Deloitte.

# Fuels of the future

## Exploring alternative fuel options for transport

**June 2024**

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# Executive summary

India has overtaken Japan as the third-largest light vehicle market in the world in 2023. The country sold more than 5 million units last year.[i] Over the past few years, India has made significant efforts to become one of the world's leading automotive markets, largely driven by increasing income, strong demand for personal mobility, and favourable government initiatives. The automobile industry currently contributes 7.1 percent to the country's Gross Domestic Product (GDP)[ii] and is expected to play a pivotal role in India's vision to become a US$5 trillion economy by 2027.[iii]

## Time to reimagine energy sources for the auto sector

While this sector's growth has contributed to the country's economic growth, the rising energy requirement has intensified the dependence on the global oil market and challenges related to the environmental impact. India substantially depends on fossil fuel imports. The recent geopolitical crisis and the resulting impact on commodity prices have clarified that India must be self-sufficient in terms of energy consumption. In addition, the country has committed to achieving net-zero emissions by 2070,[iv] with the interim goal of reducing GHG emissions by less than 45 percent by 2030.[v] Therefore, India must explore alternative "fuel" options, that are sustainable, more environment friendly, and available in abundance compared with conventional petrol and diesel.

> India must achieve the real goal -- that is energy Independence or an economy which will function well within total freedom from oil, gas, or coal imports[vi]
>
> **Abdul Kalam,**
> Former Indian President

## Exploring alternative fuel options

### Natural Gas (NG)

Of the various alternatives available, NG has been witnessing the strongest demand across the country (Figure 1). According to the International Energy Agency (IEA), India's NG consumption is expected to increase by 9 percent annually until 2024.[vii] The transport sector is one of the prime consumers of NG, primarily in the form of Compressed Natural Gas (CNG), which has wider availability after petrol/diesel. Moreover, substantially lower prices and GHG emissions led to the high adoption of CNG.[viii]

### Liquified Petroleum Gas (LPG)

It is another alternative with similar accessibility as CNG. However, LPG adoption is currently limited to only a few vehicle segments due to its higher production cost than CNG.

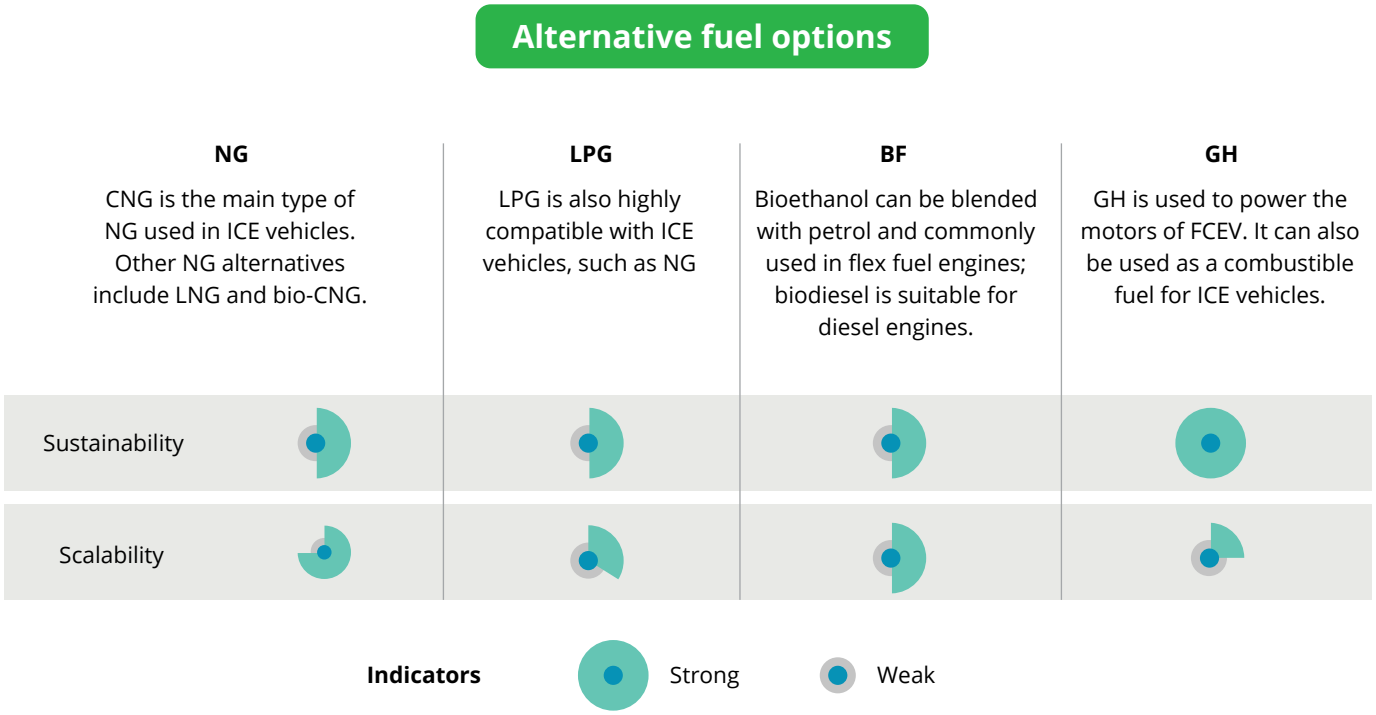
### Biofuel (BF)

Although at a nascent stage, BFs have a high possibility of scaling up in India because of the abundant raw ingredients and supportive government initiatives. However, sourcing raw materials and ensuring smooth logistics in the supply chain are key challenges.

### Green Hydrogen (GH)

It has the best environmental profile amongst all. Fuel Cell Electric Vehicles (FCEV) running on GH have zero carbon emissions. However, the existing technology required to produce GH is expensive and relatively inefficient, limiting the adoption rate and scalability of this fuel type.

**Figure 1: Alternative fuel landscape**



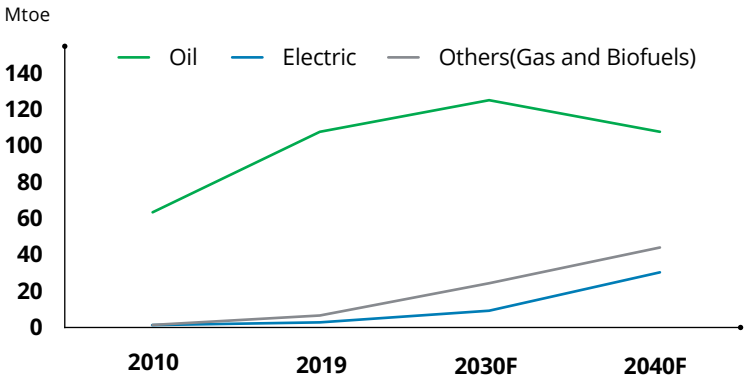
## Are we ready for electrification of transport

A discussion on the evolution of greener energy alternatives for automobiles must include EVs. Therefore, we have compared the evolution of alternative fuel options with that of EVs over the next few decades (Figure 2). Recently, there has been a growing focus on the adoption of Battery-operated EVs (BEVs) due to their better environmental profile.

Despite their environmental benefits, the adoption of BEVs still lags behind some existing alternatives. Its adoption at a mass scale will not be immediate because of the following reasons:

- These are prohibitively expensive for most Indians. Economic diversity and preference for economical fuel sources are expected to limit the adoption of BEVs amongst cost-sensitive customers.
- Despite being cleaner than conventional fuel-based cars, the current carbon footprint during a BEV's lifecycle remains significant. For instance, power sources (for charging batteries) mainly use non-renewable sources, such as coal, which accounts for nearly 75 percent of India's electricity generation.[ix]

**Figure 2: Alternative fuels – Energy demand in transport, India**




Source: International Energy Agency (IEA)

## Preparing for a seismic shift

As India establishes itself as a multimodal logistics hub over the next 25 years, it must prepare for smaller but quicker leaps towards sustainability. It will have to move away from conventional fuel sources for transport over the next few years (keeping in mind the diverse economic and geographic profiles of customers, growth of logistics demand, and India's sustainability commitments). As the ecosystem and infrastructure become robust, India must scale up its efforts to transition to greener alternatives in the long run.

Leaders in the auto or energy industry or executives in Original Equipment Manufacturers (OEMs) must be aware of various fuel options, their profiles and possible penetration across various segments of vehicles (even as the world continues to explore them as feasible alternatives). There must be a debate over the advantages and challenges of these fuel types based on their availability, affordability, and sustainability profiles in the next few years.

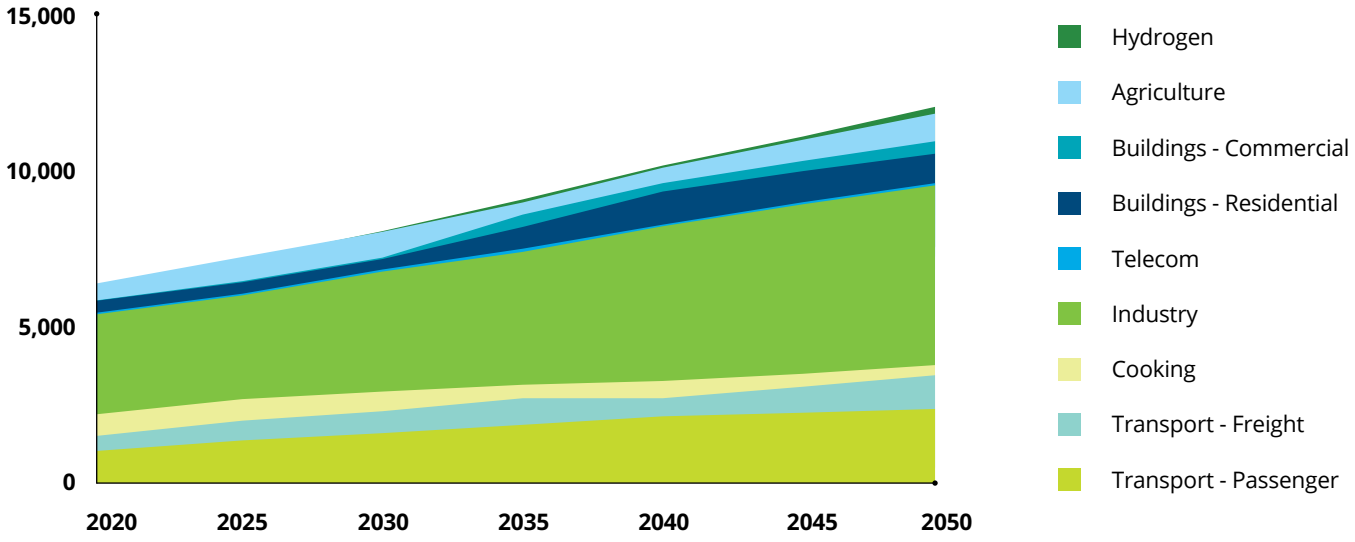
This report's objective is to help leaders and executives align themselves with the needs of the future of mobility. Executives will have to accelerate their efforts towards faster adoption and penetration of alternative fuel categories across different vehicle segments in the next few decades. A few greener options, such as GH, are expected to gain prominence as India reaches the centenary of independence.

# Chapter 1 The need for alternate fuels

# Growth in energy demand

India will have the fastest growth of energy demand amongst the top 20 Greenhouse Gas (GHG) emitters, starting from a very low base (Figure 3). The industry and transport sectors will drive the future growth of energy demand and emissions. In this mix, passenger transport will continue to form three-fourths of the total transport demand.

**Figure 3: Energy demand by sector, India (TWh)**




**Source:** Deloitte Research

**Cars are uniquely poised to garner a large share of travel demand, potentially drawing**

from intercity rail and bus travel, and intracity two- and three-wheelers as the disposable income rises within the target segment.

**Vehicle-on-demand mobility solutions (ride-sharing, ride-hailing, and micro-mobility)**

would augment public transport (bus and rail) by providing seamless point-to-point intracity mobility, reducing excessive burden on roads and associated infrastructure.

**Buses and rail are expected to increase their share in intracity travel demand**

mostly from three-wheelers, emphasising cities' renewed focus on improving mass transit systems.

