A GSP WORKSHOP FOR SCHOOL TEACHERS

CLEARING THE AIR

An introduction to the crisis of air pollution and mobility, and what schools can do about it

DATE: MARCH 5-7, 2024

VENUE: ANIL AGARWAL ENVIRONMENT TRAINING INSTITUTE (AAETI), NIMLI, RAJASTHAN
What can we do? -- Exploring Solutions
Transport: The Coming of E-mobility

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Why transport sector is important?

- Globally, transport accounted for 28 per cent of global energy demand and 23 per cent of global energy-related CO₂ emissions in 2014 (IEA 2017b).

- Transport sector emissions are growing rapidly and increased by 2.5 per cent annually between 2010 and 2015 (Rogeli et al. 2018), largely driven by economic growth, behavioural changes and population increase.

- It is particularly concerning, when other sectors have been able to get some control over their emissions in past couple of years, transport is the only sector which is growing continuously.

Source: ourworldindata.org
Why transport sector is important?

The rate of growth is high in case of emerging economies; like China and India, as over the last decade, the vehicular population has increased 2-5 times.

This trend will continue, as motorization rate is still very low compared to developed economies.

Source: ourworldindata.org
Worrying trend of increasing personal vehicle use

- Increasing mode share of private vehicles at the expense of declining sustainable modes.

City-wise mode share trend

- Steady shift towards bigger engine vehicles – which are energy guzzlers. In between 2010-21, number of bigger engine cars has increased from 0.2 to 1.3 millions, almost 6.5 times.
Transport demand is expected to increase rapidly

Demand for different mode of transport will increase over time. Due to lack of adequate public and para transit, private transport will overtake public transport mode share by 2040.

India’s passenger km is also expected to increase more than 3 times by 2050 (from 6000 to 18000 p-km per annum).

Indian freight transport demand is going to increase five fold between 3 trillion to 16 trillion tonne km (t-km).
Growing demand of energy and oil

Transport sector energy demand has already grown almost 2.5 times in between 2000-2019

Oil demand is growing and it mainly comes from transport sector.
In between 2000-2022, crude oil price per barrel has increased more than 3 times – putting huge strain on Indian exchequers
In 2022, India spent around 119 billion dollars for oil.

Source: IEA 2020
Tailpipe emissions from road transport plays a pivotal role

- Road transport accounts for about 87% passenger traffic and 60% freight traffic.

90% of India’s transport sector energy consumption and GHG emissions are contributed to road transport only.

Source: IEA

Source: Second Biennial update report 2018, MoEFCC, GOI
Why tailpipe emissions is bad?

Tailpipe emissions account for emissions of both greenhouse gases as well as other pollutants including SOx, NOx etc. which causes both environmental and health hazards.

The International Council on Clean Transportation (ICCT) report estimates around 74,000 premature deaths due to tailpipe emissions in India (2015).
Why tailpipe emissions is bad?

A study conducted by “System of Air Quality Weather Forecasting And Research (SAFAR)” in 2018, reported that approximately 41% of Delhi’s pollutions (particularly particulate matters – 2.5 & 10) are sourced from the transport sector, highest among other sectors.

Tailpipe emission is considered as one of the major source of particulate matter emissions in urban areas.
As a result,

Globally, countries including India are adopting various strategies to reduce emissions from transport.
### How countries are responding?

#### Summary of mitigation measures

<table>
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<tr>
<th>Category</th>
<th>Measures</th>
<th>Source: GIZ &amp; SLOCAT</th>
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<td>Transport system improvements</td>
<td>Education and awareness raising</td>
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<td>Freight efficiency improvements</td>
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<td>Parking management</td>
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<td>Intermodality</td>
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<td>Improve infrastructure</td>
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<td>Land use</td>
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<td>Comprehensive planning</td>
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<td>Mode shift and demand management</td>
<td>Economic instruments</td>
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<td>Taxes</td>
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<td>Subsidies</td>
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<td>Logistics/freight avoidance</td>
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<td>Access regulation</td>
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<td>Public transport improvement</td>
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<td>Low-carbon fuels and energy vectors</td>
<td>Active mobility</td>
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<td>Fuel policies</td>
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<td>Vehicle improvements</td>
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<td>Alternative fuels</td>
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<td>Labels</td>
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<td>Innovation and up-scaling</td>
<td>General innovations and digitalisation</td>
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<td>Promotion of technical improvements</td>
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<td>Shipping improvements</td>
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<td>Aviation improvements</td>
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<td>Electric mobility</td>
<td>Mobility as a Service (MaaS)</td>
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<td>Micromobility</td>
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<td>Shared mobility</td>
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</table>

#### Measures in new Nationally Determined Contributions (NDCs)

- **116 countries** have submitted their 2nd Gen NDCs.
Why electric vehicle?

- Zero tailpipe emissions
- Reduced noise pollution
Why electric vehicle?

