

UiO : **Faculty of Law**
University of Oslo

**Implementation of Supportive Measures and
Economic Mechanisms for the Development of
Advanced Biofuel in Latvia**

Candidate number: 8012

Submission deadline: 01.12.2012

Number of words: 17,610

Supervisor: Christina Voigt

26.11.2012



Table of Contents

List of Abbreviations.....	IV
1 Introduction	1
2 Background.....	5
2.1 General Definition of Biofuel.....	5
2.2 Clasification and Description of the Next Generation Biofuel	7
2.2.1 Second Generation Biofuel.....	7
2.2.2 Third Generation Biofuel.....	9
2.2.3 Forth Generation Biofuel.....	11
3 General Overview of EU Biofuel Policy and Law in the Transport Sector	13
3.1 General EU Policy of Biofuels	13
3.2 Sustainability Criteria for Biofuels.....	23
4 Latvian Legal Framework and National Policy of Biofuels in the Transport Sector	21
4.1 Latvian Legal Framework of Biofuels in the Transport Sector.....	21
4.2 National Policy of Biofuels in the Transport Sector	23
5 Support Measures for Development of Advanced Biofuel Internationally and in the EU	26
5.1 International Practice of State`s Policy Instruments	26
5.1.1 The United States of America	26
5.1.2 Australia	30
5.1.3 Canada	31
5.1.4 Brazil	33
5.1.5 China.....	34
5.2 EU Member States` Practice of Policy Instruments	36
5.2.1 Denmark	36
5.2.2 Finland.....	38
5.2.3 Sweden	39
6 Initiatives and Economic Mechanisms to Promote Development of Advanced Biofuels Production and Consumption in the Transport Sector	42
6.1 Measures to Promote Initial Development of Advanced Biofuels Industry in Latvia ...	42
6.2 Direct v. Indirect State Support for Advanced Biofules Industry in Latvia.....	45

6.3 Implementaion of Economic and Market-Based Support Mechanisms in the Latvian Legal Framework	49
7 Conclusions	53
Bibliography	58
Acknowledgments.....	76

List of Abbreviations

CO ₂	Carbon dioxide
EC	European Commission
EEA	European Economic Area
EU	European Union
GHG	Greenhouse gas
IEA	International Energy Agency
IFPRI	International Food Policy Institute
IPCC	Intergovernmental Panel on Climate Change
NGO	Non-governmental organization
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

In general, analysis of biofuel industry should be started with the core problem – substantial changes in the Earth’s atmosphere and ecosystem. The Intergovernmental Panel on Climate Change (IPCC) in its Fourth Assessment Report clearly confirms that: “Most of the observed increase in global average temperature since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations.”¹ “Energy sector is the major contributor of GHG emissions accounting for 90% of the total CO₂ emissions globally, resulting from fossil fuel combustion.”² “Global carbon-dioxide (CO₂) emissions from fossil-fuel combustion reached a record high of 31.6 gigatonnes (Gt) in 2011 [...]”³

Climate change is a united and global problem for the whole mankind. The consequences of the changes are already visible⁴ and they will affect all regions in the long-term perspective without the positions of “winners” and “losers”. The international society in the United Nations Framework Convention on Climate Change (UNFCCC) acknowledged and agreed on characterization of climate changes as a “common concern of humankind”.⁵

However, one of the fundamental state rights recognized in the Charter of the United Nations⁶ and in the principles of international law is: “the sovereign right to exploit their own resources pursuant to their own environmental and development policies

¹ IPCC Plenary XXVII. *Fourth Assessment Report: Climate Change 2007*. Summary for Policymakers. Valencia, 2007, p.5. http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf (GHG - greenhouse gas).

² Kumar Saxena, Anil. *Greenhouse Gas Emissions: Estimation and Reduction*. Asian Productivity Organization, India, 2009. p.5. <http://www.apo-tokyo.org/publications/files/gp-19-gge.pdf>

³ *Global carbon-dioxide emissions increase by 1.0 Gt in 2011 to record high*. International Energy Agency (IEA), news, 24 May 2012. <http://www.iea.org/newsroomandevents/news/2012/may/name.27216.en.html>

⁴ *The vanishing north*. The Economist homepage, 16 June 2012.

<http://www.economist.com/node/21556921?fsrc=scn/tw/te/ar/thevanishingnorth>

Mark, Monika. *Nigeria floats idea for life on the water*. Guardian.co.uk, Lagos, 4 October 2012.

<http://www.guardian.co.uk/global-development/2012/oct/04/nigeria-floats-idea-for-life-on-water>

⁵ United Nations Framework Convention on Climate Change (UNFCCC), 1771 UNTS 107/ [1994] ATS 2/31 ILM 849 (1992), Preamble.

⁶ The Charter of the United Nations, ATS 1/59 Stat. 1031; TS 993; 3 Bevans 1153, 26 June 1945, Article 1.2.

[...]”⁷ In practice, this basic right can be used in the two policy directions. The first one focuses mainly on the process of economic development and intensive use of fossil fuels, especially exploited in the 20th century. The second is sustainability direction with a shift towards the development of the renewable energy resources, including biofuels as an alternative fuel for transport.

Although combustion of biofuels in the engines of vehicles also releases CO₂, during the process of growing biofuels feedstock consumes fixed amount of CO₂. Therefore, considering the problem of climate change, produced and utilized biofuels can be one of the direct and more environmentally friendly alternative solutions to traditional petroleum fuel (petrol or diesel). In general, produced biofuels can be divided into the first generation (crop-based) biofuels and the next generation or advanced biofuels. The latest are produced from more sustainable non-food feedstock with larger GHG emission savings.

Worldwide tendency, considering sustainability requirements and scientific-technical development, is a gradual shift from first generation to advanced biofuels production and consumption. Therefore, consistency with European Union (EU) law and policy, long-term national strategy and amendments to the legal framework should be elaborated to stimulate the development of advanced biofuel industry in Latvia. National strategy with amendments of national laws should create legal framework with emphasis on economic and market-based mechanisms to create an attractive investment environment for research and commercial production of advanced biofuels.

Taking into consideration EU and a broader international perspective, the objective of study is to prepare the legal analysis of the transition and development in a sustainable way from first generation to the next generation biofuels in Latvia. The analysis will be based on best known examples from EU and the international practice in different initiatives and economic support mechanisms to stimulate the development of advanced

⁷ Rio Declaration on Environment and Development. UN Doc. A/CONF.151/26 (vol. I)/31 ILM 874 (1992), 14 June 1992, Principle 2.
See also Preamble of UNFCCC.

biofuel industry as, in today's global world, it is essential to study and analyze already existing supporting measures from the world's most active and leading countries.

Thereby the main issues according to the research target are, firstly, to give the general description of biofuel and the classification of second, third and fourth generation biofuels and their technical description. Secondly, to give overview of EU biofuels policy and regulations with the focus on advanced biofuels. Particularly, to summarize targets and rules of Renewable Energy Directive⁸, Biofuel Directive⁹ and EU policy documents such as An EU Strategy for Biofuels¹⁰, Biofuels Progress Report (2007)¹¹, etc. Thirdly, to make a selective analysis of international and EU member states practice in application of different state support instruments. And in the end to provide suggestions and proposals for initiatives and economic mechanisms appropriate for implementation in the Latvian legal framework.

The research topic is urgent because Latvia's transport sector and national policy for biofuels in practice are focused on production of crop-based biofuels. Contrary to international tendencies, there is no adopted explicit and detailed future strategy and national targets/economic mechanisms promoting advanced biofuels in Latvia. Taking into account persistent progress in the field, it is important to assess in this study what are the required measures for Latvia to create conditions to attract investment for research and development of advanced biofuels.

The study consists of the first introduction part, six chapters with a number of subchapters and the conclusion as the seventh part, demonstrating thesis statement and the main proposals made during the research. The study is based on the use of descriptive, historical, systemic, analytical, comparative, deductive, and inductive approaches. The bibliography of the study's consists of legal documents: sources of international law, EU law and policy documents, national laws and regulations of

⁸ Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, OJ L 140 of 05.06.2009, p.16-62.

⁹ Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport, OJ L 123, 17.05.2003, p.42-46.

¹⁰ *An EU Strategy for Biofuels*, Communication from the Commission, COM(2006) 34 final, 08.02.2006.

¹¹ *Biofuels Progress Report*, Communication from the Commission to the Council and the European Parliament, COM(2006) 845 final, 10.01.2007.

different countries, Latvia's national laws, regulations of the Cabinet of Ministers. Due to specifics of topic, the study contains references to a broad spectrum of scientific research, reports of government institutions, international organizations and NGOs, international literature, publications and the Internet data.

2 Background

2.1 General Definition of Biofuel

For full understanding of biofuels nature, at first it is necessary to define meaning of biomass. “‘Biomass’ means the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste; [...]”¹² Biomass was also the first energy form (wood-burning) for people and now it continues to develop in different modern varieties. “It must be noted that fossil fuels, such as coal and petroleum, are also products of plants and animals.”¹³ Though, it is necessary emphasize that fossil fuels are non-renewable energy sources, because of long-term creation process and non-regenerating ability.¹⁴

“‘Biofuels’ means liquid or gaseous fuel for transport produced from biomass; [...]”¹⁵ Almost identical definition of biofuels is included in the Biofuel Law¹⁶. Biofuels produced from biomass basically have a substitute’s role for the fossil fuel as there is no necessity for significant engine modifications and its CO₂ emission neutrality.

There exist different kinds of biofuels products. One of the best known products is “‘bioethanol’: ethanol produced from biomass and/or the biodegradable fraction of waste; [...]”¹⁷. The fermentation process can be based on starch crops (corn, wheat) or sugar crops (sugarcane, sugar beet), or advanced (next generations) cellulosic materials (wild grasses, agricultural, wood, municipal solid waste).¹⁸ Ethanol is produced to blend

¹² Article 2(e), Renewable Energy Directive.

¹³ Michaelides, Efstathios E. (Stathis). *Alternative Energy Sources*. Berlin, (Springer) 2012, p.289.

¹⁴ Michaelides (2012) p.289.

¹⁵ Article 2.1(a), Biofuel Directive.

¹⁶ Biofuel Law. Latvian Law. *Ziņotājs* No. 52 (3210), 01.04.2005, Article 1.1.

<http://www.likumi.lv/doc.php?id=104828>

¹⁷ Article 2.2(a), Biofuel Directive.

¹⁸ *Creating Markets for Renewable Energy Technologies EU RESTMAC. Bioethanol Production and Use*. European Biomass Industry Association. Brussels, p.4-5.

http://www.erec.org/fileadmin/erec_docs/Project_Documents/RESTMAC/Brochure5_Bioethanol_low_re_s.pdf

it with petrol, thus ensuring decrease of CO₂ emissions in the atmosphere. A percentage of ethanol blends in petrol vary by countries (for example, the U.S. mostly 10%, EU 5-10%, Brazil 25% and 85% in flex-fuel vehicles (E85)).¹⁹

The second the most widely produced type of biofuel is “biodiesel”: a methyl-ester produced from vegetable or animal oil, of diesel quality; [...]”²⁰. Biodiesel is made (using rape seeds, sunflowers, soybeans, palm oil, greases) through chemical process (transesterification), separating glycerin from fat/vegetable oil and creating methyl-esters (the chemical name for biodiesel).²¹ It can be blended with petrol diesel with different percentage for the engines of vehicles.

