



Is E-mobility a Green Boost for European Automotive Jobs?

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At a glance

Historically, the automotive industry has, directly and indirectly, been a strong and stable motor for various kinds of jobs in Europe. But recent developments have led stakeholders within and outside the industry to question whether this will continue. Have we reached an inflection point?

The next ten years promises to be a time of transition for the automotive industry. Prior to the COVID-19 pandemic, automakers produced approximately 17.7 million light vehicles in Europe, adding up to a huge overall production value of approximately €700 billion. Production fell sharply during the pandemic and is not expected to rebound to historical levels. Electric vehicles (EVs) will play a major role in the industry's recovery, as people and organizations throughout society recognize the urgency to achieve net-zero carbon emissions. The transition to EVs is already underway and accelerating. Forecasts indicate that by 2026 EVs will account for more than half of light vehicles sold globally. (See [“Why Electric Cars Can't Come Fast Enough,”](#) a BCG report.)

Although the actual driving experience of EVs feels similar to passengers, the underlying technology and supporting infrastructure are tremendously different. Indeed, replacing an internal combustion engine (ICE) and fuel tank with an electric motor and battery cell is having massive effects on the entire automotive industry and beyond. A tangible example is the need to set up public and private electric charging infrastructure across Europe.

A recent BCG study explored how these tremendous changes will affect jobs in Europe. The study is distinctive for considering not only core automotive industries (such as OEMs, suppliers, and maintenance providers), but also adjacent industries (including equipment providers, fuel and electricity producers, and providers of fuel and charging infrastructure). The comprehensive scope allowed us to fully assess the net development of automotive jobs in Europe.

Contrary to what some observers expect, we found that EVs will have only a minor net impact on jobs through 2030. Drilling down to the level of specific industries, however, reveals a more varied picture. While the core automotive industry will certainly suffer significant job losses, some new industries that support electrification will experience tremendous job growth over the next ten years. As a consequence, massive employment transitions will occur over time, between industries and job profiles, and across regions.

Our findings have important implications for governments, companies, and individual workers. Governments should create the framework conditions that enable the automotive industry to master the enormous shift in qualifications. Companies should conduct Strategic Workforce Planning to identify requirements for up- and reskilling as well as goals for recruitment and retention. Individuals should focus on lifelong learning to constantly acquire new skills, and take a more flexible approach to their career paths.

A Comprehensive Study

To gain an in-depth understanding of how e-mobility will affect jobs, the study took a holistic approach encompassing a total of 26 industries grouped into eight clusters. The clusters fall into two categories of industries—core automotive and adjacent.

Core Automotive. Four clusters encompass the core automotive industries that directly relate to vehicles. For the most part, these clusters have been covered in previous studies:

- **OEMs.** European automotive producers that are well-known engines of the economy and major employers.
- **ICE-focused suppliers.** Suppliers specializing in ICE or components that are closely related to them, such as gear boxes or pumps for injection systems.
- **Non-ICE suppliers.** Suppliers producing components that are mostly independent from the type of propulsion system—for example, headlights, seats, or deliver parts for electric vehicles—for example, batteries.
- **Maintenance & Repair.** The entire maintenance and repair industry, encompassing activities such as performing oil changes or repainting after damage.

Adjacent Industries. The other four clusters are indirectly related to cars and are thus considered to be