**Air and rail are projected to take 1 percent of travel demand to share each from the road**

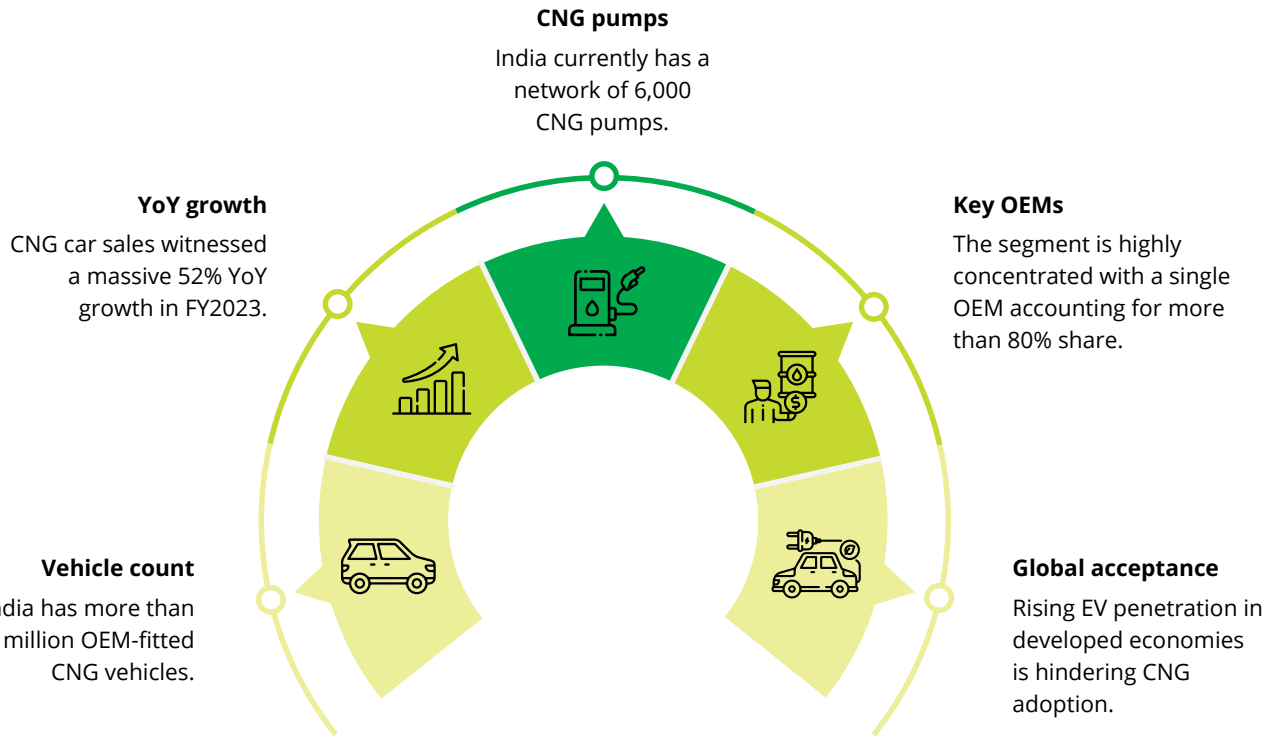
primarily for intercity travel by FY30. With this rapid growth in energy demand, it is important to re-imagine the mix and, inevitably, carbon emissions from passenger transport will significantly decouple from energy demand due to modal shifts, electrification, and efficiency gains.

# Chapter 2
# Natural Gas

# Compressed Natural Gas

CNG has been extensively adopted in India as an alternative to petrol and diesel because of better mileage (~40−50 percent lower cost per km) and reduced carbon emissions (~5−10 percent less) compared with conventional fuels.[x] Moreover, the increased rollout of City Gas Distribution (CGD) licences by government authorities has resulted in an increasing number of CNG stations in India, creating wider market penetration and higher scalability of this fuel compared with other alternative options.[xi]

**Figure 4: Alternative fuel options – Key CNG facts within India Landscape**




Source: Deloitte Research

## Challenges

### Infrastructure

The current availability of CNG stations falls short of the actual requirement, with the demand being nearly three times higher than the existing infrastructure.[xii] Besides, such infrastructure is largely concentrated in a few states. As of January 2024, India had 6,348 CNG stations (Figure 4). Of these, 80 percent are in Gujarat, Maharashtra, Uttar Pradesh, Delhi, Haryana, and Madhya Pradesh.[xiii] Consequently, the demand for CNG has been highly skewed and limited to certain geographies. The payback period for a private CNG pump owner/dealer in India is 2−3 years, which moderates the growth of new entrants.[xiv]

### Vehicle variant

Vehicle variant: Vehicles with factory-fitted CNG kits are mostly available in India on the affordable spectrum/lower variants. As customisation of vehicle models is limited, its adoption amongst the mid/high-end customer segments remains capped.

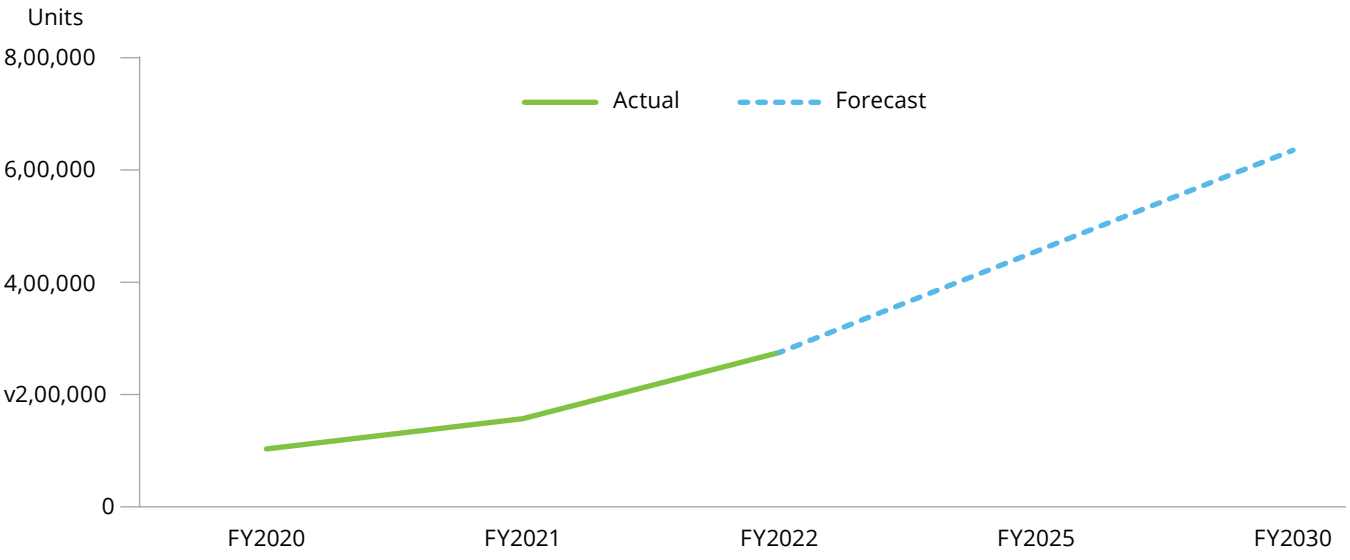
**Future potential**

We expect **4.5–5 lakh** units of CNG vehicles to be sold in FY2025 and **6–6.5 lakh** units in FY2030.

However, to boost the penetration of CNG vehicles, infrastructure and vehicle variant offering issues must be addressed.

- The Ministry of Petroleum and Natural Gas (MOPNG) will continue rolling out CGD licences to build 4,000–5,000 stations over the next 3–4 years and 10,000 stations over the next decade.[xv] State governments will have to incentivise the purchase of CNG vehicles through tax reductions and subsidies to increase the adoption rate amongst end-users.
- Public and private energy companies will have to participate in CGD bidding rounds and invest heavily in the expansion of CNG station networks to meet the ever-increasing demand. Several oil and gas majors have already announced plans to spend over INR 40,000 crore on CGD networks within the next few years in six Northeastern states and two Union Territories of Jammu and Kashmir, and Ladakh.[xvi] Local players in Mumbai and Delhi are also rolling out CNG refuelling options.[xvii] These investments will create numerous dealerships and business opportunities in the long term.
- Rising demand for CNG and improved infrastructure (including expanding gas distribution networks) is expected to encourage leading OEMs to continue launching new factory-fitted CNG variants (Figure 5). OEMs should increase their CNG offerings within the low/mid-end vehicle segments to cater to broader customer segments, particularly in the private space. This, in turn, will also prevent consumers from retrofitting their cars with CNG tanks installed by external vendors, often leading to safety and operability issues.

**Figure 5: Alternative fuels – Sales of CNG vehicles, India**




Source: Deloitte Research

Note: A forecast of CNG sales to stations ratio used to get the projections for sales.

# Other Natural Gas variants

Other natural gas variants include Liquified Natural Gas (LNG) and bio-CNG. At present, they are not widely used or commercialised but have the potential to grow, especially in heavy-duty vehicles.

## Liquified Natural Gas

The LNG market is relatively niche in India. The wide adoption of LNG in the US and Europe for heavy-duty vehicles suggests that India has the potential to replace crude oil-based fuels and CNG with LNG. Several reasons could lead to higher adoption:[xviii, xix, xx]

| | |
|---|---|
| **Economical aspect** | With LNG being 30–40 percent cheaper than conventional fuels, it can reduce the fuel bill of fleet operators by nearly 25 percent and import bill by more than 30 percent. |
| **Better storage** | LNG requires less storage space than CNG, providing a better driving range for long-haul and heavy-duty vehicles. The fuel-carrying capacity of LNG buses, for instance, is nearly 2.5 times more than CNG counterparts. |
| **Environmental friendly** | LNG is an environmentally superior fuel alternative (20–30 percent less GHG emissions) compared with conventional fuels. |

### Market outlook

Penetration and adoption rates will improve but will be limited to specific vehicle categories as LNG requires special fuelling equipment (such as cryogenic tanks) to maintain its properties. The installation of such tanks is feasible in heavy-duty vehicles. Its increased adoption will require a strong push from the government. The Government of India is exploring the possibility of using LNG in the long-haul truck segment. In addition, the MOPNG has proposed to set up 1,000 LNG stations in India in the next three years; this will be crucial to driving adoption.[xxi] The government has further set up a target of transitioning at least 1 million trucks to LNG by 2035.[xxii] In this regard, a few OEMs have started working on developing LNG-compliant vehicles. For example, one of the leading Indian multinational automotive manufacturing companies delivered its first four LNG-powered buses to a prominent oil and gas company (public sector undertaking), in 2020.[xxiii] Moreover, another leading commercial vehicle manufacturer in the country delivered the first batch of India's first LNG-powered haulage truck in 2023 in Tamil Nadu.[xxiv]

**Adoption of LNG will be contingent on the following:**

- Collaborations between oil companies and OEMs to increase the scalability potential of this fuel
- Introduction of strict government mandates (regarding the use of LNG in the truck segment) and initiatives, such as favourable tax incentives (for dealers/truckers), which will boost the commercial use of LNG-driven vehicles

