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Overview of the Polish Fuel Market

Energy Security,
Warehousing and Downstream Infrastructure,
and Diversification of Supplies
from Non-Russian Sources

Biofuels – Opportunities and Threats

Warsaw June 2007

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Preliminary comments

1. During the last shortlived failure in crude oil supplies to the Polish refineries via the *Druzhba* pipeline caused by the conflict between the Russian Federation and Belarus, Piotr Naimski, Deputy Minister of Economy, officially declared that the country's energy security was not threatened. Refineries were capable of securing full raw material supplies via sea, importing the crude through Gdansk-based Naftoport. The declaration was the first major public statement to confirm the actual state of affairs that had existed for years. Naftoport – its modernisation financed primarily from handling fees charged on (Russian and Kazakh) crude oil sent in transit through Poland via the *Druzhba* pipeline – and Port Północny (Northern Port) with the combined handling capacity of 34.0 million tonnes were and still are the guarantee of Poland's energy security.
2. Crude oil sent in transit through the Polish territory constitutes the reserve that can be utilised in extreme crisis situations.
3. A number of developments points to a shifting emphasis in the economic strategy of the government of the Russian Federation and of its oil companies. Those developments may lead to a decline in importance of the *Druzhba* pipeline and the Western-bound oil supplies:
   a. Transneft's decision not to overhaul the *Druzhba* pipeline;
   b. Increase in handling capacity of the Primorsk terminal up to 62.0 million tonnes and the decision to further expand it by 50.0 million tonnes (from roughly 60.0 million tonnes at present) related to the planned construction of the second line of the pipeline to Primorsk (BTS-II)[1]; and
   c. Forecasted increased crude exports to the Far East to China or Japan via a pipeline to be constructed along that section.
4. Implementation of the aforementioned business projects may result in price increases of crude oil imported via the Russian pipeline system. If so, the URALS/REBCO price discount against other types of crude oil will be squeezed. The likelihood of such development is rendered possible mainly by improved handling capacity of Russian ports. Only then, other directions of crude oil imports will become increasingly attractive, which in turn may accelerate economically justifiable diversification. And, as previously mentioned, rapid diversification of crude oil supplies is technically possible thanks to existence of Naftoport.
5. The state-owned PERN and Naftoport should, as long as it is possible, take advantage of the opportunity offered by the lower price of REBCO/URALS crude oil compared to other oil types. Increased transit through Poland and via Gdansk is recommended both in terms of business (increased transit fees) and politics (the country's enhanced energy security).
6. In addition to the downstream infrastructure, the construction of new warehousing tanks should primarily be stimulated for stocking liquid fuels and crude oil with the participation of private investors. Expansion of the fuel warehousing infrastructure is necessary to improve Poland's energy security (more strategic fuel and crude oil reserves will be created) and for economic reasons (fuel bases are required to carry out commercial transactions).
7. Meanwhile, in spite of pledged diversification of crude oil supplies, one could recently observe a further increase in Poland's largest refinery's reliance on crude supplies from oil companies controlled by the Russian state treasury. Long-term contracts have been signed that bind the refineries with the trader supplying Rosneft's oil until 2011.

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1 „Moskwa zrezygnowała z modernizacji rurociągu »Przyjaźń«" [Moscow has renounced from modernisation of the *Druzhba* pipeline], DI, PAP, 14.02.2007, www.pb.pl

Part one

Energy Security,
Warehousing, Downstream Infrastructure,
and Diversification of Supplies
from Non-Russian Sources

1.1. Polish Crude Oil Market

1.1.1. Value and Volume of the Market

PKN ORLEN

After three quarters of 2006, PKN Orlen Group has generated PLN 39.0 billion in sales revenues and some PLN 2.3 billion in net profit. Consolidation of the results of Unipetrol (the company was not part of Orlen a year before) was the new item on the group's books. The Czech company already in the first quarter reported CZK 842.0 million (PLN 116.5 million) in net profit.[2] PKN Orlen's advanced oil processing capacity amounted to 13.8 million tonnes in 2006, against 13.5 million tonnes in 2005.

LOTOS

Since July 2005, the modernised Gdansk refinery processes 6.0 million tonnes of crude oil annually. Its 2005 profit stood at PLN 930.0 million. In the first three quarters of 2006, the consolidated sales revenues of Lotos Group reached PLN 9,656.6 million, up 44.3% on the first three quarters of 2005, with the operating profit of PLN 720.1 million – representing an increase of 8.2%.[3]

Fig. 1. Location of Discovered Hydrocarbon Deposits Against Distribution of Petrobaltic SA Prospecting and Extraction Licenses

Source:www.petrobaltic.pl

(Petrobaltic)

Lotos SA Group holds a 69% share in Petrobaltic and is planning to exploit new B8 and B23 deposits whose resources are estimated at roughly 16.0 million cu. m. of crude. Industrial-scale exploitation is scheduled to begin in 2008. The process will take 10 years. According to the strategy's assumptions, Lotos Group is planning to increase crude oil extraction in the Baltic Sea from 300,000 tonnes to 1.0 million tonnes a year by 2012, and the planned oil processing in 2012 should reach the level of 10.5 million tonnes annually against 6.0 million tonnes in 2006.

2 www.orlen.pl; www.bankier.pl
3 http://www.lotos.pl/

The primary source of significant profits of the Polish refineries is low price of the purchased Urals oil in relation to the prices of other oil types, which, considering the prices of sold final products that are based on their world quotations, results in historic record profits.

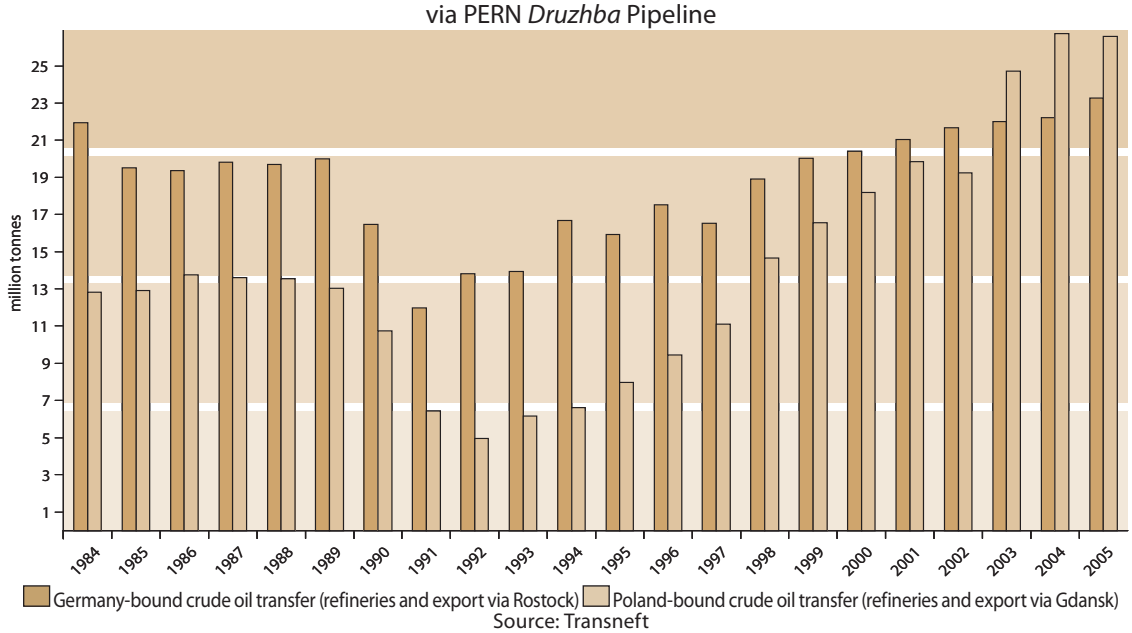
The two largest oil refining companies in Poland, PKN Orlen and Lotos Group, hold over 85% of shares in the Polish market of finished fuels production. Imported fuels make up the rest.

1.1.2. Infrastructure and the *Druzhba* Pipeline

Poland is connected with Russia by the *Druzhba* pipeline with a transmission capacity of roughly 43.0 million tonnes of crude (a possibility exists that is currently leveraged to increase transfer to over 51.0 million tonnes depending on the applied chemicals, the so-called lubricats). The *Druzhba* pipeline is owned by a one-person State Treasury company called Przedsiębiorstwo Eksploatacji Rurociągów Naftowych Przyjaźń S.A. (PERN). PERN's revenues on transmission of both crude oil to the refineries and transit via Naftoport as well as on other activities pursued amounted to PLN 628.4 million in 2004.[4] The enterprise transported 49.9 million tonnes of the raw material and 4.9 million tonnes of finished products. In 2005, PERN pumped a record 51.1 million tonnes of crude oil. The company reported PLN 581.2 million in operating revenues in 2005.[5] Following increased investment outlays in 2005 (PLN 650.0 million compared to PLN 250.0 million in 2004), its net profit rose to almost PLN 112.0 million.[6] The ongoing dynamic growth of the Polish economy has had a favourable impact on the general business climate in the fuels market.

In the first half of 2006, PERN Przyjaźń SA recorded PLN 298.0 million in revenue and PLN 62.6 million in net profit, a 21.5% increase over the corresponding period of the previous year. The pipeline constitutes the main source of oil supplies for Poland and Germany. The key principles governing crude oil transfer via the pipeline include satisfaction, in the first place, of the total demand for crude oil supplies on the part of Polish and German refineries. Only after satisfying the refineries' demand, the remaining transfer capacity (amounting to 9,170.0 million tonnes in 2005) may be utilised for oil transit through one of the two existing ports in Gdansk or in the German Rostock. Historic data suggest that, since the construction of the *Druzhba* pipeline in the 1970s, most of transported crude went to Germany. After nearly 40 years of operation, this trend has been significantly reversed since 2002 with the total volume of crude oil sent to Polish refineries and in transit via Naftoport exceeding by far that reaching Germany. It is precisely the additional transit capacity of nearly 10.0 million tonnes of crude oil obtained by PERN that contributed to generation of such extraordinary profits and enabled investment in modernisation and expansion of downstream infrastructure.

Fig. 2. Germany- and Poland-bound Crude Oil Transfer from Russia via PERN *Druzhba* Pipeline



Source: Transneft

4 Rzeczpospolita weekly, Lista 500, 2004 rok [List of 500. 2004]
5 http://www.lotos.pl/
6 Puls Biznesu, 6 June 2005. W PERN „Przyjaźń" przesył ropy i paliw w 2005 r. na poziomie z zeszłego roku [At PERN *Druzhba*, the 2005 oil and fuel transport figures match those of the preceding year]

1.1.3. Infrastructure Modernisation vs. Energy Security – Prudhoe Bay Oilfield Leak and *Druzhba* Pipeline Failure

The technical condition of the crude transmission infrastructure is key to Poland's energy security. To better illustrate that fact, we present two examples of pipeline failures: that of BP's pipeline in Alaska and that of *Druzhba I* pipeline in Russia. The first example shows also the manner in which operation of the crude transmission installation may directly affect the raw material's market prices.

a) Failure of BP's Extraction Installation on Prudhoe Bay Oilfield in Alaska

Pipeline failures are among the most severe impediments to crude oil supplies. The Prudhoe Bay pipeline, its useful life similar to that of the *Druzhba* pipeline, suffered a major setback. Because of the discovered leak (4 to 5 barrels), BP company opted for a temporary closure of some of its extraction installations in the Prudhoe Bay area. An inspection showed that corrosion destroyed 70 to 81% of the pipeline's wall. Elimination of the failure necessitated replacement of sixteen out of twenty-two miles of the pipeline in the Prudhoe Bay area. BP announced completion of repair work by January 2007.

The closure of the installation is, to a great extent, a proactive measure designed to prevent more extensive damage and losses. Earlier on, 200,000 gallons of crude oil leaked from a pipeline operated by BP on the Northern Slope.[7]

BP's oilfields in Prudhoe Bay account for some 8% of crude oil's daily extraction in the US (ca. 400,000 barrels a day). This represents 2.6% of the oil supplies to the US market, imports included. On the announcement of the closure of the installation, oil prices rose by US$ 1.59 on the commodity exchange New York – up to US$ 76.35 per barrel. Wholesale petroleum prices also grew by over 4 cents – up to US$ 2.27 per gallon (1 gallon = 3.75 litre).[8]

b) *Druzhba* I Pipeline Failure

The oil leak from the *Druzhba I* pipeline along the section between Bryansk in Russia and Novopolotsk in Belarus contributed to a fall in pressure inside the pipe. As a result, Mazeikiu Nafta, the Lithuanian refinery taken over by the Polish PKN Orlen, has not received any crude supplies (250,000 barrels a day) via the pipeline since 29 July.

The Mazeikiu refinery imports the raw material via the terminal in Butinge on the Baltic Sea. Meanwhile, the failure did not affect oil supplies to the refinery in Novopolotsk.

Rostekhnadzor, the Russian federal authority overseeing the technical condition, among other things, of crude oil pipelines, stated that most of Russian pipelines (both those carrying gas and crude oil) are in a deplorable technical state and in need of modernisation. The majority of the installations were constructed in the 1960s and 1970s. Forty per cent of pipes are over 30 years old and susceptible to corrosion. Useful life of a pipeline – according to applicable industry standards – is 30 years.[9] The *Druzhba* pipeline is 42 years old. Additionally, the pipeline was built from the metals whose use is nowadays prohibited. The Polish section of the pipeline, similarly to the rest of the pipeline, requires extensive expansion and modernisation.[10] Over 30 pipeline failures occurred in Russia alone last year, mainly due to corrosion and operation of forces of nature.

Withholding of crude oil supplies to the Mazeikiu refinery raises questions about profitability of PKN Orlen's investment in the Lithuanian plant. The installation can operate and generate income on refining the raw material delivered by sea from Primorsk but the cost of sea transport may squeeze the originally envisaged return on investment.

7 DJ BEFORE THE BELL: BP Down 2% On Alaska Oil Field Shutdown (DowJonesNewswires, pr/07.08.2006, Onet.pl)
8 PAP, pr /07.08.2006 Onet.pl 19:37, „Koncern BP »szarpnął« światowym rynkiem" [BP has shaken the world market]
9 Reuters (02.11.2006) "Russia's pipelines are worn out-standards agency", Tanya Mosolova
10 www.pb.pl (Reuters), 16.08.2006 „Transneft nie planuje stałego odcięcia Możejek od dostaw ropy" [Transneft not planning to cut off crude oil supplies to the Mazeikiu refinery on a permanent basis]; (PAP) „Rosja może zrezygnować z tłoczenia rurociągiem ropy na Litwę" [Russia may abandon pumping crude oil to Lithuania via the pipeline]

1.1.4. Modernisation and Expansion of Polish Section of *Druzhba* Pipeline

The examples of impact of the pipeline failure in Alaska and a closure of a section of the *Druzhba I* pipeline show how important it is to maintain a properly operating downstream infrastructure. Therefore, an increase in throughput along the Polish section of the *Druzhba* oil pipeline is a necessity if the crude oil flowing through it is to create the state's fuel reserves of sorts. Following the conflict between the investor (PERN) and the contractor (Prochem-Megagaz consortium), the construction of the third line of the *Druzhba* oil pipeline has come to a standstill. Since dissolution of the agreement with the contractor on 10 November 2005, PERN has been constructing the third line itself. Seventeen kilometres of the pipeline out of the planned 117 have been laid over ten months. Such initiatives on the part of PERN should be deemed totally ineffective and unlikely to contribute to the country's energy security.

1.1.5. Naftoport

An alternative infrastructure exists to crude oil supplies via the *Druzhba* pipeline in the form of Naftoport that provides a possibility to receive crude oil from any direction in the world. Naftoport's handling capacity currently amounts to 23.0 million tonnes of crude oil annually. Combined with the docks in the Northern Port, the Gdansk terminal can handle a total of 34.0 million tonnes of crude oil per year.[11] This represents nearly the double of the annual demand of the Polish refineries. The Baltic Sea has recently become comparable, in terms of volume of Russian crude oil exports, to the Black Sea. The Russian port of Primorsk is the primary alternative to crude oil exports via Gdansk in the Baltic Sea area (its handling capacity has recently been significantly upgraded to some 62.0 million tonnes), the Lithuanian port of Butinge with a maximum handling capacity of 10.0 million tonnes per year, the Latvian Ventspils with a handling capacity of up to 15.0 million tonnes per year (however, no crude oil has been handled there since 2003) and the German port of Rostock with a handling capacity of roughly 6.0 million tonnes a year (because of restrictions on crude oil transport via the pipeline). The last port is situated on the same "section of the pipe" as the Polish Naftoport. A theoretical threat exists of a takeover of a portion of crude oil transit presently effected through Naftoport by Rostock or Ventspils. Furthermore, it needs to be pointed out that the Estonian port of Tallin handles annually some 4.0 million tonnes of crude oil supplied by rail from the pipeline's end section located in the vicinity of Saint Petersburg, near the Kirishi refinery.

Additionally, a takeover of a large portion of or even whole crude oil flowing via Naftoport by the ports in Primorsk or Nakhodka and – following the launch of by-passes on the Bosporus Straits – also by Novorossiysk, is becoming a real threat. **PERN and Naftoport will have to wage a tough pricing battle to keep even a portion of crude oil transit for themselves.**

1.1.6. Development of Naftoport

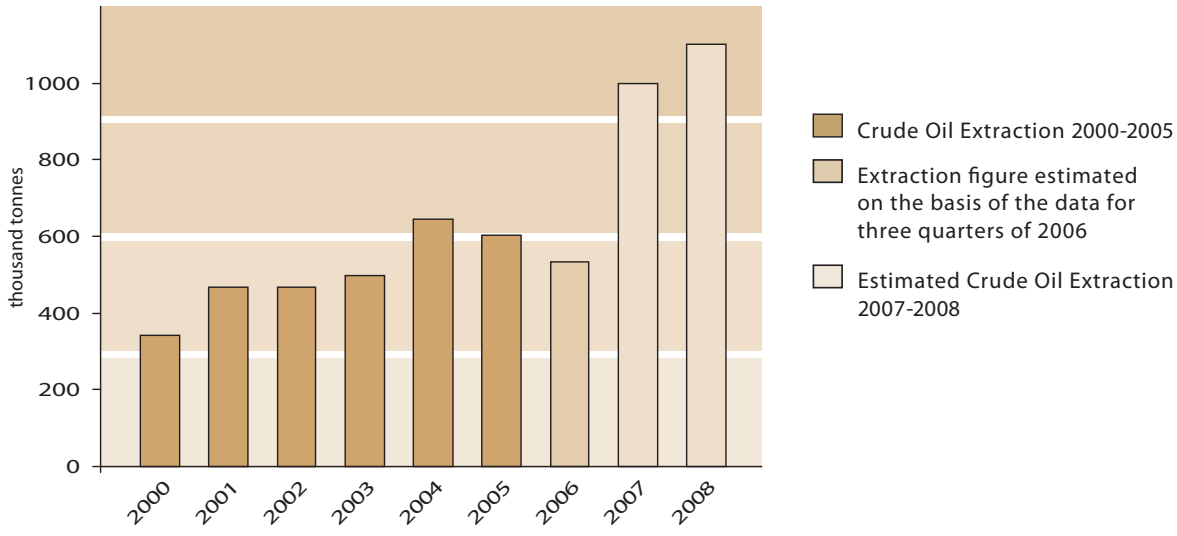
For most of the 1990s, Naftoport was virtually not utilised and its infrastructure was not modernised. At present, owing to the profits generated on handling of crude oil flowing through Poland in transit, Naftoport's installations have been extensively modernised, strengthening significantly Naftoport's position on the Baltic Sea. A major change adding to Naftoport's competitiveness was its accessibility for large tankers (in August 2003) of tonnages in excess of 300,000 tonnes which, for technical reasons, could not previously collect crude oil from the terminal. This enabled transit of Russian oil through the territory of Poland in two new directions, namely to the US and China. This transit with a volume of nearly 10.0 million tonnes and sales value of a few billion US dollars has significantly altered both the position of Naftoport and Poland's energy security compared to the preceding years. **As a result of increased transit, more crude oil flows through the territory of Poland and may be redirected in emergencies to satisfy the demand of the domestic refineries. Hence, transit of Russian crude oil via the Polish Naftoport contributes to Poland's energy security.** This was exemplified by withholding of oil supplies by Petroval (Yukos) and redirection by J&S of some of its crude oil (nearly 30%) earmarked for transit to cover the shortages in the supplies to the Polish refineries. Another example was the withholding of crude oil transport by Belarus early this year and delivery of a few hundred thousand tonnes by J&S to meet the demand from the Polish refineries. It is worthwhile to note that in both cases crude oil did not belong to the Polish refineries.

11 www.pern.com.pl

1.1.7. Railroad Tank Cars and Own Oil Extraction

Nearly 9.0 million tonnes of raw crude or finished product can be supplied using railroad tank cars. PGNiG estimates domestic oil resources at 26.1 million tonnes. Crude oil extraction from domestic deposits amounted to 602,300 tonnes in 2005.[12] Its increase is envisaged although the 2008 extraction forecast, as per the prospectus, has been revised from 1.4 to 1.1 million tonnes of crude.[13]

Fig. 3. PGNiG Domestic Crude Oil Extraction, 2000-2008



Source: Own materials on the basis of www.pgnig.pl [14]

As shown in the chart above, PGNiG forecasts are very ambitious. The recent downward revision of the 2008 extraction volume is related to the information on the actual size of oilfields in Poland (proved smaller than originally thought).

1.1.8. Further Infrastructure Expansion

Further expansion of infrastructure in the form of the Odessa-Brody pipeline seems real provided that utilisation of a minimum of 50% of its throughput capacity can be assured on the "take or pay" principle. If, however, the pipeline is constructed, **it would be hard not to notice that a large proportion of crude oil (so-called Caspian crude) will also flow across the Russian territory** and must be loaded onto tankers in the Russian port of Novorossiysk to reach Odessa. According to Yuriy Boyko, the Ukrainian minister of energy, Azerbaijan will be sending 6.0 to 7.0 million tonnes of crude via Ukraine to Europe in 2010. This is an ambitious prospect but in the light of numerous prior announcements regarding the operational date of that transportation route and given the actual work progress, that deadline also seems unlikely to be kept.[15]

1.1.9. Contracts for Crude Oil Supplies

As far as existing contracts for crude oil supplies are concerned, the situation in the Polish crude oil market differs from that of the gas market. At present, some 80% of crude oil deliveries are contracted for 3 to 5 years ahead under existing contracts. Additionally, some of them are well secured with financial guarantees, granting the refineries comfort in developing their spot purchase policies. **The Polish refineries may, at any time, order crude oil from any location in the world and receive it with no technical problems, should a political or economic need arise.** This also provides for real possibility of price competition between suppliers from Russia and the firms trading in crude oil or extracting crude oil in other regions of the world.

Lotos Group is interested in diversification of oil supply sources and, consequently, implements technological changes adapting the refinery to processing of high-sulphur and heavy types of crude oil and to generating high-quality products therefrom.

12 http://www.pgnig.pl/
13 http://www.pgnig.pl/
14 The 2006 extraction figure estimated on the basis of the data for three quarters of 2006.
15 www.wnp.pl

In October and December 2006, the refinery in Gdansk received two crude oil deliveries by sea. Two tankers carrying crude from Kuwait Petroleum Corporation sailed into the Gdansk port, each carrying one million of barrels in its tanks. Both deliveries were made on a test basis. The choice of KEC crude is consistent with the direction of technological development of Lotos Group refinery and if it is found that the raw material can be processed by the refinery in Gdansk (the Kuwaiti crude is heavier and contains more sulphur), a long-term contract will be signed.[16] The economic viability of such deliveries is not yet fully known. Some sources speak of an increase in purchase costs of as much as 10 to 15% in relation to Urals.

1.1.10. Contracts

Out of some 17.5 million tonnes of crude processed annually jointly by PKN Orlen and Lotos Group, oil is delivered under fixed contracts by:

- J&S Service and Investment – 8.0 million tonnes annually. The crude purchased by J&S originates from over 20 oil producers in Russia and Kazakhstan. The contract is secured with financial guarantees and in the event of shortage of oil supplies via the pipeline, the supplier is obliged to deliver Urals or another crude by sea for a period determined by the contract. Such obligation is secured with an irrevocable bank guarantee issued by a so-called A-class bank.
- Petroval – the contract is not being performed. Petroval's crude came from Yukos. Currently, the oilfields in Yugansk constituting the main resources of Yukos have been taken over by Rosneft. An arrangement has recently been concluded between PKN Orlen and Yukos' receiver whereby PKN Orlen renounced from its claims totalling ca. US$ 110.0 million. To all intents, this is the effect of the agreement reached by PKN Orlen and Rosneft (PKN Orlen previously signed a contract for crude supplies with Petraco Oil, Rosneft's agent). As a result, Orlen not only waived its claims worth US$ 110.0 million but also increased its dependence on supplies from Russia.
- Petraco – 3.36 million tonnes. The crude will come from Rosneft's oilfields, that is from a company fully controlled by the Kremlin whose position is built on acquired oilfields formerly owned by Yukos, including the largest one in Yugansk. The contract will be in force until the end of 2011 with a one-year extension option. Financial guarantees: EUR 200,000 in the form of an irrevocable banking letter of credit.[17]

"Well secured" fixed contracts shall be understood to mean that all the deliveries will be secured in such a manner that in the event of the supplier's default, an immediate and irrevocable possibility exists of covering the loss arising from the difference in prices of the crude purchased from another location. **Incorporation of such provision (the so-called "performance bond") in all fixed contracts concluded with suppliers would be desirable. This is not the case at present and may be treated as a threat to energy security.**

1.2. Warehouses of Crude Oil and Petroleum Products vs. Energy Security

1.2.1. Growing Competition from Baltic States

Lithuania, Latvia and Estonia have been intensively expanding their crude oil and liquid fuels warehousing capacities. Numerous fuel tanks are being erected on the harbours that enhance commercial attractiveness of the ports on the Baltic Sea as well as improve energy security of these countries (a portion of crude oil and fuels must be maintained by commercial companies).

