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Stagnating liquid biofuels developments in Russia: Present status and future perspectives

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Abstract

It is widely acknowledged that Russia possesses enormous biomass resources (Hoogwijk et al., 2005). Its vast areas devoted to agricultural production and plentiful timber resources suggest good prospects for the development of liquid biofuel production. However, no significant advances in this direction have been reported till now. None of the numerous investment projects announced at the heydays of biofuel excitement in Russia (2006-2008) are at the moment commercially operating. There are no specialised plants for the production of bioethanol and biodiesel in Russia. Little is known of the reasons for this discrepancy between biofuel potential and actual development. In investigating this discrepancy, this article analyses national developments and investigates local dynamics through a case study in the Omsk region. It is found that the reasons for this discrepancy are not related to technological incapabilities, but are to be found in the low policy and institutional priority given to non-fossil fuel exploitation and lack of market opportunities. Sprouts of second generation liquid biofuel technologies can be identified within the state system, but it remains to be seen how strong and how long these will be supported by the Russian state.

Keywords: Russia; biofuels; policies

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1. Introduction

In recent years biofuels has been one of the most outspoken and debated topics in scientific, political and public circles. At the start of the new Millennium liquid biofuels were widely seen as the panacea to a range of problems. Renewable liquid biofuels would be an answer to the decreasing fossil fuel reserves and growing energy consumption. Second, biofuels would contribute less to climate change than fossil fuels. Third, biofuels would lower the dependencies of major fossil fuel importing countries from fossil fuel producing and exporting regions, and enhance energy security by diversification. And fourth, biofuels would help to solve the crisis in rural areas of many countries following over-production of agricultural commodities, low crop prices (at least until 2007), land set asides and low farmers' income. More recently, the biofuel euphoria has been balanced by reporting on the challenges related to especially agro-biofuels such as indirect land use impacts of biofuel production, the consequences of increasing food prices, and doubts about the favourable environmental profile of agro-biofuels (Mol, 2007; Doornbosch and Steenblik, 2007; Oosterveer and Mol, 2010). Especially so-called first generation crop-based biofuels became increasingly criticized.

Still, interest in biofuels remained high during the first decade of the third Millennium and initiatives from a growing number of countries continue to be reported. Russia was not immune to this global biofuel euphoria and from 2006 it joined the biofuel excitement. Given the massive fossil energy resources and the absence of any pressure from the Kyoto protocol's CO_2-emissions reduction targets[1] (Opitz, 2007) energy security and climate change were not the main reasons for Russia to start promoting and developing liquid biofuel policies and projects. The main arguments for the Russian Government (2008) and the Russian Ministry of Agriculture in particular were related to the diversification of energy sources that may open new markets for agricultural commodities, and bring additional income to rural areas.

Vast areas devoted to agricultural production (9% of the world's arable land) and large timber resources (25% of the world's timber reserves) suggest good prospects for the development of liquid biofuel production and the diversification of energy sources (Kolchinskij, 2008). All major studies carried out till now confirm an enormous unexplored potential of bioenergy sources in Russia (cf. Martinot, 1998; Kargiev et al., 2004; Hoogwijk et al., 2005; Lins et al., 2005; Baklanova, 2007). At the end of the 1980s almost a quarter of the wood produced in the Soviet Union was used as fuel, which, however, corresponded to less then 1% of total fuel use (IEA, 1995). Combustion of wood remains a source of small-scale domestic heat production, while gas, coal, and oil-fuel (mazut) are predominantly used for middle- and large-scale heat and energy production (IEA, 2006).

Interest in liquid biofuels – the main subject of this paper – appeared rather recently in Russia. On the peak of the biofuel excitement in Russia, a considerable number of investment projects for the production of bioethanol were announced in different Russian regions (e.g. Penza Oblast, Omsk Oblast, Rostov Oblast, Tomsk Oblast, Altayskiy Kray). And the 2008-2010 programme of the Ministry of Agriculture for the stimulation of rape seed cultivation and processing has been partly initiated as an incentive for biodiesel production. But since 2008, no significant advances in actual liquid biofuels production has been reported, and all major policy proposals for their promotion have been lacking finalization and implementation. The international literature is silent on actual liquid biofuel developments in Russia, and remains focused on its large theoretical potentials.

Against this background, this article analyses the discrepancy between the potential of liquid biofuel production and the lack of actual liquid biofuel development in Russia. The study entails an analysis of general policy developments concerning bioenergy in Russia, and a detailed case-study of liquid biofuel production in one Russian region – Omsk oblast. Omsk oblast was selected for two reasons: it has been mentioned widely in Russia as the most advanced region to start industrial production of biofuels; and both bioethanol and biodiesel ventures are present in this region. The case-study of bioethanol and biodiesel ventures in Omsk oblast deepens the understanding of general dynamics and characteristics of liquid biofuel developments in Russia. The article is based on literature study, policy document analysis and 11 in-depth interviews with representatives of enterprises and government organizations involved in the production and regulation of biofuels.

2. Biofuels potential in the Russian Federation

2.1. Technical production capacity

Interest in bioenergy in Russia is not new. Throughout the last century, though dominated by fossil fuels, a certain degree of attention was always paid to fuels from biomass. As in many other countries, in Russia (and previously in the Soviet Union) research and industrial activities related to the biofuels started in the early 20th century. Between 1930 and 1970 more than 40 hydrolysis and biochemical plants were built that used waste products from timber processing, pulp and paper industries, and agro-food industries as feedstock. Forestry-based energy technology, such as the production of ethanol from wood, was developed early in the Baltic States (EIA, 1995: 257). Production of biobutanol was mounting till 1963, when the discovery of Western Siberian oil and gas fields and the rise of oil extraction by the OPEC-countries caused lower oil prices and thus economic advantages for fossil fuels (Karpov, 2007). Similarly, at the end of the 1980s production of hydrogen, methane, acetone and ethanol from biomass was replaced by more economically viable production from fossil-based sources (Energyland, 2009).

