

# 700 Refineries Supply Oil Products to the World

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REVIEW

There are about 700 oil refineries all over the world today, but - like oil - they are not equally distributed in all parts of the world. Their representation by location is greatly determined by several crucial factors; vicinity of oil sources, vicinity of intense oil products consumption or population density, vicinity of oil transportation routes, economic potential for refinery construction, etc. In turn, refineries mutually differ by type and complexity of oil refining technologies (refinery complexity), installed and utilized oil refining capacity, and more recently by technological potential for obtaining highly purified oil products and highly treated refinery emissions.

In addition to the global and regional survey of locations and refinery numbers, the paper covers their main characteristics in the period from 1996 onwards, bringing to the fore general trends of changes and global tendencies of such changes in this branch of industry.

Although availability of data on existing refineries is not simple and equal for all parts of the world, thanks to the efforts invested in data acquisition they provide a picture of global situation and balance for this industry and illustrate its changes and trends. Comparison of individual characteristic refineries with average or extreme ones in the world or in the region also becomes possible.

*Key words:* number of refineries, installed refinery capacity, utilized refinery capacity, conversion refinery capacity, refinery complexity

## 1. INTRODUCTION

Oil refineries are the basis of the industry branch called oil refining, where oil products are obtained by oil processing.

In the last several years the number of oil refineries in the world stands at about 700, and their products satisfy the demand of the modern world. In difference to the preceding period, this period is not characterized by refinery number growth trend, but primarily by certain stagnation caused by limited geological oil reserves and production capacities on the one hand and more rational utilization of refinery capacities and consumption of refinery products on the other hand.

The paper presents a global and local survey of refinery numbers and locations, as well as their basic characteristics in the period from 1996 onwards, showing general trends of changes and global tendencies of these changes in this branch of industry.<sup>1,2,3,4,7,10,13</sup>

## 2. Number of world oil refineries

The recent turn of the millennium is characterized by inflection of growth of world oil refineries into a slight decrease, as illustrated in Table 1, which shows the number of refineries by world regions from 1996 until 2008.

It is evident that strongly decreasing trends in Western and Central Europe and North America caused a global decrease in refinery numbers. In the last ten to fifteen years pronounced changes are absent in refinery numbers in other regions.<sup>2,5,6</sup>

Table 1. Number of world oil refineries, 1996 - 2008

Year	1996	1999	2003	2008
West.&Central Europe	147	142	134	125
Eastern Europe	42	44	46	45
Central Asia	11	13	12	12
Middle East	41	42	44	47
Africa	45	44	44	43
Asia & Pacific	170	189	188	189
North America	184	174	168	164
Latin America	78	77	75	75
Total no. of refineries	718	725	711	700

## 3. Installed world refining capacities

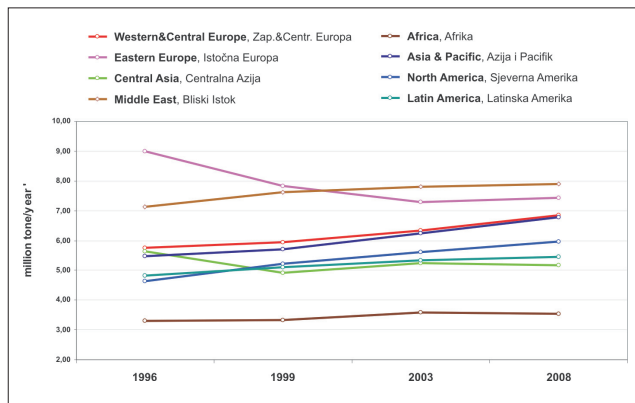
It is interesting that the situation and balance of installed refinery capacities is not proportionate to the number of refineries in the same period. It is well illustrated in Table 2 on regional representation of installed refinery capacities from 1996 until now, which clearly shows an increase, but without any indications of inflexion towards possible decrease.

