Knowledge Paper on Alternative Fuel and Its Impact on the Skill Required

KPMG in India

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Foreword ASDC

India is anticipated to be the third-largest automobile market in the world in terms of volume by 2030. There has been a shift in the consumer preferences for the alternative fuels to curb environment hazards. Additionally Central and state governments are also driving the agenda of increasing usage of EVs and other alternative fuels. The automobile manufacturing is aligning itself to produce vehicles which can operate on alternative fuels. The automobile sector across the globe is witnessing evolution driven by factors such as environmentally sustainable mobility solutions, changing consumer preference, increasing technology penetration and emergence of industry 4.0 technologies. While on one hand, such factors are driving the industry to gear up for efficiency and on the other hand, it is leading to the genesis of innovative solutions such as electric vehicle, adoption of alternative fuels, etc.

The Indian automobile industry is also witnessing similar transformation. Such transformations are expected to pave the way for change in the production of vehicles, newer business models and service delivery channels. The sector is currently providing 23.8 million direct and indirect employment, which is likely to grow to 37 million by 2022.

To sustain the growth trajectory of the sector, it is imperative that the sector needs a future ready workforce. Several innovation and technology penetration measures in the automobile sector are generating the need for upskilling and reskilling of the existing workforce. Existing skilling ecosystem in India needs to gear up to be able to bridge the demand and supply gaps, by ensuring access to industry relevant courses and their quality delivery across pan India. While the training capacity creation to support bridging the demand-supply gap is essential, it is equally critical that government, industry, TVET providers and academia collaborate to formulate lifelong learning pathways for the existing and potential workforce in the sector.

This paper attempts to delve deeper into evolutions and trends in the usage of alternative fuels in the automobile sector. The paper attempts to map the value chain of alternative fuels and the skills which will be required in future. The recommendations prescribed in the paper shall support in planning and delivery of training capacity augmentation initiatives.

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Foreword KPMG in India

In the last decade, we have seen that the pollution across various Indian cities has been rising continuously wherein these cities now occupy 63 spots among the top 100 polluted cities in the world. A careful analysis of the factors contributing to such high pollution across these cities leads us to conclude that a major contribution is from our ever-growing number of automobiles. The Central Pollution Control Board (CPCB) estimates that 70 per cent of the carbon emissions and 30 per cent of suspended particulate matter (SPM) in metropolitan cities are caused by automobiles[1]. This has led to systemic changes in the government policy across Centre as well as the state, wherein the focus has now shifted to move towards use of alternative fuel. This shift would help us in meeting two objectives wherein we would be able to combat the issue of rising pollution across our cities and help us in controlling the import bill by decreasing our reliance on imported crude oil.

This paper details various alternative fuels which are available in the market – be it biofuels, CNG, hydrogen or electric vehicle. It tries to analyse various factors driving the change, how some of the developed nations have embraced the change along with some key best practices.

The shift to alternative fuel would have an impact on the skill ecosystem wherein newer job roles and opportunities would emerge helping India leverage its positive demographic dividend. It's imperative for us to embrace this change and refocus our reskilling and upskilling programmes to meet the domestic and international demand created by usage of such alternative fuels. This would help India become the automobile capital of the world. The paper also enumerates some recommendations for all the stakeholders including the government, automobile associations, industries and various TVET players as a joint focus is needed for us to achieve the reskilling and upskilling of our existing workforce to cater to the domestic and international demand.

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1. Review of Vehicular Pollution in India, Chetana Khandar and Sharda Kosankar, Journal of Advanced Laboratory Research in Biology, July 2014

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Abbreviations

ACMA	Automotive Component Manufacturers Association
AEDP	Alternative Energy Development Plan
ASDC	Automotive Skills Development Council
CAGR	Compound Annual Growth Rate
CPCB	Central Pollution Control Board
CO2	Carbon dioxide
CNG	Compressed Natural Gas
EV	Electric Vehicle
ECU	Electronic Control Units
FDI	Foreign Direct Investment
FADA	Federation of Automobile Dealers Associations
FAME	Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles
GDP	Gross Domestic Product
GOI	Government of India
IESA	India Energy Storage Alliance
ICE	Internal Combustion Engine
ITI	Industrial Training Institute
LPG	Liquified Petroleum Gas
MNRE	Ministry of New and Renewable Energy
NHEQF	National Higher Education Qualification Framework
NSQF	National Skill Qualification Framework
NULM	National Urban Livelihood Mission
PLI	Production Linked Incentive
PMKVY	Pradhan Mantri Kaushal Vikas Yojana
R&D	Research and Development
SPM	Suspended Particulate Matter
USA	United States of America
SIAM	Society of Indian Automobile Manufacturers
TERI	The Energy and Resources Institute

Executive summary

The Indian automotive sector is one of the biggest contributors to the country's GDP and is responsible for providing employment to more than 37 million people. It is one of the fastest growing sectors in the country which is growing at a CAGR of 11.3 percent and is expected to jump from its position as the world's fourth largest vehicle market to the third largest vehicle market in the coming decade[2]. Such advanced strides in the sector point towards a positive scenario in terms of generation of job opportunities in the years to come.

Although the sector is currently largely dependent on traditional fossil fuels such as diesel and petrol, a shift to alternative fuels has been on the rise since the decade. This is largely driven by changing consumer sentiments, awareness about the environment and the harmful effect of greenhouse gases generated by fossil fuels, improvements in the standards living of the people, the rising fossil fuel prices, as well as the benefits provided by the adoption of alternative fuels.

Electric Vehicles or EVs have especially seen a huge spike in demand in the last three years. With India becoming a signatory to important climate change agreements such as the Paris Agreement and pledging commitment to environmental protection, alternative fuels and green vehicles are expected to pick up pace, both in terms of production and sales. This would lead to the generation of more jobs in the automotive sector which would require myriad sets of skills. The skill requirements would therefore be of two types – reskilling and upskilling of existing skills to comply with the green job requirements as well as skilling the workforce in new skills that would come with the alternative fuels, especially EVs.