The Polish ports, in particular Szczecin and Gdynia, have seen their competitiveness decline. As a result, fuel companies have been attracted to the ports located in Lithuania, Latvia and Estonia. Poland may miss its opportunity to become a key transit point for energy inputs. The existing oil processing installations should be utilised not only to satisfy Poland's demand for energy. The State Treasury could, indirectly or directly, reap even bigger benefits from transit of crude oil and petroleum products. Expansion of warehousing space for liquid fuels and crude oil would be especially good for further development of the Gdansk Port which is sufficiently deep to welcome the largest tankers.

16 www.tvbiznes.pl
17 gazeta.gospodarka.pl

Growing competition in the market for transit of energy inputs on the part of Baltic states and expansion of Russian pipelines stretching to the Far East is not only dangerous for commercial reasons. Bilateral European contracts for stocking fuel reserves may soon be signed. Then, producers and commercial companies will no longer be obliged to store obligatory fuel reserves in the country of their operations but will be able to keep fuel stocks in neighbouring countries. "Migration" of strategic fuel stocks abroad will then proceed for two reasons – lack of attractive stock locations (i.e. close to handling installations and pipelines) or lower costs of warehousing oil product or crude oil.

1.2.2. Strategic Reserves and Warehousing Infrastructure

According to EU standards and to the Polish Act on State Reserves and Obligatory Fuel Stocks (Journal of Laws of 2003 no. 24 item 197 article 15), **maintenance of 90-day fuel stocks and/or crude oil reserves is necessary. The Material Reserves Agency (ARM) is charged with supervising fuel and raw material reserves. The obligation to maintain fuel stocks rests with the Agency but also with private oil companies which shall store a proportion of their products or crude oil.**

Poland has time until 2008 to comply with EU requirements regarding fuel reserves. On 29 November 2006, the Council of Ministers adopted the new draft act *"on stocks of crude oil, petroleum products and natural gas, and on principles of dealing with threats to the country's fuel security and when fulfilling the international commitments at the time of disruptions in the crude oil market"* developed by the Ministry of Economy. The act will constitute the legal basis for meeting the standards set by the International Energy Agency[18] (IEA) the membership of which is sought by Poland.

The level of ARM's current stocks maintained within the framework of the state economic reserves amounts to some 675,000 tonnes of crude oil and to some 60,000 tonnes of finished products, while the annual cost of their maintenance reaches ca. PLN 60.0 million.

The estimated cost of establishment of additional stocks will approach PLN 260.0 million[19]. The annual cost associated with maintenance of such additional volume of state stocks in 2007 and subsequent years will amount to roughly PLN 15.5 million.

The change in the manner of calculation of internal consumption introduced under the act, consisting in the change of the scope of goods incorporated therein, will increase the basis on which obligatory stocks are calculated by some 4.44 million tonnes. This figure has been derived from the difference between the volume of imported crude oil and petroleum products and the volume of consumed products listed in three product groups on which obligatory stocks are currently established.

For the oil sector and in fact for producers and traders importing crude oil and fuels, this means an obligation to establish and maintain additional obligatory stocks of roughly 980,000 tonnes of crude oil as of 2007 and of additional 40,000 tonnes as of 2008. The costs involved in establishment of such obligatory stocks are estimated at a total of some PLN 1,400.0 million by the end of 2008. The estimated annual cost associated with maintenance of that additional volume of crude oil obligatory stocks amounts to some PLN 77.0 million.

The cost of erection of tanks earmarked for maintenance of the increased volume of obligatory stocks, estimated at roughly PLN 770.0 million, shall be added to the aforementioned expenditure. The expenses associated with construction of tanks shall be spread among the entrepreneurs building tanks for the purpose of maintenance of their own stocks and among the entrepreneurs providing warehousing services.[20]

For the point of view of the state, the more tanks there are, the better it is. Regardless of who erects them and who owns them. It would suffice for the state to require the fuel companies to establish reserves of liquid fuels and crude oil and enforce that requirement. Some of the tanks built by the companies should be utilised for storing strategic reserves of fuels and crude oil.

18 www.iea.org
19 The cost estimate is based on the assumption that additional stocks resulting from the change in the manner of calculating the average daily internal consumption will be established in the form of crude oil.
20 Ocena Skutków Regulacji – www.mgip.gov.pl

The consequences of the fire at the Mazeikiu refinery, in particular the closure of the Mazeikiu section of the *Druzhba* pipeline, demonstrated that an energy crisis caused by external factors may also take place in Poland. Establishment of greater strategic reserves of liquid fuels and crude oil is definitely in the interest of the Polish state. Construction and management of tanks by private companies is beneficial for the state for financial reasons – encouragement of private businesses to erect fuel terminals and warehouses by enabling them to construct such facilities in attractive locations (i.e. close to the handling and transit infrastructure) will shift a portion of the costs of construction of warehousing space from the State Treasury onto private entrepreneurs. In return for the possibility to construct tanks at such locations, the companies would be obliged to store strategic reserves in some of their facilities.

In the surroundings of handling ports in Poland, there is room to build the adequate number of tanks to raise the strategic reserves to the level prescribed in EU legislation. Warehousing areas can be found in Gdansk, Gdynia and Szczecin – on the premises of Siarkopol, Naftobazy and Port Północny.

The above locations are highly attractive to fuel companies as they are situated in the vicinity of transit and handling installations, which would allow the companies to use them for commercial purposes. The state-owned operators of terminals and pipelines would generate income on transport of crude oil and petroleum products, while the State Treasury would charge transit fees and levy taxes.

Vicinity of warehouses and handling installations is also advantageous from the point of view of the state's energy security – in the event of a fuel crisis, strategic reserves can be drawn upon rapidly and easily and at a lower cost than it would have been the case it they were kept at locations with less developed handling and transit infrastructure.

1.2.3. Impediments to Establishment of Fuel Reserves by the Private Sector

Privately-owned fuel companies (having no State Treasury among their shareholders) face major difficulties when building warehousing infrastructure in port areas near existing fuel installations.

On the one hand, in spite of significant transparency of their actions and readiness to make large investment benefiting both them and the State Treasury, private businesses encounter high level of mistrust and lack of assistance on the part of state administration.

On the other hand, their efforts are impeded by other companies which own the land and fear competition.

Negative consequences of the failure to let companies without participation of the State Treasury build tanks in the vicinity of existing fuel terminals may include:

- Fuel price growth (rising costs of transportation due to less attractive location of tanks, i.e. more distant from handling and transport infrastructure).
- Transfer of some operations and investment abroad. New tanks/warehouses will be built in the border areas of neighbouring countries (Germany, Slovakia, Lithuania, Latvia and Estonia), leading to:
  - a decline in the volume of fuels stored in Poland;
  - a fall in income earned by Polish regions from the fees associated with the company's operations in a given location; and
  - a fall in revenues of state-owned operators of fuel terminals and pipelines.

1.2.4. Private Sector vs. Strategic Reserves – Example of the European Union, the US and of International Corporations

Strategic Fuel Reserves in the European Union

The EU countries are obliged to establish and maintain 90-day reserves of crude oil and petroleum products pursuant to Directives 68/414/EEC and 98/93/EC.

According to the most recent generally available data, most countries of the "old Europe" meet the standards of the aforementioned directives. Only Italy and Austria, on the evidence of the figures for the last quarter, have failed to comply with the standards set (Austria's non-compliance being negligible). On the other hand, among the countries of "new Europe", only Slovenia and the Czech Republic managed to establish reserves of fuels and crude oil for a minimum of 90 days.[21] Similarly to other countries, Polish fuel reserves are made up of:

- State stocks created by the Minister of Economy and maintained by ARM; and
- Obligatory stocks established by crude oil and fuel producers and traders.

Individual EU countries manage their fuel reserves differently but none of the systems excludes the private sector from warehousing stocks (even those purchased within the framework of the state budget). In fact, fuel stocks are frequently stored, to a large extent, in the installations owned by private enterprises and are periodically replaced under purchase/sale transactions concluded with reliable firms trading in such raw materials.

France

In France, SAGESS (Société Anonyme de Gestion de Stocks de Sécurité) is responsible for establishment and management of fuel reserves according to the guidelines issued by CPSSP committee (Comité Professionnel des Stocks Stratégiques Pétroliers[22]). The committee is composed of thirteen members (nine appointed by various organisations grouping oil companies, two independent members and two members appointed on the recommendation of the French Ministry of Finance and Economy), the state controller and the commissar of the Department of Energy at the Ministry of Economy (DIREM). SAGESS shareholders include almost all companies of the French oil sector (shareholders represent roughly 95% of the French market). SAGESS owns only one fuel warehouse (36,000 cu. m. – 32,400 tonnes) – 99% of reserves are stored by its trade partners. SAGESS uses nearly 140 warehouses owned by some 50 various businesses, of which most are shareholders of SAGESS, where more or less 80% of stocks are kept. Stocks are transferred across the country under swap contracts concluded between the parties.[23]

Netherlands

The Dutch COVA (Centraal Orgaan Voorraadvorming Aardolieprodukten) is independent from producers and traders (no representatives of the industry sit on the agency's board). COVA operates as a foundation and its activity is not subject to taxation. Its supervisory board is appointed by the Dutch Minister of Economy and chaired by the Director of the Department of Energy. The foundation is managed by a two-person board. COVA selects the companies which take part in tenders for purchase, sale or replenishment of fuel reserves. At present, crude oil accounts for one half of COVA's fuel reserves, whereas the second half is made up of petroleum products. In addition to reserves maintained by COVA that are under strict state control, some 1/3 of all Dutch reserves are maintained by refineries[24].

Federal Republic of Germany

In Germany, the agency responsible for fuel reserves is EBV (Erdoelbevorratungsverband) whose shareholders include over 100 companies of the German oil sector (all the refineries and businesses trading in crude oil and petroleum products). Three representatives of the federal government, three representatives of the refineries and three representatives of traders sit on EBV's nine-member supervisory board. The supervisory board appoints the two-person management board. Unlike the Dutch COVA, EBV allows larger oil companies to be involved in the contracts for stocks warehousing and replenishment. The contracts are usually long-term – even up to 15 years.

21 ec.europa.eu/energy
22 www.cpssp.fr
23 www.sagess.fr
24 A presentation by Henrik Jan Beverdam, COVA's head, from www.iea.org/textbase/work/2002/zord/beverdam.pdf

In 2005, federal fuel reserves amounted to roughly 13.4 million tonnes of crude oil and 11.8 million tonnes of petroleum products. EBV stores crude oil mainly in underground tanks. More interestingly, less than half of crude oil is stored in underground tanks belonging to EBV. The remaining underground warehouses are owned by third parties. Petroleum products are warehoused in ground-level tanks, some of them located abroad in the countries with whom Germany has signed bilateral agreements for storage of strategic reserves (Netherlands, Belgium, Italy and France). A similar situation exists in some other EU countries.

In fact, German reserves are higher than the previously announced 25.2 million tonnes as enterprises and refineries stock up the raw material and its products on their own.[25] The majority of crude oil reserves established within the framework of EBV is stored in the surroundings of Wilhelmshaven because of the vicinity of the port's handling terminals and the connection with the domestic system of oil pipelines.

United States

The United States hold the world's largest crude oil reserves. In 2005, they amounted to over 1,008.0 million barrels (ca. 144 million tonnes), with one third (96.7 million tonnes) stored by the private sector.[26] Two-thirds of the US reserves of crude oil form the so-called Strategic Petroleum Reserve. The Reserve covers also crude oil stocks kept outside the United States under foreign or commercial agreements on oil warehousing.

Even the US Strategic Petroleum Reserve which is purchased from the federal budget and stored in underground salt caverns are managed by a private corporation, DynMcDermott Petroleum Operations Company, which was established specifically to manage those resources.

DynMcDermott is a corporation that leverages the synergy of four private businesses – its shareholders – namely DynCorp – acquired in 2003 by Computer Sciences Corporation (CSC); New-Orleans-based International Matex Tank and Terminals (IMTT), McDermott International and Jacobs Engineering. DynMcDermott manages and maintains warehouses of strategic stocks and the related pipeline system at the request of the US Department of Energy.[27]

International Corporations

A good example of contribution of private firms in the sector of port terminals and fuel warehouses on an international scale is the Dutch Royal Vopak (listed on the Amsterdam Stock Exchange, 2005 revenues of EUR 683.6 million, net profit of EUR 93.2 million, employment: 3,433) which owns 75 terminals in 30 countries of the combined capacity of 20.0 million cu. m. (18.0 million tonnes).[28]

Vopak manages the majority of the installations through its fully-owned subsidiaries but sometimes it also establishes joint ventures to build terminals. For instance, the companies owning terminals in Spain (Terquimsa Barcelona and Terquimsa Tarragona) and Estonia (Pakterminal or the port of Muurga) belong to the Dutch only in 50%. Similar joint ventures have been established in China and Thailand.

The statutory provision on the producers and traders' obligation to build up stocks of crude oil and fuels would suggest that encouraging growth of private fuel bases is in the interest of the state, at least because private enterprises partially create the state's fuel reserves. Therefore, private companies are allowed, all over the world, to expand existing or build new port terminals and fuel warehouses at locations convenient for their development and maintenance.

25 http://www.verivox.de/News/ArticleDetails.asp?aid=10952
26 www.eia.doe.gov
27 www.spr.doe.gov
28 www.vopak.com

1.2.5. Conclusions

The example of both the United States and individual EU countries shows that involvement of the private sector in expansion of strategic reserves of liquid fuels (both crude oil and petroleum products) is desirable to ensure energy security. Storage of energy inputs and products by private companies does not preclude in any way, and merely complements, the leading role of the state in this segment of the energy market. Skilful stimulation of private business to expand fuel bases will not adversely affect and may only raise the level of the country's energy security. A larger fuel base in the country's territory shall automatically signify higher reserves of the raw material and petroleum products.

The government (directly or indirectly through State Treasury companies owning the land) may grant building permits exclusively to the companies which will make available some of their tanks (e.g. 30%) for storage of obligatory reserves, guarantee in advance availability of tanks for a specific period of times (e.g. 20 years) and rent them at a preferential price (fixed price plus the inflation rate).

Another solution consists in leasing the tanks erected by state-controlled companies to private businesses. This will ensure ownership control by State Treasury enterprises, while allowing private businesses to generate income on lease of the installations and to recover, in the long run, the construction costs. At the same time, private entrepreneurs will be obliged to maintain fuel stocks in the tanks, thus enhancing the country's energy security.

An alternative and comprehensive approach would involve establishment of a joint-stock company whose shares would be held by the entities operating in the oil market and by the State Treasury (directly or indirectly via, for example, ARM). Such joint-stock company would be in charge of creation and management of strategic reserves (following the example of French SAGESS or German EBV). The State Treasury would have a decisive impact on the course of and control over the investment project, while transferring the costs involved onto private investors.

1.3. Diversification of Crude Oil Supplies to Poland

1.3.1. Limitations of Diversification

Due to the recent "information noise" related to the issue of energy security and diversification of oil supplies, it should be noted that in the case of the crude oil market (unlike that of natural gas) the necessary infrastructure exists to carry out immediate diversification from any location in the world or that of a finished product, i.e. fuel, should any problems arise with suppliers from the East.

During the last shortfall in crude oil supplies to Poland related to the row between Belarus and the Russian Federation, Piotr Naimski, deputy Minister of Economy in charge of the energy sector, was able to make public assurances that Poland's energy security is under no threat as the Polish refineries may import sufficient volumes of oil by sea through Naftoport.

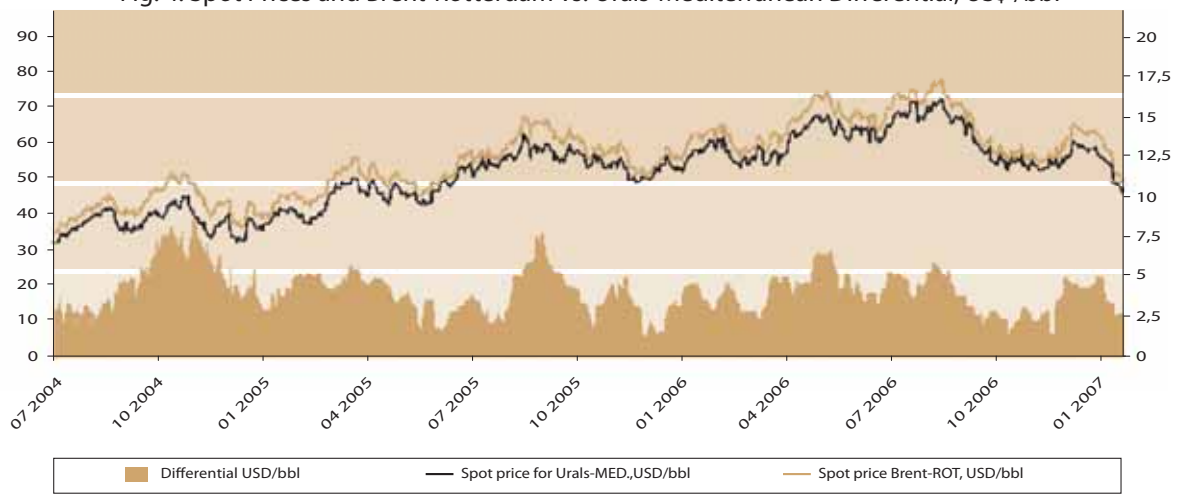
The following factors restrict such diversification: technological constraints on processing crude oil other than Urals (the cost of adaptation of the installations in both refineries would require investment that is estimated, on a preliminary basis, at some PLN 500.0 million), economic competitiveness of supplies from Russia and lack of clear objectives of such diversification. After 11 September 2001 and as a result of the process of destabilisation of the political situation in the Middle East, all major consumers of crude oil (the US, China and the EU) have sought to maximise supplies of inexpensive crude from Russia and Kazakhstan.

The purchase of the Lithuanian oil refinery in Mazeikiu by PKN Orlen can hardly be described as a move towards diversification of crude oil supply sources but rather as an attempt to build the company's market position and raise its stock value. For the Polish government, on the other hand, investment in Mazeikiu signifies tighter economic and political cooperation with Lithuania and expansion of Poland's sphere of influence in the Baltic region. Until recently, the Mazeikiu refinery had been sourcing the raw material from a branch of the *Druzhba* pipeline (through which mainly Russian oil flows) and, following its shutdown, the refinery must import the crude by sea from the nearest port - the Russian Primorsk. In the context of the Polish government's declared drive towards diversification of sources of energy input supplies, the purchase of the Mazeikiu refinery dependent on the Russian oil is a Pyrrhic victory. Although, as previously mentioned, it does raise the company's stock value and strengthen its position in the region.

1.3.2. Reasons for Purchasing Crude Oil from Russia

The main reason for purchasing REBCO oil (a mixture of various types of Urals crude) by the Polish refineries is the significant difference between the price of the Russian raw material and that of the oil imported from other directions, e.g. the mixture (Brent, Fortis, Oseberg from the North Sea). In the early 1990s, large quantities of crude oil were imported via Naftoport from the Middle East but that was due exclusively to a decline in crude extraction in Russia and to the difficulties encountered when purchasing Urals oil. The crude from the Middle East was more expensive than the Russian one, which had an adverse effect on the refineries' profits (their production balancing, at the time, on the threshold of profitability and generating financial losses). Crude oil prices in the international markets were low. Since then oil price growth has altered the situation significantly. Previously, the price discount on Urals oil in relation to Brent oil fluctuated and ranged, depending on the price of the raw material in world markets, from US$ 3.00 to US$ 9.00 per barrel. Recently, with oil prices varying from US$ 55.00 to US$ 60.00 per barrel, it amounts to more than US$ 5.00. This discount, together with the additional "geographic premium" (recently estimated at US$ 2.00 per barrel), constitutes the primary reason behind large profits of the Polish refineries in recent years and provides financing for their modernisation projects.

Fig. 4. Spot Prices and Brent-Rotterdam vs. Urals-Mediterranean Differential, US$ /bbl



Source: PKO BP Brokerage House, daily report from 16 January 2007

Last year, the differential could be seen to shrink slowly. Without doubt, that was largely attributable to new distribution channels of Russian oil (new pipelines and new buyers, namely China and the US), the Russian suppliers' strategy of optimising financial performance by leveraging their monopolist position in many regions and to the unstable situation in the Middle East.

1.3.3. Fuel Pricing Mechanism in Poland

The Polish refineries sell the finished product at filling stations at the prices corresponding to the world quotations of finished good supplies in Rotterdam (in other words, at the price reflecting the cost of production of petroleum or diesel from the raw material purchased by Western refineries and inclusive of the cost of transportation). This mechanism allows for such pricing of the product by PKN and Lotos as to maximise profit because the price set renders imports of the finished product manufactured at another refinery not profitable. Meanwhile, thanks to purchasing the raw material at the prices discounted against Brent and incorporating the so-called "land premium", that is a price discount derived from the geographic location "near the pipe", Polish refineries are able to report historic record profits. Theoretically, one could assume that a possibility exists for reducing the retail price of fuel sold at filling stations through application of the mechanism determining the cost of such fuel based on the price of purchased inexpensive Russian crude oil. Such solution could theoretically be adopted in Poland (although it would not be welcomed by investors and liberal economic mass media). Product prices at filling stations would be reduced, however, at the expense of squeezing of the refining margin and, thus, of the refineries' profits leading to a decline in their stock value (affecting the value of the holdings of the State Treasury). Another factor enabling lowering of the end product's price would be a reduction of the excise tax and of the fuel charge which, combined, currently represent about ⅔ of the final price.

1.3.4. Renouncement from or Reduction of Supplies from Russia

Theoretically, almost immediate renouncement from any quantity of imported Russian oil and sourcing of oil from another location in the world is also possible. The necessary infrastructure exists enabling execution of such operation at any time. Without doubt, this would represent a real diversification of crude oil supplies. **Such operation would be consistent with the strategy of growing independence from the Russian raw material but would go against the economic interests of the country that should ensure competitiveness of the economy by offering less expensive fuel or growth in the stock value of refineries.** Technical problems and the cost of adaptation of the refineries to the processing of another type of oil are difficult to estimate. However, contractual provisions (fixed supplies) and the cost of termination of contracts would be a constraint in the case of renouncement from supplies of Russian oil. In addition to the contractual sphere, an ongoing demand exists for spot deliveries (currently accounting for some 25%) such as oil supplies to Naftoport by sea from any direction. The cost of purchase of such oil would be significantly higher (the Brent/Urals differential and cost of transportation). In the case of supplies "from the sea", another problem also arises, namely that the least expensive alternative to supplies via the *Druzhba* pipeline are oil deliveries by tankers from the Russian port of Primorsk. In such case, one could not talk of any diversification as this would still be the same Russian Urals for which, additionally, more money would have to be paid given the cost of the crude's transportation by tankers and handling fees in Primorsk and Naftoport. Secondly, price of Russian oil remains attractive even if the crude is delivered from Novorossiysk on the Black Sea (Urals Med.). When it comes to economic parameters, oil supplies from non-Russian oilfields rank only third in terms of price attractiveness. Therefore, diversification of oil supplies through launching of sea deliveries could lead to an absurd situation where Russian oil is transported by tankers at a price a few dollars higher per barrel than that of the crude imported via the pipeline. Additionally, losses estimated at roughly PLN 100.0 million annually would be sustained by the state-controlled PERN that would be unable to execute oil transit (under such scenario, the pipeline would operate only one way and, technically, it could not be used for pumping oil the other way). Summing up, if we were to make a hypothetical assumption, crude oil originating from other sources would cost up to US$ 50.00 per tonne more times 17.5 million tonnes, i.e. US$ 875.0 million, plus PLN 100.0 million in PERN's lost income, totalling some PLN 3.0 billion of annual "losses" in the event of diversification of the entire oil demand.

1.3.5. Brent/Urals Differential

Currently, the possibility to source inexpensive Russian oil represents an opportunity for the Polish refineries rather than a threat. An assumption can be made, with a substantial degree of probability, that the current differences between the price of Brent and Urals oil constituting the primary argument in favour of imports will start to even out as the volume of crude received by China, India and Japan via the pipelines presently under construction rises (nowadays, Russian oil is delivered to China in tankers and railroad tanks). A substantial increase in demand on the part of China through establishment of the necessary infrastructure for transporting the crude and even a slight rise in demand in the US may result, **as early as in 2007, in a decline in Poland-bound oil supply and gradual shrinking of the price differential between Brent and Urals oil and, thus, contribute to enhanced economic attractiveness of crude supplies from outside Russia.** Consequently, in a natural way – through the operation of free market forces – the direction of oil stream flowing via Naftoport may be reversed.

