

Market Study: Ethylene

(2nd Ed.)



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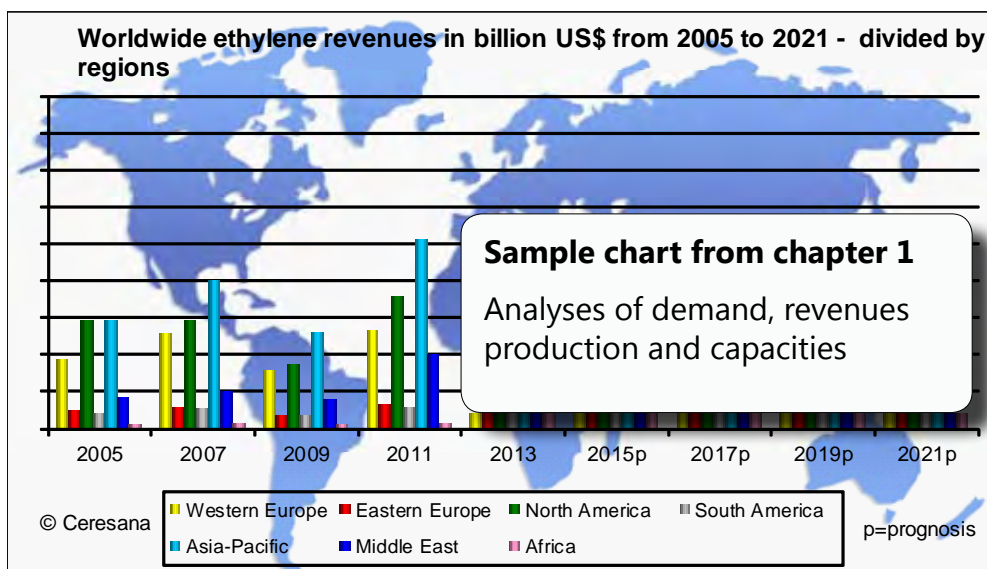
Ethylene is the most important feedstock in the petrochemical industry. About 130 million tonnes were processed worldwide in 2013. Applications include the three polyethylene plastics (HDPE, LLDPE, and LDPE) as well as petrochemical intermediates: Ethylene oxide, ethylene dichloride and ethylbenzene. With this study, Ceresana offers transparency regarding the development of the market for ethylene and ethylene-derived products.

US Fracking Boom Affects Global Market

The shale gas boom in the US has considerable influence on the global market for ethylene: The strong decline of prices for ethane has led to a number of new ethane crackers being built. This is of consequence for the global market: Several European manufacturers have announced to either close their crackers or to change over to using imported ethane as feedstock. Should the current downward slide of oil prices continue, however, the US fracking industry might lose its foothold.

Increasing Self-Sufficiency Proclaimed Goal in China

Right now China not only imports large amounts of ethylene, but also increasingly HDPE, LLDPE, and LDPE. Many producers of ethylene and polyethylene are dependent on these exports to



China. The government, however, is trying to significantly increase self-sufficiency in regard to ethylene and its derivatives. In addition to a rising number of naphtha crackers, the use of coal in the production of olefins is supposed to be stepped up.

Slow-down of Revenue Growth

Ceresana forecasts ethylene revenues on the global market to increase by 3.2% p.a. between 2013 and 2021 and thus at lower rates than before. According to our analyses, this development goes in line with the fact that the partly resource fuelled, massive increase of production capacity will proceed faster than the increase of demand. Consequently, capacity utilization is likely to fall, which has a negative influence on the price of ethylene.

Polyethylene Application Nr 1

The PE industry will continue to consume the majority of all ethylene produced. In 2013, about 63% of global demand for ethylene was accounted by producers of these plastics.

While demand for LDPE is anticipated to increase only moderately, we forecast high growth rates for the products HDPE and LLDPE. Asia-Pacific and the Mid-

dle East in particular are expected to notably increase capacity.

Growth Impulses for EO

Another application area of huge growth potential is ethylene oxide (EO). EO is mainly used to produce ethylene glycol which is a pre-product for polyester. The production of textile fibers is growing significantly, especially in Asia. In addition, producers of EO have been able to profit from the growing substitution of glass by PET bottles and containers. We forecast global demand for ethylene in the production of EO to increase by 3.2% per year.