Besides bioethanol and biodiesel there are also other biofuel products such as: biogas, biomethanol, biodimethylether, synthetic biofuels, biohydrogen, pure vegetable oil, and biobutanol.²²

It is also important to point out that the development of biofuels is not the invention of the recent years. It started with the production of first mechanical cars. At the beginning of 20th century first cars were running on steam, electricity and ethanol (from peanut oil, potato starch), e.g. the Ford’s famous Model T.²³ The situation changed radically with the large-scale oil production and the use of conventional petrol, diesel (for affordable prices) use as fuel for engines. “Throughout the twentieth century, oil retained at least a 97 percent market share in vehicles in almost every country.”²⁴ Brazil was an exception from this list, because high oil prices during the first oil crisis in 1973 led to policy of subsequential state’s support to sugar cane within the National Alcohol Program to supply vehicles.²⁵

¹⁹ Paul, Bill. *Future Energy: How the New Oil Industry Will Change People, Politics, and Portfolios*. New Jersey, (John Wiley & Sons, Inc.) 2007, p.57.

²⁰ Article 2.2(b), Biofuel Directive.

²¹ *Biodiesel Basics*. Biodiesel, America’s Advanced Biofuel webpage. <http://www.biodiesel.org/what-is-biodiesel/biodiesel-basics>

²² Article 2.2(c)-(j), Biofuel Directive.

²³ Sperling, Daniel and Deborah Gordon. *Two Billion Cars: Driving Towards Sustainability*. Oxford, (Oxford University Press) 2009, p.88.

²⁴ Sperling (2009), p.89.

²⁵ Reijnders, Lucas and Mark A.J. Huijbregts. *Biofuels for Road Transport: A Seed to Wheel Perspective*. London (Springer) 2010, p.2.

2.2 Classification and Description of the Next Generation Biofuel

“Biofuels are broadly classified as primary and secondary biofuels. The primary biofuels are used in an unprocessed form, primarily for heating, cooking or electricity production such as fuelwood, wood chips and pellets, etc. The secondary biofuels are produced by processing of biomass e.g. ethanol, biodiesel, DME, etc. that can be used in vehicles and various industrial processes. The secondary biofuels are further divided in to first, second and third generation biofuels on the basis of raw material and technology used for their production.”²⁶

2.2.1 Second Generation Biofuel

While the first generation biofuel (bioethanol from sugar or starch and biodiesel from raw vegetable oils) is produced from food-based crop, the production of the second generation biofuels is based on non-food feedstock.

The United Nations (UN) report describes second generation biofuels as ‘made from lignocellulosic biomass feedstock using advanced technical processes’²⁷. “Lignocellulosic feedstock is the botanical term used for biomass from woody or fibrous plant materials, being a combination of lignin, cellulose and hemicellulose polymers interlinked in a heterogeneous matrix”²⁸ “The production of biofuels from ligno-cellulosic feedstocks can be achieved through two very different processing routes. They are: □ biochemical – in which enzymes and other micro-organisms are used to convert cellulose and hemicellulose components of the feedstocks to sugars prior to their fermentation to produce ethanol; □ thermo-chemical – where pyrolysis/gasification technologies produce a synthesis gas (CO + H₂) from which a

²⁶ Nigam, Poonam Singh, Anoop Singh. *Production of liquid biofuels from renewable resources*. In: Progress in Energy and Combustion Science (2010), p.2 (1-17).

<http://helhaphl2010-02.wikispaces.com/file/view/Production+of+liquid+biofuels+from+renewable+resources.pdf>

²⁷ *Bioenergy Strategy: Sustainable Industrial Conversion and Productive Use of Bioenergy*. UN Industrial Development Organization, p.5.

http://www.unido.org/fileadmin/media/documents/pdf/Energy_Environment/rre_bioenergyStrategy_latest.pdf

²⁸ *From 1st to 2nd Generation Biofuel Technologies*. Ralph Sims ... [et al.] IEA. November 2008, p.35. http://www.ftsnet.it/documenti/419/2nd_Biofuel_Gen.pdf

wide range of long carbon chain biofuels, such as synthetic diesel or aviation fuel, can be reformed.”²⁹ “In general, lignocellulosic feedstocks are divided into three categories: (1) agricultural residues (e.g., crop residues, sugarcane bagasse), (2) forest residues, and (3) herbaceous and woody energy crops”.³⁰ Forest residues include logging residues produced from harvest operations, fuel wood - extracted from forestlands, and primary and secondary wood processing mill residues.³¹ Lastly, the third category of biofuel crops represents grassy (switchgrass, alfalfa) and woody energy (‘fast growing tree species’ – willow, eucalyptus) crops.³²

Basically, second generation biofuel is continuation to first generation biofuels in more technically advanced and sustainable form. Firstly, second generation biofuel feedstock reduces the necessity for agriculture land thus limiting impact on food production and market price. Secondly, GHG emissions savings from second, advanced generation biofuels are greater than from first generations biofuels. “Cellulose ethanol could produce 75% less CO₂ than normal petrol, whereas corn or sugar-beet ethanol reduces CO₂ levels by just 60%. As for diesel, Biomass-to-Liquid (BtL) technology could slash CO₂ emissions by 90%, compared with 75% for currently-available biodiesel [...]”³³

There is considerable global potential for second generation biofuel development and the transition from the research and development phase to the commercial production has already taken place. Still there remains one of the most serious problems – high production costs in comparison to fossil fuel, higher than for first generation biofuels. Production costs together with such other barriers as lack of national policy, technological development for cost-effectiveness and infrastructure for commercial production can limit and prolong the development of advanced biofuel.³⁴ However, with the help of well-considered state supporting policy and in cooperation with other

²⁹ *From 1st to 2nd Generation Biofuel Technologies* (2008), p.7.

³⁰ Carriquiry, Miguel A., Xiaodong Du & Govinda R Timilsina. *Second – Generation Biofuels: Economics and Policies*. The World Bank, Policy Research Working Paper 5406, August 2010, p.4
http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2010/08/30/000158349_20100830090558/Rendered/PDF/WPS5406.pdf

³¹ Carriquiry (2010) p.7.

³² Carriquiry (2010) p.8-10.

³³ *Biofuels: The Next Generation*. EurActiv Network, published 18 September 2007, updated 13 July 2009. <http://www.euractiv.com/energy/biofuels-generation-links dossier-188433>

³⁴ Supra.

developed countries there is a potential possibility for Latvia to achieve start of advanced biofuel production by 2020.

2.2.2 Third Generation Biofuel

Third generation biofuels are better known as algae biofuels. “In contradiction with the first and second generation biofuels the third generation is made out of microorganisms, primary microalgae.”³⁵ “The term algae can refer to microalgae, cyanobacteria (the so called “blue-green algae”), and macroalgae (or seaweed)”.³⁶ Historical beginning of algae research for bioenergy purposes was started in the U.S. approximately in the middle of the twentieth century, and more actively in 1950s and 1960s after proposals to use algae for production of methane gas.³⁷ More intensive studies on algae as feedstock were carried out after oil crisis in 1970s, which resulted in creation of special The U.S. Department of Energy’s Aquatic Species Program (1978-1996) and conscious development until present days.³⁸ Starting from the end of 20th century until today a lot of effort in research and development for algae based biofuel is invested in many regions and countries.³⁹

Lately, an intensive and considerable effort has been devoted to develop algae research because of its possible large potential in the future. Expectations are raised due to biological characteristics and cultivation advantages of algae that, as a result, could even overcome second generation feedstock outcome. In general, production of microalgae (photosynthetic growth) in the indoor or outdoor artificial conditions requires raceway ponds, light, water, fixed temperature (20-30⁰C), CO₂, inorganic

³⁵ Tanner, Simon. *Biofuels of the Third Generation – Do Microalgae Solve the Energy Problem?* Swiss Federal Institute of Technology Zurich, Department of Environmental Science, ETH Zurich, 18 December 2009, p.5.
http://www.ibp.ethz.ch/research/aquaticchemistry/teaching/archive_past_lectures/Term_Paper_HS2009/TANNER_termpaper_msHS09.pdf

³⁶ *National Algal Biofuels Technology Roadmap*. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Biomass Program. May 2010, Executive Summary ii.
http://www1.eere.energy.gov/biomass/pdfs/algal_biofuels_roadmap.pdf

³⁷ *National Algal Biofuels Technology Roadmap* (2010), p.3.

³⁸ Supra.

³⁹ Olivares, Jose interview by Jonathan Williams. *Who’s in the lead? Algae around the world*. January 12, 2012. <http://www.biofuelsdigest.com/bdigest/2012/01/12/whos-in-the-lead-algae-around-the-world/>

salts.⁴⁰ There is possibility that, in the near future, biodiesel from microalgae can compete with fossil diesel because of possibility to double biomass within 24 hours and its oil content of 20-50% dry weight of biomass.⁴¹ Extremely high level of productivity in combination with production feasibility all year long is not the only advantage. Also possibilities avoid competition with agricultural production using non-arable land without pesticides and herbicides and waste, produced or saline water use instead of freshwater.⁴² The ability of microalgae to feed with CO₂ is of special importance. “Producing 100 t of algal biomass fixes roughly 183 t of carbon dioxide.”⁴³

Therefore, biofuel produced from algae in the future can not only become a substitute for conventional fossil fuel, but also reduce CO₂ emissions thus contributing to mitigation of climate change. Besides continuous research of new cost-effective technological solutions to simplify production, there have already been created first research and commercial demonstration facilities. Announcements about public and private investments in commercial scale demonstration projects of algae biofuel came from different world’s regions - Europe (Spain)⁴⁴, Brazil⁴⁵, the U.S. (New Mexico)⁴⁶.

However, limiting factors include not only high production costs, but also considerable environmental concerns about algae production. Mostly it is linked with today’s scientific research and cultivation of genetically engineered microalgae for the future’s biofuels production. The aim of experiments is to increase growth rate in harsher environment, increasing the tolerance of algae feedstock by giving it new strains.⁴⁷

⁴⁰ Chisti, Yusuf. *Biodiesel from microalgae*. Biotechnology Advances 25(3), 13 February 2007, p.297 (294–306). <http://www.tamu.edu/faculty/tpd8/BICH407/AlgaeBiodiesel.pdf>

⁴¹ Chisti (2007) p.296.