## Bio-Compressed Natural Gas

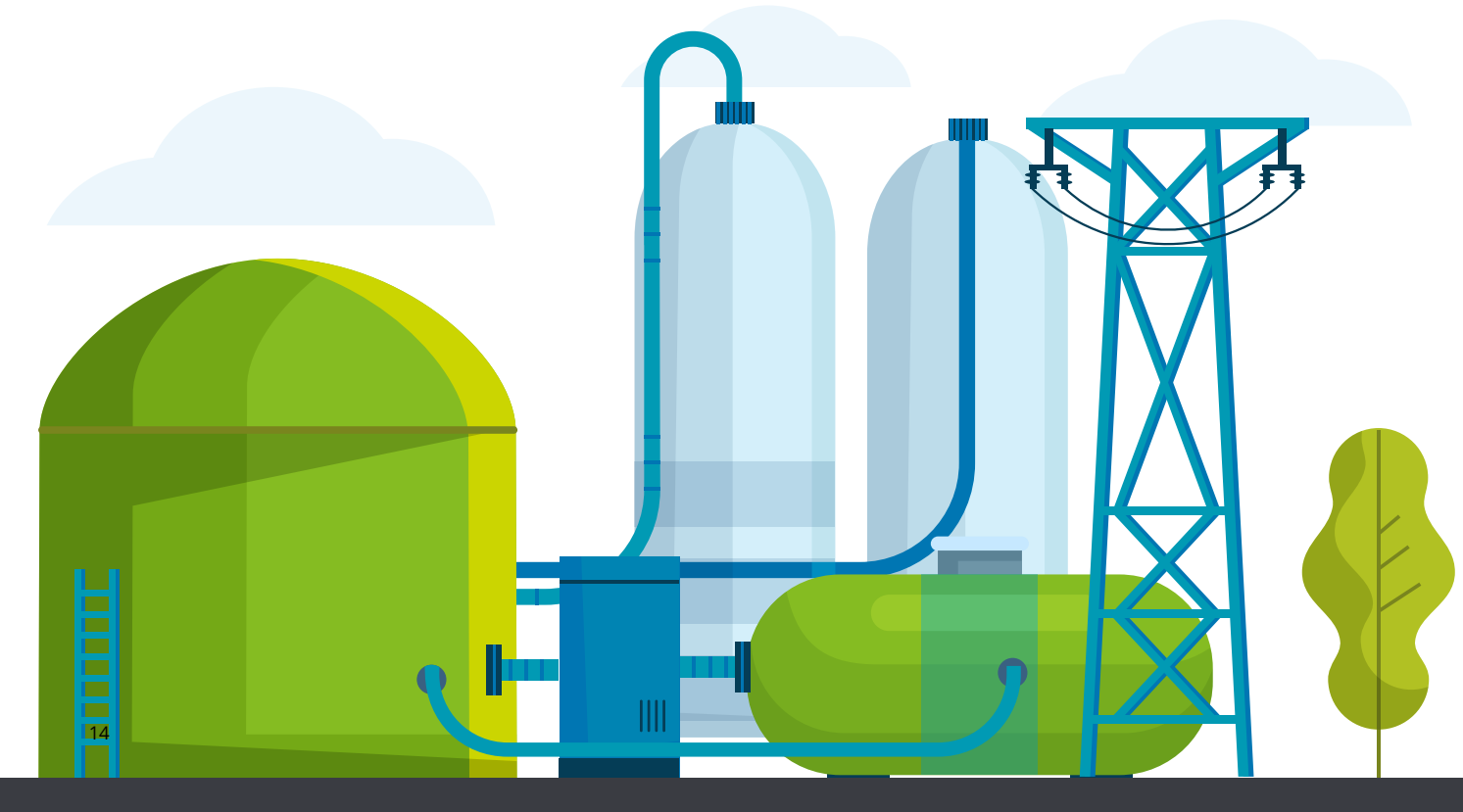
An alternative to CNG, which is greener, is bio-CNG. This is a renewable fuel and can be used in passenger and light-duty vehicles. The government is promoting this fuel, as emissions from this source are negligible. In February 2022, the government inaugurated its newest bio-CNG plant in Indore, which is expected to produce nearly 19,000 kg of bio-CNG gas per day. It is expected to be Asia's biggest plant in terms of capacity. Per the centre's "waste to wealth" initiative, the plant has been established on a Public-Private Partnership (PPP) model by the Indore Municipal Corporation (IMC) with an initial investment of INR 550 crore.[xxv]

### Challenges

The adoption of biogas technologies has been quite low in India. The effective segregation of municipal and agricultural waste at source, which requires advanced equipment and huge capital investment, is the main problem. These requirements make biogas generation difficult for small-scale players. Thus, a low fuel supply inhibits the adoption of bio-CNG in India.

### Outlook

The adoption of bio-CNG will moderately pick up in the near term. The fuel generated from the new plant will be used for 400 buses in Indore.[xxvi] Moreover, per the government's estimate, 75 such large bio-CNG plants are expected to be further set up across the country over the next two years.[xxvii] According to the Ministry of Road Transport and Highways (MoRTH), the country has the potential to develop 5,000 bio-CNG manufacturing units; it will expect huge investments in this segment.



# Chapter 3
# Liquified Petroleum Gas

LPG was one of the first relatively greener energy alternatives adopted in India.[xxviii] It costs nearly 30–40 percent less than petrol.[xxix] It is more economical than diesel in terms of mileage but marginally higher than CNG.[xxx] Despite being derived from fossil fuel sources, LPG has a lower carbon footprint compared with petrol and diesel.

Despite its early introduction in 2000, the scalability potential beyond three-wheelers has been limited, due to high competition from other economical alternatives, such as CNG.

**Figure 6: Alternative fuels – Key LPG stats, India**

| | | |
|---|---|---|
| **2.5 million**<br>(Number of LPG vehicles) | **90% are three-wheelers**<br>(Number of LPG vehicles) | **1,100**<br>(Number of LPG stations) |
| **0.35 million tonnes**<br>(Auto LPG consumption) | **Bengaluru, Chennai, and Hyderabad**<br>(Key adopters of LPG vehicles) | **40–50%**<br>(Leading OEM share) |

LPG's current consumption in India stands at about 0.35 million tonnes per year (Figure 6), compared with the global number of more than 26 million tonnes (the bulk of the demand from countries, including South Korea, Turkey, Poland, Japan, Australia, Italy, Mexico, the US, Russia, and China).[xxxi]

### Factors restraining growth

The low penetration of LPG across the country has been largely because of the highly substitutable and affordable options, such as CNG, which are available to consumers. In addition to its huge calorific value, LPG is highly flammable and considered to be less safe than its CNG counterparts in the event of a spill/leakage.[xxxii] A few policies, such as the promotion of CNG across different vehicle categories while restricting LPG use to large three-wheelers, along with higher taxes on the sale of LPG vehicles (18 percent GST) and retrofitment kits (28 percent GST) have further constrained its growth potential.[xxxiii]

### Market potential and outlook

There are several advantages of using LPG. India is self-sufficient in LPG. Due to their lower operating pressure, LPG cylinders weigh much less than their CNG counterparts, providing better vehicle performance and easier fuel refill options. Besides, the establishment costs of LPG stations are also lower than those of CNG stations.[xxxv] Moreover, according to industry research, LPG emits about 52 percent lower carbon monoxides, 47 percent lower total hydrocarbons, and 68 percent lower nitrogen dioxides than petrol. It emits about 120 times fewer particulate emissions compared with diesel.[xxxvi]

However, we expect LPG take-off to remain limited and restricted to only a few segments of vehicles (despite the advantages) as other alternative cost-efficient and safer options with similar/better sustainable and scalable profiles are now being explored in the market.

# Chapter 4
# Biofuel

# Bioethanol

## Global market trends

One of the widely adopted BFs across the globe is bioethanol, which is commonly used in combination with petrol to run flex-fuel engines. According to the US Department of Energy, bioethanol has the potential to reduce GHG emissions by up to 40 percent[xxxvii] and is also 20−30 percent more economical than crude oil-based fuels with zero carbon emissions.[xxxviii] However, there are countries with vehicle engines running on 100 percent bioethanol (E100). For instance, Brazil (E20 to E100), the US (E85), and Sweden (E85) are leading ethanol flex-fuel vehicle markets.[xxxixx] Brazil and the US manufacture ethanol from sugarcane[xl] and corn,[xli] respectively, whereas Sweden imports more than 80 percent bioethanol from Brazil and other countries.[xlii]

## Domestic market trends

The Government of India has been advocating for the use of flex-fuel to power cars and motorbikes, aiming to reduce carbon emissions and fuel costs for consumers. This initiative gained momentum in 2021.

- The transport minister advised carmakers to incorporate flex-fuel engines in their vehicles by 2022.[xliii]
- The Government of India launched the E100 pilot project in Pune to conduct a feasibility analysis of the production and distribution of ethanol across the country.[xliv]

The government initiatives led to a 10 percent blending of ethanol with petrol in 2022.[xlv] This further encouraged India's Oil Marketing Companies (OMCs) to take contracts for 4.08 billion litres of ethanol in the Ethanol Supply Year (ESY) 2021−22 (December 2021 to November 2022), up from 0.38 billion litres eight years ago.[xlvi] Moreover, India achieved 12 percent ethanol blending in ESY2022−23 and plans to procure 15 percent blending in the ongoing ESY2023−24.[xlvii] Amongst OEMs, India's largest automaker with more than 50 percent market share is already compliant with E10 norms.[xlviii]

## Challenges

### Dependency on sugarcane

India is heavily dependent on sugarcane for bioethanol production.[lii] Sugarcane cultivation is a water-intensive process that adds to water scarcity challenges and causes an ecological imbalance in the regions where sugarcane is cultivated.[liii]

- Government authorities are exploring other options (wheat, maize, and corn) that require fewer water resources.[liv]
- This has been a concern for food experts who believe that ethanol production from grain-based sources might impede food supply, as farmers may move away from food grain production to ethanol production as fuel alternatives (driven by higher incentives and better returns). This, in turn, may add to the price pressure of certain food products.[lv]

### Customer acceptability

There are concerns regarding customer acceptability of flex-fuel engines, as consumers might witness a 4-5 percent drop in fuel efficiency with E20 petrol due to its lower calorific value than petrol.[lvi] Moreover, for manufacturers, re-orienting the supply chain and manufacturing car components to introduce E20-compliant vehicles will add to auto manufacturing costs.[lvii]

### Limited availability

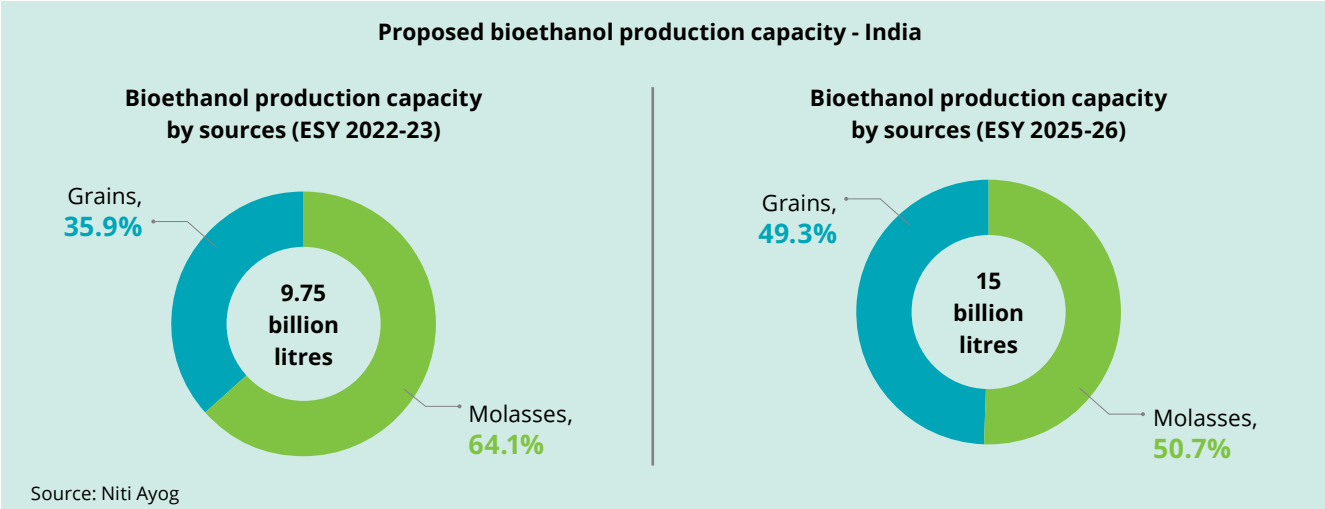
In addition, the low availability of bioethanol also limits private participation, limiting scalability.[lviii] At present, state-run companies sell ethanol-blended petrol, while private players sell unblended petrol.[lix]

## Outlook

As part of its ethanol blending roadmap for 2020−25, the government rolled out several ethanol blending guidelines to promote sustainability.[xlix] The authorities have set a target to achieve 20 percent bioethanol blending in petrol, which would require around 10.16 billion litres of ethanol to be produced by 2025 (Figure 7).

