



**PAGEV**

# **Turkish Automotive Plastics Materials Industry Follow-Up Report 2017**

## **PREFACE**

The plastics industry is one of the most important actors of the Turkish economy. Today, the contribution of the plastics industry to the country's economy is gradually increasing with the total production exceeding 9 million tons, and 35 billion dollars worth of turnover, the approaching direct exports of 5 billion dollars and the annual growth of 12% for the last 10 years.

Our industry, with its production capacity, has reached the second place in Europe and the sixth place in the world. As PAGEV, we continue to lead the industry successfully in the framework of the "Unifying Power" mission of the Turkish Plastics Industry.

We also know that having the right and reliable data and information is the most important part of the solution when we sign the indispensability of Plastics in our lives and sign our work to tackle our industrial problems with concrete steps based on scientific evidence. In this direction we constantly investigate, collect new data, compile and report them. We present our reports that we believe are important for the development of our industry and our booklets containing important information to the plastics industry representatives, stakeholders and public institutions.

As PAGEV, we prepared a report set that will contribute to the industry in a serious way in the face of our long and dedicated researches. With our reports, we made booklets with the comments of our expert reporters about the point where the Turkish Plastics Industry is in the right and reliable light, common problems and what should be the search for concrete solutions. We believe that our reports and information set will benefit all of our stakeholders, especially our members, and will guide the plastics world. At the same time, we are pleased that our public institutions have reached the most up-to-date and accurate information about the plastics industry.

On the other hand, with our sector reports in English, we think that our colleagues will be able to share the potential of our country's plastics industry with the most up-to-date business partners in the global marketplace.

Hereby, presenting our current reports and information files relating with our industry, we would like to thank all of our colleagues who have contributed to this day's achievement of our industry, who has taken a position as a locomotive mission in the development of our country.

**Best regards,**

**Yavuz EROĞLU**  
**PAGEV President**

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## **EXECUTIVE SUMMARY**

Turkey ranks 7<sup>th</sup> in the EU countries and 17<sup>th</sup> in the world in passenger cars production, ranks the first among the EU countries and 8<sup>th</sup> in the world in commercial vehicle production. The production of vehicles in Turkey is following a different course every year in parallel with the economic conjuncture and the crises that have taken place. In the period covering from 2012 to 2016, annual compound annual growth rate (CAGR) of production is 13.3% in passenger cars, 1.9% in commercial vehicle and 8.5% in total.

In the first 6 months of 2017, a total of 869 thousand vehicles, including 502 thousand passenger cars and 268 thousand commercial vehicles, were produced. In comparison with the same period of the year 2016, production increased by 20% in total and 36% passenger cars and declined 6% in commercial vehicles. By the end of 2017, it is expected that production will increase by 27% in passenger cars and 17% in total and remain at the same level in commercial vehicles. It is seen that the production is predominantly exported rather than the domestic market demand.

Every day the global automotive industry faces more and more demands from drivers and society. While drivers seek higher performance, superior reliability and safety, more comfort, lower fuel consumption, smarter style and lower prices in the automobiles they want to purchase, social pressures for a more effective environmental protection are on the increase. The only material that meets these contradicting demands optimally and that will shape cars of the future is considered to be plastic.

As of 2016, an average of 53.3% of a vehicle's net weight is steel and 17% is made of metals other than steel. It is estimated that the share of plastics in passenger cars production, which was 9.9% in 2010, increased to 12.2% and share of rubber from 5.4% to 6.9% in 2016. Taking into consideration the first 6 months of 2017, it is expected that the proportion of plastic materials will increase by 0.5% to 12.7% and share of rubber by 0.3% to 7.2% at the end of 2017 compared to 2016.

In the production of vehicles in Turkey and the demand for the renewal of vehicles in the park, an increase of 27% in the amount of plastics and 31% in the amount of rubber used in the total material weight compared to 2010 was achieved in 2016. As a result of this increase, it is seen that consumption of plastics which was 275 thousand tons in 2016 increased to 419 thousand tons in 2016 while consumption of rubber increased from 150 thousand tons to 236 thousand ton in the same period.

In the first half of 2017, plastic consumption in the automotive industry was realized as 246 thousand tons and it is estimated that it will increase to 509 thousand tons at the end of 2017 increasing by 21% compared to 2016.

## **1. CURRENT SITUATION IN THE TURKISH AUTOMOTIVE INDUSTRY**

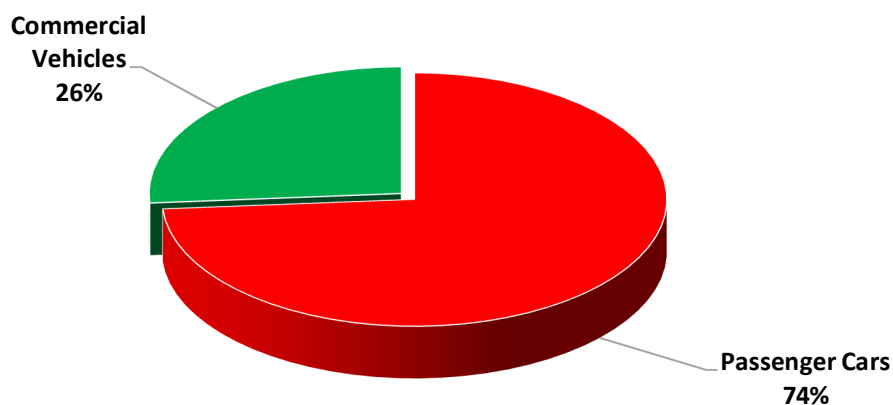
The automotive sector, as it is in the other developed and developing countries, is principally one of the engines, biggest exporter and investor sectors of the Turkish economy. Apart from the added value and employment it provides to the national economy, it is the leading strategic sector of the economy in terms of its impact for advancing the technological development.

Within the Turkish automotive industry, the companies are putting vehicles of different models on the market by domestically manufacturing and importing every year in parallel with the changing preferences of the consumer. As of today, the number of vehicles, commercial vehicles and models that have been put on the market is over 100.

As from the year 2000, the Turkish automotive industry selected the manufacturing model based on large scales of vehicle and spare part exports. The structural change which began in the early 2000s and lasted until today within the sector brought upon the international competition conditions in the manufacture of vehicles and sub-industry manufacturing rather than a domestic competition and vehicles and part manufacturing in the automotive sector can now be carried out on an international standart.

### **1.1. PRODUCTION CAPACITY**

As of the January – September period of 2017, 12 companies (except farm tractors) are active in the vehicles manufacturing industry and the total production capacity of these companies is at a level to manufacture 1.917.437, 74% of which are passenger cars and 26% are commercial vehicles.



**Graphic 1: Production Capacity in Turkish Vehicles Industry**

Source: Automotive Manufacturers Association (OSD)

### 1.1. PRODUCTION

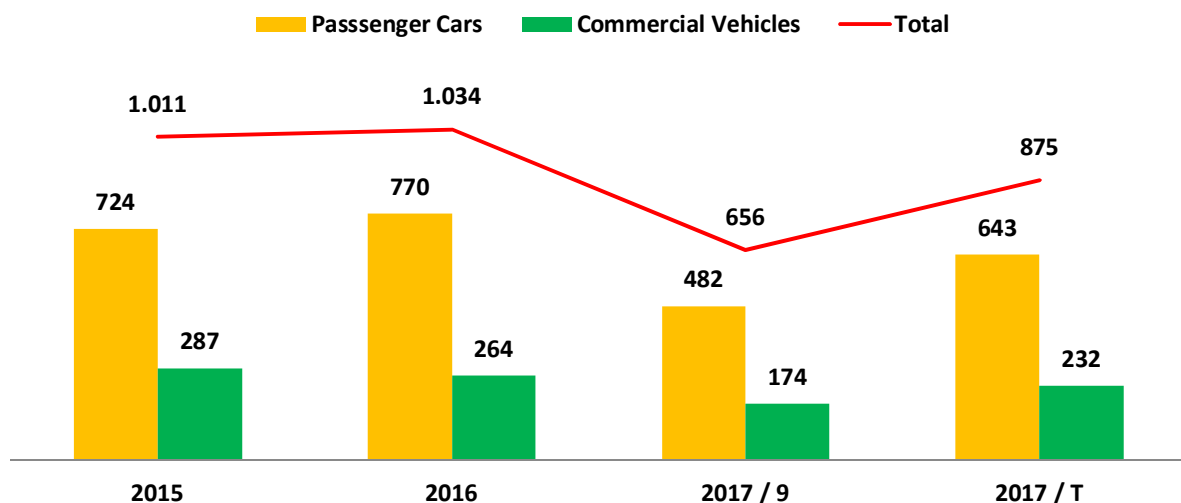
Turkey ranks 7<sup>th</sup> in the EU countries and 17<sup>th</sup> in the world in passenger cars production, ranks the first among the EU countries and 8<sup>th</sup> in the world in commercial vehicle production. The production of vehicles in Turkey is following a different course every year in parallel with the economic conjuncture and the crises that have taken place. In the period covering from 2012 to 2016, annual compound annual growth rate (CAGR) of production is 13.3% in passenger cars, 1.9% in commercial vehicle and 8.5% in total.