EV, biofuel, CNG and hydrogen fuel are expected to lead the alternative fuel demand in the near future with the change broadly driven by EV. Additionally, apart from CNG, other fuels have different value chain process which would require different types of skills and different types of workforces. Depending on the alternative fuel chosen, skilling programmes would be required to tailor their courses accordingly. The EV market alone is expected to generate about 65 million jobs by 2030 which would require upskilling of workforce already skilled in ICE and additional skilling for the completely new jobs that would be generated by the sector such as battery manufacturing, charging infrastructure maintenance, end of life services as well as recycling and disposal. Similarly, the biofuel, CNG and hydrogen fuel markets are expected to create jobs in the domain of production, storage, transportation as well as energy conservation and utilization. Each of these domains would require training in specific skills such as operation of boilers and shredders, processing of biochar, operation of balers and technicians skilled in handling ammonia, as well as researchers and developers for fuel cell development.

Transition to alternative fuels such as biofuels, green hydrogen is expected to create job roles, especially for rural population. Hence, upskilling-reskilling initiatives and related livelihood need to be targeted towards rural India. Additionally, activities related to agriculture allied fuels such as green hydrogen and biofuels have limited aspirations among the workforce. Hence, targeted information communication campaigns will be required to address the awareness about the potential of such job roles.

2. Automobile Sector, Invest India, Nehal Bajwa, September 2022

In order to leverage the opportunities being created by these alternative fuels, steps are necessary to be taken to move forward in the right direction. This paper provides the following stakeholder-wise recommendations to utilise these opportunities to their maximum potential:

To the government

1. Providing greater incentives to green vehicles
2. Encouraging more production linked incentive (PLI) schemes in the green automotive sector
3. Promote future of work by establishing a hybrid governance model for vocational and higher education
4. Enhanced access by subsuming automobile skill training under the national skilling programmes
5. Institutionalise industry-institute collaboration through internships, apprenticeship, and faculty exchange programmes
6. Targeted information communication campaigns - especially focused on rural India - to increase the awareness of alternative fuel related job roles.

To the industry and skill development councils

1. Capacity building through industry collaboration, especially industries operating in alternative fuel sectors
2. Develop course on emerging job profiles and make them available on open-source platforms such as SWAYAM and Bharat Skills Portal
3. Embracing the dual system of training to provide practical experience to students on alternative fuel technologies
4. Regulating and standardising skills to ensure scalability and inter-operability of learning and content
5. Involving women and persons with disabilities in the automobile skilling domain
6. Launch dedicated programmes to recognise and up-skill workforce with transferable skillset in the existing ICE sector.

To vocational education institutes and ITIs

1. Imparting early vocational education focusing on alternative fuels
2. Developing credit-based courses in collaboration with educational institutes to enable credit transfers for all the students across higher education and vocational education ecosystem
3. Upgrading the ITI ecosystem and promote trades addressing job role requirements in alternative fuel segment.

01 Introduction

India is the world's fourth largest vehicle market and manufactures more than 22.9 million vehicles annually. The contribution of automobile industry towards India's Gross Domestic Product (GDP) is 7.1. per cent and towards GDP contribution towards the manufacturing activities is 49 per cent. The sector is valued at USD222 billion and contributes 4.7 per cent to the nation's total exports[1]. It is also one of the few sectors in the country that allows 100 per cent Foreign Direct Investment (FDI). It is estimated that the automobile industry is supporting 37 million direct and indirect jobs in India. By 2026, the sector is predicted to employ 65 million people[2].

During April 2021 to March 2022, the industry produced a total 22.93 million vehicles including passenger vehicles, commercial vehicles, three wheelers, two wheelers, and quadricycles. Two-wheelers and passenger cars dominate the market share with percentage contribution of 76 per cent and 17.4 per cent respectively. India currently enjoys a strong position in the global heavy vehicles market as largest tractor producer, second-largest bus manufacturer, and third-largest heavy trucks manufacturer in the world.

The Indian automotive sector has witnessed consistent growth over the past two decades and is projected to reach USD251 billion[3] by 2026. The Indian automobile industry in India is projected to grow at a CAGR of 11.3 per cent till 2027 in a span of 6 years from 2021. Innovation in automobile industry such as electric vehicles, are expanding their penetration in India with threefold increase in sales at 4,29,217 units in 2022 compared to 1,34,821[4] units in 2020. Electric vehicle segment in India is expected to grow at CAGR of 49 per cent between 2022-2030.

Average household income tripled, rising to $18,448 in 2020 from $6,393 in 2010

The industry is primarily producing vehicles, which are running on two fuels - gasoline and diesel. While the transportation industry uses almost all of the gasoline produced, it also uses 70 per cent of the diesel produced. Of late tremendous focus has been given to the reduced dependence on imports of crude oil and reduction in the impact of CO2 and other harmful emissions.

1. Automobile Sector, Invest India, Nehal Bajwa, September 2022
2. Government Aims to Raise Auto Sector Contribution to GDP, Job Creation: Gadkari, Business Standard, August 2021
3. Automobile Industry in India, India Brand Equity Foundation, September 2022
4. Federation of Automobile Dealer Association (FADA), accessed in September 2022

The automobile industry is witnessing tremendous change driven by factors such as adoption of technology in vehicles, advent of electrified vehicles and growing awareness of environmental/pollution hazards promotes the adoption of alternative fuel vehicles. The alternative fuels provide option to replace conventional fossil fuels, which also offer chances to lower oil import costs, reduce pollution, and create fuels sustainably. These factors coupled with favourable government policies is going to drive the market growth and will trigger the need for upskilling and fresh skilling of the workforce.

This paper attempts to delve deeper into the emerging trends in the automobile industry, to carve out pathway for skilling of the workforce, aligned to the evolving industry needs. The key objectives of the paper are enlisted in the figure below:

- Assessment of factors driving the change in the automobile industry
- Enumeration of existing landscape of alternate fuels in India
- Assessment of potential impact of the evolving changes on skilling needs of the workforce
- Strategies to prepare Indian workforce for the future

02

Factors driving the change in automobile industry in India

By 2030, India is anticipated to be the third-largest automobile market in the world in terms of volume. The growth trajectory and innovation in the automobile industry in India have been influenced and driven by several factors. Some of these factors are described below:

a. **Increase in the average household income:** In India, there were 121 million middle-class households as of 2016, with annual gross incomes ranging from USD7,700 to USD15,400[1]. By 2025, this number is projected to increase to 140 million families, making the middle class in India a sizable portion of the country's population in terms of wealth and level of living. Improvement in household income is an indicator indicating improved purchasing power of the people.

b. **Youngest nation by 2025:** As per the Census Commissioner of India, people under the age of 25 years constitute 46.9 per cent of the country's population. Rising middle class income and a sizable youth population will result in increased demand for vehicles.

c. **Conducive policy environment for industry growth:** Government of India (GoI) introduced several policy initiatives for creation of conducive regulatory environment and availability of financial resources to provide impetus to the industry.

