World Vehicle Forecasts & Strategies

Propects 2050

The Global conundrum

People or the Planet

by

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Introduction, summary and conclusion

Introduction

This edition of ***World Vehicle Forecasts and Strategies*** (***WVFS***) examines the prospects for the world automotive industry for the years up to and including 2050. As well as the actual volume forecasts provided, the main emphasis is more concerned with the strategic aspects of coping with a rapidly changing world.

Globalisation has dramatically pivoted the industry way from the historic, traditional setting of a dominant "West", with manufacturers mainly in the USA, Germany, France Italy, the UK, and - latterly - Japan and S Korea. Many of the manufacturers and famous names located in these nations have now disappeared, become significantly weakened or have merged. Although those that remain will still play their part in their home regions, their presence is likely to become marginal on a global scale.

The report looks at historic **sales and production** volumes and provides forecasts for the years to 2050, the future size of the **vehicle parc,** the level of **vehicle ownership density, -** measured as the number of vehicles per 1,000 population - and the number of vehicles likely to be **scrapped.** These forecasts are therefore calculated on a detailed 64-year history of the industry and future drivers of growth.

Summary

The core arithmetic is as simple as it is stark. In summary, sales of vehicles with four wheels and more have recovered strongly since the **Covid** epidemic and are now approaching the almost **100 Mn** units per year achieved immediately prior to Covid.

At a static no-growth level of activity, some **2.6 Mn** units will come off the production lines between 2025 and 2050 inclusive. However, this volume world be insufficient to meet the needs of a population forecast to reach almost **9.7 Bn** by 2050, **1.5 Bn or 20%** higher than at present.

The new core forecast therefore suggests that **production/sales** volume will be **3.6 Bn** units over the period, which means annual output will need to rise to a net **182 Mn** units a year by 2050,

The **vehicle parc** will rise from **1.7 Bn in 2024** to at least **2.7 Bn** in 2050, an increase of **1.03 Bn** units or 60%, but it is distinctly possible that the parc could exceed **3.0 Bn.** Over the same period the number of vehicles **scrapped** will reach **2.6 Bn** units equal to a scrap rate of 71%, assuming average vehicle life remains at 12 years. (It also needs to be remembered hat there are circa 600 Mn 2- and 3- wheelers in circulation and millions more are being added each year.)

This will increase global **ownership density** from **211** per 1,000 in 2025 to **282** per 1,000 in 2050.

Conclusion

There is already concern on some fronts about the number of vehicles plying the roads of the world and their contribution to climate change and global warming. As this forecast suggests that the number of vehicles in existence could almost double or more by 2050, with only a modest expansion in the markets of the future, some serious questions must be asked.

1. Can the planet sustain such an increase in motorisation?
2. If not, should a limit be imposed on the global volume of vehicles produced/sold and in use?
3. Should there be a limit on automotive activity in the mature nations to allow the developing world to catch up?
4. Should the developing world be asked to accept limited development and would it be enforceable?
5. How would the burgeoning populations of the developing world advance, flourish and evolve without an increase in motorisation, the most important single tool necessary for development?
6. Who would make these decisions and on what authority?

With more than 100 Mn units - and rising - rolling onto the world's each year, the time for decision or acceptance is not far off.

The forecast

Creating the forecast relies on many calculations for 20 of the most important individual countries and as well as entire regions. W Europe, for example, is so homogenous that it is considered in this forecast to be a single country, rather than 16 individual nations.

The results and information behind these forecasts are contained out below and include discussions on:

1. The future size and structure of the industry
2. Why there is a Global Conundrum
3. Why is there a choice between the **People or the Planet** and is it resolvable
4. Where we are now
5. What the future holds
6. Appendix

The main data analysed are:

1. Population, expansion and deprivation
2. Sales
3. Production
4. Scrappage

and their relationships, including:

1. Sales to population

2. Vehicle ownership density
3. Landmass, people and vehicle density
4. Urbanisation
5. Roads
6. Electricity generation

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As the old saying goes ***"forecasting is difficult, especially when it's about the future".***

Some of the data presented are remarkable and may seem to be optimistic - or, if you prefer - pessimistic, as many believe the world is already awash with vehicles and there is no room for large additional volumes to ply its roads.

However, this is mainly true for the "more developed" world. Africa and Asia alone are already home to 77% of the world's population, rising to more than 80% by 2050 with Africa on its own representing more growth over the years to 2050 than the rest of the world combined.

There is little doubt that a significant majority of the world's population is badly in need of additional resources if deprivation is to be reduced, and conflict avoided. This means future automotive volumes may well be significantly in excess of the numbers shown above.

There is a major rift, however. This is concerned with the automotive drive trains of the future. The section on electricity examines this aspect against forecasts for the rate of expansion of generation, but the mainstream vehicles currently available will not be suitable for operation in many developing areas of the world.

Hence the subtitles to this report **The Global Conundrum** and **People or the Planet.**

The Global Conundrum

The creation of this forecast has considered several important global metrics - as shown later in this report - but some primary factors have a major impact.

Although the global industry has shown impressive growth in many countries and regions, other areas have almost negligible levels of motorisation. There really is a great divide, with some harsh realities affecting the future of the least developed areas of the world.

Probably the most important drivers of change in the evolution of motorisation are the size and distribution of the global population, the availability of energy, and purchasing power, along with several other crucial metrics.

The choices facing the world are largely encapsulated in the three charts below.

Looking at the future

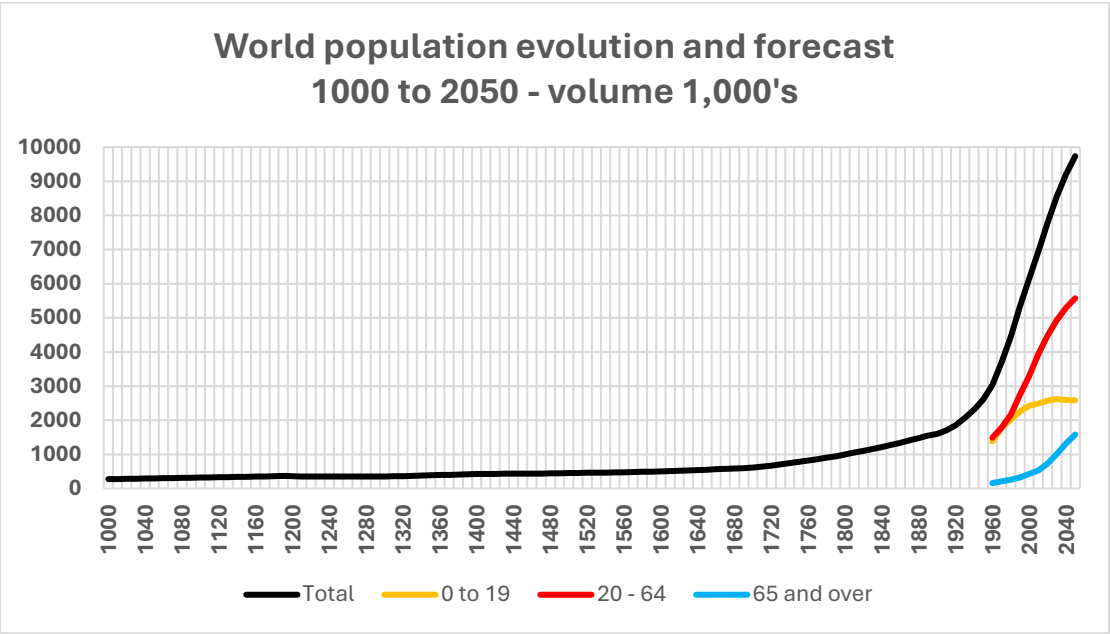
Population

Looking at the future involves recalling the long-term evolution and development of humanity, the time-scales and technology concerned, and reminding ourselves of the challenges that have been – and will have to be – overcome during the years to 2050 and beyond. The most important single element concerns the global population, its age groups, how it has developed and where it is located.

Graph 1 is shown to provide some perspective on how the world's population has evolved since the year 1,000 and the expected population trajectory by major age groups, including the crucial 20–64-year-old cohort, from 1960 to 2050.

It is the expansion of this economically active 20–64-year-old group that will be one of the main drivers of change in the years to come.

Graph 1 - World population, evolution and forecast – 1000 to 2050



The population was relatively stable for almost 600 years from the year 1,000, before growth really began around 1700. It took until 1810 for the population to breach the 1 Mn level, as depicted in the graph and more than 100 years to rise to 2 Bn in 1920. It then took just 40 years to 3 Bn in 1960. Numbers increase by 1Bn in ever shorter time scales, reaching 4 Bn by 1972, 5 Bn by 1988 and rising to 7.8 Bn in 2020.

The graph also demonstrates how recently the "modern" age commenced as advances in agriculture, science, technology, nutrition and medicine allowed the start of exponential growth that will lead to almost 9.7 Bn people by 2050.

World population evolution 1960 to 2050

The current situation

The global population stood at 3.03 Bn in 1960, rising to 5.5 BN in 1990 and 7.8 BN in 2020. The current forecast is that almost another 2 Bn will be added to give a total of almost 9.7 Bn by 2050.

Although there has been remarkable success in recent years in some parts of the globe in maintaining and improving economic, social and medical well-being, severe levels of deprivation continue to exist in developing nations.

Global data suggests that:

1. Some 700 Mn people still have no access to basic drinking water. ***(United Nations)***

2. Circa 2.2 Bn people, or 23% of the world's population still do not have access to clean water. ***(United Nations)***

3. Some 3.5 Bn, or a remarkable 44% of people, have little or no access to managed sanitation. Such is the rate of population growth in Africa and other countries, mainly in Asia, it seems likely these data will get worsen, not improve. ***(United Nations)***

4. Circa 800 Mn people have no access to electricity, of which 700 Mn live in Africa. ***(International Energy Agency)***

5. *"Conflict, climate change, growing water scarcity, demographic change, and urbanisation are already harming safe water supply systems. By 2025, (the year of writing) half the global population will live in regions suffering from water stress. This means that demand for water will exceed the amount of water available. This is already the case for 17 countries, including India, Libya, Qatar, Botswana, The United Arab Emirates, Morocco, Jordan, Pakistan, and Lebanon, according to the* ***World Resources Institute*** *2019 report."*

Population evolution 1960 to 2050 – by region

As the world's population continues to soar, it poses serious challenges as how to this expansion can be managed, both for the people and the planet. In broad terms the populations of the more mature nations, such as those in Europe and N America, are

stabilising, while the populations in Africa and some of the nations in Asia are growing apace.

It seems inevitable that some of the conditions listed above will worsen between now and 2050 as populations grow more rapidly than it is possible to increase GDP, install incremental infrastructures and expand the generation of electricity.

Chart 1. World population evolution 1960 to 2050 – by region

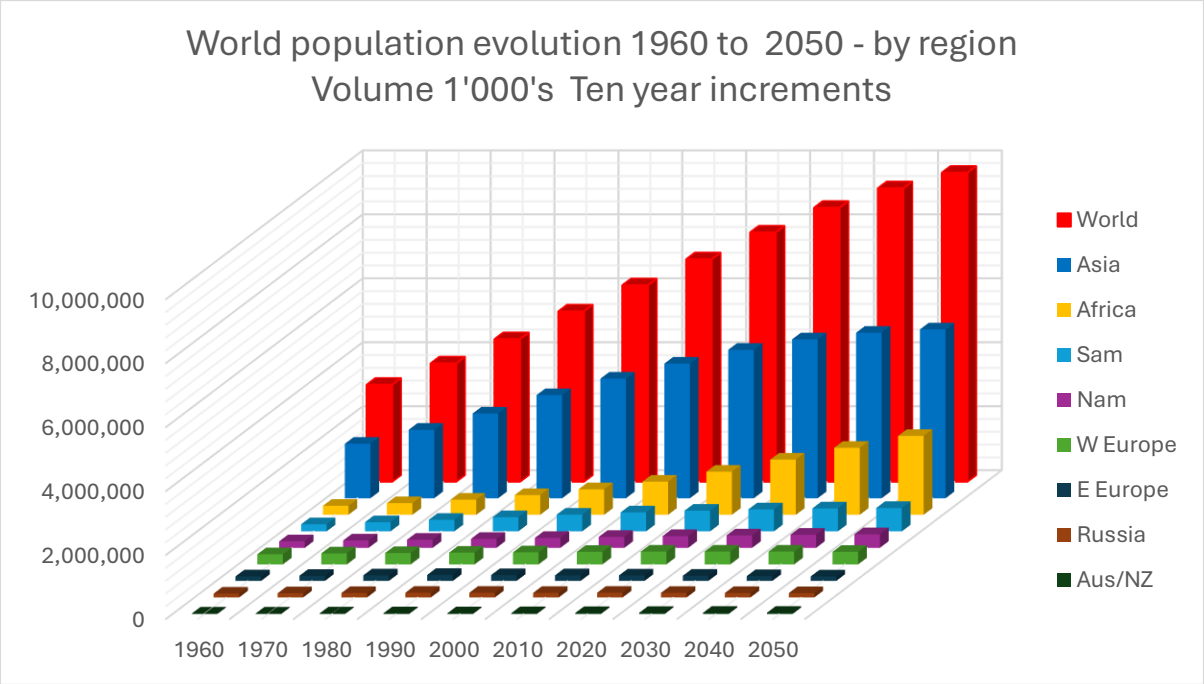


Chart 1 shows the broad picture of the recent evolution of the population by region and how it will be dominated in 2050 by Asia and Africa, with more than 80% of the total. Just two nations, China and India, will be home to almost 1/3rd of the world total by 2050.

Global vehicle distribution in 2020 vs population.

Chart 2 provides indicators that will affect the future size and direction of the industry over the years to 2050. The chart is a scatter diagram that looks at the global structure of motorisation in 2020, for a range of countries/regions.

