Outline of the Presentation

❖ Introduction & Methodology
  – Brief background/ Policy initiatives
  – Project objectives
  – Framework/Data and sources

❖ EV Barriers & Enablers
  - Barriers tree ranking
  - Enablers (policy goals & initiatives)
Africa & Ghana is fast urbanising with attendant mobility challenges e.g. congestion, air pollution, fossil-fuel dependency etc.
Ghana/Africa risk becoming a dumping ground, yet again?

“Drive Electric Initiative” to shore up productive use of excess electricity in Ghana.
Project Objectives

- Develop **electric-mobility policy, and market readiness and implementation framework** to transform Ghana’s transport sector into a modern, sustainable, and results driven sector.
- Deliver an **implementation roadmap** and **business case** for E-Vehicles and charging infrastructure deployment.
- Assess the **market feasibility** of e-mobility and **EV charging infrastructure** to enable deployment of EVs.
- Build the **capacity of stakeholders** and **promote public awareness** and understanding of EV potential, to facilitate the deployment and scale-up of EVs.
Highlights of previous key findings

1. Attitudes toward Government’s EV adoption policy

2. Reasons for support

- technology
- adoption
- transport
- cheaper
- electricity
- accessible
- efficient
- cost
- benefits
- fossil
- independence
- environmental
- system
- public
- innovation
### Key findings Cont’d

#### 3. Buses and Cars prioritized for EV adoption

<table>
<thead>
<tr>
<th>Usage type</th>
<th>Modes</th>
<th>Overall Score</th>
<th>Percent Score by usage type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>Bus</td>
<td><strong>70.11</strong></td>
<td><strong>34.2</strong></td>
</tr>
<tr>
<td></td>
<td>Trotro</td>
<td>65.08</td>
<td>31.8</td>
</tr>
<tr>
<td></td>
<td>4w-Taxi</td>
<td>69.71</td>
<td>34.0</td>
</tr>
<tr>
<td>Personal</td>
<td>Car</td>
<td><strong>55.64</strong></td>
<td><strong>36.5</strong></td>
</tr>
<tr>
<td></td>
<td>3W-Personal</td>
<td>47.24</td>
<td>31.0</td>
</tr>
<tr>
<td></td>
<td>2W-Personal</td>
<td>49.55</td>
<td>32.5</td>
</tr>
</tbody>
</table>
Methodology for EVs Barrier Analysis

FRAMEWORK FOR BARRIERS IDENTIFICATION & ANALYSES

- **DESK REVIEW**
  - Identification & Contextualization of barriers

- **EXPERT INTERVIEWS**
  - National Policy Actors & Regulators
  - Donors & EV End-Users

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Diagram:

**National Policy Actors & Regulators**
- Ministry of Environment, Science, Technology & Innovation
- Ministry Trade & Industry
- Ministry of Transport
- Ministry of Finance & Economic Development
- Ghana Standards Authority
- Energy Commission
- Environmental Protection Agency
- Driver & Vehicle Testing Authority

**End Users**
- Public/Private Transport Companies
  - Greater Accra Passenger Transport Executive (GAPTE)
  - Metro Mass Transport Limited
  - OA Travel and Tours Limited
  - Intercity State Transport Company

- Transport Operator Associations/Unions
  - Ghana Road Transport Coordinating Council
  - Ghana Private Road Transport Union

- OEMs & Service Providers
  - Solar Taxi Ghana
  - Stallion Group Ghana
FRAMEWORK FOR BARRIERS IDENTIFICATION & ANALYSES

DESK REVIEW
Identification & Contextualization of barriers

EXPERT INTERVIEWS
National Policy Actors & Regulators, Donors & EV End-Users

MARKET SURVEY DATA
Consumer Preference Survey

TAMALE

Legend
- Study sites

UNIVERSITY OF GHANA
FRAMEWORK FOR BARRIERS IDENTIFICATION & ANALYSES

DESK REVIEW
- Identification & Contextualization of barriers

EXPERT INTERVIEWS
- National Policy Actors & Regulators
- Donors & EV End-Users

CATEGORIZATION OF BARRIERS
- Multi-criteria Decision Method (MDCM)
- Weighted Sum Method (WSM)
- Analytical Hierachy Process (AHP)