- The Indian government announced a PLI programme in September 2021 for vehicles and auto parts valued at INR25,938 crore (USD3.49 billion[2]). By 2026, this programme is projected to attract investments totaling more than INR42,500 crore (USD5.74 billion) and generate 7.5 lakh new jobs in India. In November 2021, the Union Government expanded the PLI programme for automobiles to include more than 100 cutting-edge technologies, such as alternative fuel systems like compressed natural gas (CNG), Bharat Stage VI compliant flex fuel engines, electronic control units (ECU) for safety, advanced driver assistance systems and e-quadricycles.
- The Government of India and the Indian automobile industry jointly launched the Automotive Mission Plan 2016–26 to set the course for the sector's growth.

1. Automobile Sector, Invest India, Nehal Bajwa, September 2022
2. Automobile Sector, Invest India, Nehal Bajwa, September 2022

d. **Rising investments in the sectors:** The industry accounted for FDI inflow worth USD 32.84 billion between April 2000-March 2022, which is 6 per cent[3] of the total FDI during this period. By 2023, the Indian government anticipates that the vehicle industry would bring in USD 8–10 billion[4] in domestic and foreign investments contributing towards growth of the industry.

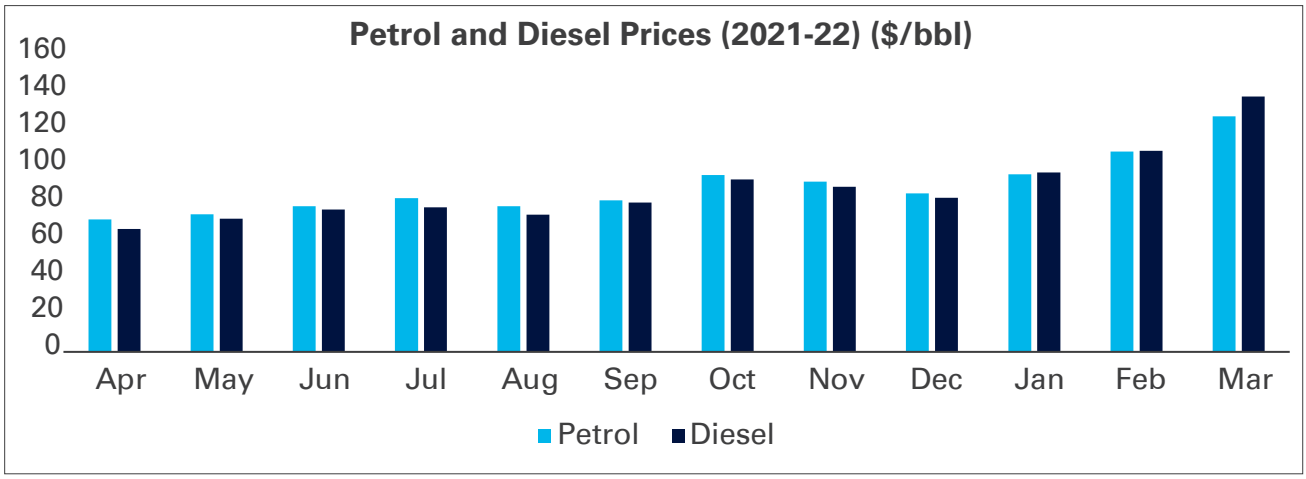
e. **Rising pollution across key metropolitan cities and government's commitment towards global climate norms driving surge towards environment friendly solutions:** The governmental has adopted several policies towards climate change commitments impacting the automobile sector. This is largely driven by the increasing air pollution in major metropolitan cities in India, especially New Delhi. The Central Pollution Control Board (CPCB) estimates that 70 per cent of the carbon emissions and 30 per cent of suspended particulate matter (SPM) in metropolitan cities are caused by automobiles[5]. To combat the ill effects of the air pollution caused due to automobiles, the various initiatives taken by the Central government have been:

- All vehicles sold from 1 April 2020 have been mandated to follow the Bharat Stage VI emission
- At COP26, India made several pledges to combat vehicular pollution:
  - Achieve Net Zero Emissions by 2070
  - 50 per cent of all energy needs to be sourced from renewable energy by 2030
  - Reduce total projected carbon emissions by one billion tonnes by 2030.
- India is also a signatory to the agreements on Climate Change: Alignment to the Paris Agreement committing towards reduction of emission intensity by 35 per cent and creation of carbon sink of 2.5 – 3 billion tonnes of CO2 equivalent by 2030.

Such policy measures have triggered extensive focus on R&D, manufacturing, and sales of environment friendly vehicles with a focus on using alternate sources of fuels.

3. Automobile Industry in India, India Brand Equity Foundation, accessed in September 2022
4. Automobile Industry in India, India Brand Equity Foundation, accessed in September 2022
5. A Review of Vehicular Pollution in India, Chetana Khandar and Sharda Kosankar, Journal of Advanced Laboratory Research in Biology, July 2014

f. **Rising fuel prices triggered demand for alternative fuels:** The post-COVID scenario has seen a sharp rise in the prices of traditional fuels – petrol and diesel[6].



g. **Continuous innovation focusing on tech-enabled and eco-friendly solutions:** Four per cent of the USD31 billion spent globally on engineering and research and development (R&D) comes from India. The automotive industry accounts for 8 per cent of the nation's R&D spending. Increased R&D expenditure is supporting the growth of innovative, tech enabled and environment friendly vehicles such as EV in the country.

h. **Shift in focus towards electric vehicles to reduce emissions:** In the upcoming years, the penetration of electrified vehicles (hybrid, plug-in, battery electric, and fuel cell) will gain new and strong momentum due to stricter emission restrictions, cheaper battery costs, more widely available charging infrastructure, and rising consumer acceptability. Additionally, the government is encouraging the growth of the eco-system for electric vehicles by offering incentives like Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles (FAME) programmes. Manufacturers are also making significant investments and forming alliances to build EV infrastructure across the nation. The sale of EVs is expected to hit 10 million units of annualised sales by 2030. By 2030, the electric car industry is anticipated to generate five crore employment opportunities.

i. **Changing consumer sentiments:** A variety of different, on-demand mobility solutions will be added to the conventional business model of automobile sales, particularly in crowded metropolitan settings that actively discourage the use of private vehicles. Shared mobility solutions and cab aggregator models are likely to get further impetus.

