Clean Air and Mobility in rapidly urbanizing Africa

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Centre for Science and Environment
State of Africa’s Environment Report, 2023
The 2023 Africa Science Journalist Congress
Nairobi: October 11-12, 2023
We are all in it together

Most populous cities in Africa and South Asia with the highest population-weighted annual average PM$_{2.5}$ exposures in 2019

<table>
<thead>
<tr>
<th>City</th>
<th>Population-weighted PM$_{2.5}$ (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delhi, India</td>
<td>110</td>
</tr>
<tr>
<td>Kolkata, India</td>
<td>84</td>
</tr>
<tr>
<td>Dhaka, Bangladesh</td>
<td>71.4</td>
</tr>
<tr>
<td>Karachi, Pakistan</td>
<td>63.6</td>
</tr>
<tr>
<td>Mumbai, India</td>
<td>45.1</td>
</tr>
<tr>
<td>Kano, Nigeria</td>
<td>43.6</td>
</tr>
<tr>
<td>Lagos, Nigeria</td>
<td>41.8</td>
</tr>
<tr>
<td>Accra, Ghana</td>
<td>38.3</td>
</tr>
<tr>
<td>Abidjan, Côte d'Ivoire</td>
<td>34.5</td>
</tr>
<tr>
<td>Bamako, Mali</td>
<td>32.9</td>
</tr>
<tr>
<td>Kinshasa, DRC</td>
<td>28.8</td>
</tr>
<tr>
<td>Cairo, Egypt</td>
<td>26.7</td>
</tr>
</tbody>
</table>

Source: CSE based on SoGA 2022;
Clean air battle in Africa

Population weighted annual average PM2.5 concentration

- **Western Africa**: Highest PM$_{2.5}$ pollution with an average concentration of 64.1 µg/m$^3$

- More than 90% of the population live in areas where PM$_{2.5}$ levels do not meet the least stringent interim target of WHO

- **Southern Africa**: Lowest at 26.5 µg/m$^3$

- Namibia, Zimbabwe and Tanzania meet the WHO’s least stringent interim target

Source: State of Global Air, 2020
Double burden: Household air pollution exposure very high in sub-Saharan Africa

Source: SoGA 2020 Report
Dust invasion from Sahara June 2020

Source: Pawan Gupta NASA
New Threat: Ozone

Population weighted average seasonal 8-hour daily maximum ozone concentration

Nigeria and a few other countries in Africa show high level of ozone concentration

Source: SoGA 2020 Report, p 10
Growing public health risk.....
Black lungs of Delhi: 1998
Our evidence

Sputum cytology of a 14-year old girl, showing abundance of particle laden alveolar macrophages – indicate pollution stress.

Look at these black spots on the lung. The unfortunate owner lives in Delhi and has been breathing polluted air. All full of carbon particles which accumulate in the lungs (black spots). What you can’t see is a cocktail of gases and tiny particles, even smaller than carbon that get into our bodies. Actually, you are getting polluted.

Scary? But those cars are so sexy!
### Top 10 countries with the highest number of deaths linked to PM2.5 in Africa

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Number of PM$_{2.5}$-Linked Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>90,600 (66,800–116,900)</td>
</tr>
<tr>
<td>Nigeria</td>
<td>68,500 (41,500–101,700)</td>
</tr>
<tr>
<td>Morocco</td>
<td>27,000 (20,300–34,000)</td>
</tr>
<tr>
<td>South Africa</td>
<td>25,800 (19,700–30,000)</td>
</tr>
<tr>
<td>Algeria</td>
<td>21,600 (15,300–29,000)</td>
</tr>
<tr>
<td>Sudan</td>
<td>16,600 (10,200–24,400)</td>
</tr>
<tr>
<td>Ghana</td>
<td>12,500 (8,000–17,800)</td>
</tr>
<tr>
<td>Democratic Republic of Congo</td>
<td>11,000 (4,700–20,900)</td>
</tr>
<tr>
<td>Cameroon</td>
<td>10,200 (6,100–14,800)</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>9,000 (4,200–16,200)</td>
</tr>
</tbody>
</table>

**Source:** The State of Air Quality and Health Impacts in Africa, 2022

### Top 10 countries with the highest number of deaths linked to household air pollution in Africa - 2019

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Number of PM$_{2.5}$-Linked Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>128,200 (88,700–171,600)</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>67,800 (52,700–82,400)</td>
</tr>
<tr>
<td>Democratic Republic of the Congo</td>
<td>58,000 (41,200–77,500)</td>
</tr>
<tr>
<td>United Republic of Tanzania</td>
<td>39,200 (29,200–49,900)</td>
</tr>
<tr>
<td>Somalia</td>
<td>27,600 (19,600–39,000)</td>
</tr>
<tr>
<td>Niger</td>
<td>26,500 (18,300–35,600)</td>
</tr>
<tr>
<td>Mozambique</td>
<td>25,000 (18,800–32,000)</td>
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<tr>
<td>Burkina Faso</td>
<td>24,300 (17,500–32,100)</td>
</tr>
<tr>
<td>Uganda</td>
<td>23,000 (16,900–29,300)</td>
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<tr>
<td>Mali</td>
<td>22,600 (15,900–29,700)</td>
</tr>
<tr>
<td>Madagascar</td>
<td>21,500 (15,800–27,900)</td>
</tr>
</tbody>
</table>
New born exposure to air pollution in Africa

Top 10 countries with highest number of new-born deaths from air pollution exposure

Top 10 African countries with highest number of new-born deaths from air pollution exposure

Source: The State of Global Air
Top 10 countries in Africa with maximum infant deaths due to air pollution 2019

Source: CSE based on SoGA Report 2020

Top 10 African countries with maximum neo natal deaths in 2019

Source: CSE based on SoGA Report 2020
Also climate concerns around air pollution...