The sizes of populations are shown as a percentage of the world total in 2020 and are compared with the share of vehicles in use in 2020, to provided a deeper overview of the recent structure of the industry.

The population forecast for 2050 is also included as an indicator of the forces in play that will have a profound effect on the future locations of automotive development.

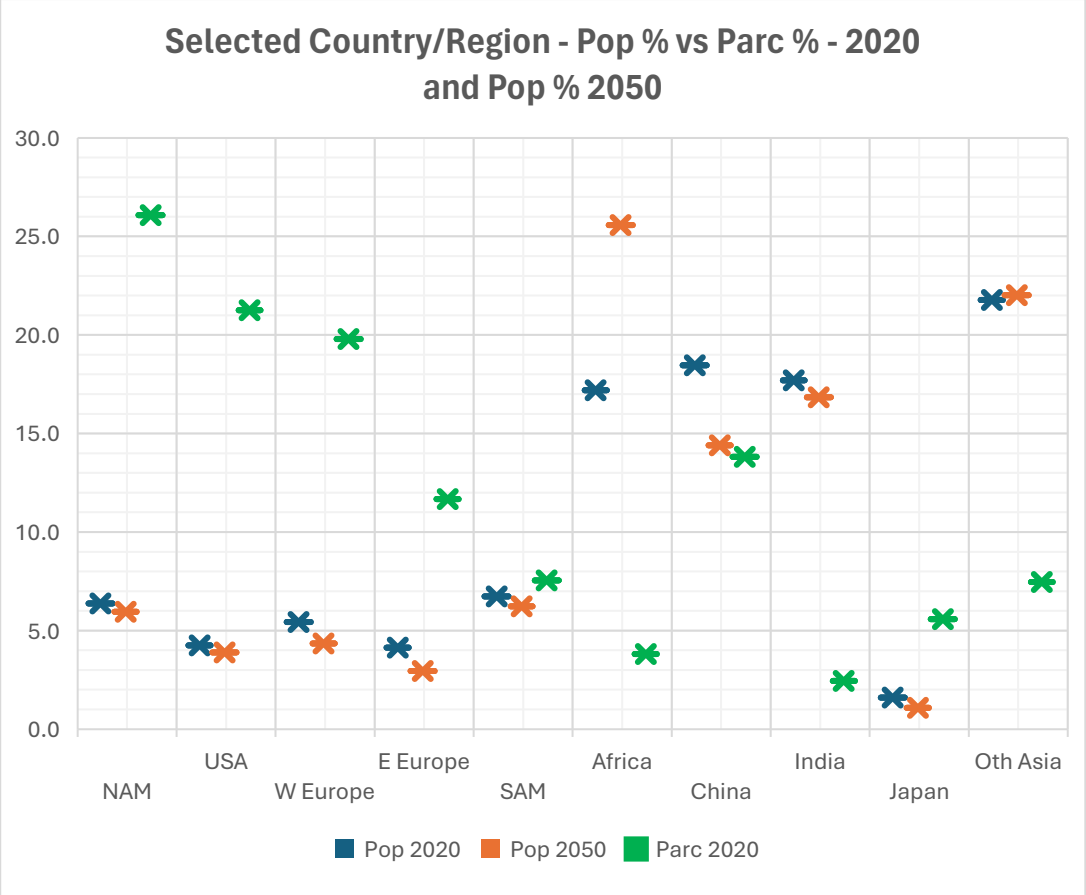
The chart shows, for example, that the **USA** was home to 4.2% of the world's population in 2020. It also shows that the USA contained 21.3% of the vehicle parc in the same year.

This provides an ownership density in 2020 of 895 vehicles per 1,000 population, and that its share of the global population will have fallen slightly to 3.9% by 2050. It is

reasonable to assume that the vehicle ownership ratio will be similar in 2050 as near saturation levels of motorisation already exist in the country.

At the other end of the scale the continent of **Africa** had 17.2% of all humanity in 2020 but its share of the vehicle parc languished at just 3.8% with a consequent ownership level of circa 45 vehicles per 1,000 population. As Africa's population is expected to rise to 25.6% of the global total in 2050, it seems inevitable that there must be a major increase in sales and ownership over the coming years if the continent is to have any chance of development. It also needs to be rememberd that the continent of Africa is massive with a landmass of 29.4 Mn Sq Km's, or 23% of total landmass. *It is therefore larger than either S America or Russia or N America, (that is the USA and Canada combined!)*

Chart 2. Comparison of population % world total in 2020 and 2050 vs Parc % in 2020



China has demonstrated just how rapidly a country can develop. In the year 2000 it was home to just 2.2% of the global vehicle parc, but this had increased to almost 14% by 2020 and to 18% in 2023. Even with this major growth, China is still in the lower echelons of global ownership density (180 per thousand) and can expect substantial further growth.

Japan punches above its weight in parc share versus population terms, and will remain stabilised due to its limited landmass, but "**Other Asia's**" parc share of 7.5% is well below

its 2020 population share of 21.8%, with major a major increase in motorisation expected as it's population continues to grow and incomes expand.

India also has a profound mis-match, with its population share of 17.7% likely to fall slightly to 16.8%, but its share of vehicles currently in use in 2020 is just 2.4% which represents an ownership ratio of just 33 per 1,000 vehicles with four wheels or more.

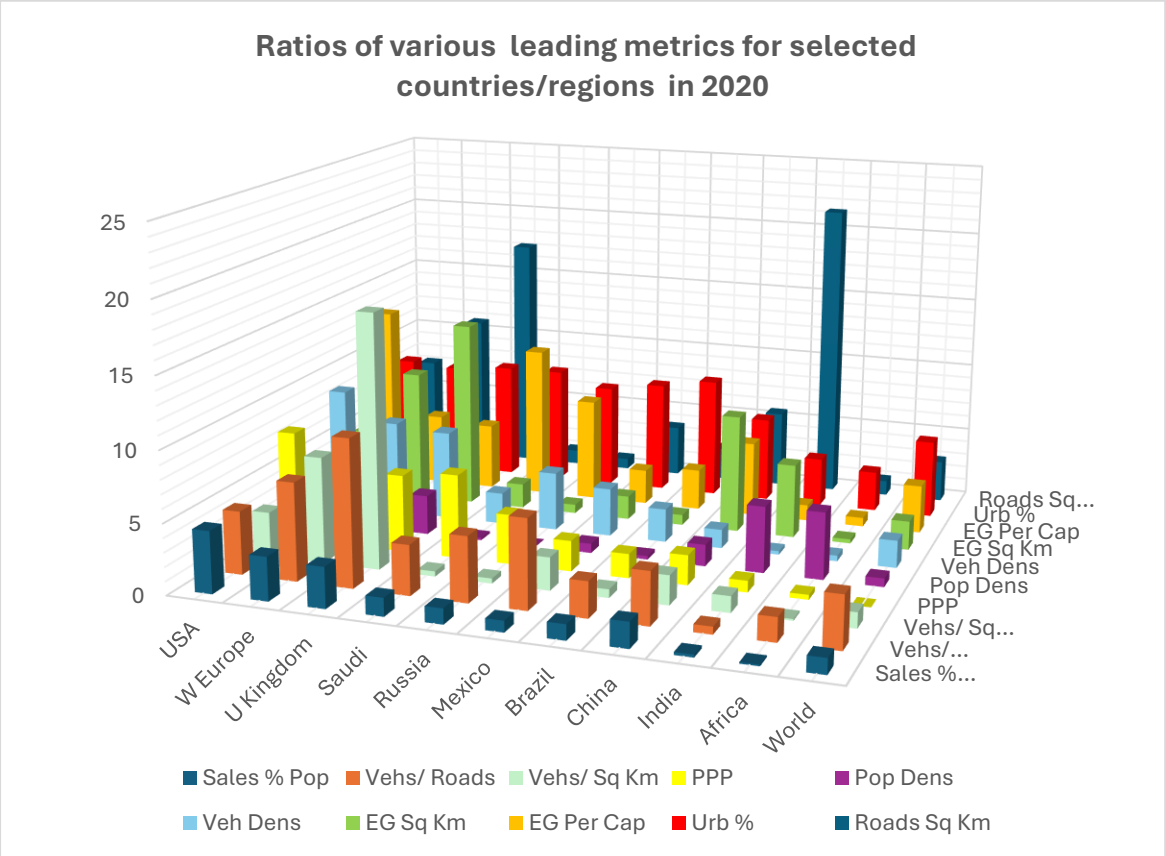
Please note that although India's share of population falls between 2020 and 2050 the total number of people there continues to rise substantially.

Regional Metrics

Ratios of various leading metrics for selected countries/regions in 2020

As well as the current distribution of motorisation described above there are several metrics which will influence the future shape, size and specification of the vehicle market over the years to come which are shown in **Chart 3.**

Chart 3 - Ratios of various leading metrics for selected countries/regions in 2020



The metrics contained in the chart have been selected on the basis that they are all intrinsic to the supply and operation of motor vehicles and the development of infrastructure, although there may be more that fit that description.

1. **Vehicle sales as % Population**
2. **Vehs/roads** - the number of vehicles per kilometre pf road
3. **Vehs/Sq Km** – the number of vehicles per square kilometre of landmass

4. **PPP** – relative Purchasing Power Parity
5. **Pop Dens** – the number of people per square kilometre of landmass
6. **Veh dens** – the number of vehicles per 1,000 population
7. **EG Sq M** – electricity generated per square kilometre of landmass
8. **EG per cap** – the amount of electricity generated per cap per annum
9. **Urbanisation** - the proportion of people living in an urban environment
10. **Roads per Sq Km –** road length per Sq Km of land mass

(Road networks in Kilometres – World Bank - (**Note Caveat).** This network refers to the complete road network and includes paved and unpaved length. Broadly, paved networks are estimated to account for 60% of the total, with West and East Europe (with the exception of Russia), circa 95% paved and Russia 66% paved. China claims 100% paved and India 60%. Data for Brazil suggests just 12% paved. Data for Africa shows paved length at just 43%, but 30% of the paved sector is in S Africa. The USA has 73% paved, but Mexico just 21%.)

Although this data is complex, it shows that there is little homogeneity across the regions/countries of the world in terms of socio-economic development, the effects of population distribution versus land mass, available purchasing power and the availability energy in the form of electricity.

Below are the data from which Chart 2 is constructed

Some aspects of global development in 2020

	Sales % Pop	Vehs/ Roads	Vehs/ Sq Km	PPP	Pop Dens	Veh Dens	EG Sq Km	EG Per Cap	Urb %	Roads Sq Km
USA	4.4	4.5	3.2	7.8	0.4	8.8	4.7	13.0	8.3	7.2
W Europe	3.1	7.0	7.5	6.0	4.9	6.7	9.5	5.2	8.0	10.8
U Kingdom	2.9	10.4	18.0	5.5	2.8	6.4	13.5	4.8	8.4	17.2
Saudi	1.3	3.6	0.4	6.0	0.2	2.3	1.8	10.9	8.4	1.0
Russia	1.1	4.6	0.4	3.6	0.0	4.2	0.6	7.4	7.5	0.8
Mexico	0.8	6.3	2.3	2.2	0.7	3.5	1.7	2.5	8.1	3.7
Brazil	1.1	2.6	0.6	1.7	0.3	2.4	0.7	3.0	8.7	2.4
China	1.8	3.7	2.1	2.1	1.6	1.4	8.5	5.4	6.1	5.6
India	0.2	0.5	1.2	0.8	4.7	0.3	5.3	1.1	3.5	21.4
Africa	0.1	1.7	0.1	0.4	4.8	0.4	0.3	0.6	2.9	1.1
World	1.1	3.7	1.1	0.0	0.6	2.0	2.1	3.5	5.6	3.0

The data shows, for example, that the density of vehicle ownership compared with population ranges from 8.8 in the US to just 0.4 in Africa, with a world average measure of 2.0.

The volume of vehicles sold as a percentage of the population ranges from 4.4% in the USA to 0.1% in Africa with a world average of 1.1%.

In terms of the amount of electricity generated per capita, the ratio ranges from 13.0 in the USA to 10.9 in Saudi Arabia, 5.2 in W Europe and 0.6 in Africa.

The level of urbanisation is generally high with more than 80% of the population living in an urban environment in many of the named areas. This is especially important in large landmass countries/regions such as Russia and Brazil, where population are concentrated, versus India and Africa where populations are widely dispersed.

Chart 4 concentrates on the 20 countries forecast to have the largest populations in 2050 and the resultant change since 2020. India continues to see substantial growth, but China' population is forecast to reduce by millions.