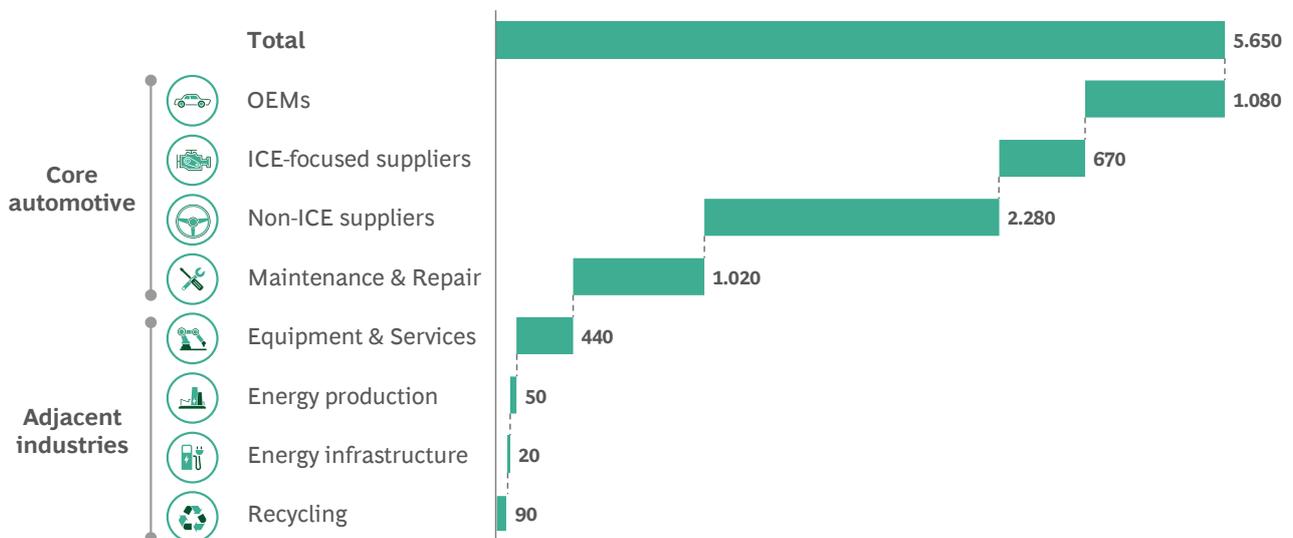
adjacent. Previous studies have not comprehensively considered how e-mobility will impact jobs in these clusters:

- **Equipment & Services.** Producers of equipment and machinery directly used in manufacturing, testing, or research and development (R&D), as well as providers of industrial service offerings related to consulting, legal compliance, real estate, communications, storage, or processing.
- **Energy production.** Companies involved in the production, transmission, and distribution of electricity that is consumed by EVs, as well as companies that refine oil into gasoline or diesel. For each industry, our analysis included only the share of the workforce whose jobs relate to automobiles.
- **Energy infrastructure.** Companies that manufacture and service or install and operate electrical charging and fueling infrastructure.
- **Recycling.** Companies that process materials from used vehicles into secondary raw materials, typically using a mechanical or chemical conversion process.

Spanning the scope of these eight industry clusters, the study covered a total of 5.65 million jobs within Europe. Exhibit 1 shows their distribution across the industries.

EXHIBIT 1 | 5.7M employees across automotive and adjacent industries

Number of employees (2019, in thousands)



ICE = internal combustion engine; OEM = original equipment manufacturer
Source: Eurostat; BCG

Across all of the eight industry clusters, people work in very different kinds of jobs, and the shift toward EVs affects these jobs to different degrees. A salesperson, for example, might not experience much difference in selling an EV versus an ICE-powered vehicle. But for employees involved in producing EVs, the work is very different. To take into account such differences, our study distinguished a total of 31 different job families. We aggregated these into five job categories:

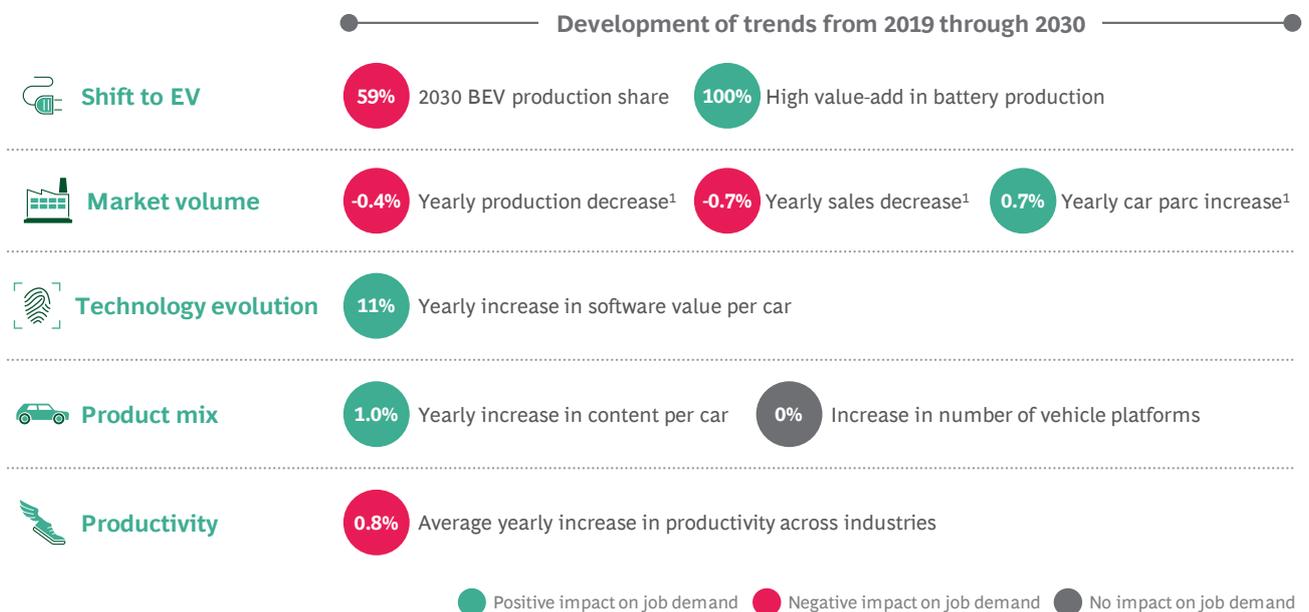
- **Engineering.** R&D related to vehicles, components, features, software, and systems, and the management of such projects.
- **Procurement.** The purchasing of materials, facilities, services, and parts, as well as associated controlling and accounting functions.
- **Production & Service Operations.** The performance of production and service operations by, for example, machine operators, logistics workers, and maintenance staff, as well as the planning of such activities.

- **Sales.** Sales, after-sales, and marketing of the products and services covered by the study, including positions such as market analysts and sales managers.
- **Other Functions.** Those jobs—mostly central indirect functions such as HR or IT—that do not fall into one of the previous categories.

Five Trends Will Drive Massive Disruptions Over the Next Ten Years

Technological developments and changes in customer demand and preferences are not the only trends bringing massive disruptions to the automotive industry. The study considered five trends that are impacting employment within the affected industries. (See Exhibit 2.).

EXHIBIT 2 | Five major trends are driving job changes in Europe



1. 2019 as baseline year.
BEV = battery electric vehicle
Source: Eurostat; IHS Markit; BCG

- Market volume.** A major driver of employment is, of course, the overall number of cars that are produced, sold, and in use. We expect that the development of car production volume will not fully recover to pre-COVID levels. The market will recover to some extent by 2025, but then remain constant at approximately 17.1 million cars per year through 2030. Overall through 2030, production volume will decrease by 0.4% per year. We expect sales volume to decrease by 0.7% per year. Because the European market is already quite saturated, sales volume will fall to approximately 16.3 million cars in 2030, down from close to 18 million in 2019. Consequently, we expect that the car parc in Europe will increase by only 0.7% per year over the next ten years—resulting in approximately 343 million cars on the road in 2030.
- Technology evolution.** Autonomous driving, greater connectivity, and the migration from analog to digital will have a strong impact on the technological development of cars over the next decade. This trend is especially important from a software perspective: we expect the value of the software within a car to increase by approximately 11% per year—rising from approximately €280 per vehicle in 2020 to approximately €760 per vehicle in 2030. This steep increase will, in particular, promote higher demand for software engineers.
- Product mix.** Two aspects of the mix of cars produced are relevant to the development of jobs. The first is how the mix of vehicle categories is shifting. These categories, in terms of the cost of content per car, are entry (less than €30,000), mid (€30,000 to €50,000), and premium (more €50,000). A higher share of mid or premium cars increases the average content per car. Based on an analysis of the content per car across various vehicle categories and the projected production mix, we expect the overall content per car to increase by approximately 1% per year through 2030. The second important aspect is the number of vehicle platforms used to produce these different kinds of cars. This number strongly influences the demand for R&D engineers. Across all European car manufacturers, we expect that the number of vehicle platforms will not increase over the next ten years, resulting in stable demand for R&D engineers associated with vehicle platforms.
- Productivity.** Productivity gains in the automotive industry were lower over the past ten years than during previous decades. Despite this trend, we expect that digitization and automation will promote a steady increase in productivity over the next ten years. We analyzed the gross value added per employee—also referred to as apparent labor productivity—on a sector level. Based on this analysis, we expect an average productivity gain across the industries covered in our study of approximately 0.8% per year. Growing industries, such as battery production, are in a position to achieve significant productivity gains—the gross value added per employee could reach up to 5% per year in these industries.
- Shift to EV.** During the next ten years, automotive production will transition from ICE-powered vehicles to battery electric vehicles (BEVs.) In 2020, approximately 80% of vehicles produced in Europe were solely ICE-powered. As accelerated by the stronger climate commitments announced in recent months, we expect this share to drop dramatically to less than 5% in 2030. By that year, the share of BEVs will be around 59% plus 11% PHEVs. The remaining 25% will be hybrid EVs (HEVs).