In the January – September period of 2017, a total of 1 million 224 thousand vehicles, including 839 thousand passenger cars and 385 thousand commercial vehicles have been produced. In comparison with the same period of the year 2016, production increased by 18% in total and 31% passenger 18% in commercial vehicles. By the end of 2017, it is expected that production will increase by 18% in passenger cars and 10% and 4% decline in commercial vehicles. It is seen that the production is predominantly exported rather than the domestic market demand.

|                     | 2012         | 2016         | 2017/9       | CAGR (%)   | 2017/E       |
|---------------------|--------------|--------------|--------------|------------|--------------|
| Passenger Cars      | 577          | 951          | 839          | 13.3       | 1,119        |
| Commercial Vehicles | 496          | 535          | 385          | 1.9        | 513          |
| <b>Toplam</b>       | <b>1,073</b> | <b>1,486</b> | <b>1,224</b> | <b>8.5</b> | <b>1,632</b> |

**Table 1: Vehicles Production (1000 Units)**

Source: Automotive Manufacturers Association (OSD)



**Graphic 2: Vehicles Production (1000 Units)**

Source: Automotive Manufacturers Association (OSD)

A total of 1 million 243 thousand vehicles were produced in Turkey between 2012 and 2016, with an average of 737 thousand passenger cars and 505 thousand commercial vehicles per year. In this

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period, 59% of total production and 41% of commercial vehicles were commercial vehicles. In the January - September period of 2017, 69% of the total production was made by passenger cars and 31% by commercial vehicles.

## 1.2. FOREIGN TRADE

### 1.2.1. IMPORTS

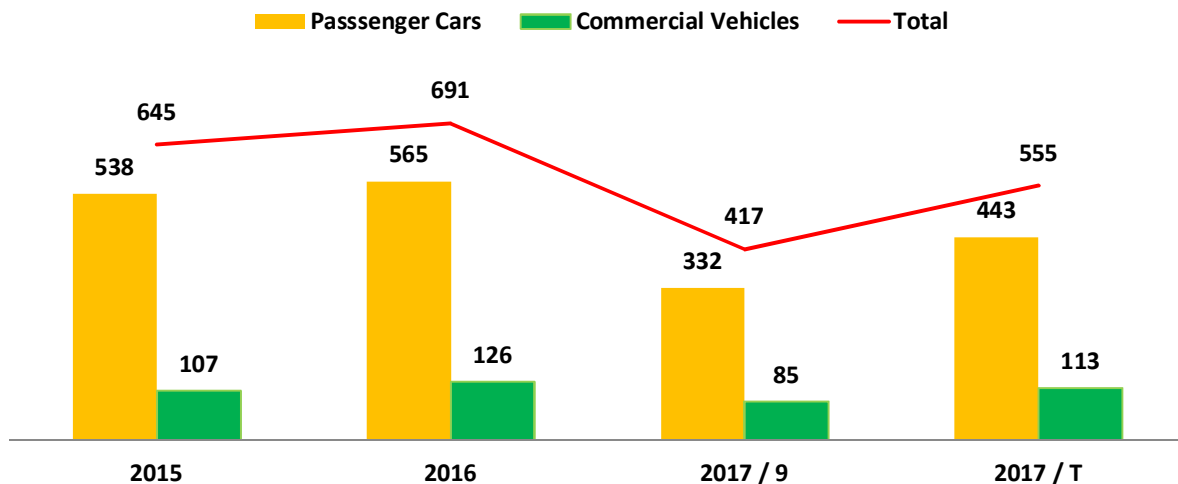
Imports increase in vehicle vehicles shows significant changes over the years. After the Customs Union integration in 1996, imports of motor vehicles increased rapidly. Between 2012 and 2016, annual average rate of increase (CAGR) of imports is 8.3% in passenger cars, 7.9% in commercial vehicles and 8.3% in total.

In the January – September period of 2017, a total of 417 thousand vehicles, 332 thousand of which are passenger cars and 85 thousand are commercial vehicles, were imported. In comparison with the same period of the year 2016, imports decreased by 11% in passenger cars and increased 6% in commercial vehicles. By the end of 2017, imports are expected to decline by 22% in passenger cars, 10% in commercial vehicles and 20% in total.

|                     | 2012       | 2016       | 2017/9     | CAGR (%)   | 2017/E     |
|---------------------|------------|------------|------------|------------|------------|
| Passenger Cars      | 410        | 565        | 332        | 8.3        | 443        |
| Commercial Vehicles | 93         | 126        | 85         | 7.9        | 113        |
| <b>Toplam</b>       | <b>503</b> | <b>691</b> | <b>417</b> | <b>8.3</b> | <b>555</b> |

**Table 2: Vehicles Imports (1000 Units)**

Source: Automotive Manufacturers Association (OSD), TurkStat



**Graphic 3 Vehicles Imports (1000 Units)**

Source: Automotive Manufacturers Association (OSD), TurkStat



### 1.2.2. EXPORTS

Important structural changes took place in the automotive sector following the 2000s. Foreign partners of manufacturing companies selected Turkey as their manufacture and exportation center which will meet the demands of global markets for some of the models and Turkey became one of the cornerstones of world manufacture and exportation center for sedan automobiles and commercial vehicles. This change in the manufacturing industry of vehicles positively affected the automotive sub-industry and many automotive sub-industry companies started to become the alternative supplier of global vehicle manufacturers.

As a result of key and sub-industry global manufacturers selecting Turkey as a manufacturing center, great progress was also made within the sector in terms of technology and Turkey came to be regarded as an economic manufacturing and exportation center for many of the brands, models and accessories and spare parts of these models.

The exports in automotive industry rapidly increased together with the extensive development in the integration process with the EU countries. As a consequence of the new investments made by the automotive sector, close to 60% of its manufacture became exportable.

Keeping in mind that it changed by years, the compound annual growth rate of exports between the years 2012 – 2016 was 15.9% for passenger cars, 5.8% for commercial vehicles and 11.9% for the total vehicles.

In the January - September period of 2017, a total of 714 thousand vehicles, 689 thousand of which are passenger cars and 295 thousand are commercial vehicles, were exported. In comparison with the same period of the year 2016, exports increased by 38% in passenger cars, 24% in total and stayed at the same level in commercial vehicles.

By the end of 2017, exports are expected to be 919 thousand units in passenger cars and 393 thousand in commercial vehicles.

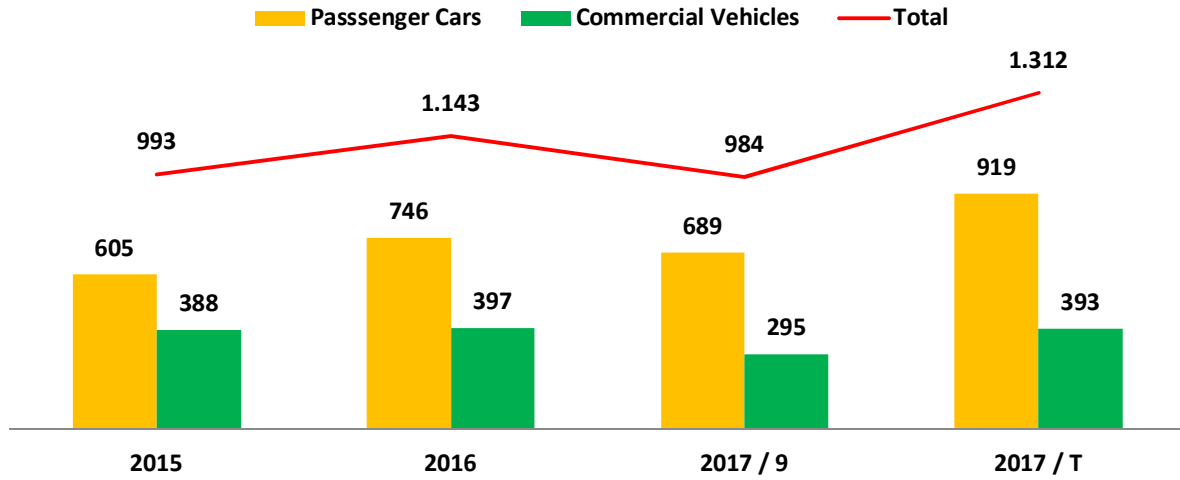
In the January – September period of 2017, 82% of total passenger cars, 77% of commercial vehicles and 80% of total production was exported.

|                     | 2012       | 2016         | 2017/9     | CAGR (%)    | 2017/E       |
|---------------------|------------|--------------|------------|-------------|--------------|
| Passenger Cars      | 413        | 746          | 689        | 15.9        | 919          |
| Commercial Vehicles | 317        | 397          | 295        | 5.8         | 393          |
| <b>Toplam</b>       | <b>730</b> | <b>1,143</b> | <b>984</b> | <b>11.9</b> | <b>1,312</b> |