**Table 2. World refinery capacities, 1996 – 2008 MMt/y**

Year	1996	1999	2003	2008
West. & Central Europe	845	843	850	857
Eastern Europe	378	345	336	335
Central Asia	62	64	63	62
Middle East	292	320	343	371
Africa	149	147	158	152
Asia & Pacific	932	1 077	1 172	1 282
North America	854	910	942	979
Latin America	377	393	400	409
Total refin. capacities.	3 889	4 099	4 264	4 447

**Table 3. World refinery crude runs, 1996 – 2008 MMt/y**

Year	1996	1999	2003	2008
West. & Central Europe	697	695	711	716
Eastern Europe	200	191	230	257
Central Asia	31	28	29	35
Middle East	269	286	300	325
Africa	113	118	126	126
Asia & Pacific	775	844	939	1 081
North America	776	808	842	831
Latin America	311	334	330	354
Total refin. crude runs	3 172	3 304	3 507	3 725

**Diagram 1. Average refinery capacity, 1996 - 2008**  
Dijagram 1. Prosječni rafinerijski kapaciteti, 1996-2008

Average refinery capacities by region in the period from 1996 until 2008 are shown in Diagram 1.<sup>3,7</sup>

It is interesting that most regions of the world show gradual increase of average refinery capacities in the investigated period, while Central Asia and East Europe in particular show a stronger decrease, subsequently followed by gradual increase of average refinery capacities.<sup>7,8</sup>

#### 4. World refinery utilization

Utilization of refinery capacities in practice is necessarily functionally related to installed capacities and is mutually proportionate for the same periods, but not with the same intensity in all regions, nor with equal accent in each of the presented periods, as shown in Table 3 which refers to world refinery crude runs from 1996 until 2008.

Differences in utilization of installed refinery capacities by region are particularly well displayed in Table 4, which interprets the percentage of practically utilized installed capacities. It is evident that utilization percentage of installed refinery capacities is high in the Middle East, North and Latin America, Western and Central Europe, Asia and the Pacific. It is followed by Africa, while East Europe and Central Asia are at the end of the list.<sup>1,4</sup>

**Table 4. World refinery utilization, 1996 – 2008, %**

Year	1996	1999	2003	2008
West. & Central Europe	83	82	84	84
Eastern Europe	53	55	68	77
Central Asia	51	44	46	58
Middle East	92	90	87	88
Africa	76	80	80	83
Asia & Pacific	83	78	80	84
North America	91	89	89	85
Latin America	83	85	83	87
Refinery utilization	82	81	82	84

#### 5. World refinery complexity

Alongside with human potential, the basic precondition for competitive strength of a refinery is structure and participation of conversion processes in its total processing capacities.<sup>8,10,13</sup> Table 5 shows the balance of total refinery conversion capacities by above mentioned regions in the period from 1996 to 2008.

**Table 5. World conversion refinery capacity, 1996 – 2008, MMt/y**

Year	1996	1999	2003	2008
West. & Central Europe	256	266	290	306
Eastern Europe	47	47	51	57
Central Asia	17	17	17	17
Middle East	58	63	71	81
Africa	17	16	27	30
Asia & Pacific	290	390	518	622
North America	598	633	680	706
Latin America	125	139	161	179
Conversion capacity	1 408	1 571	1 815	1 998

Table 6 shows complexity ratio as percentage of refinery conversion capacities in total refinery (distillation) capacity by world regions in the period from 1996 to 2008, and much better interprets regional differences for periods under review.<sup>8,9,13</sup>

Table 6. World refinery complexity ratio, 1996 – 2008, %				
Year	1996	1999	2003	2008
West.&Central Europe	30	32	34	36
Eastern Europe	13	14	15	17
Central Asia	27	26	27	27
Middle East	20	20	21	22
Africa	11	11	17	20
Asia & Pacific	31	36	44	49
North America	70	70	72	72
Latin America	33	35	40	44
Complexity ratio	36	38	43	45

North American refineries have the highest average complexity ratios, which are significantly above those in other world regions. Refineries in Asia and the Pacific, Latin America and Western and Central Europe have average levels of complexity ratios, while Central Asian, African and at the very end Eastern European refineries have the lowest average complexity ratios.<sup>11,12</sup>

Interestingly, North American refineries have not shown any trend of further complexity ratio increase in the last decade, while regions with average ratio levels have the most intensive growth trend. If the existing trend continues in the following years, global changes towards convergence of regions with refineries of average complexity ratios and highly-complex North American refineries can be expected, as well as bipolarization due to further lagging of regions with low complexity ratios, with possible exception of Africa, if the trend realized in this millennium continues.

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