Regional Development differs

Between 2005 and 2013, the Middle East has become one of the most important regions in regard to the global ethylene industry following a growth of 9.1% per year. Output is likely to rise by up to another 10 million tonnes until 2021. After production had largely stagnated between 2005 and 2013, the US are significantly increasing output, capitalizing on cheap shale gas. Eastern Europe, dominated by Russia, and Africa are also expecting to see a high relative increase of production volume.

1 Market Data

1.1 World

- 1.1.1 Demand
- 1.1.2 Revenues
- 1.1.3 Production and Capacities

1.2 Western Europe

1.3 Eastern Europe

1.4 North America

1.5 South America

1.6 Asia-Pacific

1.7 Middle East

1.8 Africa

2 Country Profiles

2.1 Western Europe

2.1.1 Belgium

2.1.1.1 Demand and revenues

2.1.1.2 Production, capacities, and trade

2.1.2 France

2.1.3 Germany

2.1.4 Italy

2.1.5 Spain

2.1.6 Sweden

2.1.7 The Netherlands

2.1.8 United Kingdom

2.1.9 Rest of Western Europe

2.2 Eastern Europe

2.2.1 Czechia

2.2.2 Hungary

2.2.3 Poland

2.2.4 Russia

2.2.5 Turkey

2.2.6 Rest of Eastern Europe

2.3 North America

2.3.1 Canada

2.3.2 Mexico

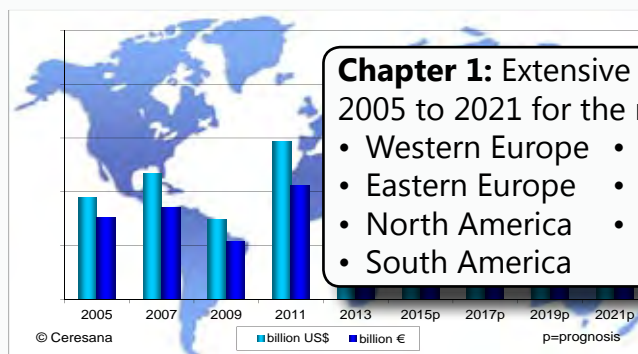
2.3.3 USA

1.1.2 World – Revenues

Global revenues generated with ethylene rose from US\$ X billion (€X billion) in 2005 to US\$X billion (€X billion) in 2013. This development translates into an average increase of X% per year.

Market value will increase at notably lower growth rates in the future. One reason is the massive increase of ethylene capacity. Demand will not rise as strongly as will supply. Accordingly, prices will increase much more slowly. Besides, we also expect the good situation in regard to the feedstocks ethane and crude oil to have positive effects on the pricing pressure producers of ethylene are facing. This effect, however, will become weaker on the long term. While prices for crude oil fell to less than US\$85 per barrel in the last quarter of 2014, we forecast a price level of about US\$X per barrel within the next years.

We forecast global revenues earned with ethylene to increase by X% p.a. to approx. US\$X billion (€X billion) in 2021.



Chapter 1: Extensive market data from 2005 to 2021 for the regions:

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

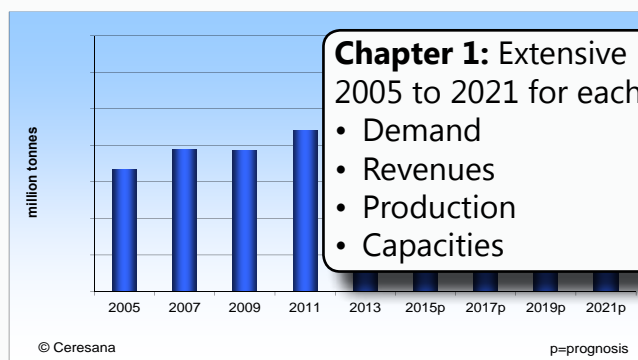
Graph: Worldwide revenues generated with ethylene between 2005 and 2021 in billion US\$ and billion €

1.6.1 Asia-Pacific - Demand

In 2013, Asia-Pacific processed about X million tonnes of ethylene. Since 2005, market volume rose at an AAGR of X%. This region was the worldwide largest consumer of ethylene in 2013.

