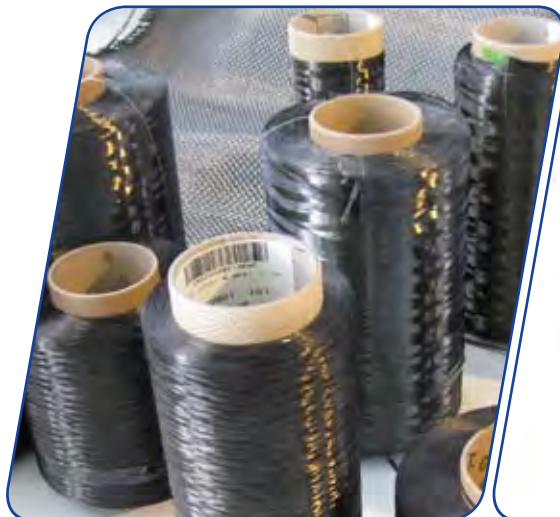


# Market Study: Composites (CFRP & GFRP)



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Learn which time is the best for entering or leaving a market
- **Have a look at the future**  
Find out if new investments and technologies are worthwhile and how to gain access to future markets. We also show possible market scenarios
- **Recognize opportunities and risks**  
Identify opportunities & risks on your target markets in time

## This study is useful for:

- Manufacturers, Processors, and distributors of carbon fiber reinforced plastics (CFRP) and glass fiber reinforced plastics (GFRP)
- Suppliers of raw materials such as glass fibers, carbon fibers, primary and intermediate products like mats, fabrics, rovings, prepregs, and others as well as manufacturers and suppliers of plastic components
- Actors and companies of the segments wind power, automotive, construction industry, aerospace, sports and leisure (including boats), electrical and electronics, pressure tanks
- Associations and institutes
- Executive board, technology and production, strategic planning, R&D, market research, marketing, sales and distribution, procurement

### In this brochure you will find the following information:

- An introduction on page 3
- A summary of the table of contents on page 4
- Following this, there are example pages from the study
- Please use the form on the last page to easily order your study or a free reading sample!

Combating climate change by expansion of wind power, revolutionization of the automotive market by introduction of electric mobility or modernization of the aircraft fleet: all of these path-breaking projects are dependent on the use of modern materials. Lightweight yet high-performing composites allow for the reduction of weight of components - and thus for saving energy.

The present study examines the global market for carbon fiber reinforced plastics (CFRP) and glass fiber reinforced plastics (GFRP). Especially the excellent weight / carrying capacity ratio makes CFRP attractive for many applications. Ceresana expects the global market for CFRP and GFRP to increase to a volume of over 9.98 million tonnes by 2024. The study also analyzes the individual markets for both materials in detail and offers separate data for CFRP and GFRP.

## **More Wind Power Due to CFRP in Rotor Blades**

After the climate conference of Paris in December 2015, the follow-up conference in Marrakech in November 2016 did not come up with essential news: The climate targets of Paris were affirmed and unity was demonstrated. Without a reduction of the CO2 emission during energy supply, an effective climate protection can hardly be reached according to the summit. Wind energy continues to be one of the most important instruments in the change towards non-fossil energy sources. More and more countries - and not only developed industrial nations of the

western hemisphere - invest massively in the expansion of wind energy. If the location is well-suited, increasingly larger and more powerful wind turbines with increasingly larger rotor blades are installed. The enlargement of the length of the rotor blades is made possible by the increased application of CFRP. However, cost is rising disproportionately with the use of CFRP for rotor blades which sets limits for the growth potential of wind turbines from a financial point of view. In any case, the number of installed wind turbines is increasing further in most countries. The market for GFRP benefits from this development as well since they are also applied in the production of rotor blades.