After the collapse of the Soviet Union in 1991 the majority of the hydrolysis and biochemical enterprises were privatised. Most of them were producing spirit that was used for ersatz alcohol and none produced biofuels. Due to the dramatic weakening of the state regarding imposing standards and control over the production of alcohol, many of these industries became involved in criminal activities with falsified products (chemical solvents, potable and industrial alcohol, etc.), contributing to the rapid rise of human deaths between 1991-1995 (Nemtsov, 2001). According to Baklanova (2007) the bankruptcy of hydrolysis plants reached high levels: from 38 plants in 2002 only 16 were operating in 2005. Moreover, approximately 190 distillery plants are currently operating at two thirds of their total capacity and depreciation of technical facilities and equipment reached 75% (Baklanova, 2007).

Hence, capacity for the production of ethyl alcohol is still available and could be used for the production of bioethanol (Karpov, 2007). In addition Russia has an advanced scientific base as well as a long industrial experience in ethanol production using hydrolysis technologies (Rabinovich, 2006). However, this originally favourable scientific and technological foundation for the development of biofuels is undermined by the continuous dismantling of industrial capacities and obsolete technologies.

2.2. Resource potential

The potential for renewable energy, and particularly biomass, in Russia is huge, but its use is extremely low (Table 1). Estimations of annual non-crop biomass suitable for energy production include 800 million tonnes of timber, 250 million tonnes of agricultural waste products, 70 million tonnes of wood wastes from pulp and paper industries, 60 million tonnes of municipal solid wastes and 10 million tonnes of sewage wastes (Lins et al., 2005). Potentially these resources could yearly provide approximately 100 mtce of biogas and 30-40 mtce of ethanol (IEA, 2003).

Table 1. Potential of renewable energy sources in Russia (million tonnes of coal equivalent per year) (*Source*: IEA, 2003).

Sources	**Gross potential**	**Technical potential**	**Economic potential**[a]
Small Hydropower	360.4	124.6	65.2
Geothermal Energy	180	20	115[b]
Biomass Energy	***10,000***	***53***	***35***
Wind Energy	26,000	2,000	10
Solar Energy	$2.3x10^6$	2,300	12.5
Low Potential Heat	525	115	36
Total RES (excluding large hydropower installations)	$2.3x10^6$	4,593	273.5

[a] The potential is estimated in three groups, considering renewable energy resources available for extraction (gross potential), resources which can be used with current modern technologies (technical potential), and resources which can be used economically (economical potential). The economic potential is a part of the technical potential, while the last is the part of the gross potential (IEA, 2003).
[b] The economic potential of geothermal energy is higher than the technical potential because it includes hot waters and steam-water flows of geo-circulating systems (Bezrukikh et al., 2002).

Russian forests supply most of the biomass suitable for bioenergy production. North and North-West Russia are historically important regions in terms of timber resources, and timber and pulp and paper industries (Martinot, 1999; Akim, 2005). Siberia and the Far East of Russia, though less explored, also have colossal biofuel potential (Zakrzhevskiy, 2005). This forest potential, however, stays unexplored due to a number of constraints, such as lack of adequate transportation networks, technological limitations, and remoteness from domestic and foreign markets. At the same time the annual net growth in wood reaches 1 billion m^3, of which 540 million m^3 is available for logging (IEA, 2003).

Table 1 shows that the technical potential of biomass corresponds to a third of domestic coal consumption. The economic potential of biomass is equivalent to almost 25% of the coal consumed in Russia. Moreover, according to the Energy Strategy of Russia until 2020 and recently approved Energy Strategy-2030, the economic potential nowadays is higher than presented in Table 1 due to higher fossil fuel prices in recent years. The use of biomass in the energy balance of Russia is regarded very low and estimated at 1% of total primary energy supply (Strukova, 2008). This figure, however, may vary (e.g. it was estimated at 3% by Strebkov, 1998) as there are no official statistics on traditional biomass use for heating, cooking and hot water (e.g. in Russian saunas "banyas") in the Russian countryside (IEA, 2003: 60).

Notably, this biomass energy potential does not include the potential from energy crops. Apart from agricultural wastes and cellulose, the Ministry of Agriculture seeks to use wheat for bioethanol production and rape seed for biodiesel production. The availability of agricultural land creates major opportunities for the cultivation of energy crops. As reported by the speaker of the State Duma, Russia possesses 20 million hectares of arable land that were abandoned during the economic crisis in the 1990s and are currently not used for agricultural activities. At least 10 million ha of this land can be used for producing crops for biofuels (Russian President portal, 2008). This potential of abandoned land for woody biomass production was confirmed by Hoogwijk and colleagues (2005) in their study using different land dynamic scenarios. CIS countries, including

Russia, have the highest geographical potential for energy crop production, reaching about 71-125 EJ yr^{-1} in 2050 (Hoogwijk et al., 2005). This would represent 5% to 20% of the projected global primary energy consumption in 2050 under different scenarios (Nakicenovic et al., 2000). Interestingly, the geographical potential of the former USSR countries exceeds their regional energy demand in the year 2050 in all scenarios (Hoogwijk et al., 2005).

The hopes for bioethanol production from wheat are associated with the fact that Russia is self-sufficient in wheat and demonstrated significant increases of wheat export in recent years: almost 10 million tonnes in 2006 and 18 million tonnes in 2009, which corresponds to around 8% and 14% of the world total wheat export respectively. (FAO, 2009). Till now, however, no quotas or targets for bioethanol from wheat have been discussed. Therefore excess of wheat adds to mounting wheat export of the Russian Federation and not necessarily stimulates bioethanol production.