China is the largest individual market in this region; in 2013, its market volume of X million tonnes accounted for about X% of total regional demand. South Korea and Japan ranked second and third at a considerable distance, followed by India. Aggregated consumption in the remaining major countries of Asia-Pacific (Vietnam, Australia, the Philippines, Bangladesh) amounted to X million tonnes in 2013.

We forecast demand for ethylene to increase by X% p.a. between 2013 and 2021 and to amount to approx. X million tonnes at the end of this period.



Chapter 1: Extensive market data from 2005 to 2021 for each region:

- Demand
- Revenues
- Production
- Capacities

Graph: Demand for ethylene in Asia-Pacific from 2005 to 2021

- 2.4 South America
 - 2.4.1 Argentina
 - 2.4.2 Brazil
 - 2.4.3 Rest of South America

- 2.5 Asia-Pacific
 - 2.5.1 China
 - 2.5.2 India
 - 2.5.3 Indonesia
 - 2.5.4 Japan
 - 2.5.5 Malaysia
 - 2.5.6 Taiwan
 - 2.5.7 Thailand
 - 2.5.8 Singapore
 - 2.5.9 South Korea
 - 2.5.10 Rest of Asia-Pacific

- 2.6 Middle East
 - 2.6.1 Iran
 - 2.6.2 Kuwait
 - 2.6.3 Qatar
 - 2.6.4 Saudi Arabia
 - 2.6.5 United Arab Emirates
 - 2.6.6 Rest of Middle East

3 Applications

- 3.1 World
 - 3.1.1 Polyethylene - HDPE
 - 3.1.2 Polyethylene - LLDPE
 - 3.1.3 Polyethylene - LDPE
 - 3.1.4 Ethylene oxide
 - 3.1.5 Ethylene dichloride
 - 3.1.6 Ethylbenzene

3.2 Western Europe

3.3 Eastern Europe

3.4 North America

3.5 South America

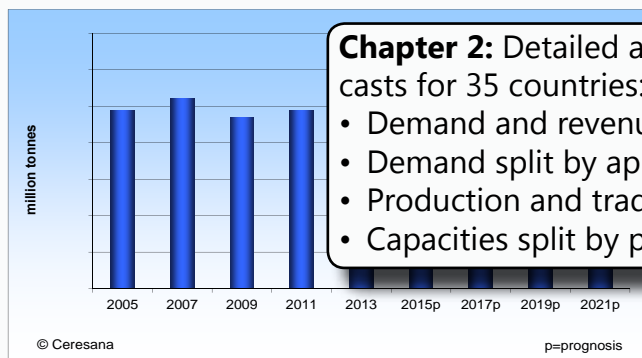
3.6 Asia-Pacific

3.7 Middle East

3.8 Africa

2.3.3.2 USA – Production and Capacities

In 2013, the USA manufactured X million tonnes of ethylene. In the upcoming years, US production of ethylene will continue to rise. We forecast output to increase at an average rate of X% p.a. to approx. X million tonnes in 2021.



Graph: Production of ethylene in the USA from 2005 to 2021

Current production capacity in the USA totals almost X million tonnes. Several companies have announced to inaugurate new ethane crackers or to expand existing capacities in the near future. Should all plans for the construction of new sites be realized on schedule, the majority of the production capacities will become available in 2017. It is, however, to be expected that neither the domestic market nor the export sector will be able to fully absorb the sudden increase of ethylene supply. We therefore anticipate capacity utilization to partly fall to less than X%.