Perhaps the most notable aspect to appear from these data is the number of countries from Asia and Africa that appear, reflecting the information already seen in **Chart 1.**

Chart 4. Top 20 populations 2020 vs 2050 -volume 1,000's

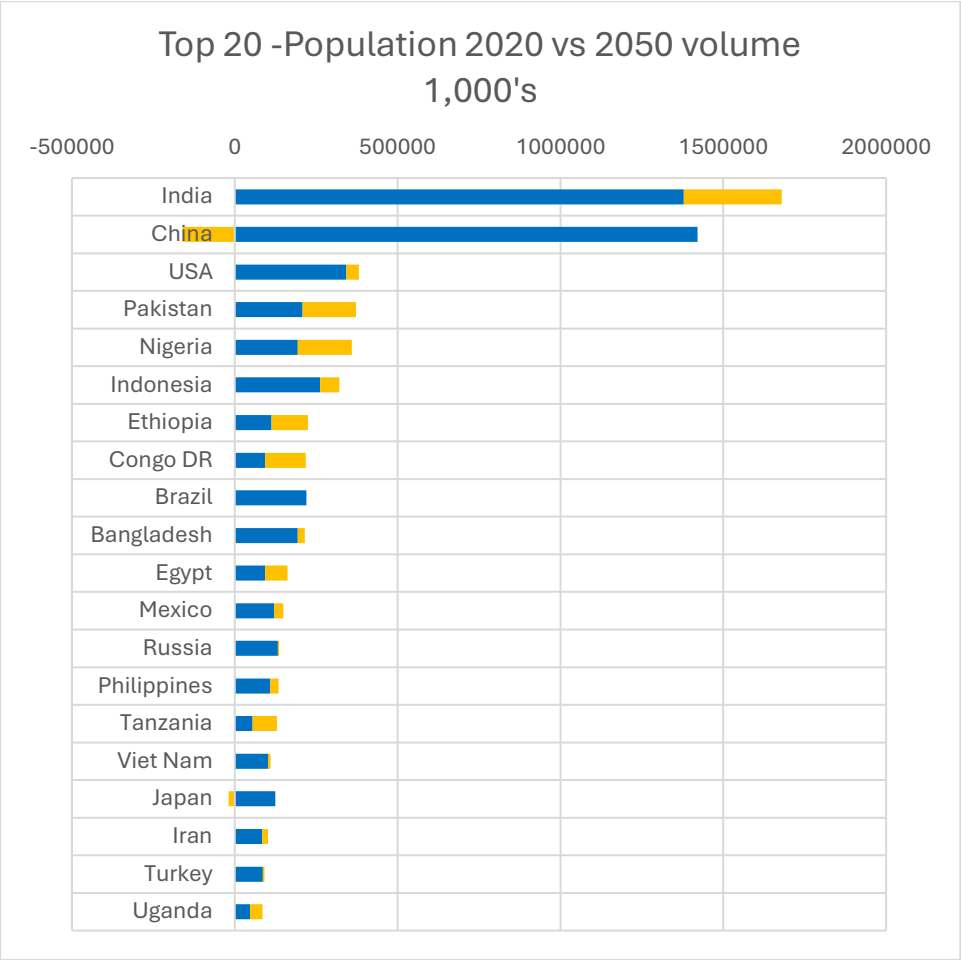


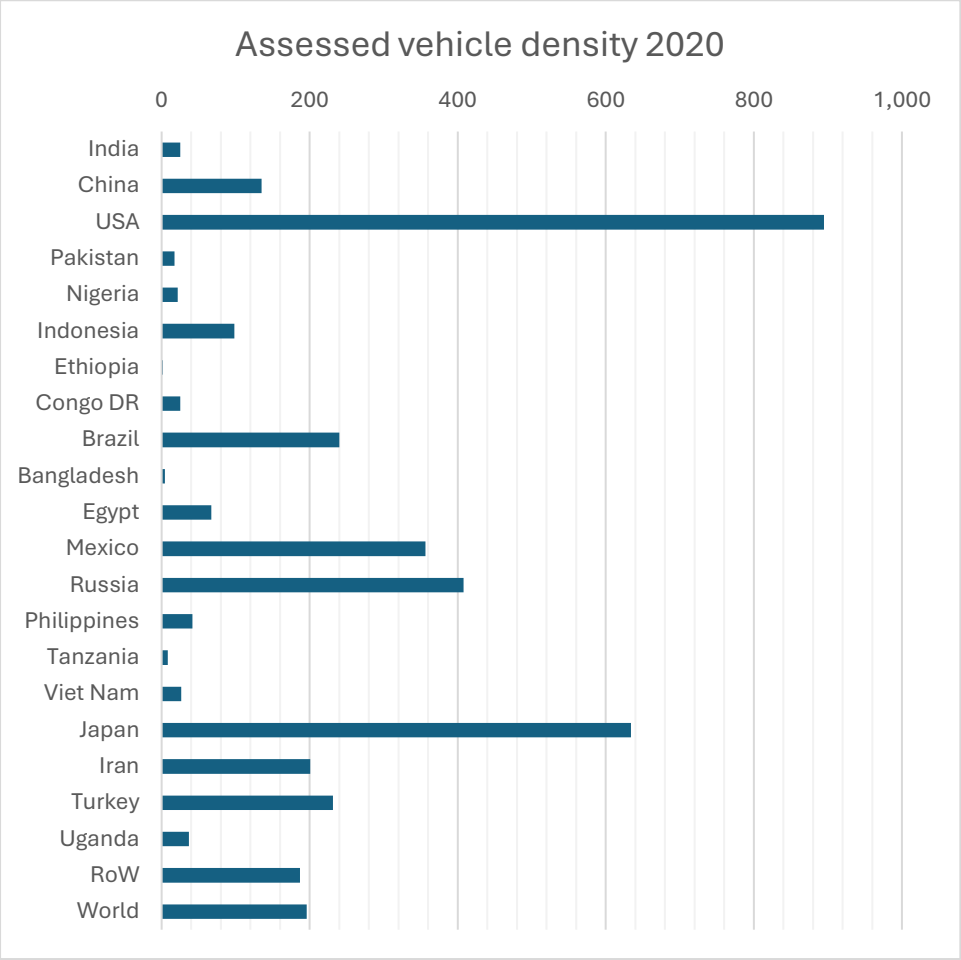
Chart 5 amplifies the direction of travel by comparing the same 20 counties with current vehicle ownership density.

Ownership in the US is the highest in the world, due not only to its high purchasing power, but also because of its huge landmass.

However, the most important message is the countries with the highest growth rates now emerging in the Top 20 also have some of the lowest vehicle density ratios in 2020.

There will need to be massive inflows of vehicle into these nations to allow even **existing** levels of social development to be maintained through to 2050.

Chart 5. Assessed vehicle density in 2020



These data for 2020 show that the USA had by far the highest ratio at 895, followed by Japan at 634 with the world ratio at 196.

India, which now has the largest world's largest population, had a modest ratio of 25 at the time and is clearly a candidate for expansion. However, it is the Asian countries of Pakistan, Bangladesh, the Philippines and Vietnam, with some of the lowest ratios in the world. that need to see a major uplift if their economies are to prosper.

The nations in Africa showing fast population growth, Nigeria, Ethiopia, the Congo Dem Rep, Tanzania and Uganda also have very low ratios and will find it difficult to improve their socio - economic development without a significant increase in motorisation.

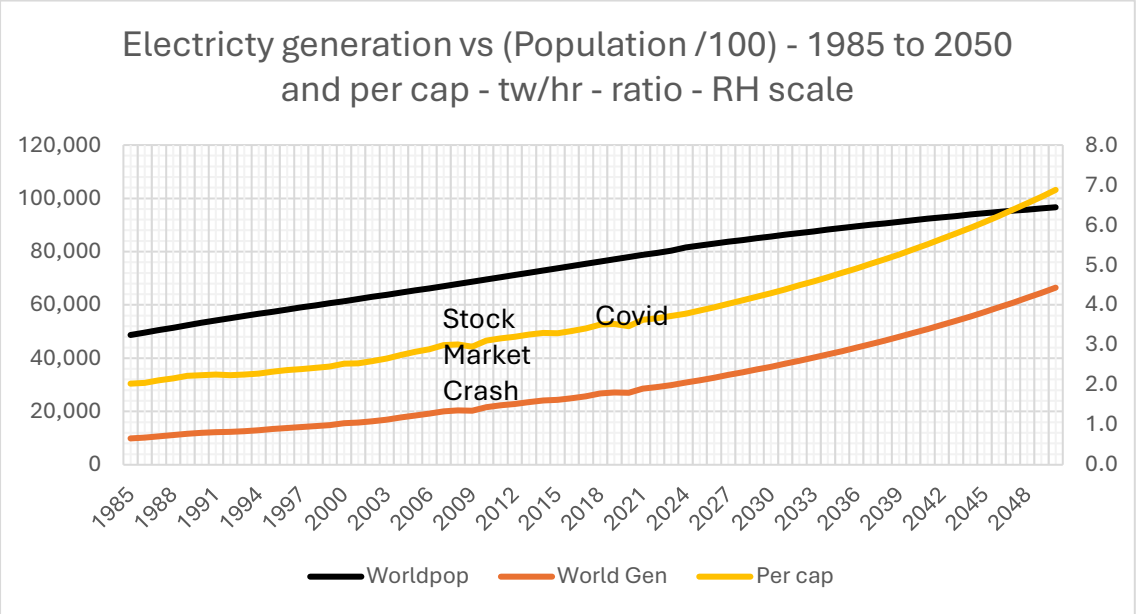
Generation of electricity

Electricity generation vs population 1985 to 2050.

The generation of electricity is a pre-requisite for the growth of economies, the well-being of its citizens and the operation of industry.

The amount of energy generated has been measured annually in a time-series running from 1985 to 2023 on a global basis, in terawatt/hours. Generation has grown at an annual rate of 3% over this period and this rate is forecast to continue through to 2050. ***(Enerdata).*** This would lift the rate to circa 67 terawatt/hours in 2050, altough some countries/regions will grow more quickly than others, as has been the case in the past.

Graph 2. Generation vs population 1985 to 2050 – tw/hr.



On a global basis the rate of generation as risen more rapidly than the growth in population, thereby lifting the tw/hr ratio per capita from 2 in 1985 to 3.7 in 2023 as shown in **Graph 2**, with a forecast of 6.9 in 2050.

However, just five countries, China, the USA, India, Russia and Japan, account for circa 60% of the total, compared with - for example - just 3% for the whole of Africa.

Electricty generation by region – 1985 to 2050 – tw/hr

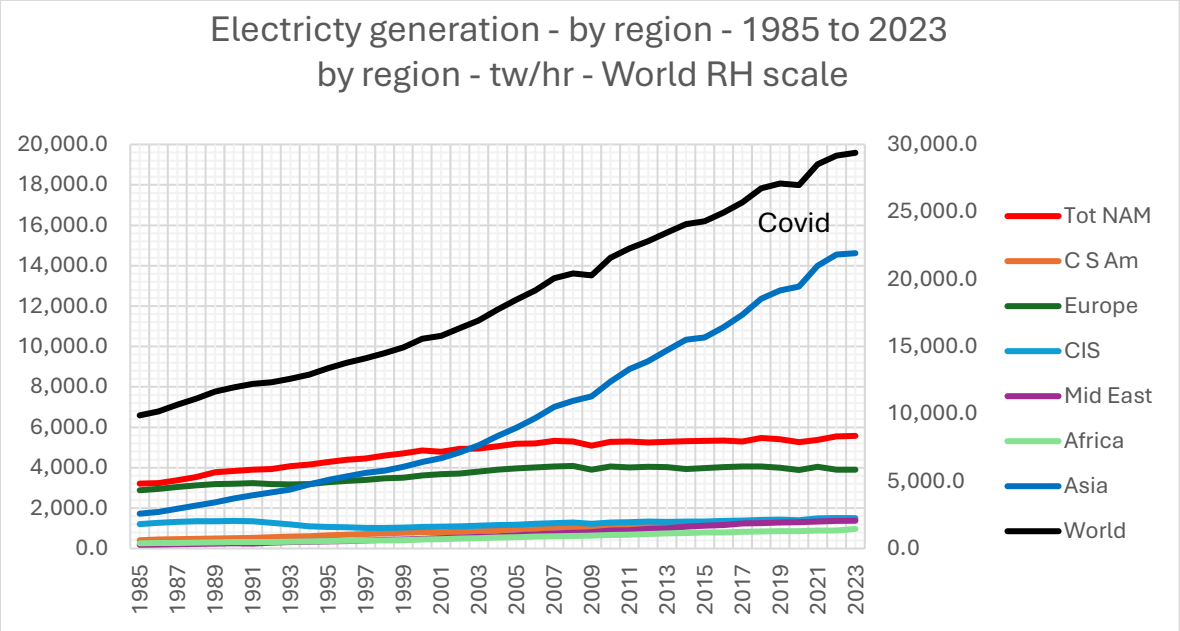
The regions shown here from the **EI stats review** source document differ from those used in the the main body of this report. Here, N America includes Mexico, and Europe consists of both W and E Europe.

There is also a region covering the Middle East and for CIS (Commonwealtn of Independent States), based on Russian influence.

Graph 3 illustrates generation by region, with the world total shown on the R H scale.

The value for Asia has soared since 1985, but those for N America and Europe have been essentially stable since 2007. The other regions generate modest levels in comparison even though Africa has an ever-expanding population.

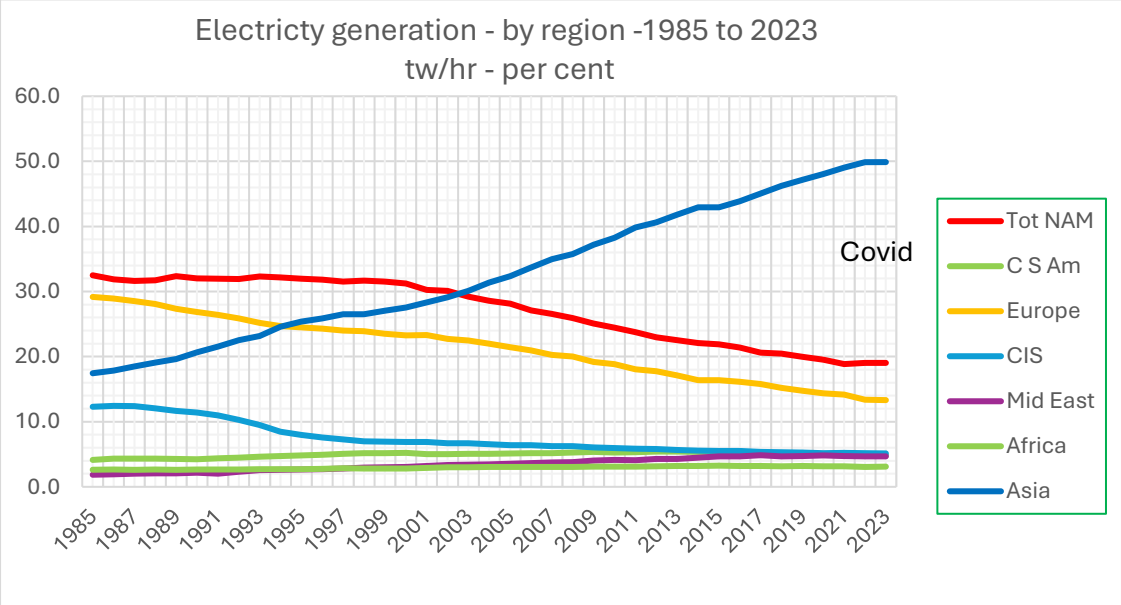
Graph 3. Electricity generation – by region - 1985 to 2050 – by region – tw/hr



Electricty generation – by region - 1985 to 2050 – tw/hr – pr cent

Graph 4 converts the same data into percentage terms and shows that Asia's share has risen from 17% in 1985 through 30% in 2004 and now stands at 50%. It seems certain that Asia will generate more electricty in the years ahead, lifting its per capita ratio, with more modest values for the other regions.

