

## Long term prognosis of crude oil price variation

K. Petkov, D. Stratiev

Lukoil Neftochim Bourgas, 8104 Bourgas, Bulgaria, e-mail: [stratiev.dicho@neftochim.bg](mailto:stratiev.dicho@neftochim.bg)

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### Abstract

Analysis of crude oil price variation in long term plan has been carried out and problems associated with the crude oil price prediction are discussed. It was found that the crude oil price variation is stepwise at which periods of slow price increase alternate with ones of accelerated price increase. The main factors that affect the long term crude oil price variation are shown. The prepared long term prognosis indicates that the crude oil price may be doubled in the next two-three years.

**Key words:** *Forecast, Prognosis, crude price*

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### 1. Introduction

Crude oil is one of the main natural feed stocks used to meet energy demands of mankind. That is why its price variation has great influence on the society development. The prognoses of volume of crude oil extraction globally and regionally, consumption rates, and the crude oil price are used not only for planning the national and world economies but also for development of refining enterprise investment programmes. On the base of these prognoses management decisions are taken whose efficiency depends on the accuracy of the prognosis. The result of the decision could be sustainable development of society or development connected with concussions. This work deals with the questions related to prediction of the crude oil price and development of long term prognosis.

### 2. Crude oil consumption relative to total energy consumption

Since the beginning of this century the energy consumption pattern has been almost unchanged and for meeting the energy demand the human race has been using: crude oil – 35%; natural gas – 20.7%; coal – 25.3%, renewable sources (including water-power stations) – 12.7%; nuclear energy – 6.3%<sup>[1-3]</sup>. Despite some prognoses for depletion of crude oil reserves in the near future, the structure of energy consumption is not expected to significantly change. A marginal reduction of the crude oil influence till 2030 (up to 32%) and equalization of the energy balance of crude oil, natural gas and coal is expected till the half of the 21<sup>st</sup> century<sup>[1]</sup>.

One of the main advantages of the crude oil as an energy source is its application in the transport sector where the oil refined products are and keep on being with out serious competition. In 1973 the crude oil share as an energy source in the transport sector was 94.4% and in 2005 it is even higher – 95.56% which almost makes the words crude oil and transport synonyms. Moreover the energy sources used in the transport sector in 1973 were 27.24% while in 2005 this share was 32.73%. The population around the globe becomes “more mobile” than “energy consuming” evidence of which is the relative increase of energy consumption per capita with 20.4% in the transport sector in contrast to the total reduction of energy consumption in the remaining sectors with 7.3% in 2005 relative to that in 1973 (according to data given in ref. <sup>[3]</sup>).

It is natural that the crude oil price is affected mostly by the major importers and exporters of crude oil. In a global scale the major oil importers are: the US – 27%; EU – 26%; Japan – 11%; China – 7%; South Korea – 4.5%, India – 3.5%, and the major oil exporters are: Middle East – 40%; Africa – 15%; Russia – 14%, South America – 7%; Canada – 4.5%; and Mexico – 4.5%. It is also natural that besides the US during the last couple of years the crude oil price is significantly influenced by the fast developing China and India<sup>[4]</sup>. It is typical for their economies not only the fast growth but also the

great potential they have especially if the specific energy consumption of their inhabitants is taken into account (for China -1.4 tpy per capita; and for India – 0.6 tpy per capita) which is ten fold lower than that in the leading countries like Canada (14.8 tpy per capita) and the US (12.3 tpy per capita)

### 3. State of crude oil price prediction

The prediction of crude oil consumption and its expected price has been made since the middle of last century but the interest to these questions has been increased because of understandable reasons in the end of the last twentieth century. Tens of groups around the world prepare and update middle term, long term and above long term prognoses – till the end of this century [5,6]. The most popular institutions which prepare and update their prognoses for consumption and prices of energy sources are two: the US Energy Information Administration (EIA) [7] and the global International Energy Agency (IEA) [8] that has 26 country members.

When crude oil and oil products are concerned it can not be omitted the information agency Platt's [9] – a world leader of actual (real time) news provider about sales – quantities and price of crude oil and fuels. On the web site of the agency analyses and prognoses are published that help make investment decisions. It is practice the price levels of oil and fuels published by the agency to be used as a base for defining of current prices.

An indicative fact of the interest to the prediction as a whole and in particular of the crude oil price is the information published in the web site Russia Business Consulting twice a month [10]. It includes middle term and long term prognoses of 22 different world organizations comprising: Bank of America; Deutsche Bank; BNP Paribas; Aton; EIU; ING and others. The prognoses present statistical evaluation of the expected crude oil price in the period up to 2015. Review of the prognoses from these references for the period May – October 2007 indicates that long term expectations are significantly changed. The October predicted crude oil prices are 10-15% higher than the predicted prices in May. This is an indicator that old (long term) prognoses are not sufficiently reliable as they have been changed for such a short period of time. One reason for this is that it is still rarely made analysis of correctness and reliability of the prognoses [11], although this is one of the main approaches for their improvement of quality and authenticity.