**Table 3: Vehicles Exports (1000 Units)**

Source: Automotive Manufacturers Association (OSD), TurkStat





**Graphic 4: Vehicles Exports (1000 Units)**

Source: Automotive Manufacturers Association (OSD), TurkStat

### 1.3. DOMESTIC SALES

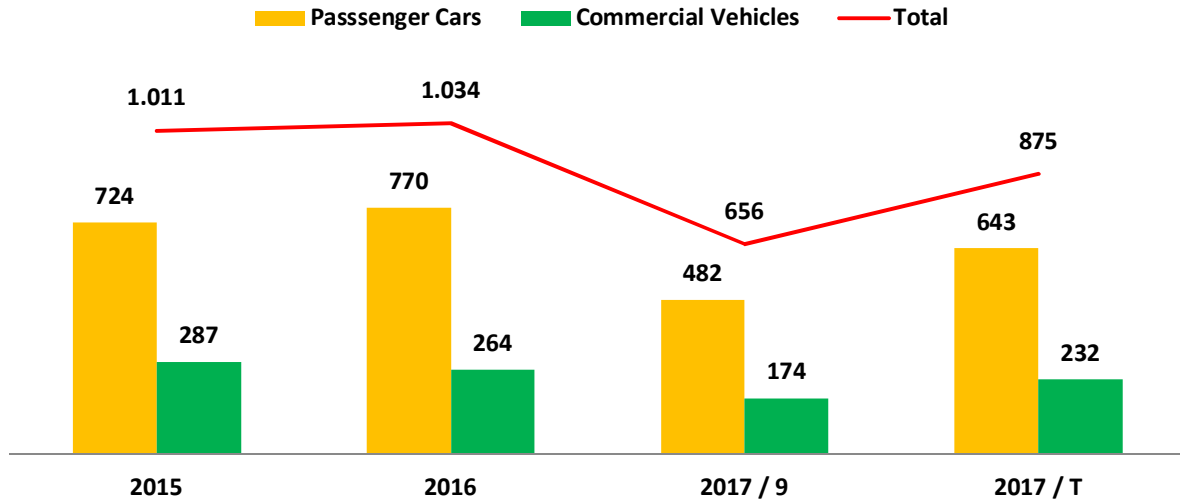
The domestic market demand for vehicles progressed in a different manner in parallel with the economic conjuncture by years. However, it is observed that a 7.6% compound annual growth rate (CAGR) occurred in passenger cars, (-) 0.7% in commercial vehicles and 5.1% in total between the years 2012 – 2016.

In the January – September period of 2017 domestic sales realized as 482 thousand in passenger cars, 174 thousand in commercial vehicles and 656 thousand in total, decreasing by 17% in passenger cars 12% in total whereas 12% in commercial vehicles.

|                     | 2012 | 2016  | 2017/9 | CAGR (%) | 2017/T |
|---------------------|------|-------|--------|----------|--------|
| Passenger Cars      | 574  | 770   | 482    | 7.6      | 643    |
| Commercial Vehicles | 272  | 264   | 174    | -0.7     | 232    |
| Toplam              | 846  | 1,034 | 656    | 5.1      | 875    |

**Table 4: Domestic Consumption for Vehicles (1000 Units)**

Source: Automotive Manufacturers Association (OSD), TurkStat

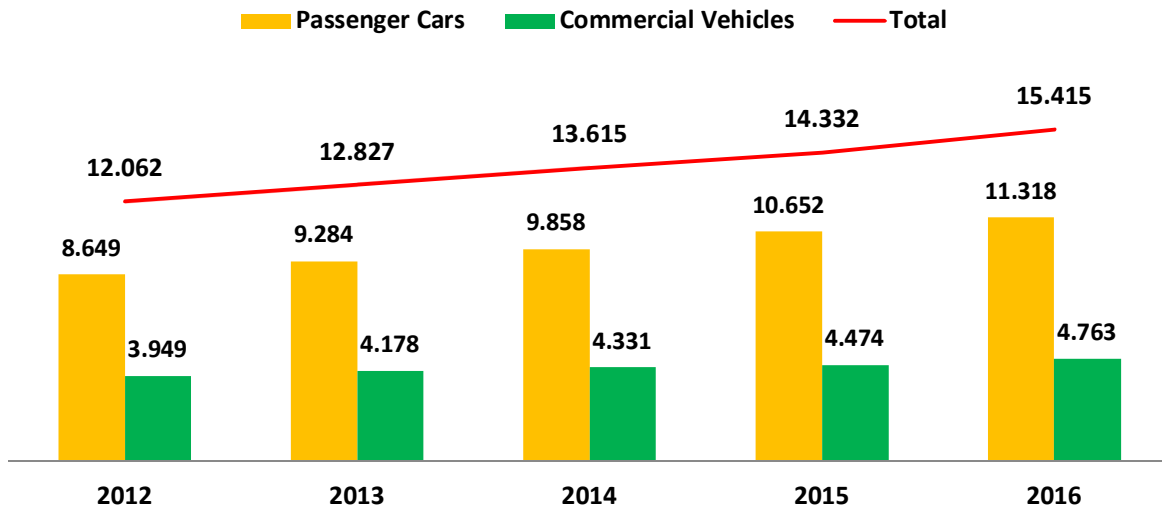


**Graphic 5: Domestic Consumption For Vehicles (1000 Units)**

Source: Automotive Manufacturers Association (OSD), TurkStat

#### 1.4. VEHICLE PARK

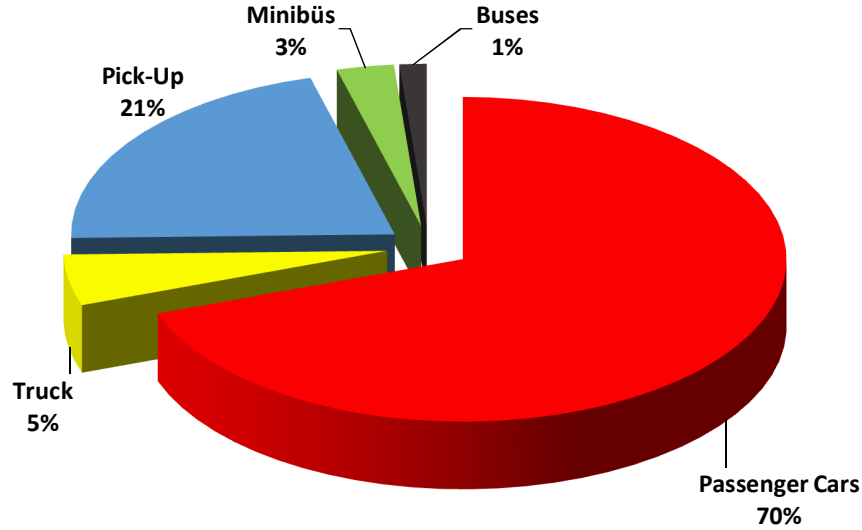
The compound annual growth rate (CAGR) of the park between 2012 and 2016 was 7% passenger cars 4% in commercial vehicles, and 6% in total vehicles. As of the end of 2016, there are a total of 11,3 million vehicles in the park, including 11.3 million cars and 5 million commercial vehicles.



**Graphic 6: Developments in Vehiclec Park (1000 Units)**

Source: Automotive Manufacturers Association (OSD), TurkStat

As of 2016, 70% of the total vehicles park is made up of passenger cars, 21% of pickups, 5% of trucks, 3% of minibuses and 1% of buses.



**Graphic 7: Share of Vehicles In Total Park**

Source: Automotive Manufacturers Association (OSD), TurkStat

### 1.5. SUPPLY AND DEMAND

In the Turkish vehicles industry, the compound growth rate between 2012 and 2016 was 8.5% in production, 8.3% in imports, 11.9% in exports and 5.1% in domestic sales. In 2016, 77% of production was exported and 67% of domestic sales are covered by imports.

In the last 6 years covering 2012 - 2016, 74% of the manufactured vehicles were exported while 65% of the domestic demand was met with imports. This shows that a production model based on exports is selected in the vehicles industry. The increase in production is realized through export rather than domestic sales, the production in the sector carries the risk of external dependency and the share of imports in domestic sales is also very high.

|                                   | 2012  | 2016  | CAGR (%) | 2017/9 | 2017/T |
|-----------------------------------|-------|-------|----------|--------|--------|
| <b>Production</b>                 | 1,073 | 1,486 | 8.5      | 1,224  | 1,632  |
| <b>Imports</b>                    | 503   | 691   | 8.3      | 417    | 555    |
| <b>Exports</b>                    | 730   | 1,143 | 11.9     | 984    | 1,312  |
| <b>Domestic Sales</b>             | 846   | 1,034 | 5.1      | 656    | 875    |
| <b>Exports/Production (%)</b>     | 68    | 77    |          | 80     | 80     |
| <b>Imports/Domestic Sales (%)</b> | 59    | 67    |          | 63     | 63     |

**Table 5: Supply and Demand Balance in Vehicles Industry (1000 Units)**

Source: Automotive Manufacturers Association (OSD), TurkStat

### 1.6. FUTURE ESTIMATES

For country industry, domestic which is not that much market big, is also important as success in export markets. With the investments made by the automotive sector, it has increased its capacity to the level of producing 1.5 million vehicles. Especially with new incentives, both production capacity and very important projects have started. However, the tax increases that affect the demand structure of the market in the negative direction are regarded as a negative development that narrows the domestic demand for the sector.

Looking at the 2023 targets, Turkey's target of 4 million requires an increase in production by 2 times. It is expected that the market, which is under pressure and depressed in the conjuncture we are in, will affect 2023 targets in the long run in the negative direction.

Turkey's domestic market, limited to high taxes, is not attractive for new capacity investments. The investments of the global industry, which has an overcapacity problem, are directed towards the BRIC countries, which have a higher demand potential. In this case, a balanced tax system that will expand the demand in the domestic market with the provisions promoting the automotive industry in the State Aid Legislation in Investment is of strategic importance.