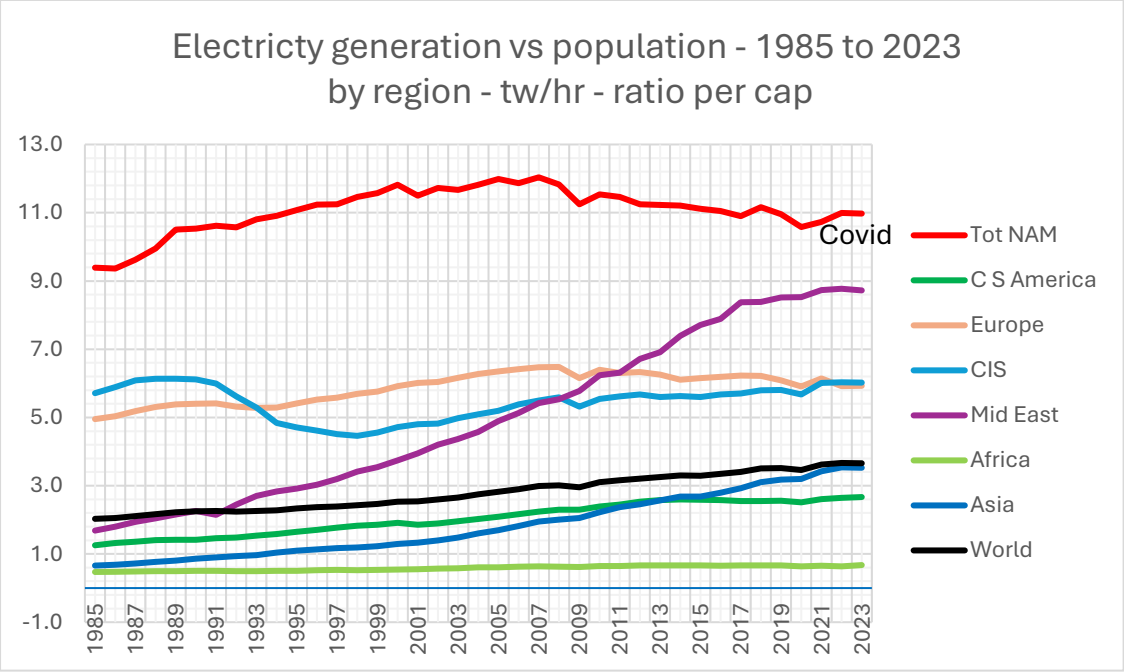
Graph 4. Electricty generation – by region - 1985 to 2050 – tw/hr – per cent



It also seems that Africa, even though it has a rapidly expanding population, may not be able to raise its per capita ratio.

The next level of analysis examines the amount of electricty generated per capita over the 1985 to 2023 time period and these relative values are shown in **Graph 5** below.

Graph 5. Electricty generation per capita by region – tw/hr – 1985 to 2023



N America generates the most electricty per head at circa 11 to 12 tw/hrs with Europe between 5 and 6 tw/hrs. The Middle East has experienced an extremely rapid increase in generation compared with population with a value of just over 1 in 1985 rising to 8.7 now.

The ratio for CIS dropped sharply following the collapse of the Former Soviet Union and the fall of the Berlin Wall, but has recovered somewhat in recent years.

The world value has risen over the years and is now at 3.7 tw/hrs, about the same as for the Asian region, but generation in Africa has scarcely changed over years with the production of electricty just about keeping pace wih the rise in population.

The steady increase of 3% per annun forecast is most likely to occur in Asia,as some of its nations, especially China and India, continue to thrive, but it is difficult to see any advance, rapid or otherwise, for Africa.

The steady and consitent rise in the overall forecast level of genertation, although lifting the global average ratio, seems low when considered against the potential needs to satisfy new data centres, the rapid development of AI, the desire to move towards an electric vehicle fleet and the need to extend the use of electricty to those nations currently without a supply, or an inadeqate supply.

Prospects 2050

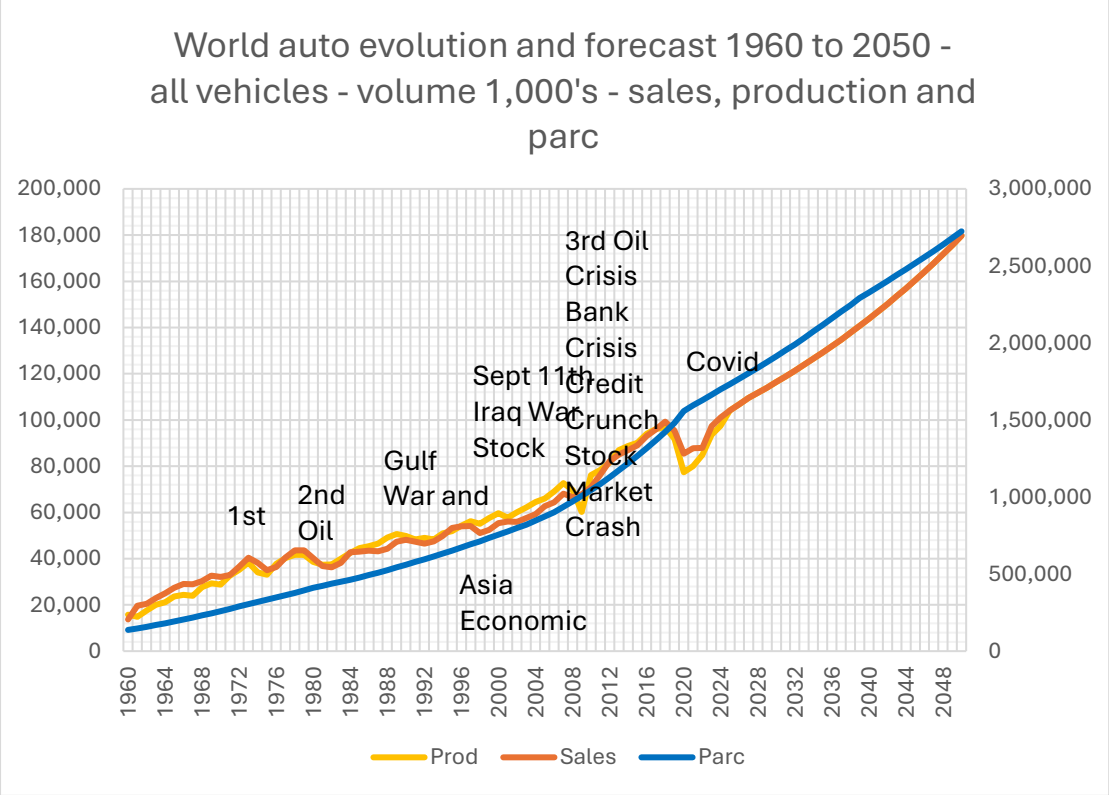
World auto evolution and forecast to 2050

This forecast looks at the prospects for the automotive industry over the years to 2050 taking into account the information and data presented above and the 64-year time series of the industry since 1960 and the **conundrum** that arises over how the world copes with the possibility of a doubling of the number of vehicles on its roads, known as the vehicle parc, consisting of the number of with vehicles of four wheels or more. This inevitably leads to the fact that a decision will ultimately have to be made as to which comes first – **people or the planet** – and that decision is not far off.

Where are we now?

The starting point for any such a forecast has to be an understanding of the current position, illustrated in the graph below and how we have arrived at it. The graph shows how the industry has developed over the years since 1960 - therefore providing a 64-year history of the global industry - and an assessment of where it will be for the years to 2050.

Graph 6. World auto evolution and forecast to 1960 to 2050



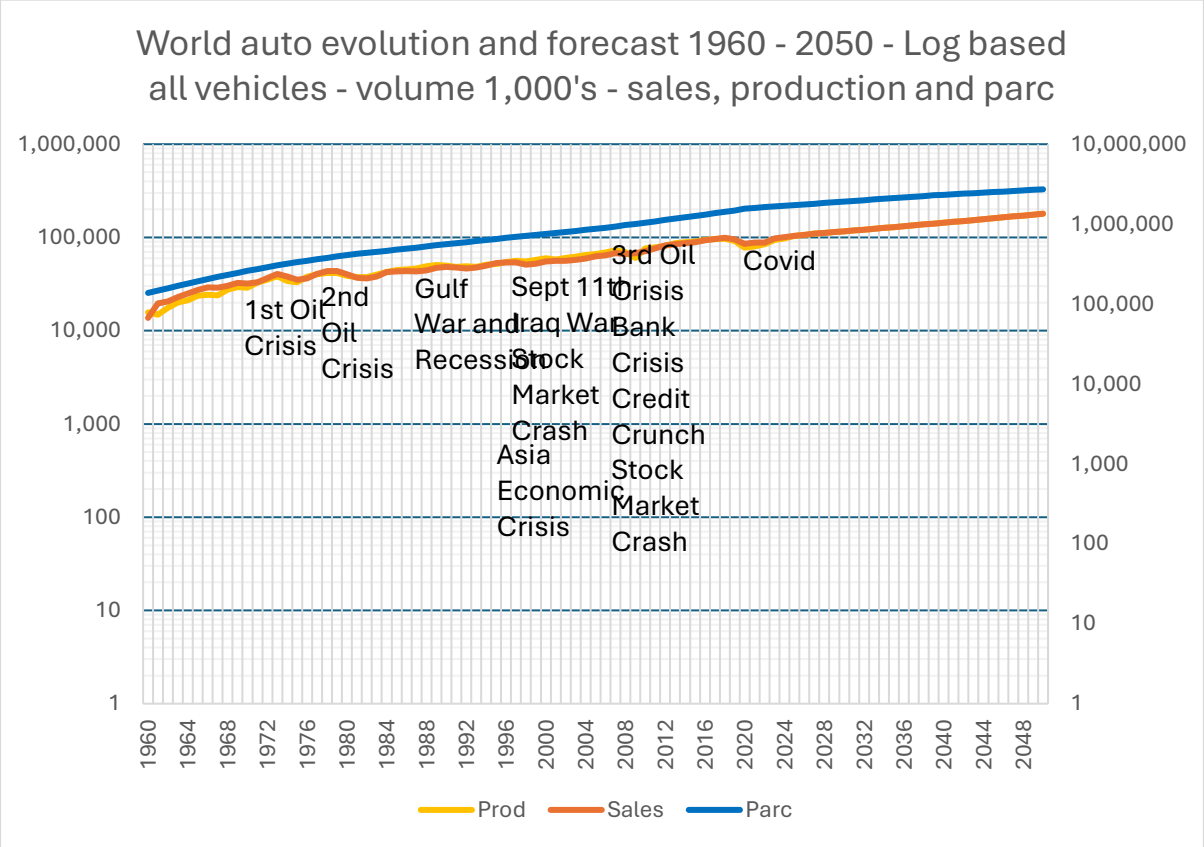
Vehicle **sales and production** peaked at almost 99 Mn in 2018, immediately prior to Covid. The disconnect shown in the graph between sales and production is attributable to destocking and production reductions in response to falling sales during the Covid period. Volumes have largely recovered with sales assessed at 98 Mn in 2023.

The parc of vehicles with four wheels and more - which is shown here on the RH scale - reached 1.66 Bn in 2023. However, in addition to these vehicles there is an estimated parc of 600 Mn or so 2- and 3- wheeled vehicles in use, mainly in countries in Asia.

This forecast is built on a "business as usual basis" as it is impossible to forecast future ruptures such the historic events shown in the graph, and indeed the "Tariff Turmoil" that is unfolding at the time of writing as well as the war in Ukraine and conflicts in the Middle East. It is also built bearing in mind the concerns enumerated in previous sections.

The forecast shows that annual vehicle production/sales will reach 182 Mn units per annum by 2050 and the four wheel and more vehicle parc will reach 2.7 Bn by the same time. This in turn shows that 2.58 Bn units will be scrapped over the period 2025 to 2050 inclusive, which is a powerful component in supporting the sales/production forecast shown.

Graph 7. World auto evolution and forecast to 2050 – Log based



The data shown in **Graph 6** is converted to a Log base view in **Graph 7** to depict the rate of growth of the industry over the actual historic period and the years to 2050.

The major events/conflicts in **Graph 6** show their effects on the development in the global industry. The Log based view reduces their apparent importance to almost ripples in the long-term view and the seemingly extravagant forecast appears muted, as the forecast rate of growth is in fact slower the historic picture.

