Propylene Market Report

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Phoenix
UNITED TRADING SPC

1.Propylene Product Introduction

Propylene is a hydrocarbon of the alkene's family. It is a colorless, odorless, flammable gas with the chemical formula C_3H_6. The most important application of propylene is the preparation of polypropylene.

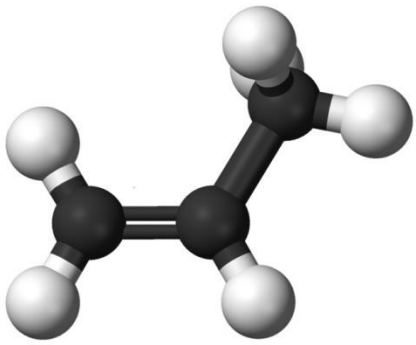

Figure 1- The spatial shape of the propylene molecule

Propylene with chemical formula CH3 CH = CH2 is undoubtedly one of the oldest raw materials used in the petrochemical industry and one of the earliest light olefins. Propylene is the second most widely consumed olefin product in the market and is used in the manufacture of plastic products, chemicals and products. Its other names include propene, methyl ethene and methyl ethylene. The physical and chemical properties of propylene are presented in the following table:

Table 1- Physical and chemical properties of propylene

Molecular Formula:	C_3H_6
Molar Mass:	42.08 g/mol
Appearance	colorless
Density	1.81 kg/m3،gas (1.013 bar ،15C) 613.9 kg/m3 ،liquid
Melting Point:	- 185.2 C (88.0 K)
Boiling Point	- 47.6 C (225.5 K)
Solubility in Water	0.61 g/m3
Viscosity	8.34 Pas at 16.7 C
Structure Molecular Shape	0.366 D (gas)
Flash point	-108 C

1.1. All types and applications of product

Propylene is used, propylene oxide, acrylic acid, isopropyl alcohol, cumin, etc. The most common use of propylene is in polymer grade and polypropylene production. Polypropylene is a thermoplastic polymer that covers a wide range of applications including film and sheet, blown molding, injection molding, food packaging, textile, laboratory and medical equipment,

tube, industrial and building applications and automotive components. Two other important organic chemicals derived from propylene are acrylonitrile and propylene oxide, which play a role in the synthesis of polymeric materials. Acrylonitrile is used in the preparation of acrylic fibers and propylene oxide is one of the compounds used in the preparation of polyurethane and propylene glycol polymers. Cumin is not used alone, but it plays a role in the process in which two precious industrial chemicals, acetone and phenol, are produced.

Propylene Chemical Derivatives generally use three different grades: Refining, Chemical and Polymer. These three grades differ in the degree of propylene purity, that their main difference is in the purity of propylene.. 55% -75% purity for refinery grade, 92% to 96% purity for chemical grade and 99.5% to over 99.95% for polymer grade. The table below shows propylene grades commonly used for the production of major chemical derivatives.

Table 2- Application of different propylene grades

Propylene grades			
name	**Refinery**	**chemical**	**polymeric**
Acrolein		❋	
Acrylic Acids and Esters	❋	❋	
Acrylonitrile		❋	
Cummins			❋
Isopropanol	❋	❋	
Exo chemicals	❋		
Oligomers		❋	
Polypropylene			❋
Propylene oxide	❋		

2. Global Market

Much of the global production and consumption of propylene in 2000 was concentrated in North America and Western Europe. These regions accounted for about 46% of global propylene consumption in 2006. Propylene demand has increased in Northeast Asia over the past decade, from 32% in 2008 to 42% in 2018. China's growing economic growth and urbanization, on the one hand, have raised global propylene demand growth. Propylene production capacity in China has increased as much as 13.1% annually since 2011. In 2018, China accounted for 29% of total global capacity. Generally, China has the largest production and demand of propylene in the world.

The major propylene markets in the world include Northeast Asia (mainly China), North America (mainly the United States of America) and Western Europe, which accounted for approximately 72% of global consumption in 2018. Propylene production capacity in 2018 is

as much as 134 million tons and it is projected to increase to 148 million tons across the world by 2021.

In the United States, propylene is produced from both PDH and olefins (Metathesis). In 2016, the United States produced approximately 1 million tons of propylene through PDH units and 500,000 tons through the transformation of olefins. By 2021, propylene production in the United States is projected to reach 3.6 million tons.