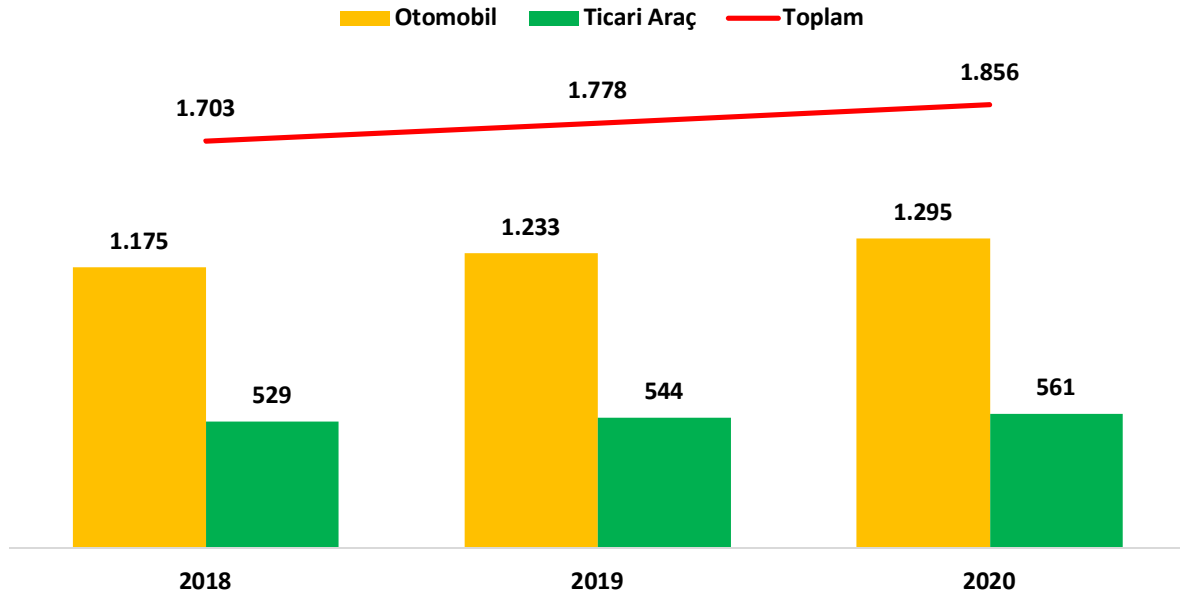
Despite the adverse conditions in the world economy, the automotive industry is in the mid-range with the support of the competitive supply chain; continue to work with determination to achieve their strategic goals of being ranked among the top 10 in the world in total production and the top 3 in the EU.

Implementing policies that will open up the automotive sector will allow for higher growth targets in the sector. It is assumed that vehicle production will continue to increase in 2017-2020 period, 5% for passenger cars and 3% for commercial vehicles.

Although, the application of the policies that will open up the automotive industry will enable the higher growth targets in the sector to be realized In order to see the risks in the estimations of automotive plastic products production, the production of vehicle production in 2018-2020 period it is estimated that production will increase 5% in passenger cars, 3% in commercial vehicles and 4.4% in total. According to this acceptance, it is estimated that the production will reach 1 million 295 thousand in automobile, 577 thousand in commercial vehicle production and 1 million 872 thousand in total.

|                            | 2018  | 2019  | 2020  |
|----------------------------|-------|-------|-------|
| <b>Passenger Cars</b>      | 1,175 | 1,233 | 1,295 |
| <b>Commercial Vehicles</b> | 534   | 555   | 577   |
| <b>Total</b>               | 1,708 | 1,788 | 1,872 |

**Table 6: Vehicled Production Estimates (1000 Units)**



**Graphic 8: Vehicled Production Estimates (1000 Units)**

## **2. PLASTICS USEAGE IN AUTOMOTIVE INDUSTRY**

According to EuPC, PlasticsEurope and American Chemistry Council, the automotive industry is facing increasingly new demands. The drivers want to have in their cars;

- ✓ Higher performance,
- ✓ Greater reliability and security,
- ✓ Higher comfort,
- ✓ More fuel economy,
- ✓ Better style,
- ✓ Social pressures are increasing in favor of more protection of the environment while seeking lower prices.

These requests are actually potentially opposite. However, the only material that meets these demands that are contradictory to each other optimally and that will shape the cars of the future is considered plastic. The superior features of plastics that optimize anticipated and contradictory demands on vehicles are;

- ✓ It is lighter and stronger.
- ✓ Reliable and high security.

- ✓ Plastic parts ensure that the balance between safety and lightness is maintained. Without plastic, today's cars will be at least 200 pounds heavier and as a result, fuel consumption is expected to increase.
- ✓ Provides high performance in the vehicle and reduces the cost of production and use of the vehicle.
- ✓ Thanks to its versatile and flexible usage, it enables technological innovation and design freedom.
- ✓ Complies with higher comfort demands.
- ✓ The automotive industry easily meets engineering demands like sophisticated, aesthetic, safety, comfort, fuel efficiency.
- ✓ Can adapt to reduce electronic performance cost.
- ✓ Positive effects on the environment due to recycling being an easy material.

### **3. PLASTICS INTERMEDIATE USAGE IN AUTOMOTIVE AREA**

It can be seen that the plastics are dominant in the passenger compartment of any car. This is where plastics are more traditionally settled. However, it is also used in control panels, interior trim and upholstery, in plastics lighting, buffer systems, fuel storage and supply systems, ducts, fenders, exterior body panels and increasingly in other parts of the engine compartment or under the bonnet.

In recent years, plastics have really occupied the under-the-hill region and large molds have been commonly used for air manifolds. They are not only about half the weight of the metal counterparts, but they also help engineers to be more productive by optimally arranging the air flow into the engine, and they also play an important role in reducing noise levels. These glass-reinforced nylon molded parts are extremely sophisticated and show that an era in which plastics are really used as engineering materials.

The use of plastics in the engine compartment is not finished yet. Plastic and automobile engineers are now able to optimize their systems, provide integration of injection and blow molded parts, and provide different properties from "soft" to "hard", but they can be molded in the same or in sequence to achieve a better product without intensive work on the assembly line. Plastics and elastomers are in close cooperation to restrain.

Plastics also contribute significantly to the structural character of the vehicles. The intensive development of thermoplastics has opened the way for the production of single body panels by injection molding and the production of electrically conductive glazes for electrostatic painting in order that the paint furnaces used by the automotive industry can withstand the high temperatures.

Structural components such as integrated front modules are also developed from plastic and especially from metal and plastic combinations. This latest development demonstrates the way forward in the future by combining materials to achieve the best performance of each.

Another important development area is fuel systems. This is also the focus of livelihood to save fuel and reduce emissions to the lowest level. It has a longer life cycle than ten years, and is made from fully plastic fuel deposits by blow molding of ultra-high molecular weight high density polyethylene. They are much sharper than single piece metal warehouses with no joints and, at the same time, they provide better design freedom in placing warehouses in difficult places as they can be molded in a good.

It is estimated that 90% of the new cars produced are plastic warehouses. Development of fuel tanks represents an important indication of the potential of plastics. Initially, the inner surface of the deposits is being processed to reduce the permeability of polyethylene, and is now manufactured by multilayered depressurized molding, which includes a high-barrier polymer layer and connecting layers to connect it to the inner and outer layers, in order to meet more stringent emission requirements, especially in the USA .

A sixth layer is often added in order to reuse the wastes generated during manufacturing. Multi-layer extrusion technology is increasingly used in the manufacture of plastic fuel tubes in order to reduce the permeability to near zero and, where appropriate, to provide electrical conductivity. The next stage will be the integration of the total fuel system to be designed as a complex unit.

Thermosetting reinforced resins have an important role to play. Although there is almost fifty years of experience in the use of glass fiber reinforced resins in body manufacturing, this has been limited to the nature of the material required for low-volume manufacture (with sports cars and "special" production). Recently, however, major steps have been taken to develop processes for molding fiber-reinforced polyesters and polyurethanes at practical serial manufacturing levels, and the volume of external body panels and buffer systems made from these hardening materials is increasing.

Computer-aided design and manufacturing systems ensure that a project is "concurrently designed" by all participants. Driver and passenger "cockpit" modules, complex doors, air control systems and fuel systems are now being developed by giant corporations.

The versatility of the plastics and the advances in plastic technology make it possible to use shapes and shapes in the advanced level without sacrificing the safety, comfort or stability of a car. For this reason plastics are becoming very attractive materials for designers. The strength and durability of these materials also extend the average life span of a car by more than 12 years, providing better protection against corrosion.



Thanks to their strength and impact resistance properties, plastics provide basic safety features for bumpers, from shock-absorbing to airbags, side impact protection and seat belts. The plastics that take up the windows and the headlight glass provide 250 times more power than the camera.

Plastics have begun to replace conventional materials in flap bodies, and some companies are now beginning to lead the development of polyetherimide flap nets, which are 40 percent lighter than aluminum equivalents and cost 40 percent less.

Vehicle manufacturers can reduce vehicle assembly times and costs by using plastics. In the past, bumpers, fenders and control panels made from conventional materials that require the manufacture of many parts and the assembly of these parts can now be formed into one piece. Technological innovations mean that in modern vehicles an increasing number of lighter, thinner but stronger plastic parts are used.

#### **4. ENVIRONMENTAL EFFECTS OF USING PLASTICS IN THE AUTOMOTIVE SECTOR**

The use of plastics in vehicle design that use less to do more work (minimizing resource use) helps to minimize the environmental impact and save resources. The real challenge for both the automotive industry and the plastics suppliers is to work together to develop new equipment that not only fulfills cost/performance requirements but also facilitates easier disassembly and recycling.