RANKING OF BARRIERS

MARKET SURVEY DATA
- Consumer Preference Survey

ENABLERS FOR BARRIERS
Hierarchical tree for ranking EV Barriers in Ghana

Categorizing EV Barriers

Technical Barriers
- Limited range (one-time travel distance at full charge)
- Lack of evidence on reliability & performance
- Limited battery life
- Fewer EV models
- Limited know-how on repairs & maintenance

Policy Barriers
- Lack of government’s long-term planning & goals
- Absence of an annual tax exemption

Infrastructural Barriers
- Insufficient charging stations
- Cost of charging or construction charging infrastructure
- Long charging time
- Unreliable power supply
- Problem of battery disposal & risk of battery degradation
- Insufficient repair & maintenance workshops
- No domestic industry

Economic Barriers
- Higher purchase cost
- Battery replacement cost
- Rising electricity cost for charging
- Lack of credit access for EVs

Social Barriers
- Mistrust and lack of knowledge on EVs
- Lack of env. awareness & doubt about env. benefits of EVs
- Limited understanding of the quality and safety of EVs
## Barrier categories

<table>
<thead>
<tr>
<th>Barrier Categories (L1)</th>
<th>L1 Weightage</th>
<th>Barrier sub-Categories (L2)</th>
<th>L2 Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td>33.3</td>
<td>Higher purchase price</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Battery replacement cost</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Risk of rising electricity price for charging</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lack of credit access for EVs</td>
<td>20</td>
</tr>
<tr>
<td>Technical</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td>26.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy</td>
<td>13.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>6.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

"Charley, honestly, I don’t think I will have such money to buy an electric vehicle. My income overtime even till pension cannot buy the EV cars. My finances are not too good" (A 47-year-old Management Accountant, Accra)

"The electric cars are meant for the rich. Even in the Developed World, it is not everyone who can afford it" (A 30-year-old Engineer at the DVLA office, Tamale)

"Initial price of this car is very expensive. I could keep the balance for other better things if I were to buy a fuel or diesel [ICE] car". (A 49-year-old car spare parts dealer, Kumasi)
Modelling initial cost effect on EV adoption

"Market Conditions"

<table>
<thead>
<tr>
<th>Type 1: ELECTRIC</th>
<th>Type 2: PETROL</th>
<th>Type 3: DIESEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Speed: 167km/h</td>
<td>210 km/h</td>
<td>183 km/h</td>
</tr>
<tr>
<td>Range: 415 km (Accra-Kintampo)</td>
<td>612 km/h (Accra-Tamale)</td>
<td>612 km/h</td>
</tr>
<tr>
<td>Fuel Consumption</td>
<td>7.4 L/100 km</td>
<td>8.5 L/100 km</td>
</tr>
<tr>
<td>ratings: 2.0 L/100 km</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charging /Fuel cost ($/yr.): 325</td>
<td>1137</td>
<td>1042</td>
</tr>
<tr>
<td>Maintenance cost ($/yr.): 320</td>
<td>640</td>
<td>640</td>
</tr>
<tr>
<td>Purchase Price: $44,999</td>
<td>$22,500</td>
<td>$25,500</td>
</tr>
<tr>
<td>GHS 269,475</td>
<td>GHS 134,741</td>
<td>GHS 152,706</td>
</tr>
</tbody>
</table>

"Policy interventions"

<table>
<thead>
<tr>
<th>POLICY BENEFITS</th>
<th>Type 1: ELECTRIC</th>
<th>Type 2: PETROL</th>
<th>Type 3: DIESEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure:</td>
<td>No Parking Fees</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Congestion:</td>
<td>Priority driving lanes</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Road tolls:</td>
<td>No tolls payment</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Charging</td>
<td>Quick charging at home</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

"Fiscal interventions"