The labor effort required to produce BEVs is lower than the effort needed for ICE vehicles. (See [“Shifting Gears in Auto Manufacturing,”](#) a BCG report.) However, BEVs need additional components, the most important being the battery pack. The production of batteries, modules, and cells will be conducted largely in Europe, resulting in the potential for significant additional employment. Based on an analysis of recent company announcements, we expect a yearly production capacity of up to 1,000 GWh in Europe

Methodology

To derive the total number of jobs by 2030 a comprehensive model was developed. Based on the holistic scope of 26 industries and 31 job families, 806 different positions, as a combination of industries and job families, were considered. In a first step the overall employment figures from 2019 were broken down to the position level. Having established this very granular employment baseline, the impact of each of the eight trends throughout 2030 on each of the 806 different positions was assessed and respective impact factors were derived. Each impact factor takes into account

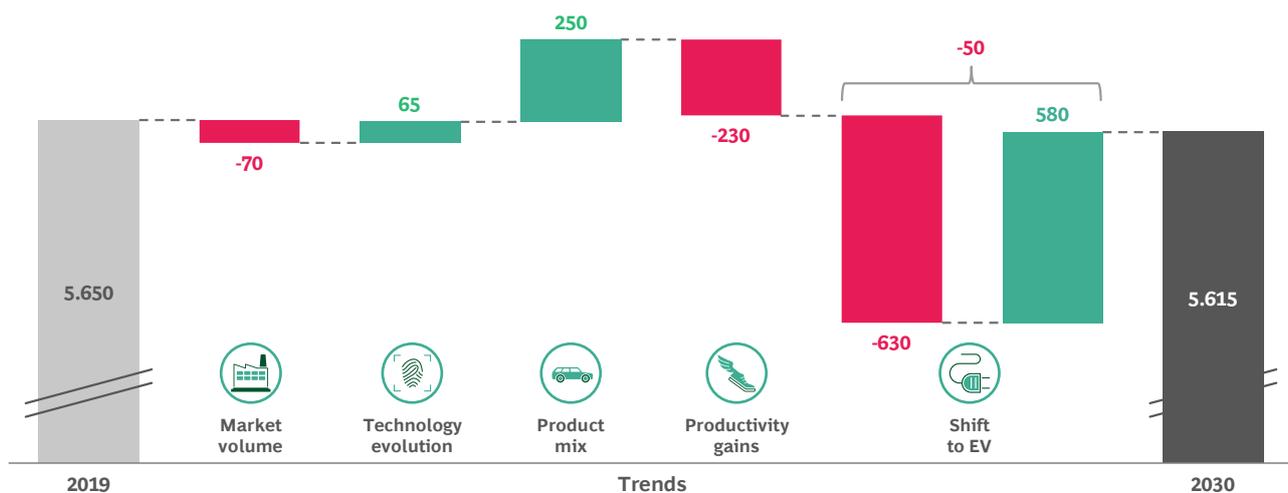
how strongly one of the trends actually impacts employment. For example, a 1% growth in vehicle production volume has a smaller impact (i.e. lower impact factor) on people in indirect functions, like HR, than it has on production workers in the final assembly (i.e. higher impact factor). Combining the granular employment baseline with the outlined forecasts for each of the trends and the respective impact factors allows us to forecast the expected employment on a position level by 2030 as well as distinguishing between the impact of each of the different trends.