With regard to biodiesel from rape seed, the Ministry of Agriculture launched a Federal programme for the period of 2008-2010, which encourages production and processing of rape seed. This initiative is intended to support the demand in rape seed oil for food and bioenergy industries. According to this Federal programme the cultivated area under rape seed will increase from 800,000 hectares in 2008 to 1,200,000 hectares in 2010, while the total yield will rise from around 0.9 million tonnes in 2008 to 1.6 million tonnes in 2010 (Ministry of Agriculture, 2008).

3. Russian Policy on Biofuels

3.1. Biofuels in Russia's Energy Strategy

The Russian Energy Strategy, initially formulated in 2003 and with a timeline till 2020, sets priorities for the long-term energy development, the modernisation of the fuel and energy sector, and the increase in production capacities and competitiveness on the world markets. It also identifies the future role of renewable energy sources and biofuels.

At the base of this energy strategy are various policy documents (cf. Box 1) formulated during the 1990s, which were intended to reform the post-Soviet energy system and introduce so-called regional aspects in the energy sector. Among the regional aspects the development of local nonconventional renewable energy sources was mentioned. However the priority was given to secure stable fossil fuels extractions. The reform in the energy sector was closely linked to the general economic reform in transitional Russia. Due to the poor functioning of the economy throughout the 1990s, many of the set goals were not achieved (IEA, 2002: 30). The transition from a centrally planned economy to a market economy called for changes in property regimes, instigating large – and often suspicious – privatisation in the oil and gas sector (Reynolds et al., 2007: 942). Developing renewable energy sources and biofuels was not part of the economic and political priorities in Russia during the last decade of the 20th century.

1992 – Concept of the new energy policy.
1995 – Main directions of Russian energy policy till 2010.
1997 – Main provisions in the structural reform of natural monopolies.
2003 – Russian Energy Strategy till 2020.
2009 – Russian Energy Strategy till 2030.

Box 1. Milestones of the State Energy Strategy.

But the 2003 Energy Strategy till 2020 points at the need to further develop renewable energy sources, including biofuels, as part of the priority to increase energy efficiency and diversify energy sources. The promotion of renewable energy sources and locally-available biofuels is directly associated with reducing the use of conventional fossil fuels (oil and gas), with lessening the environmental pressure from the fuel and energy sector activities, and with securing stable and sustainable supply of fuels to decentralised and remote regions. At the same time, the sources and use of biofuels mentioned in the 2003 Energy Strategy are very limited. Peat and firewood are outlined as the most promising local biofuels, as their direct burning will generate additional heat and electricity. The document does not consider more advanced biofuels as, for example, liquid biofuels based on further processing of agriculture and forestry products or wastes. Neither does the document formulate specified targets and an implementation roadmap for the development of renewable energy. These shortcomings do not encourage Russian market players to invest in renewable energy.

Meanwhile the new Energy Strategy has been approved by the Russian Parliament in November, 2009. This Strategy has an outlook until 2030 and is inspired by the 2008 "Concept of Long-term Social and Economic Development of the Russian Federation", which aimed to take the Russian economy on an innovative socially-oriented development path. The changing conjuncture of the world energy market, the increasing energy potential of Russia and the diversification of export markets for hydrocarbons[2] have trigged the adjustment of the Strategy. The Energy Strategy until 2030 is designed to be realized in 3 stages: (1) post-crisis recovery of the domestic economy, institution-building and elimination of barriers for energy efficiency and modernisation with a major role for the state; (2) infrastructure development and modernisation of the technological base with growing involvement of private actors; (3) development of an innovative economy via extension of innovative technologies in energy efficiency and non-carbon energy sources with a reduced role of the state.

The revised Energy Strategy pays much more attention to renewable energy sources than the 2003 Energy Strategy. It contains quantitative targets for electricity generation from renewable energy and the terms for their achievement. Thus, electricity produced from all renewable energy sources will rise from 1.5% in 2010 to 4.5% in 2020 and 8% in 2030. Apart from electricity generation, there are still no renewable energy targets established for other sectors in Russia. The overall projected investments in renewable energy[3] increase from around 8 billion US Dollars in 2010-2015 to almost 90 billion US Dollars in 2023-2030 (Table 2). Therefore around 6% of all investments in the energy and fuel sector in the third phase of the Energy Strategy are intended for renewable energy development.

The absolute and relative investments in renewable energy sources can hardly be regarded ambitious (compared with China, where 15% of all energy investments will go into renewables (Martinot et al., 2007), and the EU with 20% for renewables by 2020 (EREC, 2004)). The revised strategy is primarily oriented at preserving the current oil and coal exports, and their growth in the energy balance from 19% to 22% for oil and from 17% to 19% for coal. The export of natural gas will grow with almost 50%, while its domestic consumption will decrease from current 53% to 46% in 2030.

Table 2. Prognosis of the investments in the energy and fuel sector and renewable energy sources in the economy until 2030 (*Source*: Energy Strategy-2030).

Years	**Stages according to the ES-2030**	**Total investments in the ES-2030 (billion USD at 2007 rate)**	**Investments in renewable energy sources (billion USD at 2007 rate)**	**Relative investments in renewables (%)**	**Renewables in the energy balance (%)[a]**
2010-2015	1	544	8	1.5	0.3
2016-2022	2	590.5	26	4.4	0.7
2023-2030	3	1430	89.5	6.3	1.4

[a] Based on the draft version of the Energy Strategy-2030

Interestingly, renewable energy sources (wind, solar, geothermal, hydro and bioenergy) in the Energy Strategy-2030 are included in the group of “non-carbon energetics” together with large hydropower stations (more than 25 MW) and nuclear power plants. Non-carbon energetics in the energy balance will grow from current 10% to 14% in 2030. Actual targets for renewable energy (1.4% in 2030), as discussed in the draft Energy Strategy-2030, are not mentioned anymore in the accepted Energy Strategy. At the same time the planned growth for large hydro- and nuclear energy can largely contribute to the new goals of non-carbon energy. Though the potential of renewable energy sources and, particularly, biomass is recognised and introduced into the Energy Strategy, these are expected not to play a significant role in the national energy production and consumption in the coming decades.