⁴² Brennan, Liam and Philip Owende. *Biofuels from microalgae—A review of technologies for production, processing, and extractions of biofuels and co-products*. Renewable and Sustainable Energy Reviews (2009), p.3 [1-21]. https://wiki.umn.edu/pub/Biodiesel/WebHome/An_intensive_continuousnext_term_culture_system_using_tubular_photobioreactors_for Producing_previous_termmicroalgae.pdf

⁴³ Chisti (2007) p.297.

⁴⁴ Chestney, Nina. *Aqualia eyes large-scale algae biofuel production*. Reuters, London, 5 March 2012. <http://www.reuters.com/article/2012/03/05/us-algae-biofuels-idUSTRE8241DT20120305>

⁴⁵ Pasolini, Antonio. *Austrian algae biofuel-production technology to debut in Brazil*. Gizmag.com. 20 July 2012. <http://www.gizmag.com/algae-biomass-plant-brazil/23378/>

⁴⁶ Lane, Jim. *Sapphire completes construction of the Green Crude Farm: algae biofuels heads for the next level*. Biofuels Digest, 28 August 2012. <http://www.biofuelsdigest.com/bdigest/2012/08/28/sapphire-completes-construction-of-the-green-crude-farm-algae-biofuels-heads-for-the-next-level/>

⁴⁷ *Genetically Engineered Algae for Biofuel Pose Potential Risks*. Science Daily, 20 August 2012. <http://www.sciencedaily.com/releases/2012/08/120820121044.htm>

There can appear environmental risks, if genetically engineered algae unintentionally reach uncontrolled natural habitats. Without presence of “suicide genes” there could be possibility for them to survive in nature and it is impossible to predict the consequences of unavoidable mix with non-genetically engineered organisms.⁴⁸ There has already emerged a problematic situation with genetically modified crops due to impossibility to ensure coexistence in nature with conventional crops and harmful effect of pesticides` resistant weeds on the ecosystem.⁴⁹

It is important to avoid harmful environmental impact and ensure independent and objective environmental assessment.⁵⁰ On the other hand, it is also necessary to consider the intellectual property rights of innovative research about algae biofuel and confidential commercial information. Therefore, there should be found a compromising solution providing special access to scientific information for independent experts/scientists assessing environmental risks from algae biofuel⁵¹ according to precautionary and assessment principle, but with restrictions to later publish valuable scientific details. An independent and accurate risk assessment of advanced biofuels would provide the transparency, necessary for state officials and entrepreneurs making decisions for public or private support.

2.2.3 Forth Generation Biofuel

Although present classification divides secondary biofuels into three generations, scientists are looking to the future towards forth generation biofuels. “In fourth generation production systems, biomass crops are seen as efficient 'carbon capturing' machines that take CO₂ out of the atmosphere and lock it up in their branches, trunks and leaves. The carbon-rich biomass is then converted into fuel and gases by means of

⁴⁸ Snow, Allison A. and Val H. Smith. *Genetically Engineered Algae for Biofuels: A Key Role for Ecologists*. In: BioScience. Vol.62 No.8 (2012), p.766 (765-768). <http://www.biosci.ohio-state.edu/~asnowlab/Snow%20%20Smith%20BioScience%202012%20REPRINT.pdf>

⁴⁹ Altieri, Miguel A. *The Myth of Coexistence: Why Transgenic Crops Are Not Compatible With Agroecologically Based Systems of Production*. In: Bulletin of Science, Technology & Society. Vol.25, No.4 (2005), p.369 (361-371) http://www.odg.cat/documents/formacio/7juny_Rosa_Binimelis.pdf

⁵⁰ Snow (2012) p.767.

⁵¹ Supra.

second generation techniques.”⁵² Research has already been carried out and continues with aim: “[...] to develop a coal-biomass-to-liquids (CBTL) plant design that is potentially capable of co-gasifying mixtures of coal and biomass to produce a clean synthesis gas that can then be sent to Fischer-Tropsch units for synthesis of clean diesel, jet and naphtha liquid fuels”.⁵³

The additional concept includes creation of special fast-growing artificial trees creation with better carbon capturing abilities like *the Dahurian Larch* with 30% greater carbon storage capacity⁵⁴ and eucalyptus trees capable of ingesting up to three times more CO₂ than normal strains⁵⁵. Thus, there is a possibility for forth generation biofuels (feedstock) in the future combine and solve two problematic issues – the decarbonization of the atmosphere by capturing CO₂ and the production of biofuel from carbon rich biomass.

Although the concept of forth generation carbon negative biofuels seems to be a promising solution, the research and development phase will continue many years in the future before actual start of commercial production. However, there will arise environmental impact concerns, similar to third generation biofuel ones, because of genetically engineered technology use and possible impact on the ecosystem and the feed chain. Considering genetically modified organisms regulation (including environmental principles)⁵⁶ in Latvia there will be required a special assessment of safety aspects in the future before new biofuel technology implementation in production.

⁵² *A quick look at 'fourth generation' biofuels*. Biopact, 8 October 2007.

<http://news.mongabay.com/bioenergy/2007/10/quick-look-at-fourth-generation.html>

⁵³ *Increasing Security and Reducing Carbon emissions of the U.S. Transportation Sector: A Transformational Role for Coal with Biomass*. Department of Energy, National Energy Technology Laboratory and the Department of Defense, Air Force. August 24, 2007, p.2.

<http://www.netl.doe.gov/energy-analyses/pubs/NETL-AF%20CBTL%20Study%20Final%202007%20Aug%2024.pdf>

⁵⁴ *Japanese scientists develop hybrid larch trees with 30% greater carbon sink capacity*. Biopact, 3 October 2007. <http://news.mongabay.com/bioenergy/2007/10/japanese-scientists-develop-hybrid.html>

⁵⁵ *Gene-modified eucalyptus ingest more CO₂*. The China Post, updated 14 September 2007. <http://www.chinapost.com.tw/taiwan/2007/09/14/122524/Gene-modified-eucalyptus.htm>

⁵⁶ Law on Circulation of Genetically Modified Organisms. Latvian law. *Latvijas Vēstnesis*, No.195 (3771), 15.11.2007, Article 2,3. <http://www.likumi.lv/doc.php?id=167400>

3 General Overview of EU Biofuels Policy and Law in Transport Sector

3.1 General EU Policy for Biofuels

The general aims of the EU environmental policy are defined in the Treaty on the Functioning of the EU Title XX, Article 191.1: “[...] preserving, protecting and improving the quality of the environment, protecting human health, prudent and rational utilisation of natural resources, promoting measures at international level to deal with regional or worldwide environmental problems, and in particular combating climate change.”⁵⁷ These main environmental objectives should be respected and followed at all stages of the present biofuels production.

The EU policy of development of the biofuels as alternative fuels has always concerned not only sustainability of fuel and contribution to environment by saving GHG emissions but also it is a significant contribution to an increased independence from the import of oil products, security of supply and creation of new jobs for people in Europe. In general, the EU policy of biofuels production and use is reflected in the EU law and policy documents.

European Commission (EC) has issued many policy documents devoted to EU biofuels industry based on the aims of general energy and environmental protection policy declared in the Treaty on the Functioning of the EU. Among the first there was EC Green Paper in 2000, addressing the importance of growing biofuels production and stressing environmental advantages of biofuel feedstock.⁵⁸ Green Paper also set possible biofuel targets (20% substitution by 2020) in transport and possibility to use fiscal measures to reduce price gap with fossil fuels in the process of production.⁵⁹

⁵⁷ *Consolidated version of the Treaty on European Union and the Treaty on the Functioning of the European Union*. OJ C 83, 30.03.2010, p.47-199, Article 191.1, 194.1(c).

⁵⁸ *Green Paper: Towards a European strategy for the security of energy supply*. Commission of the European Communities. COM(2000) 769 final, 29.11.2000, p.48.

⁵⁹ *Green paper COM(2000)*, p.49.

For the first time more explicit policy regulation and minimum proportion of biofuels in transport (for all member states 2% by 2005 and 5.75% by 2010) were set in Biofuel Directive⁶⁰.

Biomass Action Plan 2005⁶¹ was the next policy document addressing future strategy approach to biofuels based on Biofuel Directive. Besides the balanced approach to an increased use of biofuels, EC also emphasized need for favorable treatment of second generation biofuels and higher priority for research in terms of the Seventh Framework Programme.⁶² Biomass Action Plan laid the foundation for further policy development adopted in An EU Strategy for Biofuels.

The main aims of An EU Strategy for Biofuels include promotion of biofuels in the EU and exploration of the opportunities for developing countries, preparation for large scale use of biofuels and support to second generation biofuels research.⁶³ Strategy aims are divided into the seven policy axes and each of them provide more detailed measures for biofuels support in the EU. One of the most important EC intentions is to ‘stimulate demand for biofuels’ using market – driven and demand - side measures.⁶⁴ And member states were active to use tax mechanisms and other economical incentives to develop first generation biofuel industry. These special tax policy measures were possible under the Energy Taxation Directive with the strict prior authorization by the EC to exclude detriment to competition and over-compensation⁶⁵.

EC willingness to: “[...] encourage Member states to give favorable treatment to second-generation biofuels in biofuels obligations [...]”⁶⁶ is also of great importance. Other EC policy direction is ‘capturing environmental benefits’, examining reduced GHG emission amount and evaluating impact on environment and biofuels production sustainability criteria for in the EU and the third countries.⁶⁷ Other EC policy axes is

⁶⁰ Article 3, Biofuel Directive.

⁶¹ *Biomass Action Plan*. Communication from the Commission, COM(2005) 628 final, 07.12.2005.

⁶² *Supra*. p.10, 15-16.

⁶³ *An EU Strategy for Biofuels*, p.4.

⁶⁴ *Supra*. 3.1., p.7-9.

⁶⁵ Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, OJ L 283, 31.10.2003, p.51-70, Article 16.

⁶⁶ *An EU Strategy for Biofuels*, p.7.

⁶⁷ *Supra*. 3.2. p.9-10.

devoted to the development of biofuels production and distribution together with expansion of feedstock supplies. Particularly, making sure that member states include biofuels production into their cohesion policy and rural development policy without discrimination and legislative barriers. Finally, one of the most important contributions to future development is EC policy axe providing support for the research and capacity building of biofuels using the Seventh Framework Programme and the European Technology Platform, especially giving ‘high priority to research into second-generation biofuels’.⁶⁸

Aforementioned the Seventh Framework Programme (2006-2013) was adopted as the Decision No. 1982/2006/EC in 2006 to support research and technical development in many areas, including energy and transport.⁶⁹ Its implementation is planned through specific programmes and special “Energy programme” providing support for renewable fuel production, particularly technology development and the research off second generation biofuels.⁷⁰ In 2006 EC also released new Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy providing general energy strategy for Europe, also giving reference to Biomass Action Plan and An EU Strategy for Biofuels.⁷¹

The next EC document fully dedvoted to biofuels was 2007 Biofuel Progress Report. It was created in order to assess the development in the biofuel industry and renewable fuel target achievements in the member states. The progress analysis reflects EC’s supporting position for biofuel as suitable substitute that can reduce dependence on fossil fuel and increase GHG emissions savings, particulrly production of second generation biofuels was considered as one of the basic measure.⁷² In Biofuel Progress Report, EC additionally admitted necessity for higher efficiency in biofuels policy together with decreasing environmental risks for biodiversity, still without critique

⁶⁸ *An EU Strategy for Biofuels*, 3.7. p.16-17.