Even so, this forecast has caveats, as might be expected. On the one hand, the sales/production forecast could well exceed the volumes shown for India for example, should it follow a similar route to China, and if Africa should awaken from its slumbers. Under these considerations annual volumes would well rise to 200 Mn units per annum and the vehicle parc would rise to over 3 Bn, almost twice its current size.

World vehicle sales evolution and forecast - 1960 to 2050 - by country/region

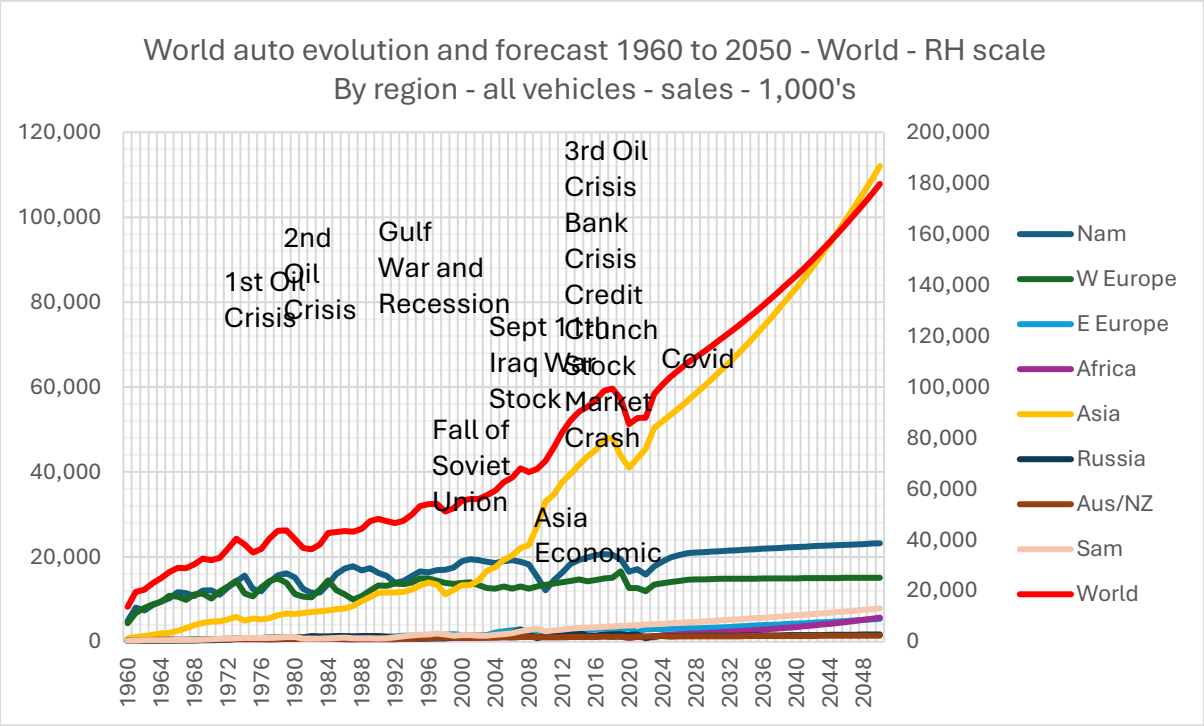
This section on historic and future sales volume by region represents the major portion of this forecast as the numbers for production, parc and scrap are all derived from it.

Please note that in **Graph 8,** the data for the World total is measured on the R H scale.

The volume of vehicles sold across the world has grown substantially and was initially dominated by a small number of markets. Even in 1990, just three markets, the US, Japan and Germany, accounted for 53% of total volume but with the addition of France, Italy and the UK the total is lifted to 68% in that year.

But it is the rise of China that began in 2000, that has transformed the recent world profile. Essentially N America (the US and Canada) are approaching saturation as are W Europe and Australia/N Zealand. There is some growth left in E Europe as it approaches parity with W Europe

Graph 8. Regional auto evolution and forecast to 2050 by region/country - sales



Consequently, forecasted sales volumes of new vehicles for these “developed” regions remain muted, and are supported by sales to replace scrapped units and exports of used vehicles.

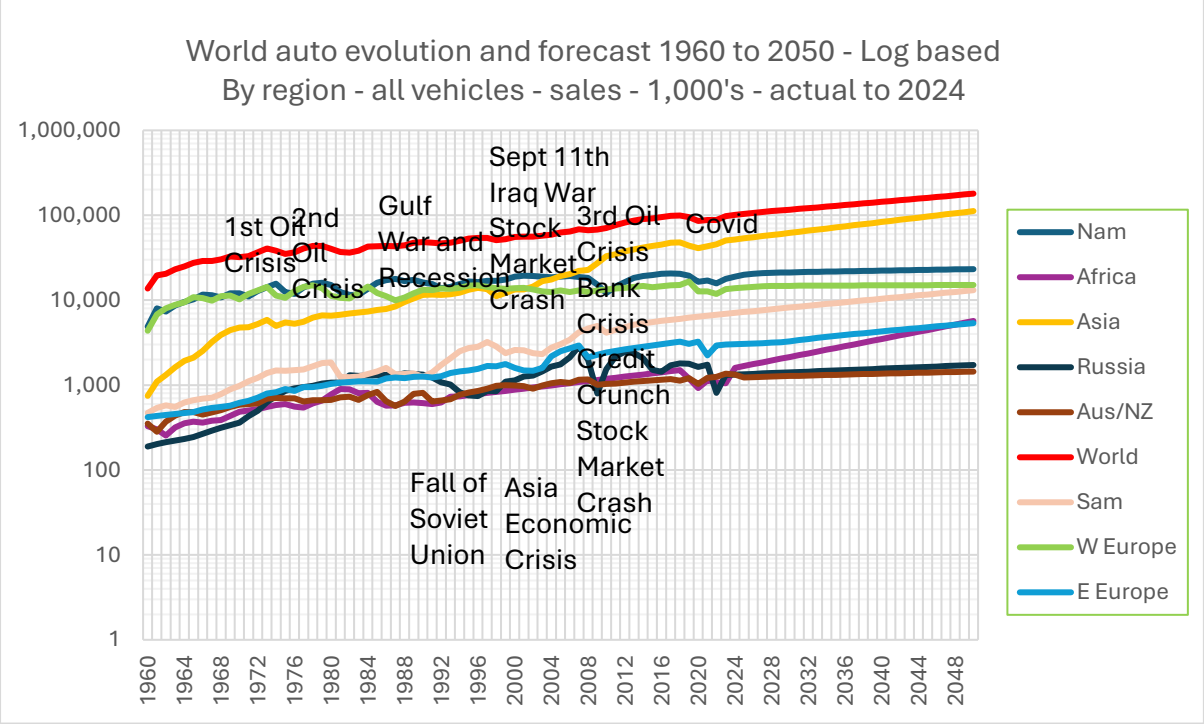
India and other markets in Asia contribute to the high volumes shown for Asia, but the forecast for Africa remains constrained by the multiple challenges the continent faces. It is expected that Africa may well be the destination for high volumes of used vehicles.

Prospects for additional volumes in S America, which includes Brazil and Mexico, will also contribute strongly to the forecast global output.

Regional sales volumes 1960 to 2050 – Log based

The log-based analysis of **Graph 9** shows the rapid rate of change apparent in the early years for all regions has moderated, with Asia showing the greatest momentum in the future, with some modest expansion still possible in E Europe. N America and W Europe are essentially in stasis.

Graph 9. Regional auto evolution and forecast to 2050 by region/country – sales Log based



Regional auto evolution and forecast to 2050 – percent -sales

The picture of how the various regional markets have managed as sales volumes have expanded, is shown in **Graph 10** and demonstrate starkly how the auto market has pivoted away from the "traditional" arena to the new centres.

N America and W Europe dominated production and sales for the first thirty years of this time series, the rise of Asia, in the form of Japan and S Korea provided the first challenge to their domination.

The addition of China from the year 2000 in terms of both production and sales has been dramatic and unprecedented and changed the international structure of the industry for ever.

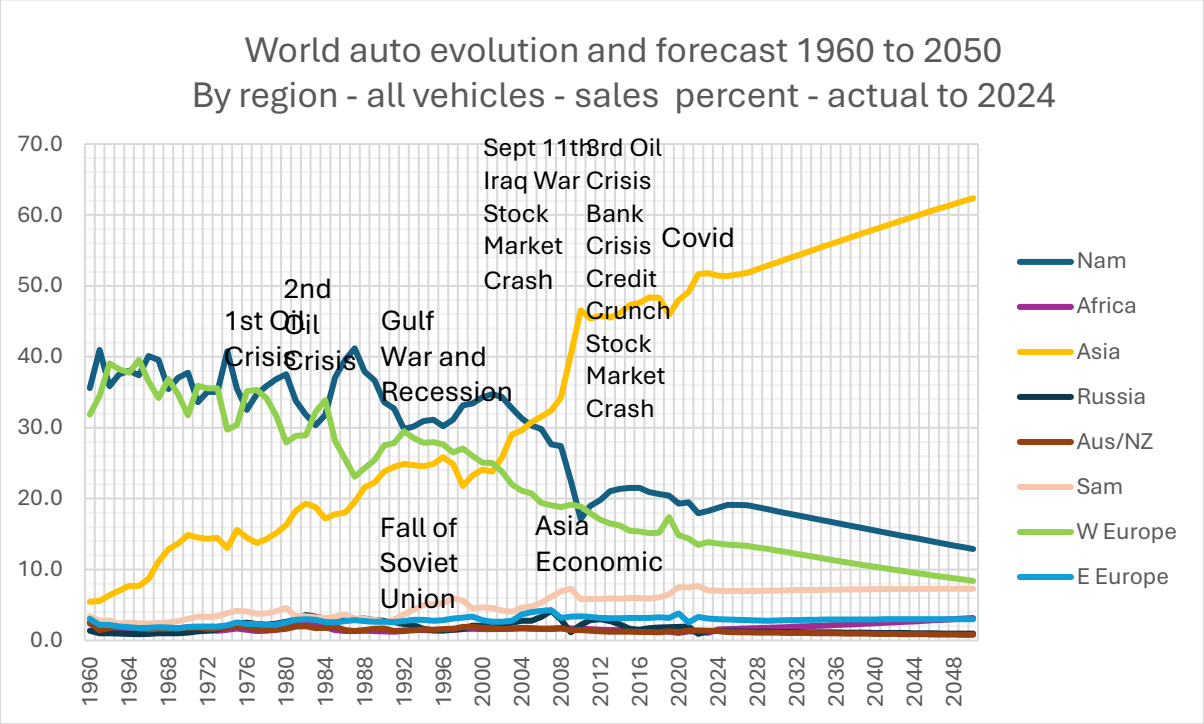
There seems little doubt that India will evolve into a major player – (it is already the world's fourth largest manufacturer of vehicles with four wheels or more and produced a total of 28.4 Mn units in 2024 including 2- and 3- wheelers).

The forecast shows that Asia will sell more than 62% of global volume by 2050 with N America at 13%, W Europe less than 9% and S America at 8.4%.

In this forecast Africa remains almost dormant, but could well surprise, as it seems unrealistic to imaging that such a vast continent, home to almost 2.5 Bn people, or 25% of the global population can continue to lag all other regions to such an extent.

The problem is how a continent with 54 highly diverse nations and more than 1,000 languages can cohere into a common entity effectively to harness its potential.

Graph 10. Regional auto evolution and forecast to 2050 – percent -sales



World auto evolution and forecast to 2050 by – sales as a percent of population

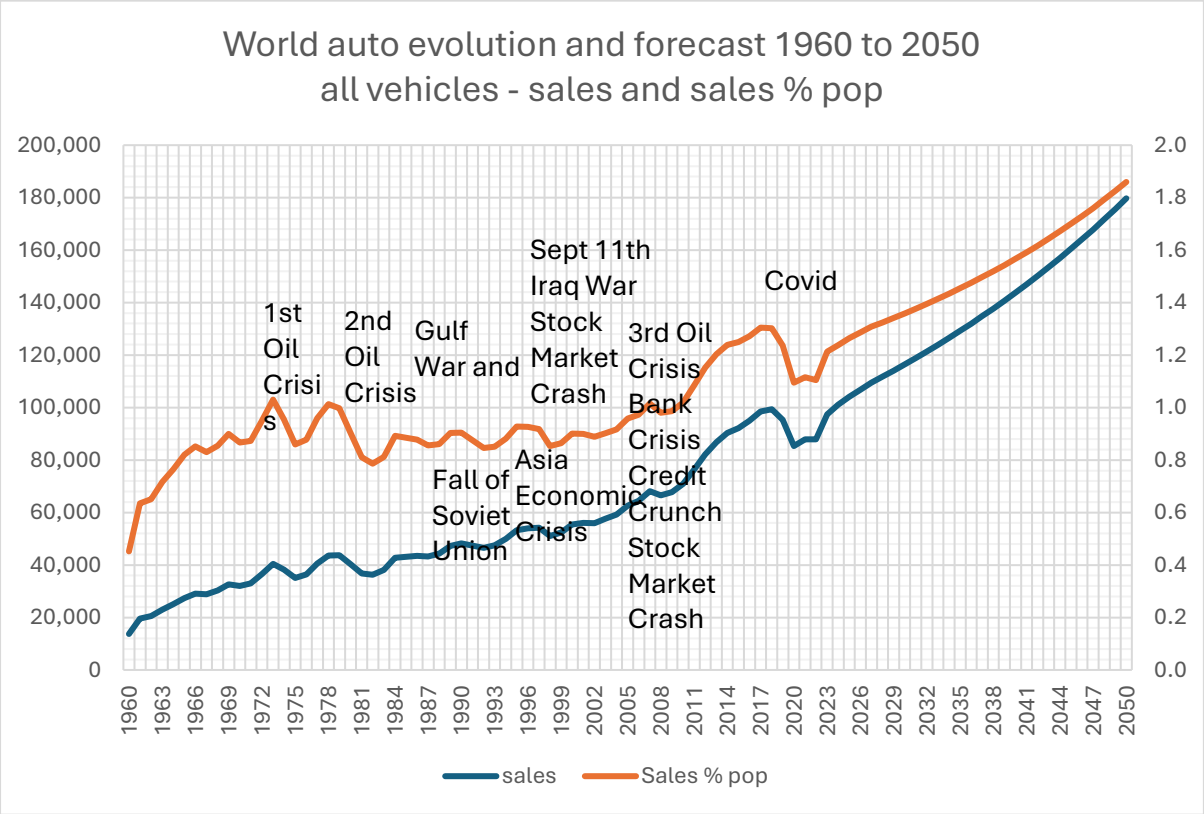
The ratio of sales volume to the size of the population is an important predictor of future sales volumes as countries/regions with a high ratio depend on maintenance of such a level to retain ownership density and parc turnover.