The EIA also significantly varies its long term prognoses. A confirmation of this is the presented on Fig.1 graphical assessment of authenticity of long term EIA prognoses prepared in 1997, 2002, and 2006 for a period of 20 -25 years. It is evident from this data set that inaccuracy of prediction gets higher with the course of time and the prognosis has always been lower than the actual crude oil price. This indicates that it is very difficult to prepare a reliable long term prognosis for the crude oil price

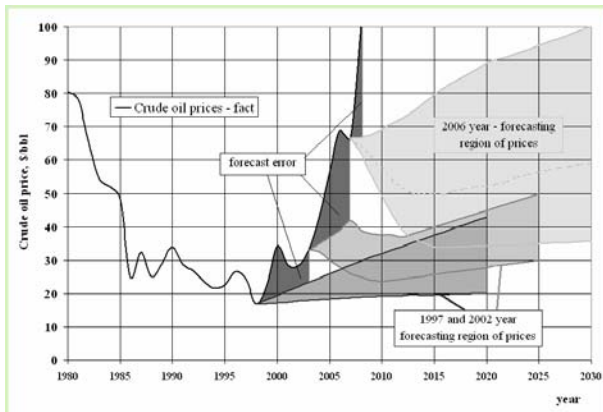


Figure 1 Evaluation of the authenticity of long term prognoses for crude oil price prepared by the EIA

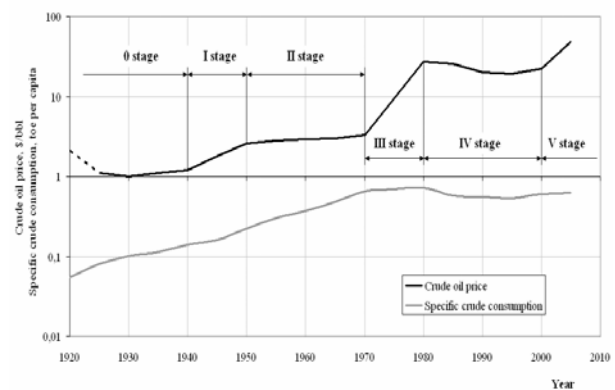


Figure 2 Variation of crude oil price in time

The situation with the middle term crude oil price prognoses made in 2002, 2003, 2005, and 2007 is almost the same. It is obvious that during preparation of the prognoses it is not foreseen stable grow of the prices because of which the expected prices are almost horizontal lines and this leads to errors in the prognoses. The limits of price variations are statistical values and they are probably correctly evaluated but at erroneous predicted durable changes in the crude oil price they do not contribute significantly to improving the reliability of the prognoses.

As a summary it can be noted that the main problem associated with the prognosis making at this moment is the obvious lack of correct solution of the evaluation of the firm trends especially in a longer period of price variation.

#### 4. Analysis and evaluation of crude oil price variation

Assessment of the possible long term trends in crude oil price variation should be made as initially the price variation is analyzed for sufficiently long period of time. It is expedient the transitory variations, that have inessential significance, to be omitted. Technically it has been made when the presenting of price in time is given not with the transient values but with the averaged values obtained for sufficient long period of time. Moreover for the x-axis a logarithmic scale has been used, that allows to avoid omitting the variations in transitional periods in time.

The crude oil price variation in the period 1920 – 2007 is presented on Fig.2. The black line indicates the averaged for 30 months price. The presentation of data in this way allows to distinctly stand out the acted trends in time and help preparation of correct long term price prognosis. As the price of every product depends on the quantity supplied to the market, the specific consumption of crude oil is additionally presented.

It is evident from these data that the crude oil price change in the examined period is step wise and can be conditionally divided into six stages. The stages can be classified in two types. The first type - stages I, II and V are characterized by accelerated increase of the price and last about 10 years. The second type stages – 0 II and IV are characterized in decelerated price variation and they are twice as long as the first type – approximately 20 years. Such conditional division helps preparation of authentic prognosis that takes into account the long term price trends. However, it is expedient to preliminary find answers of the following questions:

- What is the reason for the step wise change of crude oil price?
- Which are the main factors that affect crude oil price?
- How long will take the crude oil price increase during the V stage?

Moreover the authenticity and accuracy of the prognosis will depend on the reliability and completeness of the answers to these questions.

#### 5. What is the reason for the step wise change of crude oil price?

The most typical item for the zero stage that ends in the beginning of the world war two is the exceptional low, especially until 1930, specific crude oil consumption. In the end of this stage the automotive industry has already been mature and the mankind has realized the benefits of it.

The first accelerated increase of crude oil price has started immediately in the beginning of the second world war after which the mankind has recouped itself. However, nor the war nor the necessity to restore damages has been the reason for crude oil price increase. If it had been so, after restoring the crude oil price, it would have come back to the preceding levels. The main reason has been that after the war the mankind has not been the same and has changed its way of life. The developing industrialization has encompassed bigger and bigger parts of the world and needed more fuels / crude oil for agriculture activities and transport of goods from manufacturer to the consumer. Then it has followed slow crude oil price increase (1950 -1970), allowing the new way of life to settle and strengthen. The society has changed the priority of crude extraction and refining towards gaining benefits of fuels.