2.1. Global production capacity

Global propylene production capacity in 2018 is estimated over 134 million tons. The following table shows the global production capacity based on thousand tons:

Table 3- Zoning of Global Propylene Production Capacity (Source: SRI Consulting) - per thousand tons

Year / Zone	2015	2016	2018
North America	23.540	24.134	24.912
south America	4.003	4.003	4.027
Western Europe	17.337	17.166	17.179
Central Europe	1.787	1.787	1.826
CIS and the Baltic region	2.768	2.868	3.363
Africa	1.603	1.623	1.636
Indian Peninsula	4.922	5.092	5.808
Middle East	10.444	11.092	11.630
China	27.460	30.188	35.998
South Korea	7.003	7.885	8.520
Taiwan	3.939	3.628	3.628
Japan	6.533	6.346	6.320
Other regions of Asia	8.101	8.561	9.438
World	119.440	124.373	134.285

As can be seen in the table above, the major propylene production zones in the world are northeast Asia and North America, respectively. China is also the main producer of this substance in Asia. The following figure shows the different zones of the world's share from the production capacity of Propylene in 2018.

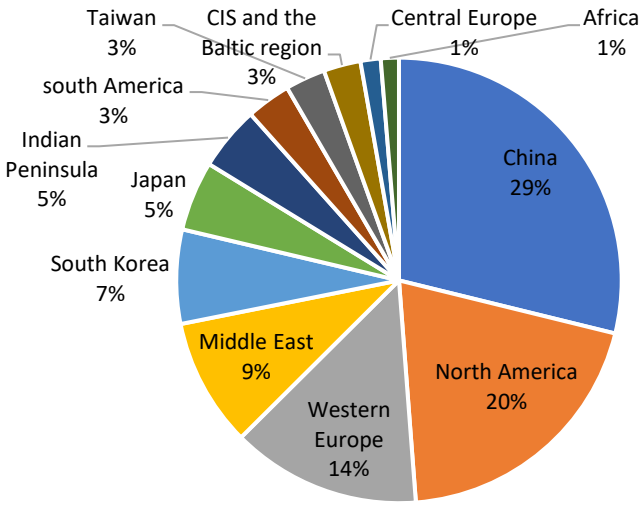

Figure 2- Different Zones' Share of Propylene Production Capacity in 2018

1.2. Global production rate

Propylene production in the world is estimated about more than 109 million tons in 2018. The largest volume of production is in the Asian region and the growth rate of this product in this region is much higher than elsewhere.

Table 4- Global Propylene Production by Zone (Source: SRI Consulting) - Values per thousand tons.

Year / Zone	2015	2016	2018
North America	15.536	16.001	16.940
south America	3.002	3.027	3.060
Western Europe	14.736	14.596	14.602
Central Europe	1.323	1.323	1.351
CIS and the Baltic region	2.463	2.560	2.993
Africa	1.074	1.094	1.096
Indian Peninsula	4.680	4.842	5.517
Middle East	8.250	8.838	9.304
China	22.791	25.159	29.878
South Korea	6.792	7.667	8.264
Taiwan	3.545	3.301	3.265
Japan	5.772	5.607	5.561
Other zones of Asia	6.237	6.603	7.307
World	**96.201**	**100.618**	**109.138**

China is considered as the largest producer of propylene in the world with about 30 million tons propylene in 2018, which accounts for 27% of production. North America is the second

largest producer of propylene in the world, accounting for 15% of global propylene production. North American propylene production in 2018 is estimated at 17 million tons.

The following figure shows the different zones of the world's share from propylene production in 2018:

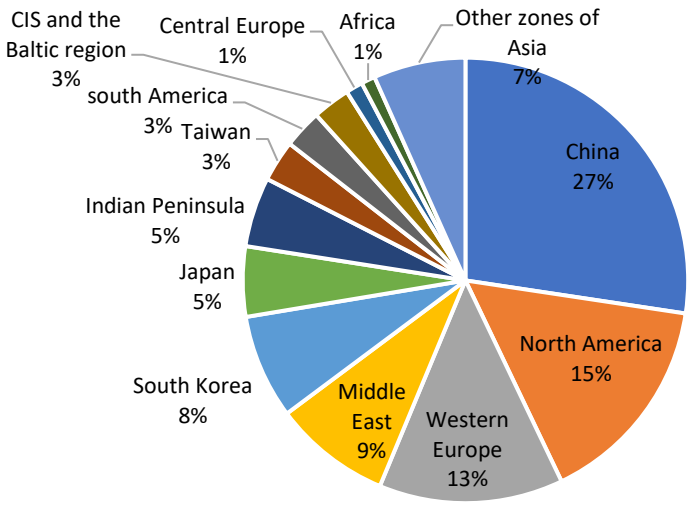

Figure 3- Different zones' share of the production capacity of polypropylene in 2018

1.2.1. Forecasting production growth

Over the past three years (2015 to 2018), the global nominal production capacity of propylene has grown as much as 4.15%, which has reached 134 million tons in 2018. The previous types of research have shown that that global propylene production capacity is projected to grow as much as 3.5% per year between 2018 and 2021. The annual growth is also observed in 2015-2018 as much as 4.15%.