Local air pollutants are short lived climate forcers and aggravate global warming ....

Need co-control and co-benefit to maximise public health benefits ....... without detracting attention from long lived CO2 or shifting the mitigation burden.....
Air pollution and climate impacts

IPCC: Rapid mitigation of all climate forcing emissions necessary — black carbon (part of particulate matter), ozone, nitrogen oxides, methane from wastes, among others.

WHO: Comprehensive mitigation of SLCPs can cut rate of global warming in half while helping to prevent 7 million premature deaths annually. Also slow down the sea-level rise by 20% by mid-century, and the rate of Arctic warming by up to two-thirds and the rate of global warming by half.

Both CO2 and local air pollutants are co-emitted by same emissions sources — vehicles, industry, power plants, waste and solid fuel burning etc. Co-control is an opportunity to protect public health, build climate resilience.

- SLCP plans in Africa: Eg Nigeria — National Action Plan to reduce SLCPs - reduce black carbon, methane and hydrofluorocarbon emissions by 42%, 28% and 2% respectively, in 2030.
- PM2.5 and NOx to be reduced by 35% and 65% respectively.

Kenya: Transport emissions account for highest share (67%) of the GHG emissions in the energy sub-sector emissions. Within the transport sector, 97% is road, 1% is rail and 2% is civil aviation.

Ethiopia: Transport emissions increasing continuously: Ethiopia's submission of Second National Communication’s (SNC) -- these emissions to multiply five-fold until 2030.

Nigeria: Energy sector– Transport sector emissions third highest (21%)

Uganda: Road transport is responsible for 84% of transport energy. Need action

Rwanda: GHG inventory for 2015 shows that transport contribution is 13%

Source: Country-wise NDC reports
What it takes to clean up the air....
Need clean air action on all sources of pollution to meet clean air targets:

- vehicles and transport – our focus today
  - Industry
  - Power plants
  - waste – household waste and construction and demolition waste
  - Solid fuel burning
  - Dust sources
Blue sky – Africa
Dramatic clean up

January 2020 - May 2020

Aerosol Optical Thickness - Jan 2020
Aerosol Optical Thickness - Feb 2020
Aerosol Optical Thickness - Mar 2020
Aerosol Optical Thickness - Apr 2020
Aerosol Optical Thickness - May 2020


Pre-COVID-19 during pandemic - aerosol optical thickness
- Aerosol suspension over countries with high population density huge
- Pollution reduced during March and April
- Started increasing after lockdown restrictions eased in May.

1) Ghana: lockdown (30/03 – 20/04)
2) Nigeria: lockdown (30/03 – 22/04)
3) Ethiopia: transport ban on 30/03
4) Kenya: movement restrictions on 12/03 till May
5) Rwanda: lockdown (21/03 – 19/04)
6) Cote D’ivoire: movement restrictions on March 4
7) Uganda: movement restrictions on 25/03
8) Senegal: movement restrictions on 23/03
Impact of COVID 19 Pandemic on activity pattern

Nigeria: (Percentage Change)

Source: CSE based on Google COVID-19 community mobility reports
Impact of COVID 19 Pandemic on activity pattern

Kenya: (Percentage Change)

<table>
<thead>
<tr>
<th>Date</th>
<th>Retail &amp; Recreational trips</th>
<th>Grocery &amp; Pharmacy trips</th>
<th>Park trips</th>
<th>Transit Stations trips</th>
<th>Workplace trips</th>
<th>Residential trips</th>
</tr>
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<tbody>
<tr>
<td>2/15/2020</td>
<td>-50%</td>
<td>-39%</td>
<td>-38%</td>
<td>-47%</td>
<td>-60%</td>
<td>+32%</td>
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<td>2/22/2020</td>
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<td>2/29/2020</td>
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<td>3/7/2020</td>
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<td>3/14/2020</td>
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<td>3/21/2020</td>
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<td>3/28/2020</td>
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<td>4/4/2020</td>
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<td>4/11/2020</td>
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<td>4/18/2020</td>
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<td>4/25/2020</td>
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<td>5/2/2020</td>
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<td>5/9/2020</td>
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<td>5/16/2020</td>
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<td>5/23/2020</td>
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<td>5/30/2020</td>
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<td>6/6/2020</td>
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<tr>
<td>6/13/2020</td>
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<tr>
<td>6/20/2020</td>
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</tbody>
</table>

Source: CSE based on Google COVID-19 community mobility reports
Level of action needed to reduce pollution: Lessons from Delhi

Vehicles

- Direct leapfrog from Euro IV-e fuel and vehicle emission standards to Euro VI by 2020.
- Entire public transport and local commercial transport on CNG
- Diesel fueled vehicles disincentivized
- Age limit set on vehicles (10 year old diesel vehicles and 15 year old diesel vehicles)
- Pollution tax on truck entry
- 12% fleet electrification

Thermal power plants

- All coal based power plants shut permanently

Industry

- Pet coke and furnace oil use banned; Pet coke imports banned
- All coal use in Delhi banned, including for industrial operations – natural gas use expanded
- NOx and SOx standards set for all industries
Delhi bends the long term PM2.5 curve: still a long way to go

Note: Data from following CAAQM stations from where continuous data is available: Anand Vihar, CRRI Mathura Road, DTU, IGI Airport, IHBAS, ITO, Mandir Marg, NSIT Dwarka, North Campus DU, Punjabi Bagh, RK Puram, and Shadipur. – Based on data from 12 stations

* Data up till 28 Nov 2021. 3-year averages are calculated using USEPA methodology and data completeness requirement, with median value substitution for missing data.