On a global basis, **Graph 11** depicts the historic correlation between sales volume and population size and shows a tendency to merge as vehicle sales volumes outpaced population growth. Even so, on this global measure the ratio only breached the 1% level in 1975 and remained below 1% right through to 2011 when China first made its presence

felt. With many countries/regions now approaching saturation, the increase in the ratio still only reaches 1.9% by 2050, when sales volume is at 182 Mn per annum, with the incremental volume coming from the developing markets.

Essentially, though, equilibrium has been maintained by sales/production volumes returning to previous levels, with vehicle parc sizes being maintained and ownership density levels and average vehicle life/parc turnover ratios remaining more or less constant.

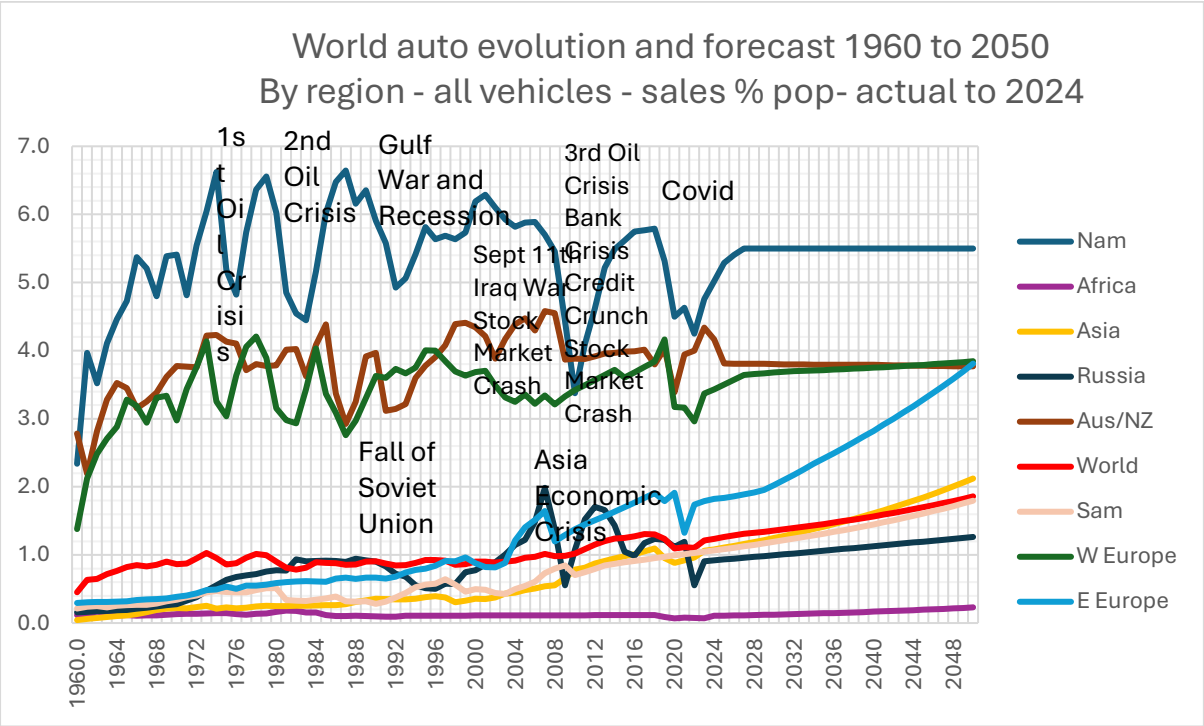
Graph 11. World auto evolution and forecast to 2050 by – sales as a percent of population



However, this world view changes completely when looked at from a regional perspective.

Graph12 shows this measure and demonstrates just how badly some regions were affected by past event. It also depicts the chasm between the regions, how volumes in the traditional regions support and underpin global volumes, and that growth relies on the newer markets to achieve the forecast sales/production volumes.

Graph 12. Regional auto evolution and forecast to 2050 by region/country – sales as a percent of population



Now that N America, W Europe and Australia/N Zealand are essentially saturated, as are countries like Japan, S Korea, Singapore and Hong Kong, these markets are forecast to maintain their sales to percentage population ratios, with volumes altering only where there are significant population changes.

Crucially, even with significant uplifts in countries such as China, and higher volumes in India, the ratio still only reaches 2.1% by 2050 for Asia as a whole.

The ratio for S America remains below 2%, as does Russia, but importantly the figure for Africa is a mere 0.2%. This figure means that something will have to give on this continent, whether it means a concerted effort to lift the nations out of poverty, mass migration occurs, draining its population, or conflict erupts.

People or the planet

One of the great drivers of the expansion of the motor industry has been the sheer necessity of meeting the wants and needs of expanding populations. The best way to achieve that has been to increase the number of vehicles in use, or the vehicle parc, as transport, whether road, rail, air or sea is an inescapable requirement for growth

This title implies a decision needs to be made between the need to support the well - being and socio-economic needs of the burgeoning global population and whether the planet can support the new volumes of vehicles involved.

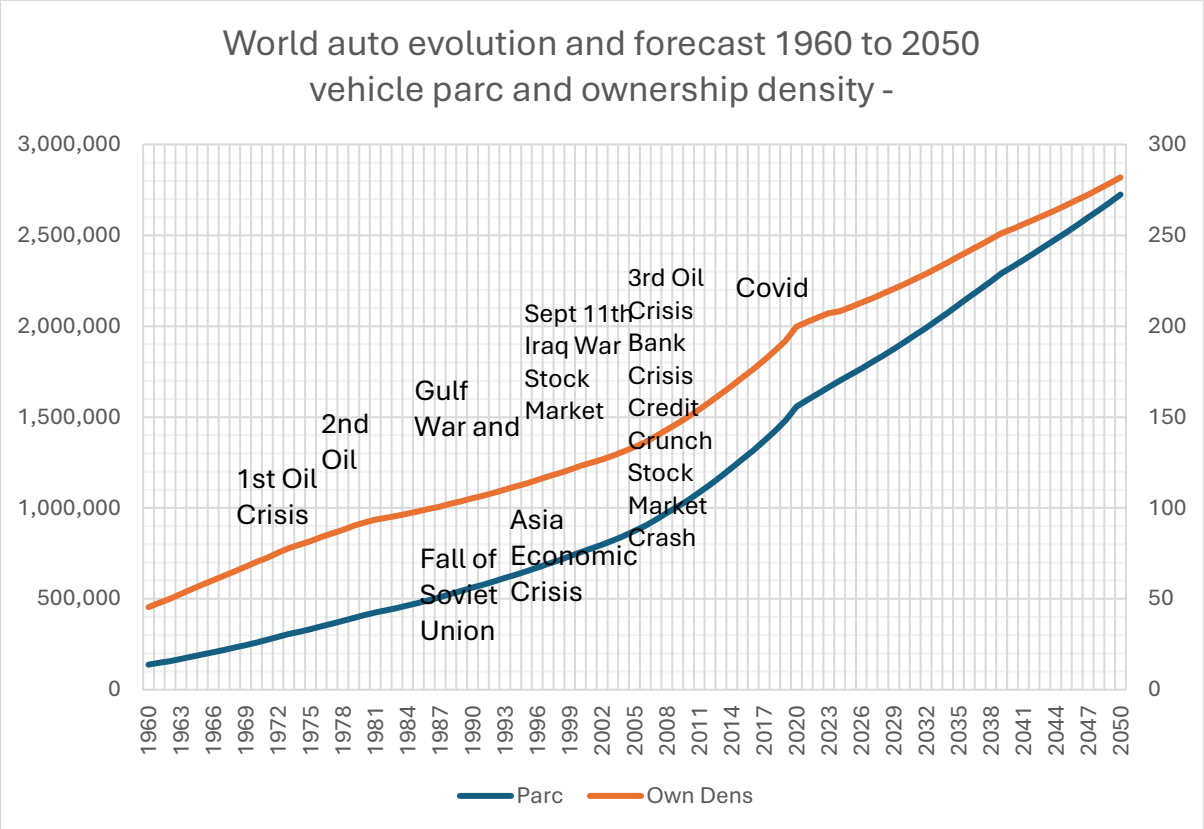
World vehicle parc evolution and forecast `1960 to 2050

World auto evolution – vehicle parc – 1960 to 2050

The number of vehicles on the roads of the world stood at 138 Mn in1960, when mass motorisation started to become a reality for some nations. Growth was rapid, doubling by 1972 and doubling again by 1992. The parc reached 1.0 Bn by 2009 and currently – 2024 - stands at circa 1.7 Bn, excluding the circa 600 Mn 2- and 3- wheelers plying the roads of Asia.

Graph 13 shows actual vehicle parc data from 1960 to 2024 and the commensurate level of ownership density. Density is on the R H scale.

Graph 13. World auto evolution – vehicle parc – 1960 to 2050



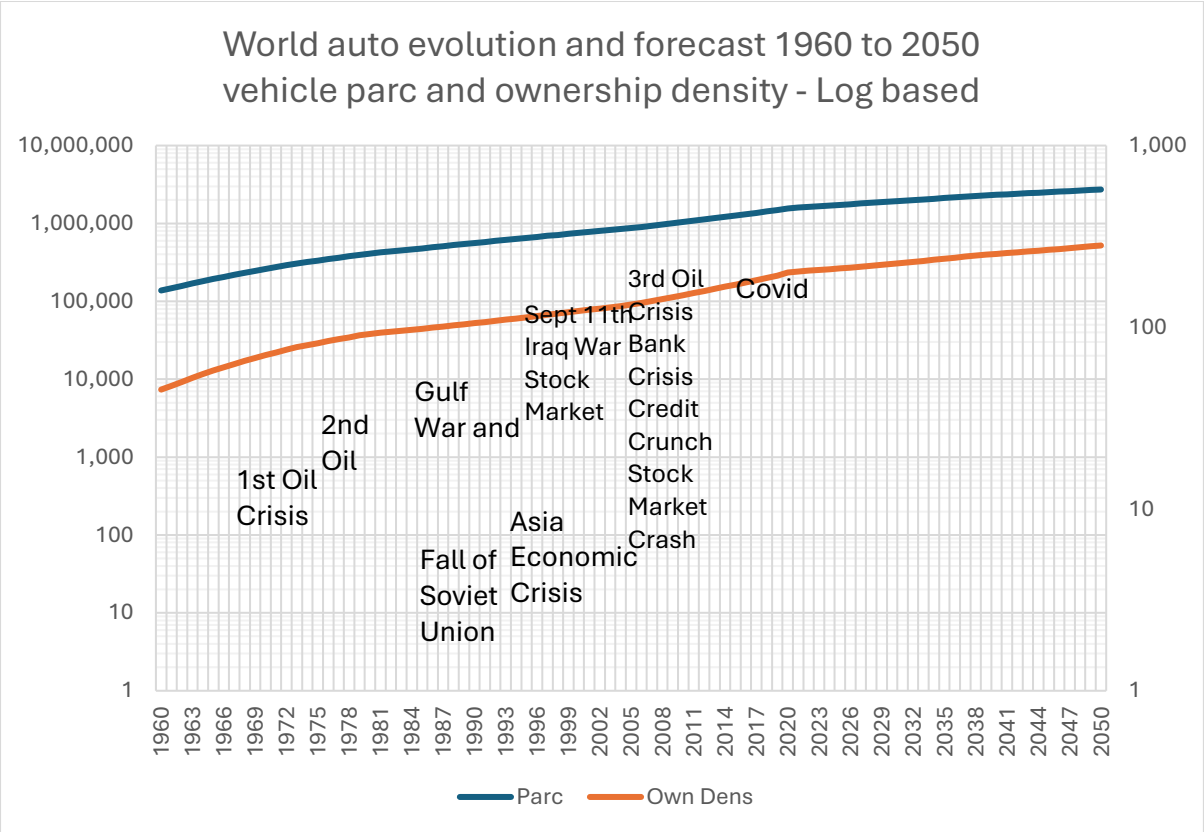
This forecast suggests the world parc could increase to nearly 2.7 Bn by 2050, with the distinct probability the number could surpass 3 Bn should the lot of some of the more deprived nations improve.

Even this level of parc expansion has a relatively modest effect on ownership, raising the ratio from just over 200 in 2023 to 280 in 2050.

Graph 14 converts the data to a log-based picture, which shows that the rate of growth is modest and slower than the historic curve.