Today, the tools are at the beginning of the list of recyclable durable goods. More than 75 percent of the weight of an average car is reprocessed, which is more than any other product. Legislation can have a positive impact on promoting even higher levels of reprocessing. However, over-emphasizing reprocessing reduces optimal environmental recovery by not fully exploiting all existing recovery paths.

In addition, the proposed reprocessing objectives and the deadlines for responding to these challenges need to be carefully considered. New automobiles are being designed with more detailed information about potential recycling techniques, with increasing recycling in mind.

The collection and disassembly of complex sub-equipment of a car is certainly not difficult, though it is difficult. At the same time, it has also been shown that plastics only provide more effective ways of recovery than mechanical recycling of materials. Techniques are being developed that allow the separation of mixed plastics into new plastics that can be chemically separated to be reformulated.

Despite their widespread use, the natural resources required to manufacture automotive plastics represent only 0.3 percent of global petroleum consumption. At the same time, a significant weight saving is achieved with the use of plastic. In a modern automobile, about 100 kg of plastic

takes 200 to 300 kg of traditional material. When all other factors are equal, this reduces the fuel consumption of an average car by 750 liters at a lifetime of 150,000 kilometers. The calculations show that oil consumption in Western Europe is reduced by 12 million tonnes per year and consequently CO<sub>2</sub> by 30 million tonnes per year.

In addition to selecting plastics for their automotive design and performance benefits, manufacturers are increasingly opting for these materials because of their environmental benefits and sustainable development. Thus resources can be used for future generations without restricting economic, social and environmental options.

As plastics find more solutions to automotive design and security problems and create new technological opportunities, their presence in the automotive waste stream is growing. The plastics industry understands the need to improve the recovery of automotive plastic parts in order to make the best use of such a valuable source. The aim of the business is to get the best combination of recycling options to maximize the environmental benefit for the community at the lowest cost.

## **5. EXPECTATIONS IN DEVELOPMENTS IN THE USAGE OF PLASTICS IN AUTOMOTIVE INDUSTRY**

Looking to the future, plastics will begin to play an increasingly indispensable role in the manufacture and use of fuel cells. This is a new development designed to produce the power to run electric cars. The versatility and flexibility of the plastics will support the trend of manufacturing many different automobiles on the same chassis and core set in the automotive industry and thus reducing the retail price during the research and development period.

With lightweight plastics, going 50 kilometers with one liter of fuel will soon be possible and today commercialization of electric cars that require just 40 kW instead of the 120 kW needed by a traditional size car may only be possible in a few years. As we move towards the next century, hybrid motors that supply energy to a car from a variety of sources, such as fuel, plastic-based solar panels, and cellular and fuel-cells that produce catalytically from hydrogen to electricity, will be installed, further reducing CO<sub>2</sub> emissions.

The new plastics are constantly adapted to meet the needs of future electronic cars. Plastics in automotive applications will continue to be found in the desire to make better, safer and cleaner automobiles. The plastics industry will continue to cooperate closely with the automotive industry to meet this challenge by developing technologies and products that will make transportation dreams come true.

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automobiles on the same chassis and core set in the automotive industry and thus reducing the retail price during the research and development period.

The new plastics are constantly adapted to meet the needs of future electronic cars. Plastics in automotive applications will continue to be found in the desire to make better, safer and cleaner automobiles. The plastics industry will continue to cooperate closely with the automotive industry to meet this challenge by developing technologies and products that will make transportation dreams come true.

Automotive supplier companies in Turkey should also follow the plastic usage trend in automobiles to maintain their future position. It will be possible to produce products for the vehicles of our future to be manufactured in our country, but to follow the technology closely and even to produce technology in these matters.

## 6. MAIN MATERIALS USED IN THE AUTOMOTIVE INDUSTRY

The percentage of main materials used for the vehicle manufacturing of the entire world between the years 2012 – 2016 is given in the table below and in 2016, an average of 53% of a vehicle's net weight was comprised of steel and 17% of metals apart from steel. It is estimated that the share of plastics in a vehicle manufacture which was 10.6% in 2012 to have risen to 12.7% in 2017 and share of rubber from 5.9% to 7.2.

|                                | 2012        | 2016        | CAGR (%)<br>2012 - 2016 | 2017 (E)    |
|--------------------------------|-------------|-------------|-------------------------|-------------|
| Plain steel                    | 37.3        | 35.7        | -0.9                    | 35.3        |
| High and Medium Powered Steel  | 13.9        | 15.0        | 1.5                     | 15.3        |
| Stainless Steel                | 1.8         | 1.8         | 0.0                     | 1.8         |
| Other Steels                   | 0.7         | 0.6         | -2.5                    | 0.6         |
| <b>Total Steel</b>             | <b>53.8</b> | <b>53.1</b> | <b>-0.2</b>             | <b>53.0</b> |
| Iron Casting                   | 4.4         | 3.1         | -6.8                    | 2.8         |
| Aluminium                      | 8.7         | 9.2         | 1.2                     | 9.3         |
| Magnesium                      | 0.3         | 0.3         | 0.0                     | 0.3         |
| Copper and Brass               | 1.5         | 1.4         | -1.8                    | 1.4         |
| Lead                           | 1.3         | 1.7         | 4.5                     | 1.7         |
| Zinc Casting                   | 0.2         | 0.2         | 0.0                     | 0.2         |
| Powder Metal                   | 1.0         | 1.0         | 0.0                     | 1.0         |
| Other Metals                   | 0.1         | 0.1         | 0.0                     | 0.1         |
| <b>Metals Apart from Steel</b> | <b>17.5</b> | <b>16.9</b> | <b>-0.7</b>             | <b>16.9</b> |
| <b>Total Metals</b>            | <b>71.3</b> | <b>70.1</b> | <b>-0.3</b>             | <b>69.9</b> |
| Plastics                       | 10.6        | 12.2        | 2.9                     | 12.7        |

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|                              |            |              |      |            |
|------------------------------|------------|--------------|------|------------|
| <b>Rubber</b>                | 5.9        | 6.9          | 3.3  | 7.2        |
| <b>Coating</b>               | 0.9        | 1.0          | 2.5  | 1.0        |
| <b>Textile</b>               | 1.3        | 1.3          | 0.8  | 1.4        |
| <b>Fluids and lubricants</b> | 5.2        | 5.2          | 0.0  | 5.2        |
| <b>Glass</b>                 | 2.3        | 2.2          | -1.2 | 2.2        |
| <b>Other</b>                 | 2.3        | 2.4          | 0.9  | 2.4        |
| <b>TOTAL</b>                 | <b>100</b> | <b>100,0</b> |      | <b>100</b> |

**Table 7: Consumption of Main Materials Used in the Turkish Automotive Sector (1000 Tons)**

Source: American Chemistry Council, TPA Plast Global Engineering

While the share of steel within the total weight of a vehicle decreased by 0.6 between the years 2012 – 2016, the share of plastics increased 1.6% saher of rubber 1% and total sahere of plastics and rubber by 3.6%. On base of the realization in the January – September period of 2017, share of plastics is estimated to be 12.7 in 2017 increasing by 0.5% and share of rubber to be 7.2% increasing by 0.3% compare to 2016.

|                                | 2012 | 2016 | Difference (%) | 2017/T |
|--------------------------------|------|------|----------------|--------|
| <b>Steel</b>                   | 53.8 | 53.1 | -0.6           | 53.0   |
| <b>Metals Apart From Steel</b> | 17.5 | 16.9 | -0.6           | 16.9   |
| <b>Plastics</b>                | 10.6 | 12.2 | 1.6            | 12.7   |
| <b>Rubber</b>                  | 5.9  | 6.9  | 1.0            | 7.2    |
| <b>Plastics + Rubber Total</b> | 16.5 | 19.1 | 2.6            | 19.8   |

**Table 8: Change in the Rates of Main Materials Used in Vehicle Production (%)**

It is observed that by taking average usage rate of materials in vehicles and total net weights of the manufactured vehicles as a basis, the main materials used in vehicle assembly and spare part renovations in Turkey between the years 2012 – 2016 improved in the manner shown in the table provided below.

|                                      | 2012  | 2016  | % Increase | 2017/9 |
|--------------------------------------|-------|-------|------------|--------|
| <b>Plain steel</b>                   | 1,064 | 1,221 | 14.8       | 972    |
| <b>High and Medium Powered Steel</b> | 397   | 515   | 29.6       | 422    |
| <b>Stainless Steel</b>               | 51    | 62    | 20.1       | 50     |
| <b>Other Steels</b>                  | 21    | 22    | 5.9        | 17     |
| <b>Total Steel</b>                   | 1,533 | 1,819 | 18.7       | 1,461  |
| <b>Iron Casting</b>                  | 125   | 105   | -15.6      | 77     |
| <b>Aluminium</b>                     | 247   | 315   | 27.5       | 258    |
| <b>Magnesium</b>                     | 9     | 10    | 20.1       | 8      |
| <b>Copper and Brass</b>              | 44    | 48    | 9.6        | 38     |
| <b>Lead</b>                          | 38    | 57    | 49.8       | 48     |

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|                         |              |              |             |              |
|-------------------------|--------------|--------------|-------------|--------------|
| Zinc Casting            | 6            | 7            | 20.1        | 6            |
| Powder Metal            | 29           | 34           | 20.1        | 28           |
| Other Metals            | 3            | 3            | 20.1        | 3            |
| Metals Apart from Steel | 499          | 580          | 16.2        | 465          |
| <b>Total Metals</b>     | <b>2,032</b> | <b>2,399</b> | <b>18.1</b> | <b>1,926</b> |
| Plastics                | 303          | 419          | 38.2        | 349          |
| Rubber                  | 167          | 236          | 41.4        | 198          |
| Coating                 | 25           | 34           | 36.2        | 28           |
| Textile                 | 37           | 46           | 25.0        | 37           |
| Fluids and lubricants   | 148          | 178          | 20.1        | 143          |
| Glass                   | 67           | 75           | 12.9        | 60           |
| Other                   | 65           | 81           | 25.7        | 66           |
| <b>TOTAL</b>            | <b>2,843</b> | <b>3,468</b> | <b>22.0</b> | <b>2,808</b> |

**Table 9: Consumption of Main Materials Used in the Turkish Automotive Industry (1000 Ton)**

Even though the total material weight of vehicle manufacture and renovation demand of vehicles in park in Turkey increased by 38% in 2016 when compared to 2012, an increase of 38% of the amount of plastics used and a 41% increase in rubber have been established. As a result of this increase, it was observed that while consuming 303 thousand tons of plastics in vehicle production in 2012, this figure went up to 419 thousand tons in 2016 and for rubber consumption, the figure went up from 167 thousand tons to 236 thousand tons.