The Net Impact on Job Development through 2030

The five industry-specific trends, acting in combination, will lead to nearly flat job development in the automotive industry through 2030. (See Exhibit 3.)

EXHIBIT 3 | Nearly flat development of total jobs until 2030

Job losses and job gains (in thousands) due to various trends



Source: BCG

Starting from our baseline of 5.65 million jobs in 2019, we expect to see 5.62 million jobs in the covered industries by 2030—the loss of 35,000 jobs represents a minor decrease of less than 1%. Furthermore, at this level of detail, even small changes in the production volume significantly affect the results. Taking different volume projections into account, the overall result ranges from a loss of 88,000 to a gain of 17,000.

Looking at the impact of individual trends, we expect market volume to lead to a slight decrease of 70,000 jobs, resulting from declining production and sales

volume as well as only small growth of the car parc. On the other hand, a similar increase of 65,000 jobs will come from technology evolution, owing to demand for engineers responsible for the development of the increasing amount of technology and software content in vehicles. Changes in the product mix will lead to a bigger increase of 250,000 jobs. A continuous increase in the production of mid and premium cars will lead to higher labor effort, especially in supplier industries that provide advanced components, such as for interior design.

However, all these positive effects will be nearly offset by the anticipated increases in productivity across the affected industries, which we expect to reduce the number of jobs by 230,000. In other words, higher productivity will allow companies to meet the labor requirements driven by volume, technology, and product mix without actually needing to add more people to the workforce.

Last but not least, the shift to EV will lead to a net loss of 50,000 jobs. But this relatively small figure obscures massive changes resulting from this trend.

The reduction in labor effort required for OEMs and ICE-focused suppliers, among other industries, will result in a loss of 630,000 jobs, while demand for batteries and charging infrastructure, among other parts and services, will promote the creation of 580,000 jobs.

In addition to those outlined effects on stable employment, the shift to EV also creates temporary employment demand of around 400,000 construction man-years through 2030, approximately 40,000 jobs per year, on average. The bulk of the new demand—approximately 270,000 man-years—is generated by the need to build new battery manufacturing plants.

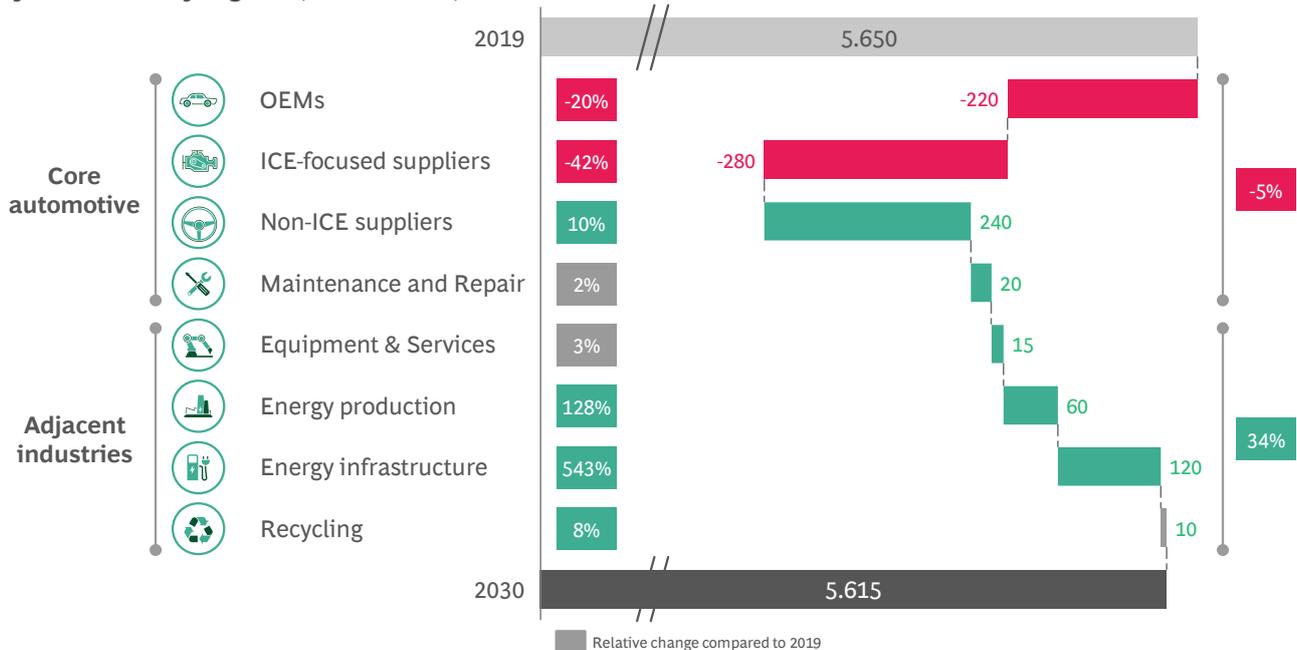
Energy production (installing new renewable energy capacity) and charging infrastructure (setting up major charging points and associated grid enforcements) each create demand for approximately 60,000 man-years

