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## MODERNIZATION OF OIL REFINERIES IN KAZAKHSTAN AS A METHOD OF INCREASING THE INDUSTRY COMPETITIVENESS

*Oil refining is one of the strategic sectors of Kazakhstan economy. This article considers the problem of necessary modernization of oil-refining complexes in the country. The key figures of Kazakhstan's oil-refining industry, the performance and problems of oil-refining complexes as well as domestic demand for refined products are analyzed. Key risks are identified, on the basis of which it is recommended to implement a less expensive project of modernization at Pavlodar Petrochemical Plant.*

*Keywords: modernization; oil refineries; competitiveness; Kazakhstan.*

Самат Ермухан, Айгерім Азімбекова

## МОДЕРНІЗАЦІЯ НАФТОПЕРЕРОБНИХ ПІДПРИЄМСТВ КАЗАХСТАНУ ЯК ЗАСІБ ПІДВИЩЕННЯ КОНКУРЕНТОСПРОМОЖНОСТІ ГАЛУЗІ

*У статті показано, що нафтопереробний сектор є одним із стратегічних секторів економіки Казахстану. Розглянуто проблему необхідності модернізації нафтопереробних комплексів країни. Проаналізовано основні показники нафтопереробної галузі Казахстану, результати діяльності та проблеми нафтопереробних комплексів, а також внутрішній попит на продукти нафтопереробки. Виявлено основні ризики, на основі чого рекомендовано реалізацію менш коштовного проекту модернізації Павлодарського нафтохімічного заводу.*

*Ключові слова: модернізація; нафтопереробні підприємства; конкурентоспроможність; Казахстан.*

*Табл. 4. Рис. 3. Літ. 14.*

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## МОДЕРНИЗАЦИЯ НЕФТЕПЕРЕРАБАТЫВАЮЩИХ ПРЕДПРИЯТИЙ КАЗАХСТАНА КАК СПОСОБ ПОВЫШЕНИЯ КОНКУРЕНТОСПОСОБНОСТИ ОТРАСЛИ

*В статье показано, что нефтеперерабатывающий сектор является одним из стратегических секторов экономики Казахстана. Рассмотрена проблема необходимости модернизации нефтеперерабатывающих комплексов страны. Проанализированы основные показатели нефтеперерабатывающей отрасли Казахстана, результаты деятельности и проблемы нефтеперерабатывающих комплексов, а также внутренний спрос на продукты нефтепереработки. Выявлены основные риски, на основе чего рекомендована реализация менее дорогостоящего проекта модернизации Павлодарского нефтехимического завода.*

*Ключевые слова: модернизация; нефтеперерабатывающие предприятия; конкурентоспособность; Казахстан.*

**Problem statement.** The development of the oil product market, the increase in its competitiveness is the most important priority of Kazakhstan economic policy. To ensure the security of energy supply in Kazakhstan becomes one of the major strategic objectives of the Republic's oil and gas sector, in particular, complete satisfaction of domestic needs in the main kinds of oil products – petrol, aviation and diesel fuels.

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One of the fundamental problems in developing the oil market in Kazakhstan is the low level of competitiveness of oil refineries. Oil refineries of the Republic built during the Soviet period, meet no up-to-date standards. The lack of high-quality production facilities to produce petrochemicals after the fine cleaning of raw hydrocarbons allows no improvement of qualitative marketable output in sufficient volumes with high value added. In 1991 deep economic recession and sharp decline of oil and oil products consumption commenced. Kazakhstan's economy started overcoming the crisis in the mid of the 1990s. The Asian economic crisis of 1998 and the fall of oil prices resulted in the reduction of GDP by 18% in the period 1990–2000, and by the end of the decade GDP fell down to 88.3 bln USD (Agency of statistics of the Republic of Kazakhstan, 1990–2000).

The economic recovery started in 1999, and in 2001 the oil demand reached the lower limit prior to the commencement of the subsequent recovery. The growth was substantial in the period until 2008 since the economy activated due to high commodity prices and the high project activity in developing oil deposits and in oil production.