3.2. Institutions and policies for the development of biofuels in Russia

In the absence of a clearly formulated long term strategy for bioenergy and renewable energy, the legal and political processes in this field have been fragmented and weak. No law explicitly addresses biofuels and they are dealt within the broader category of renewable energy sources. The first attempt to adopt a law “About the State Policy in the Sphere of New Renewable Energy Sources” took place in 1999, when the bill passed the Russian Parliament but was vetoed at the last stage by the then President Yeltsin. This draft bill did not come back during Putin’s administration.

One of the mechanisms of the adopted 2003 Energy Strategy became the Federal Programme “Energy Efficient Economy” for 2002-2005, and prolonged till 2010. The section “Renewable Energy in Northern Territories” of this programme contains concrete targets, one of which is replacing 2 mtce of fossil fuel with renewable energy sources by 2005. In 2004 it proved that the underfinancing of this programme hindered achieving these targets (Audit Chamber of the Russian Federation, 2004).

The crucial law for a successful development of bioenergy in Russia was assigned to the Ministry of Agriculture in 2007. This federal law “About the Main Principles of Bioenergy Development in Russian Federation” is still pending finalisation and is already beyond the expected deadline (which was the end of 2009). The law intends to establish legal, economic ecological, social and organisational principles for the production and use of biofuels. One of the main aims of the law is to resolve the problems related to high excise taxes on bioethanol in order to make it more economically attractive for alcohol producing plants and oil companies to blend bioethanol with liquid fuels (USDA, 2007). At present bioethanol, as an alcohol-containing liquid, falls under the federal law “On state regulation of the production and circulation of ethyl alcohol and alcohol products”, and is therefore subject to high excise taxes[4] and requirements of additional licensing and rigorous control by tax authorities. The amendment to this law suggesting to exclude ethanol fuel from its jurisdiction was proposed in 2008 but is still discussed in the Russian Parliament.

Technical standards for gasoline containing ethanol have already been developed: blends of 5% bioethanol with conventional fuel became allowed in 2002 (National Standard "ГОСТ Р 51866-2002"), followed by a standard in 2004 that permits a blend range from 5% to 10% (National Standard "ГОСТ Р 52201-2004"). In 2009 the National Standard "ГОСТ Р 52808-2007" established the key definitions and terminology in the field of biofuel production. Technical standards, however, do not oblige the blending of bioethanol with conventional fuels. There are currently no technical standards regulating the production and blending of biodiesel.

A more successful policy attempt to stimulate renewables is the "State Policy for Energy Efficiency of Electrical Energy Industry Based on the Use of Renewable Energy Sources Until 2020", adopted by the Russian Government early 2009. This document was initiated by the Russian electricity energy monopoly RAO UES (Russian United Energy System) and elaborates on the ideas of the law that was rejected 10 years ago by the President. In line with the Energy Strategy of Russia this State Policy established the quantitative targets for production and consumption of electrical energy from renewable sources. The share of renewables in the electricity sector will grow from 1.5% in 2010 to 4.5% in 2020 and the use of biomass herein will increase from 0.5% in 2010 to 2% in 2020.

Long delays in developing and adopting a legal framework and major inconsistencies relate to the actual absence of a specific governmental body responsible for the regulation of renewable energy and liquid biofuels. Theoretically, the use of timber for biomass falls under jurisdiction of the Ministry of Natural Resources and Environment, and the Ministry of Energy. At the same time the production of bioethanol for fuel, as it is still considered to be related to alcohol production, is under authority of both the Ministry of Agriculture and local administrations (USDA, 2007). It is unclear which national authority should have responsibility for biodiesel. Hence, authority over renewable energy resources and more specifically over liquid biofuels is spread among a range of governmental bodies. It leads to a number of legal, policy and regulation initiatives, which are often contradictory or ill-formulated (IEA, 2003: 80), and no institutional body is taking responsibility to advance this sector. This seems not unlike Russian policy developments in the environmental sector in general (Mol, 2009).

4. Biofuel development on the ground

To what extent and how has this failing institutional and policy framework hampered the offset of liquid biofuel production in Russia by the private sector?

The biofuel excitement since 2006 triggered the active involvement of private actors in developing biofuel production capacity. Between 2006 and 2008 more than 20 significant investment projects for liquid biofuel production were reported all over Russia. The companies that instigated these projects mainly came from the food industry sector, feedstock traders, and the petro-chemical sector. Most private initiatives preferred grains (mostly wheat) as feedstock for bioethanol production, while rapeseed was widely favoured for biodiesel production (Table 3).

Table 3. Some reported investment projects for liquid biofuel production (*Sources*: USDA, 2008; Baklanova, 2007).

Company, investor	Region	Estimated investments (million Euros)	Capacity (thousand metric tonnes)	Feedstock
Agrotor, ltd, Israel	Penza Oblast	115	n/a	Maize or wheat
Titan-Agro	*Omsk Oblast*	*150*	*150*	*Wheat*
Bashneft-Yug	Rostov Oblast	130	250	Wheat
Aston	Rostov Oblast	80-120	250	Wheat
Extrasib	Tomsk Oblast	8	15	n/a
Pava	Altay Kray	150	100	Wheat
Vipoil and PWC	Volgograd Oblast	320	300	Wheat
Direct-Holding	Lipetsk Oblast	320	300	Wheat
RusBioDiesel	Krasnodar Kray	17	100	Rapeseed
Efko	Krasnodar Kray	6-9	10	Rapeseed
Yug Rusi	Rostov Oblast	12-20	100	Rapeseed
EFKQ	Rostov / Saratov	n/a	120	Rapeseed
ProdEx	*Omsk Oblast*	*17*	*100*	*Rapeseed and sunflower seed*

n/a – information not available

The assessment of the feasibility of most investment initiatives was largely based on demand from Europe (following the development of the Renewable Energy Directive 2009/28/EC). The local use of and demand for biofuels as a substitute for fossil fuels did not play any significant role in designing business plans (USDA, 2007; personal interviews).