⁶⁹ Decision No. 1982/2006/EC of the European Parliament and of the Council of 18 December 2006 concerning the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013), OJ L 412, 30.12.2006, p.1-41.

⁷⁰ *Supra*. p.19.

⁷¹ *Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy*, Commission of the European Communities. COM(2006) 105 final, 08.03.2006, p.12.

⁷² *Biofuels Progress Report*, p.2.

about first generations biofuels emission footprint.⁷³ The report also underlines commercialization perspectives of second generation biofuels (from wood, grasses, waste etc.). Thus, besides the support of research programmes, there should also be created a framework providing ‘market-based indicatives’ for development of advanced biofuels, similarly to the stimulations policy for the first generations biofuels.⁷⁴

Therefore, in this context, it is essential to highlight EU incentives and programmes for development of biofuels, especially for the second generation biofuels. The European Strategic Energy Technology Plan (SET Plan) provides tactical solutions to the best methods reaching 10% biofuel target in transport sector by 2020. One of the ambitious targets is to create production of second generation biofuels which would be commercially available and competitive to fossil fuels⁷⁵, therefore one of the European Industrial Initiatives is Bio-energy Europe Initiative with a special ‘focus on next generation biofuels’.⁷⁶

In 2009 EC issued the Renewable Energy Progress Report containing the assessment of progress made by member states in the production and use of biofuels.⁷⁷ The Progress Report also emphasized the causes of the development made by market-based measures and positive economic (security of supply, increased employment rate) and environmental (GHG emission savings) impacts. In 2010 EC adopted new strategy Energy 2020 with repeated position to demand safe substitutes for fossil fuels.⁷⁸ The strategy underlined need for continuous implementation of SET Plan, biofuels production projects and European Industrial Bioenergy Initiative for market introduction of second generation biofuels.⁷⁹

⁷³ *Biofuels Progress Report*, p.8.

⁷⁴ *Supra*. p.13.

⁷⁵ *A European strategic energy technology plan (SET Plan) - Towards a low carbon future*, Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, COM(2007) 723 final, 22.11.2007, p.5.

⁷⁶ SET Plan, p.10.

⁷⁷ *The Renewable Energy Progress Report: Commission Report in accordance with Article 3 of Directive 2001/77/EC, Article 4(2) of Directive 2003/30/EC and on the implementation of the EU Biomass Action Plan*, COM(2005)628, Communication from the Commission to the Council and the European Parliament, COM(2009) 192 final, 24.04.2009, p.6-8.

⁷⁸ *Energy 2020: A strategy for competitive, sustainable and secure energy*, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2010) 639 final, 10.11.2010, p.3.

⁷⁹ *Supra*. p.16.

This year, EC has prepared a new strategy - Innovating for Sustainable Growth: A Bioeconomy for Europe⁸⁰. Bioeconomy is a new policy approach, taking into account food-based biomass impact on food and environment, for stimulation and development of renewable biological resources in Europe. One of the challenges of bioeconomy strategy is to find sustainable solution (ensuring safety of a food and environment) to reach 10% biofuels target in transport sector by 2020 with implementation and stimulation of the SET Plan.⁸¹

3.2 Sustainability Criteria for Biofuels

It should be emphasized that, in 2009, EU Renewable Energy Directive was adopted, containing a mandatory aim for each member state to: “ensure that the share of energy from renewable sources in all forms of transport in 2020 is at least 10% of the final consumption of energy in transport in that Member State.”⁸² Moreover, Renewable Energy Directive provides sustainability criteria for biofuels and bioliquids. These sustainability criteria consist of minimal GHG emissions savings (35% until 2017) and protection of high biodiversity land in the process of biofuels production.⁸³ A special supportive policy treatment is provided to biofuels produced from waste, residues, non-food cellulosic material and lingo-cellulosic material (advanced biofuels).⁸⁴ Additionally Directive 2009/30/EC was adopted to amend Directive 98/70/EC, and its Article 7.2 (a) sets a reduction in lifecycle of GHG emissions from fuels used in transport by 6% by 2020.⁸⁵

⁸⁰ *Innovating for Sustainable Growth: A Bioeconomy for Europe*. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2012) 60 final, 13.02.2012.

⁸¹ Supra. p.4.

⁸² Article 3.4., Renewable Energy Directive.

⁸³ Supra. Article 17.

⁸⁴ Supra. Article 21.2.

⁸⁵ Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC. OJ L 140, 88-113, 05.06.2009.

After many years of worldwide first generation biofuels commercial production there is a remarkable amount of concerns related to general sustainability consisting of environmental, social and economic issues.⁸⁶ One of the main environmental concerns related to first generations biofuels (as a substitute to fossil fuels) is ability to reach specified GHG emission savings. Therefore, it is important to take into consideration the information which appeared in the media that first generation biofuels failed the sustainability test to show less than 35% of the GHG savings as it was suppose to reach.⁸⁷ Lately, a lot of attention was also provoked by leaked data showing the results that GHG emission from crop-based biofuels (palm oil, soybean, rapeseed) together with indirect land-use change results in even higher GHG emissions than from fossil fuels.⁸⁸

The second problematic issue is change in land-use (“the conversion of land from one use to another, e.g. from forestry to cropping”⁸⁹) creating additional GHG emissions and competition in food production with the all related social and environmental problems. Land-use change can occur in two forms – “[...] directly, i.e. mostly referred to in the context of the conversion of land areas to cropland”⁹⁰ and “[...] indirectly i.e. mostly referred to in the context of land-use change as a result of displaced demand previously destined for food/feed/fibre market as a result of biofuel demand”⁹¹. And: “[...] competition with food crops will remain an issue so long as 1st-generation biofuels produced from food crops dominate total biofuel production”⁹². Indirect land-use change is a more complex issue because of difficulties to precisely estimate GHG emissions. That emphasizes necessity to assess benefits of the biofuels production according to the general EU environmental principles, particularly precautionary and assessment principle.

⁸⁶ *From 1st to 2nd Generation Biofuel Technologies* (2008), p.6.

⁸⁷ Macalister, Terry. *Biofuels fails EU sustainability test, German researchers claim*. Guardian.co.uk, 19 August 2012. <http://www.guardian.co.uk/environment/2012/aug/19/biofuel-fails-eu-sustainability-test>

⁸⁸ *Biodiesels pollute more than crude oil, leaked data show*, EurActiv Network updated 30 January 2012. <http://www.euractiv.com/climate-environment/biodiesels-pollute-crude-oil-lea-news-510437>

⁸⁹ *Impact Assessment*. Commission Staff Working Document. EC, SWD(2012) 343 final, 17.10.2012, p.72. http://ec.europa.eu/energy/renewables/biofuels/doc/biofuels/swd_2012_0343_ia_en.pdf

⁹⁰ Supra.

⁹¹ Supra.

⁹² *From 1st to 2nd Generation Biofuel Technologies* (2008), p.6.

Although EC is consistently collecting information from member countries and performs the analyses of risks and impact from biofuels on other areas, all policy documents till now showed generally positive and supporting EC attitude towards the first generation biofuels. In the 2010 Report on the indirect land-use change EC emphasized that Renewable Energy Directive: “‘already contains strict sustainability criteria for biofuels and bioliquids’ and also restriction on the land for feedstock production”.⁹³ And after identification and assessment of the problematic issues, the main EC conclusion is: “that indirect land-use change can have an impact on GHG emissions savings associated with biofuels, which could reduce their contribution to the policy goals, under certain circumstances in the absence of intervention. As such, the Commission considers that, if action is required, indirect land-use change should be addressed under a precautionary approach.”⁹⁴

Therefore, EC acknowledged importance of the indirect land-use change and assessed possibilities of the policy change to reduce demand of biofuels and consequences for the land-use change. One year later, in a different report made by the International Food Policy Institute (IFPRI) also suggested possible version of the EU policy change - to reduce the overall biofuel mandate or to increase the threshold of GHG savings for all feedstock.⁹⁵ One of the latest and most significant documents is 2012 EC Impact Assessment analyzing indirect impact from land-use changes and in its conclusion recommending option limiting conventional biofuels by promoting advanced non-land using biofuels.⁹⁶

Considering and evaluating all problematic aspects and risks, there is an obvious conclusion that the first generations biofuels can be no longer considered as a sustainable solution for the future generations. Thus, EC made a significant risk management decision in the new EC Proposal (based on accompanied Impact

⁹³ Report from the Commission on indirect land-use change related to biofuels and bioliquids. European Commission, COM(2010) 811 final, 22.12.2010, p.14.

⁹⁴ Supra. p.14.

⁹⁵ Laborde, David. *Assessing the Land Use Change Consequences of European Biofuel Policies*. IFPRI, Final report, October 2011, p.87.

⁹⁶ *Impact Assessment*. EC, SWD(2012), p.69-70.

Assessment of indirect land-use changes)⁹⁷ with the basic amendments first to Article 17(2) of Renewable Energy Directive. The amendment specifies that: “the greenhouse gas emission saving from the use of biofuels and bioliquids [...] shall be at least 60% for biofuels and bioliquids produced in installations starting operation after 1st July 2014”⁹⁸. And the second important amendment to Article 3.4 includes an additional point (d): “[...] the share of energy from biofuels produced from cereal and other starch rich crops, sugars and oil crops shall be no more than 5%, the estimated share at the end of 2011, of the final consumption of energy in transport in 2020.”⁹⁹ Therefore, EC in its latest proposal promotes sustainable (improving GHG emission savings in the biofuel production processes) and advanced biofuels development by limiting food-based biofuels production and impact on land use.

⁹⁷ *Proposal for a Directive amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EC and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources*, EC, COM(2012) 595 final, 17.10.2012.

http://ec.europa.eu/energy/renewables/biofuels/doc/biofuels/com_2012_0595_en.pdf

⁹⁸ Supra. Point 5(a).

⁹⁹ Supra. Point 2(b).

4 Latvian Legal Framework and National Policy of Biofuels in the Transport Sector

4.1 Latvian Legal Framework of Biofuels in the Transport Sector

All normative acts adopted by legislator in Latvia shall be consistent with the Constitution of the Republic of Latvia. Its Article 115 establishes that: “The State shall protect the right of everyone to live in a benevolent environment by providing information about environmental conditions and by promoting the preservation and improvement of the environment”.¹⁰⁰ Biofuels (especially advanced biofuels) in general is recognized as more sustainable and environmentally friendly alternative to fossil fuels. Therefore, promotion of biofuels production and their use could be considered as being consistent with the aim of Article 115 of the Constitution.