The refined product output in the processing industry was 626783 mln KZT in 2012 that is 2.9 times higher than the rate over 2008 (210559 mln KZT), taking into account that the rates of increase in the quantum indices for the refined product output have decreased in recent years and amounted to 100.9% (2009) and 100.5% (2010). Despite the instability of profitability of the current industrial enterprises producing refined products (in 2008: -2.2%; in 2009: -3.3%; in 2010: 13.5%; in 2011: 26.3%, and in 2012: 4.7%) over the period of 2008–2012, the number of enterprises increased from 20 to 35. The positive trend is conditioned by the increase of the share of refined product output in the industrial production structure: from 2.1% in 2008 to 3.7% in 2012. This increase is insignificant, whereas the share of crude oil output was on the average 51.5% in the industrial production structure over 2008–2012, and the share of refined product output was only 2.7% (Agency of statistics of the Republic of Kazakhstan, 2008–2012).

Thus, in view of the foregoing one can state that the research devoted to the analysis of the current oil product market conditions and further modernization of the Republic's oil refineries to increase market competitiveness as well as the identification of possible risks connected with plants modernization are of current interest and serve a useful purpose, in particular for Kazakhstan, and will be interesting for a wide range of academia.

**Recent publications analysis.** Modernization as a method of improving quality and increasing competitiveness in the Republic's oil-refining industry is widely discussed in mass media, scientific literature as well as in the publications of Y.S. Balabanova et al. (2002), R.K. Andarova (2012), U.M. Nysanbek (2004), N. Zhakupov (2002) and S.T. Yermukhan (2013).

Highly appreciating the contribution of the abovementioned scientists, it should be noted that the level of studying the issue of oil refineries modernization, competitive growth and the associated risks have been studied insufficiently. The factors impacting the enterprises competitiveness after the technological modernization are stated in scientific publications insufficiently. No issues connected with the given risks and no ways of prevention are considered in the relevant scientific literature.

**The research objectives** are: to analyze the current Kazakhstani oil product market, study the problems of the oil refining sector, consider the factors impacting the oil product market, identify types of risks and their possible consequences, research admissible risks and propose an adaptive option to modernize production facilities.

**Key research findings.** Currently, there are 3 major oil-refining complexes in Kazakhstan, which are located in Shymkent, Atyrau and Pavlodar, and the other 32 ones are the mini oil refineries. The total estimated capacity of the 3 major oil refineries is 17 mln tons per year. The use of production capacities of industrial enterprises producing oil products is 72.9% (Information Analysis Centre for Oil and Gas, 2013). The operating capacity of all the enterprises is somewhat lower than the estimated capacity and requires technological modernization to increase refinery capacities. The main reasons for the shortage of refinery capacities along with economic growth and increase in oil product consumption are high capital costs for the establishment of new capacities, durable periods of return on investments, ecological requirements toughening and the necessity of investing in the existing production facilities. The degree of depreciation of fixed assets of the enterprises producing coke and oil products is currently 29.1% (Agency of Statistics of the Republic of Kazakhstan, 2012).

Kazakhstan is far behind developed countries by oil processing depth. According to the experts, the level of conversion at the republican oil refineries is about 68%. Just for comparison: in the USA, the above rate is 90% or higher, in Great Britain and Canada – 86–90%, in Russia – from 57 to 88%, depending on technological capacities of enterprises, and in Ukraine – 76% on average, that is a low rate as well. Until the end of 2013, Ukrainian Ministry of Energy and Coal Industry plans to agree schedules and plans to modernize local oil refineries, and the project implementation will lead to the processing depth extension up to 96% (Omaraliev et al., 2006).

Due to the low depth of oil processing, the mazut production volume is quite high at Kazakhstani oil refineries, the considerable part of which is exported where the same is subject to the further deeper conversion, and the other part is combusted at electric power and thermal stations to generate heat and electric power. Mazut is the basic kind of raw material to produce a wide range of fuel, oils and other synthetic petrochemicals.

