E-mobility – Indian Roadmap Perspective

A B KOMAWAR
The Automotive Research Association of India
## Presentation Outline

<table>
<thead>
<tr>
<th>INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>About ARAI</td>
</tr>
<tr>
<td>Indian Automotive Industry &amp; EV</td>
</tr>
<tr>
<td>Driving forces</td>
</tr>
<tr>
<td>Air quality, urbanisation</td>
</tr>
<tr>
<td>India: EV way: Challenges</td>
</tr>
<tr>
<td>India: EV Roadmap</td>
</tr>
<tr>
<td>Path Ahead</td>
</tr>
</tbody>
</table>
About ARAI

Establishment : 1966
Location : Pune, INDIA (150 km from Mumbai)
Manpower : 530+
Our Offices : China, Korea and Chennai
Investments : USD $ 60 Million
Accreditations : ISO 9001, 14001, OHSAS 18001 & NABL
**About ARAI**

**R&D**
- Sponsored R&D work for the Automotive and Component industry
- Self funded R&D Projects in futuristic areas
- Government funded R&D Projects in areas of common interest to the Auto Industry

**Homologation for OEMs and component manufacturers**
- In India ~80% of homologation work is done by ARAI

**Standards formulation**
- Helps the Government in preparation of safety and emission road map and formulation standards in association with the automotive industry, BIS, Ministry of Industries, etc.
- WP29 India Secretariat (UNECE activities of World Harmonization of Regulations)
ARAI's Journey

1970 – 1980
Focus Area
Facility Establishments

1981 – 1990
Focus Area
Testing Competency

1991 – 2005
Focus Area
Technology Development

> 2005
Focus Area
Research

Tools → Experience → Expertise → Knowledge

ARAII
Progress through Research
Indian Automotive Industry

Passenger Vehicles
- PC / MUV / SUV

Commercial Vehicles
- LCV / MCV / HCV / Bus

Tractors
- Farm / Earthmoving / Construction Equipment

Two Wheelers
- Motor Cycles / Scooters / Mopeds

Three Wheelers
- Passenger Carrier / Goods Carrier
India As An Automotive Hub - Advantages

- Product Development Capabilities
- Availability of Skilled Manpower
- Export Potential
- High Quality Standards
- Proximity To Emerging Markets
- Growing Domestic Demand
India As An Automotive Hub - Rankings

- World's Second Largest Two Wheeler Market
- Asia's Third Largest Passenger Vehicle Market
- World's Fifth Largest Bus and Truck Market (by volume)
- World's Fourth Largest Commercial Vehicle Market
Indian Automotive Industry – Turnover Forecast

Figures in US $ bn

Source: Automotive Mission Plan

16% CAGR

2006 2016
34 145

Source: Automotive Mission Plan
Indian Automotive Industry – Contribution To GDP

Source: Automotive Mission Plan

Auto Sector Output As % Of GDP

5 %

India
### BRIC – Projected GDP Growth Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
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<tbody>
<tr>
<td>2000 – 2005</td>
<td>207</td>
<td>5.9</td>
<td>5.3</td>
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<tr>
<td>2005 – 2010</td>
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<td>4.8</td>
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<td>7.2</td>
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<td>2010 – 2015</td>
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<td>2015 – 2020</td>
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<td>3.4</td>
<td>5.7</td>
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<tr>
<td>2020 – 2025</td>
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<td>3.4</td>
<td>5.7</td>
<td>4.6</td>
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<tr>
<td>2025 – 2030</td>
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<td>3.5</td>
<td>5.9</td>
<td>4.1</td>
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<tr>
<td>2030 – 2035</td>
<td>3.9</td>
<td>3.1</td>
<td>6.1</td>
<td>3.9</td>
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<tr>
<td>2035 – 2040</td>
<td>3.8</td>
<td>2.6</td>
<td>6.0</td>
<td>3.9</td>
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<tr>
<td>2040 – 2045</td>
<td>3.6</td>
<td>2.2</td>
<td>5.6</td>
<td>3.5</td>
</tr>
<tr>
<td>2045 – 2050</td>
<td>3.4</td>
<td>1.9</td>
<td>5.2</td>
<td>2.9</td>
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</tbody>
</table>

Source: Dreaming With BRICs: The Path to 2050 by Goldman Sachs
Low Carbon Vehicles - Driving Forces

High GHG Emissions

- India 4th in CO2 Emissions
- CO2 Emissions from Transport Sector was 1853 Mt in Year 2005
- CO2 Emissions from Fossil Fuels was 1167 Mt (63%) in Year 2005
- CO2 Emission from Road Transport was 135 Mt (7%) in Year 2005

Multiple Growth in Indian Automotive Industry

- Reflection in Total CO2 Emissions
- Urban Air Quality
- Oil Dependency
- Transportation Issues
Low Carbon Vehicle - Pathways
Controlling GHG Emissions From Transport Sector

Vehicle Technology

GHG Emissions

Awareness

Infrastructure
Low Carbon Vehicles - Technology

- Engine Technology
- Efficient Alternator System
- Weight Reduction
- Aerodynamic Drag
- Hybrid Technology
- Tyre Technology
- Air Conditioning Systems
- Alternate Energy Vehicles
- Life Cycle Assessment Of Vehicles
Low Carbon Vehicles - Technology