The government initiatives have encouraged several oil and gas majors to invest INR 14,000 crore to set up 12 2G bioethanol refinery plants in India from cellulosic and lignocellulosic biomass, including petrochemical routes.[l] These initiatives are expected to increase bioethanol production in the country. Several OEMs are also working on developing vehicles capable of adapting to higher percentages of blended ethanol. These efforts are expected to position India as the third-largest ethanol market globally, following the US and Brazil, by 2026.[li]

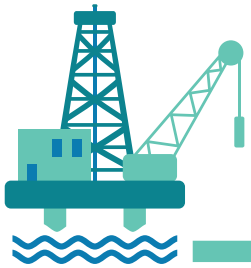
**Figure 7: Alternative fuels – Bioethanol production capacity, India**




Source: Niti Ayog

According to the NITI Aayog, India's bioethanol production capacity of 9.75 billion litres (64.1 percent derived from molasses-based distilleries and 35.9 percent from grain-based distilleries) in ESY 2022-23 is proposed to be expanded to 15 billion litres (50.7 percent from molasses and 49.3 percent from grains) by ESY 2025-26. This is to achieve the production target of 10.16 billion litres for bioethanol blending and 3.34 billion litres for other uses.

Given the push from the government for sustainable energy sources, we expect bioethanol to be the most adopted sustainable energy source in the medium term because of its feasibility and scalability. That said, given the possibility of water and food shortages that sourcing may cause, authorities will have to be highly prudent and must explore non-food/food-waste-based feedstock. OEMs must conduct field trials before introducing E20-compliant vehicles and support vendors financially and technically to re-orient their manufacturing process to supply ethanol-compatible parts.



# Biodiesel

Biodiesel is a bio-degradable and non-toxic fuel that emits nearly 75 percent lower carbon than conventional diesel.[lx] India has more than six biodiesel plants with an operating capacity of nearly 550 million litres.[lxi] However, the penetration rate of biodiesel has remained negligible in the country. This is primarily due to limited feedstock (imported palm oil) availability, volatility in their prices, and inadequate supply chain infrastructure, making biodiesel production commercially less attractive than conventional diesel.[lxii]

- As of 2021, the average blending rate achieved was only 0.09 percent. Blended diesel buyers are limited to retail outlets of certain OMCs, such as Indian railways, State Road Transport Corporations, port authorities, and fleet companies.[lxiii]
- Although government authorities have been promoting the use of domestically available Used Cooking Oil (UCO) as a feedstock to reduce import dependency on palm oil, the insufficient infrastructure for UCO collection deters market growth.[lxiv]

The situation is expected to improve, as a leading Indian petroleum company has announced plans to set up a biodiesel manufacturing plant using UCO (expected production capacity is 4 million litres per annum), with the help of a prominent OMC.[lxv]

India has set a target of achieving a 5 percent blending of biodiesel with diesel by 2030, as stated under the National Biofuels Policy announced by the Ministry of Petroleum and Natural Gas (MOPNG) in 2018. However, to meet its 2030 blending target, the country needs to substantially increase the production capacity of biodiesel to more than 3.45 billion litres.[lxvi] Higher production capacity will require sustainable availability of feedstock at stable prices. This will require setting up more plants using alternative feedstock, such as UCO.[lxvii]

OMCs will also have to focus on biodiesel procurement pricing models that reflect various macroeconomic factors (related to feedstock price volatility, diesel retail prices, etc.). They will have to periodically float an Expression of Interest (EOI) to procure biodiesel (produced from UCO) to different prospective suppliers across the country. Such initiatives from OMCs will support biodiesel suppliers to strengthen their production capacities, which is highly critical in achieving the set blending rate.

# Action items for value chain players

## Ethanol producers

### Driver

With central government mandate, OMCs will increase their ethanol procurement.

### Action points

- Evaluate procurement needs to achieve blending targets.
- Assess feedstock options, such as sugarcane or grains and make strategic arrangements.
- Fix a route for ethanol production (sugar molasses/sugarcane).
- Expand the distillation capacity of existing facilities per demand.

## OMCs/Fuel retailers

### Driver

Due to the low calorific value of ethanol, there will be more requirement of ethanol per station to achieve the desired blending levels.

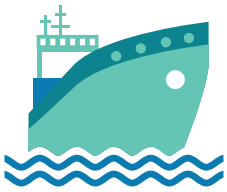
### Action points

- Evaluate existing refuelling stations and project the average tankage capacity augmentation by 2025.
- Streamline supply chain to minimise downtime.

# Chapter 5
# Green Hydrogen

GH is emerging as an eco-friendly fuel to power FCEVs. Its use is increasing in countries such as the US, China, Japan, and the European Union.[lxviii] Due to the high calorific value of hydrogen, automakers are exploring GH usage as a combustible fuel for Internal Combustion Engine (ICE) vehicles.[lxix] Companies also conduct feasibility analyses of using blends of Hydrogen and CNG (H-CNG) fuels for heavy-duty vehicles; these fuels have the potential to reduce carbon monoxide emissions by nearly 70 percent compared with neat CNG counterparts.[lxx] Besides, researchers have successfully split seawater to produce GH with 100 percent efficiency (without the need for any pre-treatment processes). Seawater, which is an almost infinite resource in India with long coastlines and abundant sunlight, can therefore become a natural feedstock electrolyte.[lxxi]

India is ambitious in its plans to use GH. There is a considerable push from the government to produce GH domestically, as it aspires to become a global hub. Considering the abundance of renewable energy sources (solar, wind, tidal, etc.), India has the potential to become a net exporter of GH in the next few years.[lxxii]

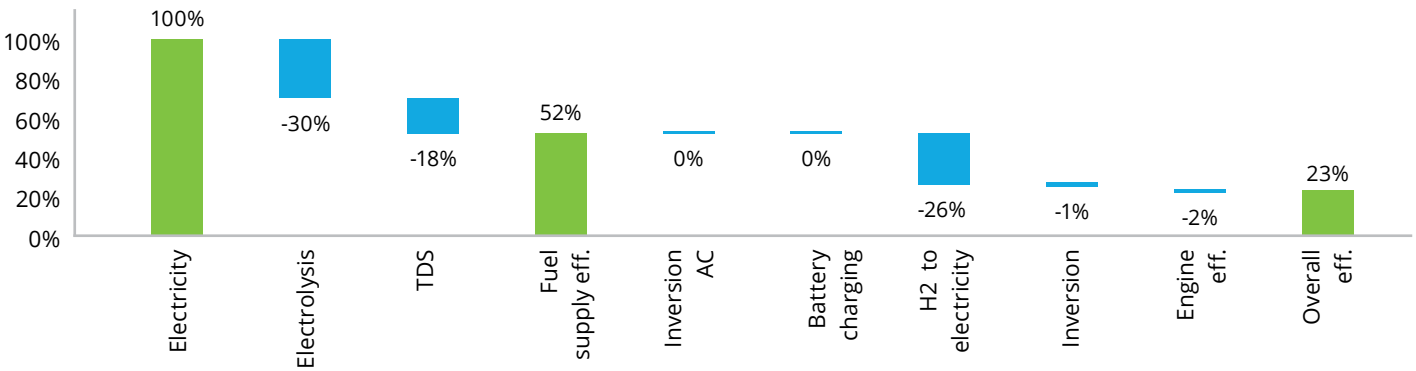


- With the launch of the National Hydrogen Mission in 2021, India has become one of the few countries that have declared their hydrogen plans.[lxxiii]
- In the Union Budget 2023–24, the government allotted INR 19,700 crore towards the mission to achieve a target of 5 million tonnes of GH production per annum by 2030.[lxxiv]
- The country plans to establish separate manufacturing zones, waive off inter-state power transmission charges for 25 years, and offer connectivity to electric grids to GH producers on priority to incentivise production.[lxxv]
- The Union Budget for FY25 has allocated INR 600 crore for the mission, a whopping 102 percent hike over the first-year allocation of INR 297 crore (from the total outlay of INR 19,700 crore) in the Budget 2023–24. This provides a continuous push towards the development of a GH ecosystem in the country.[lxxvi]

## Challenges

High cost (US$5–6 per kg) [lxxvii] and lower electricity conversion efficiency (20–30 percent)[lxxviii] are expected to limit the growth potential of GH in the near term.

**Figure 8: Alternative fuels – Energy conversion efficiency of hydrogen in FCEV**




Source: https://www.teriin.org/sites/default/files/2021-07/Report_on_The_Potential_Role_of_%20Hydrogen_in_India.pdf

Figure 8 highlights the electricity conversion efficiency of hydrogen gas required to power an FCEV. Production of hydrogen starts with an input of 100 units of electricity. During the process of electrolysis, 30 units of energy is lost; Transmission, Distribution, and Storage (TDS) results in an additional loss of 18 units. The hydrogen produced in this process is next introduced to FCEVs, wherein there are no energy losses during the following two stages: inversion AC (conversion of AC to DC) and battery charging. The subsequent phase involves the conversion of hydrogen into electricity that powers a vehicle's electric motor and incurs a conversion loss of 26 units. The final stages include inversion DC (conversion of DC back to AC) and engine efficiency (conversion of electric energy to mechanical energy) that incur minor losses of 1 and 2 units, respectively. The overall result is only a 23 percent conversion of the input electricity (100 watts) into mechanical energy powering the FCEV. The rest is being lost across the value chain during numerous energy conversions.

**Factors that add to the cost**

- To meet its GH target of 2030, the country would require at least 10 gigawatts of electrolyser capacity per year.[lxxix] In India, despite the abundance of natural resources, only a few companies manufacture electrolysers required to generate GH. India will have to initially rely on imported electrolysers, resulting in higher manufacturing costs and import bills.
- Hydrogen as a combustible fuel has low density.[lxxx] Hence, storing hydrogen as a gas requires high pressure and larger tanks, whereas compressed cryogenic tanks are needed to store hydrogen in liquid form.[lxxxi] This makes the storage and transportation of hydrogen quite challenging and cost-intensive, hindering its scalability as a combustible transport fuel in ICE vehicles.
- Producing H-CNG involves a cost-intensive electrolysis process of producing GH and an expensive high-pressure blending process for CNG.[lxxxii] Hence, despite being an eco-friendly fuel, the adoption rate of H-CNG has also been extremely limited worldwide.

## Market outlook

The Niti Aayog predicts GH demand in India to reach nearly 10 percent of global hydrogen consumption, amounting to 29 million tonnes by 2050.[lxxxiii] While the majority of the demand growth is expected from using hydrogen as an industrial feedstock and in chemical processes, heavy-duty trucking is anticipated to drive nearly 22 percent of the overall GH demand in India by 2050.[lxxxiv] However, this uptake is subject to advancements in technology merits, storage, refuelling time constraints, efficiency considerations, costs, and duty cycles.