Source: CSE analysis of CPCB’s realtime data
Accelerate vehicle technology and fuel quality roadmap...
Africa – lower rate of motorisation but rate of change is rapid

**Vehicles per thousand population in African countries**

Source: Anon. 2015, Vehicles in-use 2015 data, International Organization of Motor Vehicle Manufacturers (OICA)
Mitigating vehicular pollution:

**Technology roadmap:**
- Speed up emissions and fuel quality standards for vehicles
- Fleet renewal and discouraging old vehicle import
- Improve on-road emissions monitoring and inspection
- Manage heavy duty truck traffic

**Electric mobility for zero emissions transition**

**Public transport, walking and cycling strategy**

**Vehicle restraint measures**
Technology roadmap
Global Vehicles Standards—Light Duty Vehicle Emissions Standards (as of June 2022)

Slow action on heavy duty vehicles in Africa

Source: https://www.unep.org/global-sulphur-levels
Diesel Sulphur level (2022): Promising progress – a lot more is needed

### Diesel fuel Sulphur levels across Africa

<table>
<thead>
<tr>
<th>Diesel fuel sulphur levels</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 15 ppm</td>
<td>Morocco</td>
</tr>
<tr>
<td>15-50 ppm</td>
<td>Tanzania, Ghana, Benin, Nigeria, Namibia, Lesotho, Eswatini, Mozambique, Zimbabwe, Malawi, Kenya, Uganda, Rwanda, Burundi</td>
</tr>
<tr>
<td>50-500 ppm</td>
<td>Niger, Chad, Sudan, Ethiopia, South Sudan, DRC, South Africa, Botswana</td>
</tr>
<tr>
<td>500-2000 ppm</td>
<td>Angola, Gabon, Guinea, Burkina Faso, Mauritania, Algeria, Libya, Tunisia, Gambia</td>
</tr>
<tr>
<td>2000-5000 ppm</td>
<td>Senegal, Cote d'Ivoire, Sierra Leone, Cameroon, Central African Republic, Zambia, Djibouti</td>
</tr>
<tr>
<td>Above 5000 ppm</td>
<td>Mali, Togo, Republic of Congo, Somalia, Egypt</td>
</tr>
</tbody>
</table>

Progress in fuel quality as on November 2022

**East Africa**
- 2016 Low sulfur fuel standards (actual 10-15 ppm)
- Kenya and Rwanda: Adopted Euro 4/IV vehicles standards - implementation ongoing
- May 2022 East Africa Community Council of Ministers adopted regionally harmonised Euro 4/IV vehicles standards
- After the EAC standard was gazetted early July, countries have 6 months to adopt standard as national law

**West Africa**
- September 2020 ECOWAS Council of Minister adopted regionally harmonised fuel and vehicle standards
- New set of fuel quality standards
- EURO4 minimum vehicles emissions standards new & used vehicles.
- Used vehicles age restrictions – 5yrs for LDV, 10yrs for HDV – 10 yrs to implement
- Adopted fuel economy roadmap

Progress in fuel quality as on November 2022

Southern Africa

• Botswana, Eswatini, Lesotho, Mauritius, Mozambique, Namibia, Seychelles, Tanzania, Zambia and Zimbabwe have completed phasing out high sulphur content diesel and fully migrated to 50 ppm sulphur content diesel;

• South Africa has introduced rolling out of ultra-low-sulphur (10 ppm) content diesel;

• Zimbabwe has advanced in terms of preparations for decarbonisation of the transport sector and has developed a policy for adopting hybrid and electric vehicles and standards for charging stations for electric vehicles;

Fuel pricing strategy and alternate fuel pricing strategy

- **Diesel consumption** In several countries, (Angola, Madagascar and others), the share of diesel in total fuel consumption can be 70–80%
  - Botswana, Namibia, Lesotho etc. have narrower price gaps and the share of diesel consumption is 50–55 per cent.

- **Nigeria, Tanzania - good-practice:**
  - Price of petrol is kept effectively cheaper than that of diesel. This has controlled dieselisation of cars and reduced diesel consumption.

- **Move towards Compressed natural gas (CNG) programme in Nigeria, Egypt and Cote d’Ivoire**
Taming energy guzzling....
Energy demand from road transport to increase significantly

Rapid expansion of the fleet – especially cars and trucks – to increase transport energy demand, - - oil remaining the dominant fuel in 2030

Notes: SAS = Sustainable Africa Scenario. Other category includes hydrogen-based fuels and biomethane.

Sources: Africa Energy Outlook, 2022
High shares of imported second-hand cars with limited standards result in poor fuel economy and limit the scope for reducing emissions in the medium term.