Latvian legal framework of biofuels consists of laws and the Cabinet of Ministers Regulations. Majority of the legal norms were implemented in the national law from EU law in consistency with the EU policy documents. The main law in force is Biofuel Law with legal norms from Biofuel Directive adopted by the Parliament of the Republic of Latvia (Saeima) in 2005. General aim of Biofuel Law is to stimulate: “the trade in biofuel - any activities with biofuel (the production and processing of raw materials, as well as the production, marking, storage, transportation, import, export, distribution, marketing, disposal etc. of biofuel), as well as the provision of information to consumers; [...]”.¹⁰¹ Law on Biofuel provides promotion of trade in biofuels in two policy directions – state assistance instruments and financial mechanisms (use of the excise tax rate).¹⁰² Therefore, the second important legal act is Law on Excise Duties providing indirect support - lower excise tax rate for biofuels and fuel blend with percentage of biofuels added.¹⁰³ Until 31 December 2010 the Cabinet Regulation No. 280 “Regulation Regarding Financial Supply Quotas for Biofuels” provided legal

¹⁰⁰ The Constitution of the Republic of Latvia (Satversme). Latvian Law. *Latvijas Vēstnesis* No. 43, 01.07.1993, Article 115. <http://www.saeima.lv/en/legislation/constitution>

¹⁰¹ Article 2, 1.2, Biofuel Law.

¹⁰² Article 8, 9, Biofuel Law.

¹⁰³ Law on Excise Duties. Latvian Law. *Ziņotājs* No. 161 (2926), 14.11.2003, Article 14. <http://www.likumi.lv/doc.php?id=81066&from=off>

framework also for direct state support to producers every year from 2005 until the end of 2010.¹⁰⁴

Other Cabinet regulations specify rules about fuel quality standards and criteria arising from EU Fuel Quality Directive¹⁰⁵. The First regulation is the Cabinet Regulation No. 332 “Requirements for Conformity Assessment of Petrol and Diesel Fuel” with its aim to: “determine the quality requirements for petrol and diesel fuel offered in the Latvian market [...]”.¹⁰⁶ Secondly, it is Cabinet Regulation No. 772 adopted on October 18, 2005 “Regulations Regarding Requirements for Biofuel Quality, Conformity Assessment, Market Supervision and Procedures for Consumer Information” specifically establishing quality requirements for biofuels and requirements to provide consumers with the to receive information about fuel.¹⁰⁷

Rules containing sustainability criteria from Renewable Energy Directive and Fuel Quality Directive in 2009 were directly implemented and included into the Cabinet Regulation No. 545 “Regulations Regarding the Sustainability Criteria for Biofuels and Bioliqids, the Mechanism for Introducing Thereof, and the Procedure by Which They Shall Be Supervised and Monitored”.¹⁰⁸ Biofuels comply with the sustainability criteria if feedstock is not “obtained from land with high biodiversity value” and “the GHG emission saving from the use of biofuels and bioliqids shall be at least 35%.”¹⁰⁹ Regulation established conformity certification for: “Biofuels and bioliqids produced in Latvia or brought for consumption in the Republic of Latvia from the European

¹⁰⁴ Regulation Regarding Financial Supply Quotas for Biofuels. The Cabinet Regulation No. 280, *Latvijas Vēstnesis* No. 63 (3847), 23.04.2008. <http://www.likumi.lv/doc.php?id=174321>

¹⁰⁵ Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC, OJ L 140, 05.06.2009, p. 88-113.

¹⁰⁶ Regulation for Conformity Assessment of Petrol and Diesel Fuel. The Cabinet Regulation No. 332, *Latvijas Vēstnesis* No. 341/343 (2252/2254), 29.09.2000, Article 1. <http://www.likumi.lv/doc.php?id=11217>

¹⁰⁷ Regulation Regarding Requirements for Biofuel Quality, Conformity Assessment, Market Supervision and Procedures for Consumer Information. The Cabinet Regulation No. 772, *Latvijas Vēstnesis* No. 168 (3326), 21.10.2005, Article 1. <http://www.likumi.lv/doc.php?id=119463&from=off>

¹⁰⁸ Regulation Regarding the Sustainability Criteria for Biofuels and Bioliqids, the Mechanism for Introducing Thereof, and the Procedure by Which They Shall Be supervised and Monitored. The Cabinet Regulation No. 545, *Latvijas Vēstnesis* No.111 (4509), 19.07.2011. <http://www.likumi.lv/doc.php?id=233225>

¹⁰⁹ *Supra*. Point 5, 10.

Union Member States or imported from third countries, shall be considered to be in conformity with the sustainability criteria, if such conformity is certified: 12.1. within the framework of a bilateral or multilateral agreement, which has been concluded by the European Union with a third country and which contains conditions regarding the sustainability criteria for biofuels and bioliquids; 12.2. within the framework of a voluntary scheme approved by the European Commission; 12.3. within the framework of a national certification system; or 12.4. within the framework of the national certification scheme of Latvia.”¹¹⁰

Finally, the Cabinet adopted Regulation No. 830 of October 10, 2006 “Statute of the Biofuels Development Advisory Board”¹¹¹ establishing trans-sectoral advisory body with the aim to coordinate implementation of the Law on Biofuels. The Cabinet also issued Instruction No. 69 of 23 February 2011 “On the Biofuels Development Advisory Board”¹¹² for the selected members of the advisory body.

4.2 National Policy of Biofuels in the Transport Sector

Latvia’s national policy for biofuels production, consumption and vision for future development is reflected in several policy-guiding documents. National Sustainable Development Strategy of Latvia until 2030 will be the basic future policy document with an ambitious aim to create ‘green’ country with ‘green’ economy and sustainable consumption.¹¹³ Besides the general aim to gain energy independence by increasing usage of renewable energy resources, the strategy also aims at linking the development of biofuels with innovations and good practice, and to technically adjust the public transport infrastructure for biofuel use.¹¹⁴

¹¹⁰ Supra. Point 12.

¹¹¹ Statute of the Biofuels Development Advisory Board. The Cabinet Regulation No. 830, *Latvijas Vēstnesis* No. 163(3531), 12.10.2006, Article 1. <http://www.likumi.lv/doc.php?id=145503&from=off>

¹¹² On the Biofuels Development Advisory Board. The Cabinet Instruction No. 69, *Latvijas Vēstnesis* No. 32 (4430), 25.02.2011. <http://www.likumi.lv/doc.php?id=226346>

¹¹³ Sustainable Development Strategy of Latvia until 2030/„Latvija 2030”. Approved by the Latvian Parliament, 10.06.2010, p.12. http://www.latvija2030.lv/upload/latvija2030_en.pdf

¹¹⁴ Supra. p.47-53.

Apart from general national strategy, on September 26, 2012 the Ministry of Economics developed and presented Long-term Energy Strategy of Latvia 2030. These policy guidelines establish new national target - 50% energy from renewable sources in its gross final consumption by 2030 and also new policy measures for biofuels industry.¹¹⁵ Firstly, it means discontinuation of the direct state support to first generation biofuels, while in the medium term – maintainance of the requirement to increase the biofuels blend to fossil fuel and, secondly, to elaborate support mechanism to promote the production of second generation biofuels.¹¹⁶

The Informative Report on the Situation of Biofuels Industry issued by the Ministry of Economics is more closely related to biofuels.¹¹⁷ The Report summarizes present situation in the industry (national production and use) and provides conclusions with suggestions for the future policy direction.¹¹⁸ The new state policy will focus on the instruments promoting consumption in form of indirect support to sustainable biofuels by increasing the biofuel blending with fossil fuel from 5% to 7%.¹¹⁹ Other proposals include technical adjustment and purchase of public and private transport suitable for fuel with higher concentration of biofuel blend.¹²⁰ Although section 2.4. of this report contains advantages of the next generation biofuels, especially GHG emission savings above 70% comparing to first generations biofuels, the Ministry of Economics holds the position to postpone the development of the state support programme for the production and use of second generation biofuel.

Taking into account increasing research and technical development in the world, the position of the Ministry of Economics in relation to advanced biofuel development timeframe should be revised. The research in best foreign practice and preparation of national strategy for production and use of advanced biofuels in Latvia should be started as fast as possible, preferably from 2013. The significance of the state support

¹¹⁵ Long-term Energy Strategy of Latvia 2030. Project developed by The Ministry of Economics of the Republic of Latvia, 25 September 2012, p.4. <http://www.em.gov.lv/em/2nd/?id=32707&cat=621>

¹¹⁶ Supra. p.10.

¹¹⁷ The Informative Report on the Situation of Biofuels Industry. Project developed by The Ministry of Economics of the Republic of Latvia, 2 August 2012.

<http://mk.gov.lv/lv/mk/tap/?pid=40248005&mode=mkk&date=2012-08-27>

¹¹⁸ The Informative Report on the Situation of Biofuels Industry, p.33-34.

¹¹⁹ Supra. Point 4, p.33.

¹²⁰ Supra. p.34.

programmme means not only improvement in energy independence, but also in global competition for foreign investments.

5 Support Measures for Development of Advanced Biofuel Internationally and in the EU

This section will mainly be focused on support mechanisms for advanced biofuels which has been used all around the world and in the EU. Unlike already developed first generation industry, advanced biofuels industry is still in the development phase, therefore, all policy instruments will be considered jointly.

5.1 International Practice of State Policy Instruments

5.1.1 The United States of America

In 2000 Agriculture Risk Protection Act was adopted by the U.S. Congress which also contains Biomass Research and Development Act of 2000 with Section 302 the Congress finds that: “[...] (8)(A) cellulosic feedstocks are attractive because of their low cost and widespread availability[...]”.¹²¹ And therefore, Section 307: “[...] establish and carry out a Biomass Research and Development Initiative under which competitively awarded grants, contracts, and financial assistance are provided to, or entered into with, eligible entities to carry out research on biobased industrial products”.

One of the broader and inclusive definitions of advanced biofuel is included in the U.S. Code¹²²: “The term "advanced biofuel" means fuel derived from renewable biomass other than corn kernel starch. (B) Inclusions Subject to subparagraph (A), the term "advanced biofuel" includes - (i) biofuel derived from cellulose, hemicellulose, or lignin; (ii) biofuel derived from sugar and starch (other than ethanol derived from corn kernel starch); (iii) biofuel derived from waste material, including crop residue, other vegetative waste material, animal waste, food waste, and yard waste; (iv) diesel-equivalent fuel derived from renewable biomass, including vegetable oil and animal fat;

¹²¹ Agriculture Risk Protection Act of 2000. Public Law 106-224, June 20, 2000. <http://www.gpo.gov/fdsys/pkg/PLAW-106publ224/pdf/PLAW-106publ224.pdf>

¹²² The Code of Laws of the United States of America (the U.S. Code), Title 7 Agriculture. Chapter 107, Section 8101. <http://us-code.laws.com/title-7-agriculture/chapter-107-renewable-energy-research-and-development/8101-definitions>

(v) biogas (including landfill gas and sewage waste treatment gas) produced through the conversion of organic matter from renewable biomass; (vi) butanol or other alcohols produced through the conversion of organic matter from renewable biomass; and (vii) other fuel derived from cellulosic biomass.”