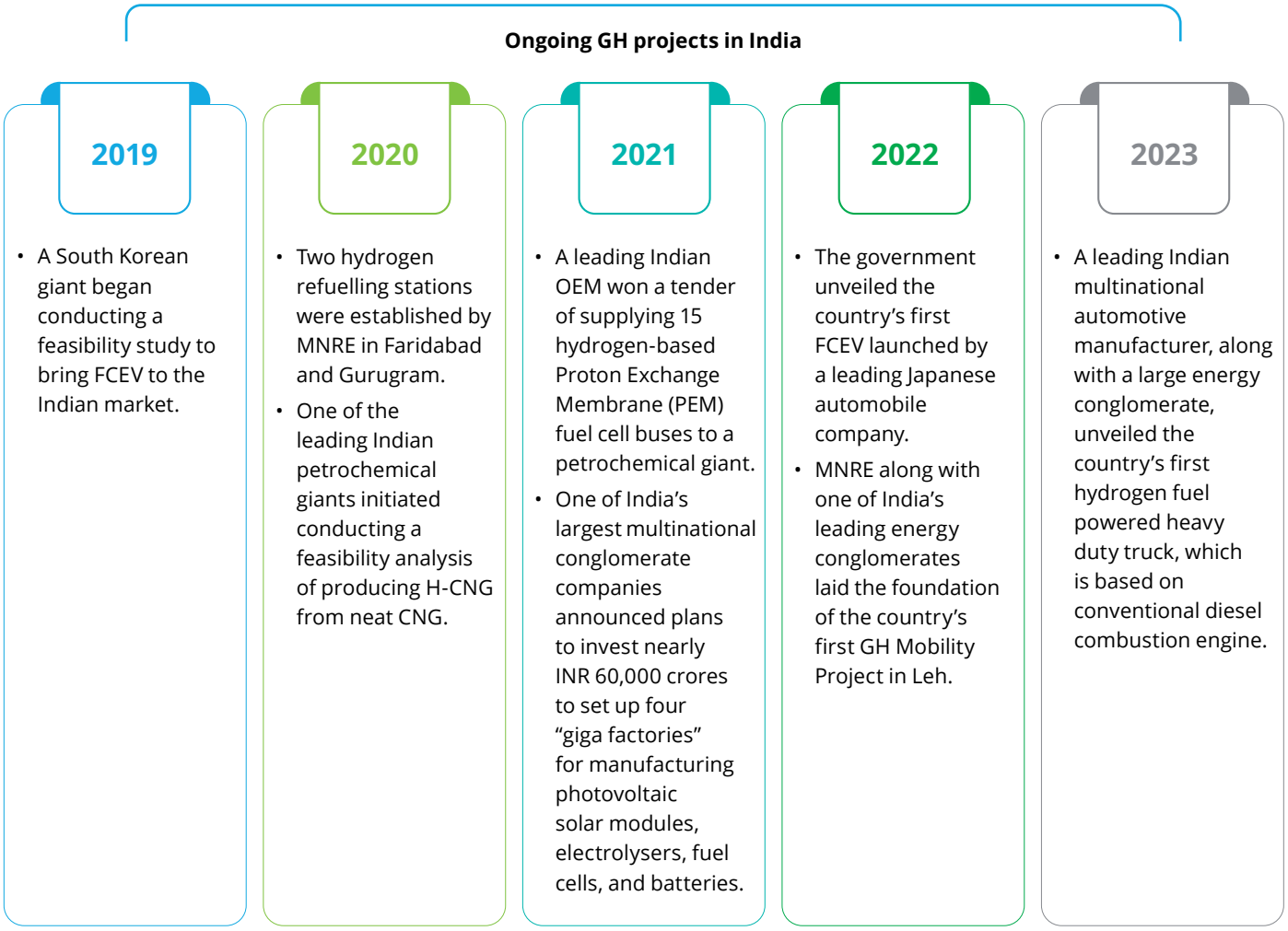
We believe FCEVs will initially face tough competition from lower-priced BEVs. However, as production cost reduces and technology enhances efficiency, the potential to offer greater energy security in the long run (as India can domestically produce GH for FCEVs) will result in a faster adoption rate over BEVs. This requires higher dependence on the import of batteries and other critical components/minerals. With technological advancements, hydrogen as a combustible fuel is expected to be more economical with a negligible carbon footprint.

The success of GH will be contingent on how quickly production costs can be reduced and fuel efficiency is improved. The cost will have to decrease to US$1–2/kg for GH to be cost-competitive than other alternative energy sources.

- Production Linked Incentive (PLI) schemes to promote domestic manufacturing of electrolysers must be scaled up to bring down prices.
- To make the FCEV technology cost-effective, the initial adoption of GH must be amongst specific fleets, such as heavy-duty, high mileage, long-range, and (currently) more polluting commercial vehicles (such as buses and taxis).
- Technological advancements in cost-effective storage and transportation of GH will be essential.

**Blue and grey hydrogen**

Until India achieves a green production process of hydrogen in its entirety (where the lifecycle has a negligible carbon footprint) or can reduce production costs of GH, energy companies are expected to increase the production of blue hydrogen generated from fossil fuels. Blue hydrogen is cheaper than its "green" counterpart. Moreover, unlike grey hydrogen (majorly used in India for industrial purposes), which is also produced from fossil fuels, blue hydrogen uses the Carbon Capture, Usage, and Storage (CCUS) technology. That is carbon neutral despite being produced from non-renewable sources.[lxxxv]




**Source:** Deloitte Research

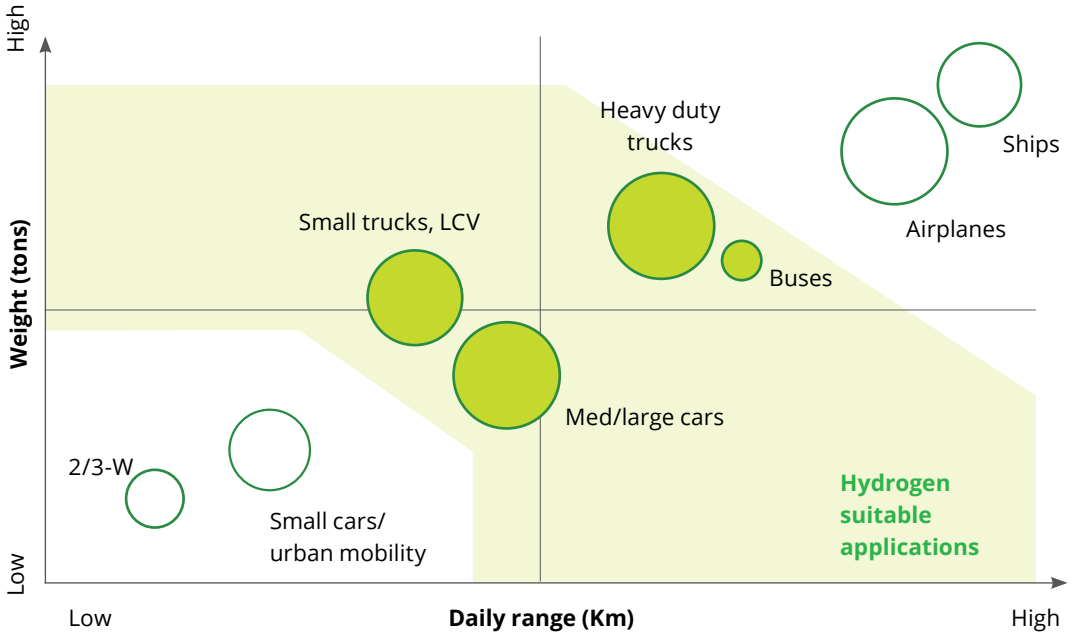
## Summarising our point of view

In comparison to BEVs, hydrogen vehicles have a higher energy density, shorter refuelling time and greater range.

All these characteristics make hydrogen highly relevant for vehicles requiring longer runs, shorter turnaround time during refuelling and heavier payloads.

From Figure 9, it is clear that the heavy-duty trucks and buses being the most appealing segments to stimulate the country's adoption of hydrogen for mobility.

**Figure 9: Suitability of hydrogen fuel across different segments**




Note: Size of bubble indicate relative energy consumption

Source: Harvard Kennedy School, FCH hydrogen roadmap Europe, Deloitte analysis

Source: Deloitte Research

From timeline perspective, hydrogen adoption will be at nascent stage over the next few years and will move into mass adoption over the next few decades:

| | Outlook 2030 | Outlook 2050 | Remarks |
|---|---|---|---|
| **Passenger cars** | ✗ | ✗ | **Less adoption** expected due to high cost and low efficiency |
| **Buses** | – | ✓* | **Moderate adoption** expected considering limited range and back-to-base refueling needs |
| **Heavy duty** | – | ✓ | **High adoption** considering longer daily run and heavy payload |

*For the bus segment, we understood that if BEVs are adopted at scale in the next five years, hydrogen may be permanently locked out from the sector

When we look at the technology perspective, we have two options for using hydrogen for mobility: FCEV and for use as fuel in ICE (H2-ICE). Per the current scenario, H2 ICE seems more likely than FCEV due to factors involving the initial acquisition cost and purity of hydrogen fuel. Globally, there has been some traction in the FCEV space, with Korea leading the adoption efforts.

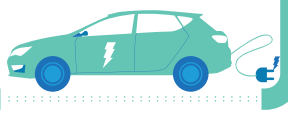
| Technology | Outlook 2030 | Outlook 2050 | Remarks |
|---|---|---|---|
| **Fuel Cell Electric Vehicle (FCEV)** | ✗ | ✓ | Less adoption in the early stages due to **high cost** and **high H2 purity requirement**; greater adoption expected once the technology matures and becomes cost effective (higher uptake expected in buses, light load and long-haul segments) |
| **H2 ICE** | –# | ✓ | **Lesser time-to-market** due to incremental investment required over existing manufacturing systems; **cheaper** than FCEV and accepts **low purity H2** (ideal for heavy load applications) |

# Chapter 6
# Electric Vehicles

Although electricity is not an alternative "fuel" option, a discussion on EVs cannot be ignored given their widespread usage across the globe as an alternate option for conventional fuels. EV adoption has been accelerating, more so after the pandemic as countries strive to achieve carbon neutrality and reduce dependence on fossil fuels. Despite disruptions in the supply chain during COVID-19, production and sales have remained strong. According to a recent IEA report, global EV sales reached more than 10 million units in 2022; BEVs accounted for nearly 70 percent. The growth was driven by favourable government initiatives and changing consumer preferences.[lxxxvi]

The growth outlook is strong as well. According to Deloitte research, annual sales of new EVs are expected to reach 31.1 million units by 2030.[lxxxvii] BEVs will continue to be the predominant segment accounting for nearly 81 percent (an estimated 25.3 million) of all new EVs sold, whereas Plug-in-Hybrid (PHEV) sales are expected to reach nearly 5.8 million by 2030.[lxxxviii]

A strong adoption momentum of EVs can potentially delay the adoption of alternative fuels in the near term. However, it will vary across countries and how innovation changes the transport system and energy alternatives

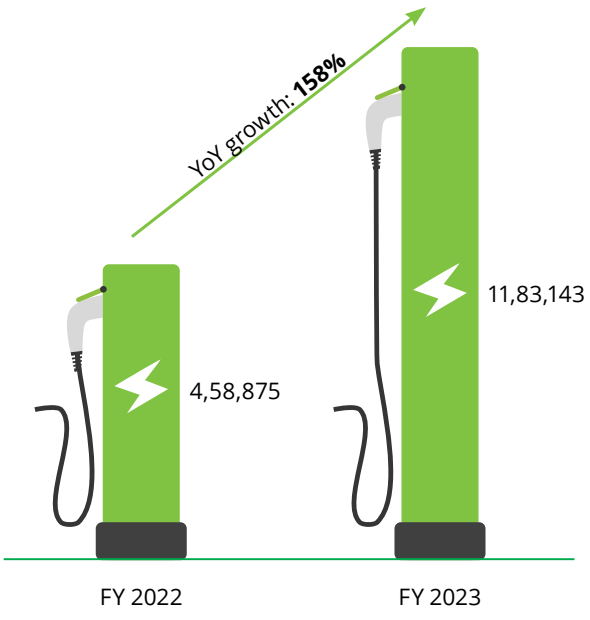


### Domestic market

In India, the EV market's growth will largely be contingent on policy support measures, supply chain investments, indigenous battery manufacturing, and charging infrastructure. These will create the desired cost-effective ecosystem.

The considerable push from the government has led to strong growth in this segment in India (Figure 10). The central government introduced the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME)-phase I scheme in 2015 with an initial outlay of INR 895 crore from 2015 to 2019 to make EVs affordable.[lxxxix] The scheme provided demand incentives of INR 343 crore for 2,78,000 EVs.[xc] FAME phase II of the scheme began in 2019 with an outlay of INR 10,000 crore for three years but was then extended to another two years in March 2024[xci] Under this scheme, approvals have been granted for 6,315 electric buses and 2,877 charging stations worth INR 5 billion in about 68 cities and 1,576 EV charging stations amounting to nearly INR 1 billion across 16 highways and 9 expressways.[xcii] Moreover, FAME II provides incentives of INR 10,000/kWh of battery capacity for all EVs, excluding e-buses. E-buses have been provided with a maximum demand incentive of INR 20,000 for every kWh.[xciii] Karnataka was the first state to introduce a comprehensive EV policy and has emerged as the hotspot for EV businesses in India, both in EV and EV ancillary manufacturing as well as an R&D hub.[xciv]

**Figure 10: Number of EVs sold in India (units)**




Source: Vahan Dashbooard and Deloitte Analysis

**Prominent Electric Vehicle Schemes by the Government of India[xcv]**

**2019**

- The cabinet approved the National Mission on Transformative Mobility and Battery Storage to create a Phased Manufacturing Programme (PMP) until 2024. The PMP will help set up large-scale, export-competitive giga plants for integrated batteries and cell-manufacturing in India, as well as localising production across the EV value chain.

