ Battery State of Health – SoH: a key parameter

Challenge 3: vehicles procurement

New vehicles:

- **Fuel consumption**
- **Battery range**
- **Battery charging time**
- **Battery durability**

Used vehicles:

- **SoH**

Challenge 4: Vehicles in use

JUNE 2023 | POSITION PAPER

ENSURING LIFETIME COMPLIANCE OF ELECTRIC VEHICLES WITH SAFETY AND SUSTAINABILITY REQUIREMENTS.

- REVISION 01

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Challenge 5: Where is the benchmark?

We still do not have an inspiring reference

The way forward

Making vehicle electrification a success history:

- ✓ **Knowing technology limitations**
- ✓ **Being aware of indicators' meaning**
- ✓ **With an impartial assessment of vehicles**

Thank you for your attention!

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Jane Akumu

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