Thereby the U.S. support to the next generations biofuels is provided in different forms consisting of broad combination of different economical measures. At present, a considerable amount of research and effort are provided to find new advanced production technologies. Energy Policy Act of 2005¹²³ Title XV, Subtitle A, Section 1514 [...] contains Section 306 of the Biomass Research and Development Act of 2000, establishing a program, to be known as the “Advanced Biofuel Technologies Program”, to demonstrate advanced technologies for the production of alternative transportation fuels. The aim of the program is to: (c) (1) “[...] fund demonstration projects - (A) to develop not less than 4 different conversion technologies for producing cellulosic biomass ethanol; and (B) to develop not less than 5 technologies for coproducing value-added bioproducts (such as fertilizers, herbicides, and pesticides) resulting from the production of biodiesel fuel”. President Barack Obama’s Administration continues to focus on renewable energy as a measure to reduce oil import and develop domestic resources in the U.S., including latest 62 million dollars federal funding for the development of advanced biofuels commercial-scale production.¹²⁴ The funding of biofuel industry development is mainly provided through the Department of Energy (DOE) and the US Department of Agriculture (USDA).¹²⁵

Besides the direct federal funding of technical research and commercial-scale production development, there are introduced broad market-based measures promoting faster start of large-scale production. One of the most important measure with potential impact on production is the standard for advanced biofuels. It was firstly included into

¹²³ Energy Policy Act of 2005. Public Law 109-58, August 8, 2005.

<http://www.gpo.gov/fdsys/pkg/PLAW-109publ58/pdf/PLAW-109publ58.pdf>

¹²⁴ *Obama Administration Announces New Investments to Advance Biofuels Industry and Enhance America’s Energy Security*. The U.S. Department of Energy, 2 July 2012.

<http://energy.gov/articles/obama-administration-announces-new-investments-advance-biofuels-industry-and-enhance-0>

¹²⁵ Supra.

the Clean Air Act incorporated in the U.S. Code¹²⁶ and setting regulation for Renewable Fuel program ensuring that gasoline in the U.S. contains the applicable volume of renewable fuel. A subparagraph with applicable volumes has been amended and included into the Energy Independence and Security Act of 2007, in Section 202 defined as The Renewable Fuel Standard.¹²⁷ Paragraph (2) subparagraph (B) II of this Section defines applicable volume of advanced biofuels for the time period 2009-2022 (target for 2022 – 21 billion gallons of fuel) and in separate part III - applicable volume for cellulosic biofuel from 2010-2022 (2022 – 16 billions of gallons fuel). To ensure flexibility for produced amount of advanced biofuels Clean Air Act paragraph 2 of Section 211(o) and the Energy Independence and Security Act paragraph 1 of Section 202 requires to the Administrator (the Environmental Protection Agency) to annually define new standards under The Renewable Fuel Program (in 2012 - 2 billion gallons of advanced biofuels).¹²⁸

One of the most significant and productive measures is tax credits provided for second generation cellulosic ethanol in the Internal Revenue Code¹²⁹ incorporated into the U.S. Code. Section 40 (E) (i) in general defines that: “cellulosic ethanol means any liquid fuel which - (I) is produced from any lignocellulosic or hemicellulosic matter that is available on a renewable or recurring basis, and (II) meets the registration requirements for fuels and fuel additives established by the Environmental Protection Agency under Section 211 of the Clean Air Act (42 U.S.C. 7545)”. (6) (A) (B) also provides that: “The cellulosic biofuel producer credit of any taxpayer is an amount equal to the applicable amount for each gallon of qualified cellulosic biofuel production and this applicable amount now is \$1.01”. However Section (d) (6) defines special restriction: “No cellulosic biofuel producer credit shall be determined under subsection (a) with respect to any cellulosic biofuel unless such cellulosic biofuel is produced in the United

¹²⁶ The Clean Air Act. Public Law December 31, 1970, included in the U.S. Code, Title 42, Chapter 85, Section 211 (o), Paragraph 2 (A). <http://www.law.cornell.edu/uscode/text/42/7545>

¹²⁷ Energy Independence and Security Act of 2007. Public Law 110-2007, December 19, 2007. <http://www.gpo.gov/fdsys/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf>

¹²⁸ EPA Finalizes 2012 Renewable Fuel Standarts. The U.S. Environmental Protection Agency, December 2011. <http://www.epa.gov/otaq/fuels/renewablefuels/documents/420f11044.pdf>

¹²⁹ Internal Revenue Code. Public Law 16 August 1954. The U.S. Code, Title 26, Chapter 1, Section 40. <http://www.gpo.gov/fdsys/pkg/USCODE-2011-title26/html/USCODE-2011-title26-subtitleA-chap1-subchapA-partIV-subpartD-sec40.htm>

States and used as a fuel in the United States. For purposes of this subsection, the term “United States” includes any possession of the United States”.

Others economical measures include grants and loans for development of production. Section 211 of the Clean Air Act (42 U.S.C. 7545) Title “Regulation of fuels” (s) (1) provides that: “The Secretary of Energy may provide grants to merchant producers of cellulosic biomass ethanol, waste-derived ethanol, and approved renewable fuels in the United States to assist the producers in building eligible production facilities described in paragraph (2) for the production of ethanol or approved renewable fuels. A production facility shall be eligible to receive a grant under this subsection if the production facility - (A) is located in the United States; and (B) uses cellulosic or renewable biomass or waste-derived feedstocks derived from agricultural residues, wood residues, municipal solid waste, or agricultural byproducts”. “Grant program to encourage the production of advanced biofuels” is also provided in the Energy Independence and Security Act of 2007 Section 207 with special focus on reduction in the lifecycle greenhouse gas emissions.

Additionally, next part of Clean Air Act (42 U.S.C. 7546) “Renewable fuel” provides loan guaranty program for cellulosic biomass ethanol and municipal solid waste: “(2) Demonstration projects (A) The Secretary shall issue loan guarantees under this section to carry out not more than 4 projects to commercially demonstrate the feasibility and viability of producing cellulosic biomass ethanol or sucrose - derived ethanol, including at least 1 project that uses cereal straw as a feedstock and 1 project that uses municipal solid waste as a feedstock. (B) Each project shall have a design capacity to produce at least 30,000,000 gallons of cellulosic biomass ethanol each year.”

An additional measure is provided in Section 248 (a) of Clean Air Act “Biofuels distribution and advanced biofuels infrastructure” - ‘program of research, development, and demonstration relating to existing transportation fuel distribution infrastructure and new alternative distribution infrastructure’ is carried out in the coordination with the Secretary of Transportation and in consultation with the Administrator of the Environmental Protection Agency.

Taking into consideration the U.S. legal regulation, it is clear that the aim of the U.S. federal government is to continue leadership in more sustainable and advanced biofuel industry. For Latvia, the U.S. legal regulation is one of the best examples with broad variety of considerable measures for advanced biofuel, especially, definition, funding for research and development, as well as grants for production projects.

5.1.2 Australia

Australia's pathway of building the state support system for advanced biofuels is in the development phase/start-up position. In 2011 Australian Renewable Energy Agency (ARENA)¹³⁰ was established with its main function to provide financial assistance to renewable energy technologies, including development of advanced biofuels. Australian Government also established a new Australian Biofuels Research Institute to undertake research into the next generation biofuels and established an Advisory Council to provide advice on the most effective allocation of funding.¹³¹ In 2011 the Advanced Biofuels Study was released containing cost estimates and providing future perspectives of available advanced biofuel in Australia.¹³² Based on the advice from the Advisory Council, on 24 February 2012, the Government granted 5 million dollar to James Cook University macro-algae biofuel project.¹³³ Additionally, there was announced the opening for applications under a new 15 million dollar Advanced Biofuels Investment Readiness (ABIR) Program. This government program offers grant funding for selected pre-commercial demonstration projects for the investment in the development of advanced biofuels technologies.¹³⁴ There are not provided any direct specific regulations in relation to advanced biofuels. General granting for biofuels is included in Energy Grants (Cleaner Fuels) Scheme Act¹³⁵ fully or partly giving offset of any excise

¹³⁰ Australian Renewable Energy Agency Act. No.151 of 2011. Section 7,8.

<http://www.comlaw.gov.au/Details/C2012C00629>

¹³¹ *Advanced Biofuels Investment Readiness Program*. Program Administrative Guidelines. Australian Government. The Department of Resources, Energy and Tourism. 16 February 2012, p.3.

<http://www.arena.gov.au/documents/abir/ABIR-Program-Administrative-Guidelines.pdf>

¹³² L.E.K. Consulting. *Advanced Biofuels Study*. Strategic Directions for Australia.14 December 2011.

<http://www.arena.gov.au/documents/abir/advanced-biofuels-study.pdf>

¹³³ *Advanced Biofuels Investment Readiness Program* (2012), p.3.

¹³⁴ *Supra*.

¹³⁵ Energy Grants (Cleaner Fuels) Scheme Act. No.41 of 2004. Section 2A.

<http://www.comlaw.gov.au/Details/C2006C00429>

duty or customs duty payable in relation to the manufacture or importation of different kinds of biofuel.

Australia's policy is a significant example of how to build a new advanced biofuels industry that could be taken into consideration as a basic example for the transformation process for Latvia. Initiatives like Advisory Council, Advanced Biofuels Study, investment program for new technologies and tax policy could also be implemented as the development measures in Latvia.

5.1.3 Canada

Canada is another example of the federal government supported policy for establishment of mature and developed first generation biofuel industry. In 2006 the Canadian Renewable Fuels Strategy was adopted as a roadmap for implementation of 5% biofuel target in transport by the Government of Canada¹³⁶. The key initiative of this strategy was Renewable Fuels Regulation published on September 1, 2010 with requirement for fuel producers and importers to have an average renewable fuel of at least 5% based on the volume of gasoline.¹³⁷ In 2011 additional requirement included an average annual renewable fuel content equal to at least 2% of the volume of diesel fuel and heating distillate oil.¹³⁸ According to Renewable Fuels Regulation definition in 1(1) "renewable fuel" means ethanol or biodiesel produced not only from traditional food feedstock but also from second and third generation feedstock like: "[...] (d) cellulosic material that is derived from ligno-cellulosic or hemi-cellulosic matter that is available on a renewable or recurring basis; (e) starch; (f) oilseeds; (g) sugar cane, sugar beets or sugar components; (h) potatoes; (i) tobacco; (j) vegetable oils; (k) algae; (l) vegetable materials or other plant materials, other than those mentioned in paragraphs (a) to (k), including biomass; (m) animal material, including fats, greases and oils; (n) animal solid waste; and (o) municipal solid waste". Therefore, Canada's biofuel targets

¹³⁶ *Canadian Renewable Fuels Strategy*. Canadian Renewable Fuels Association. July 25, 2006, p.1. <http://www.saaep.ca/CanadianRenewableFuelsStrategy.pdf>

¹³⁷ Renewable Fuels Regulation. SOR/2010-189. Part I, Article 5(1). <http://laws-lois.justice.gc.ca/PDF/SOR-2010-189.pdf>

¹³⁸ Article 5(2), Renewable Fuels Regulation.

in transport can be fulfilled in the next years by developing commercial-scale production projects and starting production of second and third generation biofuels.