In the January – September period of 2017, plastics consumption of automotive industry realized as 349 thousand tons and expected to be as 482 thousand tons by the end of the year increasing by 15% compared to 2016.

## **7. MAIN PLASTIC PARTS USED IN THE AUTOMOTIVE SECTOR**

The average percentage distribution of total plastic usage in vehicle production is based on the following table. The parts that are most consumed on the basis of amount of plastics in the vehicles are the interior lining and seats.

| <b>Plastics Parts</b> | <b>% Share</b> |
|-----------------------|----------------|
| Interior Trim         | 9.5            |
| Seat                  | 12.4           |
| Bumper                | 6.7            |
| Under-Hood            | 5.7            |
| Others                | 5.7            |
| Floor                 | 8.6            |
| Front Console         | 19.0           |

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|                               |              |
|-------------------------------|--------------|
| Electricity                   | 6.7          |
| Fuel Systems                  | 3.8          |
| Chassis                       | 4.8          |
| Illumination                  | 7.6          |
| External Components           | 1.0          |
| Liquid Tanks                  | 8.6          |
| <b>TOTAL PLASTIC MATERIAL</b> | <b>100.0</b> |

**Table 10: Share of Plastic Part Weight Per Vehicle in Automotive Industry**

Source: American Chemistry Council, TPA Plast Global Engineering

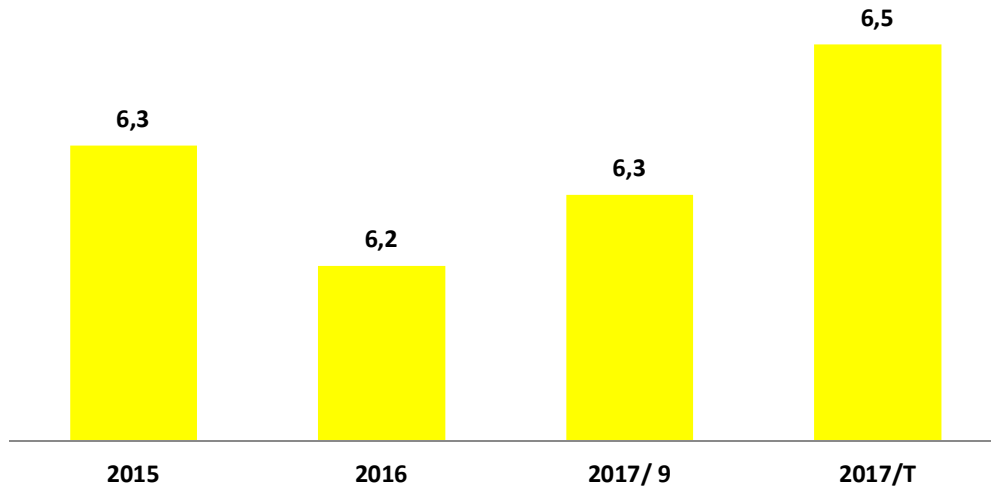
Based on the average % usage of parts in vehicle production, the following table shows the development of the plastic parts produced in the Turkish automotive industry between 2012 and 2016 based on quantity.

|                               | 2012       | 2016       | Difference<br>( 2016 – 2012 ) | 2017/9     | 2017/T     |
|-------------------------------|------------|------------|-------------------------------|------------|------------|
| Interior Trim                 | 29         | 40         | 11                            | 33         | 46         |
| Seat                          | 38         | 52         | 14                            | 43         | 60         |
| Bumper                        | 20         | 28         | 8                             | 23         | 32         |
| Under-Hood                    | 17         | 24         | 7                             | 20         | 27         |
| Others                        | 17         | 24         | 7                             | 20         | 27         |
| Floor                         | 26         | 36         | 10                            | 30         | 41         |
| Front Console                 | 58         | 80         | 22                            | 66         | 92         |
| Electricity                   | 20         | 28         | 8                             | 23         | 32         |
| Fuel Systems                  | 12         | 16         | 4                             | 13         | 18         |
| Chassis                       | 15         | 20         | 6                             | 17         | 23         |
| Illumination                  | 23         | 32         | 9                             | 27         | 37         |
| External Components           | 3          | 4          | 1                             | 3          | 5          |
| Liquid Tanks                  | 26         | 36         | 10                            | 30         | 41         |
| <b>TOTAL PLASTIC MATERIAL</b> | <b>303</b> | <b>419</b> | <b>115</b>                    | <b>349</b> | <b>482</b> |

**Table 11: Plastic Part Production Used in the Turkish Automotive Sector (1000 Ton)**

## **8. SHARE OF PLASTICS USED IN AUTOMOTIVE SECTOR WITHIN THE TOTAL PLASTIC CONSUMPTION**

Plastic usage in the Turkish automotive industry is increasing in parallel with the manufacturing of vehicles apart from the technological developments. Changing according to vehicle production, plastic usage of the Turkish automotive industry comprised over 6% of the total plastic production and in the first half of 2017 rose up to 6.5%.



**Graphic 9: Share of Plastic Consumption of Automotive Industry in Total Plastic Consumption (%)**

## 9. MAIN PLASTIC RAW MATERIALS USED IN THE AUTOMOTIVE SECTOR

Plastic consumption, which is ever-increasing in vehicle production, also diversifies the plastic raw materials used in the manufacturing of plastic parts. Although more than 10 different plastic raw materials are used in the automotive sector more than 50% of the raw materials consumed are comprised of PP, PUR and PA.

The use of computers to control the motor performance of vehicles creates new areas of application for plastics where metal parts are of no use. While vehicles are gradually becoming more of “electronic” machines and cease to be mechanic, the need for vehicle components which provide temperature and chemical resistance apart from electronic protection is also increasing.

As a consequence of the aforementioned, the demand for thermoplastics is increasing. For example, new engineering plastics such as polybutylterephthalate, aliphatic polyethon and liquid crystal polymers in advanced applications are more increasingly used in extremely challenging applications including connectors and electricity part housings.

| Parts         | Main Plastics Raw Materials Used |
|---------------|----------------------------------|
| Interior Trim | PP, ABS, PET, POM, PVC           |
| Seat          | PP, ABS, PA, PC, PE              |
| Bumper        | PUR, PP, PVC, ABS, PA            |
| Under-Hood    | PP, ABS, PC                      |
| Others        | PA, PP, PBT                      |
| Floor         | PVC, PUR, PP, PE                 |



|                     |                       |
|---------------------|-----------------------|
| Front Console       | PE, POM, PA, PP       |
| Electricity         | PP, PE, PBT, PA, PVC  |
| Fuel Systems        | PP, PPE, UP           |
| Chassis             | PP, PC, ABS, PMMA, UP |
| Illumination        | ABS, PA, PBE, ASA, PP |
| External Components | PP, PE, PA            |

**Table 12: Major Types of Plastic Raw Materials Used in The Production of Plastic Parts of Vehicles**

| <i>Plastic Raw Material</i>                        | <i>% Consumption</i> | <i>Plastic Raw Material</i>       | <i>% Consumption</i> |
|--|----------------------|-----------------------------------|----------------------|
| <i>PP ( Polypropylene )</i>                        | <b>23.3</b>          | <b>Other Engineering Plastics</b> | <b>12.0</b>          |
| <i>PUR ( Polyurethane )</i>                        | <b>17.0</b>          | Polyacetal                        | <b>1.9</b>           |
| <i>PA ( Nylon – Polyamide )</i>                    | <b>12.3</b>          | PPE                               | <b>3.8</b>           |
| <i>ABS ( Acrylonitrile – Butadiene – Styrene )</i> | <b>7.9</b>           | Thermoplastic Polyester           | <b>5.7</b>           |
| <i>PVC ( Polyvinyl Chloride )</i>                  | <b>7.0</b>           | Other Engineering Plastics        | <b>0.6</b>           |
| <i>PE ( Polyethylene )</i>                         | <b>4.4</b>           | <b>Other Resins</b>               | <b>9.5</b>           |
| <i>PC ( Polycarbonate )</i>                        | <b>4.7</b>           | Acrylics                          | <b>1.5</b>           |
| <i>PBT ( Polyvinyl Butrayl )</i>                   | <b>2.0</b>           | Phenolics                         | <b>3.1</b>           |
|  |                      | Unsaturated Polyester             | <b>3.8</b>           |
|  |                      | Others                            | <b>1.1</b>           |
|  |                      | <b>Total Plastic Usage</b>        | <b>100</b>           |

**Table 13: Plastic Raw Material Rate Used in Automotive Plastic Part Production (%)**

Source: American Chemistry Council, TPA Plast Global Engineering

The total consumption amount of plastic raw materials used for automotive plastic part production between the years 2012 – 2016, in Turkey were calculated in the table provided below by taking the plastic raw material rates used in automotive plastic part production and automotive plastic total consumption as basis.