1.3.6. Impediments to Diversification associated with Crude Oil Price

Contrary to the opinion widely publicised in the past years, Poland possesses adequate technical infrastructure to pursue diversification of oil supplies. The reasons for importing oil from Russia are technological and economic. Nevertheless, a political decision to import oil from a non-Russian source via Naftoport, in addition to political repercussions, would have a serious adverse economic impact on the profits of Polish refineries and PERN. It needs to be stressed at this point that, from a purely legal point of view, the Polish government has no instruments to "coerce" the management boards of PKN Orlen or Lotos Group to act to the economic detriment of their companies by purchasing expensive inputs (this would require a statutory regulation). Imports of more expensive crude would affect the price of the end product at filling stations. Another option would be to reduce retail prices at filling stations by leveraging real advantages of low pricing of the Russian Urals and by squeezing the refining

margin. That move would stimulate the economy at the expense of shareholders. It seems of paramount importance to stress that there is room for practically any political decision on diversification. Such decision would be restricted solely by legal (e.g. statutory coercion of the management boards of PKN Orlen and Lotos Group to diversify and buy non-Russian oil) and media considerations. **Meanwhile, the Polish government is free to purchase, at any time, oil from sources other than Russian, for instance, in order to replenish its strategic reserves.**

1.3.7. Supplies from Non-Russian Sources vs. Economic Security

The most rapid method of enforcing diversification would be, regardless of economic and legal considerations, the decision to launch oil imports from non-Russian sources at the level of 12 to 13% of the annual consumption. This would mean a monthly purchase of one tanker, i.e. some 130,000 tonnes and would not cause major technological disruptions. **The most important thing is that oil imported in such volume, given the capabilities of the technological process, would not substantially affect the refineries' bottom line and the product's price (with the additional cost per one litre of fuel amounting to roughly 1 grosz).** It would represent a meaningful **political and media success,** while not impacting the relation with the previous and current crude oil suppliers, provided that this development will be presented to the general public as an **increase in oil processing capacity (e.g. increased oil processing capacity at Lotos) and not as supplanting of the previously delivered Russian or Kazakh oil.** That type of diversification – which should be stressed – would have, however, primarily a "propaganda" character and would in fact represent a mere "dummy" of the long-term strategy.

1.3.8. Growth Directions

The long term energy security strategy in the case of possession of the necessary receiving infrastructure requires investment in oilfields. The key things is the long-standing collateralisation of the Polish oil industry with the guarantees of access to up-stream oil extraction. The current profits of PKN Orlen or Lotos Group should be allocated to gaining direct access to oil extraction rather than investment in distribution or processing. By pursuing the strategy of building its own value and strengthening its competitive position, PKN ORLEN actively develops its own prospecting and extraction business which will allow, in the not so distant future, for gaining access to crude oil deposits. The company's plans foresee gradual increase in the volume of crude extraction from 0.4 million tonnes in 2007 to 4.3 million tonnes in 2015.[29] The Polish company would like to allocate around US$ 130 million annually for acquisition of oilfields over the next three years. In the subsequent five years, the annual spending on oilfield purchase would reach US$ 440 million. At that point, PKN ORLEN will probably engage itself in prospecting and oilfield exploitation.[30] Such investment would have to fulfil the conditions of long-term safety. From that point of view, most reasonable seems investment in oil extraction in Canada, Nigeria, Angola or Iraq, and not in Russia or Kazakhstan. It needs to be stressed that in the context of high oil prices, a typical conventional approach to investment in extraction may be very costly and will not necessarily rapidly generate the anticipated results. Therefore, other unconventional solutions should also be considered as real prospects exist for achieving that goal without the need for committing gigantic funds to acquire small shareholdings in oilfields. The largest reserves of unexploited oil are currently held by Canada (bituminous sands). They meet investment criteria and offer a guarantee of security given the country's stable political and economic situation. Theoretically, one can assume that at the current break-even point of the extraction cost in Canada amounting to US$ 27.00 per barrel, an up-stream investment should be roughly US$ 2 billion spread over some 10 years. This would ensure possible annual extraction of around 100 million barrels and would, at the same time, require annual investment of about US$ 200 million, which, at the current profits of PKN Orlen alone exceeding one billion of US dollars, seems real and feasible.

It is quite likely that crude oil extraction from Canadian deposits may be commenced within 3 years (when first oil begins to flow) at a relatively bearable investment burden and while ensuring maximum safety of deposits. Nigeria and Angola (which should account for some 25% of PKN Orlen's foreign extraction) may rank second in terms of attractiveness of extraction and as an element of extraction diversification. **Only investment in oil extraction in stable regions of the world assure a possibility of real and not virtual diversification of supply sources.** For economic reasons, it is certain that such

29 http://www.biznesnet.pl/
30 http://www.plastech.pl/

investment would not entail physical oil imports from the source to Naftoport as this would not represent a financially viable option. If an investment were to be made presently into upstream oil extraction, it would be desirable and viable to sell the raw material in international markets to maximise selling prices while continuing to purchase less expensive Russian oil for Polish refineries. **Nevertheless, access to such deposits would guarantee utilisation of sourced oil in the face of a direct threat to Poland's energy security as a result of absence of supplies of Urals or other types of oil in world markets.**

The necessary condition is to make investment in politically stable regions. The strategy adopted by the current management board of PKN Orlen seems different. During his visit to Moscow on 1 November 2005, Igor Chalupec, PKN Orlen's management board president, announced PKN Orlen's commitment to projects of exploitation of Russian crude oil deposits. Such projects are at a preliminary stage only, work is underway on the investment plan. The Polish company is planning to present the relevant details at the beginning of 2006.[31] The exact plans of PKN Orlen or Lotos Group's involvement in extraction projects remain unknown and seem to be primarily media statements. Possible cooperation with a company like Rosneft would contradict the government's political declarations. The strategy of investing in oilfields in the territory of Russia does not in any way alter Poland's energy security in terms of diversification. On the contrary, it strengthens Poland's reliance on Russia offering the latter a potentially very powerful instrument of pressure.

A slightly bigger progress can be seen in the initiatives pursued by private entrepreneurs: Ryszard Krauze (stakes purchased in oil extraction companies in Kazakhstan) and Jan Kulczyk (a bid submitted for the purchase of a shareholding package in the Libyan Tamoil). Despite the expectations of some of the media and probably some of decision-makers and the general public, oil from those deposits does not necessarily have to end up in Polish refineries. Whether the raw material from Kazakh oilfields will be sent to Poland depends exclusively on the project's financial viability. Also, whether the oil originating from Kazakh oilfields were to flow, sooner or later, through the Russian system of oil pipelines.

Example of strategic utilisation of crude oil deposits located abroad

The Indian government made a similar decision in 2005 to invest in oilfields in Russia but for India this is an element of reducing reliance on oil from the Middle East. In an attempt to diversify oil supplies to India, the Indian state-controlled Oil and Natural Gas Corporation (ONGC) purchased 20% of shares in the Sakhalin-1 project – i.e. exploitation of crude oil deposits in the Ochotsk Sea.[32] However, importing the extracted oil is highly troublesome – the port on Sakhalin is too small to welcome large tankers. Still worse, the port's waters are frozen from December to May. Therefore, ONGC is planning to use smaller vessels to transport the crude to less distant ports in South Korea. It makes a better business sense for India to swap for ChinaOil Corp.'s oil stored in tanks in South Korea (China have a limited storage capacity for its oil stocks) than to transport its own oil from Sakhalin.[33] Relying on a mechanism similar to that used by the government of India but adopting a reverse approach, Poland should invest in deposits of oil other than Russian and, like India, make swap transactions (sell the oil extracted from its own fields in international markets and import less expensive oil from Russia like India which, despite investment in Russia, continues to import the crude from the Middle East).

1.3.9. Summary

There is no doubt that the strategy of the Polish government regarding oil supplies should aim to maximise energy security. The top priority in this respect should be continuous modernisation and development of the possessed import and storage tank infrastructure (Naftoport terminal, railroads, Odessa-Brody pipeline, 3rd line of the *Druzhba* pipeline, and oil tanks erected by private businesses) and expansion of domestic extraction. An equally important task would be to verify whether the existing contracts for oil supplies are adequately secured in legal and financial terms, whether the supplies originate from one or a number of producers and whether the deliveries made thereunder may be impacted by politics. Imports of some 130,000 tonnes of oil (one tanker per month) ensuring an over 10% diversification and raising the retail price of fuel by a mere 1 grosz, would ensure balance between economic security and the drive to ensure imports from non-Russian sources. In the long-term perspective, Polish refineries should, however, make investment in oil extraction in Canada (¾) and in Nigeria or Angola (¼) where, owing to an investment of US$ 2 billion that can be borne by Polish refineries and spread over 10 years, access could be assured to 70% of crude oil required by Poland.

31 Interfax, 01.11.2005. "PKN Orlen considers Russian oil production projects"
32 Neft Trader Weekly vol. 5, issue 40, 07.10.2005. "India to bring home its share of crude from Sakhalin-1 project"
33 ChinaWire vol. 11, no. 208, 25.10.2005. "ChinaOil Leases 2.7 million bbl crude storage facilities in South Korea"

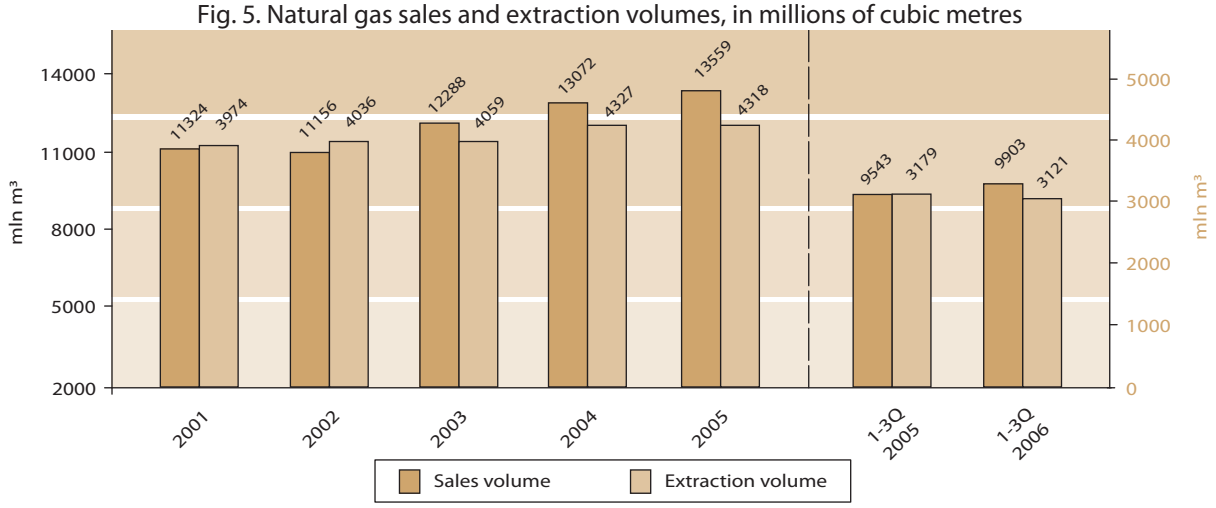
1.4. Natural Gas Market in Poland

The information on the gas market is provided in this report solely to the extent enabling comparison of the situation in the crude oil market and in the natural gas market. Both markets are frequently confused although their situation in terms of energy security, diversification and economic condition differs substantially.

1.4.1. Market Volume and Value

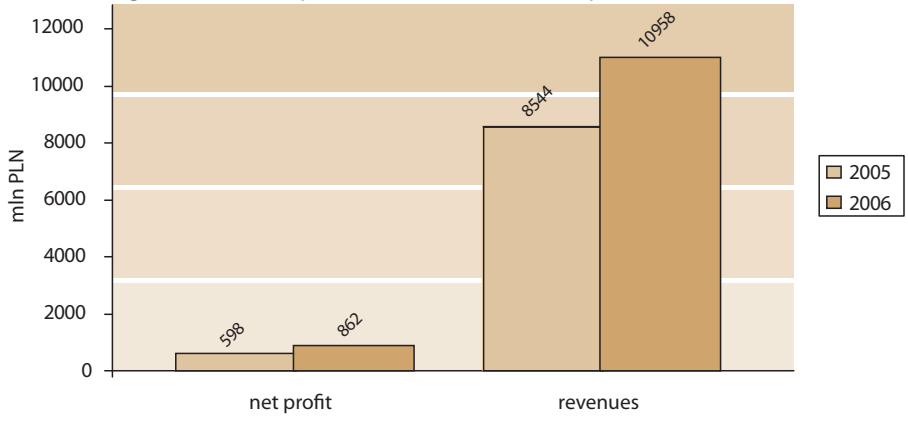
After three quarters of 2006, PGNiG generated PLN 862.0 million in net profit, or 44% more than in the corresponding period of 2005. Sales revenues amounted to PLN 10,958.0 million, or 28% more than over the same period a year earlier. During the first three quarters of 2006, PGNiG extracted 3,121 million cu. m. of natural gas. Its sales volume over the period reached 9,903.0 million cu. m. In the same period, 9,543.0 million cu. m. were sold in 2005, with the extraction of 3,179.0 million cu. m. After three quarters, the sales increased whereas domestic gas extraction declined slightly.

Fig. 5. Natural gas sales and extraction volumes, in millions of cubic metres



Source : www.pgnig.pl

Fig. 6. PGNiG net profit and revenues for 3 quarters of 2005/2006



Source : www.pgnig.pl

In 2005, the company generated PLN 1.13 billion in net profit against sales revenues of PLN 9.88 billion.

After three quarters of 2006, the company reported increased revenues and net profit compared to the first three quarters of 2005.[34]

34 www.pgnig.pl

1.4.2. Infrastructure

In terms of imports infrastructure and gas transmission, similarities between the crude oil and natural gas markets are basically limited to the fact that in both cases natural gas and crude oil are imported from Russia via a pipeline. The Yamal-Europe gas pipeline supplying Poland is managed by the Polish/Russian EuRoPolGaz company whose sales revenues in 2005 amounted to PLN 1,519.0 million, with a net profit of almost PLN 205 million.[35]

The largest growth dynamic was reported by PGNiG in natural gas extraction and distribution. Revenues from sale of gas grew in the first HY 2006 by 32 per cent in relation to 2005 and stood at PLN 8,184.0 billion. However, PGNiG recorded a net loss on EuRoPolGaz operations in the first six months of that year. The company's representatives attributed the losses to US dollar-based settlements within the Polish/Russian joint venture.

Poland has no infrastructure enabling fairly rapid diversification of natural gas supplies:

- No inter-connectors, or connections between systems, have been built to connect Poland to the Western European grid or to the neighbouring grid in the south;
- Poland has no LNG port that would allow for reception of liquefied gas from any source in the world;
- No gas pipeline has been built from Norway;
- The contract for purchase of natural gas from Gazprom has been renegotiated so that the only constructed line of the Yamal pipeline enables us to receive merely 2.4 billion cubic metres of gas, whereas the rest is collected from the "big pipe" by Germany;
- In practice, we have ourselves waived the possibility to build the second line of the Yamal pipeline;
- Poland has no right to re-export Russian gas;
- Implementation of alternative projects, like Nabucco, is at the preliminary stage.

In addition to the inexistent infrastructure, there is yet another key factor affecting in a fundamental way energy security associated with natural gas market, namely the agreement with Gazprom, i.e. Russian monopolist in natural gas extraction and transmission controlled by the Russian State Treasury. The absence of an alternative infrastructure and nature of the concluded agreement contribute to the fact that the prices of Russian gas are far from low. The only, basically, key positive factor is the possibility to increase own extraction of less expensive domestic natural gas (its deposits are estimated at 150 billion cubic metres).

Unlike the market of crude oil supplies where traders compete one against the other for spot and long-term contracts (in addition, there are also suppliers delivering the raw material under spot contracts), in the case of natural gas imports we are dealing with lower differentiation: Russian natural gas is supplied to Poland by RosUkrEnergo whose shareholders include Gazprom (50%), the state-controlled monopolist, and CentraGas Holding (50%), a private company. CentraGas is controlled by two businessmen from Ukraine – Dmitri Firtash, owner of BC Kiev basketball club, former representative of Erual Trans Gas and owner of two Ukrainian TV channels, K-1 i K-2, and Ivan Fursin, the majority shareholder of the Odessa film studio and owner of Misto-bank.[36]

The difficulties related to the market of gas supplies are illustrated not only by painstaking periodic negotiations by PGNiG but also by the recently resolved conflict between Russia and Belarus triggered by the decision of the state-controlled Gazprom to discontinue selling natural gas to Belarus at a discount price. Both parties agreed in the end that Gazprom would acquire a 50% stake in Beltransgaz, the Belarussian national gas company (it trades in gas in Belarus, operates gas pipelines transporting Russian natural gas to Poland, Ukraine, Baltic states and Kaliningrad). Owing to that transaction, Belarus will pay for gas less than Gazprom originally demanded (ca. US$ 200.00 per 1,000 cu. m.). Belarus imports 19 billion cubic metres of gas from Russia annually. Long-term consequences of such decisions will undoubtedly hurt the interests of Belarus. The actions of the Russian side are very clearly designed to expand and increase dependence of recipients of energy inputs on their supplies. Only real not apparent diversification of gas supply sources may even partially protect Poland against the side effects of political disputes.

In mid-December 2006, the management board of PGNiG SA adopted a resolution on the choice of the site where the LNG terminal in Świnoujście is to be constructed.[37]

35 Rzeczpospolita, Lista 500, 2005 rok
36 www.izvestia.ru
37 http://www.portalmorski.pl

Polskie Górnictwo Naftowe i Gazownictwo announced on 17 January 2007 that discussions were scheduled to start with Sonatrach from Algeria on 18 January 2007. The discussions will be devoted to possible natural gas supplies to Poland. If the discussions are successful, the first natural gas deliveries to LNG port in Świnoujście would arrive at the turn of 2010/2011.

The cost of construction of the terminal varied from US$ 400 to 600 million. The government included the project under the Infrastructure and Environment Operational Programme. The venture may be subsidised with EU funding. The terminal in Bilbao (commissioned in 2002) receives about 2.7 billion cubic metres of natural gas per year. Following its expansion (construction of the third tank is scheduled to start shortly), it will have a handling capacity of 4 to 5 billion cu. m. of gas per year. Its construction has cost almost US$ 265 million. Today, the investment would be cost twice more.[38]

The planned construction of LNG port terminal of annual handling capacity of 3 to 5 billion cu. m. will secure around 30% of the domestic demand for gas.

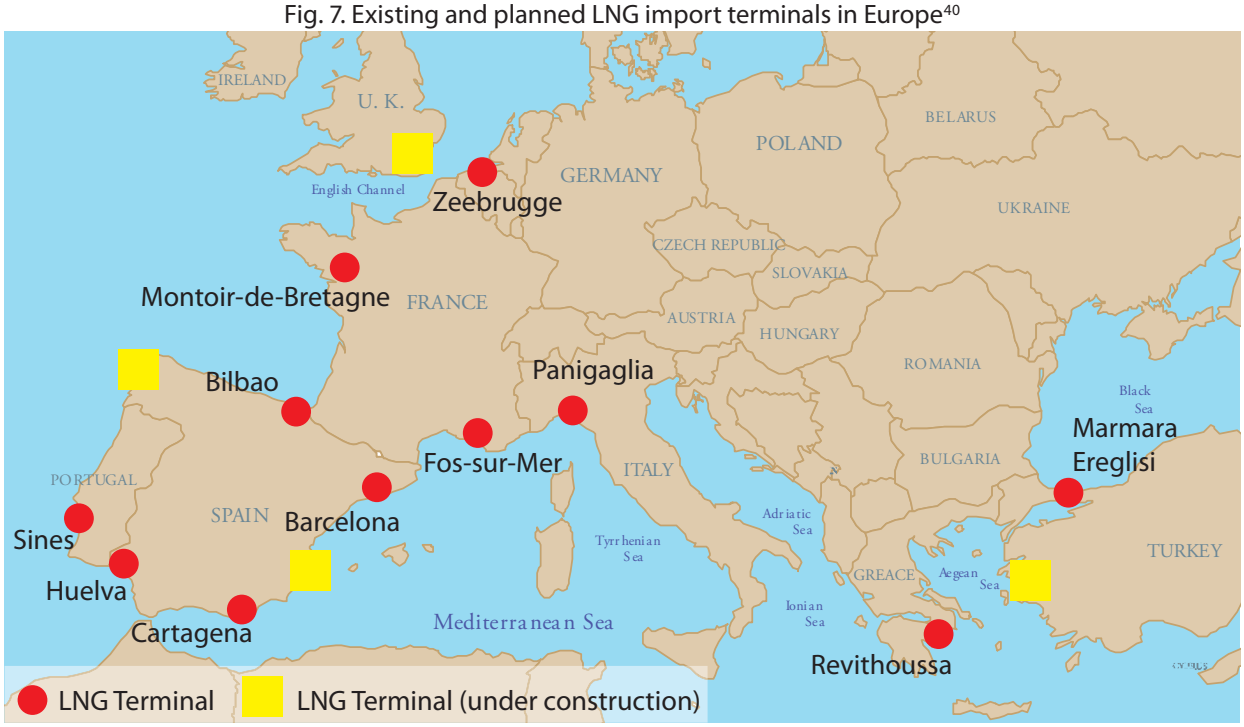
LNG transportation across the Danish Straits to Świnoujście will take place in the basins monitored by NATO's security system. Owing to that, the terrorist threat will be minimised and expansive designs by third countries to place interests in that region (which cannot be ruled out in the case of location in the Gdansk Bay, in the close vicinity of Russia, e.g. military manoeuvres limiting or preventing movement of gas tankers).

Another benefit derived from that location is higher distribution of strategic fuel bases, which is of major importance for the country's energy security. Excessive concentration of energy bases in the Trójmiasto agglomeration: petrochemical, Naftoport, Siarkopol and, possibly, LNG port constitutes a major threat because of potential failures, fires, terrorist attacks, etc.

The Świnoujście location also has its advantages stemming from possible connections to the existing and envisaged EU and domestic grid of gas pipelines: Wielkopolska grid, Norwegian gas pipeline in Niechorze, Bernau-Szczecin pipeline, and Russia-Germany sub-marine gas pipeline in Greifswald.[39]

Usefulness of LNG terminals has been appreciated in numerous European countries.

Fig. 7. Existing and planned LNG import terminals in Europe[40]



Source: Energy Information Administration "The Global Liquefied Natural Gas Market: Status and Outlook, December 2003"

38 www.terminallng.pl
39 http://www.terminallng.pl (raport ekspertów)
40 (LNG terminals on other continents - see Appendix 2)

After securing the above concessions and constructing the LNG terminal, Poland would establish "real" price competition between Russian and non-Russian gas in its territory, which would effectively and permanently ensure both enhanced security of supplies and lowering of prices to the level derived from "gas-to-gas" market competition. Furthermore, it would be reasonable, as in the case of crude oil, to invest in non-Russian gas deposits situated outside the territory of Poland, e.g. in Nigeria (Africa) or in Qatar (Middle East).

1.5. Alternative Concepts of Energy Sources

Obviously, the issue of the country's energy security in the long-term perspective is very complex. Reduction of the country's energy consumption would surely greatly benefit its energy security in emergencies. Automatically, in the face of a crisis, it would mean that less energy needs to be secured as "backup".

Among the suggested directions of measures aimed at ensuring Poland's energy security, renewable sources of energy are noteworthy. The annual technical potential of renewable energy resources in the territory of Poland is about 1750 PJ (almost half of Poland's demand for fuels and energy).

Adequate legislation (special economic zones, companies with participation of the State Treasury, utilisation of EU structural funds and green card strategy) could draw on Polish resources of renewable energy while safeguarding the country, to some extent, against the need for trading in (importing) raw materials.

An interesting idea seems to be hydro power stations (pumped storage power stations) and their expansion. Their tanks could also serve as retention tanks at the time of flood hazard.

Obviously, renewable sources of energy, combined with gradual reduction of energy consumption by the Polish economy in the areas where it is possible, may only constitute the elements complementary to diversification of supplies of energy inputs (crude oil).

Given the rate of implementation of previous infrastructural (expansion of airports, construction of roads) and energy-related projects (fuel tanks, natural gas storage facilities, hydro power stations, wind power stations/farms), it seems that such ideas in the context of the Polish legislative reality are long-term plans. The biggest problems arise in the area of property law and in discussions with environmentalist organisations.

As far as reduction of consumption of energy inputs is concerned, slow introduction of biofuels has begun in Poland. However, the process has soon faced numerous obstacles that are discussed in the following section of the report.

Part TWO

Biofuels – Opportunities and Threats

Overview of Situation in Poland and in the World

Introduction

The presented report provides an analysis of world trends in natural resources management. It describes initiatives aimed at popularisation of biofuels based on new international political agreements, customised approach by national governments, involvement of non-governmental organisations, the business world and the world of science. It discusses differences and similarities between the situation in Poland (part one of the report) and that of the rest of the world (part two).

The actions designed to mitigate risks arising from degradation of the natural environment have many supporters all over the world. Coordination of all the efforts aimed at elimination of those hazards represents a challenge for international communities. The obligations stemming from the United Nations Framework Convention on Climate Change and from the Kyoto Protocol (1997) impose on the signatories the obligation to increase utilisation of energy from the so-called renewable sources (*inter alia*, wind energy, energy of sea waves, geothermal energy, energy from biomass combustion).

Environmental risk may be reduced in many ways but, constituting a natural theme for discussion or controversy, it temps various groups of interest. There are many examples in history when groundbreaking innovations, inventions and discoveries were frequently associated with significant social resistance as a result of violation of somebody's interests or general concerns about upsetting the status quo. On the other hand, however, the need shows that man is capable, when forced to adapt to a new situation, of implementing bold ideas in a surprisingly easy, courageous and effective manner.

New scientific, government and business initiatives involving biofuels come into being throughout the world. The quantity and type of bio-components as well as the timeline of their introduction have so far raised the biggest controversies. In Poland, the development of the market for biofuels stalled after an unfavourable media campaign due to the controversies that arose during a public debate on biofuels held in the years 2002-2003, referred to as "economic sabotage" by Marek Sawicki from the Polish Peasant's Party (PSL).[41] Today, despite the adoption of a new act on biofuels by the government, the situation remains uncertain as attacks from its opponents, also found within the ruling coalition itself which is generally supportive of biofuels, are likely.