It is notable that no major Russian oil and gas companies showed much interest in biofuel development and did not participate in any of the reported investment projects. Most of the companies do not have departments for research and development in the field of renewable energy, with the exception of Lukoil, which only focuses on solar, wind and tidal energy (Martynov, 2008). Russian oil and gas companies have a rather short time horizon and do not seem affected by warnings that, at the projected export rates for oil (160-180 million tonnes per year) and gas (265-285 billion m^3 per year), their reserves might be depleted around 2025 and 2035 respectively (Kargiev et al., 2004).

4.1 Biofuel production in Omsk Oblast

We will analyse a case from Omsk Oblast to further understand the actual implementation of investment projects. Until recently Omsk Oblast has not been known for any endeavours in the field of biofuels. On the contrary, the largest Siberian oil-refinery and affiliated enterprises, previously owned by Siboil and in 2005 acquired by Gazprom Neft, are the most important taxpayers in the region. Regional gas and oil reserves are only represented by Tevrizskoe gas condensate field and Krapivinskoye oil field in the north of the Omsk region. The last provides a minor share of oil for the refinery with most oil coming from the nearby Tyumen Oblast.

Omsk Oblast is situated in the southern – most populated and economically developed – part of the Western Siberian region, covering an area of 141.1 thousand km^2 (1/15 part of the Western Siberia) (Fig. 1). Its population is 2 million, with most citizens living in the regional centre, the city of Omsk (1.1 million people). The geography of the Oblast is mainly flat with altitudes of 100-140 meters above sea level. The north of Omsk Oblast lays in the cold sub-taiga and forest-steppe zones with peat and podzolic soils, while steppes with leached chernozem soils in the south are favourable for agriculture.

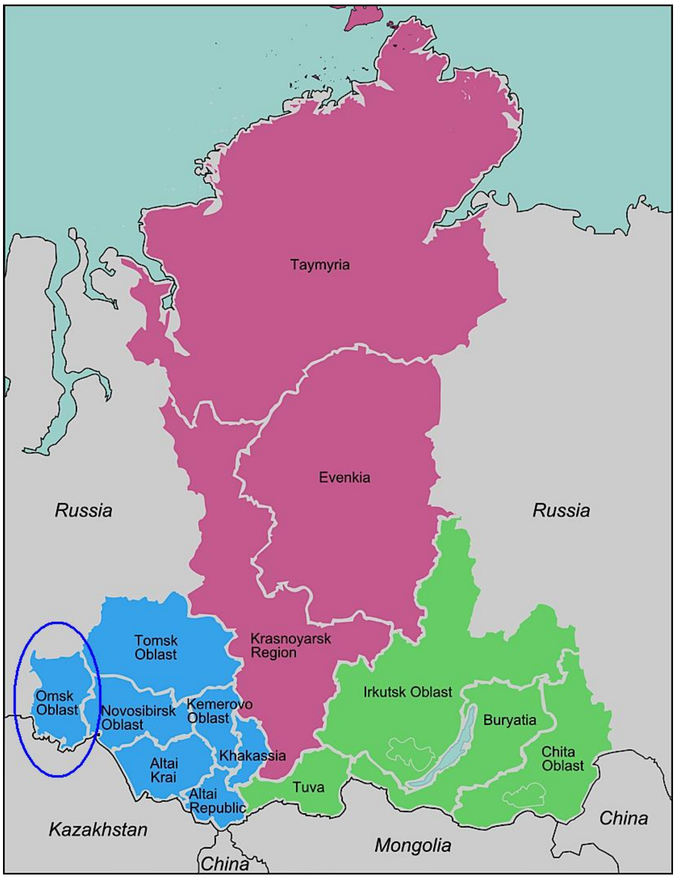

Fig. 1. Map of Russian Siberia with Omsk Oblast highlighted (*Source*: http://iguide.travel/illustrations/Siberia-2.png).

Biofuel initiatives in Omsk Oblast rely on the regional agriculture potential, which, despite the adverse inland climate (cold and snowy winters with an average temperature of -19°C, and warm and dry summers with an average of +19°C), plays an important role in the regional economy. The local companies and entrepreneurs intended to use wheat, rapeseed, and sunflower seed from the region as a source for liquid biofuel production. Regional demand in these major agricultural products is covered by regional production. The gross production of grains including wheat in the recent years was about 3 million tonnes and was partly exported to the nearby regions and Kazakhstan. The area for rapeseed increased from 5 thousand hectares in 2005 to 35 thousand hectares in 2007, further contributing to regional overproduction (Information Portal of Omsk Oblast, 2008).

Bioethanol production – "Biocomplex" project

One of the investment projects in liquid biofuels announced between 2006 and 2008 was an initiative by the Titan Group[5]. Their plan for a bioethanol plant integrated in agricultural production received support from the regional authorities and even attention at the federal level. The so-called "Biocomplex" project of the Titan-Agro company was presented as an innovative enterprise stressing the production of bioethanol as one of its core features. Whereas most of the earlier bioethanol investment projects were either cancelled or postponed due to lack of governmental subsidies and high prices for agricultural products, the Titan-Agro project has recently been reported as the only one fully operational (USDA, 2009). But this proved wrong; our field work found that Titan's "Biocomplex" is facing financial difficulties, not unlike the other biofuel projects. Previously promised funding (required investments amount to 150 million Euro) from the federal budget and financial institutions was suspended and the launching of the "Biocomplex" project was postponed till at least 2012.