Nonetheless it does pose the problem of an extra1 Bn vehicles or more on the roads of the world as well as a potential increase of hundreds of millions more of 2- and 3-wheelers. This is at a time when there is major concern about motor transport and its effect on global warming/climate change. So, the question has to be **whether the people or the planet takes precedence?**

Graph 14. World auto evolution – vehicle parc – 1960 to 2050 – log based

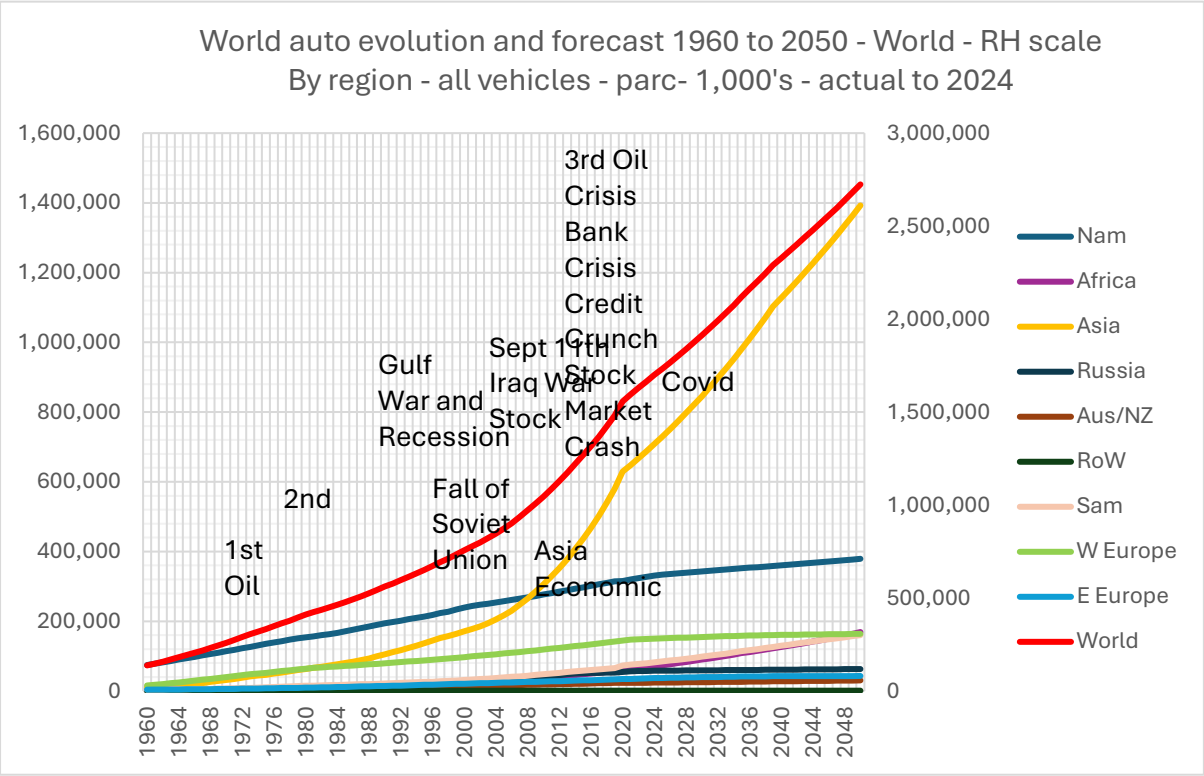


World auto evolution – vehicle parc – 1960 to 2050 by region

When the vehicle parc is measured by region **- Graph 15** - it shows that Asia has firmly established itself as home to more than 700 Mn vehicles by 2023, having risen from modest beginnings in 1960, assisted initially by Japan and S Korea, before the ascendency of China. Please note that the World measure is on the R H scale.

The forecast shows that Asian parc will double to 1.4 Bn units by 2050 while volume in the other regions remains relatively muted. N America, with 380 Mn, has relatively modest growth, as does W Europe.

Graph 15. World auto evolution – vehicle parc – 1960 to 2050 – by region



World auto evolution – vehicle parc – 1960 to 2050 per cent

The speed at which the structure of the industry is changing is confirmed by the shape of the vehicle parc as a percentage by region as shown in **Graph 16**. As vehicles currently have an average life of 12 years it takes longer to establish a full picture of the rate of change.

As the time-scale shown here covers several decades it provides a long-term confirmation of how the automotive world has pivoted away from the traditional regions to the new markets.

In 1960, N America and W Europe jointly accounted for 75% of all the vehicles on the roads of the world, with Asia at 8%. While W Europe expanded, N America declined, rapidly. Within 44 years Asia had overtaken W Europe, and N America within 50 years.

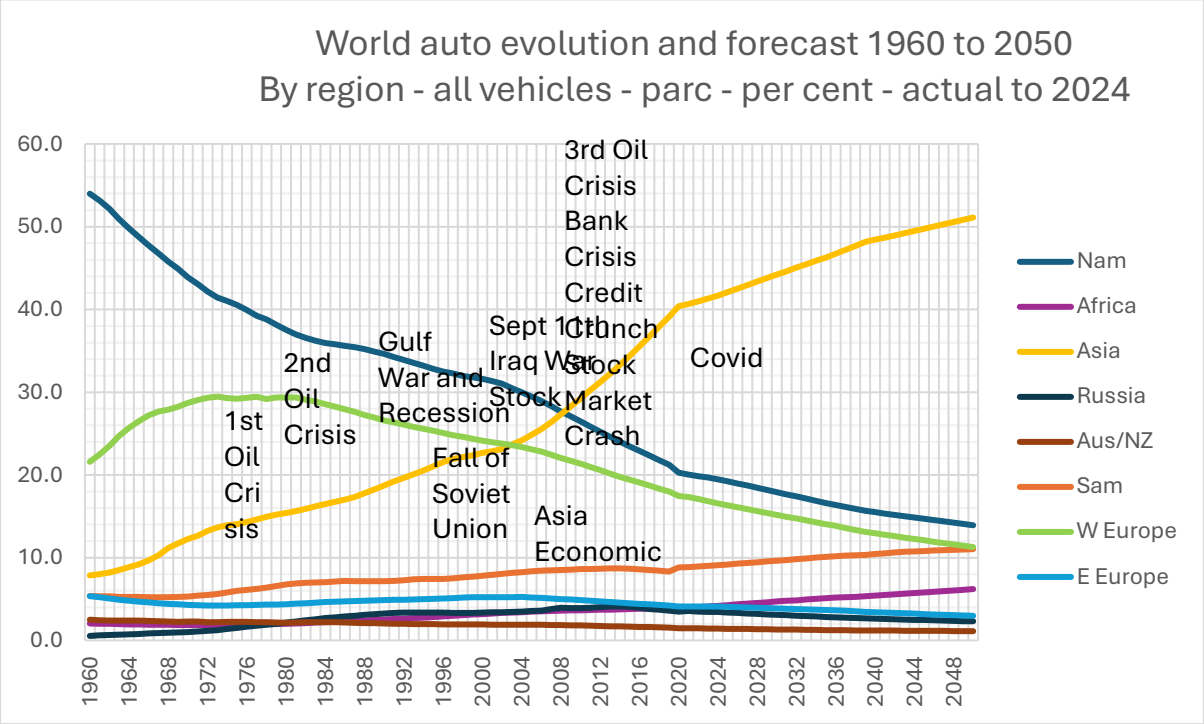
Nothing can reverse this trend. Population now determines parc size as well as the fact the saturated markets in Europe and N America have reached their peak.

By the year 2050, N America and W Europe will account for just 1 in 4 of all the vehicle in existence. The forecast shows that the S America parc will increase to 11% on a par with

W Europe and that Africa will be at 6% - a far cry from its population proportion of more than 25%.

Once again, it shows that although the parc share of the African continent rises, the volume is singularly inadequate to cope with its burgeoning population.

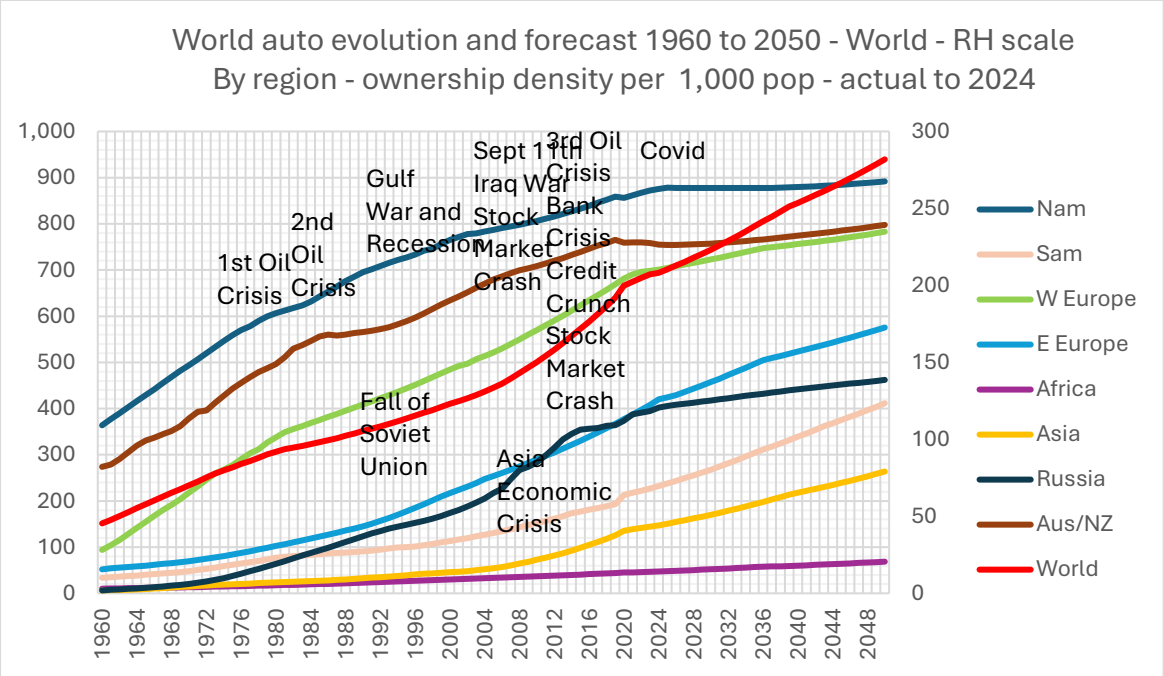
Graph 16. World auto evolution – vehicle parc – 1960 to 2050 per cent – by region



Vehicle ownership density - by region – 1960 to 2050

As has been discussed, a key measurement of the history and future of the auto industry is the level of vehicle ownership per 1,000 population. **Graph 17** shows the wide gulf in current and future ownership levels across the world.

Graph 17. Vehicle ownership density - by region – 1960 to 2050



The ratio is reaching its peak in N America and currently stands at 870 per 1,000. The huge landmass of the region will not influence further expansion, but saturation levels of ownership will, so the forecast shows virtual stability on this measure.

W Europe has a ratio of 698 per 1,000, with some further growth still possible, but a limited landmass will constrain levels. However, the rise in the W European level indicated is more due to a slightly falling population rather than a growing vehicle parc.

Ownership densities in E Europe are well behind W Europe and although an increasing density it is forecast, it will remain well below that of W Europe, mainly due to a significant reduction in population and a limited landmass.

Australia/N Zealand are saturated, with modest population growth anticipated and ownership levels are forecast to remain stable.

Although Asia has come to dominate the global industry, with sales and production soaring, the sheer size of its current population and the expansion forecast suggests that density in the region remains modest compared with N America and W Europe, rising to 284 per 1,000, but remaining below the world average, even though it is home to some of the highest densities in the world, such as Japan, S Korea, Hong Kong, Singapore and Taiwan.

However, the Asian region is also home to some of the most deprived nations in terms of motorisation as shown above in **Chart 4,** where the Top 20 nations by population in 2050 are compared with their current ownership densities.

The same applies to Africa, where **Chart 4** also highlights the challenges facing not only the named countries but the entire continent. The forecast here shows a ratio of just 69 per thousand. Although the value is up by 50% it comes nowhere near enough to meet the rate of expansion of the population.

Substantial growth is expected in S America, particularly in Brazil and Mexico, but the huge landmass of Brazil and its high urbanisation of level of 88% suggest that ownership density will remain constrained.

World vehicle production – 1960 to 2024

Vehicle production by country/region 1960 to 2024

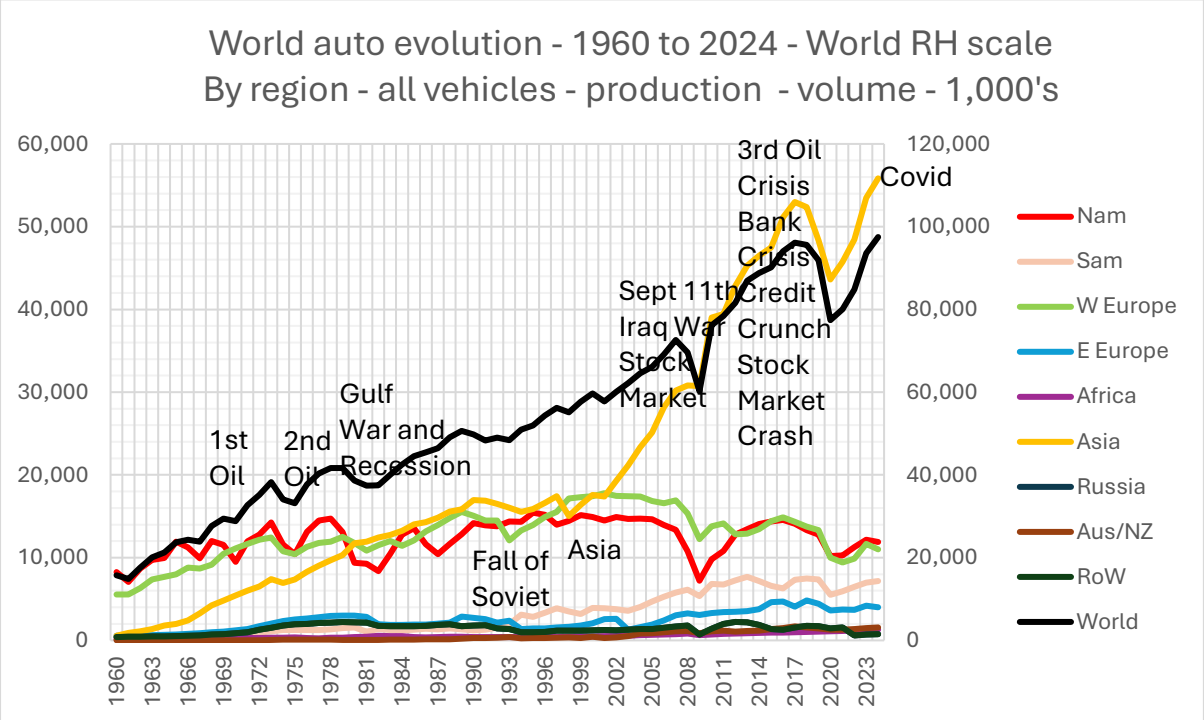
There is – unsurprisingly – a good correlation between production and sales volumes both on a global and regional basis. The two graphs that follow show regional production volumes for the period 1960 to 2024 inclusive and the effect that the various historic events had on output.

