

Comprehensive Electrification and Alternative Fuels

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Special Address: Shri Ajay Kumar Bhalla, Secretary, Ministry of Power

Background Address: Mr. Seethapathy Chander

Panelists

1. Mr. Mahesh Babu, CEO, Mahindra Electric Mobility Limited
2. Mr. Soumitra Bhattacharya, MD, Bosch Limited
3. Ms. Debarati Sen, India MD, 3M
4. Mr. Yoshihiro Onomura, General Manager, Toyota Motor Corporation
5. Dr. Gregor Matthies, Former Head of Bain's Global Automotive Practice
6. Dr. RR. Sonde, Executive VP, THERMAX
7. Mr. Rajendra Petkar, President & CTO, Tata Motors Ltd.
8. Mr. Sumit Sawhney, CEO, Renault India Private Limited
9. Mr. Saurabh Kumar, Managing Director Energy Efficiency Services Limited (EESL)
10. Mr. Plinio Mario Nastari, President, DATAGRO

Goals & Takeaways

Goals:

- Build on the existing public discourse on a comprehensive electrification agenda and potential alternative sources of energy for transport
- Suggest a potential way forward for clean mobility technologies

Takeaways:

- India will have to embrace clean technologies to address the challenges of rising oil imports, GHG emissions, and air pollution
- Potential clean technology pathways include hybrid-electric, pure-electric, and alternative liquid or gaseous fuels

Strong divergence exists in the recommended approach

- Industry carries strong and sometimes divergent ideas about how India can realize its clean transportation vision
- Three different pathways emerged in the process of this panel:
 1. Predominantly battery-electric vehicles (BEVs)
 2. A slowly evolving mix of hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), fuel-cell vehicles (FCEVs), and BEVs; the non-engine HEV technologies apply to the rest too
 3. Alternative fuels—coal-to-methanol or -ether, biomass-to-ethanol, compressed biogas, compressed natural gas, renewable hydrogen
- Analyses diverge sharply and opinions are strongly held
- Some options integrate with legacy fossil fuels and traditional capabilities whilst others displace them

Predominantly battery-electric vehicles (BEVs)

- India is poised for an EV revolution, and has the opportunity to be a global leader in making this fast-moving transition
- The EV pathway provides the opportunity to wean India's transportation sector off of oil altogether (even in heavy transport)
- BEVs are significantly cleaner than ICEs even after counting the CO₂ emission from power generation; BEVs will only become cleaner with India's RE targets and the plummeting cost of achieving them
- Lithium-ion battery-pack costs have fallen at 4x—in some aggressive automaker purchases, as much as 7x—in the past five years, and are widely (though not universally) agreed to be poised to drop further
- New battery chemistries rapidly moving to market from formidable firms would use no lithium or cobalt—only India-abundant materials like zinc and manganese—capturing *all* value for Make in India

The Hybrid + Electric Pathway

- Given that it may be difficult to achieve a high penetration of battery-electric vehicles (BEVs), using hybrid electric vehicles (HEVs) and alternate fuels can help save oil
- HEVs present an immediate partial solution because of lower cost difference with ICEs and no need for additional infrastructure
- Plug-in hybrid electric vehicles (PHEV) can be a mid-term solution between HEVs and BEVs
- BEVs are a long-term solution because although they are very effective, it takes time to drop battery costs to highly affordable levels (only 2% of Indian vehicles are the BEV-predominant >10 lakhs premium sector) and install recharging infrastructure
- The Indian concept of modular, rechargeable-in-place-or-swappable, smart batteries is advancing rapidly, with global implications

Alternative Fuels

- Alt-fuel vehicles require new or different fueling infrastructure: mild shifts for high- or all-ethanol fuels (rapidly achieved in Brazil), medium for methanol, high for CNG and hydrogen
- Lead times look comparable to or longer than BEV infrastructure
- Methanol from coal/biomass/MSW is proposed as a conventional alternate option for India's ICE and e-mobility, though its economics, water use, and climate-safety remain to be demonstrated at scale
- Methanol can fuel both ICEs and EVs (hydrogen production from methanol can power fuel-cell vehicles, though onboard reformers would still release carbon)
- Ethanol requires no additional fueling infrastructure, and could have lower life-time CO₂ emissions than EVs powered by a fossil-renewable mix—*if* its biomass feedstock adds net soil carbon—though India's power mix is rapidly shifting from coal to renewables

Closing thoughts

- Technologies should be evaluated based on their merit and use case
- India's petrol is 2/3 used by 2- and 3-wheelers (w/ 1/3 of resultant air pollution)—perfect for BEVs; then public transit; lastly 4-wheelers
- Divergent technology and fuel options will all compete in the market, but each needs government financial or policy support that may conflict or distort choices if not technology- and pathway-agnostic
- India needs to be planning for the near-term and long-term simultaneously, to avoid potential lock-in effects or a compromised pathway, to ensure that today's decisions can deliver lasting benefits
- Vehicle and fuel technologies are evolving with profoundly different *speeds*—e-mobility extraordinarily quickly (accelerating with IT integration), H₂ fairly fast; hybrids, CNG, and alt-liquids are mature
- Shared, connected, *and* electric mobility offers major *new* benefits, for equity, inclusion, and supporting power-grid stability and solvency