**2021**

- FAME phase II, launched in 2019 for three years, with an outlay of US$1.36 billion, was extended until March 2024.
- The government approved an INR 26,058 crore PLI scheme for the auto and drone sectors to incentivise the manufacturing of advanced automotive technology vehicles and components. This scheme, coupled with the previously launched PLI schemes for advanced chemistry cells (INR 18,000 crore) and FAME (INR 10,000 crore), is intended to accelerate the adoption of EVs in the country.
- At the COP26 summit in Glasgow, India rolled out the website e-AMRIT which functions as a one-stop destination for information on EVs.
- The Ministry of Road Transport and Highways announced that battery-operated, ethanol-powered, and methanol-powered transport vehicles will be exempted from the commercial permit requirement.

**2022**

- The Ministry of Power issued revised guidelines on charging infrastructure to enable faster adoption of EVs.
- The NITI Aayog released a draft battery swapping policy (yet to be finalised) that will be valid until 31 March 2025, from the date of its notification. The policy is specifically designed for battery-swapping systems to be used for two- and three-wheelers.

**2023**

- In the Union Budget 202324, the government has announced customs duty reduction on lithium batteries from 21 percent to 13 percent and an extension of subsidies on EV batteries for another year.

**2024**

- In the interim Budget 2024–25, the government has launched a new scheme for bio-manufacturing aimed at promoting green growth and bolstering EV manufacturing and charging ecosystem.

## Challenges

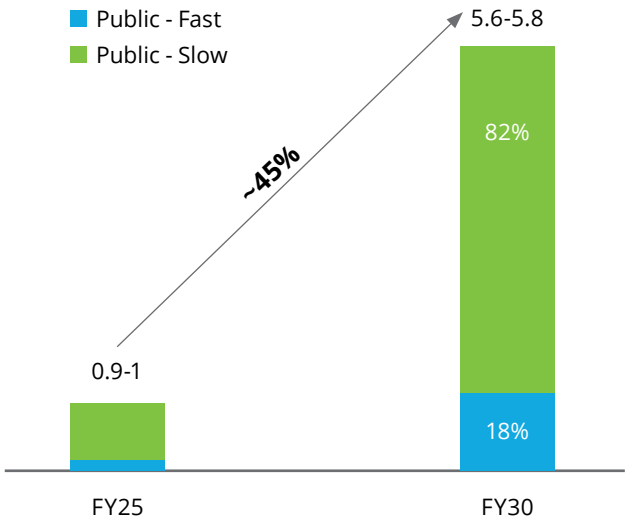
The only big hurdle for the growth of EVs in India is the high dependence on the import of lithium-ion batteries and other EV components. Import dependency increases vehicles' production costs and the sector's vulnerability to global geopolitics. At present, EVs are available in India at nearly double the price of their ICE counterparts.[xcvi] Other challenges include the low driving range (km/charge), limited product variants, grid challenges, and insufficient charging infrastructure.[xcvii] Besides, the increasing incidence of vehicle fires (due to inadequate testing of batteries for Indian conditions) adds to customer scepticism and hence slows down adoption.[xcviii]

## Opportunities

According to Deloitte's 2024 Global Automotive Consumer Study, nearly 42 percent of Indian customers cite a paucity of public charging stations as a concern and 43 percent cite the charging time as the primary concern while using EVs.[xcix]

As targeted by the government, when the EV sales penetration reaches ~30 percent by 2030, this will necessitate the deployment of approximately 5.6–5.8 million public charging infrastructure units by then. We must have a combination of slow and fast chargers.[c]

**Figure 11: Public EV charging requirement by 2030 (million units)**




Source: Deloitte analysis

Trends and opportunities within the EV charging sector are plenty, promoting innovation (Figure 11):

- **Supply and delivery:** India is targeting to achieve net zero by 2070; therefore, there is a larger focus on decarbonising power generation. It is highly anticipated that power supply to the EV charging stations will be through renewable energy plants and even promote onsite power generation.
- **Hardware:** At present, all the charging stations/chargers installed in India are unidirectional. However, as the charger penetration increases in India, there will be higher push towards installation of bi-directional chargers. OEMs can either decide on building in-house capability (through R&D) or go for acquisition/partnership route.
- **Software:** Software that would enable utility to perform active managed charging would find more customers. Similarly, software solutions that assist utilities in live network monitoring or enable aggregation of EVs to participate in the power market are expected to have considerable market in India.
- **Services:** With the increasing maturity of the EV charging segment, there would be new entrants, unique operating models, and complex business functionalities. Services related to providing an aggregated platform for all EV related payments could be seen as an emerging business in the country.

## Market outlook

We believe, favourable government initiatives will bolster EVs' growth in India in the next few years. According to Deloitte research, overall EV sales are expected to reach 16,44,000 units in FY25 and jump further to 1,53,31,000 units by 2030.[ci] However, growth in the EV segment will be spearheaded by the increasing use of electric two- and three-wheelers in the B2B segment for last-mile deliveries. This will drive the demand for battery swapping and other EV infrastructure.

Other than strengthening the infrastructure ecosystem, building domestic capabilities in EV R&D in various components and manufacturing and skilling people with the technological know-how of EV manufacturing for Indian conditions will be important. India will have to make efforts towards exploring alternative battery technologies (based on calcium and sodium ions) to reduce dependency on lithium ions.[cii] In addition, developing a regulatory framework for component manufacturers is imperative to ensure that best manufacturing practices and standards are integrated during vehicle production.

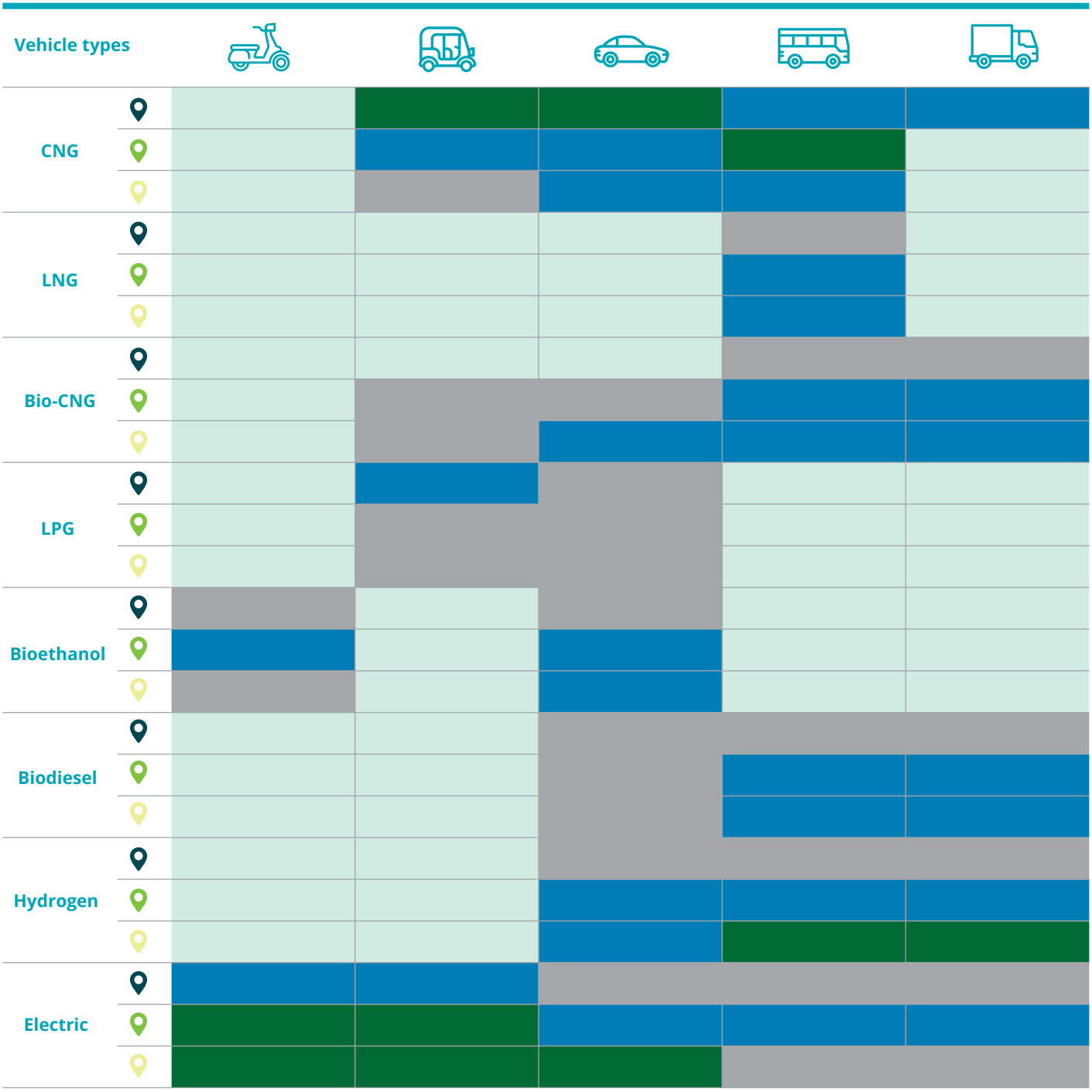
# Alternative fuels: Possible penetration across vehicle categories in India

**Per our research, here are some expectations about how the adoption of different alternative fuels will pan out (Figure 12).**

- **CNG-** accounts for the maximum share of the alternative vehicle fuel market at present. It will continue witnessing resilient demand over the next 10 years across most vehicle types, except for two-wheelers.
  - **Bio-CNG** will see increasing adoption in passenger and light-duty vehicles, but only in the long term.
- **LNG-** is expected to penetrate the bus and truck segments within the next five years because of its capability of providing a better driving range for the long haul.
- **LPG and biodiesel-** penetration is anticipated to remain lower because of high costs and limited feedstock availability.
- **Bioethanol-** use will increase for passenger cars due to favourable government initiatives (some penetration in two-wheeler vehicles for a short time).
- **Electric Vehicles**
  - The rising penetration of EVs in the country is expected to give tough competition to these alternative fuels over the next two decades, primarily in the two-to-four-wheeler segments.
  - EV adoption across long-ranged vehicles will rise in the medium term but will be capped because of trade-offs between battery weight and driving range limitations.
  - In addition, the battery manufacturing process and charging (using non-renewable energy for electricity) of BEVs are highly carbon intensive. As long as the grid mix for electricity production depends on non-renewable sources, EVs in India will continue to have a significant carbon footprint. Dependence on minerals and their extraction for battery manufacturing will reduce EVs' non-sustainability profile.
- **Green Hydrogen**
  - The government will push for an accelerated adoption of GH given the country's abundance of renewable energy sources and the benefits of reduced import costs of conventional fuels. However, it will remain contingent on the success of the government's efforts to bring down domestic production costs.
    - Several studies show that salt water, which is in abundance in India, can be used as feedstock to produce GH with reduced costs.
  - **Hydrogen-based FCEV:** While FCEVs will remain one of the prominent fuelling options for GH, improvements in energy conversion efficiency will remain pivotal in mass adoption.
    - Dependence on non-renewable energy sources to generate electricity will result in a non-zero carbon footprint in hydrogen-based FCEVs.
    - Besides, the overall life cycle of carbon emissions (associated with production, use, and disposal) of FCEVs is expected to be marginally higher than that of BEVs because of the former's inefficient energy-conversion process.
  - **Hydrogen-based ICE:** GH's direct consumption will be more suitable to replace heavy-duty internal combustion vehicles because this energy vector has a high calorific value and the best energy-to-weight ratio of any fuel. This will enable a longer travel range and reduced range anxiety amongst users.

**Due to direct consumption, hydrogen-powered internal combustion engines will have significantly lesser lifecycle emissions and higher adoption compared with FCEVs and BEVs amongst the heavy-duty segment in the long run.**

**Figure 12: Alternative fuels – Penetration across vehicle categories in India**



# Scenario analysis: Likely adoption of alternative fuels in the long term

**We believe the increasing emphasis on shifting towards cost-effective, sustainable alternative energy sources will reduce the use of petrol and diesel after 2030 (Figure 13).**

1

The adoption of **natural gas and LPG** will increase in the near future. However, we anticipate it to peak by 2040 and start decline within a decade due to high competition from less import-dependent alternatives with better sustainability profiles becoming increasingly available.