The Canadian Renewable Fuels Strategy, besides federal requirement of biofuel content in the fuel, consists of many federal level support programmes. However, 590 million dollar SD Tech Fund is more important instrument to support the late-stage, pre-commercial demonstration clean-technology pilot projects, like advanced renewable fuels.¹³⁹ The main reason is because start of commercial production and high expenses with free ownership of intellectual property or any repayment of funds at this stage is limiting factor for the emerging industry. The 500 million dollar NextGen Biofuels Fund is a fund which is constructed on the same basis the as SD Tech Fund making connection between new technology solution and commercialization in the market conditions. The main aim of NextGen Biofuels Fund is to contribute to: ‘technology expertise and innovation capacity for large-scale demonstration projects for cellulosic ethanol and biodiesel production in Canada’.¹⁴⁰

The cooperation and exchange of scientific information between countries is an additional direction towards improvement of the development. The Clean Energy Dialogue was established between Canada and the U.S. in 2009 for joint collaboration on the development of clean energy science and to combat climate change.¹⁴¹ In 2009 the first and in 2012 the second Action Plan was released.¹⁴²

The Canadian Renewable Fuels Strategy with direct funding for pre-commercial demonstration pilot projects and cooperation with the neighboring country is a good policy example for Latvia. Such kind of scientific cooperation in future should be established not only with other Baltic states, but also with Scandinavian region, for example, Norway, Sweden and Finland.

¹³⁹ SD Tech Fund, NextGen Biofuels Fund. Sustainable Development Technology Canada homepage, 2012. http://www.sdtech.ca/index.php?page=about-our-funds&hl=en_CA

¹⁴⁰ Supra.

¹⁴¹ The U.S.-Canada Clean Energy Dialogue. Canada’s Action on Climate Change. Government of Canada homepage. <http://www.climatechange.gc.ca/dialogue/default.asp?lang=En&n=E47AAD1C-1>

¹⁴² Supra.

5.1.4 Brazil

In Brazil: “Historically, six instruments were utilized for the promotion of bioethanol production in Brazil [...]: (i) price controls: the requirement that bioethanol be priced lower than gasoline at the pump; and a guaranteed even price across the nation for all bioethanol producers; (ii) tax incentives for automobiles running on bioethanol; (iii) loans to bioethanol producers for expanding capacity; (iv) the obligation for gas stations to sell bioethanol; (v) the creation and maintenance of strategic bioethanol reserves; (vi) and guaranteed government purchases.”¹⁴³ Initial period economic mechanisms which are still in force include biofuels blend (for ethanol 25%¹⁴⁴ and 5%¹⁴⁵ for biodiesel from 2010) and tax reductions which are separated for ethanol (favorable for fuel, credit lines for production) and biodiesel (tax exemptions).¹⁴⁶ A special initiative to increase ethanol consumption provides lower tax rates and lower customer price for buying ethanol flex-fuel cars than gasoline powered vehicles. For example, the tax burden for 1,001 to 2,000 cylinder ethanol/flex-fuel vehicles is 29.2 percent and 30.4 percent for gasoline units.¹⁴⁷

Now Brazil (after the U.S.) is the world's second largest producer of industrial bioethanol, with 24.9 billion litres produced in 2009.¹⁴⁸ Hence, the next energy policy step is forward to the next generation biofuel production. Brazil has two leading research and development centers working on the development of a commercial technology - The Sugarcane Technological Center (ethanol) and the Bioethanol Science and Technology Center (cellulosic ethanol, action of enzymes, pilot plant).¹⁴⁹ Brazil still is no started commercial production of advanced biofuels due to the high costs of technology transfers to industrial scale. However, Brazilian bioenergy company

¹⁴³ *Case studies on bioenergy policy and law: opinions for sustainability B.Brazil*. UN Food and Agriculture Organization, [Rome, 2009], p.115. <http://www.fao.org/docrep/012/i1285e/i1285e03.pdf>

¹⁴⁴ Reduction of Pollutant Emissions from Automobiles - Law No. 8.723. National Congress of Brazil, 28.10.1993. <http://repository.unm.edu/handle/1928/12644>

¹⁴⁵ Introduction of Biodiesel in the Brzilian Energy Mix – Law No. 11.097. National Congress of Brazil, 13.01.2005. <http://repository.unm.edu/handle/1928/12656>

¹⁴⁶ Barros, Sergio. *Biofuels Annual report Brazil 2011*. USDA Foreign Agricultural Service, 27 July 2011, p.3,4,5. http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Sao%20Paulo%20ATO_Brazil_7-27-2011.pdf

¹⁴⁷ Supra p.3

¹⁴⁸ *Ethanol fuel in Brazil*. UN-Energy, January 8, 2011. <http://www.un-energy.org/stories/38-ethanol-fuel-in-brazil>

¹⁴⁹ *Biofuels Annual report Brazil 2011*, p.29

“GraalBio” recently announced start of cellulosic ethanol production from sugarcane bagasse and straw in December 2013 with planned volume 82 million liters per year at a new factory in the Brazilian state of Alagoas.¹⁵⁰

Brazil’s long-term practice with special measures supporting biofuel industry can be considerable for Latvia in future perspective. Special tax incentives for vehicle purchase and use can be an example for implementation in Latvia to raise economic demand for cars and biofuel.

5.1.5 China

China with its rapid economic growth and the world’s biggest population is suffering from foreign oil dependence and increasing fuel consumption. Thus support for growing biofuel industry is significant for China’s future development. The Renewable Energy Law of the People’s Republic of China 2005¹⁵¹ is the basis for biofuels development in China. Article 16 of the Renewable Energy Law contains direct statement of Government’s support to biofuels: “The Government encourages clean and efficient development and utilization of biological fuel and encourages the development of energy crops.” Chapter 6 also provides economic incentives and Article 24 is establishing renewable energy development fund for support of: “[...] 1. Scientific and technological research, standard establishment and pilot project for the development and utilization of renewable energy; 2. Construction of renewable energy projects for domestic use in rural and pasturing areas; 3. Construction of independent renewable power systems in remote areas and islands; 4. Surveys, assessments of renewable energy resources, and the construction of relevant information systems; 5. Localized production of the equipment for the development and utilization of renewable energy.” Additionally Article 25 provides: “Financial institutions may offer preferential loan with financial interest subsidy to renewable energy development and utilization projects

¹⁵⁰ *Novozymes to supply first advanced biofuels factory in Brazil.* News, Novozymes.com, 23 May 2013. <http://www.novozymes.com/en/news/news-archive/Pages/Novozymes-to-supply-first-advanced-biofuels-factory-in-Brazil.aspx>

¹⁵¹ The Renewable Energy Law of the People’s Republic of China. Approved by the Standing Committee of the National People’s Congress (NPC) of the People’s Republic of China in the 14th Session on February 28, 2005. China Climate Change Info-Net, English version. <http://www.ccchina.gov.cn/en/NewsInfo.asp?NewsId=5371>

that are listed in the national renewable energy industrial development guidance catalogue and conform to the conditions for granting loans.” Additionally Article 26 defines that: “The Government grants tax benefits to projects listed in the renewable energy industrial development guidance catalogue, and specific methods are to be prepared by the State Council.”

In 2005 according to Article 25, the Guiding Catalogue for Renewable Energy Industries was issued and interest-free government loans were provided for the technology research and development of non-grain and forest-based biofuels.¹⁵² In 2008 China’s limited financial support for grain-based ethanol fuel production in form of government subsidies.¹⁵³

In addition to Renewable Energy Law, China’s State Administration of Taxation and the Ministry of Finance issued the “Circular 118 on Exempting Pure Biodiesel Oil Made from Waste Animal and Vegetable Oil from Consumption Tax Collection”¹⁵⁴. The Circular 118 announces that starting from January 1, 2009, pure biodiesel is exempt from consumption taxes if: (A) The total amount of waste animal oil and vegetable oil shall account for no less than 70 percent of the raw production materials. (B) The pure biodiesel produced shall meet the national standards of the “Biodiesel Blend Stock (BD 100) for Diesel Engine Fuels”.

China is also focusing its attention and efforts on the development of new technologies and the next generation biofuels. In 2011 the National Energy Administration established the National Energy Research & Development Center for Non-food Biomass Feedstocks at China Agricultural University to carry out the research on non-grain feedstocks and available land for production.¹⁵⁵ China and the U.S. too have a

¹⁵² Wang, Huanhuan. *Building a regulatory framework for biofuels governance in China: Legislation as the Starting point*. Natural Resources Forum Vol.35 (2011) p.204 (201–212).
<http://onlinelibrary.wiley.com/doi/10.1111/j.1477-8947.2011.01390.x/pdf>

¹⁵³ Scot, Ryan and Jiang Junyang. *Biofuels Annual report Peoples Republic of China 2012*. USDA Foreign Agricultural Service, p.2.
http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Beijing_China%20-%20Peoples%20Republic%20of_7-9-2012.pdf

¹⁵⁴ Circular 118 on Exempting Pure Biodiesel Oil Made from Waste Animal and Vegetable Oil from Consumption Tax Collection, 17 December 2010. China State Administration of Taxation.
<http://www.chinatax.gov.cn/n8136506/n8136593/n8137537/n8138502/10514634.html>

¹⁵⁵ *Biofuels Annual report Peoples Republic of China 2012*, p.5

long-term collaboration program “The U.S. – China Clean Energy Cooperation” with multidirectional energy initiatives, including biofuel development under Renewable Energy Partnership.¹⁵⁶

Knowledge of international practice can provide a broader perspective and better understanding of the best economic instruments available for implementation into Latvia’s legislature. China’s practice in providing exemptions from taxes and support for research and development center at China’s Agricultural University could also be a significant example for Latvia in its transition from first to the next generation biofuels.

5.2 EU Member States` Practice of Policy Instruments

In majority of EU countries, the support schemes consist of two directions - administrative defined mechanisms (biofuel quota obligation – federal government defined percent of biofuels blended into fossil fuel) and fiscal mechanisms (special tax regime for biofuels). This section will present some measures and regulations in EU countries towards the next generation biofuel that could be an example for Latvia in developing new advanced biofuels industry.

