Wie bei der Dimensionierung der Grundwasserwärmepumpe, wurden zwei Fälle betrachtet mit zwei möglichen benötigten Heizleistungen des Gebäudes. Für die Heizlast von 23.983,0 W wurde die Wärmepumpe geoTherm VWS 300 / 3 mit einer Heizleistung von 30.000 W genommen. Die Heizlast 34.914,4 wird mit der geoTherm VWS 460/3,W mit einer Heizleistung von 45.700 W bedient. Für beiden Wärmepumpen wurden die Verdämpferleistungen berechnet: 23333,3 W und 35544,4 W.

Die Bohrungen der Erdwärmesonden mit einer Länge von 50 bis 100 m muss durch drei Schichten durchgeführt werden: oberer sand-kiesiger Grundwasserleiter, Zwischenhorizont aus Ton und Schluff und dem zweiten Grundwasserleiter aus Sand und Kies. Die Erdsondenlänge wurde für zwei Falle berechnet, mit niedrigsten und höchsten Entzugsleistungen der Schichten. Ebenfalls wurde es für zwei Verdämpferleistungen ausgerechnet. Für die niedrigere Verdämpferleistung beträgt die Erdwärmesondenlänge 428,1 m bis 534,9 m. Die maximale Anzahl der Sonden mit der Länge 50 bis 100 m für der Heizlast 23.983 W beträgt 11 und die Minimale 4. Die maximale Anzahl der Sonden für der Heizlast 34914,4 W beträgt 16 und die Minimale 7.

Die durchgeführte Berechnungen zeigen, dass die minimale gesamte Länge der Sonden für das gegebenen Haus ca. 428 m und die Maximale ca. 815 m beträgt. Wegen der Bohrkosten, wird die Wärmepumpe mit der Erdwärmesonden nicht günstiger, als die Grundwasserwärmepumpe.

Im Laufe des Projektes wurden Dimensionierungen für zwei Wärmepumpenarten durchgeführt: Grundwasserwärmepumpe und Wärmepumpe mit Erdwärmesonden.

Literatur

1. Leitfaden zur Nutzung von Erdwärme mit Grundwasserwärmepumpen, Umweltministerium Baden-Württemberg, Auflage, April 2009.
2. Wärmpumpen für Heizen und Warmwasserbereitung, Projektierungs- und Installationsbuch, Dimplex, 2014.
3. Planungsunterlage Luft-Wasser und Sole-Wasser Wärmepumpe, Wolf
4. Wärmepumpenanlagen, Das kleine Helferlein für Einsteiger, Johannes Wegesin, 1. Auflage, 2011.
5. DIN EN 2831, 2003.
6. VDI 4640, 2011.

CURRENT TRENDS IN GLOBAL OIL REFINING INDUSTRY

P.G. Petkova, E.M. Vershkova
Scientific advisor assistant E.M. Vershkova
National Research Tomsk Polytechnic University, Tomsk, Russia

The aim of economics is to find an optimal way to share out the limited amount of resources among industries and respectively people's necessities. Business developing on the background of market economy is in need of economy forecasting. Economic prognoses and trends are usually made by statistical model and in our case the analysis is focused on oil industry. Forecasts are based on the demography indicator and changes in population preferences, because the main factor for consumption of any kind of resources is the number of people using it.

According to the statistic information of the International Energy Agency [1] and world population prospects of the United Nations [2], Figure 1 indicates the global amount of consumed oil, gas, coal, nuclear , bio and hydro energy from 2009 with prognoses of their consumption till 2050.

It is visible that use of oil energy will decrease in the future. In 2009 it is 34% of all the consumed energy and in 2013 it is 37%. According to forecasts in 2025 it tends to decrease to 28%, and in 2050 consumption will drop down to 18% - twice less than in 2013. But it does not mean that decrease of oil products is going to be that big. There are two reasons to have these results. The first one is negative population growth and the second one is rapidly developing technologies.

Innovations are the main ratio of progress and consummation of any industry or company. Refining industry is doing researches and innovation in petroleum chemistry and production continuously. That is how they find new methods of deeper refining petrol and producing goods with even better quality. Innovations in oil refining will lead to decrease of crude oil consumption, especially in counties importing big amounts of petrol to meet the needs of its population in using oil products.

Using green energy will take higher positions because of technology innovations as well. Making prognoses that consumption of green energy will exceed oil consumption in 2050 is not surprising if we take the American engineer Elon Musk and his achievements in this sphere. His companies producing electric cars (Tesla Motors) [3] and solar energy (Solar City) [4] are already rapidly expanding.

Energy is needed in Transport, Industrial and Building sectors. Musk's company is producing a wide range of electric cars giving the opportunity to open-minded people to have a small urban car or a beautiful powerful car using electricity. Even if the only fuel resource does not change for planes and ships, consumption of oil in transport sector will go down considerably, because the alternative electric cars. The amount of used biofuels will increase as well; this is one more reason for petrol consumption rates to go down.