Otomotiv plastik parça üretiminde kullanılan plastik hammadde oranları ve otomotiv plastik toplam tüketimi baz alınarak Türkiye’de 2012 – 2016 yılları arasında otomotiv plastik parça üretimi için kullanılan plastik hammaddelerin toplam tüketim miktarları aşağıdaki tabloda görüldüğü biçimde hesaplanmıştır.

|                     | 2012 | 2016 | Differnec<br>2016 - 2012 | 2017/9 | 2017/E |
|---------------------|------|------|--------------------------|--------|--------|
| <b>PP</b>           | 68   | 93   | 26                       | 78     | 108    |
| <b>Polyurethane</b> | 47   | 65   | 18                       | 54     | 75     |

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|                            |            |            |            |            |            |
|----------------------------|------------|------------|------------|------------|------------|
| Nylon                      | 38         | 53         | 15         | 44         | 61         |
| ABS                        | 22         | 31         | 8          | 25         | 35         |
| Polyvinyl Chloride         | 25         | 34         | 10         | 29         | 40         |
| PE                         | 15         | 21         | 6          | 17         | 24         |
| Polycarbonate              | 15         | 21         | 6          | 18         | 25         |
| Polyvinyl Butrayl          | 6          | 8          | 2          | 7          | 9          |
| Other Engineering Plastics | 40         | 56         | 15         | 46         | 64         |
| Polyacetal                 | 6          | 9          | 2          | 7          | 10         |
| PPE                        | 12         | 16         | 5          | 14         | 19         |
| Thermoplastic Polyester    | 19         | 26         | 7          | 22         | 30         |
| Other Engineering Plastics | 3          | 4          | 1          | 3          | 5          |
| Other Resins               | 27         | 37         | 10         | 31         | 42         |
| Acrylics                   | 4          | 5          | 2          | 5          | 6          |
| Phenolics                  | 10         | 14         | 4          | 12         | 16         |
| Unsaturated Polyester      | 9          | 13         | 4          | 11         | 15         |
| Others                     | 3          | 4          | 1          | 3          | 5          |
| <b>Total Plastic Usage</b> | <b>303</b> | <b>419</b> | <b>116</b> | <b>349</b> | <b>482</b> |

**Table 14: Average Plastic Raw Material Consumption per Vehicle in the Turkish Automotive Sector (kg)**

## 10. MATERIALS CONSUMPTION ESTIMATION IN TURKISH AUTOMOTIVE INDUSTRY

Based on the average material usage rate in vehicles and the estimation of vehicle production and net net weights, the percentage of total consumption of major materials to be used in vehicle production in Turkey between 2017 and 2020 is estimated as follows.

| Main Materials                | 2017        | 2018        | 2019        | 2020        |
|-------------------------------|-------------|-------------|-------------|-------------|
| Plain steel                   | 35.3        | 34.9        | 34.5        | 34.1        |
| High and Medium Powered Steel | 15.3        | 15.6        | 15.9        | 16.2        |
| Stainless Steel               | 1.8         | 1.8         | 1.8         | 1.8         |
| Other Steels                  | 0.6         | 0.6         | 0.6         | 0.6         |
| <b>Total Steel</b>            | <b>53.0</b> | <b>52.9</b> | <b>52.8</b> | <b>52.7</b> |
| Iron Casting                  | 2.8         | 2.6         | 2.4         | 2.2         |
| Aluminium                     | 9.3         | 9.5         | 9.6         | 9.8         |
| Magnesium                     | 0.3         | 0.3         | 0.3         | 0.3         |
| Copper and Brass              | 1.4         | 1.3         | 1.3         | 1.3         |
| Lead                          | 1.7         | 1.8         | 2.0         | 2.1         |
| Zinc Casting                  | 0.2         | 0.2         | 0.2         | 0.2         |
| Powder Metal                  | 1.0         | 1.0         | 1.0         | 1.0         |

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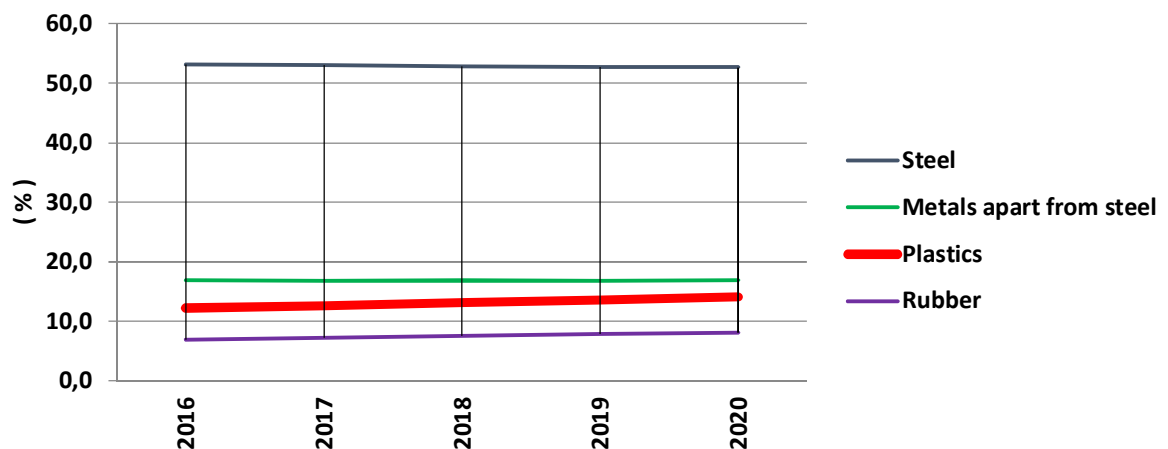
|                         |            |            |            |            |
|-------------------------|------------|------------|------------|------------|
| Other Metals            | 0.1        | 0.1        | 0.1        | 0.1        |
| Metals Apart from Steel | 16.9       | 16.8       | 16.8       | 16.9       |
| Total Metals            | 69.9       | 69.7       | 69.6       | 69.5       |
| Plastics                | 12.7       | 13.1       | 13.6       | 14.1       |
| Rubber                  | 7.2        | 7.5        | 7.8        | 8.1        |
| Coating                 | 1.0        | 1.1        | 1.1        | 1.1        |
| Textile                 | 1.4        | 1.4        | 1.4        | 1.4        |
| Fluids and lubricants   | 5.2        | 5.2        | 5.2        | 5.2        |
| Glass                   | 2.2        | 2.1        | 2.1        | 2.1        |
| Other                   | 2.4        | 2.4        | 2.5        | 2.5        |
| <b>TOTAL</b>            | <b>100</b> | <b>100</b> | <b>100</b> | <b>100</b> |

**Table 15: Turkish Automotive Industry Plastic Parts Consumption Rate Estimation (%)**

The share of steel within the total material consumption will decrease by 0.5%, metals apart from steel by 0.1% and all materials by 0.6% in 2020 for the Turkish automotive sector when compared to 2017. On the other hand, the share of plastic will increase by 1.8% and of rubber by 1.2%. The share of plastic and rubber within the total material consumption is expected to increase by 3.1%.

|                         | 2017 | 2018 | 2019 | 2020 | % Difference (2020- 2017) |
|-------------------------|------|------|------|------|---------------------------|
| Steel                   | 53.0 | 52.9 | 52.8 | 52.7 | -0.5                      |
| Metals Apart From Steel | 16.9 | 16.8 | 16.8 | 16.9 | -0.1                      |
| Plastics                | 12.7 | 13.1 | 13.6 | 14.1 | 1.8                       |
| Rubber                  | 7.2  | 7.5  | 7.8  | 8.1  | 1.2                       |
| Plastics + Rubber Total | 19.8 | 20.6 | 21.4 | 22.2 | 3.1                       |

**Table 16: Changes in the Rates of Materials Used in Vehicles Production (%)**



**Graphic 10: Changes in the Rates of Materials Used in Vehicle Production**

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According to the calculations provided above the consumption amount of main materials within the automotive sector is estimated as to be in the table provided below. These estimates show that the automotive plastics amount which was 419 thousand tones in 2016, will increase by 43% and go up to 565 thousand tons and the rubber on the other hand, will increase by 41.4%.

|                                | 2017  | 2018  | 2019  | 2020  | % Difference<br>(2016 – 2020) |
|--------------------------------|-------|-------|-------|-------|-------------------------------|
| <b>Steels</b>                  | 1,944 | 1,997 | 2,052 | 2,114 | 18.7                          |
| <b>Metals Apart from Steel</b> | 619   | 636   | 655   | 677   | 16.2                          |
| <b>Total Metals</b>            | 2,563 | 2,633 | 2,707 | 2,792 | 18.1                          |
| <b>Plastics</b>                | 482   | 495   | 528   | 565   | 38.2                          |
| <b>Rubber</b>                  | 275   | 283   | 303   | 326   | 41.4                          |
| <b>Other Materials</b>         | 448   | 460   | 476   | 493   | 21.5                          |
| <b>TOTAL</b>                   | 3,768 | 3,871 | 4,014 | 4,175 | 22.0                          |