Prior to the "Biocomplex" project Titan participated in the "Biokhim" project in Kazakhstan, where a bioethanol facility using wheat as feedstock was reportedly opened in 2006. "Biokhim" delivers yearly 57,000 tonnes of bioethanol, while the "Biocomplex" in Omsk Oblast is expected to reach a capacity of 150,000 tonnes of bioethanol per year. The expertise from the project in Kazakhstan served a good base for the planned venture in Omsk Oblast.

Production of bioethanol in Omsk is considered one element of an integrated production process in the "Biocomplex" project. Besides the bioethanol facility, the technological chain includes a feed-stuff factory, a pork facility (100,000 heads), a poultry facility (15,000 tonnes) and a meat-processing plant (cf. Fig. 2).

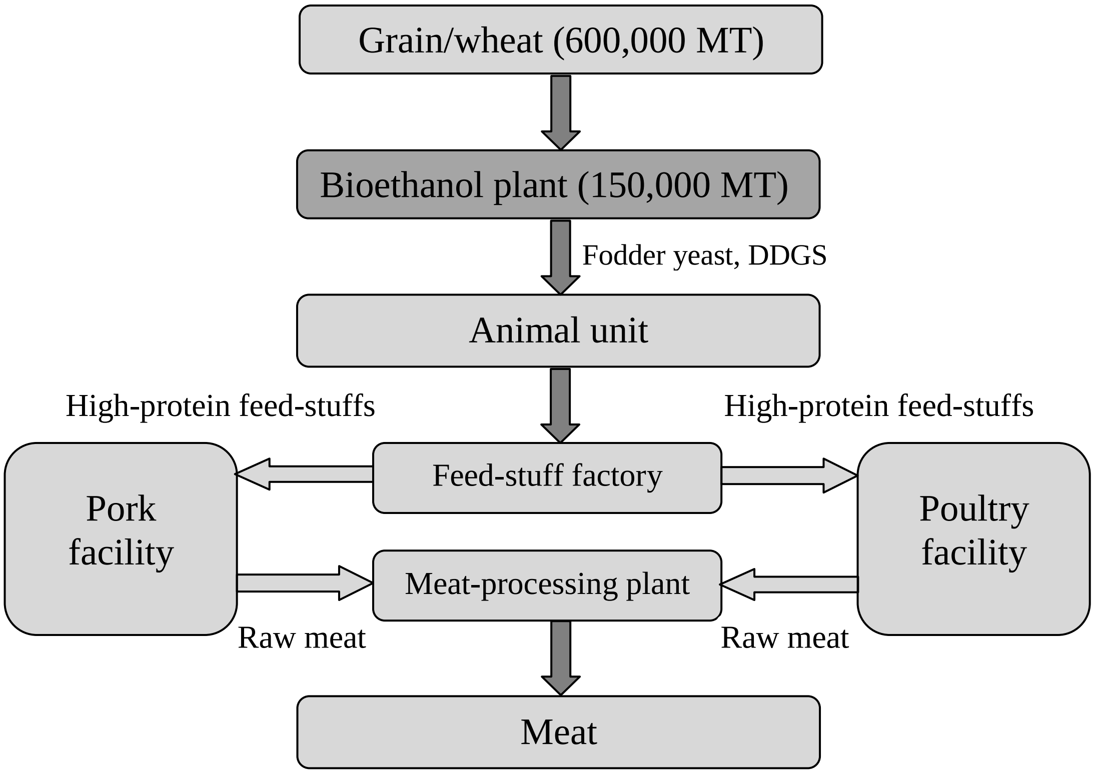

Fig. 2. Main elements of Titan's "Biocomplex" project.

The Biocomplex is estimated to process 600,000 tonnes of wheat annually. For that, "Titan" plans to grow its own feedstock, for which it currently owns 250 hectares and rents about 7,000 hectares. The remaining feedstock will be supplied by local farmers and agricultural enterprises, which regard this new venture as a potential market for their products (personal interviews). Wheat for bioethanol production can be of low quality, not suitable for the food industry (devalued processed wheat or sprouted wheat fodder). Apart from 150,000 tonnes of bioethanol, Biocomplex is expected to produce 240,000 tonnes of Dried Distillers Grains with Solubles (DDGS) and 115,000 tonnes of carbon dioxide annually. DDGS will further be used for the production of high-protein feed-stuffs in the Animal unit of the Biocomplex. Carbon dioxide is an important primary product for petrochemical ventures of the Titan Group.

It is doubtful whether "Titan" will be able to secure a stable feedstock supply given that wheat prices may fluctuate and harvests are subject to weather conditions. Therefore significant corrections were made to the original plan of the "Biocomplex". "Titan" now also plans to use straw and sawdust for the production of bioethanol. While the costs of cellulose raw material and wheat are comparable, cellulose productivity scores 2.5-3 times higher (USDA, 2009). Additionally, bioethanol itself is no longer seen as a final commercial product, due to the absence of adequate regulations and the high excise taxes on alcohol-containing liquids. The slow advancements in biofuel policy and the lack of basic legislation (such as pending federal law "About the Main Principles of Bioenergy Development in the Russian Federation") hinder the ambitious plans of the company and have discouraged Titan's earlier "biofuel excitement".[6] Instead, bioethanol is planned to be used for ethyl-tert-butyl ether (ETBE) production, which has high export potential as it can be added into fuels at 5-10%. From 150,000 tonnes of bioethanol "Titan" expects to produce around 330,000 tonnes of ETBE[7].

In the long run, the "Biocomplex" project is planned to be linked to other businesses of the "Titan" group, such as the production of polymers, enzymes and edible grade acids.