During the third stage an accelerated increase of crude oil prices has started. The human population number has been increased approximately by 50% during the preceding twenty years, that has led to famine of fuels. The crude oil price augmentation during the third stage has been higher than seven fold and after its end the number of engineers occupied in this branch has been almost triple reduced. The engineers have turned to other activities <sup>[12]</sup>. It has been already clear in the beginning of the third stage that mankind has not been in position yet to secure fuels for every one at the levels of the preceding years. The specific consumption growth (grey line) has been practically stopped until nowadays. During the fourth stage (1980 – 2000) again a relatively slow crude oil price increase has been observed. It has been accompanied by strong variations and local military conflicts in the regions of crude oil extractions in contrast to the previous stage of relative stable crude oil price (the second stage). The crude oil price has not been increased during the fourth stage as a result of improvement in the transport means and the use of more efficient engines. This has not been sufficient to keep the low level of crude oil price. During the current - fifth stage an accelerated crude oil price increase starts again. The human population number has been increased by 40% that causes again famine of fuels. It is even difficult to keep the specific consumption from the period till 1970. The price augmentation is related again to: the low growth of world extraction rate of crude oil; high refinery utilization rates and the increased demand of transportation fuels <sup>[12]</sup>. Probably temporary (for the next 20 years) alleviation of crude oil price increase may be achieved as a result of entry of hybrid engines in automobiles and communication and computer technologies used in navigation of transport systems.

It could be summarized that the key reason for the step increase of crude oil price in long term period is the continuous development of mankind. On one hand the population continuously grows, on the other hand the mankind periodically finds radical solutions of the energy problems and implements them to meet its transport needs. Most transport needs of the mankind are still based on the crude oil and as long as this will be so the crude oil price is expected to change in a stepwise manner.

#### **Key factors affecting the crude oil price**

- Growing population and economic output are the key drivers for increased energy demand. Streamlining of energy consumption efficiency alleviates this factor (Improving transport engine efficiency and the efficiency of management of the whole transport section).
- Increased cost of finding and developing oil. In 2006 it was estimated that the cost of finding and developing oil on a per barrel basis was three times greater than in 1999 [13]

#### **Long term prognosis of the crude oil price variation**

How long will take the crude oil price increase during the V stage?

Defining the border line of the crude oil price increase during the current V stage could be made on the base of the stepwise price change, repeatability of the processes of the world economy and of the border line change in a long term aspect.

The evaluation has been made on the base of investigating the function crude oil price =  $f(\text{time})$  during a period of relatively stable development of the world economy.

The region of crude price variation is specified by upper limit and lower limit of the price. The upper limit is defined by the accepted maximum price of crude importers while the lower limit is determined by the minimum accepted price of crude exporters. The approach of the actual price to the border lines is related to tremors of the development – wars, local conflicts, terroristic acts, etc. Moreover, an optimal balancing all interests price (the line in the middle of the region of price variation) may be applied if a world economy planning exists

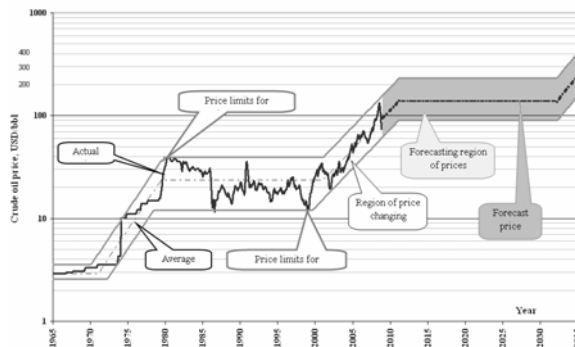


Figure 3 Crude oil price variation forecast

The prognosis itself is depicted on Fig.3. It is prepared in an analogous way with the preceding stages as it is forecasted the duration of the fifth stage to be 10 – 11 years long. The border lines are defined on the base of the border lines observed during the third stage. The same approach has been used by defining the border lines of the sixth stage when the crude price variation is expected to be low. The fifth stage is forecasted to finish in 2010 – 2011. It can not be expected to finish earlier because of the following reasons:

- The human population increase is not expected to be reduced for such a short period of time – till the end of the fifth stage;
- The required new refining facilities to process crude oil for meeting mankind needs are not expected to run earlier than 3-4 years that automatically means that the fuel demand will be high and in particular the crude price will keep on rising;
- The use of hybrid engines is still in the very beginning of renewal of the automotive park;
- The price of fuels/crude oil has not reached the required highest level that will make attractive projects associated with alternative solutions for meeting the transport needs of the mankind.

## **Conclusions**

The long term crude oil price variation has been found to be step wise in which periods of low price with high price variation are alternated.

Not accounting the stepwise price variation leads to lack of authenticity in prepared long term forecasts

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