**Table 17: Consumption Estimate of Main Materials In the Automotive Sector (1000 Ton)**

The amount of plastic parts consumption between the years 2017 – 2020 within the Turkish automotive industry was estimated to be as shown in the table below by taking the average % usage of parts in vehicle production.

|                               | 2017 | 2018 | 2019 | 2020 | Difference<br>2020 - 2016 |
|-------------------------------|------|------|------|------|---------------------------|
| <b>Interior Trim</b>          | 46   | 47   | 50   | 54   | 11                        |
| <b>Seat</b>                   | 60   | 61   | 66   | 70   | 14                        |
| <b>Bumper</b>                 | 32   | 33   | 35   | 38   | 8                         |
| <b>Under-Hood</b>             | 27   | 28   | 30   | 32   | 7                         |
| <b>Others</b>                 | 27   | 28   | 30   | 32   | 7                         |
| <b>Floor</b>                  | 41   | 43   | 45   | 49   | 10                        |
| <b>Front Console</b>          | 92   | 94   | 100  | 107  | 22                        |
| <b>Electricity</b>            | 32   | 33   | 35   | 38   | 8                         |
| <b>Fuel Systems</b>           | 18   | 19   | 20   | 21   | 4                         |
| <b>Chassis</b>                | 23   | 24   | 25   | 27   | 6                         |
| <b>Illumination</b>           | 37   | 38   | 40   | 43   | 9                         |
| <b>External Components</b>    | 5    | 5    | 5    | 6    | 1                         |
| <b>Liquid Tanks</b>           | 41   | 43   | 45   | 49   | 10                        |
| <b>TOTAL PLASTIC MATERIAL</b> | 482  | 495  | 528  | 565  | 115                       |

**Table 18: Consumption Estimate of Main Materials In the Automotive Sector (1000 Ton)**

The consumption of plastic raw materials which will be used for the automotive parts production between the years 2017 – 2020 in Turkey is estimated to be as shown in the table provided below

by taking the rates of plastic raw materials used in the automotive plastic parts production and total consumption estimate of autootive plastics.

|                                     | 2017       | 2018       | 2019       | 2020       | Difference<br>2020 - 2016 |
|-------------------------------------|------------|------------|------------|------------|---------------------------|
| Polypropylene                       | 108        | 110        | 118        | 126        | 33                        |
| Polyurethane                        | 75         | 77         | 82         | 88         | 23                        |
| Nylon                               | 61         | 62         | 67         | 71         | 18                        |
| Acrylonitrile – Butadiene – Styrene | 35         | 36         | 39         | 41         | 11                        |
| Polyvinyl Chloride                  | 40         | 41         | 43         | 46         | 12                        |
| Polyethylene                        | 24         | 24         | 26         | 28         | 7                         |
| Polycarbonate                       | 25         | 25         | 27         | 29         | 7                         |
| Polyvinyl Butrayl                   | 9          | 9          | 10         | 11         | 3                         |
| Other Engineering Plastics          | 64.1       | 65.9       | 70.3       | 75.1       | 19                        |
| Polyacetal                          | 10         | 10         | 11         | 12         | 3                         |
| PPE                                 | 19         | 19         | 21         | 22         | 6                         |
| Thermoplastic Polyester             | 30         | 31         | 33         | 36         | 9                         |
| Other Engineering Plastics          | 5          | 5          | 5          | 6          | 1                         |
| Other Resins                        | 42         | 44         | 47         | 50         | 13                        |
| Acrylics                            | 6          | 6          | 7          | 7          | 2                         |
| Phenolics                           | 16         | 17         | 18         | 19         | 5                         |
| Unsaturated Polyester               | 15         | 15         | 16         | 18         | 5                         |
| Others                              | 5          | 5          | 5          | 6          | 1                         |
| <b>Total Plastic Raw Material</b>   | <b>482</b> | <b>495</b> | <b>528</b> | <b>565</b> | <b>146</b>                |

**Table 19: Plastic Raw Material Consumption Estimate of the Turkish Automotive Sector (1000 Ton)**

It is estimated that in 2020 the Turkish automotive industry will consume at least 565 thousand tons of plastic raw materials and the consumption of plastic raw materials will increase by 35% compared to 2016 and that the share of automotive plastics in total plastic consumption will increase to 6.5% in 2020 .

The demand for plastics within the global automotive sector is ever-increasing with each passing day. This is due to the fact that while drivers seek higher performance, safety, more comfort, lower fuel consumption, smarter style and lower prices in the automobiles they want to purchase, the society, on the other hand, demands lower pollution levels. The ever-increasing demands of the drivers and society has increased the competition within the automotive sector and forced vehicle manufacturers to continuously invent innovations. As for these innovations, they obliged the selection of plastics as an alternative material.

The manufacture of products and raw materials with higher added values and that are innovatory is dependant on the increase of production of plastic oriented towards the automotive sector which is dependant on the vehicle production. However, due to the inability to reach the target production level in vehicle production, Turkey remained under developed western societies, which is 10% of total plastic consumption, compared to the share of automotive plastics in total plastic consumption.

## **11. PAGEV PROJECTS**

PAGEV which is the "Unifying Power" of the Turkish Plastics Industry develops different projects aiming to solve the problems outlined above. These are in summary: "PAGEV Plastics Center of Excellence" and "International Regional Plastics Production Center".

### **11.1. PLASTICS CENTER OF EXCELLENCE**

Plastic materials, used in all areas of life, are rapidly taking place of other alternative products, because of their superior properties. In Turkey as well as in all over the world, plastics which useage in all sectors increasing is becoming an indispensable material for the 21<sup>st</sup> century.

Turkish Plastics Industry which is one of the fastest growing sectors in our country despite being young, is the 6<sup>th</sup> in the world and the 2<sup>nd</sup> in Europe. Growing with the goal of leadership in Europe, the Turkish Plastics Sector aims to increase the certification and added value of its products.

PAGEV, "Unifying Power" of the Turkish Plastics Industry, is leading the industry with the "PAGEV Plastics Excellence Center" for realizing this purpose. The mission of the PAGEV Center for Plastics Excellence will include the following activities,

- ✓ Research and Development
- ✓ Test and Laboratory Services
- ✓ Certification
- ✓ Training
- ✓ Competent Consulting

With the Center of Excellence, the test and laboratory support that the plastic industry needs will be provided to the industry. So, many problems that lead to loss of time and energy such as high test costs, overseas shipping, customs clearance, long test times will be removed.

The platforms that will provide information to and knowledge sharing in the industry will be developed by the Center and detailed training programs will be prepared and presented for the benefit of the industry. While working on the newest technologies, the Center of Excellence will work together with industry organizations, universities, research institutes, professional

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associations and non-governmental organizations to work for the Turkish Plastics Industry to be the world leader with R&D and innovation based work.

Established with the support of the Ministry of Science, Industry and Technology, PAGEV Plastics Center of Excellence will provide to the plastics industry and Turkish economy, especially the development of industrial skills and capabilities that will form the basis of Turkey's national projects.

By PAGEV Plastics Center of Excellence, which will be established by strategic cooperation, it is aimed to grow the plastic industry faster with its traceable targets, scientific quality and high potential for commercialization.

Upon completion, the Center of Excellence, which will have an area of over 30 thousand m<sup>2</sup>, rises right beside PAGEV Vocational and Technical Anatolian High School in Küçükçekmece, Istanbul. PAGEV Plastics Center of Excellence, which will make Turkey the center of plastic production in the world, will carry out innovative projects.

In addition to this, the Center will create a control mechanism for the products exported abroad. The Center will also contribute to the preservation of the reliability and reputation of the plastic products produced in Turkey. On the other hand, the introduction of poor quality and non-standard goods into the country will be prevented by determining the technical suitability of the plastic products imported from abroad without any definite importation in the laboratories.

With its superior information infrastructure, the Center of Excellence will present the important documents required by the players of the sector more economically and quickly.

By accelerating the development, we will focus on the development of products and production technologies that will increase the competitive power of our firms.

The Center of Excellence, which will develop innovative ideas by following the developments in the world plastic sector, will increase the competitive power of our firms by providing many field consultancy services from the determination of appropriate input materials to the optimization of production process.

## **11.2. INTERNATIONAL REGIONAL PLASTIC MANUFACTURING CENTER**

Although the Turkish Plastics Sector, with its process capacity reaching 9 million tons, has the 6<sup>th</sup> largest plastics production capacity in the world and 2<sup>nd</sup> in Europe, imports more than 85% of the plastic raw material it needs.



One of the most important advantages of the plastics industry in Turkey is that it is located between the Middle East countries which are the main petroleum and plastic raw material producer and the European market which is the main plastic consumer.

PAGEV aims to unify the plastic raw materials potential of Middle East countries with the Turkish Plastics Industry's competent production capability and experience at the international regional plastic production center, which Turkey aims to establish in South East Anatolia Region.

In the center, to be established with the win-win principle, the plastics raw materials producer countries will be supplying cheap and reliable raw materials having a large volume and reliable market while Turkish Plastics Industry will have greater competition possibilities in the global markets with its growing production capacity and falling costs.



# CONNECTING POWER OF PLASTICS INDUSTRY



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