Biodiesel production – ProdEx-Omsk

The nature-climatic conditions of Russia are extremely favourable for growing rapeseed. Investors in biodiesel projects were encouraged by the federal programme of the Ministry of Agriculture to cultivate and process rapeseed for food and for biofuels production. In 2007 "ProdEx-Omsk", a Tomsk-based agricultural company, announced its intention to build a biodiesel facility connected to the existing edible oil extracting factory. This decision, as in most other investment projects, was guided by the increasing demand for biodiesel from European countries and the growing "biofuel excitement" in Russia. "ProdEx-Omsk" aspired to use both rapeseed and sunflower seed for the production of biodiesel. Supply of oil seeds was partly secured by a co-owner of "ProdEx-Omsk" (one of the biggest landowner and agro-industrial enterprise in Russia), while the rest was meant to be obtained from regional farmers. Feedstock supply, however, may be problematic, because Omsk Oblast traditionally specialises in grain crops and active promotion of oil seed cultivation started only recently.

The oil extracting factory of “ProdEx-Omsk” was designed to be constructed in 3 consequent stages in order to assure economic viability of the project. The first stage consists of the construction of a transfer elevator (where the seed will be brought, stored and transported elsewhere afterwards), and an oil elevator (where preliminary preparation and drying of the feedstock for further refinery takes place). Both sunflower seed and rapeseed will be refined into vegetable oil at the first production stage. The annual capacity at this stage is 140,000 tonnes of sunflower seed and 100,000 tonnes of rapeseed, with a projected output of 60,000 tonnes of sunflower oil and 40,000 tonnes of rapeseed oil. The second stage would then involve the construction of an oil extracting unit, only for rapeseed, with a production capacity of 315,000 tonnes per year. Production of biodiesel from rapeseed is more economically interesting than from the sunflower seed, because unrefined sunflower oil is already useable for food purposes, while only refined rapeseed oil is suitable in food. The third stage entails the construction of the biodiesel facility itself.

However, “ProdEx-Omsk” postponed its plans for this third stage indefinitely. Economic reasons were given as the main cause for this delay. Currently, markets for unrefined rapeseed oil exist only in the European Union, which adds transportation costs. Additionally, local demand for rapeseed and sunflower oil exceeds production, making export less important. Growing oil and fat industries accommodating surplus of rapeseed serve for extra competition with potential biofuels (personal interviews). Moreover, the current price structure is unfavourable for biodiesel: without government subsidies gasoline sells at 27 Roubles per litre (0.6 Euro), diesel fuel at 28 Roubles/l (0.62 Euro), and vegetable oil at 49 Roubles/l (1.1 Euro) (personal interviews). Currently there is no enterprise manufacturing commercial biodiesel in Russia, although there is capacity and significant experience in producing and refining various vegetable oils, which can be used to manufacture biodiesel. In the absence of financial support from the government production of biofuels in Russia remains unrealistic under current economic conditions.

4.2 Overall assessment of biofuel investments

These two case studies from Omsk Oblast are representative for the wider situation in Russia, in spite of the less impressive potential of Omsk compared to other regions in the south of the European part of Russia. Higher agricultural potential, more favourable climate and geographic conditions of the southern regions have not resulted by now into any substantial development of biofuel enterprises. Neither has any further progress been made in Omsk Oblast.

Despite numerous statements from Russian officials promising significant developments in Russian biofuels (Russian President portal, 2007), liquid biofuel production has not found its place in Russian reality. Partly this is related to global developments that have also affected some of the biofuel investment projects in other parts of the world, such as the rising grain prices in 2008, which reduced the economic advantages of bioethanol over fossil fuels. At the same time, the high oil prices fell sharply towards the end of 2008, increasing the comparative disadvantage of biofuels over fossil fuels. This combined with an intensive debate on the sustainability of crop-based biofuels (Fargione et al., 2008; Searchinger et al., 2008), making international market prospects uncertain. Interestingly, until recently global discussions about food security and the moral issue of using food crops for fuel production did not emerge in Russia. The June 2009 Grain Forum was one of the first occasions, where Russian authorities mentioned the negative effects of bioethanol production from grain crops and called for exploring alternative feedstocks for biofuels (Russian President portal, 2009). This viewpoint has never been mentioned in any national policy or legal document before.

Besides these global developments the failure in getting liquid biofuel production from the ground in Russia also had some national and local reasons. Considerable taxes on bioethanol and the failure of policy makers to deal with this continue to disadvantage liquid biofuel production in Russia. In addition, failure to receive any local or national financial support forced company-investors to put earlier plans for biofuels on hold. At present, biofuel investment projects listed in Table 3 are either cancelled or postponed and none of them has entered the commercial production stage.

4.3 Biofuel innovations as a new strategy?

But this does not mean that biofuel developments in Russia have stopped completely. The above mentioned change in governmental preferences towards non-food based biofuels reflects the global debate on sustainability of biofuels (e.g. Naylor et al., 2007). Recent successes in the export of wood pellets from the North-Western region of Russia (USDA, 2009) suggests a shift away from crop-based biofuels towards wood and agricultural waste products. Approximately 90% of wood pellets produced in Russia (around 270 thousand tonnes) are exported to the EU, with more than two thirds of the export volume intended for Sweden and Belgium (Aleksandrova, 2008).

This comes together with a stronger emphasis on technological innovation, especially around the state corporation "Rostekhnologii" (Russian Technologies) created in 2007. This corporation was assigned to initiate and coordinate – on behalf of the government – the development, production and export of high-tech products. "Rostekhnologii" was given significant authority, privileges, resources and excessive management rights over state assets that include more than 400 companies and enterprises[8]. It was established following the model of "Rosoboronexport" to centralise the country-wide efforts to enter the global hi-tech market.