Table 5- Forecasting Worldwide Production Capacity Growth (Source: SRI Consulting)

Year / Zone	2015	2016	2018	2021	Annual Growth Rate٪	
					2018–2015	2021–2018
North America	23.540	24.134	24.912	26.096	9.1	58.1
south America	4.003	4.003	4.027	4.073	19.0	0.38
Western Europe	17.337	17.166	17.179	17.206	3.0–	0.0523
Central Europe	1.787	1.787	1.826	1.887	7.0	11.1
CIS and the Baltic region	2.768	2.868	3.363	4.068	7.16	6.98
Africa	1.603	1.623	1.636	1.643	68.0	14.0
Indian Peninsula	4.922	5.092	5.808	6.842	6	5.93
Middle East	10.444	11.092	11.630	12.409	76.3	23.2
China	27.460	30.188	35.998	44.059	36.10	46.7
South Korea	7.003	7.885	8.520	9.445	2.7	6.3

Year / Zone	2015	2016	2018	2021	Annual Growth Rate٪	
					2018–2015	2021–2018
Taiwan	3.939	3.628	3.628	3.628	-6.2	0
Japan	6.533	6.346	6.320	6.288	-12.1	-0.168
Other zones of Asia	8.101	8.561	9.438	10.702	5.5	46.4
World	**119.440**	**124.373**	**134.285**	**148.346**	**15.4٪**	**5.3٪**

1.3. Investigation of global consumption

The following table shows the global consumption of propylene in 2015, 2016, and 2018. The largest consumption of propylene is in China with 33 million tons per year.

Table 6- Global Propylene Consumption by Zone (Source: SRI Consulting)- Values per thousand tons

Year / Zone	2015	2016	2018
North America	15.713	15.867	16.833
south America	3.010	3.136	3.211
Western Europe	14.418	14.764	14.764
Central Europe	1.448	1.379	1.390
CIS and the Baltic region	2.199	2.255	2.689
Africa	1.165	1.206	1.225
Indian Peninsula	4.329	4.451	4.991
Middle East	7.665	8.408	9.024
China	25.522	28.660	33.058
South Korea	6.416	6.644	7.117
Taiwan	4.878	4.847	4.827
Japan	2.771	2.830	2.835
Other zones of Asia	7.005	6.737	7.498
World	**96.539**	**101.184**	**110.462**

Propylene demand is expected to grow at a rate of about 4% per year over the next three years, largely due to high economic growth in Asia. In North America, the availability of propane has been extracted and expanded export capacity has led to increased investment in PDH units. The following figure shows the different zones of the world's share from the consumption of propylene in 2018.

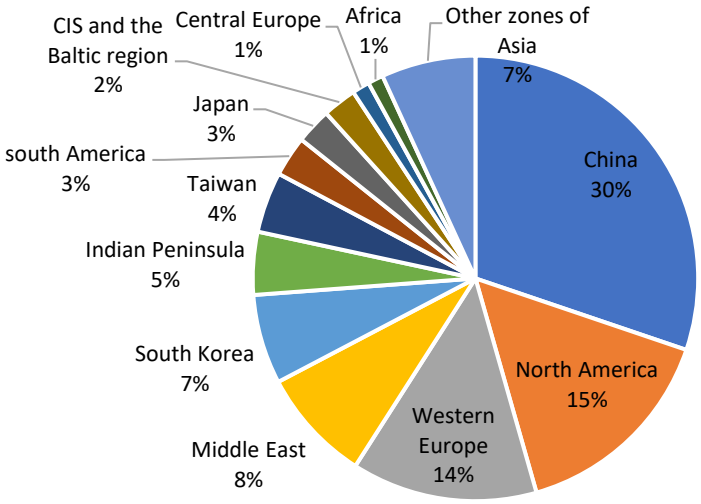

Figure 4- Different zones of the world's share from propylene consumption in 2018

1.3.1. Consumption growth forecast

Global studies show that propylene consumption will reach 58.8 million tons in 2021. During these years, China will have the highest consumption growth.