<table>
<thead>
<tr>
<th>FINANCIAL BENEFITS</th>
<th>Type 1: ELECTRIC</th>
<th>Type 2: PETROL</th>
<th>Type 3: DIESEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing (8 years):</td>
<td>Lower rate at 15%</td>
<td>Regular at 24%</td>
<td>Regular at 24%</td>
</tr>
<tr>
<td>Import duty</td>
<td>Nil</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>VAT</td>
<td>Nil</td>
<td>12.5%</td>
<td>12.5%</td>
</tr>
<tr>
<td>NHIL</td>
<td>Nil</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>
Talking about driving range, in case you have an important meeting let’s say at Tamale and you need to travel in an electric car from Accra, you may have to pause the driving at least twice and charge it before you continue. Meanwhile, when I fill my petrol car to full capacity, I can make the same journey without interruptions” (A 35-year-old Auditor, Kumasi)

<table>
<thead>
<tr>
<th>Barrier Categories (L1)</th>
<th>L1 Weightage</th>
<th>Barrier sub-Categories (L2)</th>
<th>L2 Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>20</td>
<td>Limited driving range (one-time travel distance at full charge)</td>
<td>33.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lack of evidence on reliability and performance</td>
<td>13.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited battery life</td>
<td>26.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fewer EV models and types</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lack of technical know-how on repairs and maintenance</td>
<td>20</td>
</tr>
</tbody>
</table>
When I get a shortage [of fuel], I can take a gallon and go to the [nearest] fuel station to purchase some, but this is not possible with the EV. There is no way I can leave the car behind and go looking for a charging facility” (A 38-year-old banker, Osu, Accra)

“As for me, I think that a brand-new petrol or diesel car with good exhaust equally emits fewer polluting gases into the atmosphere. In my view, the [EV] car really doesn’t have any advantage over other cars [ICEs] in terms of promoting a cleaner air” (A 46-year-old human resource manager, Kumasi)
Overall ranking of barriers (weight in percentages)

- Limited understanding of the quality of EVs
- Lack of environmental awareness and doubts about environmental benefits of EVs (e.g., poor safety due to the risk of fire)
- Mistrust and lack of knowledge on EVs
- Absence of awareness raising about EVs
- Absence of an annual tax exemption
- Lack of government long-term planning and goals
- No domestic industry
- Insufficient repair and maintenance workshops
- Problem of battery disposal and risk of battery degradation
- Unreliable power supply
- Long charging time
- Cost of charging or constructing charging infrastructure
- Lack of (or insufficient) charging stations
- Lack of technical know-how on repairs and maintenance
- Fewer EV models and types
- Lack of evidence on reliability and performance
- Limited driving range (one-time travel distance at full charge)
- Lack of credit access for EVs
- Risk of rising electricity price for charging
- Battery replacement cost
- Higher purchase price
<table>
<thead>
<tr>
<th>Policy Goal</th>
<th>Policy initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improve economic &amp; fiscal measures to accelerate uptake of EVs</strong></td>
<td>Introduce <strong>tax waivers</strong> and <strong>tax holidays</strong> for full EVs (over specified period after which re-imposition is encouraged)</td>
</tr>
<tr>
<td></td>
<td>Implement <strong>special electricity</strong> (energy) <strong>tariff</strong> for EVs (i.e., differentiated and subsidised tariff system for EV charging (e.g. from 8pm to 6am))</td>
</tr>
<tr>
<td></td>
<td>Provide affordable <strong>electricity price</strong> for charging EVs</td>
</tr>
<tr>
<td></td>
<td><strong>Sale of Carbon surpluses</strong> arising from EV adoption on carbon market platforms, including the Chicago Climate Exchange (CCX), the European Energy Exchange (EEX), European Climate exchange (ECX) to offset revenue losses</td>
</tr>
<tr>
<td><strong>Develop institutional framework, policy and regulatory measures to drive and promote the use of EVs</strong></td>
<td><strong>Review of the Harmonised System (HS) Customs code</strong> (to facilitate proper estimation of import duties, and related issues of registration)</td>
</tr>
<tr>
<td></td>
<td><strong>Standardisation, licensing and certification</strong> of EVs and related components (proper regulation of chargers, charging systems and charging installation)</td>
</tr>
<tr>
<td></td>
<td>Strengthen <strong>research and capacity building</strong> (especially at the TVET)</td>
</tr>
<tr>
<td></td>
<td>Ensure <strong>constant power</strong> supply (e.g., through adoption of Geographic Information Systems and the Meter Management System (MMS) platforms)</td>
</tr>
<tr>
<td></td>
<td><strong>Encourage energy security</strong> through promotion of renewable EV charging and battery storage facilities</td>
</tr>
<tr>
<td></td>
<td>Ensure close <strong>collaboration among partnering ministries and agencies</strong> (e.g., Ministry of Transport, Ministry of Finance, Energy Commission and Environmental Protection Agency) in promoting the transition to green technologies.</td>
</tr>
<tr>
<td></td>
<td>Attract <strong>funding</strong> for promoting EV uptake (e.g., through the Sustainable Use of Natural Resources Energy Finance (SUNREF))</td>
</tr>
<tr>
<td></td>
<td>Implement <strong>reforms</strong> including importation of overaged vehicles to meet best practices</td>
</tr>
</tbody>
</table>
## Enablers to EV adoption Cont’d