2

The penetration of **EVs** will continue to rise in the medium term, driven by favourable government norms and falling production costs. It is expected to witness significant dominance until 2040–45. However, we expect the adoption to decline thereafter with greater availability of greener fuel options (rise of green hydrogen) and advancements in technology to improve their fuel efficiency.

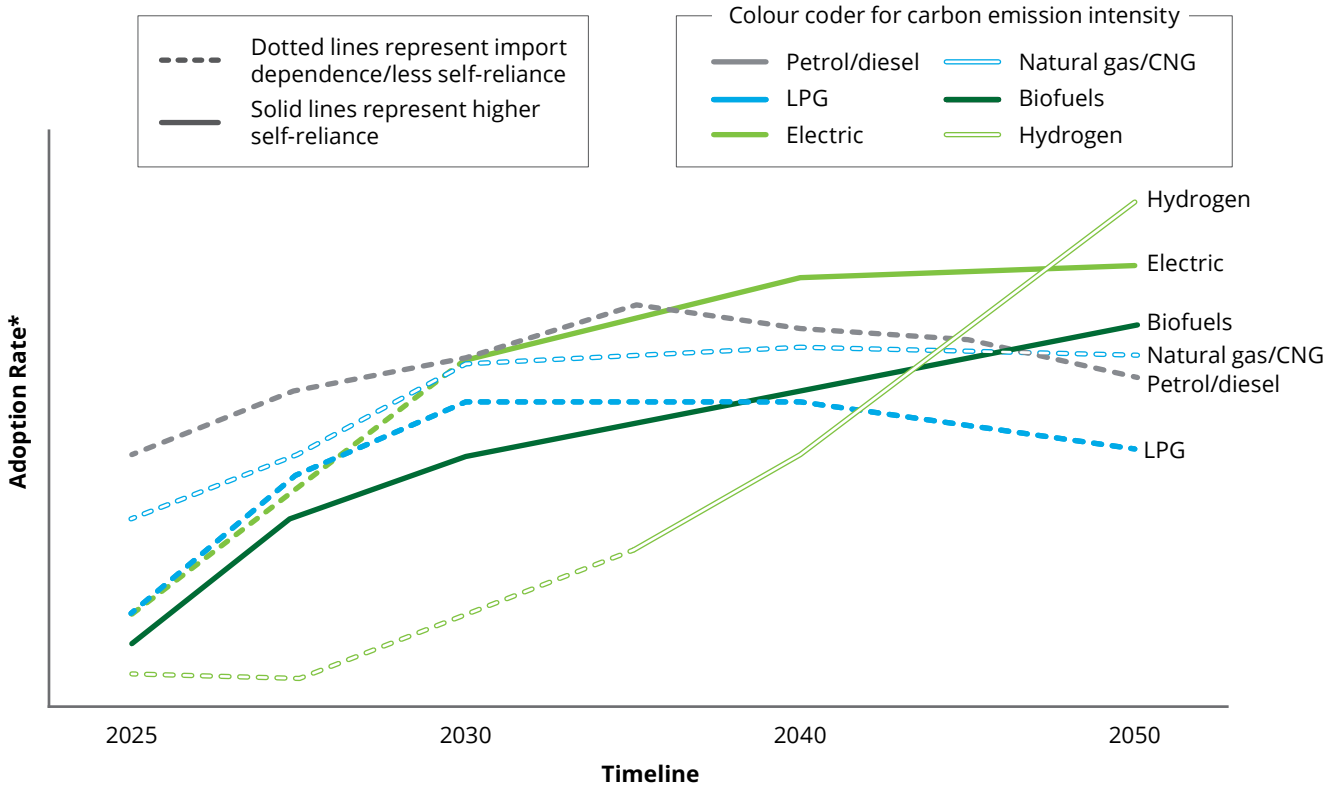
3

Despite being at a relatively nascent stage, domestic production of **biofuels and GH** may rise substantially, with the adoption biofuels seeing a sharp rise from 2025. The government's policy support and technological advancement to improve fuel efficiency and lower costs will be critical. This will result in a significant jump in the adoption of these fuels.

4

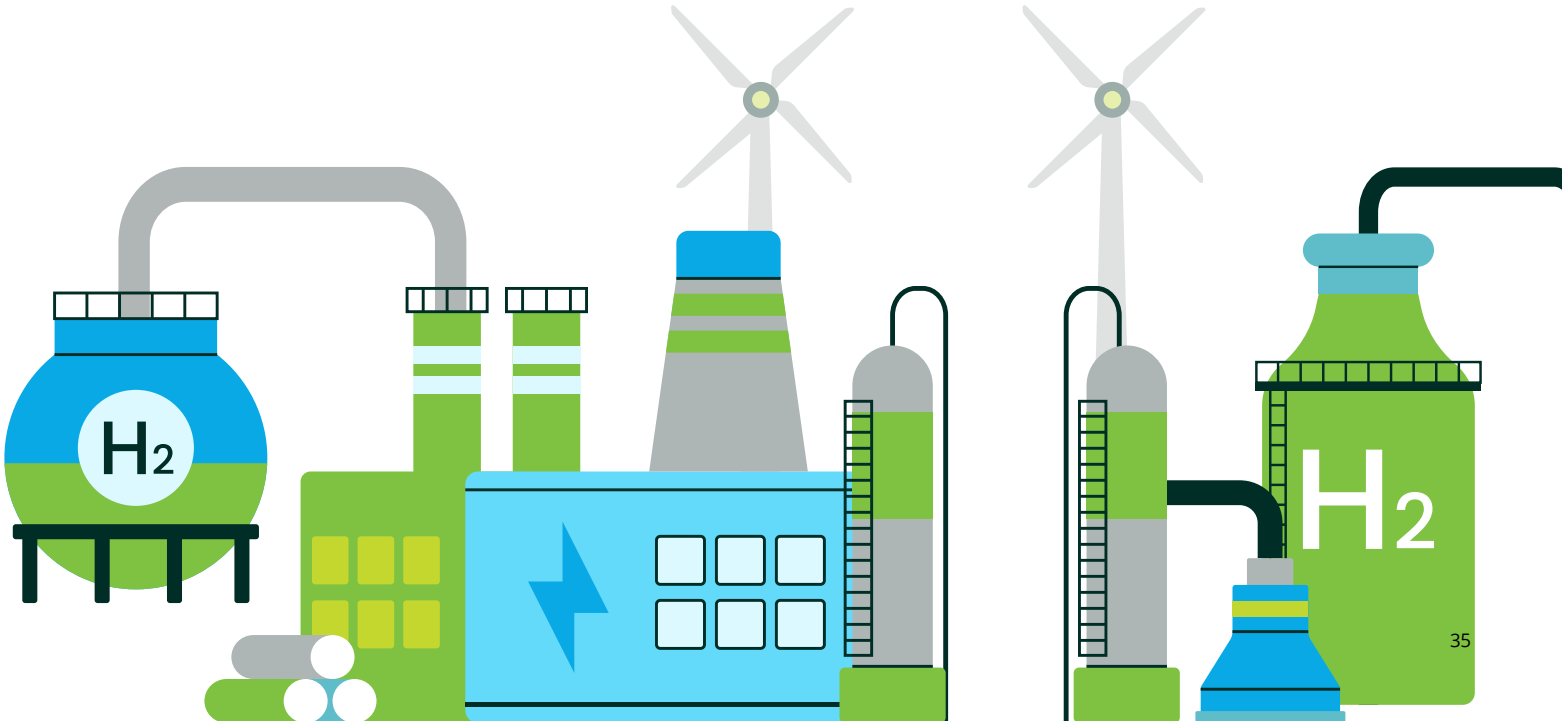
With the establishment of multimodal logistics parks, demand for larger trucks and heavy-duty vehicles (to lower freight cost on a per tonne per kilometre basis) will increase. **GH** is expected to see accelerated adoption amongst FCEVs from the mid-2030s due to falling production costs. *Thereafter, in the long term, GH as a directly combustible fuel will see an increased adoption amongst heavy-duty vehicles over FCEVs and EVs with the expected reduction in storage and transportation costs driven by technological advancements.* Many more auto companies will explore ways of improving its fuel efficacy and using it directly in ICE vehicles. Encouraged by a few recent successes, we believe that GH, especially as a combustible fuel, will outpace EVs in the long run.

**Figure 13: Alternative fuels – Overall adoption in India in the long term**




*Weightage in total transport consumption

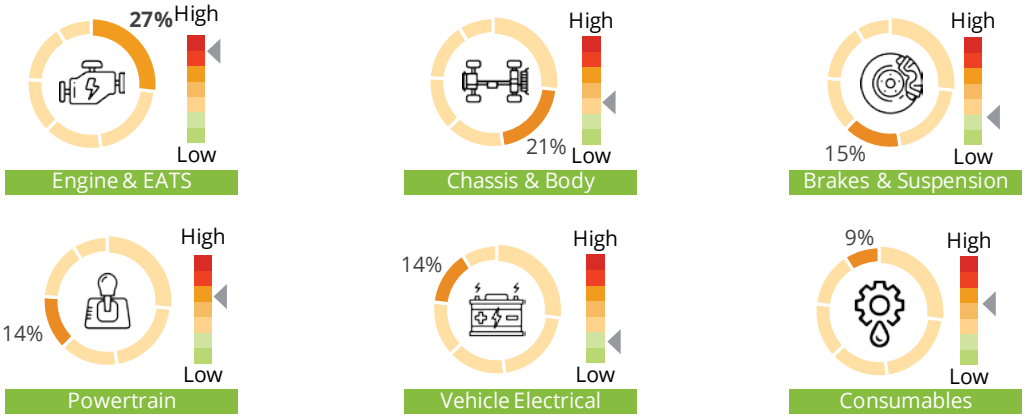
**Source:** Deloitte Research



# Impact on component manufacturers: Agile approach in the long term

Per Figure 13, no single solution or fuel can be the way forward for the entire automotive industry. Each segment has certain inherent requirements in the near term and long term. OEMs and component manufacturers must be agile in their strategy and planning. Diversifying the product portfolio will be necessary to be relevant in this fast-evolving market. Although not each component will go through major changes after the adoption of alternative fuels, the powertrain and fuel systems will be most affected. Figure 14 highlights the potential impact of alternative fuels across different component groups.

**Figure 14: Impact of alternative fuels on ICE component**




**Source:** Deloitte Research

With the progress in the alternative fuel segments, IC engines have been facing a huge impact. This is particularly true for EVs and FCEVs, where ICE engines are being replaced with electric traction motors, fuel cell stacks, and batteries to produce energy. On the contrary, in the case of biofuels and natural gas, the impact on ICE and the fuel system is minor, although suitable changes are needed to accommodate these fuels.

As the chassis and body components are least affected by fuel choices, technological advancements are being incorporated to reduce chassis weight and improve the overall durability of vehicles. For instance, lightweight materials, such as aluminium, carbon fibre composites, and high-strength steel alloys are being used in several automotive applications. This transition has a higher impact on EVs and FCEVs as the weight of the vehicle directly correlates with the range and efficiency.