Summing up, the shift to EV will have only a minor net impact on jobs, leaving the total number of jobs in the affected industries largely unchanged in 2030 compared with 2019.

However, besides the overall number, it is equally important to analyze how these jobs are distributed across the different industries and functions. Exhibit 4 shows the overall job demand as well as the change relative to 2019 across the industries. Green boxes indicate higher job demand compared with 2019 while red boxes indicate lower relative demand. The core automotive industries, especially OEMs and ICE-focused suppliers, will suffer significant job losses, aggregating to a decrease of 5%. On the other hand, the adjacent industries, especially those that are energy related, will see significant job gains, aggregating to an increase of 34%.

EXHIBIT 4 | Decrease for core and increase for adjacent industries

Job losses and job gains (in thousands) across different industries



ICE=internal combustion engine; OEM=original equipment manufacturer
 Source: Eurostat; BCG

An industry-level perspective shows a variety of impact. On the one side, we expect major increases for automotive – relate employees within energy infrastructure (543%) and production (128%), as well as a smaller increase for non-ICE suppliers in general (10%) and recycling (8%). On the other side, we expect a significant decline for ICE-focused suppliers (–42%) and OEMs (–20%). We expect stable job development through 2030 for the other industry clusters: maintenance and repair and equipment and services.

Transitions Over Time, Between Industries and Job Families, and Across Regions

Although e-mobility will have only a slight impact on the overall number of automotive jobs in Europe,

We expect major transitions from three perspectives: time, industries and job families, and regions.

Over Time. The transition over time will occur in two phases during the next decade. First, the COVID-related setback from 2020 through 2023 will lead to a massive decline in volume, as well as governmental

programs to prevent job losses. The pre-COVID employment level of approximately 5.7 million jobs will return by 2024. Second, we expect a consolidation phase from 2025 through 2028, with a slight decline in volumes and stabilization thereafter. Comparing those developments with the previous ten years, we find that the previous growth trajectory will not be reached until 2030.

Between Industries and Job Families. We distinguish three scenarios for job transitions and the corresponding training requirements. (See Exhibit 5.)

- **Same Job Profile.** Approximately 1.6 million jobs will stay in their current company and/or profession and not transition to different industries or job profiles. However, because job requirements will change, at least slightly, these workers will require on-the-job retraining.
- **Similar Job Profile.** Approximately 610,000 jobs will transition to a similar industry and/or job profile—for example, moving from gearbox production to electric motor assembly. These workers will require retraining and may need to relocate.