## **Lightweight Construction Spurs on Airplane Manufacturers**

Composite materials are used both in civil as well as in military aerospace industries. Yet, the majority is currently accounted for by civil aerospace. Global aviation and thus the demand for new civil airplanes will presumably continue to increase considerably in the upcoming years. Especially Asia-Pacific, Latin America, Africa, and the Middle East register the highest growth rates. In regard to the demand for composites in the segment aerospace, the two globally largest aircraft manufacturers Boeing and Airbus play a major role. The new models of Airbus and Boeing have a significantly higher share of composites than older models. Especially the models Boeing 777, Boeing 787 (Dreamliner), Airbus A380,

and Airbus A350 have a large impact on the market. CFRP are mainly utilized in fuselage and wings.

Accordingly, the majority of the global demand in this segment is accounted for by the large West European countries (Airbus) and the USA (Boeing). Additional important airplane manufacturers like Bombardier (Canada) or Embraer (Brazil) ensure an increasing demand at the corresponding production sites.

## **Heavy Batteries Need Light Car Bodies**

Lightweight construction will play a major role in the context of e-mobility in the automotive sector in the upcoming years: Heavy materials such as steel, other metals or engineering plastics are increasingly replaced by composites with low weight. In the segment of series production of cars, GFRP are preliminarily used. CFRP parts are still too expensive in most cases, at the same time, a suitable processing technology is still missing which would be up to the high standardization and production speed in the manufacture of cars. Furthermore, many segments lack suitable testing processes for series production which do not damage the products.

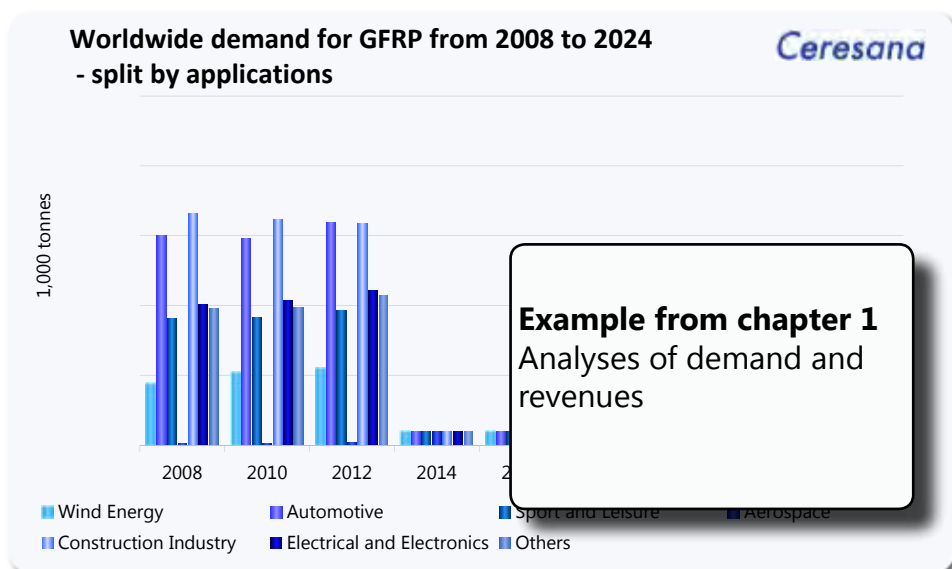
A promising processing technology in the automotive industry is RTM (Resin Transfer Molding), a resin injection process. In this process, preforms made of continuous fibers are prefabricated; afterwards, the resin is injected into them in a press form.

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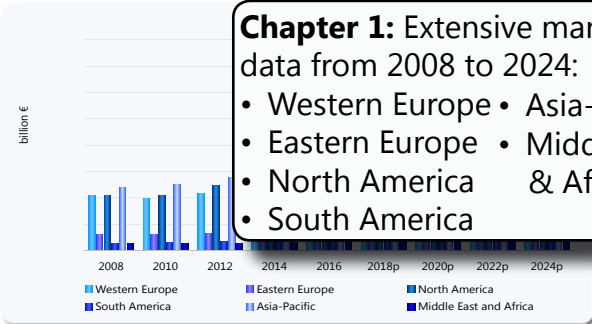
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## 1.1.2 Revenues – World

Global revenues generated with composites rose from USD X billion (EUR X billion) in 2008 to USD X billion (EUR X billion) in 2016. This development translates into an average increase of X% per year (X% p.a. for values in EUR). In 2016, approx. X% of global revenues were generated in Asia-Pacific, followed by North America (X%) and Western Europe (X%).