The key emerging theme in the automobile industry has been the shift towards technology driven, environment friendly solutions which is driving the EV surge. Additionally, this change in consumer sentiment and push by the regulatory policies have promoted the adoption of alternate source of fuels. The landscape of alternative fuels driving the change in the automobile industry is described in detail in the following section.

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6. International Prices of Crude Oil (Indian Basket) – Petrol and Diesel, Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India, accessed in September 2022

03

Landscape of alternative fuels used in automobile sector in India

Due to their inherent advantages in terms of economy, high quality energy, compatibility with the environment, and renewability, alternative fuels are gaining attention around the world. Therefore, many nations, including the USA, Brazil, Canada, Australia, China, Thailand, and the majority of European nations, are adopting higher proportion of alternative fuels in order to prevent an economic and environmental crisis that could result from the depletion of fossil fuels and the fluctuating prices of those fuels. The pace of adoption of alternative fuels is also picking up in India. The GoI is also emphasising on the need for an all-encompassing policy on alternative fuels, focusing on CNG, LPG/LNG, biodiesel, and biofuels with a clear road map for increasing the production of alternative fuels and proportionately reducing the reliance on fossil fuels. An overview of the EV and other alternative fuel usage and promotion in India is described below:

3.1. Electric vehicle

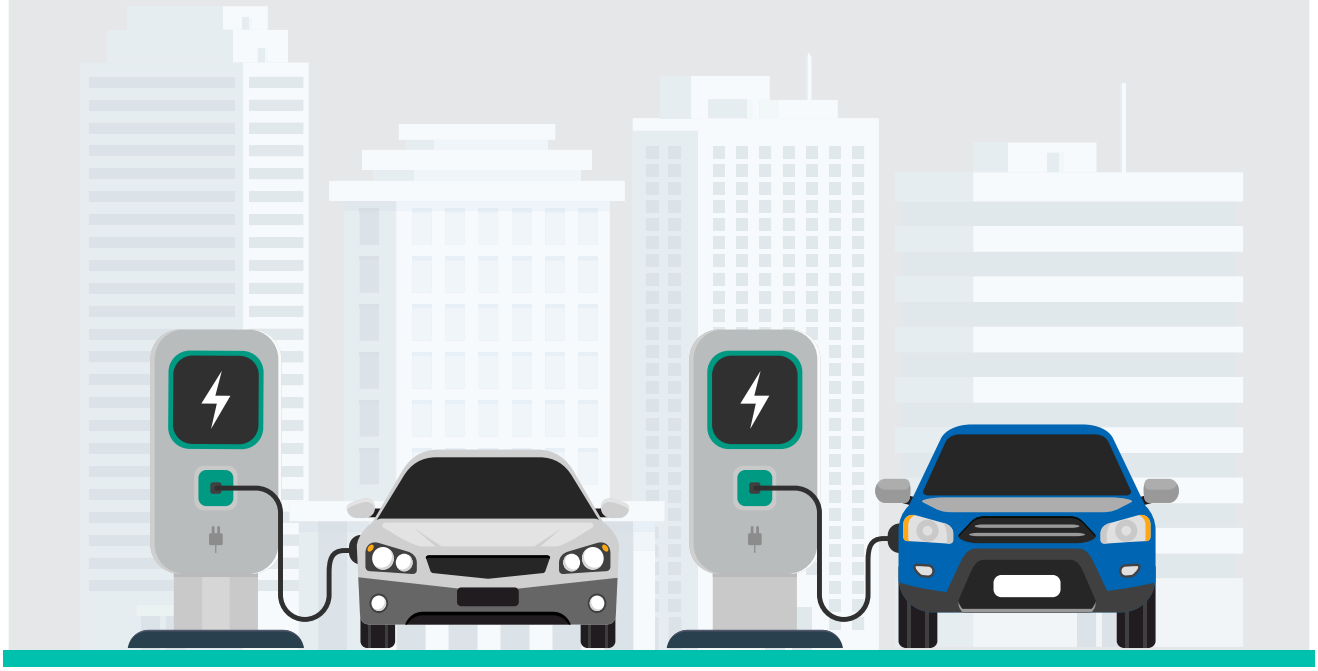
The EV market in India is on the rise and according to the India Energy Storage Alliance (IESA), it is expected to grow at a CAGR of 36 per cent. NITI Aayog has a set a target of achieving a penetration rate of 70 per cent for EVs in the commercial car market, 30 per cent in the private car market, 40 per cent for buses, and 80 per cent for two and three wheelers by 2030. In 2020, the EV market in India was valued at USD220.1 million and 0.52 million EVs have been registered from 2019 to the present date. The most widely adopted EVs are two-wheeler vehicles. In 2022, the sales of EVs exceeded the sales of CNG vehicles in the national capital of Delhi. The market leaders for the EV market in India are divided on the basis of vehicles:

- Two-wheelers
- Four-wheelers

To capitalise on the benefits provided by EVs, the Department of Heavy Industries (DHI) under the Central government introduced the Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles (FAME) in 2015. The second and current phase of implementation, FAME II, has been allocated INR10,000 crore. The Phased Manufacturing Programme (PMP) has been introduced which would promote the production and assembly of parts and sub-parts of EVs over a period of time in a graded structure. Additionally, several state governments have also introduced their own EV policies.

Case in point: Policies to strengthen EV ecosystem

The countries are following a gradual adoption policy at the national level wherein direct and indirect subsidies as well as incentives are being offered to the general public to encourage adoption of EVs. At the provincial level, governments have been offering incentives based on the local economic situation. Additionally, government policies such as New Energy Vehicle (NEV) credit mandate wherein vehicle suppliers are given NEV credit targets that must be achieved, which includes parameters such as energy efficiency and emissions. Parallelly countries been proactive in the rolling out of the electrification schemes to promote charging infrastructure for EVs. In some of the countries, provincial and city-level governments have also announced their own subsidy policies for charging infrastructure.