The world prospects are quite the opposite. Investment in production of bio-components are highly praised there, advertisements of companies blending fuel with bio-additives are broadcast/printed in the media. The European countries, in particular Germany, France and Austria, are investing in the development of ecological fuels, are building numerous modern installations for production of esters and ethanol dehydration. They have also been successful in creating a favourable social, tax and information climate.

41 Biofuels: Economic Sabotage? – an interview with Marek Sawicki, 07.2006 Nowy Przemysł

2.1. Overview of Situation in Poland

2.1.1. Biofuel, or fuel with a Bio-component

Bio-components represent a real alternative to oil-based liquid fuels. Biofuels is a wider concept encompassing, in addition to bio-components, traditional fuel. The biofuels business can generally be divided into relatively independent sectors of the economy:

List 1. Sectors of economy
Raw materials Covers suppliers, i.e. primarily farmers,
Bio-components Raw material processing installations, i.e. press plants, oil mills, ester plants, alcohol distilleries, etc. for bio-ethanol this is a two-step process (first alcohol distillery and then spirit dehydration)
Biofuels Applicable to refineries. Consists in mixing bio-components with diesel or petroleum in proper installations.

Introduction of biofuels is a process that will take many years and crude oil will constitute, for many years to come, the primary raw material for production of transport fuels. As a result of recent oil price increases, a number of world oil concerns have merged: Amoco and BP, ARCO, Exxon and Mobil; Chevron and Texaco; Total, Fina and Elf. The purpose of the above mergers was to lower processing and warehousing costs and to eliminate excessive processing capacity.[42]

Huge demand for oil is displayed by China but also by Indonesia which turned from the exporter into importer of that raw material. The International Energy Agency (IEA) forecasts that as early as in 2015 the first problems will arise with defaults on oil supplies due to shortages in its extraction.

2.1.1.1. Bio-components vs. Natural Environment

The progressing degradation of the natural environment, shrinking stocks of crude oil and conflicts around access to existing resources constitute a major incentive in the search for alternative sources of energy. The environmental impact of biofuels is less severe than in the case of traditional fuels.

Positive aspects of biofuels

Low emission of toxic gases. Compared to diesel, fumes from bio-components contain virtually no sulphur. The transport currently accounts for 25% of greenhouse gas emissions (is growing) and for 70% of NO_x production in municipal air. Unleaded petroleum partially solves the problem of heavy metals. However, as a result of its combustion other toxic compounds are created (benzene derivatives) for the reduction of which special catalysers are required.[43]

High biodegradability. A runoff of bio-components into waters risks environmental complications on a significantly smaller scale than in the case of crude oil or oil-based fuel. Owing to that, they may find application, first of all, in agriculture, forestry, in work on river banks, sailing, spas and areas subject to protection. They will also be used, to a larger extent, in urbanised areas, e.g. in public transport (currently in Stockholm and Vienna, among other cities).

CO_2 closed circuit. Each of organic compounds generates CO_2 during combustion. Its layers halt and reflect large volumes of heat released by the planet. Climate change (average estimated temperature growth of 1.4 to 5.8^{0}C by 2100) poses a threat to the natural environment. CO_2 emission in the case of combustion of oil-based hydrocarbons and hydrocarbons from bio-components is similar. The advantage of bio-components consists in the fact that they are produced from plants. Plants assimilate CO_2 from the atmosphere, owing to which as much gas is absorbed as is emitted.

Negative aspects of biofuels

Environmental risk posed by energy plant crops. Development of plantations may lead to disruptions within natural ecosystems (soil erosion, water availability and quality, chemicals). This problem applies in particular to the areas of the Amazon jungle rooted out for soybean and sugar cane fields and tropical forests of south-east Asia earmarked for palm tree plantations.[44] According to EEA, achievement of a 5.75% proportion of biofuels in European transport would correspond to occupation by energy plants of 4 to 13% of agricultural land in the EU. Therefore, the European Commission, which acknowledges existence of the above risks, has promised to implement all the available measures to examine and ultimately eliminate them.[45]

42 Energia Gigawat – prof. W. Kotowski, e-petrol.pl
43 On the other side of the Oder – Marek Jastrzębski, Nowe Życie Gospodarcze, dodatek 26.04.2006
44 Biofuels for transportation – June 2006, Worldwatch Institute
45 www.rzeczpospolita.pl; Communication from the Commission – A EU Strategy for Biofuels, European Commission; 2006

2.1.1.2. Biofuels and RES (Renewable Energy Sources) Economy

Crude oil price growth. Oil price growth is attributable, first of all, to unstable political situation in the countries of major exporters of the crude (Middle East and Russia) and to shrinking natural resources of that raw material. Highly developed countries, whose economies (mainly transport) rely on crude oil, are forced to search for alternatives to that raw material. The prices of biological raw materials (oilseed rape, cereals, sugar beet) of key importance to Europe are far more predictable. However, the cost of biofuels production currently exceeds by a few dozen per cent the price of fossil fuel. The advantage will be gained by those who apply the most effective technologies for production of bio-components, combined with most extensive utilisation of by-products. In the long term, investment in the development of biofuels production technology is worthwhile as, sooner or later, crude oil prices will surge again.

Reduction of unemployment. For biofuels, workload is a few dozen times bigger than in the case of fossil fuels. Production of biofuels requires both highly and poorly qualified staff. Educational and training measures encompassing both producers and users will be necessary. Owing exclusively to renewable sources of energy, job growth in the EU may be as high as 2.5 milion by 2020. For the European Community, this will mean savings in the form of reduction or liquidation of subsidies to non-competitive produce and reduction of social/economic costs of unemployment.[46] Although the EU agricultural reform hurt sugar producers, the new situation will help them get back on track. Biofuels represent an opportunity to develop idle land and contaminated soil not fit for growing crops for consumption purposes.

Competition for the foodstuffs sector. Producers of vegetable fats are currently recording low profits (of a few per cent). Demand for that raw material exceeding supply will raise the price of rapeseed oil which is most frequently used for margarine productions (also sunflower, palm tree oil, etc.). It is believed that valuable food compounds (*inter alia,* vitamins, essential fatty acids) should be eliminated from the oil earmarked for a bio-component as these components may impede production and contribute to deterioration of the properties of the final product and, hence, technologies for their extraction should be introduced. However, opinions to the contrary have also been voiced claiming that biofuels obtained under the state-of-the-art technologies have better properties with non-extracted oils. [47]

2.1.1.3. Bioethanol or Waterless Spirit

Bio-ethanol is dehydrated ethyl alcohol (ethanol) obtained primarily from cereals, sugar beets, sugar cane and production waste. Bio-ethanol fuels are marked with the letter E and the number determining percentage content of the bio-component, e.g. pure E100. Existence of a few dozen types of bioethanol fuel imposes stricter technical requirements on car producers. Gasohol (benzynohol) popular in the US contains 85% of the bio-component (E85). The French Institute of Crude Oil maintains that an increase of bio-ethanol content in petroleum to 10% does not require modification of car engines. Its application as independent biofuel is rendered difficult due to lower vapour compressibility, which may give rise to problems when starting the engine.

Wider use of bioethanol in the worlds is contingent on such factors as local climate, size of areas and types of crops, city pollution and consumer requirements. Efficiency of biomass is at its highest in a tropical environment. Additionally, costs of biofuels production (especially that of bio-ethanol) are relatively low there as the energy input necessary to produce ethanol is considerably lower than the input required to produce ethanol in Europe.

Ethanol enables rational utilisation of all surpluses of produce, also those of inferior quality cereals, potatoes or waste raw materials that may be converted into raw spirit and, subsequently, into bioethanol. It may be mixed in any proportion with petroleum. It is used as substrate for production of ETBE or MTBE (ethyl or methyl ethers – their properties similar to those of alcohol).

46 Opinion of the European Economic and Social Committee on regrowing raw materials — development outlook for producing materials and energy (2006/C 110/10) – MITRE Synthesis Report (2003)
47 R. S. Reszel (Zastąpią ropę? – Gazeta Wyborcza 10.10.2000) kontra H. Zamojski – KIB

Bio-ethanol vs. Petroleum[48]

Advantages

- During combustion, less sediments are generated (additionally, prevents generation of sediments);
- Reduced emission of noxious gases (CO_x, NO_x, toxic and carcinogenic volatile organic substances and solid particles);
- Does not contain sulphur;
- Does not contribute to the greenhouse effect;
- Higher octane number, which improves oxidising properties and, finally, increases power; and
- Engines fed with bio-ethanol have higher energy efficiency than petroleum engines.

Disadvantages

- Lower energy value obtained from bio-ethanol combustion (65% for petroleum)
- Tendency to absorb water;
- More corrosive as more acids are generated during combustion;
- Destructive impact on some types of polymers (seals or cables);
- Instability of the mixture (delamination) can be prevented by stabilisers;
- During ignition, supplies substantially more aldehydes; and
- Inferior lubricating properties.

2.1.1.4. Bio-diesel – a Petroleum Diesel Substitute

Bio-diesel is usually the compound referred to as FAME (Fatty Acid Methyl Ester). Bio-fuel with bio-diesel is marked with the letter B. Pure bio-diesel is marked as B100, diesel mixtures are marked with the relevant percentage number defining the content of the bio-component, e.g. B20 contains 20% of ester.

Bio-diesel vs. Diesel

Advantages

- Higher density (0.885 g/cm^3). Fuel injection into the combustion chamber commences earlier and is easier.
- Superior lubricating properties extending the engine's useful life. The record has been set by a German truck – a mileage of 1.25 million kilometres without engine repair.
- Bio-diesel has a higher so-called cetane number than diesel. This value translates into the engine's power and also defines the ease with which a cold engine can be started as well as fuel ignited.
- Negligible amount of sulphur - ca. 0.001% (the acceptable standard is 0.05%). Combustion products are cleaner by almost 75%.
- Non-explosive (beyond the 3rd fire hazard class).

Disadvantages

- Reduced resistance to oxidisation (shorter useful life).
- Higher viscosity, use of bio-diesel in winter is possible after addition of substances reducing its viscosity.
- Best combustion in high temperature (above 200°C).
- Forty-times stronger water absorption. Hence, more care is required especially during transport and distribution.
- Slightly lower energy from bio-diesel combustion (corresponds to 95% of diesel's energy).

48 www.biodiesel.pl; KIB; A technical Study on Fuels Technology related to the Auto-Oil II programme – European Commission Directorate for Energy

The ester's properties are similar to that of petroleum diesel and, technically, no counter-indications exist for their mixing in any proportion. Bio-diesel is produced on the basis of any fat: vegetable oil, waste oil (old frying oil) or animal fat. Bio-diesel obtained from rapeseed oil features best properties from among esters of vegetable origin.

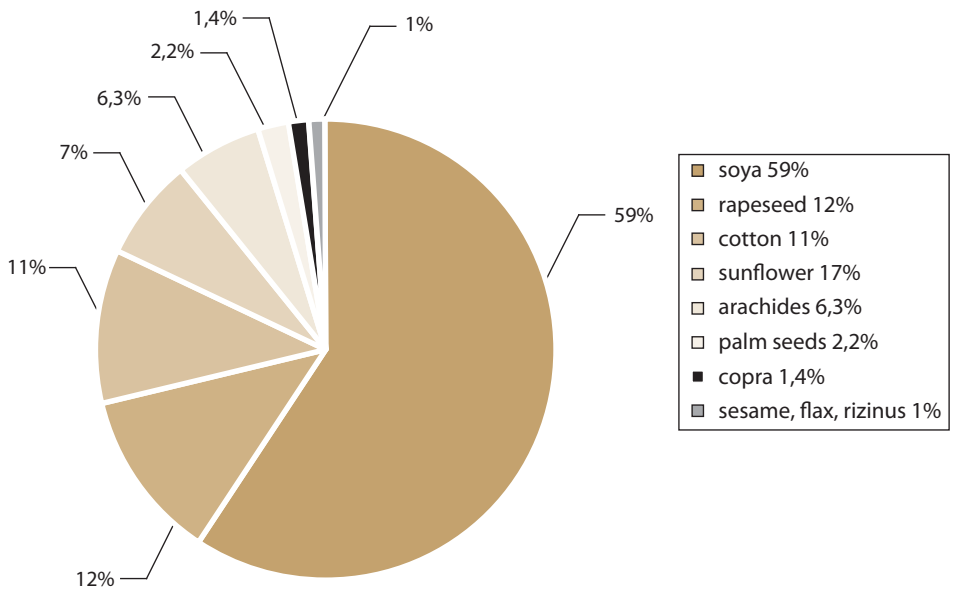
A by-product of esters' production (reaction of alcohol with oil) is glycerine that can be utilised in production of pyrotechnical materials, pharmaceuticals, in the cosmetics or foodstuffs industry. For producers, lower income on ester production may be compensated with higher glycerine price. The model of rapeseed oil production operates on an identical basis. Here, the success is determined by revenues from the oil itself and from rapeseed meal (raw material for fodder production).[49]

2.1.1.5. Oilseed Rape best for Bio-diesel

The most important oilseed crops whose seeds and fruit provide some 95% of the world production of vegetable fats include soybean, oilseed rape, cotton, sunflower, peanuts, sesame, flax and castor bean as well as trees such as oil palm and coconut (copra) palm and olive tree.

Out of the world's oilseeds, the most produced include:

Fig. 8. Oilseeds in the world (production in 2004)
World Oilseed Production 2004 (%)



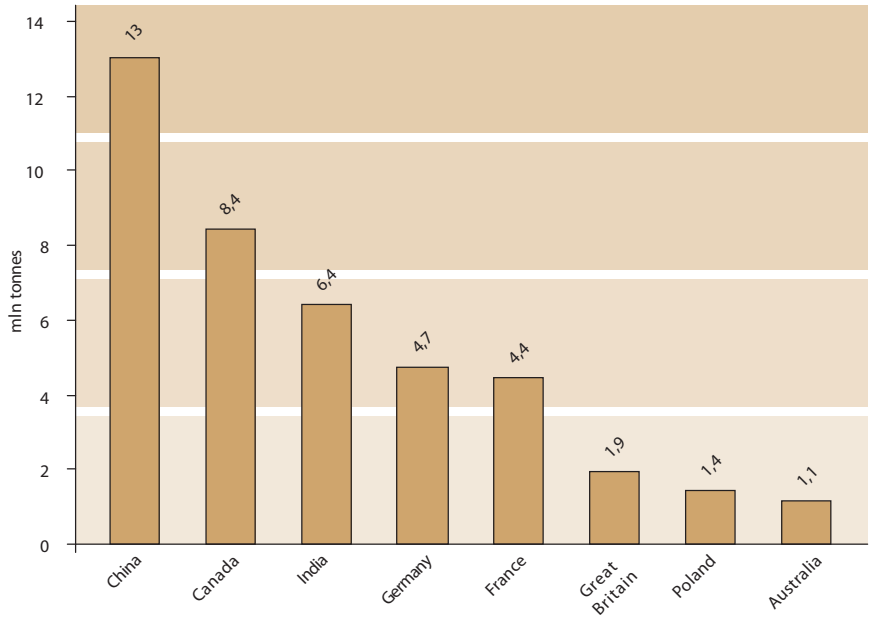
Source : Institute of Agricultural and Food Economics, Warsaw, December 2004

The world's five largest oilseed rape growers (China, Canada, India, Germany and France) produce over 37 milion tonnes of oilseed rape. On the one hand, this illustrates the production potential and the drive towards gaining independence from crude oil. On the other hand, the true value of biofuel production capacity will only be known after comparing supply to demand which is largely dependent on legislation and media communication. The most important plant, from the point of view of European bio-diesel production, is oilseed rape. It is the key raw material for production of oil converted into esters. Therefore, many factors seem to indicate that demand and, consequently, oilseed rape crops will grow. At the end of 2005, one tonne of oilseed rape cost around US$ 710.0, whereas in August 2006 its price amounted to US$ 820.0.

Rapeseeds contain 35 to 45% of oil which, once pressed, turns yellow and brown. It absorbs large quantities of sulphur from soil, however the seeds do not accumulate heavy metals. The Chinese scientists have grown a new variety of record high oil content of almost 55%, i.e. by nearly 2% higher than the previous record content. The variety matures earlier and shows greater resistance to disease.[50]

49 Dylematy przyszłych inwestorów [Dilemmas of prospective investors] – Ireneusz Krawczyk, Nowe Życie Gospodarcze, dodatek 26.04.2006
50 www.biodiesel.pl; Zastąpią ropę? [Will they replace crude oil?]– R. Reszel, Gazeta Wyborcza 10.10.2000; KIB

Fig. 9. World's largest oilseed rape producers in 2005



Source : UN Ford and Agriculture Organisation

Europe collects 40% of the world's oilseed rape crops. From one tonne of the raw material, an average of 400 kgs of oil is obtained. In the world, oilseed rape (and closely related agrimony) production is expanding steadily and currently amounts to over 41 million tonnes despite relatively low average yields of 1.5 t from one hectare. Most of seeds are produced by China, Canada, India and Germany. Almost one third of the world oilseed rape crops originates from China, from the Yangtze river valley. The rapeseed ester production capacity has reached 40 million tonnes per annum there.

Given optimum growth and development conditions, oilseed rape displays high crop yield potential (its crops exceeding 4 tonnes per hectare). However, weeds, diseases and pest reduce oilseed rape crops to 30%. Oilseed rape requires fertile soils rich in nutrients, not-acidified, holding well humidity and careful soil cultivation, good sowing and systematic protection against weeds, pest and fungal diseases.[51]

2.1.2. Poland: a historic outline

As late as in 2002, everything seemed to suggest that Poland would become the European giant in application of ecological fuels. At the time, tax incentives were in place to use bioethanol (excise tax on bio-components lowered by the Ministry of Finance). Then, virtually all owners of vehicles with petroleum engines filled them up with bioethanol, usually unwittingly (one third of petroleum fuels contained bioethanol in 4.5%). Average consumption of that raw material in the years 1996-1998 amounted to 100 million litres per annum.[52] Nobody seemed to mind that until autumn 2002 when the act streamlining the biofuels and bio-components market was to be adopted. Among other things, it provided for the obligation to add a minimum of 4.5% of bio-components to every litre of fuel.

2.1.2.1. Origins of Vegetable Fuels

The Polish army was one of the first in the world to replenish its fuel shortages with rapeseed oil or alcohol during the World War II. A T-72 tank already drove on vegetable fuel in the experimental environment in Poland. In the 1970s, after the fuel crisis Mr. Elsbett, a German engine constructor, was trying to win the Andrychow engine plant over to rapeseed oil. The impact of the first Polish esters added to fuel were tested in the years 1989-91 on a Tarpan car. Esters were examined at the Aviation Institute in the years 1991-1994 (applied in I-23 Manager). A Polonez Caro car covered the distance of 174,000 km on a biofuel.

Even though all the experiments were successful, biofuels were not widely used.

51 Krajowe Zrzeszenie Producentów Rzepaku [National Association of Oilseed Rape Producers]
52 Bioetanol nie szkodzi silnikom naszych pojazdów [Bioethanol does not harm our cars' engines] – Lech Solarek, 04.12.2002, www.biodiesel.pl

How biofuels were launched in Poland?

In 1992, all the world's producers of engines and cars signed the World-Wide Fuel Charter. The same year in Poland, a fuel standard was introduced accepting a maximum 5% bio-component content in fuel. In 1993, application of 4.5 to 5% bioethanol addition to petroleum fuels commenced. In the years 1996-1997, 38% of petroleum fuels sold in Poland contained bioethanol. In 2001, 58% of petroleum fuels originating from the Gdansk Refinery contained 4.5% of bioethanol.[53]

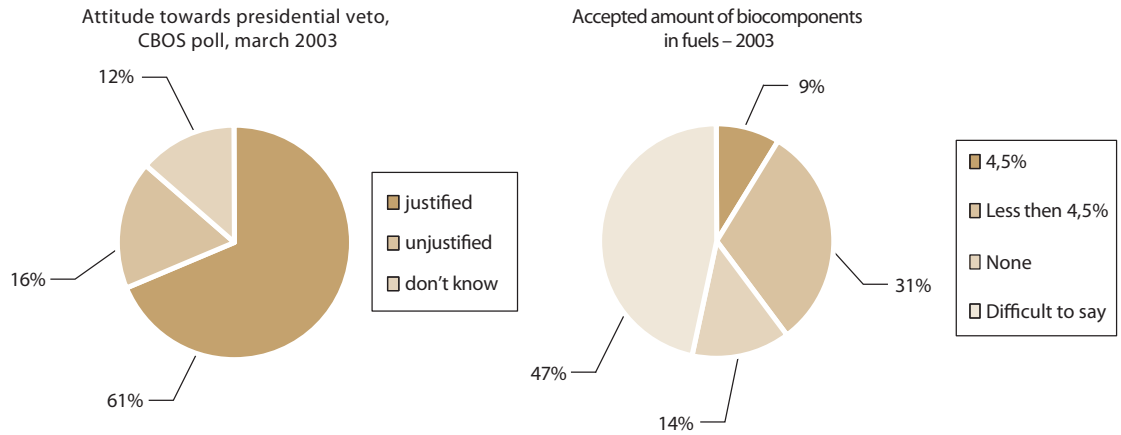
History of the first act on biofuels (2001-2003)[54]

- October 2001 – Biofuels included in the SLD – PSL coalition contract (4.5%).
- 2 July 2002 – Draft act prepared by the Ministry of Agriculture is sent to the Diet. Starting from 2003, a minimum of 4.5% of bio-components should be found in each litre of fuel.
- Early September 2002 – Orlen's lobbying campaign in the parliament gets underway.
- September – November 2002 – Parliamentary debates are held regarding the limit on bio-component content.
- 13 November 2002 – The Sejm approves the 4.5% limit almost unanimously.
- November – December 2002 – a public debate is held on the consequences of using bio-components in fuels production.
- 13 December 2002 – The Senate reduces bio-component content to 3.5%. It also provides for a possibility to sell fuels without bio-additives.
- 17 January 2003 – The President's veto based primarily on the coercion to purchase.

2.1.2.2. Impact of Media Criticism on Public Perception of Biofuels

The decision to veto the act on biofuels taken by President Kwaśniewski was most welcome by households owning passenger cars. Users of other vehicles did not share the President's opinion. The CBOS polling agency concluded that the group was dominated by owners of agricultural vehicles, most open to fuel experiments. They represented the group of interest that stood to lose most on that decision.

Fig. 10. Public assessment of biofuels[55]



The most common arguments raised by car owners against biofuels were primarily higher price and faster tear and wear of car engines. Neither did they appreciate lack of possibility to select fuel used. Most of the respondents (65%) claimed that the concept of launching biofuels was backed, first of all, by potential producers – owners of processing plants, distilleries and large farms. Sixty per cent believed that biofuels present an opportunity to create new jobs. For 56%, biofuels would be welcome as a prospect for better utilisation of land and idle soil and, consequently, an opportunity for economic upturn. Majority of the respondents (two thirds) agreed to the introduction of biofuels on the condition that regular petroleum is still available.

53 Jarosław Kalinowski dla Pulsu Biznesu (14.01.2003) w artykule Moniki Romaniuk, ISB: Biopaliwa groźne nie dla silników, a dla obrotu gospodarczego [Biofuels pose a threat not to car engines but to business trade]
54 Wojna o biopaliwa, czyli lobbing po polsku [War on biofuels, or lobbying the Polish way] – M. Majewski, P. Reszka, Rzeczpospolita
55 CBOS – 2003

In spring 2003, Poles were largely disoriented and divided on the issue of appropriateness and effects of application of biofuels. This could be attributable to the conflicting information presented by those in favour of and against biofuels. The Polish business, law and science circles considered the act on biofuels to be by far the worst act in 2003.[56]

The media criticism ultimately built the society's scepticism about biofuels. It paralysed the biofuels market for a number of years ahead. In 2002, the ethanol content in the fuel's total capacity was ca. 1.5%, falling down to 0.5% in 2005. In 2006, Poland planned to match the 2002 figure of 1.5%.

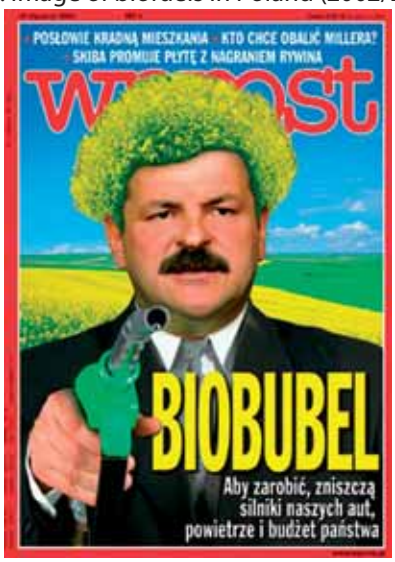
Currently, no explicit attacks on biofuels are reported. Journalists and experts tend to make statements with emphasis on substance rather than rhetoric (at the time, they referred to shortcomings as *threats*; nowadays, they use the word *difficulties*). Still, people responsible for highlighting the dire consequences of biofuel use are unlikely to have dramatically changed their views. What changed is that there is no one powerful and interested enough to compromise ecological fuels.

The figures below show the difference in perception of biofuels in the Polish and Western European press

Fig. 11. Image of biofuels in Western European press (May 2006) [57]

The French oil concern highlights its achievements: "TO DEVELOP THE FUELS OF THE FUTURE, WE GET A LITTLE HELP FROM NATURE. Can automotive fuel be environmentally friendly? As Europe's leading refiner, Total was the first oil company to produce and market biofuels and is the world's No. 1 distributor of diesel blended with rapeseed ester. Today, we're leveraging this position to pursue research programmes to develop new products derived from biomass."