Although the production forecast is shown for the world in **Graph 6**, above, no forecast has been attempted in this report at a regional basis.

The reason for this is that the industry is in such a state of flux, with the rise and fall of manufacturers, where they are based, and their production locations.

It is sensible to say that volumes will increase dramatically in Asia, but the markets that can be served by companies in N America and Europe will be constrained to produce units for sale in their domestic regions. This is due to the fact that the prices and specification of the units they currently produce for domestic consumption will not serve the populations of the developing countries, unless of course, a way is found to match the product to the destination.

Graph 18. Vehicle production by country/region 1960 to 2024



It is important to note in this context that some of the past major manufacturing nations no longer appear in the list of top 10 producer countries. Examples include France, Italy and the U Kingdom.

Graph 18 shows that output grew steadily over the years to 2008 with volume interrupted only by the two oil crises and war. Production was dominated by N America and W Europe

for the first 15 years although the booming industry in Japan and S Korea was soon to prevail, surpassing both regions.

In the year 2000, N America, W Europe, Japan and S Korea jointly produced almost 46 Mn units, or 76% of global output, but it was also the year that China showed its force. The price paid by N America and W Europe is clear to see as their production volumes diminished in a growing global market.

However, it is probable that production in N America and W Europe will continue to serve domestic markets, but it is unlikely that volumes will increase, and they may well be subject to increased volumes of imports.

It is probable - indeed likely - that the production sources for the emerging markets will mainly originate in Asia, while production will expand in Brazil and Mexico to serve S America and to some extent the USA.

The vehicles necessary to serve the expanding new markets will need to have specifications suitable for those markets, which will be much less expensive than current offerings produced in N America and Europe.

It is also probable that these vehicles will require petrol/diesel transmissions as the infrastructures required for electric vehicles simply do not exist and the electricity generation and distribution systems are still far out of reach for most of the new markets.

Given that, according to the **IEA,** there are circa 40 Mn electric vehicles - including hybrids - on the road in 2023, out of a total volume of 1.7 Bn, it seems inevitable that oil extraction, refining and distribution will continue to be a primary requirement if motorisation is to continue to be available to coming generations.

This is supported by the fact that ICE fuelled vehicles, including hybrids and plug-in hybrids, will still be sold in the traditional markets through to 2035 or later, and in developing nations for much longer, it is highly unlikely that EV sales will transition to 100% of the global market until well after 2035.

Add in the fact that current ICE vehicles have a life of 12 years or more and many will be exported as used vehicles, ICE drive trains will still be on the world's roads in large numbers until well past 2050: which is only as far in the future as 2000 is in the past

Vehicle production by country/region 1960 to 2024 – percent

Graph 19 shows production volumes by percentage share by country/region for the period 1960 to 2024 and illustrates starkly how the shape and structure of the industry has changed over the years.

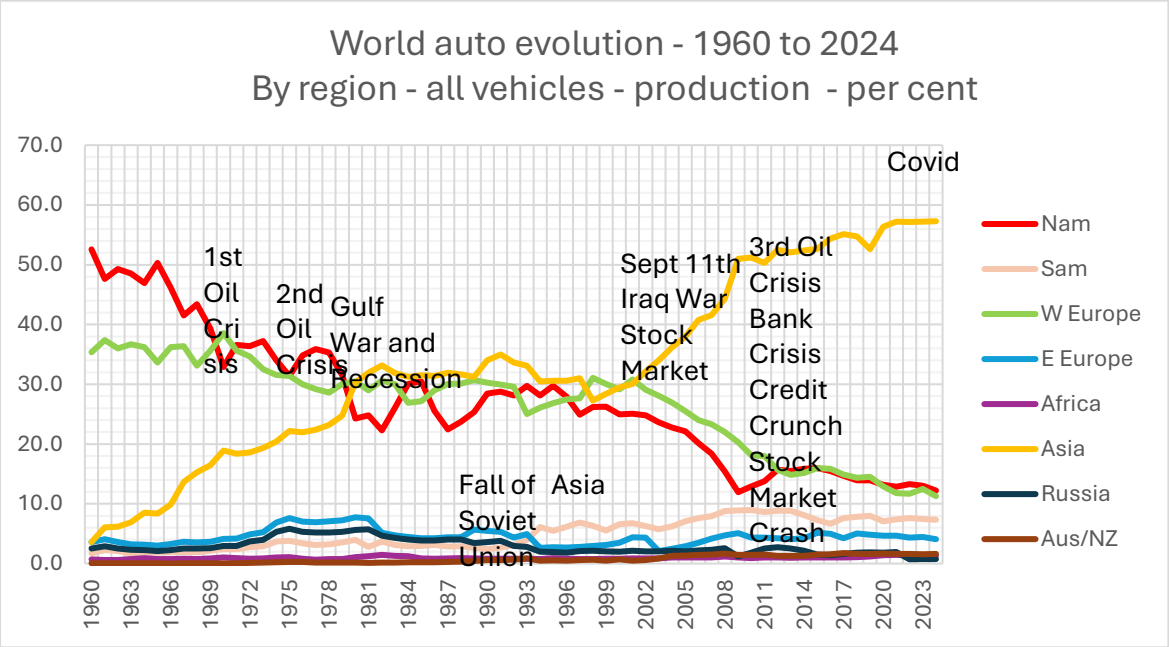
Most apparent is the rapid and steep decline of N America, falling from more than 50% in 1960 to 12% in 2024.

It is followed by W Europe, although the decline was less precipitous over the early years but has nonetheless fallen from 38% to just over 10% in 2024.

Asia now dominates, having risen from less than 5% in 1960 to a mighty 57% in 2024, a position that seems unassailable as the traditional producer countries and manufacturers are no longer able to produce vehicles with the prices and specifications necessary to meet the demand of the customers in the emerging markets.

There will be an increase in output in S America to meet local demand and potentially to supply N America, but it remains hard to see any significant expansion in the African continent, which will continue to rely on mainly on used imports and small volumes of new vehicles, possibly from local production.

Graph 19. Vehicle production by country/region 1960 to 2024 – percent

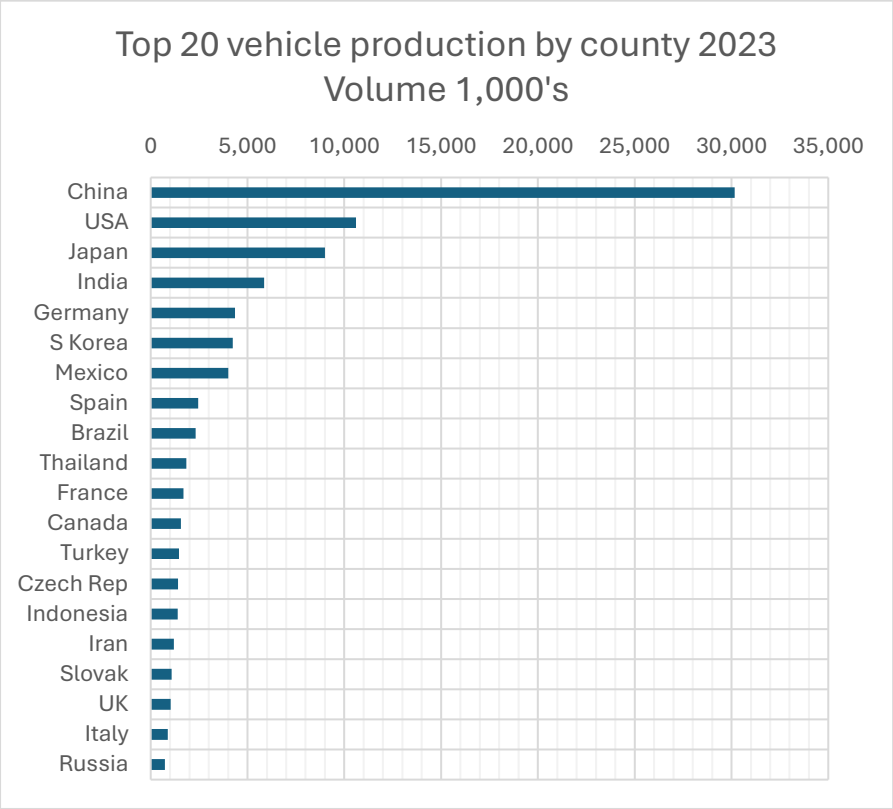


Top 20 producing nations in 2023

The number of nations producing significant volumes of motor vehicles continues to increase as the global market moves decisively to the east.

Of the circa 94 Mn units produced in 2023, the Top 20 nations jointly produced 88 Mn, or 95% of global output. Within that total, the top five nations contributed 60 Mn units or 70% and the top 10, 75 Mn units, or 80% of the total.

Graph 20. the top 20 vehicle producing nations in 2023.



No less than six Asian countries are in the top 10, but it is notable that Germany and Spain are the only European nations that make it into the top 10, while France, Italy and the UK - previously major manufacturing nations - only just make it into the Top 20.

It is hard to see a resurrection of the "traditional countries/manufactures in the near or longer term unless their products are engineered to suitable specifications/prices that match the purchasing power of the new markets.

The near saturations level of motorisation obtaining in N America, Europe, Australasia and some Asian markets means that the industry will depend largely on replacement sales for scrapped or exported vehicles.

Even then, it is also likely that these same markets will also face the probability of increasing competition from large volumes of cheaper imports from the expanding manufacturers based mainly in the East.

****

Acknowledgements:

United Nations Population Division – for population information, urbanisation, deprivation

World Bank - Landmass, roads, Purchasing Power Parity

Acea – European Automobile Manufacturers Association

Oica - Organisation Internationale des Constructeurs d'Automobile – for production data

UNICEF - United Nations Children's Fund – for information on access to water, nourishment

Enerdata - for information on Electricity Generation Growth

EI stats review 2024 – for electricity generation

IEA – International Energy Authority – for information on EV's

World Resources Institute

All other data, algorithms, information is from **Pemberton Associates** databases

About the author:

Although I am now officially retired, I needed something to keep me active during Covid. As I was concerned about the direction of travel of the automotive and related industries, it seemed the answer was to restart and update my databases and look at how the global industry would operate over the years to 2050, especially in the light of potential moves to electric drive trains.

The results that appear in this document - my 62nd publication/book/research report/forecast - shows there are major concerns ahead which will require international solutions.

Why do I qualify for this task? Please forgive the third person approach.

Max is an acknowledged authority on world markets and structures and long-term, global forecasts, strategic developments and drivers of change as they apply to the automotive and related industries and organisations.

He is a qualified Mechanical Engineer

He was trained in the Royal Air Force in Logistics, Supply and Accounting

He has been commissioned by several major companies in the international industry to carry out specialised research programmes and studies, ranging from the future of the retail environment and parts and service operations, niche research on specific component demand and supply, the opportunity to extend breakdown services to a pan-European level and potential demand for fuel and oil products and long-term vehicle demand.

He has been a retained consultant for major auto and related companies in Europe and the US and has spoken at Automotive Conferences around the world

He is a Fellow of the Institute of Automotive Industry: FIMI

A member of the Guild of Motoring Writers

A Fellow of the Fellowship of the Motor Industry

He has served in staff and operational roles for a major OEM including

- Regional Manager – Central and South America
- Regional Manager – Far East, Australasia and Pacific
- Global Programme Manager – CKD operations
- International Marketing Manager

He has travelled widely and has visited 50 countries

He was Chairman of the SMMT Export Trade Committee and a member of the SMMT Consultants Group

He founded Pemberton Associates in 1987

He was a Founding Partner of www.autelligence.com

He was a Founding Partner of the Automotive Strategies Group

He was a Non-Executive Director of Autogreen, a major automotive recycling and reprocessing company

He was a member of the Governments Dept of Business ELV (End of Life vehicle) Consultation Group

He was a member of the House of Commons All Parliamentary Waste Group

His publications, mainly concentrating on forecasting for, and the operation of, the international motor and associated industries have been published by such houses as:

- The EIU (Economist Intelligence Unit)
- The FT (Financial Times)
- Wards Communications – Detroit
- Automotive World
- Oxford Brookes University
- Pemberton Associates
- Autelligence
- Automotive Strategies Group

and many others

He has written some 300 articles/comment pieces that have been published in various industry and press outlets/magazines across the world

Latterly, he was automotive advisor and consultant to the School of Technology at Oxford Brookes University

He was involved in the creation of the Sustainable Vehicle Engineering Centre and its Board at Oxford Brookes University, which concentrated on, and researched into, all aspects of the global automotive and related industries, including electric vehicles.

He became Chairman of that Advisory Board and remained Chairman until he officially retired.

MJP -22/04/2025