3.2. Biofuel (Ethanol, Biodiesel etc.)

India is actively taking part in biofuel production, purchase, and usage. There has been a Biofuel Purchase Policy in place since 2006. Since 2015, the Government has allowed for mixing of biofuel for all bulk consumers and transportation corporation and this was further expanded in 2017 when the sale of biodiesel was allowed for all consumers. However, in terms of production, biofuel in India is produced from palm stearin oil. This oil is imported and is not locally available. Recently, fueled by the Make in India campaign, a phase-out of palm stearin oil has been initiated as an import substitution measure. In the place of palm stearin oil, domestically available cooking oil has been chosen to be the raw material or the feedstock for biofuel production as per the National Policy on Biofuels 2018[1]. The Government has also implemented the Ethanol Blended Petrol Programme (EBPP) in the entire country wherein petrol is sold with a mixture of 10 per cent ethanol. To increase production of ethanol, the government has taken several steps such as reduction of GST on ethanol, interest subvention scheme for ethanol production by the Department of Food and Public Distribution, as well as formulation of policies on ethanol procurement in the long run[2].

Case in point: Leading practices on biofuel adoption

Ethanol mixing has seen widespread adoption in some countries due to the introduction of “flex engines” in vehicles that can make the same vehicle run on either ethanol or gasoline or a mix of both. This has led to great improvements in environmental commitments as is evidenced by the reduction of CO2 equivalents across many cities.

3.3. Compressed Natural Gas (CNG)

India has been one of the early adopters of CNG with the entirety of the national capital of Delhi adopting the fuel for public transportation since the early 2000s. According to a report by NRI titled "Path to clean mobility: Increasing penetration of NGVs in India," CNG vehicle sales grew steadily in FY22, increasing by 55 per cent to 2,65,383 units from 1,71,288 units in FY21. According to the report, CNG vehicle penetration has improved over the past five years, and it has expanded at a CAGR of 5.3 per cent from 30.90 lakh units in March 2018 to 37.97 lakh units as of 2022. Positive developments in the CNG fueling infrastructure and regulatory environment are promoting the use of CNG cars. The spread of NGVs is anticipated to be aided by the growth of the CGD (City Gas Distribution) network and an increase in the number of CNG stations (natural gas vehicles).

In 2019, the Ministry of Petroleum and Natural Gas released the Natural Gas Infrastructure Development Plan under which a goal of setting up 10,000 CNG stations has been targeted. A total of INR70,000 crore has been allocated to this plan to expand the City Gas Distribution network to reach the goal of 10,000[3] stations in 10 years[4].

1. Bio Diesel, Ministry of Petroleum and Natural Gas, Government of India, accessed in September 2022
2. Ethanol Blended Petrol Programme, Ministry of Petroleum and Natural Gas, Government of India, accessed in September 2022
3. 10,000 CNG Stations to be Set Up in 10 year: Pradha, The Economic Times, September 2018
4. CNG Adoption in India: Where We Are and Where We Wil Be, Maruti Suzuki, January 2019

Compressed Natural Gas (CNG) programme in India

In 1998, the Environment Pollution (Prevention and Control) Authority was set up by the Supreme Court of India to curb the rising pollution in the capital city of New Delhi. This was a result of several public interest litigations (PILs) filed by people ailing from respiratory problems due to the rising pollution levels. One of the recommendations given by the Supreme Court in this regard was the introduction of a CNG programme. The CNG programme mandated the following rules:

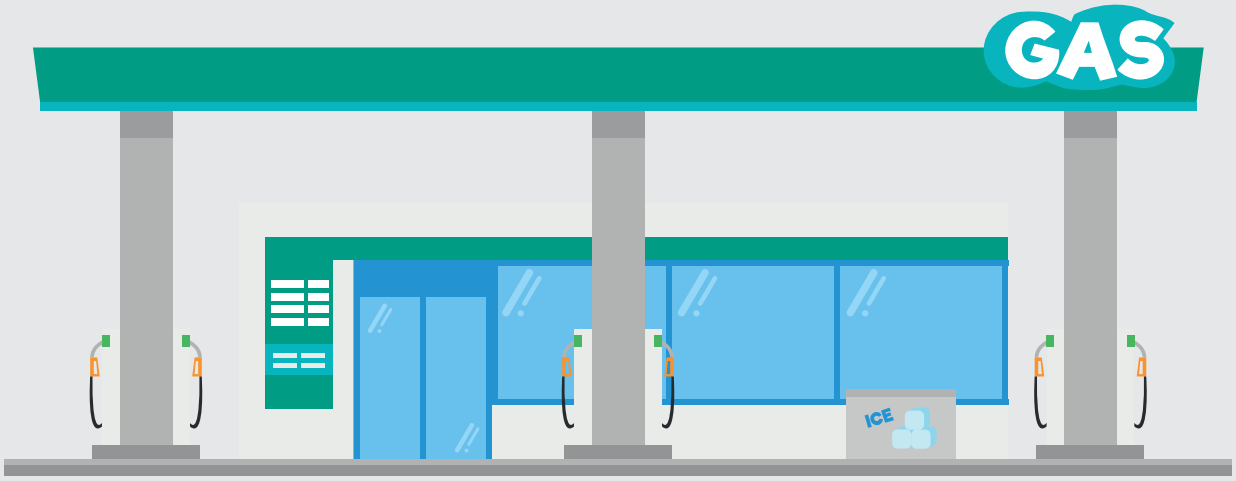
a. All buses were to be converted into CNG-powered buses by 2000

b. The number of CNG stations was to be increased to 80 by 2000

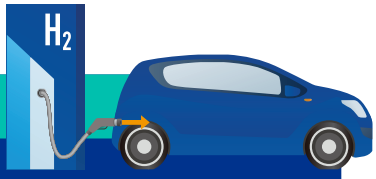
c. All autos and taxis were to be converted to CNG-powered vehicles by 2000.

The programme saw immense success as the government recorded more CNG conversions than they had anticipated. Apart from commercial public vehicles, lakhs of private vehicles also converted to CNG. In 2018, 4.5 lakh private vehicles were recorded to be running on CNG.