Solar power is already extensively used in European countries for heating and cooling homes, lighting office buildings and manufacturing the products. Solar technologies are rapidly developing. It means that over the next decade solar energy will be cheaper and available for companies and costumers, and respectively preferable as energy resource in countries without oil and gas. This will indicate a significant decrease in oil consumption.

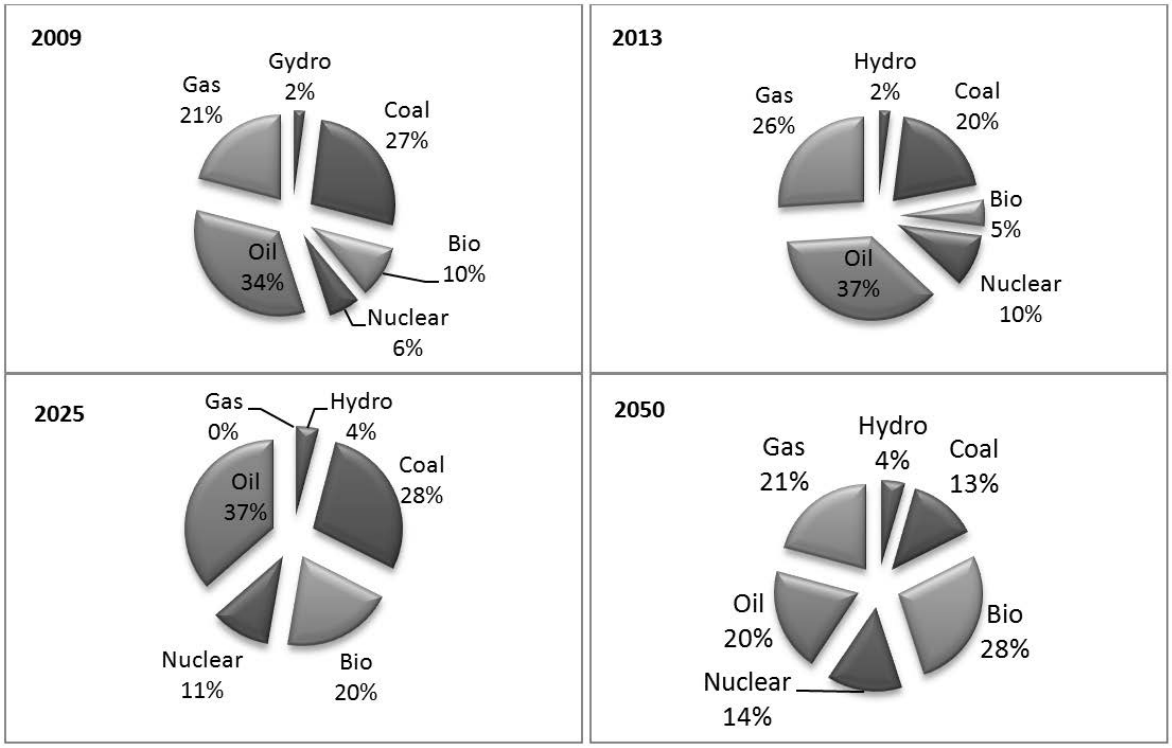

Fig. 1. Global consumption of energy resources

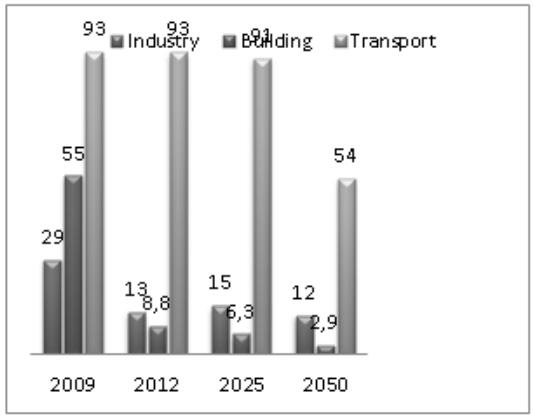

Fig. 2. Global consumption of oil in different industries (EJ)

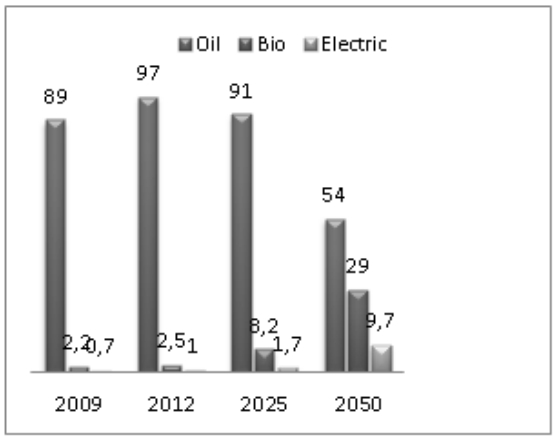

Fig. 3. Energy resources in transport industry (EJ)