Table 7- Prediction of World Propylene Production Capacity Growth (Source: SRI Consulting) - values per thousand tons

Year / Zone	2015	2016	2018	2021
North America	15.713	15.867	16.833	18.383
south America	3.010	3.136	3.211	3.326
Western Europe	14.418	14.764	14.764	14.767
Central Europe	1.448	1.379	1.390	1.409
CIS and the Baltic region	2.199	2.255	2.689	3.496
Africa	1.165	1.206	1.225	1.252
Indian Peninsula	4.329	4.451	4.991	5.942
Middle East	7.665	8.408	9.024	10.017
China	25.522	28.660	33.058	40.966
South Korea	6.416	6.644	7.117	7.903
Taiwan	4.878	4.847	4.827	4.791
Japan	2.771	2.830	2.835	2.840
Other zones of Asia	7.005	6.737	7.498	8.797
World	**96.539**	**101.184**	**110.462**	**123.889**

1.4. Applied Consumption Segmentation

Propylene is the second most widely used chemical in the world. It is an important raw material for the manufacture of products such as polypropylene, acrylonitrile, propylene oxide, exo alcohol and various types of industrial materials. In 2018, approximately 67% of the produced propylene (for chemical use) is used to produce resins. Approximately 8% of the

global propylene is used to produce propylene oxide. The third area of consumption of propylene is the production of acrylonitrile, which accounts for approximately 6% of the global consumption. The residual of the consumed Propylene in chemicals is used to produce materials such as acrylic acid, cumin (isopropyl benzene), and oxalcohol.

The following figure shows the Propylene Consumption Segment 2018:

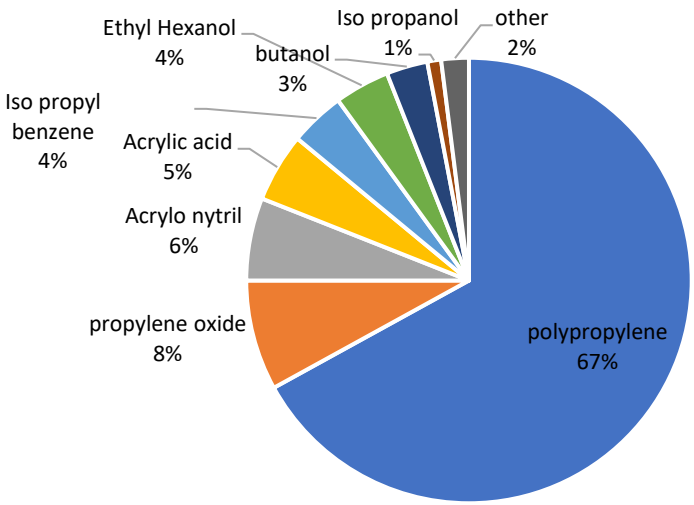

Figure 5- Practical segmentation of propylene consumption in 2018

1.5. Global Propylene Supply and Demand Summary

The following table shows the global supply and demand status of propylene in thousand tons in different years:

Table 8- Propylene Supply and Demand Balance in the World-thousand tons

Year / Zone	Nominal production capacity			Production			Consumption		
	2015	2016	2018	2015	2016	2018	2015	2016	2018
North America	23.540	24.134	24.912	15.536	16.001	16.940	15.713	15.867	16.833
south America	4.003	4.003	4.027	3.002	3.027	3.060	3.010	3.136	3.211
Western Europe	17.337	17.166	17.179	14.736	14.596	14.602	14.418	14.764	14.764
Central Europe	1.787	1.787	1.826	1.323	1.323	1.351	1.448	1.379	1.390
CIS and the Baltic region	2.768	2.868	3.363	2.463	2.560	2.993	2.199	2.255	2.689
Africa	1.603	1.623	1.636	1.074	1.094	1.096	1.165	1.206	1.225
Indian Peninsula	4.922	5.092	5.808	4.680	4.842	5.517	4.329	4.451	4.991
Middle East	10.444	11.092	11.630	8.250	8.838	9.304	7.665	8.408	9.024
China	27.460	30.188	35.998	22.791	25.159	29.878	25.522	28.660	33.058
South Korea	7.003	7.885	8.520	6.792	7.667	8.264	6.416	6.644	7.117
Taiwan	3.939	3.628	3.628	3.545	3.301	3.265	4.878	4.847	4.827
Japan	6.533	6.346	6.320	5.772	5.607	5.561	2.771	2.830	2.835

Year / Zone	Nominal production capacity			Production			Consumption		
	2015	2016	2018	2015	2016	2018	2015	2016	2018
Other zones of Asia	8.101	8.561	9.438	6.237	6.603	7.307	7.005	6.737	7.498
World	**119.440**	**124.373**	**134.285**	**96.201**	**100.618**	**109.138**	**96.539**	**101.184**	**110.462**

In Following table, global propylene supply and demand figures in 2018 are presented.