Note: Lge = litres of gasoline equivalent

Sources: IEA analysis and UNEP (2020).
What is slowing down ICE vehicle trajectory? -Imported old vehicles....
Heavy reliance on imports of second-hand vehicles.

Over 50% of all new registrations across the continent today, despite an import ban in some countries, including Egypt and South Africa.

Share of second-hand imported vehicles is over 85% in Kenya and close to 95% in Guinea.

2015 to 2020: Africa accounted for a quarter of total global trade in LDVs, with imports averaging around one million cars per year.

European Union and Japan dominate; shares of United States and Korea increasing.

Libya and Nigeria are the biggest importers. Together with Benin, Ghana and Kenya, account for over half of all used car imports in 2020 (UNEP, 2021).
Where used vehicles come from? (% represents value of import)

Imports of vehicles also increased from China and India in 2022 compared to 2014.

Source: Computed by Centre for Science and Environment based on data from International Trade centre Statistics, 2022 and 2014
### Old vehicle policy in Africa – as of 2020

<table>
<thead>
<tr>
<th>Country</th>
<th>Vehicle Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulations based on age cap</td>
<td></td>
</tr>
<tr>
<td>Gabon, Chad, Seychelles</td>
<td>A ban of a used vehicle more than 3 years of age</td>
</tr>
<tr>
<td>Senegal</td>
<td>A ban of a used vehicle more than 4 years of age</td>
</tr>
<tr>
<td>Libya, Tunisia, Cote d'Ivoire</td>
<td>A ban of a used vehicle more than 5 years of age</td>
</tr>
<tr>
<td>Guinea, Mauritania, Namibia, Cameroon</td>
<td>A ban of a used vehicle more than 8 years of age</td>
</tr>
<tr>
<td>Eritrea, Equatorial Guinea, Liberia</td>
<td>A ban of a used vehicle more than 10 years of age</td>
</tr>
<tr>
<td>Niger, Swaziland, Uganda</td>
<td>A ban of a used vehicle more than 15 years of age</td>
</tr>
<tr>
<td>Benin, Togo, Burkina Faso, Malawi, Mali, Niger, Somalia, Zambia, Madagascar, Lesotho, South Sudan, DR Congo, Ethiopia Burundi, Comoros, Zimbabwe, Tanzania, Sierra Leone</td>
<td>No import restrictions on vehicles</td>
</tr>
</tbody>
</table>

# Old vehicle policy in Africa – as of 2020

<table>
<thead>
<tr>
<th>Country</th>
<th>Vehicle Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age cap and emissions standards</strong></td>
<td></td>
</tr>
<tr>
<td>South Africa, Egypt</td>
<td>Ban on used vehicle import and Euro II standard regulation for new vehicles</td>
</tr>
<tr>
<td>Morocco</td>
<td>Ban on used vehicle import and Euro IV standard regulation for new vehicles</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Ban on used vehicles over 15 years of age, ban on import through borders and land to regulate smuggling, Proposed Euro III standard regulation for new vehicles</td>
</tr>
<tr>
<td>Ghana</td>
<td>Ban on importation of used vehicle above 10 years, salvage vehicles, and Euro II standard for new vehicle</td>
</tr>
<tr>
<td>Algeria</td>
<td>Ban on used vehicles and Euro III for the regulation of new vehicles</td>
</tr>
<tr>
<td>Botswana</td>
<td>Euro III standards for new vehicles but no age restrictions for used car import</td>
</tr>
<tr>
<td>Mauritius</td>
<td>A ban of a used vehicle more than 3 years of age, about 45% less tax on import of electric cars</td>
</tr>
<tr>
<td>Rwanda</td>
<td>No age restriction (only consideration of 5 years based on EAC proposal). Euro IV standards for new vehicles</td>
</tr>
<tr>
<td><strong>Tax measures</strong></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>Tax increments on used vehicles by capping the maximum depreciation rate at 65 per cent of the value of the vehicle and 8 years age restriction</td>
</tr>
</tbody>
</table>

*Source: 2021, Vehicle regulations in Africa: Impact on used vehicle import and new vehicle sales, https://t.ly/1Ealy*
Vehicle import: Emerging good practices

- **Kenya**: Age restriction (8 years), incremental tax on vehicles, increase in price of imported vehicles. Exemption for battery operated and environmental friendly vehicles. Imported vehicles to be tested for road worthiness.

- **Ghana**: Introduced higher import taxes on vehicles with bigger engines. On April 30, 2020 -- a law banning importation of cars older than 10 years

- **Ethiopia**: The Ethiopian Revenues and Customs Authority (ERCA) working on new version of tariff tax proposal; Proposed limit for imported vehicles. Existing excise tax increases with increase in engine capacity. No excise tax and surtax imposed on public transport, trucks and cabs. Diesel cars pay more tax than transport goods

- **Nigeria**: Tightening of tax measures for vehicle import: Adopted tougher policies on vehicle import. Cost of import increased.