- **Engine Technology**
  - Variable Valve Technology
  - Cylinder Deactivation
  - Dual Clutch Transmission
  - Direct Injection

- **Accessories Technology**
  - Efficient Alternator System
  - Electric Power Steering
  - Improved Oil And Water Pump

- **Weight Reduction**
  - Every 10% Weight Reduction – FE Up By 7%

- **Aerodynamic Drag**
  - Reduced Aerodynamic Drag – FE Up By 2%
**Low Carbon Vehicles - Technology**

- **Hybrid Technology**
  - Mild Hybrid – FE Up By 10 To 15%
  - Full Hybrid – FE Up By 30 To 40%

- **Tyre Technology**
  - Reduced Tyre Rolling Resistance – FE Up By 2%

- **Air Conditioning Systems**
  - Use Of Energy Efficient Compressors
  - Use Of Low GWP Refrigerants
  - Reduce Refrigerant Leakage

- **Alternate Energy Vehicles**
  - Hybrid, EV, CNG, LPG, Biofuels, Solar, Hydrogen

- **Life Cycle Assessment Of Vehicles**
  - Material Extraction And Processing
  - Manufacturing
  - Fuel Production
  - Vehicle Use
Low Carbon Vehicles - Infrastructure

- Fuel Availability
  - Clean Fuel Development
  - Availability Of Clean Fuel

- Road Condition And Availability
  - Road Condition w.r.t. Vehicle Technology
  - Availability Of Roads

- Traffic System Management And Regulations
  - Segregation Of Lanes
  - Clear Traffic Code And Regulations

- Travel Demand Management
  - Moderation Of Private Vehicle Demand

- Land Use And Transport Planning
  - Transport Plans Mandated With Air Quality Objectives
Low Carbon Vehicles - Infrastructure

- **Inspection And Maintenance Centers**
  - Availability Of Service Centres
  - Identification Of Gross Polluting Vehicles And Ensuring Their Repairs

- **Fleet Management And Sectoral Shift**
  - Improvement And Promotion Of Public Transport
  - Vehicle Scrapping Policy

- **Retrofitment**
  - Up Grading In Use Vehicles To Meet New Norms
  - Need To Have Network Of Authorised Retrofitment Agencies
  - Cost Effective Option

- **Transport Information System**
  - Transport Data Management
  - Transport Network Overlays
  - Fuel And Emission Data Management
**Low Carbon Vehicles - Awareness**

**Eco Driving Habits**
- Accelerate Smoothly, Brake Gradually, Check Tyre Pressure
- Avoid Clutch Riding, Start Engine When You Are Fully Ready

**Vehicle Maintenance**
- Regular Servicing Of Vehicle

**Driving Planning**
- Plan Driving Route Based On Traffic Conditions

**Good Product Choice**
- Procurement Of Green Product
Low Carbon Vehicles - Awareness

- Scrap Old Vehicles
- Replace Old Tyres As Per Recommendations
- Monetary Incentives For Commercial Vehicle Drivers
- Reward Best Eco Drivers
- Awareness Campaign On Traffic Discipline And Regulations
**EVs As A Solution For India - Challenges**

- Are we shifting pollution sources from urban to power plant?
  - $\eta$ of IC engine < 30% (well to wheel)
  - $\eta$ of electric > 85% (socket to wheel)
  - What about energy up to socket?
    - Depends on power plant
    - In India, dominating power source is Thermal
    - If it is continued....

- **Is sufficient “electricity” available to support “electrification” of vehicles?**
  - UK study shows peak power demand increase by 2% with 10% PHEVs & un-controlled charging
  - What about India?
    - More than 25% loss in grid.
    - Energy crunch
    - Robust grid
    - Smart grid

- **Infrastructure for support?**
  - Innovations in “Fuelling” options
  - Use of renewable energy sources: solar/ wind/ tides/...
**EVs As A Solution For India - Challenges**

- **Is EV affordable?**
  - Initial cost
  - Life cycle cost
  - Need to have special promotional policies

- **Is EV acceptable?**
  - Does meet consumer demands?
  - Features compared to ICE?
  - “Zero fuelling time”?
  - Cost sensitivity

- **Can international solution be directly adopted?**
  - Cost
  - Consumer requirements of various segments
  - Climate
  - Drive patterns
  - Supply chain

- **Adaptation**
- **Availability**
- **Indigenous solutions**
Still Want To Go EV Way….

Have a vision for EVs in India: 2030 & Beyond

• Cohesive focused efforts of
  – OE, component
  – R&D wing
  – Government in terms of
    • Policies
    • Incentives
    • Infrastructure

• Based on vision, prepare a roadmap for
  – Technology
  – Policies
    • Role of various govt wings/ departments
Policy Roadmap

- Everyone has a role to play
  - Infrastructure:
  - Grid Strengthening:
  - Renewable energy:
  - Environmental effects/ LCA:
  - EV manufacturing
  - On road taxation & incentives
  - Technology mapping, synergy in R&D efforts & innovation
Let’s Work Together For A Brighter Future…

Thank you!