In 2012, Kazakhstan oil refineries processed 14214 ths of oil tons without treatment by mini oil refineries that is 3.56% higher than the rate of 2011 (in 2010 – 13%) (Table 1).

*Table 1. Refining outputs of Kazakhstan mini oil refineries, 2002–2012, ths of tons*

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Oil refinery Pavlodar Petrochemical Plant	2043	2508	2994	3720	3895	4275	4056	4124	4800	4649	5038
Petro Kazakhstan Oil Products	3497	3946	3496	3936	4034	4060	4308	4007	4583	4605	4753
Atyrau Petrochemical Plant	2264	2311	2919	3500	3686	3701	3924	4004	4300	4471	4423
<b>TOTAL</b>	<b>7804</b>	<b>8765</b>	<b>9409</b>	<b>11156</b>	<b>11615</b>	<b>12036</b>	<b>12288</b>	<b>12135</b>	<b>13683</b>	<b>13725</b>	<b>14214</b>

Source: Information Analysis Centre for Oil and Gas, 2012.

The total refining output in 2012 was 15094 ths of oil tons subject to oil refining by mini oil refineries, which exceeded the result of 2011 by 48000 tons. Actually, the year was successful for domestic oil refineries as the refining output of the major oil refineries increased from 13725 ths of tons in 2011 to 14214 ths of tons in 2012. The rates of growth of refining output reduced owing to the decrease in refining output of the RK mini oil refineries from 1321 ths of tons in 2011 to 880 ths of tons in 2012 that amounted to -33% (more than 120.3 ths of oil tons refined by mini oil refineries in 2012 was imported from the Russian Federation by railway) (Table 2). The fall of refining outputs was caused by the oil export policy tightening by Russian Federation against the Republic of Kazakhstan.

*Table 2. Refining outputs by mini oil refineries over 2011–2012, tons*

No.	Mini Oil Refinery	2011	2012
1	Condensate JSC	403853	325043
2	Amangeldy Gas Treatment Plant LLP	96628	192156
3	DOSTYK REFINERY LLP	397795	129412
4	Aktobe Oil Refining LLP	62661	94041
5	Qyzylorda Low-Tonnage Oil Refinery LLP	31224	38739
6	Vernal Oil LLP	119080	19276
7	En-Gin Production LLP	41862	18011
8	Shygys Munai Sauda LLP	-	12372
9	Kaz Gas Treatment Plant LLP	11334	10367
10	Zharas LLP	4635	8685
11	PROFILEX NAFTA LLP	13213	8070
12	Alentransoil LLP	10001	7156
13	"Kazkhinvest Oil Refinery LLP	2809	4760
14	MegaTransAsia	12728	4405
15	SINUR-OIL LLP	1111	3920
16	Zheksen & Co.	1046	3351
17	Sa-Ba Ltd	14262	1134
18	Bakhanga LLP (West Kazakhstan Oblast)	38987	-
19	Bakhanga LLP (Aktyubinsk Oblast)	31132	-
20	Sat Operating Aktau LLP	26756	-
TOTAL		1321117	880898

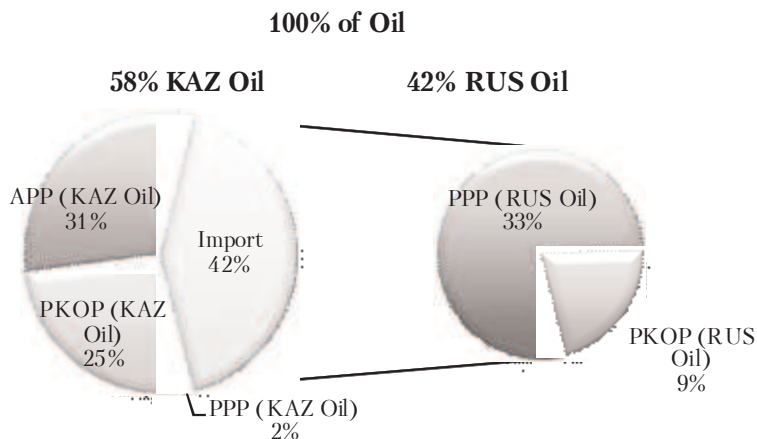
Source: Information Analysis Centre for Oil and Gas, 2012.