- **Uganda**: Environment levy and higher taxes on older engines. Vehicle age restriction proposed at 8 years. Re-established mandatory vehicle inspection and pre-shipment inspection.
Vehicle import: emerging good practices

- Mauritius:
  Age limit on all imported used vehicles *(Used imported cars, SUVs and jeeps to be between 18 months and 4 years; Double cabs between 18 months and 3 years. Goods vehicles 6 years; vans – 4 years; buses – 3 years and motorcycles less than one year without any permission for resale. Minimum age limit of 18 months to protect the new car industry.)*
  CO2 levy/rebate system and subsequent introduction of excise duty restructure linked with engine size
  Other fiscal measures promoting cleaner vehicles:
  Setting systems for verification for imported vehicles
  Obligation of vehicle dealers and accountability

- Uganda:
  - Used imported vehicles to undergo inspection.
  - Environment levy imposed on all vehicles except those below 5 year old vehicles. The environment levy slabs are 20% for 5 to 6 year old vehicles, 35% for 6 to 10 year old vehicles and 50% for more than 10 year old vehicles.
  - Local production of cleaner vehicles is being promoted
**Vehicle import: emerging good practices**

- **Tanzania**: Additional excise duty that increases with age of vehicles. No age restriction;

- **Zimbabwe**: Age restriction; charges levied on vehicle imports include customs duty, surtax and VAT. Vehicles with large engine capacity have to pay high customs duty. To encourage both local and foreign direct investment in the local automotive assembly and components manufacturing to be 10% of total foreign direct investment by 2026 and exports to be 50% of total local production by 2026.

- **Côte d'Ivoire**: Age restriction; Import of vehicles is governed by a law that imposes a contributory fee (US $300) on road safety, congestion and pollution from vehicles. This is imposed on ten-year-old passenger and freight vehicles. This is a pre-importation inspection for road worthiness.

- **Mozambique**: No age limit; but an extra tax is imposed from seven years onwards; Stratified tax system based on engine size. Bigger engines attract higher taxes.

- **Rwanda**: No age restriction. But to discourage old vehicles, car depreciation factor is applied on taxes to make older cars more expensive.

- **Zambia**: Duties and taxes on used vehicles are specific and based on the age and type of vehicles. Vehicle registration fee and carbon emissions surtax. Older vehicles attract higher duties and taxes. Deliberate policy to encourage purchase of new vehicles.
Next steps

**Importing countries**
- **Limit age** of imported vehicles
- **Use tax measures** to make older vehicles expensive; encourage new and electric vehicles
- **Link emissions standard and fuel efficiency limits with imports**
- **Ban used vehicles imports** on the basis of health and emissions grounds
- **I/M is small part of solution**
- **Need regional platform for harmonised** Africa-wide action
- **Adopt scrappage policy for material recovery**

**Exporting countries**
- **Identify global platform to influence export policies** of the exporting countries to stop dumping. Eg WTP 29. Need global agreement
- **Exporting countries need circular policy to stop export** of old vehicles.
- **Europe and US have recycling of end of life policy**; But does not stop export of old vehicles
- **Japan increases taxes on older vehicles to speed up** turnover

**Finally reduce numbers:** There is a limit to dumping
Electric mobility: Opportunity to leapfrog to zero emissions trajectory
EV sales: share of passenger vehicles

- **IEA**: electric car sales across Africa increased by 90% from a very low base.
- Small market size- limited models available
- **EV market shares** in South Africa, Morocco, and Tunisia – about 0.1%.
- Mauritius’s EV share is relatively high at 1.7%
- **Tanzania**: Electric cars introduced for tourism in National parks

EV numbers are small – but have potential to grow in selected countries

• **South Africa**: 1000 EVs in 2022 - out of a total fleet of 12 million automobiles.
• **Kenya**: EVs estimated at 350, while about 2.2 million registered vehicles likely in use in the country


Source: IEA, Global EV data explorer, 2022
Unique and win-win focus of the developing world --- Mass transport and the most polluting segments like 2/3 wheelers to become zero emissions ......

Several countries have cleaner electricity to reduce upstream pollution
Priority focus – 2/3 wheelers; deliveries and aggregators

A big opportunity

• **2 wheelers dominates the fleet** (46% in Uganda, 50% in Rwanda. 2wheelers stock to triple in Kenya)
• **Motor cycle taxis** -- Rwanda – Ambersand
• **App based electric three wheelers** -- South Africa
• **Leasing for electric three wheeler and scooters** -- Zimbabwe
• **Private companies distributing e-2/3 wheelers with cheaper insurance** – Morocco
• **Solar powered 3 wheeler taxi** – Ghana
• **Renting of batteries (battery swapping) and retrofitting e-2/3wheelers** -- Uganda

**UNEP piloting to introduce electric 2w and 3w.** (Ethiopia, Togo, Kenya, Rwanda, Uganda, Burundi, Madagascar, Sierra Leone, and Tanzania)

**Targeting different consumer base** – **bulk purchase by business, start ups on rent services**

• **Electric vans for delivery service** -- Zimbabwe
• **Uber Eats deliveries on EVs** -- Kenya
Priority focus: buses and para transit

Bus service

- **Nairobi**: Electric bus service introduced in March 2022 with Basigo company operating buses on selected routes, also to start local production
- **Kampala**: 200 Kayoola electric buses manufactured by Kira Motors with range up to 300 km and seating capacity of 90 passengers
- **Egypt**: Overall 300 electric buses in cities
- **UNEP’s soot free bus fleet programme**
- **Medium duty electric buses can be twice the price of ICE** – need localization and preferential taxation policy and supportive infrastructure

Para transit

- **Electric bod boda and bike taxi increasing; Kigali**: E-motorcycle para transit service – Ampersand
- **E-motorcycle service Ampersand**, 35 vehicles doing taxi and delivery work
- 60 EV light-duty delivery vehicles in South Africa, Botswana and Namibia