The government followed a targeted policy campaign which addressed all the diesel-powered vehicles in the city. This was due to the fact that diesel contained the largest amount of pollutant matter such as NOx, suspended particulate matter, and other air toxins. The deadlines for the year 2000 as mentioned above were strictly enforced with huge fines levied on buses, autos and taxis that failed to convert to CNG in 2001. The CNG bus technology standards that were first introduced were compliant with the Euro II standards and have continued to evolve with the European standards in the following years.
The government's targeted approach resulted in the widespread adoption of CNG vehicles in the city which led to a significant reduction in the pollution levels as evidenced by the 15-yearlong study conducted by Resources for the Future from 2000 to 2015. A study conducted by The Energy Resources Institute (TERI) found that the particulate matter (PM) levels from the first generation CNG buses was 46 per cent lesser compared to the diesel buses. As a result, the Central Pollution Control Board (CPCB) recorded a fall of 26 per cent in pollution levels in 2018 as compared to the pre-CNG levels in 1996.



3.4. Hydrogen fuel



Hydrogen fuel is one of the most recent alternative fuels to have been developed. There are very few countries that have hydrogen fuel policies in place, and it is an area that is yet to be explored in its full capacity.

India has set its eyes on harnessing hydrogen energy and is making policies for the same. On the 75th Independence Day, the Prime Minister unveiled the National Hydrogen Mission which aims at making India the global leader and hub of green hydrogen production and distribution which would help in making India self-reliant in energy by the 100th Independence Day in 2047. NITI Aayog estimates that India would be home to 10 per cent of the global hydrogen demand by 2050. In order to achieve this estimate, the Indian government has put several policies for the production of green hydrogen in place:

- Inter-state transmission charges have been waived off for 25 years for the producers
- Green hydrogen has been made a priority item in the Electricity (Transmission System Planning, Development of Inter State Transmission Charges) Rules 2021
- The Ministry of New and Renewable Energy (MNRE) is establishing a one-stop clearance portal for all clearances and permissions required for the entire process of hydrogen production from feedstock to distribution
- Land is being earmarked in renewable energy parks for the manufacturing of green hydrogen.

Case in point - Policy impetus to adoption of hydrogen as alternative fuel

Some of the countries have conceptualised Hydrogen Framework which laid out the roadmap of legislations and policy changes to expand its hydrogen production in the countries. Strategic Roadmaps are being developed which enumerate basic technology requirements and the key activities that are to be undertaken in order to achieve the country's goal of hydrogen production. Investment have been made by the government and the private sector for research and development of fuel cells, infrastructure for hydrogen fuel production, hydrogen supply chain development, and construction of hydrogen refueling stations. The leading automobile makers have taken active initiatives in following the country's decarbonisation and hydrogen development plans. The metropolitan governments have also taken up steps themselves to promote hydrogen fuel cell vehicles.

04

Impact of the alternative fuel and EV on the Job market

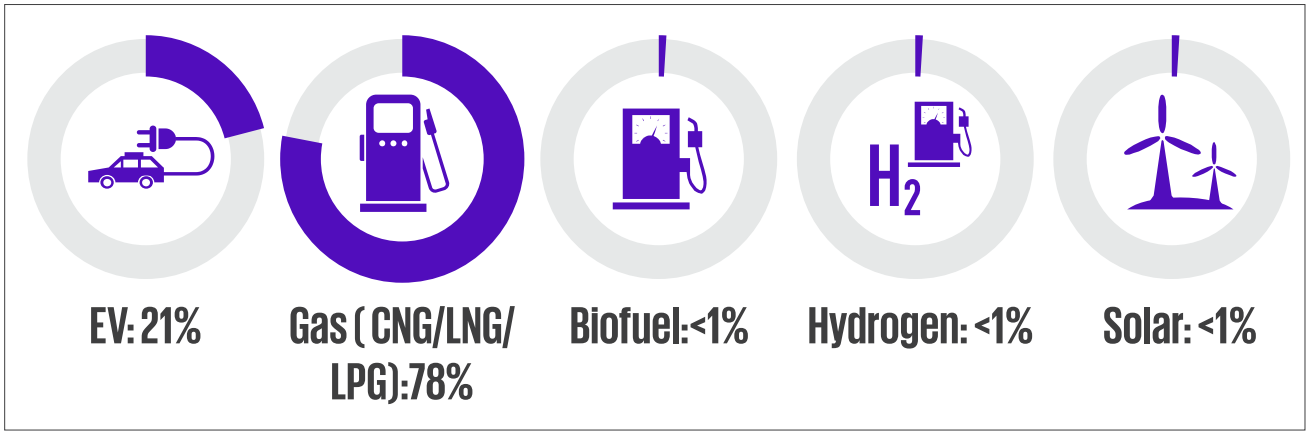
India signed the Paris Climate agreement in 2015 with the aim combating global warming by cutting down on greenhouse gas emissions. At COP21, India has pledged to reduce its carbon footprint by 33 per cent-35 per cent by 2030 below 2005 levels. It has also pledged to increase the share of non-fossil fuels-based electricity to 40 per cent by 2030.

Accordingly, government of India is pushing for reduction in fossil fuels. Currently, 33 per cent of the total petroleum oil consumed in India is attributable to Indian transportation sector. Also, 80 per cent of this transportation share is being consumed by road transportation. It also accounts for around 11 per cent of total carbon dioxide emissions from fuel combustion[1].

Hence policies of the government of India are geared toward promoting alternative fuel options to minimise air pollution and control the rising crude oil import bill of the country so that we can meet our commitments at the global level.

Based on the last decade of sales data, only 3 per cent of the total vehicles are running on alternative fuels. Following is the proportion of the vehicles on Indian roads running on alternative fuels:

Figure: Sale share of vehicles running on alternative fuels 2013-22[2]



As detailed above, electric vehicles (EVs) and gas run vehicles are the most preferred alternative fuels in India. Availability of fiscal incentives for electric vehicles and low prices of CNG compared to petrol and diesel could explain such preference for these technologies.

1. Status quo analysis of various segments of electric mobility and low carbon passenger road transport in India, Niti Aayog, 2021
2. VAHAN database accessed on 13 September 2022. Note: Data includes hybrid vehicles as well

Going forward, adoption of EVs is broadly expected to lead on the job market. Electric vehicles are one of the key focus areas to counter India's air pollution and reduce greenhouse emissions. Accordingly, policymakers in India have been actively pushing for electric vehicle adoption through policies such as Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME II) and other policies.