The reduction of refinery outputs in 2012 as compared to 2011 was caused by macro- and microeconomic conditions within the Customs Union such as the appreciation of prices for oil imported from Russian Federation to be refined at Pavlodar Petrochemical Plant (PPP) and Petro Kazakhstan Oil Products (PKOP). Imported oil became more expensive, on average up to 430 USD per ton on the terms of FCA factory, in accordance with oil prices at the world markets, whereas retail prices for oil products remained actually unchanged during 2012 (Platts, McGraw Hill Financial, 2012).

In addition, the reduction of oil product outputs is due to the fact that in 2012 oil with high contents of sulfur was delivered from Russian Federation to PPP. Oil quality deterioration was observed with the effect from the first half-year period of 2011 when sulfur content increased up to 1.22% (processing equipment is designed to treat oil containing less than 1%) (Argus Media Ltd, 2011). Due to the fact that processing plants at PPP are designed to process oil with lesser sulfur contents, the oil quality deterioration leads to the decrease in processing depth and light oil product

output by 10% as related to the increase in the boiler fuel output, and to early wear of the equipment as well.

The dependence of an oil refinery on imported oil deliveries from Russia is one of the problems of domestic oil refining. Within 14214 ths of oil tons processed by the RK oil refineries in 2012, the share of Russian oil is 5978 ths of tons (Analysis Centre for Oil and Gas, 2012). In total, the share of Russian oil in the total refined output of RK oil refineries is 42% that is indicative of the substantial dependence of RK oil refining industry on Russian oil market behavior (Figure 1).



Source: Drawn by the authors on basis of the data from Information Analysis Centre for Oil and Gas, 2012.

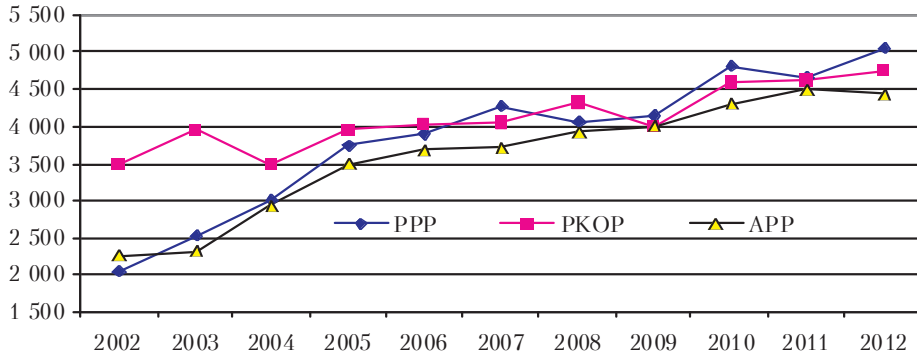
**Figure 1. Shares of Russian and Kazakhstan oil in refining by RK oil refineries over 2012**

Pavlodar Petrochemical Plant fully processes oil from West-Siberian Deposits in Russia, and PKOP was also initially designed to treat oil from the said deposits but the reconstruction of some production facilities of the plant in the 1990s allowed, for the purposes of refining, the usage of oil from the deposits of Kumkol Group not depending on Russian crude oil deliveries.

From year to year, problems remain connected with Russian oil deliveries to the country's refineries, for example, during the whole 4th quarter of 2011 Russian oil deliveries to Kazakhstan were being reduced as the Russian Ministry of Energy refused to provide Russian companies with additional quotas to ship oil in that direction. Russian authorities are intended to restrict oil deliveries to Kazakhstan up to 7 mln/t per year under the intergovernmental agreements. In January-October Russian oil suppliers already shipped 6.5 mln/t to Kazakhstan. To ensure uninterrupted operation of PPP, 300 ths of tons of the Kumkol and Aktyubinsk oil were to be delivered by Kazakhstan oil companies in December 2011. Kazakhstan oil deliveries may result in fast exhaustion of oil-refining facilities owing to high sulfur content in oil and to the process features of enterprises, designed to treat West-Siberian crude oil (Argus Media Ltd, 2011).