Fig. 12. Image of biofuels in Poland (2002/2003)[58]



56 Gazeta Prawna – December 2003
57 International Herald Tribune (part of New York Times Company) – May 2006
58 Wprost weekly, 19 January 2003

2.1.3. Poland: new legislation

The Act ***on bio-components and liquid biofuels*** adopted by the Sejm on 25 August 2006 supersedes the document of 2 October 2003 ***on bio-components used in liquid fuels and liquid biofuels.*** The concurrently passed new act ***on the system of monitoring and controlling quality of liquid fuels and liquid biofuels***, which supersedes the act of the same name of 23 January 2004 shall govern organisation and control of liquid fuels' quality. The basic difficulties that had to be overcome by the deputies working on the act on biofuels was its consistency with the Polish Constitution Act, the need for compliance with the requirements of Directive 2003/30/EC and observance of the EU principle of free competition. At the next stage of law-making, the act must be notified by the European Commission. Unless challenged by the Commission, it will take effect in January 2007.

Abolition of the excise tax relief applicable to biofuels has forced some of the entrepreneurs who based their business model on the level of excise tax to revise their production forecasts. The Trzebinia refinery quickly withdrew from biofuel production.

2.1.3.1. Act *on Bio-components and Liquid Biofuels*

a) In accordance with Constitution Act and EU Directives

As far as promotion of biofuels, the government found itself in a fix. On the one hand, the EU directive, and, on the other hand, the limitations of the domestic Constitutional Tribunal. The draft act was submitted to the European Commission for consultation in terms of compliance with the Community law. The Ministry of Agriculture maintained that it could not afford to have another act challenged by the Constitutional Tribunal. Still, the act was theoretically in force in its entirety, except for the three challenged articles:

Article 12 Section 1:

Producers shall introduce into circulation, in a given calendar year, bio-components in the quantities defined in the regulations issued on the basis of Section 6:

1) in liquid fuels or

2) as self-contained engine fuels, or

3) in liquid biofuels other than those defined in Item 2.

Article 12 Section 6:

The Council of Ministers shall determine, by 31 October of a given year, by way of a regulation, for the following calendar year, in a fraction of capacity expressed as a percentage, the minimum quantity of individual bio-components that a producer shall be obliged to introduce into circulation in liquid fuels or liquid biofuels. The quantity of bio-components introduced into circulation in liquid fuels or liquid biofuels shall be determined in a fraction of capacity expressed as a percentage of the overall quantity of liquid fuels introduced into circulation.

Article 14 Section 1:

Exclusively liquid fuels may be introduced into circulation without the marking indicating the percentage content of bio-components.

To evade the risk of the articles of the new act being challenged, the authors have abandoned the original concept consisting in the imposition on producers of the obligation to add *not less than 4%* of bio-components *in terms of volume*. Under the act, implementation of National Indicative Targets is to be ensured by:[59] *The entity implementing the National Indicative Target shall ensure, in a given year, at least the minimum proportion of bio-components and other renewable fuels in the overall quantity of liquid fuels and liquid biofuels sold, distributed in another form or consumed by it for own purposes.* Fuel pumps, however, must be marked in such a manner that differentiates them from the pumps of other fuels. It is not clear, here, whether the obligation imposed on producers and leaving the freedom of choice to consumers will suffice to convince the latter.

59 Article 23 Section 1

b) Expansion of Definition of Bio-components

Biomethanol, pure vegetable oil and synthetic bio-components are added to bioethanol and ester previously classified in the bio-component category. The draft act lists a number of categories of liquid biofuels. From the industrial perspective, the most important application shall have:

List 2. Engine petroleum and diesel
• Engine petroleum containing, in terms of volume, over 15% of ether and 5% of bioethanol (or other bio-components, if any)
• Diesel blended, in terms of volume, with ester in excess of 5%

The act lists as biofuels also self-contained bio-components, *inter alia*, ester, bioethanol, biomethanol, dimethyloester and pure vegetable oil. Also in this aspect, life is a few steps ahead of the law as many persons (such as farmers or taxi drivers) already use rapeseed oil, furnace oil or old frying oil in their diesel engines. Gas (the so-called biogas and bio-hydrogen – both derived from biomass) is also listed in the act as liquid biofuel.

c) National Indicative Targets (NITs)

All the countries of the European Union shall attain in 2010 a 5.75% energy (or heating) share of bio-components in the overall volume of sold fuels. The EU has defined in detail the so-called Indicative Targets for the years to follow (Directive 2003/30/EC). It does, however, provide for a possibility of implementing NITs, i.e. the volume determining, separately for each country, the method of arriving at the 5.75% value. NITs consist in determining the biofuels' minimum energy share in the overall quantity of liquid fuels in transport. This requires successive growth of bio-component consumption. The countries which do not operate their own raw material processing plants shall be forced to import bio-components.

The act imposes an obligation on the Polish government:[60] *The Council of Ministers shall determine, every three years, by 15th June of a given year, by way of a regulation the National Indicative Targets for the subsequent 6 years, taking into consideration raw material and production capabilities, potential of the fuel sector and the applicable EU legislation.* The logic of obligating the government to set limits for the following six years when it is forced to reset them prior to the lapse of their expiry (after three years) should be given some thought.

Another section allows the government to renounce from the declared levels in justified cases:[61] *In the case of occurrence in the market of extraordinary events resulting in the change of terms of supply of agricultural raw materials or biomass, the Council of Ministers may reduce, by way of a regulation, the National Indicative Target (NIT) set for a given calendar year.* This regulation represents a loophole owing to which NIT values may become a fiction if interpreted in an over-zealous manner.

In 2005, Poland achieved a mere 0.5% of bio-components' energy content instead of the EU prescribed level of 2.0% (some 3% of the volume). In 2005, bio-diesel (ester) production and sale was launched in Poland. Previously, the only bio-components were bioethanol produced in the installations owned by the Gdansk Refinery (Lotos Group) and ether (the substance obtained from bioethanol and having similar properties) produced by Orlen.

Table 1. Comparison of EU Indicative Targets (IT) of bio-component content and of original National Indicative Targets (NIT) – in percentage terms

	2005	2006	2007	2008	2009	**2010**
Indicative target under Directive 2003/30/EC	2.00	2.75	3.50	4.25	5.00	5.75
NIT[62]	0.50	1.50	2.75	3.75	4.75	5.75

60 Article 24 Section 1
61 Article 24 Section 2
62 The listed National Indicative Target values were considered by the parliament for a long time. Finally, the idea to set exact values was abandoned but the listed NITs may be expected to be similar.

d) Principles of Inspection, Reporting and Penalisation

The act regulates ministerial reporting for the European Commission. It also imposes on manufacturers and producers the reporting obligation. *Producers are obliged to file, within 45 days of the end of the quarter, to the President of the Energy Regulatory Office (URE), quarterly reports drawn up on the basis of VAT invoices or other documents*[63] in particular those pertaining to the number, types, costs of produced and marketed biofuels and bio-components. Additionally, manufacturers shall be obliged to submit reports to the President of the Agricultural Market Agency (ARR).[64] Failure to comply with production, imports and marketing requirements shall be subject to cash penalties that will go to the National Fund for Environmental Protection and Water Management (NFOŚiGW). The Commercial Inspection (IH) shall inspect quality of bio-components, pump marking and display of biofuel notices.

e) Privileges for Farmers

After securing an entry into the register, farmers will be able to produce biofuels for their own use. The act prohibits marketing of biofuels and their dilution with oil fuels. Agricultural biofuels may meet lower quality standards. Still, environmental requirements must be fully satisfied.

The act exempts agricultural biofuel from excise tax (compare with the subsequent regulation of the Minister of Finance, Appendix 1). However, it must be a self-contained fuel and its production should be limited (100 litres per ha per annum). Vegetable oil can be expected to be the most popular biofuel manufactured by farmers owing to its relatively simple and safe production. High penalties are meant to prevent the temptation to resell the homemade biofuel. In the case of production of vegetable oil, the farmer (group of farmers) will be forced to operate a so-called bonded warehouse (special tax supervision location; applicable to products exempted from excise tax). Keeping of bonded warehouses involves pursuit of complicated formal procedures and submission of a deposit (excise tax bond), the latter being particularly resisted by farmers' organisations. Nevertheless, a provision that would release farmers from the obligations to submit bonds within the framework of operated bonded warehouses was not incorporated in the act.

f) Modification of Contracting Principles

Production of bio-components has previously been possible exclusively on the contracting principle. Under the new act, a producer must source the raw material in its annual volume not less than 75% on the basis of contracting agreements with the farms located in the EC territory. This is regulated by the following provision:[65] *The content of bio-components produced from biomass obtained otherwise than in the manner specified in Section 1 may not exceed, annually, 25% of all the bio-components produced by such manufacturer.*

The new act, similarly to its predecessor, regulates the principles within the production chain between the biomass manufacturer, intermediary and producer. Agreements will be concluded for a minimum period of 5 years. The play-safe provision demanded by the agricultural lobby that guarantees certainty of raw material's sale may prove unfavourable to them, especially that nothing points to difficulties in selling energy plants, such as oilseed rape.

In the course of government work on the draft act, numerous corrections regarding compliance with the EU law were submitted by the Office of the Committee for European Integration (UKIE). Most of these comments were accepted. One of the controversial provisions related to the obligation of contract-based contracting of supplies of raw materials for production of bio-components. Theoretically, the provision could raise concerns in terms of its compliance with Article 28 of the Treaty establishing the European Community (TWE) related to free movement of goods. However, according to the Committee, the clause stipulating that raw materials should be sourced from a minimum of one member state protects it from being challenged by the European Commission.

List 3. For agricultural producers, five-year contracting does not have to be advantageous

- Exposes suppliers to penalties imposed by recipients – a default on the declared deliveries may take place, for instance, during a poor harvest or natural disasters; and
- Reduces profits – it impairs freedom of establishment, ruling out altogether the possibility of changing the recipient and revising the market calculation. Previously applicable principles of sale were automatically regulated by the market – also in this case contracting is effected but for a shorter period

63 Article 30 Section 1
64 Article 30 Section 2
65 Article 11 Section 1

2.1.3.2. Qualitative Regulation

A major problem for producers of liquid biofuels has so far been the absence of the regulation on qualitative requirements that would be acceptable to the European Commission. The Ministry of Economy drafted a document accepting the EU standard for pure esters and the domestic standard for B20 biofuel. The regulation raised questions from the European Commission (8 May 2006), which withheld work for a period of 3 months.[66]

Comments were submitted by Poland's potentially largest competitors in bio-diesel production: Austria, Italy and France (behind Germany – the largest producer of esters). They related to qualitative requirements that are not present in other countries of the Community, and in the concurrent absence of the clause of mutual recognition are equivalent to the restrictions imposed on free movement of goods, which violates Article 28 of the Treaty establishing the European Community. Polish producers would theoretically be placed in a privileged position as biofuels produced in another country of the European Community, Turkey or another member state of the European Free Trade Association (EFTA) would be illegal in Poland.

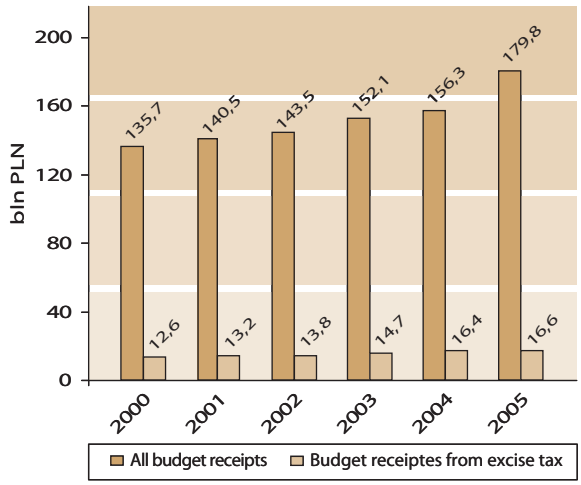
Enterprises interested in investment in fuel blending in Poland withheld or modified decisions to launch production because they could face fiscal consequences. It was estimated that the regulation will not take effect until late autumn. The consultations of the Ministry of Economy with the European Commission proved that it would suffice to slightly modify the content of the regulation by complementing the document with the so-called mutual recognition clause, that is a marketing license for fuels produced outside Poland. The Ministry signed it in September 2006.

2.1.3.3. Act on Tax Relieves (Regulation of the Minister of Finance)

The regulations in force in Poland (Regulation of the Minister of Finance on Excise Tax Exemptions of 26 April 2004) were fairly advantageous to investors. Lack of transparency was their drawback. Politicians were aware of the fact that new fiscal solutions were necessary – provisions that would stimulate investors' interest while not excessively burdening the state budget. Annually, the state budget gains billions of Polish zlotys from excise tax, or roughly 10% of its total receipts.

The government adopted the resolution on reimbursement of excise tax charged on agricultural biofuel (end of June). The tax relief amounts to 45 groszy on every litre. Andrzej Lepper, Minister of Agriculture, assured that the state budget would allocate PLN 650.0 million for that purpose.[67]

Fig. 13 Budget receipts from excise tax



Source: GUS and Ministry of Finance

In December 2006, Zyta Gilowska, Minister of Finance, issued a regulation reducing in fact the tax relief on biofuels by half. This move was criticised by the circles interested in production of biofuels. Such legal approach places fuel production on the brink of profitability. In some plants, it may lead to discontinuance of production. In others, the whole output may be earmarked for exports. The Ministry of Finance explains that the regulation was necessary due to the fact that previous regulations were not consistent with EU laws.

One of the most transparent and attractive tax exemptions applicable to biofuels exist in Germany – excise tax is paid only on diesel or petroleum contained in biofuel. Bio-components **enjoy full excise tax exemption in Germany**, however, probably only until the end of the year despite earlier guarantees that they would apply until 2013. The authorities withdraw from their promises due to the interest displayed by business circles and consumers that significantly exceed the earlier most optimistic forecasts.

66 The note regarding the notification process in the European Commission of the draft regulation of the Minister of Economy on qualitative requirements applicable to liquid biofuels – from 26 June 2006 – after the National Chamber of Biofuels (KIB).

67 Tańsze paliwo dla wsi [Cheaper fuel for rural areas] – mak, Rzeczpospolita, 28 June 2006

2.1.3.4. Calendar of Polish Legislation on Biofuels[68]

- October – December 2002 – the parliament votes in favour of the first Polish act on biofuels;
- January 2003 – Aleksander Kwaśniewski, the President, vetoes the act on biofuels citing lack of possibility to choose another fuel and obligation to produce and purchase fuel;
- July 2003 – The second draft of the act is withdrawn by the Sejm's Speaker because someone has added the words "and other plants", such wording being disadvantageous to farmers' circles as it accepted imports of vegetable (palm, soybean, etc.) oils competitive to the local oilseed rape.
- 2 October 2003 – Act ***on bio-components used in liquid fuels and liquid biofuels*** (Journal of Laws no. 199 Item 1934, as amended). The act also had an unsuccessful follow-up – The Constitutional Tribunal found that some of its provisions were inconsistent with the constitution (21 April 2004). The underlying rational was analogous to that of the presidential veto.
- 6 January 2004 – Regulation of the Minister of Agriculture and Rural Development on the mode of issuance of quality certificates for bio-components and on the mode of ruling on quality of bio-components by accredited certification units and accredited research laboratories.
- 6 January 2004 – Regulation of the Minister of Agriculture and Rural Development defining accredited certification units and accredited research laboratories..
- 12 January 2004 – Regulation of the Council of Ministers on the mode of appointment and work of and number of members of the Commission for bio-components used in liquid fuels and liquid biofuels.
- 23 January 2004 – Act ***on the system of monitoring and controlling quality of liquid fuels and liquid biofuels*** (Journal of Laws no. 34 item 293, as amended). It was superseded with the new act (25 August 2006).
- 23 January 2004 – Act ***on excise tax.*** It governs the principles and mode of marketing goods subject to excise tax and provides the "bonded warehouse" definition that is of relevance for biofuels.
- 10 March 2004 – Regulation of the Minister of Economy, Labour and Social Policy on the manner of marking pumps destined for sale of liquid biofuels.
- 26 April 2004 – Regulation of the Minister of Finance on exemptions from excise tax. It postulates 3 exemption thresholds and intricately regulates tax discounts for biofuel producers. Still, it is an advantageous and highly important provision for development of the biofuel business.
- 27 April 2004 – Regulation of the Council of Ministers on detailed conditions for extending public assistance for investment projects associated with renewable energy sources. The document precludes, however, the possibility for Polish entrepreneurs to seek credit facilities to finance investment projects encompassing production of bio-components.
- 10 March 2006 – Act ***on reimbursement of excise tax contained in the price of diesel used for agricultural production.*** It sets out the principles and mode of reimbursement of excise tax contained in the price of agricultural diesel.
- 25 August 2006 – the Sejm passes new acts on biofuels:
  1) ***on bio-components and liquid biofuels***; and
  2) ***on the system of monitoring and controlling quality of liquid fuels***
- The regulation of the Minister of Finance on the lowering of tax relief for biofuel producers is in force since the beginning of 2007.

68 On the basis of www.sejm.gov.pl

2.1.4. Biofuels in Poland

Bio-components have been added regularly to fuels in Poland since 1993. In 2002 they accounted for 1.5% of all liquid fuels (this number projected for 2006). Before the onset of an unfavourable media campaign it seemed that we would become a European power in the production and consumption of ecological fuels. In 2005 the total share of bio-components (in practice, bioethanol and ETBE ether) amounted to 0.5% of the energy value of all fuels. This placed us in the 14th spot, behind Greece (0.7%), before Hungary (0.4%) and far behind the leaders (Sweden – 3%; the Czech Republic – 2.84% and Austria – 2.5%).

Directive 2003/30/EC takes on the form of a recommendation, but the EC does not preclude the imposing of sanctions on countries which will stray far behind the recommended indicators. The value of the biofuel market in Poland can reach PLN 5.0 billion by 2010. If the new act is passed in line with the government's intentions, then in 2007, fuel manufacturers may need ca. 150,000 tonnes of bioethanol and ca. 270,000 tonnes of esters. The majority of bio-components for liquid fuels manufactured in Poland in 2006 was exported.[69]

The use of biofuels in public transport in certain cities is increasing. Bus stock in Wrocław, Kielce, Starachowice and Słupsk include vehicles powered with almost pure bio-diesel. On the other hand, Warsaw is planning to introduce a number of hydrogen-powered buses. This is likely after the Polish capital has joined the C-20 club – a group of world metropolises (including New York, Paris, Delhi, London and Istanbul) which have declared their care for the natural environment. C-20 works together with the William J. Clinton Foundation – an organization which has been acquiring funds from corporate giants to fight dangers to civilization (including halting emissions of carbon dioxide to air). A single vehicle costs several million zlotys. The construction of a filling station costs several hundred thousand zlotys. Decisions to finance these investments should be in place by spring of 2007.[70]

The elimination of the excise tax exemption will result in the majority of production being exported because domestic sales will be unprofitable.

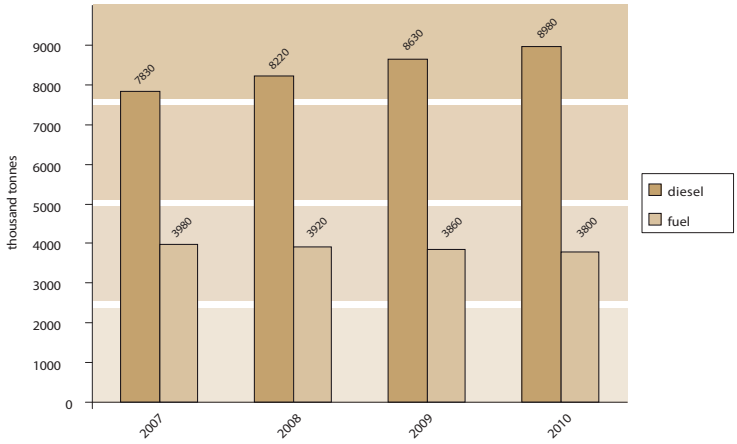
2.1.4.1. Bioethanol

Bioethanol holds an important position among bio-components. It was introduced to petroleum on an industrial scale in the middle of the previous decade. The greatest consumption by the petrochemical industry (ca. 111.0 million litres) occurred in 1997.

In the year 2005, 52.4 million litres (42.8 million tonnes) of bioethanol found its way to the market.[71]

The main raw material used to manufacture bioethanol is a distillate obtained in distilleries mainly from rye and potatoes. The significance of potatoes is decreasing, however, with increasing interest in sugar beet, triticale, corn and industrial wastes. Bioethanol is manufactured in two stages: the distillate from the distillery is processed in dehydration facilities. This method is costly, so single-stage production processes are implemented and planned. A number of facilities with a capacity of 50-100 million litres annually is planned. These investments will modernize the sector.[72]

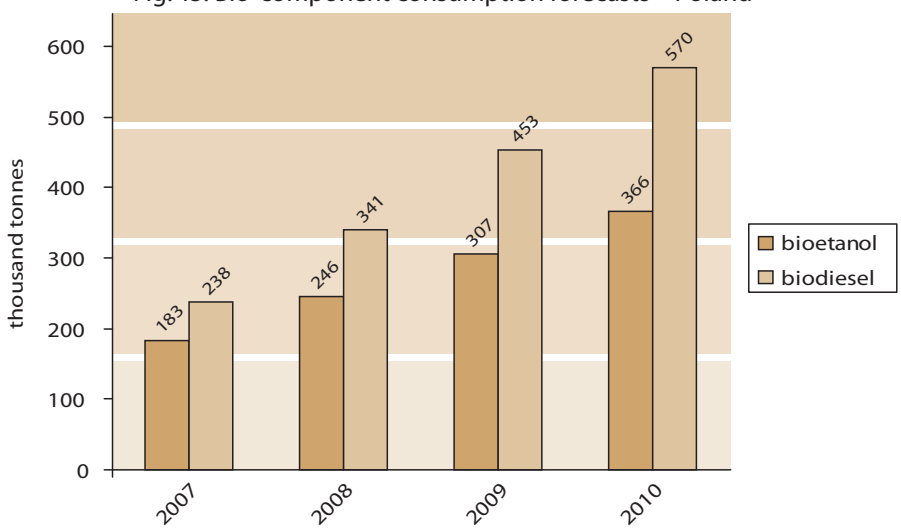
Fig. 14. Fuel Consumption Forecasts – Poland[73]



69 Biokomponenty w każdym baku [Bio-components in Every Gas Tank] – data n/a, Rzeczpospolita, 09.05.2006
70 Autobusy od Clintona dla Warszawy [Buses from Clinton for Warsaw] – M. Hadaj, Dziennik 08.08.2006
71 2nd Report for the European Commission developed in the Ministry of Agriculture and Rural Development, June 2005
72 Dr T. Zakrzewski – KIB
73 Dev. after IERiGŻ-PIB [National Research Institute of Agricultural and Food Economics] – Nowe Życie Gospodarcze no. 8/2006, 26.04.2006

Table 2. Fuel and Bio-component consumption in Poland[74]					
Year	Petroleum consumption (incl. bioethanol)		Bioethanol		Share of bioethanol
	(Litres mln)	(Tonnes ['000])[75]	(Litres mln)	(Tonnes ['000])[76]	(%)[77]
1994	7300	5548	27	21,33	0,37
1995	8300	6308	63	49,77	0,76
1996	6200	4712	101	79,79	1,63
1997	6700	5092	111	87,69	1,65
1998	6700	5092	100	79	1,5
1999	7800	5928	83	65,57	1,07
2000	6800	5168	51	40,29	0,75
2001	6200	4712	66	52,14	1,07
2002	5600	4256	83	65,57	1,47
2003	5500	4180	76	60,04	1,4
2004	5600	4256	48	37,92	0,94
2005	5200	3952	54	42,66	1,05

Fig. 15. Bio-component consumption forecasts – Poland



Source: Dev. after [National Research Institute of Agricultural and Food Economics] – Nowe Życie Gospodarcze no. 8/2006, 26.04.2006

2.1.4.2. Oilseed Rape Will Be Needed

The fat industry is one of the most concentrated in the food industry. There are nine major players that count on the Polish oilseed rape processing and fat manufacture market. The largest processing companies are Zakłady Tłuszczowe Kruszwica (part of the Bunge Group) and Zakłady Tłuszczowe Szamotuły (part of the ADM Group). Together, they hold a 50% share of the rape purchase market and 75% of the oil production market.[78]

The key raw material for the ester business will be rapeseed oil. In rape production, we place behind Germany, France and Great Britain (total EU production amounts to ca. 10.0 million). Poland's rapeseed production amounts to more than one million tonnes annually (1,250 tonnes in 2005), of which most consumed by the food industry or exported to Germany (mainly for biofuels).