Based on an analysis of key enablers for EVs, KPMG in India[3] expects 25 to 35 per cent penetration in two-wheeler segment, 65 to 75 per cent penetration in 3-wheeler segment by 2030. However, there is expected to be limited penetration in 4-wheeler segment - with 10 to 15 per cent penetration in personal segment and 20 to 30 per cent in the commercial one by 2030. About 10 to 12 per cent of the overall market for buses is expected to be electrified by 2030.

The complete transition to EVs requires a total investment of USD267 billion (~ INR19 lakh crore) in EVs, battery infrastructure and charging infrastructure[4]. Accordingly, the government's push and incentives for local manufacturing will help create an indigenous EV supply chain in the country. Further, the government's plan to extend the benefit of the concessional corporate tax rate[5] of 15 per cent till March 2024 for newly incorporated manufacturing companies will promote private investment across the EV sector, and thus creating job opportunities in the sector. Particularly, investments are expected to be focused on manufacturing of EVs and batteries, which are suitable for the varied climate conditions of Indian environment.

Further R&D in battery technology related chemical and materials engineering is expected to open additional employment opportunities for the sector. Also, transition of mobility from conventional fuels to alternative fuels such as EV, biofuels, green hydrogen, etc. could launch new business opportunities. These are expected to emerge in areas such as fuel generation and battery manufacturing, fuel transportation (e.g., sources of biofuels and green hydrogen), battery charging and swapping infrastructure, energy infrastructure as a service, captive and micro-power units and integrated transport. In India, players are exploring possibilities in charging infrastructure, and the battery manufacturing, sales and service business. There is an urgent need for transforming and scaling small and medium sub-system and auto-component industries to meet the needs of the alternative fuel run vehicles. A careful plan to hand-hold such industries and help them during the transition to EV components manufacturing is required.

3. Shifting gears: the evolving electric vehicle landscape in India, KPMG, 2020
4. Mobilising Electric Vehicle Financing in India, NITI Aayog, 2021
5. Union Budget, India for 2022-23

05

Requirement of industry 4.0 skills

There is a massive shift underway in the global economy. In the wake of the pandemic, the world is witnessing a historic transformation in how people work, why they work and where they work. Great reshuffle is being accompanied by Green Reshuffle - a shift to green skills and jobs.

In India, the majority of transition is expected to be led by EV industry and CNG. There is expected to be limited change in job requirement because of emergence of CNG fuel-based vehicles since skill requirements are similar to ICE vehicles. CNG vehicles are broadly expected to increase skill requirement of retro fitting vehicles with CNG kits and storage/dispensing of CNG at the stations.

However, EV vehicles are expected to bring change in skill requirements across the entire value chain of EV production.

Following is the value chain of EVs and its key features:

Mining and mineral extraction	
Majority EVs powered by lithium ion and lithium batteries	Major source countries are Chile, Australia and China and workforce for this skillset is not required in India

Battery manufacturing	
Consists of battery case, battery module and battery electronic components	Currently dominated by China but gradually India is moving towards indigenisation

EV assembly	
Less metal cutting and maching involved in component parts	Lesser number of individual quality checks required on parts because of simpler transmission (versus ICE) and lesser number of parts

EV maintenance	
Maintenance cost of EV is 20-35% lower than ICE	Existing technicians/garages expected to undergo specialised certification for EV maintenance

Charging infrastructure	
Infrastructure for normal power and high power charging	Battery swapping infrastructure

Battery disposal and recycling	
Extraction of mineral from battery	Waste management of battery parts

As far as the automotive sector is concerned, a large part of the supply chain will get transformed in the power train segment. Traditional suppliers may move from supplying automotive components such as ICEs and exhaust pipes to battery components, battery casing materials, durable and lightweight thermoplastics, regenerative braking systems and electric motors. In addition, EV battery charging and swapping would create a large number of jobs throughout the country.

The EV sector in India is expected to create 65 million jobs[1] - including direct and indirect jobs by 2030.

Transition to EVs is expected to create two set of jobs:

01 Skillset already available in the existing ICE sector

This includes workforce skilled in fields such as vehicle system engineering and software jobs, computers and machine learning, service jobs such as brake systems, maintenance and manufacturing of the vehicle body and components. Workforce with such skill sets is already available in the market. Hence, they can immediately transition from ICE fuel vehicles market to EV market with minimal intervention.

02 Jobs with new skillset specifically designed for EVs

This includes workforce skilled in fields such as complete battery management, charging infrastructure creation and management of charging stations, battery component manufacturing and digital technology, servicing for electronic and electrical components. As more EVs enter the Indian market, the challenge of sustainable end-of-life practices for battery disposal and recycling will also arise.

1. KPMG India Analysis

Accordingly, the above EV value chain is expected to provide requirements for the following job roles:

Value chain area	Job roles
Battery Manufacturing and Recycling	Battery design & testing, wiring harnesses technicians, Thermal management and heat treatment technicians, Chemical Engineers, Chemists, And Materials Scientists, Test Drivers
EV Design & Assembly	Controls Technicians, Industrial Electricians, Industrial Engineers, Machinists, Mechanical Assemblers, Mechanical Drafting Technicians, Millwrights and Industrial Mechanics, Mold Designers and Toolmakers, Pipefitters, Software Engineers, Electricians, Industrial and Commercial Designers
EV Sales and Retail	EV Salespeople (with knowledge of automotive software), EV training instructors
EV Maintenance	Battery Management Technicians, Automotive Service Technicians and Mechanics, IOT Experts
Charging Infrastructure	Electricians, Power-Line Installers/ Repairers, Urban/Regional Planners, Civil Engineers, Re-modelers- for making existing building infrastructure EV-ready

Figure: Expected job roles across EV value chain[2]

Additionally, transition to alternative fuels such as biofuels, green hydrogen is also expected to create requirement for the following job roles:

Value chain area	Job roles[3]
Production	Boiler Operator, Shredder Operator, Biochar processor
Processing, Storage and Transportation	Automatic Baler Operator, Technician for conversion to green ammonia, liquid ammonia and fertilisers, Fuel Cell development
Energy Conversion and utilisation	Biomass plant operator, Hydrolyser Plant Operator, Micro Grids for power generation, captive power unit operators

It is expected that transition to alternative fuels such as biofuels, green hydrogen will create job roles, especially for rural population. Hence, upskilling-reskilling initiatives and related livelihood need to be targeted towards rural India.