Source: https://www.vehiclecontracts.co.uk/blog/could-evs-solve-the-uks-noise-pollution-problem/
Why electric vehicle?

- Zero tailpipe emissions
- Reduced noise pollution
- Easy to drive
Why electric vehicle?

It’s an advanced technology: more energy efficient than IC vehicles

Source: US Department of Energy
Why electric vehicle?

Cost of operating an electric vehicle is much lesser than IC vehicles

- Battery contributes to 45-50% cost of EV.
- Over the past 9 years, the cost of battery has gone down by 81% (from $684/kWh to $132/kWh)

Operating cost of an EV is almost 80-85 per cent lower.

Source: business today

Volume-weighted average pack and cell price split ($/kWh)

Source: BNEF, 2021
Why electric vehicle?

Electric vehicle comprises lesser parts than IC vehicles, which resulting to lesser maintenance cost.

IC Engine
>200 moving parts

EV Motor
One/ two moving part

Source: https://www.laserax.com/blog/electric-motor-manufacturing
Why electric vehicle?

Regenerative breaking is possible with EVs.

EVs can regenerate and store **15-20 per cent** of the kinetic energy into the battery.

Source: Automotive IQ
How EVs are different from IC vehicles?

- What’s new:

  - Use **electric motor** than engine: motor is simpler than engine – has only 2 moving parts and need no maintenance, while an average 4-cylinder engine has at least 40 parts and oil & fuel filters has to be changed on regular basis.

  - **High voltage battery**, instead of fuel tank.

  - **Power electronics** responsible to convert DC to 3 phase AC for electric motor during propulsion. The opposite happens during regenerative braking - AC gets converted to DC in order to charge the high voltage battery.

  - **Onboard charger**, it converts the AC 1 or 3 phase from the grid to DC in order to charge the battery. In case we are using DC current to plug with the vehicle – onboard charger is not required.

  - **Charging socket**.
How EVs are different from IC vehicles?

- What’s different:
  - **Air conditioning compressor (ACC)** – although both ICE and EV uses air conditioning system but the way they power this component is different.
    
    In EV, ACC is a high voltage device and directly powered by the battery, while in ICE vehicle ACC takes power from crankshaft of the engine. Thus, we feel power loss when AC is on in an ICE vehicle.
  
  - **Gear box** – EV gear box is much simpler, usually comes with one speed, while ICE vehicle use multi speed gear box.
  
  - **Braking system** – In EV, when the driver pushes the brake pedal, the electric motor serves as a generator that does the initial braking and recharges the battery at the same time - that’s why we call it “regenerative braking”. And after a certain threshold conventional hydraulic braking system brakes the vehicle – it also increases the service life of brake pads and discs.
Major area of concern?

- High up-front cost of EV compared to diesel/petrol vehicles.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Price</th>
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<tbody>
<tr>
<td>Honda Activa 125</td>
<td>0.9 lakh</td>
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<tr>
<td>Suzuki Access 125</td>
<td>0.9 lakh</td>
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<tr>
<td>TVS Jupiter 125</td>
<td>0.9 lakh</td>
</tr>
<tr>
<td>OLA S1</td>
<td>1.3 lakh</td>
</tr>
<tr>
<td>OLA S1 Pro</td>
<td>1.5 lakh</td>
</tr>
<tr>
<td>Ather 450x</td>
<td>1.4 lakh</td>
</tr>
</tbody>
</table>
Major area of concern?

- Inadequate infrastructure.
- Range anxiety.
- Lack of product availability.
- Uncertainty about after sale services.
- Resale value of the EV.
- Lack of awareness.
Future looks promising for EVs

- Centre has already set up an ambitious target of **30 percent penetration** in EV sale by 2030.

- To promote electric mobility both central and state governments are providing:
  - Purchase incentives (subsidies)
  - Developing EV ecosystem – charging network
  - Providing fiscal and non-fiscal subsidies.

- Except, J&K, Nagaland and Mizoram, all states has come up with their own state policies to promote EV.
Future looks promising for EVs

Vehicle category-wise EV penetration level (2023)

- Public Bus: 4.82%
- 4W (Commercial): 3.99%
- 4W (Personal): 2.09%
- 3W (Goods): 41.73%
- 3W (Passenger): 54.91%
- 2W: 5.18%
- Goods Carrier: 0.34%
Future looks promising for EVs

- Assisting EV and associated industry to grow through production linked incentive (PLI) schemes:
  - EV component manufacturer
  - Advanced cell manufacturer
Future looks promising for EVs

Already 7000+ e-buses are operating across different cities in India.

Another 9000+ buses shall be deployed in 2-3 years time. [purchase order placed]

Recently, PM e-bus seva was launched to deploy 10,000 e-buses in medium and smaller cities in India.

Focus is on electrifying the public transport services like buses and autos.

[making millions of trips into zero emission trips]
Future looks promising for EVs

It’s not just us, WORLD is moving towards EV
US has started to converting their school buses into electric and targeted to electrify completely by 2030.

Thank You..!!