Initiated by "Rostekhnologii" the corporation "Biotekhnologii" (Russian Biotechnologies) was founded in March 2008. This establishment was predominantly associated with the programme "Biotechnology development in Russia till 2020" instigated by the Putin-led party "United Russia". The goal of the corporation was to create a group of industries specialised in advanced processing of renewable feedstock, among others by reviving and renewing the hydrolysis industry that was active in the Soviet Union era towards second generation biofuel production, especially biobutanol. As such the policy seems to leapfrog biofuel production directly towards second generation technologies. Biobutanol has the advantage (over bioethanol) of greater energy density, lower vapour pressure and lower water imbibitions (Rowlands et al., 2008). Currently “Biotechnologii” comprises 5 enterprises in Irkutsk, Krasnoyarsk, Tyumen and Arkhangelsk Oblasts. The final realisation of the first project in Tyumen Oblast is expected to initiate the production of 30,000 tonnes of biobutanol, 60,000 tonnes of wood pellets and 13,000 tonnes of feed protein annually. “Biotechnologii” plans to construct 30 plants for the production of biobutanol from cellulose by 2017, resulting in the production of 2 million tonnes of biofuels.

Notably, “Biotechnologii”, supported by the state corporation “Rostekhnologii” and therefore demonstrating governmental intentions and policy, does not consider food crop-based biofuel production (e.g. from wheat, rapeseed or others). Moreover, the emphasis is on consolidating existing (and emerging) bioindustry companies and enterprises in which the Russian state has an equity share. Though private capital participation is encouraged, this is a strongly state-initiated, innovative development in the field of biofuels (and beyond).

5. Conclusions

The period between 2006 and 2008 was associated with excitement and initiatives in biofuels in Russia, following earlier international developments and debates. During that period several plans have been announced in Russia to start liquid biofuel production, but none of them have been materialised. Seeing the enormous potential of biomass in Russia, this might surprise us. At the same time, various reasons explain this poor record of liquid biofuel production until now. First, Russia feels no pressing need to enter into large scale liquid biofuel production, as some of the biofuel arguments in other countries are less valid in Russia (such as climate change and energy security). Rural renovation (a third argument for biofuel development) is relevant for Russia, but is not one of the main priorities of the Russian government, certainly not compared to developments and investment in the oil and gas sector. Second, compared to countries with major liquid biofuel production, the Russian state remained absent in developing a stimulating and facilitating policy and institutional framework. On the contrary, the Russian state showed its incapability to set targets, change the fiscal regime, make subsidies available and organise market creation to assist the private sector in biofuel development. This is not too surprising if we consider Russian state performance in related (renewable energy and environmental) fields. Third, given the absence of government support, the market structure for both energy and food crops in these years was such that crop-based biofuel development could never be profitable, neither for domestic use nor for exports. Hence the biofuel euphoria of 2006-2008 has not transformed the structure of the Russian energy sector and has not integrated the agro-food and energy industries, as it did in other countries.

New legislation, such as the Energy Strategy-2030 and the draft Principles of Bioenergy Development, provides indications that biofuels and renewable energy might gain a more prominent place on the future policy agenda. But also here the proposed goals are hardly ambitious and lag behind developments, for instance, in China and the European Union. The main drivers for liquid biofuel development might come from state corporations involved in technological innovation. If the plans of "Biotechnologii" materialise it would mean that liquid biofuels in Russia would not only leapfrog to second generation technologies, but that they would also remain strongly under control of the Russian state, reflecting the tendencies in the oil and gas sector during the last decade in Russia.

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Notes

[1] According to the Kyoto agreement Russia has to keep greenhouse gas (GHG) emissions at the level of 1990. During the economic recession of 1990s GHG emissions fell sharply. Currently (according to the data of 2004) GHG emissions in Russia are 33% below the level of 1990 with projections to be still 10% below the base level by year 2020 (Ministry of Economic Development and Trade, 2006).

[2] Russia is striving to diversify its oil and gas exports in order to reduce its reliance only on European markets. The more intensive energy cooperation between Russia and China should be understood in this regard and is recently supported by an agreement for the export of Russian oil to China until 2030 (BBC, 2009).

[3] The investments in the fuel and energy sector according to new Energy Strategy-2030 comprise oil industry, gas industry, coal industry, electrical energy industry, renewable energy sources, heat supply, autonomous (reserve) power system, and energy efficiency in the economy.

[4] Excise taxes on alcohol-containing products greatly increase the costs of bioethanol, making its use as a fuel economically not viable. Excise tax on anhydrous alcohol in Russia is 191 Roubles per litre (±4.3 Euro at July, 2009 rates) and is collected in two stages: 27.7 Roubles (±0.6 Euro) is paid by a plant producing anhydrous alcohol and 163.3 Roubles (±3.6 Euro) is paid by a producer of final alcohol-containing products. The cost of bioethanol production in Russia is estimated to be around 10 Roubles per litre (±0.2 Euro at July, 2009 rate).

[5] The Titan Group was set up in 1989 and bioethanol is "one of the 28 business spheres". It entered Omsk regional market as a dealer of BMW cars and later greatly diversified its interest varying from agriculture-related to petrochemical industry.

[6] One of the co-owners of the "Titan" group is a major lobbyist for biofuel interests in the Russian Parliament, the State Duma.

[7] ETBE is produced by mixing ethanol and isobutylene of comparable amounts in a catalytic reaction. ETBE in gasoline is seen as alternative to more widespread and environmentally-harmful methyl tertiary butyl ether (MTBE). ETBE contributes to a better air quality by reducing emissions of carbon monoxide and volatile organic compounds. ETBE containing ethanol from renewable sources is one of the opportunities of biofuel development (EFOA, 2006).

[8] A state corporation has a status of a non-commercial organisation established by the state for pursuing social, managerial or other society-beneficial goals. The sphere of activities of state corporations grew from long-term and target-oriented (as "Olimpstroy" for managing infrastructural preparations for the 2014 Olympic Games) to general and broad state endeavours in various areas (as "Rosatom" in nuclear energy, "Rosnano" for the development of nanotechnologies, "Rosoboronexport" for export and import of military products, or "Rostekhnologii" for innovations

in general). While acquiring enormous administrative and financial resources, state corporations are criticised for their non-transparency, lack of accountability and actual functioning outside a defined legal framework (Committee for industrial policy of the Federal Council of the Russian Federation, 2008).