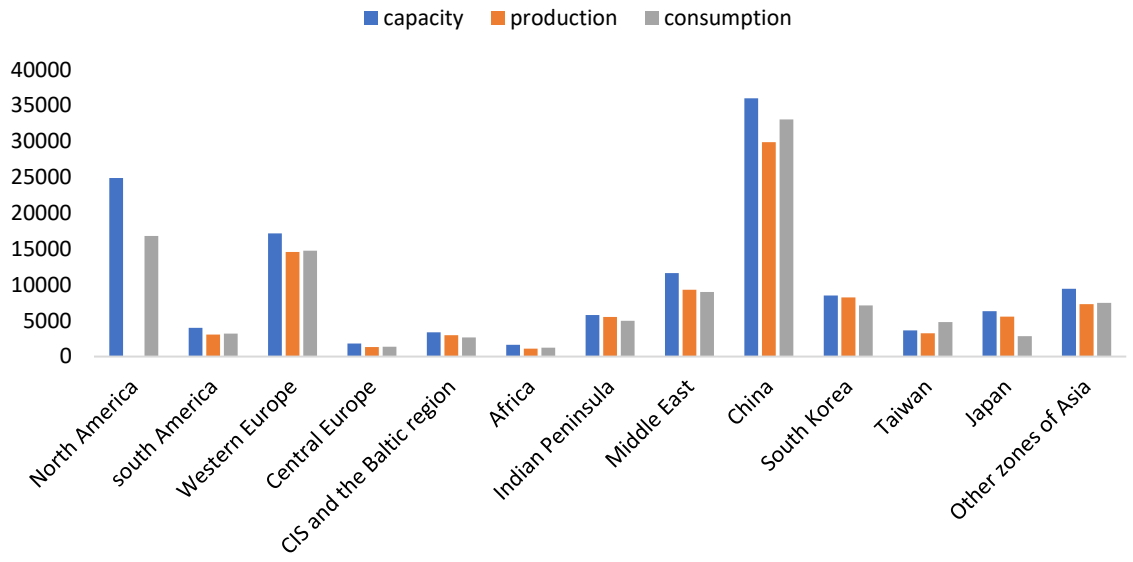

Table 9- Global Propylene Supply and Demand in 2018

The following figure shows the global supply and demand for propylene in different years:

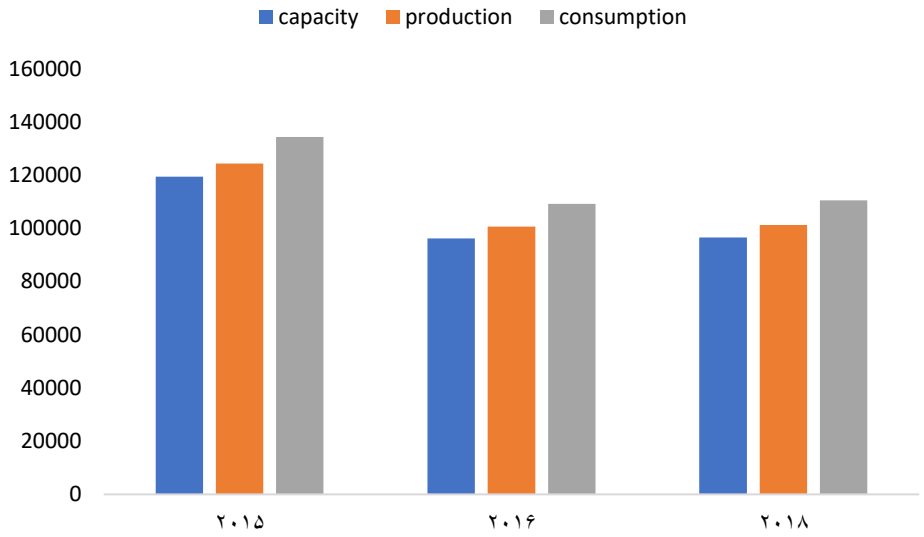

Figure 6- Global Propylene Supply and Demand Status in Different Years