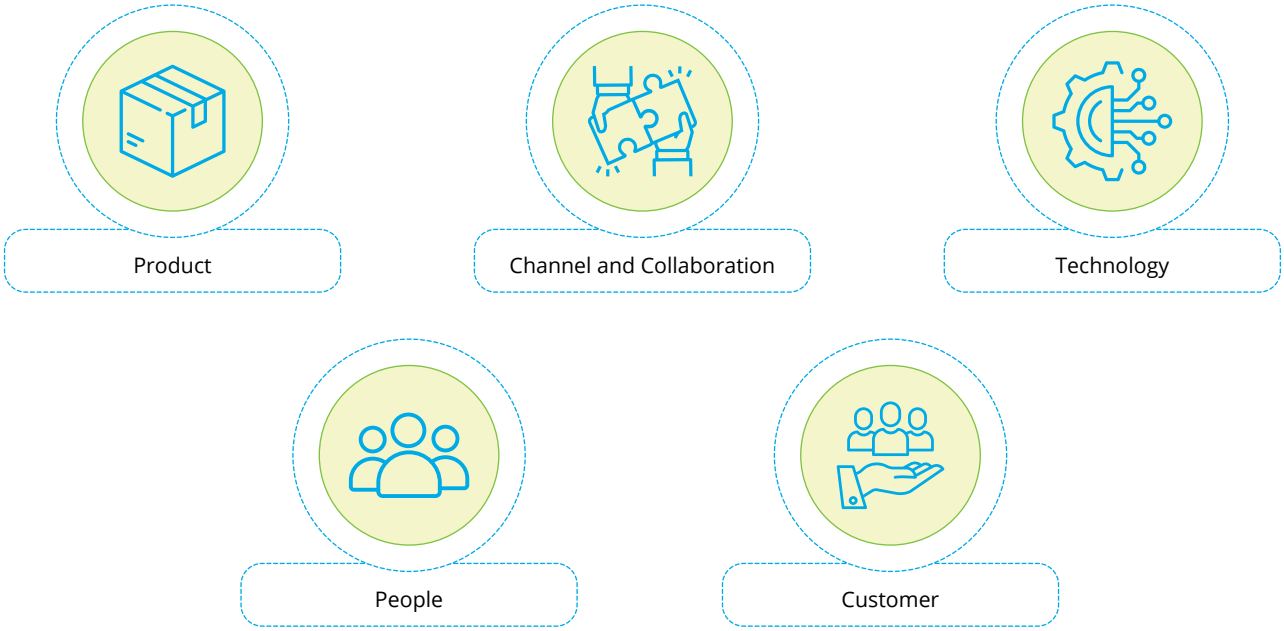
Technological transition in the brakes and suspension segment, although slow, would soon be evident with a switch from conventional friction braking to regenerative braking in BEVs and FCEVs. The suspension system will remain standard irrespective of the fuel choice and technology improvements. For example, suspension arms as a one-piece stamping will further reduce weight and cost.

EVs are more efficient in terms of energy generation. An EV converts more than 50 percent of the electrical energy from the grid into power at the wheels, whereas gas-powered vehicles manage to convert only 17–21 percent of the energy stored in gasoline.[ciii] Multi-speed transmission would soon not be required due to consistent torque (at a given RPM) from electric motors. In addition, technologies such as e-axle will completely replace transmission systems in the future.

Due to rapid technological developments, battery pack prices have dropped from US$1183/kWh in 2010 to US$156/kWh in 2019. The prices are further expected to drop by 50 percent by 2030.[civ] Some of the largest lead-acid battery brands in the country have repositioned themselves as "energy and mobility" players in the industry, as they seek to expand their portfolios to cater to EV demand and other home energy solutions.[cv]

Consumables form a big chunk of the spare market and a key revenue source for suppliers and OEMs. With the adoption of alternative fuel, this space will see significant disruptions. Although biofuels and natural gas options require consumables similar to ICE vehicles, it is different for EVs and FCEVs. For example, part categories, such as engine oil, air filter, and transmission oil will have a high impact on EVs/FCEVs. However, at the same time, new avenues, such as lubricants for vital electrical components and coolants for battery packs will open. Standard consumables, such as gear oils for differentials, brake fluids, and grease will also remain in demand irrespective of the fuel type.

**Apart from just product diversification and foraying into adjacent sectors, component players must also focus on some key operational dimensions.**




**Critical product identification**

In the long run, identifying a “hero” product is important for manufacturers to mitigate the risk of going out of business. For example, the “hero” product for a battery manufacturer could be EV battery packs and associated components. This can be seen as a low-hanging fruit, as it does not require the development of a separate customer base.

**Partnerships for ecosystem development**

Component players must be agile with rapid ecosystem development; the shift from being just a product company to a product and service company is required to be relevant in the long run. To accomplish this, players must create an ecosystem of partnerships. For example, OEM and tech companies collaborate to create a "software-defined vehicle". This will cater to new on-demand services and enable continuous upgrades to the car by building on the existing automotive OS and cloud technology.

**Data-enabled services and solutions**

Auto component players will embrace data-enabled services and solutions to enhance their offerings and provide value-added services to customers. These services include over-the-air updates, remote diagnostics, connected vehicles, and component-level performance reporting.

**Capability development**

Enhancing core manpower skills is important to remain relevant with evolving technologies and changing demands. Such skills will include electronics, mechatronics and calibration, advanced materials, and additive manufacturing, further expanding the technical expertise of component manufacturers in software, big data, and digital and analytics.

**Identifications of potential customers**

Auto component suppliers must expand their product portfolios and foray into adjacent industries, such as aerospace, defence equipment, railways, power generation equipment, and EV components.

# Impact on the customer: Total Cost of Ownership

The emergence of alternate fuel powertrains brings with it an aspect of Total Cost of Ownership (TCO) (Figure 15), which is a critical factor in the buying and ownership journey of the customer. According to Deloitte's 2024 Global Automotive Consumer Study, 63 percent of customers are going for EVs due to lower fuel costs and more than half of them (56 percent) see lower maintenance cost as another factor to opt for alternate fuels.[cvi]

**Figure 15: Alternative fuels – Total cost of ownership comparison between fuel types**

| | ICE | CNG | EV |
|---|---|---|---|
| 2023 | Rs.10-11/km | Rs.9-10/km | Rs.10-11/km |
| **Purchase cost** | ↑↑ | ↑↑ | ↑ |
| **Financing** | ↔ | ↔ | ↓ |
| **Fuel Prices** | ↑ | ↑↑ | ↔ |
| **Servicing Cost** | ↔ | ↔ | ↓ |
| **Insurance Cost** | ↔ | ↔ | ↓ |
| 2030E | Rs.14-15/km | Rs.12-13/km | Rs.10-11/km |

When we look at the fuel prices, petrol prices have grown at a CAGR of ~6 percent since 2018 and are expected to increase TCO. While CNG does offer alternatives to petrol and diesel, CNG prices have increased at a CAGR of 10 percent since 2018 and are expected to increase TCO in the future. Contrary to this, electricity prices are largely expected to remain constant due to increased focus on renewable sources.

Along with the lowered fuel cost, with increased adoption of EVs, the financing and insurance costs are expected to decrease over time and mitigate high acquisition costs. While subsidy might help in the short term, in the long run, operating costs are going to be the game changer for EVs and other alternate fuels.

# Impact on the Original Equipment Manufacturers: Roles across the lifecycle

With the growing acceptance of alternate fuel vehicles, OEMs will have to plan timely interventions and technology advancements across the product lifecycle to stay ahead of the curve.

## Vehicle sale

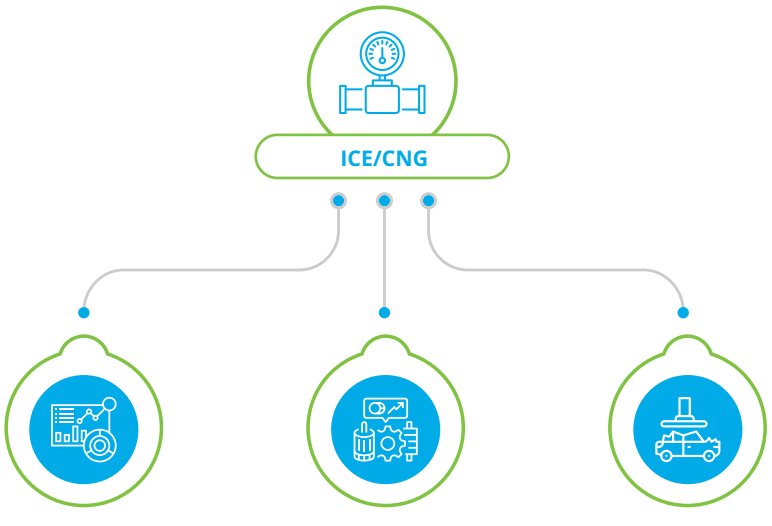
We foresee a shift from an ownership to a usage mindset in Indian consumers, making dealer networks less significant and necessitating the development of newer channels and flexible usage-based product offerings. According to Deloitte's 2024 Global Automotive Consumer Study, 60 percent of the customers are ready to move into a subscription model of ownership. Automakers will need to make a calculative decision on whether they plan to invest in newer powertrains or utilise the traditional landscape,

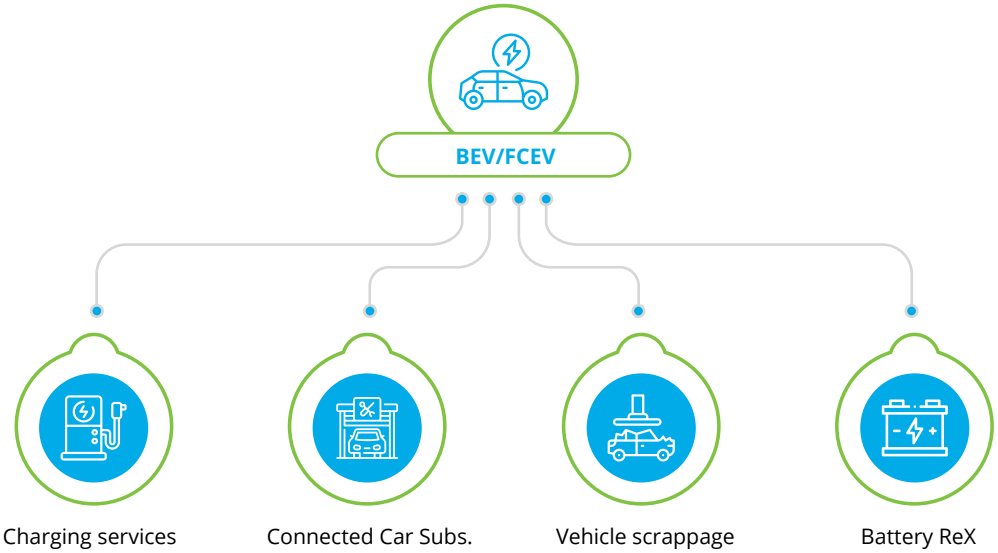
- Invest in the emerging powertrains and D2C business model and enjoy a first-mover advantage.
- Continue the traditional business model and await ecosystem development.
- Initiate ecosystem development followed by necessary investment.

## In-life services

In-life services will witness the introduction of connected tech leading to data monetisation opportunities for the OEM. The primary challenge for the stakeholders will be to build a habitual services model for the consumers, which will result in consistent monetisation.

By 2030, traditional profit pools, such as spare part sales and software updates will still exist. However, with the growing emergence of alternate fuel powertrains and connected vehicles, other in-life services such as over-the-air updates, battery refurbishment, and charging services will occupy a major chunk of revenue.






The increasing adoption of EVs and FCEVs will result in a shifting of the profit pool, with in-life services contributing as much as 30–40 percent compared with the 10–15 percent contribution in the traditional profit pool. Unique proposition, connected-tech-based offerings, relevant partnerships, and a strong connection with the consumers will be the key to driving the competitive advantage and emerging as a leader in the auto landscape.

## End-of-life services

End-of-life services include procurement followed by re-sale of the vehicle for subsequent ownership cycles. Multiple ownership cycles present an opportunity for the dealer to earn additional margins. In addition, the new policies, such as vehicle scrappage and Extended Producers Responsibility (EPR) will necessitate focus and effort from OEMs and dealers.

With increased EV penetration, OEMs will need to establish a strong system for tracking and tracing batteries and reusing and recycling the same. Dealers should have an aggressive procurement of used cars to monetise scrappage service at the end of life, generating an additional revenue source and presenting an opportunity to serve the same customer again.

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# Connect with us

**Rajeev Singh**
Partner and Consumer Industry Leader, Deloitte AP
**rpsingh@deloitte.com**

**Rajat Mahajan**
Partner, Consulting
Deloitte India
**rajatm@deloitte.com**

**Anish Mandal**
Partner, Consulting,
Deloitte India
**anmandal@deloitte.com**

**Atul Jairaj**
Partner, Consulting
Deloitte India
**ajairaj@deloitte.com**

# Contributors

**Prashanth Nutula**

**Sayantan Sengupta**

**Nitesh Nawge**

**Dr. Rumki Majumdar**

**Vishwas Kashyap**

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