UNEP-GEFI – policy development for electric vehicles in Ghana, Mauritius, Mozambique, Tunisia, Cote d’Ivoire, Zambia among others.
Towards price parity – need interventions to build the market

- Fuel and maintenance cost 40% lower than ICE – but upfront cost high
- Average price of locally assembled ICE 2wheelers is USD1300 in contrast to USD ICE which is USD 1800 in Kenya
- Mali Burkina Faso – TCO of e-3 wheelers for freight is 40% lower than ICE (UK Aid and World bank 2022)
- Swapping/renting of batteries can reduce upfront cost.
- For full price parity need incentives, product innovation, innovation in business model and charging model

Charging infrastructure
- Kenya modifying building bylaws for charging
- Uganda – battery swapping started
- Concessional electricity tariff
- Battery recycling and urban mining
**EVs as industrial policy**

- Several countries adopting EVs as industrial policy
- **Thrust on localization** – South Africa, Uganda, Nigeria, Ethiopia, Morocco, Rwanda, Ghana, Tunisia, Sudan, Zambia, Zimbabwe, Togo, Namibia, Botswana, Cape Verde
- Retain value chain of its battery minerals
- Local assembly of cars (as in Nigeria, Kenya etc)
- South Africa aims to be a EV hub, build export market
- Attracting foreign manufacturing partners
- E-mobility start ups and businesses producing e-2/3 wheelers
- Some importing completely built up units others importing completely knocked down units.
- Nigeria, Uganda are developing assembly capacity and manufacturing of new vehicles
- Uganda is adopting retrofitting
# Evolving EV policies in selected countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Phase-out target</th>
<th>Regulations</th>
<th>Incentives</th>
<th>Infrastructure</th>
<th>Demand</th>
<th>Industrial development</th>
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<tbody>
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<td>South Africa</td>
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$\bullet$ indicates that a given country has at least some policy actions for the given policy category.

EV policy and regulations

• **EV included in the Nationally Determined Commitment (NDCs) of several countries**

• **Some countries have set aspirational target** – for new sales of cars –
  • Cape Verde 100% e cars by 2035 and urban buses by 2040;
  • Morocco – EV production of 1 million unit by 2025
  • Kenya has set 5% target for newly registered vehicles by 2025. Setting up a national e-mobility policy

• Tanzania developing EV policy – targeting Dar, Dodoma and Mwanza for fast growth

• Rwanda developing regulations – Investment set aside for EVs and charging

• DRC-Zambia Battery Council was recently established with the goal of manufacturing batteries using local raw materials
Nigeria E-mobility initiatives

- Licensing requirement and assessment data for establishment of auto assembly plants
- Developing policies and regulatory instruments and implementing pilot programmes,
- To promote local assembly capacity for electric vehicles and setting up charging infrastructure
- NADDC has developed and launched models for solar powered charging stations that have been set up in Lagos, Sokoto, etc.
- The average cost of a new EV is about $55,600 which is much higher than the average annual salary of Lagos residents.
- NADDC is now working on a demand incentive programme including possible reduction in vehicle registration and ownership taxes, toll charges and also providing non-fiscal incentives.
Rwanda progressing towards E-mobility

- Gender inclusive e-motorcycle taxis, Feasibility of e-buses is being looked
- In 2019, Climate action plan to promote green mobility- shift to EV and reduce emissions and air pollution
- 2030 targets include 30 per cent of electric motor-cycles, 8 per cent of electric cars and jeeps, 20 per cent of electric buses and 25 per cent electric taxis and mini/microbuses.
- Provision of fiscal and non-fiscal incentives. Fiscal incentives include capping electricity tariff for charging stations at the industrial tariff level (large industry category); reduced tariff for electric vehicles during off-peak time; VAT and import and excise duties exemption on electric vehicles, spare parts, batteries and charging station equipment; exemption of 5 per cent withholding tax at customs and introduction of carbon tax to discourage polluting vehicles.
- Non-fiscal incentives include rent free land for charging stations (for land owned by the government); provision of charging stations in the building code and city planning rules; green license plate in electric vehicles, free entry into congested zones, and free license and authorisation for commercial electric vehicles
- Companies manufacturing and assembling Evs given incentives : 15% corporate income tax and tax holiday (irrespective of the investment value). Administrative measures such as establishment of restricted zones for green transport and provide preference to EV for government hired vehicles will also help.
- As per the 2021 National Transport and strategy for Rwanda there is a strategic paper on electric mobility adaptation in Rwanda (with incentives that includes tax exemption and reduced electricity tariff among others).
- Electric mobility strategy for the City of Kigali is in the final stage.
- Electric Mobility technical committee for better coordination
Rwanda: Steps to progress towards E-mobility

- Ampersand has 35 operational electric motorcycles assembled locally with four swapping stations. There is a plan to add more 40 e-motorcycles.
- Safi Universal Links Ltd has 30 e-motos in operation with seven charging stations. Training centre is also available.
- Rwanda Electric Motorcycle Company (REM) has started assembling electric motorcycles and plans to retrofit existing ICE motorcycles into electric ones.
- The International Finance Corporation, IFC/World Bank expressed interest to partner with Rwanda to introduce e-buses in City of Kigali (CoK).