74 Report for the European Commission (…) for 2005 – Ministry of Agriculture and Rural Development
75 Density of petroleum = 0.76 g/cm^3
76 Density of ethanol = 0.79 g/cm^3
77 NB.: the share of bio-components is by volume; energy share is necessary to calculate share by mass!
78 www.kib.pl

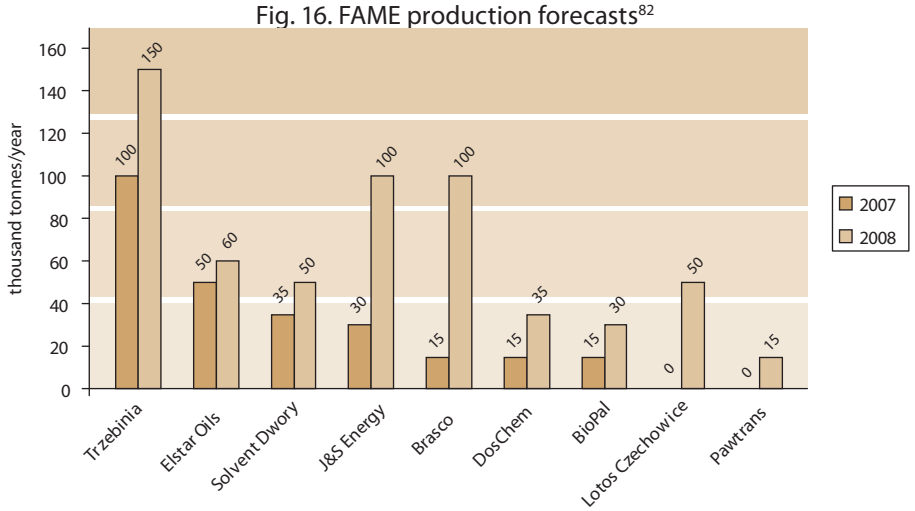
Table 3. Oilseed rape forecasts in Poland[79]		
	2006 r.	**2008 r.**
Growing area (thousands of ha)	530	750
Oilseed rape crop (thousands of tonnes)	1 400	2 100
Rapeseed oil production (thousands of tonnes)	495	882
Oil for ester production (thousands of tonnes)	159	546
Growing area (thousands of ha)	530	750

Oilseed rape is the most popular oily plant in Poland. Growing area in 2005 amounted to 550,000 ha, from which 1.5 million tonnes of oilseed rape were collected (second largest crop after 2004). Crops amounting to 2.7 t/ha exceeded the average crop by ca. 30%. Arable land area equals to ca. 14 million ha. Observing crop rotation and growing rules, rape can be sown on about 10% of the total growing area – ca. 1.4 million ha. A threefold increase in rape growing area is possible on the condition that growers improve their qualifications. In Germany, 3.6 tonnes of rape seed are collected from every hectare, while our farmers collect 2.6 tonnes.[80]

2.1.4.3. Interest in Bio-diesel Production

After they have expressed their interest in FAME ester production, the shares of these companies have gone up. The value of Skotan shares went up by more than 1000% within six months (one shareholder, however, has informed the prosecutor of Skotan listing manipulations and the company has withdrawn from investment plans).[81] The shares of Lotos and Elstar Oils also went up and even those of Z.A. Puławy, which has not even ultimately reached a final decision.

Fig. 16. FAME production forecasts[82]



Source: National Chamber of Biofuels or directly from companies

a) Rafineria Trzebinia

In Trzebinia, Orlen commissioned (December 2004) the first installation in Poland which produces bio-diesel on an industrial scale (the first experimental processing facility in 1995 in Mochełek – 1000 tonnes of esters and 3600 tonnes of rape annually). Orlen invested PLN 120.0 million in the facility. Its current capacity equals to 150,000 tonnes annually with annual production of 100,000 tonnes.

The company closed the year 2005 with a loss of PLN 50.0 million. The management board adopted a savings program. The "Południe" [South] program was developed on Orlen's orders. The program assumed the consolidation of subsidiaries located in the south of Poland. Further plans provide for the construction of a pipeline from Boronów to Trzebinia and leasing the fuel terminal owned by the refinery. The refinery's trade unions do not share the management's optimism regarding the project's success.[83]

79 Based on estimates by J&S Energy
80 KZPR; KIB
81 Drobny inwestor Impexmetalu szantażuje Boryszew? [A Minority Impexmetal Investor Blackmails Boryszew?] – M.Śliwiński, Parkiet, 19-20.08.2006; Tak – dla oleju, stop dla ziarna [Yes to Oil, No to Grain] – M.Grzegorczyk, Puls Biznesu 04.09.2006
82 ibid
83 Czy Rafinerii Trzebinia grozi zamknięcie? [Will Rafineria Trzebinia be Closed Down?] – Dziennik Polski; 21.07.2006

Orlen blends its own diesel fuel using esters produced in Trzebinia to obtain biofuel. The corporation initially sold biofuel to wholesalers (transport companies, the Polish State Railways (PKP)), as well as for export. After six months,, the corporation permitted retail sales of B20 fuel from marked pumps. The production of methyl esters was, and still is more expensive than diesel, so it could be competitive only thanks to excise tax relief. Originally, B20 was ca. 10% cheaper than diesel.

When the biofuel acts were passed, Rafineria Trzebinia paradoxically faced the dilemma of having to cease production, since the Energy Regulatory Office (URE) can charge the company with a multi-million zloty fine for the sale of B20. By manufacturing biofuels, the refinery complied with the statutory obligation of introducing bio-components on the market, but at the same time it was committing a crime since the appropriate quality regulation, blocked by France, Austria and Italy has not been yet passed.

Explaining the efficacy of the fines, the Ministry of the Economy asked society to assess the situation: *Such a product cannot be traded in other member states, except for the Czech Republic, so please say whether this is a mess or a forward-moving action which, by the fact of moving forward, is causing certain perturbations. (…) There were three comments from member states, all resulting from an absolute lack of knowledge of Polish law.*[84] The evident interpretation is obvious: this is a mess and Trzebinia stepped ahead of the law. Henryk Zamojski, Vice-president of KIB stated: *This would be an event unprecedented worldwide, where someone, through no fault of his own is penalized because state authorities have not performed their obligations. It would also be a very bad signal for the market, for all investors.*

b) Elstar Oils

Elstar Oils is also planning production of both bio-components and biofuels. By the year 2008, the company will plan to invest a total of PLN 120.0 million. Elstar Oils will begin bio-diesel production in the fall. The company will assign PLN 25.0 million just to increase ester production capacity in the city of Malbork (target 100 000 tonnes). The company has obtained a loan of PLN 80.0 million to purchase raw materials. Funds will also be assigned to increase the rape processing capacity in the facility in Czernin (from 150,000 to 250-300,000 tonnes). The company also does not preclude the construction of a new ester production plant in the south of Poland, with a production capacity of 100-150,000 tonnes annually (most likely in the Wałbrzych Special Economic Zone).[85]

Ester production will most likely commence in late August and the company will not be able to offer the first batches of sufficient quality product before October. It is not yet known whether the esters will be purchased in Germany, where the company has signed preliminary contracts, or by Polish enterprises. Elstar Oils' CEO Aleksander Rysiewicz estimates that the act is neutral for the biofuel business and "household" production will not disturb market demand because it will be too small.[86] (The view was stated before the entry into effect of the Regulation of the Minister of Finance, Appendix 1).

c) Grupa Lotos

The company has been producing fuels with the addition of bioethanol since 1997. Currently, there are plans to commission a bio-diesel production installation in the Czechowice refinery, with a production capacity of up to 100,000 tonnes (at a cost of PLN 71.0 million). In early June, the company signed a contract with the MAN Ferrostal company to build a fatty acid production installation. Lotos may avoid raw material availability problems by choosing an installation which will enable the processing of a raw material different from rape.[87]

d) J&S Energy

J&S is building two bio-component production installations in the towns of Brzeg and in Stobno near Szczecin. The planned cost of the investment is PLN 200.0 million. J&S is considering the construction of five such installations in Europe. Contrary to Trzebinia, J&S has abandoned the blending of fuels with bio-components, thus avoiding treasury consequences. *We are in constant contact with all institutions responsible for supervising the fuel market we have ceased such activity the moment at which discrepancies in the interpretation of binding regulations have appeared* – explains **Grzegorz Zambrzycki, the CEO of J&S Energy SA.**

84 TVN24, 24.07.2004
85 Coraz dłuższa kolejka chętnych do rynku biopaliw [A Lengthening Line of Takers for the Biofuel Market] – M. Zwierzchowski, Życie Warszawy 25.04.2006; Elstar Oils stawia na biopaliwa [Elstar Oils Bets on Biofuels – Rzeczpospolita 13.10.2005,
86 Biopaliwa Elstaru Oils jesienią na rynku [Elstar Oils' Biofuels Hit the Market in the Fall] – Parkiet, 22.07.2006
87 02.06.2006 – PAP

e) Spectra

In 2005 Jerzy Starak acquired ZPT Warszawa (PLN 49.0 million) – a company whose privatization Aleksander Gudzowaty backed out of in 2003. Oil manufactured in ZPT Warszawa will ultimately be used in biofuel production as well. On the other hand, Spectra has announced an investment in the Starogard Gdański Polpharma to build an ethanol dehydration facility with an annual production capacity of 200,000 tonnes.

f) Zakłady Azotowe Puławy

The company is considering the construction of an ester production facility with an annual production capacity of up to 100,000 tonnes. 270-300,000 tonnes of rape are needed to attain this production, which is more than the current production capacity of the Lubelszczyzna region. An additional benefit which would reduce ester production cost would be if farmers in the Lubelskie voivodship would use fertilizer manufactured in the Puławy plant.[88]

g) Brasco

Brasco's current CEO, Wiesław Kaczmarek, has announced the takeover of 50% of the domestic bioethanol market and 25% of the ester production market. Brasco is currently the largest manufacturer of bioethanol, with an annual production capacity of 150.0 million litres. Bioethanol accounts for 38% of the production of Akwawit and 55% of the production of KS Wratislavia, the remainder being alcohol. Brasco's chief strategic objectives include the consolidation of Akwawit and Wratislavia and consolidation of production capacity in a separate company. The plants await restructuring, with the integration of management functions.[89]

W. Kaczmarek maintains that production limits are set by the efficiency of the distillery sector. Therefore, the company plans to undertake actions intended to organize raw material supply. Currently, 70% of the bioethanol manufactured by Brasco is exported, In Poland, the main customers are Orlen and Lotos. Polmos in Wrocław has begun the construction of an ester production facility with an annual production capacity of 150,000 tonnes. The investment is worth at least PLN 100.0 million. Construction will commence in the 4Q of 2006.[90]

2.1.4.4. Forecasts for Poland

The largest biofuel manufacturers will be the most important on the market. Small production plants, oil production plants and agro-refineries will stand no chance to compete with the power players. A bigger ester production facility (greater investment) will have a lower unit production cost. This is confirmed by production experience in Canada, Germany and France.

In Poland, investments under consideration are valued at several billion zlotys. As of 19 June, 85 entities have been entered into the register of businesses which manufacture or store biocomponents (of which 27 manufacture bioethanol). Trzebinia-manufactured ester biofuel can be purchased at 200 stations in Poland.[91]

Table 4. Bio-component production costs depending on the extent of ester production facility investment – examples from Canada[92]

Annual Production Capacity (thousands of tonnes)	Investment cost (Millions of Canadian Dollars)	Production Cost (Can. Dollar/ ton)
1,7	1,33	782
10	4,75	475
50	13,50	270
100	21,0	210

The growth of rape prices can be counteracted by increasing its growing area, but rape requires good soil and appropriate temperatures (it is a warmth-loving plant), so it can be grown only in some regions in Poland (with the Małopolska region the best-suited). An alternative may be to import cheaper rapeseed oil from outside the EU, e.g. from the Ukraine. Another possible solution to the raw material shortage problem may be to import cheaper palm oil or soy oil. Obtaining a product of similar quality to rapeseed esters from these substitutes will be a technological challenge for engineers. Successful technologies which will guarantee the lowest biofuel and bio-component production cost will assure market success.[93]

88 www.zapulawy.pl
89 PAP: Ogłoszenie strategii Grupy Brasco S.A.(…) [Announcement of the Strategy of Grupa Brasco S.A.] 12.07.2006
90 Szkodzą nam politycy… [Politicians Do Us Harm…] – Anna Bytniewska, Puls Biznesu 01.06.2006
91 Zarobić na rzepaku [To Make Money on Rape] – T.Dąbrowski, Dziennik 13.06.2006
92 I. Krawczyk, NŻG, May 2006
93 Potrzeba więcej rzepaku [More Oilseed Rape Needed] – M. Kozmana, Rzeczpospolita 08.03.2006

Oilseed rape growers are confident – the projected supply of this raw material will not satisfy the needs of the food, fuel sectors and will not fulfil export obligations. Greater demand will lead to increased prices. The food sector, which has so far been the beneficiary of relatively low oilseed rape prices, stands the most to lose on the discussed market changes.

It seems that many Polish decision makers are acting as if forced by the EU rather than of their own conviction. The greatest challenge to the biofuel circles will be to convince the society and politicians that the discussed idea is not just an obligation, but one of the few opportunities to improve the competitive edge of our economy.

2.2. Analysis of the situation worldwide

2.2.1. Environmentally friendly initiatives and legislation in the EU

Environmental protection initiatives usually refer to the Kyoto Protocol (1997). One of the most important topics of that agreement was a 5.2% average annual reduction of greenhouse gas emissions in the years 2008-2012 with respect to 1990 emission levels. Poland signed the protocol in 1998 and ratified it in 2002. EU actively participates in the implementation of these provisions. This is reflected in a number of documents, directives, strategies, visions and plans.

List 4. The most important biofuel directives

- Directive 2003/30/EC of the European Parliament and Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport
- 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market
- 2003/96/EC of the European Parliament and of the Council of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity

2.2.1.1. EU and Biofuels

The European Commission's interest in biofuels is focussed on transport-related issues. This is because transport is responsible for the generation of 21% of greenhouse gases. The EC is involved in activities to implement ecological fuels on many levels: [94]

- initiates the application of tax relief on bio-components;
- encourages the purchase of mainly biofuel-powered ecological vehicles in public procurement procedures;
- seeks to establish an institution dealing with development opportunities of rural regions thanks to biomass;
- encourages member states to introduce privileged treatment of second generation biofuels;
- verifies possibilities of eliminating technological obstacles in biofuel logistics;
- recommends the introduction of a wider range of vegetable oils to manufacture bio-diesel without significant negative impact on fuel quality;
- supports non-EU countries which develop bioethanol production to facilitate the sale of raw materials made by EU producers (mainly sugar refineries);
- considers the use of bioethanol in diesel engines and the replacement of methanol with ethanol in ester production.

2.2.1.2. Energy From Biomass

The strategy of using Renewable Energy Sources (RES) contains guidelines for national actions in terms of administrative, fiscal, economic and legal solutions. The EC adopted an action plan intended to promote energy obtained from agriculture, forestry and waste management (December 2005). The EU's aim is to replace 20% of the energy value of conventional fuels with alternative fuels (by 2020). The process has been divided into 3 stages:

94 Communication of the Commission – Biomass Action Plan; Commission of the European Communities, 2005

List 5. Stages of Replacement of Conventional Fuels
• by 2010 – development of the biofuel sector • 2010-2015 – promotion of natural gas • 2015-2020 – promotion of hydrogen fuel cells.

The EU cohesion policy sets out the development of renewable and alternative sources of energy (incl. biomass). Investments to process unused biomass are to be initiated with financing under the rural region development policy. When assessing the impact of biofuel support programs, the EC is to consider their potential impact on the traditional ethanol, food, forestry and crude oil markets.

Biofuel production is to take place in accordance with the principles of Sustainable Development Strategy (SDS), adopted by the Council of Europe in 2001 (Goeteborg) and amended in June 2006. The model sets out actions based on consumption patterns with the smallest impact on the natural environment. These issues are covered in the biomass actions plan: [95]

List 6. Ideas
• promotion of biofuels in the EU and in developing countries and guarantees of their safety for the environment; • introduction of widespread biofuel consumption thanks to price incentives, optimizing of energy crops and research of "second generation" biofuels, support in sales of biofuels; • study of opportunities in developing countries in terms of energy crops and biofuels..

In April of 2005, the EC published proposals for the structure, budget and thematic scope of the 7th Framework Program. The tasks will be completed in the years 2007-2013 (a budget of ca. EUR 53.0 billion – an almost two-fold increase with respect to the 6th Framework Program). Under the "Cooperation" Sub-program, research will focus on the following:[96]

List 7. "Cooperation" Subprogram
• **development of energy technology** – reduction of fuel unit cost by improving conventional technologies and development of second generation biofuels (e.g. Fischer-Tropsch bio-diesel, lignin-cellulose processing, ethanol and biodimethylether) • **development of food, agriculture and biotechnology** – application of natural sciences to improve biomass production systems

Research and promotion programs are intended to promote and implement the European vision of production and use of biofuels. One of the largest is the European Biofuels Technology Platform, which represents the following stakeholders: agriculture, forestry, the food sector, biocomponent and biofuel manufacturers, fuel companies, distributors, car manufacturers and research institutes. Other technology platforms include "Plants for the Future", the Forest-based Sector Technology Platform and "Sustainable Chemistry".[97]

2.2.1.3. Generations of Ecological Fuels

The EU has noticed the limitations and dangers connected with the obtaining of biocomponents from raw materials traditionally intended for food production. Therefore, looking forward, it has established several generations of biofuels: [98]

First (conventional). Corresponds to traditional production of bio-components mainly from cereal grains, sugar cane, oily plants and vegetable and animal wastes. These technologies consist of fermentation, pressing, chemical synthesis, fermentation and estrification.

95 Communication of the Commission – Cohesion Policy for employment and growth, 2005; Communication of the Commission – Biomass Action Plan; 2005
96 www.mnii.gov.pl; Communication of the Commission – EU Strategy for Biofuels, Commission of the European Communities; 2006
97 Communication of the Commission – EU Strategy for Biofuels, Commission of the European Communities; 2006
98 ibid

Second. The near future for bio-components; they are not competition for the food industry. The technologies are currently under intensive investigation (Sweden, Spain, Denmark et al.). Bio-components are obtained in processes of synthesis, gasification and advanced hydrolysis. Most advanced is research on biofuels obtained from lignin and cellulose materials (wood, plant stems, straw). Other methods under investigation include Fischer-Tropsch bio-diesel and biomethylester.

Higher. Set out the more distant future of biofuels but in principle refer only to hydrogen. The use of hydrogen fuel cells will enable operation practically devoid of CO_2 emissions. Their introduction is very expensive because engine production technology must be modernized, large investments made into hydrogen production facilities and a new distribution system set up.

2.2.1.4. EU and the World. Trade Agreements and Negotiations

So far, the EU has no separate customs classification for biofuels. The EC intends to introduce individual customs codes for various bio-components. Currently, the import of methanol, oily seeds and vegetable oil intended for biofuel production is treated equally. It is duty-free, with the following rules of preferential trade:[99]

- the *Everything But Arms* initiative with the least developed countries;
- the Cotonou agreement with countries of Africa, the Carribbean and the Pacific (ACP);
- a new *GSP plus* system of incentives (special incentives on behalf of SDS and good management);
- certain bilateral preferential agreements, especially with the Euro-Mediterranean Partnership.

The EC is involved in the monitoring of the consequences of biofuel demand in Europe and among trading partners outside the EU. The Commission is currently conducting bilateral and multilateral negotiations with ethanol producing countries. The negotiations will help to shape ethanol markets in the following ways:

- on a multilateral level – the Doha development round: tariff cuts allowed with respect to bioethanol. The bioethanol availability issue is discussed during negotiations on trade and the environment and the availability of industrial products used as biofuel additives;
- on a regional level: free trade agreement between the EU and Mercosur (Argentina, Brazil, Paraguay and Uruguay).

2.2.1.5. CAP and Farmers' Interests

The 2003 reform of the Common Agricultural Policy (CAP) has introduced special subsidies for energy crops. It guarantees subsidies for farmers, equal to 45 EUR/ ha. CAP reduces farming subsidies by emphasizing the deregulation of farming. Subsidies will depend on compliance with ecological requirements, while higher quality of production will improve competitiveness. It was decided to move funds (1 billion euros annually starting in 2007) from direct subsidies to actions for rural development.

An agreement was reached in 2006 on the fundamental reform of the organization of the sugar market. Quotas will still not apply to sugar beets grown for bioethanol. The Commission will pursue its proposition to make sugar beet grown for bioethanol eligible for both the non-food regime on set-aside land and the energy crop premium.[100] Mandatory setting aside of land, that is a time during which crops are not grown on the land in order to reduce crop volume was introduced in the reform of 1992. Land assigned to be set aside is subject to special agro-technical supervision. Furthermore, it cannot have been idle land for more than 2 years. Land set aside usually cannot be used for any type of production. Growing of non-food crops (including energy) is allowed on the condition that the use of the biomass will be guaranteed by a contract or by the farmer. Under such circumstances the farmer does not lose his subsidy on account of setting land aside and also receives the subsidy for growing.[101]

99 ibid
100 ibid
101 Communication of the Commission – EU Strategy for Biofuels, Commission of the European Communities, 2006; Centrum Informacji Europejskiej – 03.2006

The set-aside obligation applies to farms with sufficient area to produce 92 tonnes of crops. On this account, farmers receive so-called compensation payments, i.e. subsidies paid to anyone who grows any kind of cereal or oily plants. Subsidies are calculated before crops are harvested based on reference crops, i.e. average crops in a given country over the past 5 years with two extreme results rejected. Poland's reference crop amounts to ca. 3 t/ha, which corresponds to a minimum growing area of 30 ha. Subsidies are calculated as the product of the growing area, reference crops and the subsidy rate.[102]

2.2.2. Car manufacturers and petroleum corporations on biofuels

The support of the automobile industry is a crucial factor for the success of any vehicle power initiative, including the promotion of biofuels. No politician, journalist, ecologist or even scientist will be able to influence the public opinion as strongly with their statements as a manufacturer of cars, parts or motors. Several years ago, real or alleged views of representatives of the automobile corporations quoted in Polish newspapers about the deadly effect of biofuels on engines have contributed significantly to society's prejudice to bio-components.[103]

Among biofuel opponents and sceptics were such companies as Toyota, Ford, Renault, Peugeot, Seat, Fiat, Daewoo, Opel, Honda and the manufacturer of Bosch oils. It is characteristic that in practically all cases, the position of the person stating these views was never given, so the reader did not know whether he was dealing with a small-time salesman, mechanic or receptionist.[104]

Some corporations move forward to intercept trends of introducing fuels obtained from alternative energy sources, often out-boasting each other on the state of their research on AFV (Alternative Fuel Vehicles). The necessary condition for combustion engines to operate properly is appropriate, stable parameters of the fuel. Using biofuels without modifying the engine requires compliance with standards set out for fuels obtained from crude oil. This is easy to achieve by blending renewable and conventional fuels.[105]

2.2.2.1. ACEA and BEST

The car industry saw its chance to get its hands on EU funds. In June of 2006 the European Automobile Manufacturers' Association (ACEA; members include Fiat, BMW, GM, Daimler Chrysler, Renault and Volkswagen) appealed to the EC to become involved in the promotion of biofuels by providing discounts for manufacturers of vehicles which emit the smallest quantities of carbon dioxide. The association announced that it will submit to the Commission a detailed proposal on biofuel promotion. This year, the work of the organization is headed by Fiat. Corporations which still recently seemed to oppose biofuels are becoming their most ardent supporters.[106]

In January of 2006, thanks to financial support from the EU, the 4-year BEST project was established (BioEthanol for Sustainable Transport). Among those working on the project are three car makers (Saab, Scania and Ford), five bioethanol manufacturers (including SEKAB, Sweden Nedalco, Wessex) and four universities. The initiative is to conduct research to facilitate the introduction of biofuels in Europe.[107]

2.2.2.2. Automobile Manufacturers

Scania

Most models of trucks made over the past 8 years (more than 300,000 vehicles) can run on pure bio-diesel. In July 2006, the Swedish manufacturer announced that it will guarantee the proper operation of vehicles equipped with so-called "unit injector" engines. In doing so, it maintains, it moves to meet the market which expects a declaration of safety in using pure bio-diesel in trucks. According to Scania, the basic limitation for such extensive use of bio-diesel in transport is the insufficient area of arable land to grow rape. Maximizing rape crops in the European Union would allow to obtain enough product to replace only 10-15% of diesel fuel.[108]

102 KIB; Wspólna Polityka Rolna zasady funkcjonowania oraz ich reforma [Common Agricultrural Policy – Its Function and Its Reform] – MRiRW, 2003
103 M.in. Rządu pęd do roślin [The Government's Green Drive et al.] – A. Kublik, Gazeta Wyborcza, 25.11.2002; Opel też ostrzega [Opel Also Warns] – A. Kublik 28.11.2002 GW; Co mówią producenci aut [What Car Makers Say] – A.Kublik, Gazeta Wyborcza, 05.12.2002; Biobubel [Biolemon] – K. Trębski, J. Fijor, J. Piński Wprost, 1051, 19 Jan. 2003; Balcerowicz wprost - Silnik i demokracja [Balcerowicz straight up – the Engine and Democracy], Wprost 1051, 19.01.2003;
104 Supplement – statements from car manufacturers
105 Biofuel Development Program – KIB
106 Statement of the CEO of Fiat in the supplement to this report
107 www.miljobarometern.stockholm.se
108 www.biodiesel.pl

Saab

The company touts cars fitted with flex type engines, that is, suited to run on petroleum blended with bioethanol in any proportion: [109]

it is best to fill up with bioethanol (E85), but if it is unavailable in a given area, the engine will run normally on regular petroleum.

Contrary to ideas endorsed in Poland, bioethanol used in Saab engines provides more power and generates less sludge:

the engine has much more power and more torque. Furthermore, a more efficient combustion process means less soot compounds (…)

The engines must be modified, however – mainly reprogramming of the control system. It turns out that the company is able to deal with the shortcomings of bioethanol:

valves and valve seats are made of modified alloys. Likewise, other components of the fuel system, including the gas tank, have undergone suitable changes.

Fig. 17. The manufacturer tells us that dynamic driving on bioethanol is possible

Source: www.saab.pl

The company is also developing hybrid power systems – a combustion engine running on pure bioethanol and an electric motor. Hybrid engines in a vehicle are capable of generating a maximum of 260 HP and 785 Nm of torque.