The importance of oil products use in the sphere of transport in the period from 2009 to 2050 is indicated in Figure 2 and Figure 3. In 2013 consumption of petrol in Transport will rise within 4%, in 2025 compared to 2009, but in 2025 is expected 2% decrease, in 2050 – 37% less than in 2009. Figure 3 shows resources used in Transport. Economic trends and prospects for the next years are for downturn in consumption of crude oil in all the industries but in Transport sector it is more considerable. In 2050 consumption of petrol is expected to be about twice less than in 2013. Respectively, the scale of usage bio and electric energy is rapidly going up.

Statistic information of the International Energy Agency and world population prospects of the United Nations gives a very reliable economic forecast for the consumption of crude oil for a long term period. It will decrease because of expected population downturn, innovations in oil refining and technology development in using green energy.

References

1. World Population Prospects. Retrieved from: http://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf
2. International Energy Agency. Retrieved from: http://www.iea.org/Sankey/#?c=IEA Total&s=Balance
3. Tesla Motors. Retrieved from: https://www.teslamotors.com/supercharger
4. Solarcity. Retrieved from: http://www.solarcity.com/

LOW-TEMPERATURE PROPERTIES ESTIMATION OF DIESEL FUELS WITH THE APPLICATION OF COMPUTER MODELING SYSTEM OF CATALYTIC DEWAXING PROCESS

N.V. Popova
Scientific advisor assistant N.S. Belinskaya
National Research Tomsk Polytechnic University, Russia, Tomsk

Modern petroleum refinery industry has a tendency to the increase in oil convertion ratio and enhancement of resource efficiency. One of the most obligatory processes used widely to improve the properties of diesel fuels is the catalytic dewaxing technology. The quality of produced fuels must correspond to the technical standards and requirements for consumers' ability to use them in severe climatic conditions. Such low-temperature properties as freezing point (T_f), cold filtering plugging point and cloud point (T_c) are key characteristics of the ability of using diesel fuels in winter period [4].

Along with decreasing temperature a paraffin row of fuel composition primarily starts to transform into the solid condition. Among the main reactions the reactions, isomerization of n-paraffins C_5-C_{16} and hydrocracking of n-paraffins C_{17}-C_{27} have the crucial significance [2]. This work is devoted to the mathematical model development with the aim to optimize the catalytic dewaxing process and estimation of diesel fuel low-temperature properties. The work objective presumes the investigation of influence of the feed composition over the product (hydrodewaxed diesel fraction) composition, low-temperature properties and product yield. The study was carried out with implementation of the computer modeling system developed at the Department of Fuel Engineering and Chemical Cybernetics of Tomsk polytechnic university. In the mentioned system method of mathematical modeling is applied, which allows successfully conducting analytical description of processes taking place in the reactor.

Freezing point and cloud point strongly depend upon the number of n-paraffins C_{10}-C_{27} in the feed. The properties were determined for the feed entering the dewaxing reactor and for the product (unstable hydrogenate) leaving the reactor. To estimate the impact of feed composition on the above mentioned properties, five different feed stocks with various compositions were used. In addition, the feed flow rate, pressure in the reactor and the flow rate of hydrogen bearing gas were assumed constant while changing the temperature in the reactor.

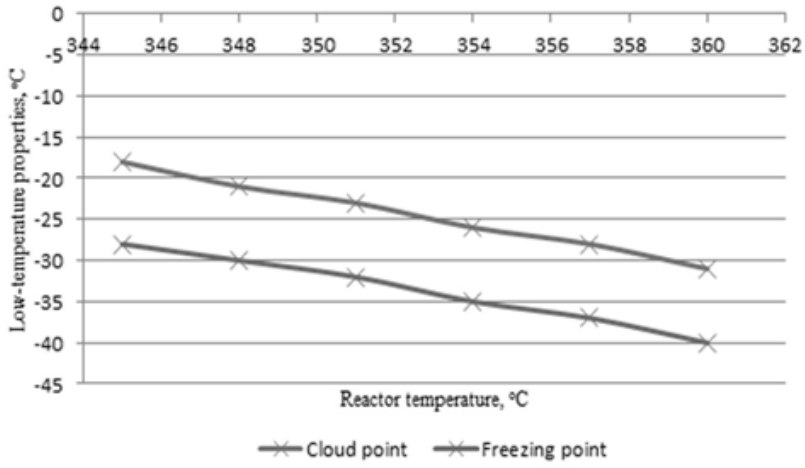

Fig. 1. Cloud and freezing points of diesel fraction leaving the reactor depending on the temperature in the reactor