According to the Indicative Plan of the RK oil refineries for 2012, the oil refining volume was 14200 ths tons. But the actual refining in 2012 was 14214 ths tons: PPP – 5038 ths tons, PKOP – 4753 ths tons and APP – 4423 ths tons (Analysis Centre for Oil and Gas, 2012). Thus, the oil refining plan was realized.

The considerable increase in oil refining over 10 years can be explained by the increase in the domestic demand for oil products. Figure 2 demonstrates that over the last 10 years, the refining outputs of the said oil refineries have been continuously increasing, the increase in refining output of PPP was 246%, of PKPO – 135% and of APP – 195%.



Source: Drawn by the authors on the basis of the data of Information Analysis Centre for Oil and Gas, 2012.

Figure 2. Oil refining dynamics with a breakdown into RK oil refineries over 2002–2012, ths tons

At the domestic market, a certain disbalance remains in the oil product output and consumption. A considerable part of domestic demand is covered by import. In 2012, the import of main fuel and lubricants was as follows: high-octane petrol – 30%, diesel fuel – 10%, and bitumen – 57% of domestic consumption (Table 3).

High dependence of Kazakhstan oil product domestic market on import operations is a threat to the energy security of the Republic and one of the factors of inflation development.

Table 3. Domestic oil product market over 2010–2012, ths tons, own study

Years	Oil Product	Output	Import	Export	Demand
2010	Petrol (benzine)	2923.2	755.3	51.0	3627.5
	Diesel fuel	4092.5	399.1	272.8	4218.8
	Jet fuel	489.6	111.4	10.5	590.5
	Mazut	3789.8	68.2	2266.9	1591.0
	Bitumen	110.7	377.7	2.0	486.4
2011	Petrol	2782.7	950.6	-	3733.3
	Diesel fuel	4122.6	391.4	61.1	4452.9
	Jet fuel	387.1	119.4	-	506.6
	Mazut	3760.8	170.1	2174.9	1756.0
	Bitumen	171.3	349.5	31.6	489.2
2012	Petrol	2860.4	1348.3	-	4208.7
	Diesel fuel	4147.7	415.1	-	4562.8
	Jet fuel	421.1	107.3	-	528.4
	Mazut	3623.2	356.2	2293.7	1685.7
	Bitumen	186.5	432.4	86.1	532.9

The key oil product, which depends on imports, is bitumen. Bitumen consumption in Kazakhstan was 532.9 ths tons in 2012. This liquid material is required for roads construction and is primarily imported from Russia, 432.4 ths tons were deliv-

ered only in 2012. However, the technical characteristics of Russian bitumen do not correspond to the climatic conditions of Kazakhstan.

According to the approved development program of the RK motor road industry, as expected, the needs for road bitumen will be increased up to 700 ths tons per year to build and repair roads. Besides, a substantial volume will be also required to implement the "Western Europe – West China" Trunk-Line Construction Project.

The domestic demand for petrol and diesel fuel has been steadily increasing from year to year. As shown in Figure 3, the average annual increase in the demand for petrol is approximately 7.1%, and for diesel fuel – 3.8%. The increase in petrol consumption is due to the improvement of general economic situation and increase in the motor vehicles number. Thus, based on the results of 2012, the total automobiles in Kazakhstan was 3.64 mln units (Kazakhstan Auto Business Association, 2012).