Chapter 2: Detailed analyses and forecasts for 35 countries:

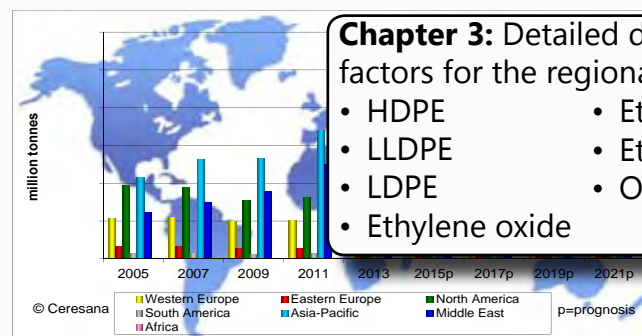
- Demand and revenues
- Demand split by applications
- Production and trade
- Capacities split by producers

3.1.4 World – Ethylene oxide

X million tonnes of ethylene were processed into ethylene oxide worldwide in 2013. Between 2005 and 2013, market volume rose at an average rate of X% p.a.

The by far most important ethylene oxide-based product is ethylene glycol, which is mainly needed for the production of PET. This is used as textile fiber or food packaging, PET bottles for beverages in particular. Other applications of ethylene oxide include non-ionic surfactants, polyols, ethanolamines, and glycol ethers. In recent years, the production of PET fibers increasingly relocated from Western industrialized countries to Asia, China in particular. Consequently, we forecast the highest growth rates for the ethylene glycol markets in that region, while especially Western European producers will have to increasingly focus on the production of alternative ethylene oxide-based products.

We forecast demand for ethylene on the part of producers of ethylene oxide to increase until 2021. That year, approx. X million tonnes will be processed; this corresponds to an average increase of X% p.a. when compared to 2013.



Graph: Worldwide demand for ethylene in ethylene oxide from 2005 to 2021 – split by regions

Chapter 3: Detailed data and influential factors for the regional use in:

- HDPE
- LLDPE
- LDPE
- Ethylene oxide
- Ethylene dichloride
- Ethylbenzene
- Other applications

4 Company Profiles

- 4.1 Western Europe
 - 4.1.1 Austria (2 Producers)
 - 4.1.2 Belgium (1)
 - 4.1.3 France (2)
 - 4.1.4 Germany (1)
 - 4.1.5 Italy (1)
 - 4.1.6 Spain (1)
 - 4.1.7 Switzerland (1)
 - 4.1.8 The Netherlands (1)
 - 4.1.9 United Kingdom (1)
- 4.2 Eastern Europe
 - 4.2.1 Belarus (1)
 - 4.2.2 Hungary (1)
 - 4.2.3 Poland (1)
 - 4.2.4 Russia (7)
 - 4.2.5 Serbia (1)
 - 4.2.6 Turkey (1)
- 4.3 North America
 - 4.3.1 Canada (1)
 - 4.3.2 Mexico (3)
 - 4.3.3 USA (13)
- 4.4 South America
 - 4.4.1 Brazil (2)
 - 4.4.2 Colombia (1)
 - 4.4.3 Venezuela (1)
- 4.5 Asia-Pacific
 - 4.5.1 China (11)
 - 4.5.2 India (6)
 - 4.5.3 Indonesia (2)
 - 4.5.4 Japan (13)
 - 4.5.5 Malaysia (1)
 - 4.5.6 Singapore (1)
 - 4.5.7 South Korea (6)
 - 4.5.8 Taiwan (2)
 - 4.5.9 Thailand (3)
 - 4.5.10 The Philippines (1)
 - 4.5.11 Vietnam (2)
- 4.6 Middle East
 - 4.6.1 Iran (2)
 - 4.6.2 Iraq (1)
 - 4.6.3 Israel (1)
 - 4.6.4 Kazakhstan (3)
 - 4.6.5 Kuwait (3)
 - 4.6.6 Oman (1)
 - 4.6.7 Qatar (2)
 - 4.6.8 Saudi Arabia (7)
 - 4.6.9 United Arab Emirates (2)
- 4.7 Africa
 - 4.7.1 Algeria (1)
 - 4.7.2 Egypt (1)
 - 4.7.3 Libya (1)
 - 4.7.4 Nigeria (1)
 - 4.7.5 South Africa (1)