Ford

Ford has been conducting AFV-powered vehicle research for many years. The company boasts accomplishments in the variety of biofuels used:

The exhaust of AFV-powered vehicles contains fewer and less harmful substances than in petroleum or diesel fuel. For 40 years, Ford has headed research on AFV vehicles and on their technology of construction. No other manufacturer markets vehicles which use such a wide range of fuels, including compressed natural gas, liquid petroleum gas, methanol, ethanol and electric energy.[110]

The International Motor Show in London took place in the second half of July 2006, welcoming more than 200 exhibitors. The most important topic was ecological fuels, production methods and environmentally friendly technologies. Ford presented its new flex type car. This is the first biofuel-powered car available on the British market. The manufacturer assures that the price of this car will not be higher than that of its conventional counterpart.[111]

109 Quotes and photographs from the Polish Saab website: www.saab.pl
110 www.ford.com.pl
111 Bilans – TVN24, 20.07.2006; www.Ford.com

Fig. 18. Biofuel-powered Ford International Motor Show (London 2006)

BP, Shell and Dupont

Shell is building distilleries in Brazil, where it intends to invest ca. 6.0 billion USD jointly with BP. BP and Dupont have announced in June 2006 that they are about to conclude their research on new, enhanced fuel of vegetable origin. The new product – biobutanol – is expected to deliver more energy on combustion than bioethanol, is easier to use as fuel and engines do not have to be modified to use it. Ethanol is capable of delivering 75% of the energy obtainable from petroleum, while biobutanol delivers 95%. Work on the technology will be completed in 2010. The technology is very expensive and presently unprofitable.[112]

Toyota

Toyota has been getting ready to subject bio-diesel power to extreme tests during the Paris-Dakar race in 2007. The first totally biofuel-powered car to participate in the race runs on bio-diesel manufactured from used frying oil. The Land Cruiser was driven by a racing novice, former Formula 1 driver Ukyo Katayama. The driver received technical support from scientists at Osaka Sangyo University.[113]

2.2.3. Biofuel forecasts around the world

The world got used to the idea of cars running on fuels made from farming and food products. Fuels are and will be blended with bio-diesel and bioethanol. In bio-component production, ethanol constitutes about 90% of all production worldwide. The remainder is bio-diesel and other components. In 2006, bioethanol production was twice as high as in 2000 (35.0 billion litres in 2005), while bio-diesel production increased four times (3.5 billion litres). Bio-diesel production capacity in 2006 was 6,069.0 billion litres.

Europe leads the world in bio-diesel production and consumption. France and Germany are especially keen to invest in the production of esters, while the United States and Brazil are the world powers in bioethanol production. Bioethanol has also been accepted in Asia, with China, India, the Philippines and Thailand showing strong interest.

International corporations which have announced significant biofuel investments include Archer Daniels Midland, Cargill, DaimlerChrysler, Dupont and Shell. Others to invest in esters include Richard Branson (Virgin), Vinod Khosla (Sun Microsystems) and Bill Gates (Microsoft). Car manufacturers – Ford, General Motors and Volkswagen are conducting advanced research on biofuel-compatible vehicles.[114]

Table 5. Bioethanol – production in selected areas of the world (billions of litres)[115]

	2002 r.	2003 r.	2004 r.	2005 r.	2006 r.
USA	8,2	10,6	12,9	14,8	18,2
Brazil	12,6	14,7	14,7	16,1	16,7
EU	0,4	0,5	0,6	1,0	1,4
China	0,3	0,8	1,0	1,0	1,0
India	-	0,2	0,1	0,3	0,5
Columbia	-	-	-	0,2	0,3
Canada	0,3	0,3	0,3	0,3	0,3

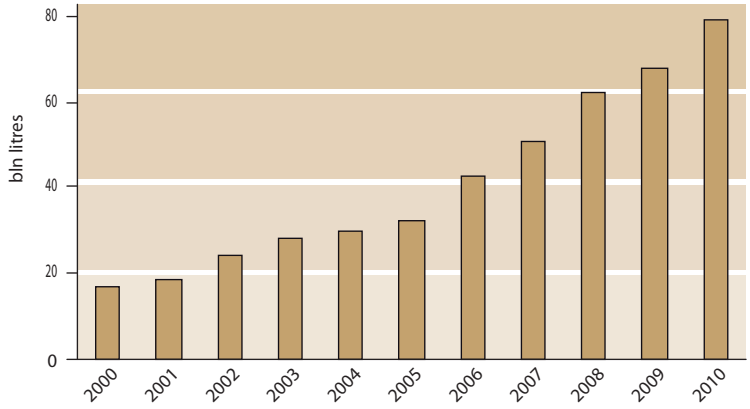
112 BP and DuPont in biofuel breakthrough – Financial Times 21.06.2006; KIB
113 www.channel4.com
114 Biofuels for transportation – June 2006, Worldwatch Institute
115 F.O.Licht's World Ethanol and Biofuels Report, Vol 09.05.2006

2.2.3.1. World Powers

It is estimated that total ethanol production in 2006 reached 50.0 billion litres (an increase of 5.0 billion litres), of which ca. 67% (33.6 billion litres) was to be turned into bioethanol. The largest manufactures of bioethanol are the United States, Brazil, China and India. 2005 witnessed the first-ever change in the leadership position – the United States overtook Brazil. Both countries manufactured record quantities, slightly exceeding 160.0 million hl, for a total of 320.0 million hl. Together, these countries produced three times more of the substance than the rest of the world combined.[116] Pure bioethanol (E100) can be poured into gas tanks at most filling stations in the United States and Brazil. In Europe, E100 can be found only in selected filling stations in Germany and Sweden.[117]

The average value of CAGR (Compound Annual Growth Rate) for bioethanol production in 2000-2005 was very high, amounting to 14%. Over the next five years, the CAGR value is expected to be even higher – as much as 19%. The largest contribution to this will be from the United States.[118]

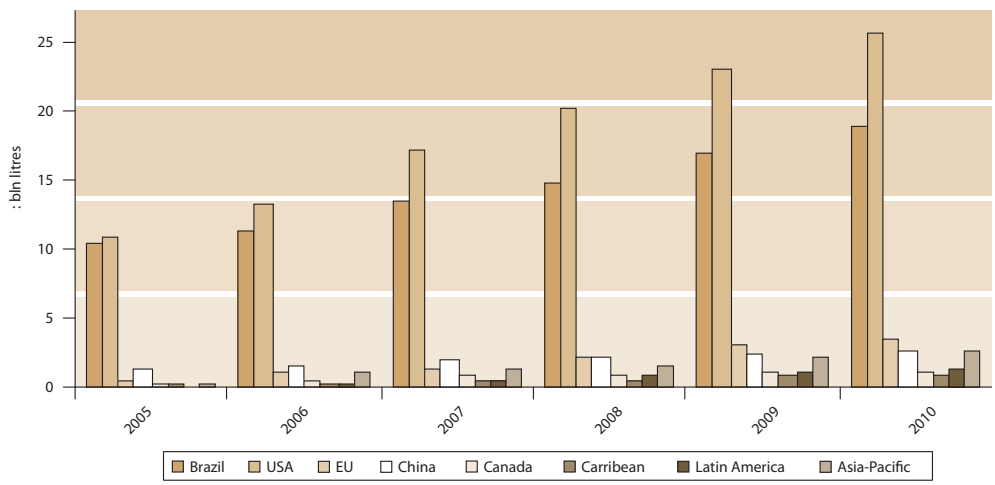
Fig. 19. Bioethanol – production worldwide[119]



a) The United States

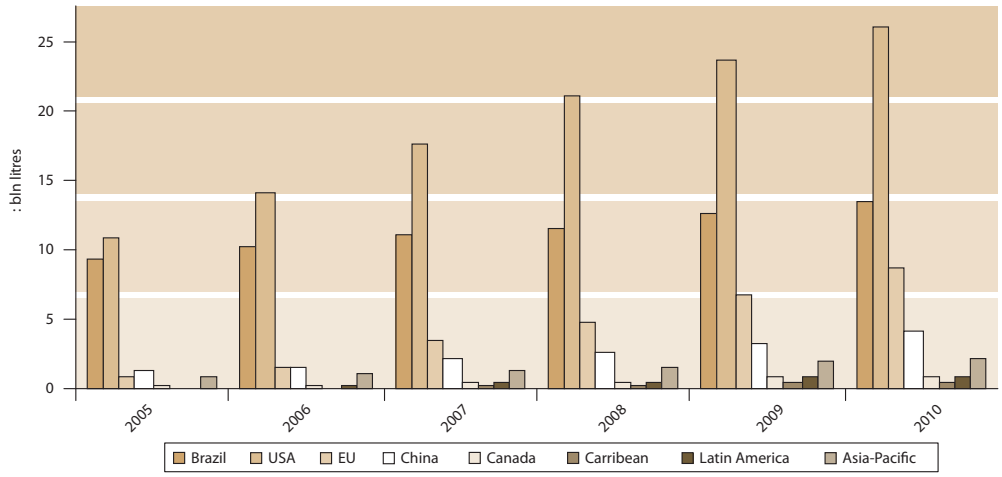
This country is the largest producer and consumer of bioethanol. In 2005 the United States placed first for the first time, overtaking Brazil slightly (record production in both countries). Forecasts show that this distance will increase in upcoming years. Bioethanol demand is so high that domestic supply is insufficient to satisfy all needs and the United States must import the raw material. The bioethanol industry is very fragmented: the 12 largest companies share 50% of the market, with the remainder shared among 69 manufacturers. The largest manufacturer is ADM, which holds a ca. 25% share of the market.[120]

Fig. 20. Bioethanol – global supply projections[121]



116 F.O.Licht's World Ethanol and Biofuels Report, Vol 09.05.2006
117 Zapanują biopaliwa [Biofuels will Rule] – M. Rybarczyk, Przekrój, no. 36/2005
118 Ethanol: A High-Octane Player in Energy Sector – Friedman, Bilings, Ramsey & CO., 27.03.2006
119 Ethanol: A High-Octane Player in Energy Sector – Friedman, Billings, Ramsey & CO., 27.03.2006
120 Ethanol: A High-Octane Player in Energy Sector – Friedman, Bilings, Ramsey & CO., 27.03.2006
121 Ethanol: A High-Octane Player in Energy Sector – Friedman, Billings, Ramsey & CO., 27.03.2006

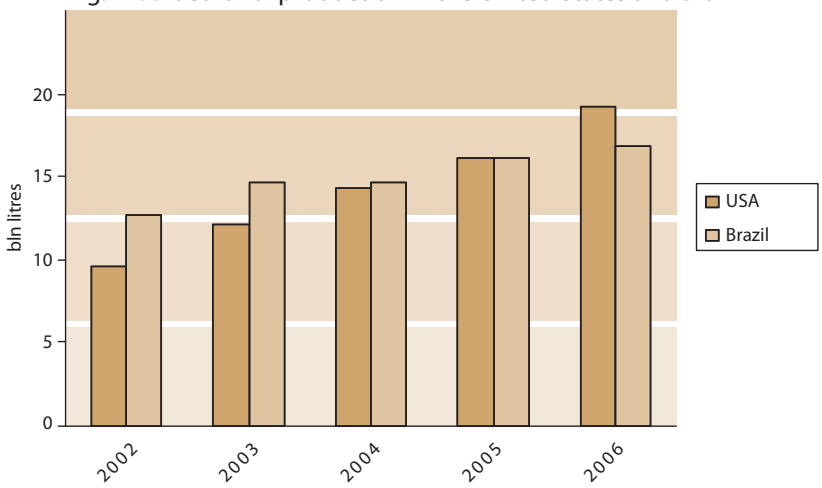
Fig. 21. Bioethanol – global demand projections[122]



The most popular type of engine in the United States runs on petroleum. The most popular additive is bioethanol – about 10% of petroleum contains varying amounts of bioethanol. Currently ethanol amounts for 3% of the total energy value of total consumption of vehicle fuels. This share may increase to 10% in 2010, as its growth rate amounts to ca. 20% annually.

E10 are the most popular ethanol-containing fuels. In the United States there are 5-6 million cars which run on E85. GM, Ford and DaimlerChrysler have announced that by 2010 each company will double the production of vehicles powered by bioethanol or other renewable fuels, to 2.0 million annually. Taxes on such fuels are much lower.[123]

Fig. 22. Bioethanol production in the United States and Brazil[124]



The Americans are enthusiastic about bioethanol. The Wall Street debut in June of 2006 of the second manufacturer of ethanol from corn – VeraSun Energy – was a resounding success, with company shares gaining more than 30% in value in the first days of trading. Another manufacturer, Aventine Renewable Energy, issued half a million more shares and more companies are planning to go public. Bioethanol demand is the consequence of withdrawing MTBE ether from the market, as it turned out to be carcinogenic. The price of bioethanol is about 5 US$ / gallon, much higher than the price of petroleum (ca. 3 US$ / gallon). Americans are expecting bioethanol prices to drop in 2007, as more companies commence its production.[125]

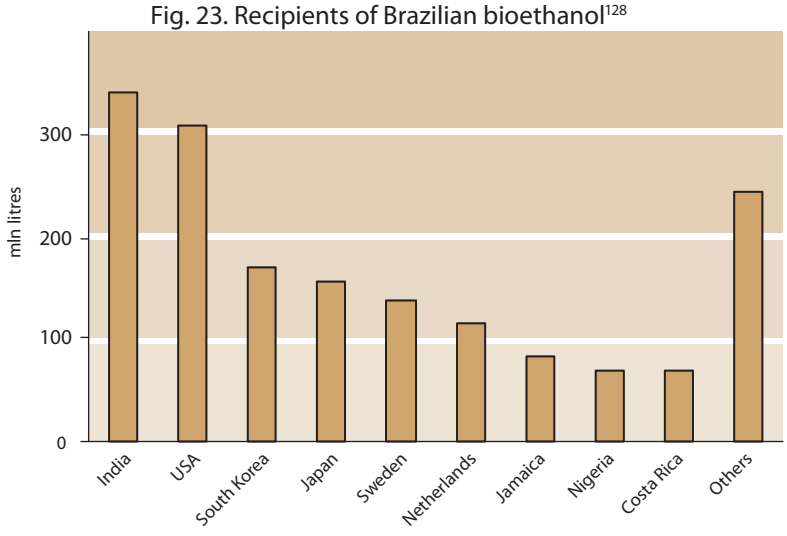
122 Ethanol: A High-Octane Player in Energy Sector – Friedman, Billings, Ramsey & CO., 27.03.2006
123 www.bloomberg.com
124 F.O.Licht's Word Etanol and Biofuels Report, Vol 09.05.2006
125 Wall Street kocha etanol [Wall Street Loves Ethanol] – T. Deptuła, Dziennik, 29.06.2006

The US places highest among non-European countries in bio-diesel production classification (3rd place in 2005 – 250,000 tonnes). Efforts continue to have B20 approved by all engine manufacturers. These actions are supported by the National Bio-diesel Board. Currently, most leading manufacturers support the use of B5 biofuel. New Holland and DaimlerChrysler have approved B20 biofuel, but only in vehicles ordered by government agencies, the military and fleet customers. The petroleum potentate Chevron is also planning to make money on bio-diesel. For this purpose, the corporation acquired a 22% stake in the Galveston Bay Bio-diesel company, which is building a bio-diesel production facility in Texas – one of the first installations of its kind in the US. The initial production capacity of the installation is to be about 75 000 tonnes of bio-diesel annually. [126]

b) Brazil

Brazil has 300 bioethanol production plants, obtaining bioethanol mainly from sugar cane. Demand is guaranteed by regulations dating from 1993, obligating manufacturers to add 25% of bio-components to petroleum annually. Bioethanol is commonly available at 29,000 filling stations in the whole country, with consumption in 2005 reaching 9.45 billion litres. Brazil was the second largest manufacturer and consumer of bioethanol. More than half the cars are adapted to run on high-ethanol fuels. This share will continue to grow. In 2010, projected production will reach 18.9 billion litres (10.8 billion litres in 2005).[127]

Fig. 23. Recipients of Brazilian bioethanol[128]



The beginnings of Brazilian biofuels go back to the 1970s oil crisis, when the junta in power decreed the use of bioethanol. A decade later, 90% of Brazilian cars ran on bioethanol, which currently accounts for one third of the total production volume in the fuel industry. There are 50 distilleries under construction. BP and Shell are planning to invest 6.0 billion dollars on biofuel production in Brazil.

Brazil is the largest exporter of bioethanol in the world, supplying the product to countries all over the world. The country intends to make up for losing its leader's position as producer by strengthening exports. The economy favours these plans – a barrel of bioethanol is more than twice as cheap as a barrel of crude oil.[129] Due to growing demand, one of the key customers is the largest producer of bioethanol in the world – the United States.

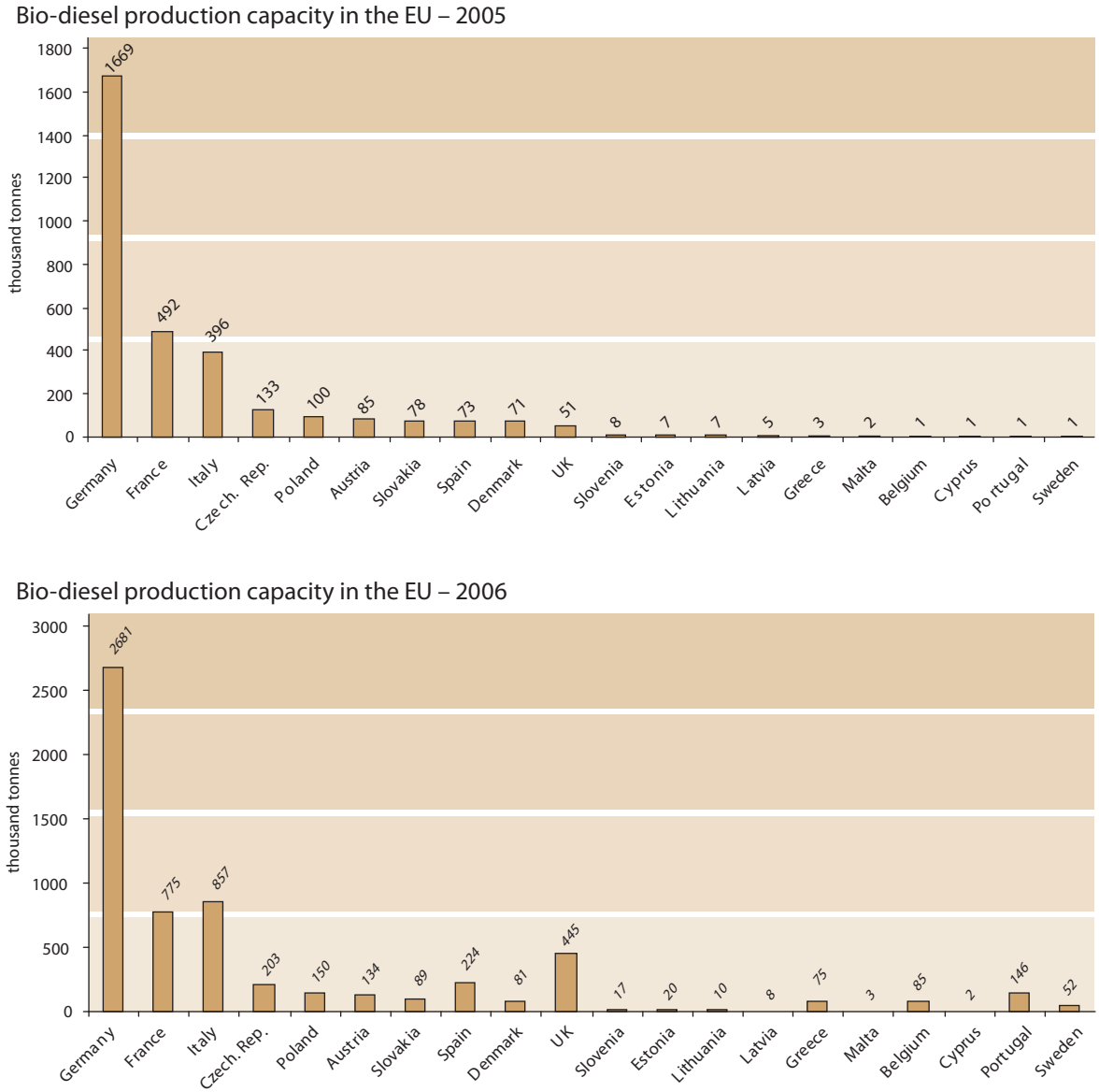
2.2.3.2. Europe – Bio-diesel in Demand, an Oversupply of Bioethanol

Bio-component consumption in Europe amounts to about 1% of all liquid fuels in transport, but this number is growing steadily.[130] Europe is the world's largest producer and consumer of bio-diesel. Most European vehicles are fitted with diesel engines. Everything indicates that the share of cars sold with diesel engines will grow with respect to engines running on petroleum. In effect, a deficit of diesel fuel is anticipated, leading to the necessity of importing this fuel. In recent years, Europe has become the second largest importer of palm oil (raw material to manufacture bio-diesel) after China.

126 www.biodiesel.pl; Biofuels for transportation – June 2006, Worldwatch Institute; F.O.Licht's World Ethanol and Biofuels Report, Vol 09.05.2006
127 Ethanol: A High-Octane Player in Energy Sector – Friedman, Billings, Ramsey & CO., 27.03.2006
128 ibid
129 Zapanują biopaliwa [Biofuels will Rule] – M. Rybarczyk Przekrój, no. 36/2005
130 EESC opinion on "Sustainable development in agriculture, forestry and fisheries and the challenges of climate change" (2006/C 69/02); www.biodiesel.pl

Ester production in Europe is developing dynamically. Currently, 20 countries produce bio-diesel on an industrial scale (as opposed to 11 in 2005). Esters account for ca. 80% of all bio-component production in the EU. Overall production in the 25 member states increased from 1.9 million tonnes in 2004 to nearly 3.2 million tonnes in 2005 (a 70% increase; growth in previous years was lower, equal to 30-35%). Bio-diesel production capacity in 2006 will amount to 6.0 million tonnes (a 90% increase!).

Fig. 24. Bio-diesel in the EU[131]



Germany is the unquestioned world leader in bio-diesel production and consumption. In 2005 Germany produced 1.6 million tonnes of bio-diesel – as much as the rest of the European Community combined. France comes second (nearly 500 million tonnes) before Italy (nearly 400 million tonnes), followed by the Czech Republic (133 million tonnes) and Poland (100 million tonnes). Austria's production capacity is similar to that of Poland.[132]

In the year 2006 bioethanol production in the EU may reach 3.2 billion litres. The largest production increase is anticipated in Germany (57%), with Spain also displaying a high growth rate. The highest value of production is in France. In Poland, the growth of bioethanol production is stable, with an increase of several percent for the past few years. As production of bioethanol around the world increases, production costs of this fuel will drop. It is estimated that the cost of production of 1 litre of E85 in 2030 may be as low as PLN 0.50.[133]

131 European Biodiesel Board, 2005
132 ibid
133 US Department of Energy after www.saab.pl

Table 6. Europe – ethanol production for food and fuel (millions of litres)[135]					
	2006 r.	2005 r.	2004 r.	2003 r.	2002 r.
France	95	91	83	81,7	84,4
Germany	55	35	23	28	27,5
Italy	16,25	15	15	14,9	20
Poland	23	22	20	17	16,5
Spain	47,5	37,6	33,4	29,2	25,8
Sweden	11,5	11	10,5	10	97
Great Britain	28	29	35	41	40
Russia	77	7,5	78	74,5	72,8
Ukraine	27	24,5	25	28,6	27,4

Germany

The German parliament actively supports the biofuel program. For this purpose, the German Biofuel Association (LAB) was established to promote the production and consumption of biofuels. A Bundestag member was chosen as its CEO. The organization's member bodies include associations of farmers, distillers and grain producers and bio-component manufacturers. The German Ministry of Food, Agriculture and Consumer Protection (BMELV) offers owners of agricultural and forest farms refunds to build or modernize filling stations adapted to distribute biofuels. Support may cover as much as 40% of the total cost. Entities operating in forest management and agricultural sectors will still be able to use biofuels (bio-diesel and rapeseed oil) without paying the afore-mentioned tax.[135]

Germans lead Europe in terms of production and distribution of organic renewable raw materials. This position is possible thanks to intensive state support scientific research and active promotion of biofuels among the population. There is great demand for raw materials to manufacture biofuels, as well as greases and technical lubricants. The first large biofuel production facilities were commissioned in 1999 and 2000. In the year 2002, 700,000 ha of idle land (6% of the total growing area) was designated to grow renewable crops, with the largest share going to oilseed rape (340,000 ha).[136]

In Germany, biofuels rule among diesel engines, with most drivers buying B5. Since 2002, bio-diesel production has tripled, amounting to 1.5 million tonnes, which corresponds to 4% of the diesel market and 2% of the fuel market overall. ADM – the largest bio-diesel manufacturer in Germany plans to increase production capacity in Hamburg by commissioning an additional palm oil refining installation. The new refinery is to have the greatest production capacity in Europe – 350,000 tonnes annually.[137]

France

In 2006 the French government announced a plan to triple biofuel production within three years. By the end of 2007 one third of fuel for public administration vehicles is to be biofuel. By the year 2025 all of public transport is to run on biofuels.[138]

In the year 2005 France manufactured almost half a million tonnes of bio-diesel. The largest European bio-diesel production facility (290,000 tonnes annually) is located in Grand Couronne. Domestic diesel production is not sufficient to cover domestic demand. Currently, every other car with a diesel engine in France uses biofuel containing up to 5% bio-components. Several thousand cars (including regular production cars) are involved in a pilot program testing B30 fuel.