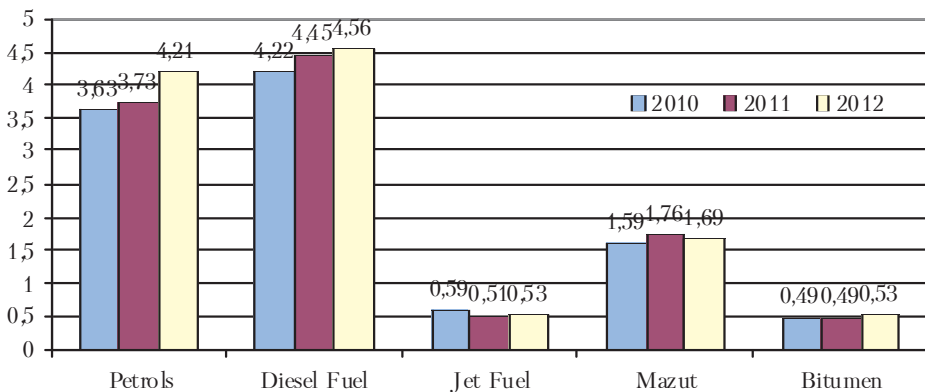
Table 4. Increase in light motor vehicles in Kazakhstan, 2008–2012, ths

2008	2009		2010		2011		2012		% of increase over the 5 years
Quantity	Quantity	% of increase	Quantity	% of increase	Quantity	% of increase	Quantity	% of increase	
2576.6	2656.8	3.0	3087.6	14.0	3553.8	13.1	3642.8	2.4	29.3

Source: Kazakhstan Auto Business Association.

In recent years there has been a positive trend of increase in sales of new automobiles according to the Kazakhstan Auto Business Association, the increase in sales of new automobiles was 109% in 2011 and 117% in 2012, that is indicative of the increase in the automobile fleet of the country, and of the future expansion of demand for high-octane fuels, which are in compliance with the current eurostandards.

As expected, the demand for motor petrol in Kazakhstan will increase from 4.21 mln tons per year (in 2012) to 6.59 mln tons per year by 2020. The total rate of the demand increase will be 36%, and the average annual one – 7.1%.



Source: Drawn by the authors on the basis of the data of Information Analysis Centre for Oil and Gas, 2012.

Figure 3. Dynamics of demand for key oil products over 2010–2012, mln tons

All the indicated above evidences of the need to satisfy the increasing domestic demand for high quality oil products that, in its turn, requires modernization of oil refineries. Currently, the State Program for Forced Industrial-Innovation Development of the Republic of Kazakhstan for 2010–2014 is being implemented

where modernization of the oil refining sector's production facilities is concerned. One of the program objectives is to meet the domestic market demand for oil products and gases – to increase the refined product output up to 19 mln tons per year and to expand the processing depth up to 87–90%.

The implementation of the following projects is in progress under this Program:

1. To reconstruct a vacuum block of the CDU / VDU-3 and a Delayed Coker of the Atyrau Oil Refinery (Atyrau region) with the capacity of the Delayed Coker of 1.8 mln tons/year, and with the capacity of the Delayed Coker – 1.0 mln tons/year.

2. To modernize and reconstruct the Shymkent Oil Refinery (South-Kazakhstan region) with the oil refining capacity of 6.0 mln tons/year.

3. To modernize and reconstruct the Pavlodar Petrochemical Plant with the primary refining capacity of 7.5 mln tons/year.

The above projects are accompanied by some risks, in particular, the PPP Modernization Project is subject to severe risks. As we think, the highest risks are as follows:

- risks associated with cessation of crude oil deliveries from Russia to PPP;
- risks associated with changes in oil export duties in Russia and Kazakhstan.