EXHIBIT 5 | 2.4M positions with dedicated training needs

	Same job profile	Similar job profile	New job profile
Situation	Remaining in the company and profession with slightly different requirements	Change to a similar industry and / or job profile	Change to other industry and / or new job profile
Requirements	On-the-job training	Retraining and relocation	Requalification and relocation
Affected positions	~1,600k	~610k	~225k
Example	Employee stays in final assembly of an automotive OEM	Employee moves from gearbox production to electric motor assembly	Employee moves from auto assembly to battery cell production

OEM=original equipment manufacturer
Source: BCG

- **New Job Profile.** Approximately 225,000 jobs will transition to another industry and/or a new job profile—for example, moving from automotive assembly to battery cell production. These workers will require requalification and may need to relocate.

In total, approximately 2.4 million workers will have dedicated training needs.

The remaining 3.2 million jobs, out of the total 5.6 million by 2030, will remain largely unchanged, allowing workers to perform the related tasks without special training.

Across Regions. The number of jobs is expected to grow slightly in Germany while declining in some other European countries. For Germany, we expect an increase of 25,000 jobs (2%) by 2030 compared with 2019. During the same period, we expect, for example, the number of jobs to decrease in Spain and remain stable in Poland. Social and cultural barriers will likely limit the ability of workers to transition to jobs in a different country.

Taking Actions Today to Master the Transition

Taking control of the transition to e-mobility requires immediate actions by governments, companies, and individuals:

Governments. Governments need to perform whole-of-economy workforce planning on a country level, including advanced models for supply and demand. To help employees manage their transitions, it is essential to rethink education and reskilling and provide additional initiatives. The largest challenges should receive the highest priority. The public sector should also build new career and employment platforms that allow workers to navigate to jobs and training opportunities quickly and more easily. Social safety nets will need updating, so that they can promote up- and reskilling during transitions and support part-time workers and people who are unable or unwilling to adapt to the new challenges. Finally, governments should drive innovation and support small and medium-size enterprises during the transitions, because they lack the analytics and training resources of bigger companies.

Companies. The labor market will not supply enough new talent to meet companies' rapidly shifting job requirements. To meet the challenges, each company should perform Strategic Workforce Planning (SWP),

including skills mapping and advanced models for supply and demand. The insights will inform efforts to up- and reskill the existing workforces on a large scale. So that these efforts pay off, companies need to devise new talent recruitment and retention strategies that allow them to keep the best suited and most talented workers in a competitive market. It is also essential to foster a lifelong learning culture that integrates constant learning in different formats into every employee's daily routine.

We recommend companies to facilitate their efforts along the following pillars:

- Create a deep understanding of future product evolutions and demands relevant for the existing business
- Analyze its implications on the internal value chain including its workforce
- Develop a company-specific target picture for 2030, based on a "greenfield" approach – incl. future product spectrum and internal value-add. Question for example existing "make-or-buy" decisions (e.g., battery cell production)
- Perform Strategic Workforce Planning, including skills mapping and advanced models for supply and demand
- Develop retraining and upskilling programs as the labor market will not supply enough new talent to meet companies' rapidly shifting job requirements
- Devise new talent recruitment and retention strategies that allow them to keep the best suited and most talented workers in a competitive market.
- Foster a lifelong learning culture that integrates constant learning in different formats into every employee's daily routine

Individuals. Each worker should regard lifelong learning as the new normal. Constant learning and the acquisition of new skills, especially universal skills, must become a central part of the working life. Individuals should take a more flexible approach to their career paths, considering that it may be necessary to make increasingly frequent career changes into positions with similar requirements. They should also remain focused on up- and reskilling opportunities as more sources of information about future jobs and skills will become available.

In conclusion

Over the next decade, the total number of employees in the European automotive industry and adjacent industries will remain nearly constant. Even so, massive shifts in employment levels will occur in individual industries and job profiles. Maintaining or even accelerating the transition to EVs as the core automotive technology for the near term is essential to give a “green boost” to employment. Focusing in this direction would thereby not only significantly help to achieve the European climate goals but also foster the European competitiveness on the global market for electric vehicles. However, such a strategy must be accompanied by skill building and retraining on a tremendous scale. Governments, companies, and individuals all have a role to play in meeting the challenges. With well-informed planning and thoughtful implementation, stakeholders can ensure that the automotive industry continues to be a strong and stable motor for employment in Europe.

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For Further Contact

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