Total S.A.				
2, place Jean Millier La Defense 6 92400 Courbevoie France Tel.: 33 1 47 44 45 46 Web: www.total.com				
Financial Key Data				
(in billion €)	2010	2011	2012	2013
Revenue	159	185	200	190
Net Income	10.8	12.6	10.8	8.66
General information about the company				
Divisions, Product Range	The company is divided into 3 business units: <ul style="list-style-type: none"> • Upstream: Oil exploration and production activities in natural gas and new energies (mainly solar and bio) • Refining & chemical: Refining, chemicals (rubber, resins, adhesives) and shipping activities • Marketing & services: Supply and marketing of oil products and activities of new energies 			
Production Sites	Together with its subsidiaries and affiliates, Total S.A. operates more than 130 countries on 5 continents including refineries and petrochemical plants as well as refineries and petrochemical plants and <ul style="list-style-type: none"> • North & South America (60) • ... 			
Profile Summary	Total S.A. is one of the world's largest companies and a major player in the chemical business. Total S.A. was formerly known as Compagnie Française des Pétroles (CFP) and renamed as Total-CFP and as Total in 1982. The company employed about 99,000 people and held total assets exceeding €173 billion as of December 31 st , 2013...			

Chapter 4: In-depth profiles for the world's largest manufacturers, including Braskem, Chevron Phillips, Dow Chemical, ExxonMobil, Formosa Plastics, LG Chem, LyondellBasell, NPC, NOVA Chemicals, Petrochina, PTT Global, Sabic, Shell, and Sinopec. (Note: The profiles are assigned to the country in which the company is headquartered and include JVs and subsidiaries.)

Specific information about Ethylene		
Product Details	Total's ethylene cracker based in Antwerp, Belgium is designed to use naphtha as feedstock. To be more competitive against cheap US shale gas the company uses refinery flare gas to supply low costs feedstock for the petrochemical complex. Near the cracker, Total S.A. uses the ethylene obtained to produce bimodal resins. Through its joint venture...	
Associated Companies	Subsidiary: <ul style="list-style-type: none"> • Total Olefins Antwerp N.V. Joint venture: <ul style="list-style-type: none"> • ... 	
Site / Plant – Ethylene (current)	Antwerp, Belgium xxx xxx (xx % of 1,000,000) xxx xxx (xx % of 1,000,000) xxx xxx (xx % of 720,000) xxx xxx xxx xxx xxx xxx (xx % of 800,000) xxx xxx (xx % of 250,000) xxx xxx (xx % of 1,300,000) xxx xxx	
Total Capacity (current)	xxx	
Site / Plant – Ethylene (planned)	Start-Up/Closure	Capacity (tonnes/year)
xxx	2014	(closure) xxx
xxx	2013	(closure) xxx
xxx	2016	(xx% of xxx) xxx
Total Capacity (2016)	xxx	

Chapter 4: Data and facts on major producers, clearly arranged by:

- Contact details
- Turnover and profit
- Production sites with capacities
- Profile summary
- Product details

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- [Carbon Black - W](#)
- [Catalysts - W](#)
- [Chelating Agents - W](#)
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- [Ethylene - China](#)
- [Ethylene - USA](#)
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- Plastics**
- [Bioplastics - W](#)
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 - [Masterbatches - W](#)
 - [Plastics - E](#)
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 - [Polyethylene \(HDPE\) - W](#)
 - [Polyethylene \(LDPE\) - W](#)
 - [Polyethylene \(LLDPE\) - W](#)
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- [Paints & Varnishes - W](#)
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- [Plastic Extrusion - W](#)
- [Plastic Injection - W](#)
- [Plastic Pipes - E](#)
- [Plastic Pipes - W](#)
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- [Printing Inks - W](#)
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- [PUR – Paints & Coatings - W](#)
- [Windows & Doors - E](#)

Packaging

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- [Bags & Sacks - W](#)
- [Caps & Closures - E](#)
- [Corrugated/ Solid Board/ Carton - E](#)
- [Flexible Packaging - E](#)
- [Food Packaging - E](#)
- [Labels - E](#)
- [Plastic Bottles - E](#)
- [Plastic Caps & Closures - E](#)
- [Plastic Caps & Closures - W](#)
- [Plastic Containers - E](#)
- [Plastic Containers - W](#)
- [Plastic Films - E](#)
- [Plastic Films - W](#)
- [Rigid Metal Packaging – E](#)

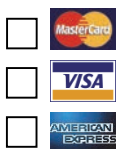
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