Graph 1: Global revenues generated with composites from 2008 to 2024 – split by regions

in billion USD	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Western Europe	X	X	X	X	X	X	X	X	X	X% p.a.
Eastern Europe	X	X	X	X	X	X	X	X	X	X% p.a.
North America	X	X	X	X	X	X	X	X	X	X% p.a.
South America	X	X	X	X	X	X	X	X	X	X% p.a.
Asia-Pacific	X	X	X	X	X	X	X	X	X	X% p.a.
Middle East and Africa	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X% p.a.</b>

Table 1: Global revenues generated with CFRP from 2008 to 2024 – split by regions

### Chapter 1: Extensive market data from 2008 to 2024:

- Western Europe
- Eastern Europe
- North America
- South America
- Asia-Pacific
- Middle East & Africa

in billion USD	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Western Europe	X	X	X	X	X	X	X	X	X	X% p.a.
Eastern Europe	X	X	X	X	X	X	X	X	X	X% p.a.
North America	X	X	X	X	X	X	X	X	X	X% p.a.
South America	X	X	X	X	X	X	X	X	X	X% p.a.
Asia-Pacific	X	X	X	X	X	X	X	X	X	X% p.a.
Middle East and Africa	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X% p.a.</b>

Table 2: Global revenues generated with GFRP from 2008 to 2024 – split by regions

in billion USD	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Wind Energy	X	X	X	X	X	X	X	X	X	X% p.a.
Automotive	X	X	X	X	X	X	X	X	X	X% p.a.
Sports & Leisure	X	X	X	X	X	X	X	X	X	X% p.a.
Aerospace	X	X	X	X	X	X	X	X	X	X% p.a.
Construction Industry	X	X	X	X	X	X	X	X	X	X% p.a.
Electrical and Electronics	X	X	X	X	X	X	X	X	X	X% p.a.
Other	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X% p.a.</b>

Table 3: Global revenues generated with CFRP from 2008 to 2024 – split by applications

in billion USD	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Wind Energy	X	X	X	X	X	X	X	X	X	X% p.a.
Automotive	X	X	X	X	X	X	X	X	X	X% p.a.
Sports & Leisure	X	X	X	X	X	X	X	X	X	X% p.a.
Aerospace	X	X	X	X	X	X	X	X	X	X% p.a.
Construction Industry	X	X	X	X	X	X	X	X	X	X% p.a.
Electrical and Electronics	X	X	X	X	X	X	X	X	X	X% p.a.
Other	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X% p.a.</b>

Table 4: Global revenues generated with GFRP from 2008 to 2024 – split by applications

### Chapter 1: Specific analyses and forecasts for 6 regions:

- Revenues generated with CFRP and GFRP (in US dollars)
- Total demand (in tonnes)
- Demand for CFRP and GFRP
- Demand split by applications
- Revenue split by applications on a global level

## 2.5.3 Japan - Demand and Revenues

### Demand

In 2016, around X tonnes of composites were used. This translates into an average increase of X% p.a. between 2008 and 2016.