<table>
<thead>
<tr>
<th>Policy Goal</th>
<th>Policy initiative</th>
</tr>
</thead>
</table>
| **Develop and expand infrastructural measures to support the deployment of EVs** | **Promotion of private** (home) **charging** systems (e.g., through solar energy or the national electric grid)  
**Installation of multiple public charging** points in major cities (especially at fuel filling stations, parking spaces, street-side parking lots, office parks, service stations and depots to reduce charging waiting time;  
**Installation of inter-city charging points** (through partnerships with popular oil marketing companies to install public charging points at filling stations along the Coastal and Central national highways; also, at major rest stops like Linda Dor and the Paradise Resort in the Eastern region, and elsewhere on these important highways)  
**Adoption of contraflow bus priority lanes** on existing urban roads for peak hour travels only where limited road space will disallow for dedicated BRT lane  
**Provide easily accessible fast chargers**, connectors, and charging systems in the market, at designated rest stops along national highways and prices regulated.  
**Encourage the installation of backup power systems** for charging stations to deal with power outages (e.g., Solar panels)  
**Promote battery swapping, recycling and end-of-life disposal** systems  
**Promote private sector participation** in the development and management of charging stations and facilities |

| **Promote local EV development measures to accelerate the uptake of EVs** | **Review and enhancement of the Ghana Automotive Development Policy** for ICEVs to provide enabling environment for local start-ups like Kantanka Automobile's *Amoanimaa* EV and other multinational companies that are already manufacturing or locally assembling vehicles  
**Assembling plant establishment** (taking cognisance and incorporating the operational framework of the automotive development policy.  
**Ensure local content and automotive standards** are enforced in the domestic industry |
<table>
<thead>
<tr>
<th>Policy Goal</th>
<th>Policy initiative</th>
</tr>
</thead>
</table>
| **Accelerate improvements in technical measures to facilitate efficiency in the uptake of EVs** | Encourage **longer range** EVs especially for long distance travels.  
Facilitate the continuous **training of local auto-mechanics/fitters, electricians, garage operators** etc  
Ensure **proper certification** of garages to efficiently handle EVs  
Promote low carbon **technology transfer** and develop local skills (artisans, operators, garage)  
Encourage the **retrofitting of ICEVs to EVs**: needed expertise should be developed. Local start-ups like Arke Global Technologies in Accra, and others should be identified and supported |
| **Develop and scale up social measures to promote the use of EVs**          | Facilitate the **procurement, piloting and testing of EVs** to ensure their quality, safety, performance, and reliability (e.g., piloting with STC and Avalolo buses on a few selected corridors (intra-city and inter-city respectively) as part of the BRT system.  
Promote the **adoption of buses with roof-top solar charging systems** to enhance battery life for long distance travels.  
Facilitate and promote the **addition of EVs to government vehicle fleet** (especially for the ministries, departments and agencies) to increase acceptability of EVs  
Implement a **roadmap on EV awareness creation and campaigns** (through broad grassroots consultation and inclusivity;  
Produce **easy-to-read leaflets, handouts, brochures**; aggressive **media campaigns** to improve knowledge on EVs |


Acknowledgement

- Steering Committee
- Stakeholders

Thank you