Kenya E-mobility initiatives

- Government is promoting vehicle assembly plants in Kenya.
- Target of 5% newly registered vehicles by 2025
- A task force for e-mobility policy.
- 2019/2020 budget lowered the excise duty of electric vehicles from 20% to 10%.
- Kenya Bureau of Standards has developed standards for e-mobility on energy consumption, range of vehicles and fuel consumption measurements.
**EVs: Next steps**

Need the priority action for the following:

- Overall and segment-wise electrification targets
- Policy for demand and supply incentives and infrastructure
- Replicate the pilot projects
- Promote e-bus transport services and requisite operational reforms
- Restrictive policies on old and used vehicles to promote EVs; Restrict ICE import
- Adopt old vehicle scrappage policy and replace a part of it with EVs
- Leverage fuel economy regulations to push for EVs
- Develop financing strategy
- Network plan for public charging
- Need consumer awareness
Addressing mobility crisis....
Mobility crisis

• Traffic jams cost the Nairobi City County approximately KSh 30-50 million daily in fuel consumption, manpower time wasted and cancelled business appointments

• On a Monday morning it takes 2 to 3 hours to reach CBD in Nairobi

• Lagos – A study (Bashiru and Waziri 2008): 57% of commuters spend between 30 to 60 minutes more on road due to traffic congestion.
Opportunity in Africa and India: Majority still walk, cycle and use public transport

How people travel in India?
- We have built walkable cities: 30-60% trips carbon neutral.

How people travel in Africa?
- Majority walk and use public transport

Based on: International Association of Public Transport (2010) “Major Trends and case studies”
Leveraging strength and changing the narrative
Majority in Africa and Asia including India walk and use public transport

An impressive baseline:

In most African cities 80-90% people walk and use public transport

Need to strengthen this paradigm
Do not repeat mistakes – Roads not designed for public transport, waking, and cycling can lock in more pollution and carbon

*Engineering changes once made cannot be reversed easily… It permanently decides our travel choices*
Impressive scalable public transport reforms in Africa

Building scalable clean and low carbon bus transport system
-- Tanzania, South Africa, Nigeria, Uganda, Senegal, Kenya,

Ethiopia, Ghana, Tanzania, Botswana, Rwanda, Ivory Coast etc
Need integrated public transport system

Addis Ababa transit lines

- Need scaling up of public transport system
- Need efficient and affordable bus transport
- This should be supported by last mile connectivity
- ICCT’s estimates suggest that a BRT system in Addis Ababa will result in considerable overall health benefits in the range of $41 to $45 million per year in 2035.

Upcoming BRT in Nairobi

- 5 BRT lines identified, 1 under implementation
- 3 lines under design- line 3 complete; Special planning for TOD along line 3 done
- Line 4 yet to be funded; All lines to be electric
Dar es Salaam BRT: Operational evaluation: Journey time savings

- Dar es Salaam Bus Rapid Transit (DART), Mwendokasi–University of Tanzania et al. study: 10.2 kilometers long corridor on Morogoro Road. Estimated travel times for BRT bus, non-BRT bus, and personal automobile.

<table>
<thead>
<tr>
<th>Transportation Mode</th>
<th>BRT buses</th>
<th>Non-BRT buses</th>
<th>Personal automobile</th>
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<tr>
<td></td>
<td>16 mins/10.2 KM</td>
<td>28 mins</td>
<td>18 mins</td>
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Source: Lucia Andrew, 2022, Operational evaluation of the bus rapid transit system: Case study of Dar es Salaam city
BRT – Peak and non-peak hours have nearly the same high speed

- Consumer demand levels exceed the capacity of the BRT buses
- Intelligent Transportation System (ITS) technologies not fully integrated; Need smart cards
- Other bus services not allowed to operate along the BRT route;
- Commuters need to have more affordable options travel along the BRT corridor and have limited mode choices

Predicted travel time considering time of day, dwelling time, and number of stops variables.
Why small para transit is important?

- These are high frequency services with very high throughput of passengers—meets 70% of public transport service.
- Provides the most reliable and frequent service both during peak and non-peak hours.
- Can penetrate deep into neighbourhoods and provides the most efficient last mile connectivity.
- Involves least interchanges and therefore allows lower cost of travel. High on demand.

- Pricing of public transport: IPT fare is low by regional standards—$0.17 one-way, ($0.54 in Uganda, $0.79 in Kenya, and $0.27 in Rwanda) — insufficient to cover the costs of providing the service.
- Affordability of public transport: Daladalas expensive for most potential riders; only richest 20% of households can afford a daily two-way daladala trip.

Need supportive systems of mini bus taxis. Congestion will worsen if these are replaced by cars.
Reorganising para transit (minibuses/minivans): A good practice

-- Eg Addis Ababa --- Owners of blue and white taxis organised under 13 owners' associations based on the zoning system reintroduced in 2011.

-- These associations engage in service route management

-- The 13 minibus taxi owners associations are to be reorganized into two bigger share companies. -- Members to upgrade their vehicles into midi buses, with a capacity of up to 24 passengers.

-- Similar initiatives in Nairobi

Mini and midi bus taxis should NOT be phased out if light rail system comes. These should only be improved
Opportunity for scaling up walking and cycling cities

- Implement demarcated walking and cycling lanes – preference for contact free travel high

- Local area plans to create appropriate infrastructure.

- Infrastructure to support cycling and walking e.g. bicycle lanes, expansion or repair of sidewalks, etc.