Possible occurrence of the following events may make the position of Pavlodar Petrochemical Plant is quite vulnerable:

- possible reduction or even cessation of crude oil deliveries from Russia in the years to come;

- possible reduction by Russia of export duties or introduction of oil export tax at the border with Kazakhstan that may increase the price of oil delivered to the Plant;

- possible reduction by Russia of oil volumes delivered on the duty-free basis, or cutting as a result of political discord between Russia and Kazakhstan. The history of relations between the countries of the former Soviet Union shows that Russia aspires the use its natural resources, economic power and geographical advantages for maintaining the maximal dependence of the former soviet republics on Russia. The relations between these countries may rapidly change, as soon as the countries defend their economic independence more actively. At present, the conflict concerning the supplies of duty-free crude oil exists between Russia and Belarus. During several years, the Republic of Belarus has modernized its oil refineries that made it possible to export finished refined products ensuring high profits for the country based on duty-free crude oil deliveries from Russia as well. Belarus is one of the parties in the Custom Union, so it is relying on duty-free oil deliveries. In turn, Russia tries to limit the supplies of duty-free oil in the volumes necessary for saturation of the domestic market only. This conflict is a clear example of what may occur with Kazakhstan after its modernization of oil refineries. Of course, it is economically beneficial for PPP to process Russian oil, thus increasing a margin due to low oil prices. The financial and economic analysis for PPP JSC made by us for the last 3 years has shown that for this period, there is a growth of asset and net profit volumes of PPP that, in turn, increases its return on equity (ROE). The increase in ROE is due to the increase in assets turnover and the profitability of sales as per net profit. To finance its activity, PPP attracts more borrowed capital year after year and intends to speed up its asset turnover further.



The increase in sales profitability as per net profit was conditioned by the substantial increase in gross profit and the increase in the effect of commercial and management expenses. One should note a positive increase in gross profit from year to year. The increase in the asset turnover was promoted by the improvements in the management of cash, accounts receivable, other working assets, and fixed assets and other noncurrent assets as well. It is reasonable to suppose that Russia will search for the ways to reduce oil deliveries since after the modernization, Pavlodar Plant will compete with the nearest Russian refineries and will export finished products to the near by regions of Russia.

**Conclusions.** The market demand increases from year to year and the risk associated with the insufficiently produced quantities of oil products for the domestic market is significantly less than the above stated factors. We recommend to review the modernization of PPP and to carry it out partially. To modernize and reconstruct the Pavlodar Petrochemical Plant, the following 2 alternative projects were developed, the 1st project – partial modernization increasing the total oil refining up to 6 mln tons at the cost of about 250 mln USD, and the 2nd project – complete modernization expanding the processing depth up to 87–90% and increasing the oil refining up to 7.5 mln tons per year at the cost of 900 mln USD.

Based on the analysis the following must be emphasized:

- PKOP and APP have weak processing depths, and for them, modernization with an increase in processing depth is of current interest, especially for the plant located in the Southern region since the scope of consumption in the South is higher than in other Kazakhstan regions.

- Pavlodar Petrochemical Plant remains the only bitumen producer and this could become an incentive to expand its bitumen production capacities, the more so, as the bitumen output is just 43% of the demand at Kazakhstan market.

- It is unlikely that gas distribution networks will be provided to the central regions of Kazakhstan in the nearest future. A certain demand for the products of Pavlodar Plant will remain unchanged in future. Therefore, we cannot see any necessity of the complete modernization of PPP, converting it into the advanced processing plant and implementing such an expensive project.

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### КНИЖКОВИЙ СВІТ



СУЧАСНА ЕКОНОМІЧНА ТА ЮРИДИЧНА ОСВІТА  
ПРЕСТИЖНИЙ ВИЩИЙ НАВЧАЛЬНИЙ ЗАКЛАД

## НАЦІОНАЛЬНА АКАДЕМІЯ УПРАВЛІННЯ

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Монографія присвячена фінансово-економічним проблемам розвитку економіки України в умовах глобалізації. Викладені теоретико-методологічні питання розробки стратегії входження України у світове господарство та формування фінансово-економічного механізму цього процесу. В основу викладу матеріалу монографії покладені багаторічні дослідження науковців в галузі економічної теорії, фінансів та банківської справи, які були апробовані на сторінках авторитетного журналу "Актуальні проблеми економіки" в 2004–2007 роках. В монографії обґрунтовано шляхи забезпечення структурно збалансованого економічного зростання економічної системи України та її ефективного міжнародного співробітництва, визначені напрями вдосконалення всіх ланок господарської системи.