We forecast a higher growth at rates of X% p.a. for the upcoming 2016 to 2024 period. Market volume will amount to approx. X tonnes in 2024.

in 1,000 tonnes	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Wind Energy	X	X	X	X	X	X	X	X	X	X% p.a.
Automotive	X	X	X	X	X	X	X	X	X	X% p.a.
Sports & Leisure	X	X	X	X	X	X	X	X	X	X% p.a.
Aerospace	X	X	X	X	X	X	X	X	X	X% p.a.
Construction Industry	X	X	X	X	X	X	X	X	X	X% p.a.
Electrical and Electronics	X	X	X	X	X	X	X	X	X	X% p.a.
Other	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X% p.a.</b>

Table 5: Demand for CFRP in Japan from 2008 to 2024 – split by applications

in 1,000 tonnes	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Wind Energy	X	X	X	X	X	X	X	X	X	X% p.a.
Automotive	X	X	X	X	X	X	X	X	X	X% p.a.
Sports & Leisure	X	X	X	X	X	X	X	X	X	X% p.a.
Aerospace	X	X	X	X	X	X	X	X	X	X% p.a.
Construction Industry	X	X	X	X	X	X	X	X	X	X% p.a.
Electrical and Electronics	X	X	X	X	X	X	X	X	X	X% p.a.
Other	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X% p.a.</b>

Table 6: Demand for GFRP in Japan from 2008 to 2024 – split by applications

[...]Despite a decrease in state support for vehicles with alternative drive engines, hybrid vehicles are supposed to hold a share of X% and electric and plug in vehicles of X% on the domestic traffic by 2030 according to a plan of the government. To fulfill these aims, the use of light composites in the Japanese automotive industry has to

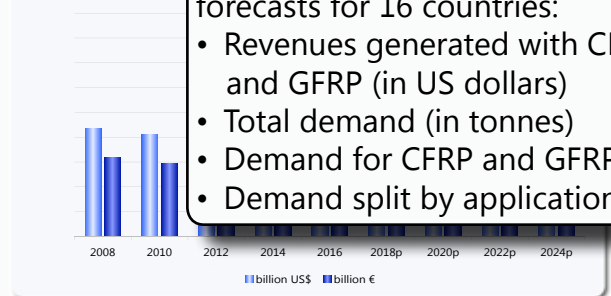
increase further. Already in 2015, about X% of the newly registered passenger cars were hybrid vehicles. However, electric and hybrid vehicles only had a share of below X% in 2015 [...]

### Revenues

Revenues generated with composites in 2016 amounted to about USD X billion. Japan's share of total regional revenues therefore fell to about X% in 2016. We forecast a market value of approx. USD X billion to be reported in 2024. Compared to 2016, this constitutes a growth rate of X% per year, which falls short of the regional average.

### Chapter 2: Specific analyses and forecasts for 16 countries:

- Revenues generated with CFRP and GFRP (in US dollars)
- Total demand (in tonnes)
- Demand for CFRP and GFRP
- Demand split by applications



Graph 2: Revenues generated with composites in Japan from 2008 to 2024, in billion USD and billion EUR

In 2008, about USD X billion were generated with CFRP. Value rose to USD X billion in 2016. We expect to see further growth by X% p.a. in the next eight years. Revenues generated with GFRP amounted to USD X billion in 2016. We forecast a value of about USD X billion in 2024. Compared to 2016, this corresponds to an increase by an average of X% p.a.

in billion USD	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
CFRP	X	X	X	X	X	X	X	X	X	X% p.a.
GFRP	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	X	X	X	X	X	X	X	X	X	X% p.a.

Table 7: Revenues generated with composites in Japan from 2008 to 2024 in billion USD - split by products

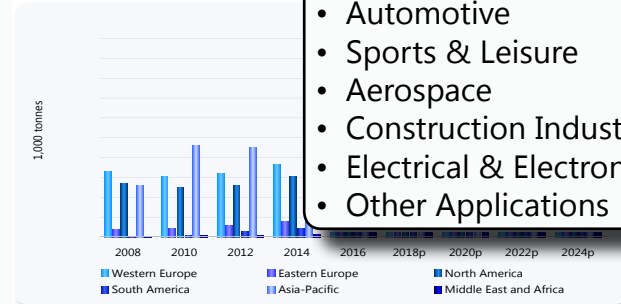
Company
X
X
X
X
X
X
X
X

Table 8: Major Japanese manufacturers in the segment composites

### 3 Application Areas

#### 3.1.1 Wind Energy

In 2016, about X tonnes of composites were consumed worldwide. Thus, demand for composites in the wind energy segment is growing at X% p.a. since 2008. Given an expected demand wind energy will amount to approx. X% p.a. until 2024.