Cargill will invest more than EUR 50.0 million in France to build a bio-diesel oil pressing facility in Montoir, in western France. The investment will be completed jointly with Sofiproteol. The target annual production capacity is to be 250,000 tonnes, with 80% of the oil to be transported by pipeline to the Diester company (Cargill's strategic partner), which will turn it into esters. The company expects that the production will satisfy biofuel standards set by the French government, which are stricter than EU standards (2008 – 5.75%; 2010 – 10%).[139]

134 F.O.Licht's World Ethanol and Biofuels Report, Vol 09.05.2006
135 www.biodiesel.pl
136 Z drugiej strony Odry [On the Other Side of the Oder] – Marek Jastrzębski, Nowe Życie Gospodarcze, supplement 26.04.2006
137 www.biodiesel.pl
138 Francja: więcej biopaliw [France: More Biofuels] – Rzeczpospolita, 03.02.05
139 F.O.Licht's World Ethanol and Biofuels Report, Vol 09.05.2006

France produces 5 times less bioethanol than bio-diesel. The very small demand, however, results in most of the product to be exported to Germany, Italy, Belgium and Great Britain. According to the Total corporation, the development of the bioethanol industry is a misguided idea to support the agricultural sector, since there is surplus quantities of this raw material in Europe.

Sweden

In August of 2006 the Swedish Statoil company commenced the production of B5 bio-diesel in Sweden, which is to replace the pure diesel fuel sold until now (target annual figure of 46.0 million litres). The biofuel was distributed to filling stations in the fall and also appeared in the corporation's four stations in Norway. The Perstorp Oxo company is building a bio-diesel production installation with an annual production capacity of 160,000 tonnes. Production will commence in early 2007.[140]

E85 is a popular fuel in Sweden. Ethanol is produced from local biomass and wood industry wastes. Currently all city buses in Stockholm run on bioethanol. Sweden provides tax exemptions for owners of homes heated with biofuel and for owners of ecological vehicles. Over Sweden intends to completely replace petroleum products with bio-components over the next 15 years. Today, Sweden is less dependent on crude oil than other EU countries. Over the past 30 years heating oil consumption to heat homes has decreased by 70%. Since 1994, despite a 70% increase of industrial production, the consumption of crude oil remains constant.[141]

Austria

The first pipeline in Europe to transport methyl esters was commissioned in June of 2006. After a test period, the pipeline was to commence full-scale transport in the fall of 2006. The pipeline connects the fuel terminal of the OMV petrochemical corporation with the ester production facility located 3 km away (target annual production capacity of 95,000 tonnes), where blending with diesel fuel will take place.[142]

Spain

The largest European ethanol producer is located in Spain – the Abengoa company's annual production capacity is 260,000 tonnes. Spain also plans to build one of the largest bio-diesel production facilities in Europe, in Bilbao and Ferrol (200,000 tonnes). Bio-diesel production would commence in 2007 and 2008.[143]

Slovakia

In 2006, petroleum consumption was to amount to ca. 750,000 tonnes and diesel fuel to 1 million tonnes.; ETBE production was to remain constant at 50,000 tonnes. The Slovakian government accepted the obligation of adding 2% of bio-components to biofuels.[144]

The Enviral corporation commenced the construction of the first modern bioethanol production facility in the town of Leopoldov near Trnava (PLN 285.0 mln , production capacity – 120,000 tonnes). The bioethanol will be manufactured from corn. The commissioning is scheduled for early 2007. The product is to the Slovnaft refinery, a subsidiary of the Hungarian MOL.[145]

The Czech Republic

The Czech Republic has more than ten years' worth of experience with a bio-diesel production program, with tested production and processing technologies. In the year 2005 133,000 tonnes of bio-diesel were manufactured in the country – more than in Poland (100,000 tonnes).

One of the largest bioethanol dehydration installations in the country, with an annual production capacity of 80,000 tonnes is being built in the northern part of the Czech Republic. The facility is scheduled to commence operation in 2007, exporting most of its product mainly to Germany.[146]

Hungary

Starting in 2008, the sale of fuels containing at least 4.4% of bio-components and low-sulphur fuels will carry a lower tax. MOL – the Hungarian petroleum powerhouse listed on the Warsaw Stock Exchange is beginning to invest in biofuels. The company has acquired several contractors to supply biocomponents. The planned investment cost is EUR 32.0 million. Production is scheduled to commence in the second half of 2007. Starting in 2008, MOL will be buying 150,000 tonnes of ready bio-diesel or intermediate products for its production.[147]

140 www.biodiesel.pl
141 ibid
142 ibid
143 F.O.Licht's World Ethanol and Biofuels Report, Vol 09.05.2006
144 ibid
145 Słowacja będzie dla nas konkurencją [Slovakia will be Our Competition] – B. Mayer, Parkiet 17.02.2006
146 www.biopact.com
147 Nie stracą na produkcji biopaliw [They Will not Lose on Biofuel Production], Parkiet, 03.07.2006

The government has announced that 40% of the energy consumed by Hungary is to originate from biomass. By 2010 renewable energy would constitute 7% of the energy supply (currently it satisfies 4-5% of domestic demand). In the year 2005 surplus grain would be sufficient to produce 800 million litres of bioethanol. In the years 2007-2013, Hungary may receive 300 million euros of assistance to implement pro-ecological investment plans. Hungary also boasts of its plant genetics success – a new species of grass was developed in the Szarvas region. According to biotechnologists, the crop delivers more energy than all known energy crops and is comparable to brown coal.[148]

2.2.3.3 Asia Bets on Bioethanol

Biofuel production in Asia was to reach 7.1 billion litres as of the end of 2006 (an increase of ca. 8%). A successive increase in bioethanol demand and production is anticipated in upcoming years in all of Asia and the Pacific. In 2010 demand will reach 2.7 billion litres annually – 10 times more than in 2005 (0.27 billion litres). The following countries are intensively developing biofuel introduction programs (litres/ year):[149]

List 8. Bioethanol in Asia
• Thailand – intends to produce more than 350.0 mln • Australia – starting in 2008 – biofuel production amounting to 350.0 mln • Indonesia – annual production will reach 60.0 mln by 2007; • Japan – plans to import 500.0 mln of biofuels; • Pakistan – will introduce E10 petroleum in 2006; • The Philippines – currently all petroleum contain 10% bioethano an addition of 20% is planned for 2010 – this corresponds to 5.4 million litres;

a) China

China is a world-leading producer and consumer of bioethanol. Currently, bioethanol constitutes 20% of domestic consumption of all fuels thanks to a nationwide initiative. Due to price increases caused by competition of the fuel with the food market for the same raw material, China intends to promote the more economic crops (e.g. potatoes, cellulose). China is also considering the possibility of building production facilities in Brazil.

In the year 2005, four bioethanol dehydration installations officially delivered 1 million tonnes of bioethanol. The plant in the Jilin province, in the northern part of China, is planning to increase annual production capacity to 1 million tonnes in 2010, from 300,000 tonnes in 2005. Consumption to follow the national plan will be 2 million tonnes in 2010 and 10 million tonnes in 2020.[150]

b) India

The greatest growth in bioethanol production is anticipated in India. Estimated sugar production will be higher by nearly 1 million tonnes than initially assumed by the government, amounting to 19.1 million tonnes. 8.7 million tonnes of molasses is sufficient to manufacture 2.0 million litres of alcohol. Reinstatement of the biofuel promotion program will increase consumption by 350.0 million litres.

c) Japan

Japan's government intends to replace at least 0.2% of total fuel energy consumption with biocomponents. The appropriate act was to be passed in 2006 and is to come into effect in March 2007. Its provisions are to act as incentives, not requirements, permitting blending of diesel fuel with 5% of bio-diesel. In Japan, the world's third economy in terms of crude oil consumption, refineries may currently add 3% ethanol to petroleum. Annual diesel fuel demand in Japan amounts to ca. 37.0 million tonnes and 61.0 million tonnes for petroleum.

148 www.budapestsun.com
149 F.O.Licht's World Ethanol and Biofuels Report, Vol 09.05.2006
150 Ethanol: A High-Octane Player in Energy Sector – Friedman, Billings, Ramsey & CO., 27.03.2006; F.O.Licht's World Ethanol and Biofuels Report, Vol 09.05.2006

2.2.3.4. "Green OPEC" in Africa

Fifteen African countries have signed the PANPP (Pays Africains Non-Producteurs de Pétrole) in Dakar (July 2006). Its ambition is to become a major worldwide producer of biofuels. The organization brings together countries which do not have crude oil deposits on land, but which have extensive agricultural and forest production capacities. Founding members include mainly western African countries (including some of the poorest: Sierra Leone, Niger and Burkina Faso), and also Congo, Zambia and Madagascar. Originators of the idea believe that the initiative may help African countries in breaking out of poverty and breaking free of their dependence on crude oil.[151]

The organization's founders admit that they were inspired by the enormous success of biofuels in Brazil. Africa grows many plants which could be used as raw material to manufacture biofuels, such as sugar cane and sugar beet, corn, sorghum (to manufacture ethanol) and peanuts and jatropha (to manufacture bio-diesel).

151 www.gulfnews.com; english.aljazeera.net

Conclusion

Over the last half-century, work on alternative sources of energy has accelerated because of diminishing reserves of strategic raw materials (crude oil) and increasingly frequent use of energy raw materials as tools for international politics.

There are places (e.g. Brazil) where drivers have been using biofuels for many years. In other countries (the US) the government's proactive energy security policy has caused biofuel production to grow rapidly. Long-term trends of change in the energy industry are also noted in Asia (China, Japan, India), as witnessed by biofuel-related investments and changes in legislation.

Using biofuels brings with it problems which must be solved. The discussion is especially heated in Europe, touching on issues of crop growing area deficit, degradation of areas prepared for growing crops, price manipulations of biofuel raw materials and finally food price increases caused by price increases of energy raw materials used to manufacture biofuels (oilseed rape, soya, etc.).

Environmental protection, an alternative to crude oil and lack of real alternatives to biofuels seem to be sufficient arguments for biofuel consumption to grow. According to a scenario developed by Prof. Katarzyna Duczkowska-Małysz of the Warsaw School of Economics, food prices (at least in Poland) will not grow because biofuel manufacturers will turn to cheaper, foreign suppliers.

There will be voices, however, that the land area available to grow biofuel raw materials may become a political tool (dependence) just like access to crude oil is today. Therefore, domestic biofuel industry and farmers in Poland should be supported.

Under such circumstances it makes the most sense to invest in new technologies, which will reduce biofuel production costs, improve production efficiency per ton of raw material and in the development of new energy technologies (e.g. hydrogen fuel cells which, even though they are still very expensive at this stage, are already used e.g. in Beijing, for reasons of prestige).

Index of abbreviations

ester (mainly methyl ester, so-called FAME – Fatty Acid Methyl Ester)

EC – the European Commission

EU – European Union

EC – the European Community

RSE – Renewable Sources of Energy

TEEC – Treaty Establishing the European Community

EIT – European Indicative Targets

NIT – National Indicative Targets

TK – Trybunał Konstytucyjny [the Polish Constitutional Tribunal]

URE – Urząd Regulacji Energetyki [Energy Regulatory Office]

UKIE – Urząd Komitetu Integracji Europejskiej [Office of the Committee for European Integration]

CAP – Common Agricultural Policy

SDS – Sustainable Development Strategy

FAME – Fatty Acid Methyl Ester

ETBE – Ethyl Tert-Butyl Ether

MTBE – Methyl Tert-Butyl Ether

AFV – Alternative Fuel Vehicle

FFV – Flex Fuel Vehicle – vehicle powered by E85 biofuel

NGO – Non-Government Organization

B20 – Diesel fuel blended with 20% (by energy value) of bio-diesel

E85 – petroleum blended with 15% bioethanol

Glossary of basic terms

Biomass – a substance of agricultural or forest origin (grain, stems, wood, wastes, etc.)

Blending – adding substances to fuel (enriching), composition of the mixture

Bio-component – a substance obtained from biomass and added to fuels or a fuel by itself. The most popular bio-components:

- **Bioethanol (or biomethanol)** – dehydrated ethyl alcohol (or methyl alcohol)
- **Ether (ETBE, MTBE) –** bio-component obtained from alcohol (ethanol and methanol, respectively)
- **Bio-diesel** – fatty acid methyl ester (FAME) - used as an alternative to diesel fuel in diesel engines

Biofuel – fuel blended with a bio-component. In practice, this is petroleum with dehydrated alcohol (bioethanol) or petroleum diesel fuel with an additive.

Figures, tables, boxes, appendices

Lists

Tables

Appendix 1

Appendix 2

Appendix 1. Regulation of the Minister of Finance

REGULATION OF THE MINISTER OF FINANCE[1)]

of 22 December 2006

amending the regulation on excise tax exemption

(Journal of Laws of 27 December 2006)

Pursuant to art. 24 sect. 2 and art. 25 sec. 5 of the act of 23 January 2004 on excise tax (Journal of Laws No 29, item 257 and No. 68, item 623, of 2005 No. 160, item 1341 and of 2006 No. 169, item 1199) it is hereby decreed as follows:

§ 1. In the regulation of the Minister of Finance of 26 April 2004 on excise tax exemption (Journal of Laws of 2006 No. 72, item 500 and No. 99, item 688) in § 12:

1) sec. 1 receives the following wording:

"1. The following are exempted from excise tax:

1) bio-components intended for liquid fuels and liquid biofuels under separate regulations, complying with quality requirements set out in separate regulations;

2) complying with quality requirements set out in separate regulations and containing more than 2% bio-components:

a) unleaded petroleum – PLN 1.50 on each litre of bio-component added to this petroleum,

b) petroleum diesel fuel - PLN 1.00 on each litre of bio-component added to this petroleum diesel fuel

- except that the exemption cannot be higher then the excise amount owing on account of the sale of these fuels;

3) bio-components which constitute self-contained fuel and which complies with quality requirements set out in separate regulations – 1,680 PLN/ 1,000 L, except that the exemption cannot be higher then the excise amount owing on account of the sale of these bio-components;"

2) sec. 3 receives the following wording:

"3. The exemption referred to in sect. 1 point 2 applies provided that:

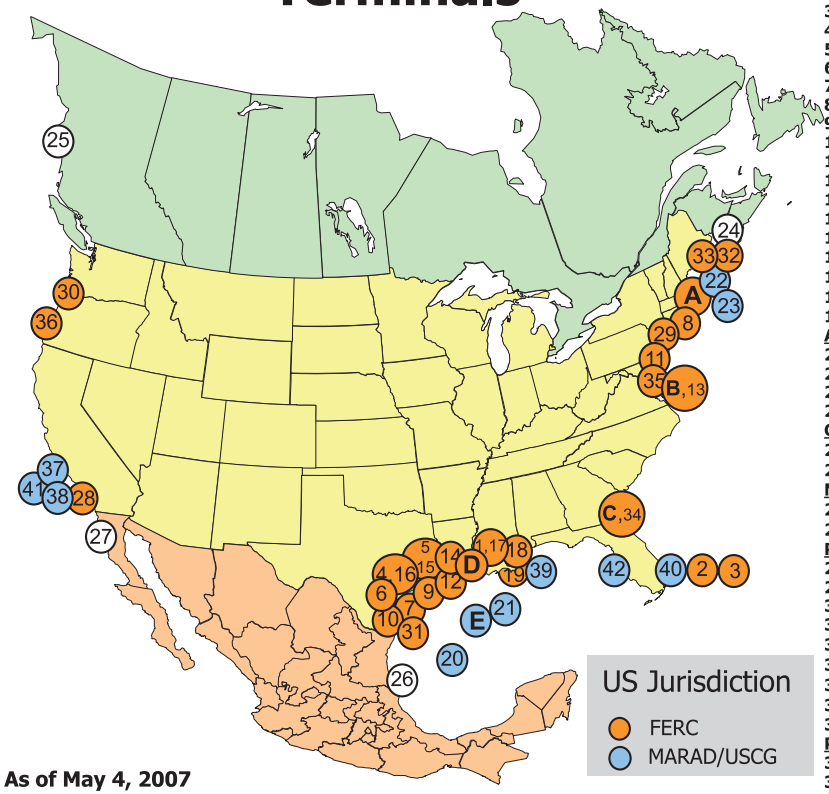
1) the entity taking advantage of the exemption and manufacturing liquid fuels containing bio-components or liquid biofuels keeps technical documentation indicating the method used to manufacture such liquid fuels or liquid biofuels and the bio-component content therein;

2) the entity acquiring liquid fuels containing bio-components or liquid biofuels for the purpose of reselling and taking advantage of the exemption shall keep records allowing the identification of exempt products and products not covered by the exemption."

§ 2. The regulation comes into effect on 1 January 2007.

FERC

Existing and Proposed North American LNG Terminals

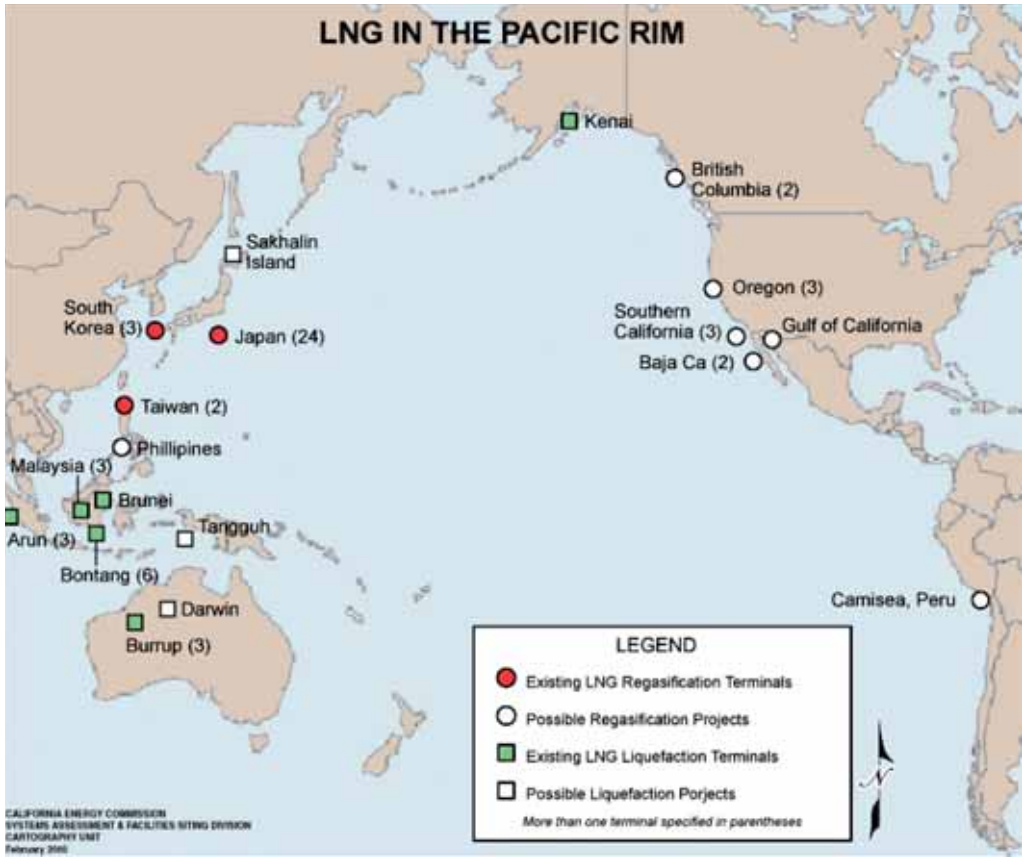


As of May 4, 2007

* *US pipeline approved; LNG terminal pending in Bahamas*
** *Construction suspended*

Office of Energy Projects

CONSTRUCTED
A. Everett, MA : 1.035 Bcfd (DOMAC - SUEZ LNG)
B. Cove Point, MD : 1.0 Bcfd (Dominion - Cove Point LNG)
C. Elba Island, GA : 1.2 Bcfd (El Paso - Southern LNG)
D. Lake Charles, LA : 2.1 Bcfd (Southern Union - Trunkline LNG)
E. Gulf of Mexico: 0.5 Bcfd (Gulf Gateway Energy Bridge - Excelerate Energy)
APPROVED BY FERC
1. Hackberry, LA : 1.5 Bcfd (Cameron LNG - Sempra Energy)
2. Bahamas : 0.84 Bcfd (AES Ocean Express)*
3. Bahamas : 0.83 Bcfd (Calypso Tractebel)*
4. Freeport, TX : 1.5 Bcfd (Cheniere/Freeport LNG Dev.)
5. Sabine, LA : 2.6 Bcfd (Sabine Pass Cheniere LNG)
6. Corpus Christi, TX: 2.6 Bcfd (Cheniere LNG)
7. Corpus Christi, TX : 1.1 Bcfd (Vista Del Sol - ExxonMobil)
8. Fall River, MA : 0.8 Bcfd (Weaver's Cove Energy/Hess LNG)
9. Sabine, TX : 2.0 Bcfd (Golden Pass - ExxonMobil)
10. Corpus Christi, TX: 1.0 Bcfd (Ingleside Energy - Occidental Energy Ventures)**
11. Logan Township, NJ : 1.2 Bcfd (Crown Landing LNG - BP)
12. Port Arthur, TX: 3.0 Bcfd (Sempra Energy)
13. Cove Point, MD : 0.8 Bcfd (Dominion)
14. Cameron, LA: 3.3 Bcfd (Creole Trail LNG - Cheniere LNG)
15. Sabine, LA: 1.4 Bcfd (Sabine Pass Cheniere LNG - Expansion)
16. Freeport, TX: 2.5 Bcfd (Cheniere/Freeport LNG Dev. - Expansion)
17. Hackberry, LA : 1.15 Bcfd (Cameron LNG - Sempra Energy - Expansion)
18. Pascagoula, MS: 1.5 Bcfd (Gulf LNG Energy LLC)
19. Pascagoula, MS: 1.3 Bcfd (Bayou Casotte Energy LLC - ChevronTexaco)
APPROVED BY MARAD/COAST GUARD
20. Port Pelican: 1.6 Bcfd (Chevron Texaco)
21. Offshore Louisiana : 1.0 Bcfd (Main Pass McMoRan Exp.)
22. Offshore Boston: 0.4 Bcfd (Neptune LNG - SUEZ LNG)
23. Offshore Boston: 0.8 Bcfd (Northeast Gateway - Excelerate Energy)
CANADIAN APPROVED TERMINALS
24. St. John, NB : 1.0 Bcfd (Canaport - Irving Oil/Repsol)
25. Kitimat, BC: 1.0 Bcfd (Kitimat LNG - Galveston LNG)
MEXICAN APPROVED TERMINALS
26. Altamira, Tamulipas : 0.7 Bcfd (Shell/Total/Mitsui)
27. Baja California, MX : 1.0 Bcfd (Energia Costa Azul - Sempra Energy)
PROPOSED TO FERC
28. Long Beach, CA : 0.7 Bcfd, (Mitsubishi/ConocoPhillips - Sound Energy Solutions)
29. LI Sound, NY: 1.0 Bcfd (Broadwater Energy - TransCanada/Shell)
30. Bradwood, OR: 1.0 Bcfd (Northern Star LNG - Northern Star Natural Gas LLC)
31. Port Lavaca, TX: 1.0 Bcfd (Calhoun LNG - Gulf Coast LNG Partners)
32. Pleasant Point, ME : 2.0 Bcfd (Quoddy Bay, LLC)
33. Robbinston, ME: 0.5 Bcfd (Downeast LNG - Kestrel Energy)
34. Elba Island, GA: 0.9 Bcfd (El Paso - Southern LNG)
35. Baltimore, MD: 1.5 Bcfd (AES Sparrows Point – AES Corp.)
36. Coos Bay, OR: 1.0 Bcfd (Jordan Cove Energy Project)
PROPOSED TO MARAD/COAST GUARD
37. Offshore California : 1.5 Bcfd (Cabrillo Port - BHP Billiton)
38. Offshore California : 0.5 Bcfd, (Clearwater Port LLC - NorthernStar NG LLC)
39. Gulf of Mexico: 1.4 Bcfd (Bienville Offshore Energy Terminal - TORP)
40. Offshore Florida: 1.9 Bcfd (SUEZ Calypso - SUEZ LNG)
41. Offshore California: 1.2 Bcfd (OceanWay - Woodside Natural Gas)
42. Offshore Florida: 1.2 Bcfd (Hoëgh LNG - Port Dolphin Energy)


LNG IN THE PACIFIC RIM
Kenai
British Columbia (2)
Sakhalin Island
Oregon (3)
South Korea (3)
Japan (24)
Southern California (3)
Gulf of California
Baja Ca (2)
Taiwan (2)
Phillipines
Malaysia (3)
Brunei
Arun (3)
Tangguh
Bontang (6)
Darwin
Burrup (3)
Camisea, Peru
LEGEND
Existing LNG Regasification Terminals
Possible Regasification Projects
Existing LNG Liquefaction Terminals
Possible Liquefaction Porjects
More than one terminal specified in parentheses
CALIFORNIA ENERGY COMMISSION
SYSTEMS ASSESSMENT & FACILITIES SITING DIVISION
CARTOGRAPHY UNIT
February 2005


China's Natural Gas Pipelines and Major LNG Terminals Under Construction, Approved, or Proposed

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The report ***"The Analysis of the Situation in the Polish Fuel Market"*** prepared by MDI Strategic Solutions discusses the issue of Poland's energy safety in the context of energy raw materials supply, development of the warehouse-transit infrastructure and the production of biofuels. The report discusses the mechanisms as well as economic and geopolitical conditions that shape the energy politics of the State in these three areas. The authors point to the possible use of the private sector potential for the purpose of building the energy safety of the country.

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