- Public amenities and public parks within neighbourhoods to enhance the experience.

- Reinforce compact urban form to reduce distances
Africa doing this right
NMT and car free initiatives

Ethiopia:
• 2020: Non-Motorised Transport Strategy with 10-year targets -- 3 km of footpaths and 2 km of bike paths per 10,000 people. Keep the number of kilometers travelled by private vehicles to 2020 levels.
• Road safety and transport plans in partnership with private sector to improve walking and cycling infrastructure.
• Streets for the People is a government backed monthly car-free day in Addis Ababa and other cities.

Nairobi: As per the NMT policy 20% of the Nairobi city transport budget is dedicated to active mobility and all new roads are built with a footpath and a bike path.

Rwanda:
• The national transport policy -- all new roads to be built with traffic calming measures and adequate sidewalks making them safer for pedestrians and cyclists.
• Fortnightly carfree days in Kigali. Guraride app allows users to rent bikes and electric-powered two wheelers.

Uganda
• NMT policy in Uganda
• Steps are also being taken to decongest Kampala.
Transform streets for people

- Streets of Delhi retrofitted

Clean air action plans in India have asked for compact urban form, low emission and pedestrian spaces

Before

Connaught Place

After

Car-free Ajmal Khan Rd of Delhi

Source: CSE
Compact and closely built city design allow shorter travel distances.
Average trip length in most African cities less than 5 km.
This makes city very accessible and walkable
Congestion have increased share of walking in our cities…It is faster to walk
Need transit oriented development policy and compact city design

India: National Habitat Standards and Transit Oriented Development Policy
Mixed use development to promote transit usage and control sprawl
-- 95% of residences to have daily needs retail, parks, primary schools and recreational areas within 400m walking distance.
-- Need small block size with high density permeable streets etc
-- 60% of Delhites to be within 15 minutes walk from transit line – need accessible infrastructure
What’s going wrong with parking

- Parking: wasteful use of cars: For about 90 to 95 per cent of the time a car is parked.
- Insatiable demand for land: Annual registration of cars generate demand for land bigger than 310 football fields in Delhi! Land is expensive and can be used for other social and public amenities
- In Addis Ababa the parking demand of the existing car fleet is equivalent to 110 football fields
- Parking takes away walk space, urban common, green spaces, etc
Designing parking policy to restrain vehicle usage

-- Notify Parking area management plan for all municipal wards and neighbourhoods
-- Allow parking only in demarcated legal areas
-- Introduce variable parking pricing
-- Penalise illegal parking
-- No parking in green areas etc
Effectively priced parking can make a difference

No meters
Grosvenor square, London

Meters

Prices quadrupled

Source: TRL in ITDP (2011): Europe’s Parking U-Turn
Parking and clean air

Boston froze their parking requirements at a level that is only 10 per cent higher than the 1973 level to meet the Federal clean air standards.

New York: very high parking fees and limited parking supply have lowered car ownership far below the average rates in other US cities.

Amsterdam: parking fees expanded to meet EU directives regarding NO2 and PM10 emissions. Car plate numbers are registered with emissions information. Trucks are allowed to unload for a maximum of 15 minutes in spots where they are not allowed to park.

Zurich considers total NO2 emissions when determining the amount of parking to be allowed.
Need synergy between clean air plans and NDCs

Kenya: Implement low carbon and efficient transportation systems. One funded NAMA support project to develop a Mass Rapid Transport System for Nairobi.

Ethiopia: Leapfrogging to modern and energy efficient technologies in transport, industry, and buildings
- Transport electrification and public transport shift to electric. Increasing share of PT
- Improvements in Addis Ababa’s public transit by building LRT, BRT, both powered by renewable. Fuel Efficiency. Alternate fuels and electric rail network

Nigeria: 100,000 extra buses by 2030, BRT will account for 22.1% of passenger-km by 2035, 25% of trucks and buses using CNG by 2030, All vehicles meet Euro III emission limits by 2023 and Euro IV by 2030

Uganda: NDC measures – more buses, BRT, Evs and CNG, leapfrogging emissions standards; Road transport fuel efficiency
Alternative fuel switch; Development of NonMotorized Transport (NMT) infrastructure
Meter Gauge Railway rehabilitation for freight transit
Efficient operation of public transportation, Residential trip avoidance through town planning and transport orientated development, BRT, GKMA passenger service, Metro rail, LRT, (Standard Gauge railway)

Rwanda: Transport and public transport Infrastructure development (BRT, NMT lanes), EV (phased adoption of e-buses, cars, 2w), Reduction in the no. of imported used cars by increasing taxes

Source: Country-wise NDC reports
Agenda for clean air

Vehicle technology and fuel quality roadmap
• Harmonise Euro IV standards for fuels and vehicles
• Restrain import of used vehicle
• Targeted electrification of vehicle fleet
• On-road emissions management
• Control freight traffic – shift to railways

Mobility transition
• Integrated public transport systems;
• Walking and cycling infrastructure, low emissions zones
• Vehicle restraint measures – parking policy, tax and pricing measures
• Funding strategy

Need regional cooperation framework for harmonised action – leverage inter-ministerial and multilateral platforms
Change the mindset....
Problem vs solution:
Getting the principle right.....
Cities are moving away from car centric infrastructure – do not repeat the mistake
Dutch Minister visits the Queen on a bicycle

Change established privileges

Source: GIZ