Additionally, activities related to agriculture allied fuels such as green hydrogen and biofuels have limited aspirations among the workforce[3]. Hence, targeted information communication campaigns will be required to address the awareness about the potential of such job roles.

2. KPMG in India Analysis, Electric Vehicle-Battery Value Chain Talent Requirements Report- Invest Windsoressex, 2021
3. KPMG India Analysis

06

Way forward to embrace the change and prepare for the future

The alternative fuel sector is fertile with job opportunities in the decades to come. The EV industry, in particular, has the highest potential to create jobs in the near future. It is evident that the alternative fuels sector can be a key to India's realisation of its demographic dividend. However, to harness the potential for fresh skilling and up-skilling of workforce is the need of the hour. Stakeholder wise recommendations to promote skilling in the alternative fuel segment are provided below:

Stakeholder	Recommendations
Government	1. **Greater incentives for green vehicles** – To generate more jobs in the sector, it is necessary to popularise the adoption of green vehicles. Thus, governmental incentives that reduce the cost of acquisition of green vehicles for the public would be a positive step forward. 2. **Encouraging more Production Linked Incentive (PLI) schemes –** PLI schemes would provide an impetus for green vehicle manufacturers to increase production which would be the key to generating more jobs in the **sector.** 3. **Encouraging adoption of renewable energy in India –** As the price of electricity generated through renewable energy has been decreasing over time, it would be the key to achieving self-reliance or Atmanirbharta in energy generation for India in the long run. Renewable energy sources would be hubs for generating specialised jobs in the country. 4. **Encouraging adoption of renewable energy in India** – As the price of electricity generated through renewable energy has been decreasing over time, it would be the key to achieving self-reliance or Atmanirbharta in energy generation for India in the long run. Renewable energy sources would be hubs for generating specialised jobs in the country. 5. **Enhanced access by subsuming automobile skill trainings on alternative fuels under national skilling programmes –** Skilling and upskilling in the alternative fuel domain can be subsumed under national schemes such as the Pradhan Mantri Kaushal Vikas Yojana (PMKVY) and the National Urban Livelihoods Mission (NULM). 6. **Targeted information communication campaigns** - Targeted information communication campaigns: It is expected that transition to alternative fuels such as biofuels, green hydrogen will create job roles, especially for rural population. Targeted information communication campaigns will be required to address the awareness about the potential of job roles elated to agriculture allied fuels such as green hydrogen and biofuels in rural India.

Stakeholder	Recommendations
Industry and Skill Development Councils	1. **Capacity building through collaboration** – Capacity building of trainers needs to be done through comprehensive stakeholder consultations and industry collaboration. If people enrolled in the skilling programmes have access to the industry, the transition from training to jobs would be smoother and less time consuming. 2. **Embracing Dual System of Training** – The Dual System of Training or "Learning on the Job" model could be adopted by the skilling councils to encourage higher enrolment in skilling courses. This is beneficial from the workers' perspective as it reduces the training time and provides a source of income. It is also beneficial for the industry as this model provides them with a ready pool of labour needed for production and distribution. 3. **Regulating and standardising skills** – Standardisation of skills and skilling programmes should be given priority as it is the best way to ensure minimum standards of quality are maintained. Industry associations such as ACMA, ASDC, FADA and SIAM can play an active part in collaborating with the government to set standards and provide certifications under the National Skills Qualification Framework (NSQF). 4. **Develop course on emerging job profiles and make them available on open-source platforms such as SWAYAM and Bharat Skills Portal:** Collaborate with star faculty members and industry experts to develop industry relevant curriculum on alternative fuels. Such course should be made available on MOOCs and open-source platforms such as SWAYAM, Bharat Skills Portal for the benefit of all. 5. **Involving women and persons with disabilities in the automobile skilling domain** – Women and persons with disabilities make up half the workforce of the country. Bringing them into the fold of the automobile sector through skilling programmes would be extremely beneficial in utilising India's demographic dividend to the full potential. This would require grassroot level interventions through awareness campaigns and promotional activities. 6. **Launch dedicated programmes to recognise and up-skill workforce with transferable skillset in the existing ICE sector:** Workforce with certain skillset available in the existing ICE sector can easily transition into alternative fuel sector. Hence, targeted campaigns and upskilling programmes need to be run to enable them to transition from ICE fuel vehicles to EV vehicles with minimal intervention.

Stakeholder	Recommendations
Vocational Education Institutions and ITIs	1. **Imparting early vocational education** – One of the goals of the National Education Policy (NEP) 2020 is to create a future ready workforce for India through vocational education. The NSQF and the National Higher Education Qualification Framework (NHEQF) can be utilised to impart vocational education related to the automobile sector from the school level itself. 2. **Developing credit-based courses in collaboration with educational institutes** – ITIs or skill councils can develop credit-based, continuous learning focussed courses in collaboration with education institutes for developing meaningful, employment-oriented offerings at affordable prices through resource optimisation strategies. This will also enable credit transfers for all the students across higher education and vocational education ecosystem 3. **Upgrading the ITI ecosystem** – The training ecosystem in India has been traditionally dominated by ITIs. With the changes in skillsets required due to the move to green jobs, these ITIs need to be upgraded with newer programmes in the domains of environmental safety and ESG requirement. The technological infrastructure also needs to be upgraded to turn them into technology centres for skilling.

About ASDC

Automotive Skills Development Council is the first Sector Skill Council Promoted by the Automobile industry through the Society of Indian Automobile Manufacturers (SIAM), Automotive Component Manufacturers Association (ACMA) and Federation of Automobile Dealers Association (FADA) and Government of India represented by the Department of Heavy Industry and National Skill Development Corporation (NSDC). Primary vision of ASDC is to continually develop and upgrade automotive skills for higher value additions through skilling which will lead to more economic activity and consequent additional jobs.

ASDC aims to achieve the same through complete industry commitment (SIAM, ACMA and FADA), ensure credibility of the assessment process and honour and celebrate skilling achievements. Model of ASDC is to conduct research, develop occupational standards across R&D, Manufacturing, Sales, Service and Driving domains, service delivery through affiliation of training and assessment partners, assessment and certification of candidates and facilitation of employment to certified candidates and undertaking quality assurance initiatives like ToT, ToA, development of assessment mechanisms, certification of content and curriculum in alignment with ASDC standards and development of assessment mechanisms.

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