Graph 3: Global demand for composites in wind energy from 2008 to 2024 – split by regions

About X tonnes of composites were consumed in Asia-Pacific in 2016 which is the worldwide largest amount. Processors in Western Europe ranked second, followed by North America. At a significant distance followed demand recorded in Eastern Europe and South America. We expect demand for composites in the segment wind energy to develop at the highest rates in the region Middle East and Africa. This region is projected to increase demand by X% p.a. until 2024. South America is also expected to see dynamic demand growth. Thus, the order of major consumers is likely to change slightly until 2024: Asia-Pacific will remain in the leading position, followed by North America, Western Europe, South America, Eastern Europe, and the Middle East and Africa.

**Chapter 3: Demand split by applications:**

- Wind Energy
- Automotive
- Sports & Leisure
- Aerospace
- Construction Industry
- Electrical & Electronics
- Other Applications

in 1,000 tonnes	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Western Europe	X	X	X	X	X	X	X	X	X	X% p.a.
Eastern Europe	X	X	X	X	X	X	X	X	X	X% p.a.
North America	X	X	X	X	X	X	X	X	X	X% p.a.
South America	X	X	X	X	X	X	X	X	X	X% p.a.
Asia-Pacific	X	X	X	X	X	X	X	X	X	X% p.a.
Middle East and Africa	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	X	X	X	X	X	X	X	X	X	X% p.a.

Table 9: Global demand for CFRP in wind energy from 2008 to 2024 – split by regions

in 1,000 tonnes	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Western Europe	X	X	X	X	X	X	X	X	X	X% p.a.
Eastern Europe	X	X	X	X	X	X	X	X	X	X% p.a.
North America	X	X	X	X	X	X	X	X	X	X% p.a.
South America	X	X	X	X	X	X	X	X	X	X% p.a.
Asia-Pacific	X	X	X	X	X	X	X	X	X	X% p.a.
Middle East and Africa	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	X	X	X	X	X	X	X	X	X	X% p.a.

Table 10: Global demand for GFRP in wind energy from 2008 to 2024 – split by regions

### 4.1. Carbon Fiber Reinforced Plastics (CFRP)

#### 4.1.2 Western Europe

In Western Europe, demand amounted to X tonnes in 2016. Compared to 2008, market volume had risen at an average rate of X% per year. Reporting a market volume of X tonnes, X is the largest sales market in this region, followed by processors in X and X.

in 1,000 tonnes	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Germany	X	X	X	X	X	X	X	X	X	X% p.a.
France	X	X	X	X	X	X	X	X	X	X% p.a.
United Kingdom	X	X	X	X	X	X	X	X	X	X% p.a.
Italy	X	X	X	X	X	X	X	X	X	X% p.a.
Spain	X	X	X	X	X	X	X	X	X	X% p.a.
Other	X	X	X	X	X	X	X	X	X	X% p.a.
<b>Total</b>	X	X	X	X	X	X	X	X	X	X% p.a.

Table 11: Demand for CFRP in Western Europe from 2008 to 2024 – split by major countries

in billion USD	2008	2010	2012
Germany	X	X	X
France	X	X	X
United Kingdom	X	X	X
Italy	X	X	X
Spain	X	X	X
Other	X	X	X
<b>Total</b>	X	X	X

Table 12: Revenues generated with CFRP in Western Europe from 2008 to 2024 – split by major countries

**Chapter 4: Demand split by product types:**

- Carbon fiber reinforced plastics (CFRP)
- Glass fiber reinforced plastics (GFRP)

Similar to the past eight years, we expect a significantly positive development in all

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