5.2.1 Denmark

Denmark is one of the EU member countries which have been active not only implementing EU biofuel regulations but also developing advanced biofuel technologies. “A visionary Danish energy policy 2025” was released in 2007 establishing long-term aim to become fossil fuel independent, increasing share of renewable energy to at least 30% of energy consumption by 2025 and 10% biofuels used in transport by 2020.¹⁵⁷

¹⁵⁶ The U.S.-China Clean Energy Announcements. The White House press release, November 17, 2009. <http://www.whitehouse.gov/the-press-office/us-china-clean-energy-announcements>

¹⁵⁷ *A visionary Danish energy policy 2025*. Danish Energy Authority, January 2007, p.2. <http://ec.europa.eu/ourcoast/download.cfm?fileID=986>

In 2009 the Act on biofuels was adopted by implementing Renewable Energy Directive to promote use of sustainable biofuels and biofuel quota 5.75% amount from fuel sales.¹⁵⁸ However, even before the adoption of the Act on sustainable biofuels on January 1, 2005 the Danish Government exempted biofuels from the CO₂ tax imposed on the ordinary petrol and diesel for transport.¹⁵⁹ Other tax mechanisms are provided in the Act on energy taxation of petroleum-originating products in the Section 1 lowering amount of tax if fuel is blended with biofuel.¹⁶⁰

Special national initiative of the second generation bioethanol was developed in the transport sector by allocating grants to construct a large-scale demonstration facility in 2010.¹⁶¹ From 2007-2009 the Danish Government allocated DKK 60 billion to the development of the pilot of projects.¹⁶² Besides that, due to successful cooperation between private sector and research work at universities and development centers including demonstration facilities, Denmark in 2010 became leading producer of combusting straw into the cellulosic ethanol (1.4 million gallons) in the world.¹⁶³

Therefore, these Denmark's national initiatives for tax mechanisms, financing demonstration facilities and creating cooperation between private sector and universities research centers are significant policy issues for Latvia's future strategy.

¹⁵⁸ Act on biofuels (No.468 of 2009). Consolidated text in Act on sustainable bio-fuels and reduction of transport greenhouse gas emissions (No. 674 of 2011) Section 3, paragraph 1. http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=103622&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL

¹⁵⁹ Law amending the Act on the carbon dioxide tax on certain energy products (No.1391 of 20 December 2004), Section 2. <https://www.retsinformation.dk/Forms/r0710.aspx?id=16678>

¹⁶⁰ Act on energy taxation of petroleum-originating products (No. 313 of 2011), Section 1. http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=114787&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL

¹⁶¹ *A visionary Danish energy policy 2025*, p.15.

¹⁶² Danish annual report under the Biofuels Directive (Directive 2003/30/EC). Danish Energy Agency, 30 June 2009, p.4. http://www.ebb-eu.org/legis/MS_6thReport2009/denmark_2009_en.pdf

¹⁶³ *World's largest Cellulosic Ethanol Plant*. The BioenergySite, July 9, 2010. <http://www.thebioenergysite.com/news/6550/worlds-largest-cellulosic-ethanol-plant>

5.2.2 Finland

In general, Finland's support measures consist of biofuel quota obligation and tax mechanisms. Section 5 of the Act on the Promotion of the Use of Biofuels in Transport contains an obligation that: "Distributor is obliged to provide biofuels for consumption. Share of biofuels in the energy content of the distributor supplied for consumption of motor gasoline, diesel fuel and biofuels in the energy content of the total number (must-carry) must be at least: 1) 6.0 percent in the period 2011-2014; 2) 8.0 percent in 2015; 3) 10.0 percent in 2016; 4) 12.0 percent in 2017; 5) 15.0 percent in 2018; 6) 18.0 percent in 2019; 7) 20.0 percent in 2020 and beyond. If the biofuel is produced from waste or residues, or inedible cellulose or lignocellulose, its energy content is calculated to satisfy the obligation to transmit twice".¹⁶⁴

Taxation system for liquid fuels in Finland is based on separate taxation of fuel components. All liquid fuels are levied with excise duty according to the Act of Excise Duty on Liquid Fuels and excise duty rate is based on energy content tax and CO₂ tax estimated separately and creating different tax rates for different production fuels.¹⁶⁵ Special support through tax mechanisms is provided for advanced biofuels in the Act of Excise Duty on Liquid Fuels Section 1, Section 2(27) and Section 2(28) implementing Article 21(2) of Renewable Energy Directive that advanced biofuels produced from waste, residue materials, non-food cellulose materials and lignocelluloses materials gain a double credit and CO₂ tax rate for them is 0.00. Special tax indicative is also provided in Vehicle Tax Act Section 12 (11) defining that vehicle using mainly wood and peat based fuel are tax-free.¹⁶⁶

Although in the result final excise duty rate for sustainable biofuel oil and advanced biofuel oil is lower, the Finnish authorities (after EC confirmation) adopted tax refund regulation stipulating that for farmers/producers: "[...] the excise tax shall be returned

¹⁶⁴ Act on the Promotion of the Use of Biofuels No.1420, 30 December 2010. <http://www.finlex.fi/fi/laki/alkup/2010/20101420>

¹⁶⁵ Act of Excise Duty on Liquid Fuels No.1472, 29 December 1994. Section 15, Annex Tax table. <http://www.finlex.fi/fi/laki/ajantasa/1994/19941472>

¹⁶⁶ Vehicle Tax Act No.1281, 30 December 2003. <http://www.finlex.fi/fi/laki/ajantasa/2003/20031281>

during the year [...] 9.20 cents per liter of biofuel [...]”¹⁶⁷ “(10) The tax refund for biofuel oil is set at 9.20 cents per litre, but not more than the actual excise duty paid for the fuel. After the refund, the amount of tax that remains to be paid is 6.85 cents per litre for standard biofuel oil and 2.85 cents per litre for biofuel oil that fulfils the requirements of the RES Directive. (11) The excise duty on double-counted biofuel oil is less than the refund amount set out in the legislation, so the maximum referred to in the legislation is applied. The excise duty on double-counted biofuel oil is refunded in full, which means that there is no tax to be paid after the refund.”¹⁶⁸

The general aim of such complex tax estimation system is to reduce fossil fuel impact on transport sector and to increase biofuels (advanced) consumption with special excise duty rate. Economic initiatives like gradual raise in biofuel share in energy content, tax-free vehicles and tax refund initiative would be appropriate for implementation in Latvia.

5.2.3 Sweden

Already in 1980s state’s investment was provided for non-food feedstock like wood chip, peat research and in 1990s funding for biofuel development was continued reaching conversion into large-scale commercial ethanol production.¹⁶⁹ In Sweden like in Finland long-term energy focus is on production of domestic forest biofuels instead of crop-based biofuel.

Support for biofuel industry was provided through tax policy with the aim to create fossil-free transport sector in the future. The structure of general tax for liquid fuel consists of energy tax and CO₂ tax and according to Sweden’s Act on the Taxation of

¹⁶⁷ Act on the Agricultural Use of Certain Energy Products No.1402, 30 December 2010, Section 4.
<http://www.finlex.fi/fi/laki/alkup/2010/20101403>

¹⁶⁸ Decision EC, C(2011) 5399, State aid/Finland No.33203. Refund of biofuel oil excise duty for agriculture and greenhouse cultivation, 25/07/2011, p.2.
http://ec.europa.eu/competition/state_aid/cases/241052/241052_1242007_65_2.pdf

¹⁶⁹ Swedish Energy Research 2009. The Swedish Energy Agency, 2009, p.44.
<http://webbshop.cm.se/System/TemplateView.aspx?p=Energimyndigheten&view=all&id=ad51a77209854b06adabfb1568b6e023>

Energy¹⁷⁰ fuels from biomass are tax-exempt. It is defined in the Chapter 2 Section 12: “The Government may, in special cases, all or part grant exemption from energy tax and carbon tax on: 1. fuels produced from biomass, or 2. fuels other than those referred to in 1., consumed in pilot projects for the technological development of more environmentally friendly products. The first paragraph also applies if fuel is included as a component of another fuel. Act (2010:1824).”¹⁷¹ According to this regulation exemption from tax applies reliably to first and the next generation biofuels.

To promote “green cars” (using biofuel) purchase special tax exemption applies to owners according to Sweden’s Road Tax Act¹⁷². In Chapter 2 Section 11 new “green cars” are exempt from vehicle tax during the first five years from the moment when the vehicle becomes taxable for the first time. According to Section 11 (1.-5.), exemption is also applied to cars with gasoline/diesel combination or running entirely using electricity from batteries.

The congestion tax system in Stockholm is a relatively new initiative of CO₂ reduction emissions in Sweden which will be also introduced in Gothenburg in 2013. Congestion tax is regulated by the Congestion Tax Act¹⁷³. Congestion tax has to be paid for vehicles registered in Sweden operated in the central Stockholm, on working days between 06.30 a.m. to 18.29 p.m.¹⁷⁴ According to Section 5(5) and Section 6 (Act 2009:229)¹⁷⁵ cars running on biofuels (first and next generation) or electricity are automatically exempted from charge of the congestion tax.¹⁷⁶

¹⁷⁰ Act on the Taxation of Energy No.1776, 20 December 1994.

<http://www.notisum.se/rnp/sls/lag/19941776.htm>

¹⁷¹ Supra.

¹⁷² Road Tax Act No.227, 30 March 2006. <http://www.notisum.se/rnp/sls/lag/20060227.htm>

¹⁷³ Congestion Tax Act No.629, 17 June 2004. http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Lag-2004629-om-trangselskat_sfs-2004-629/

¹⁷⁴ Congestion tax in Stockholm. Swedish Transport Agency homepage. <http://www.transportstyrelsen.se/en/road/Congestion-tax/Congestion-tax-in-stockholm/>

¹⁷⁵ Amendment to Congestion Tax Act No.229, 7 April 2009.

<http://www.lagboken.se/files/SFS/2009/090229.PDF>

¹⁷⁶ Exemptions. Green cars – new rules (1 January 2009). Swedish Transport Agency homepage. <http://www.transportstyrelsen.se/en/road/Congestion-tax/Congestion-tax-in-stockholm/Exemptions/>

Sweden's supportive tax-free policy for biofuels and special promotion policy for green cars using vehicle tax and congestion tax has proven to be successful and, therefore, is useful for implementation in the legal framework of Latvia.

6 Initiatives and Economic Mechanisms to Promote Development of Advanced Biofuels Production and Consumption in the Transport Sector

6.1 Measures to Promote Initial Development of Advanced Biofuels Industry in Latvia

Taking into account description and future perspectives of advanced biofuels, it is essential to start the research work and the development stage as soon as possible. The establishment of new advanced biofuel industry more likely will be a long-term complex process in Latvia which will take at least next 5 - 10 years.

From systemic point of view, the process of new industry development consists of the technical and tactical stages, as well as the timeframe. Firstly, the process of biofuel production consists of four technical phases bonded to each other – research and development, demonstration (exemplary/pilot projects), commercialization, supported market development, supported market expansion and mature market strengthening.¹⁷⁷ Secondly, tactical stages of the development consist of different forms of government actions in short-term (0-2 years), medium term (2-10 years) and long term periods (10 and more years).¹⁷⁸

The first step to fulfill the intention of such amplitude with economical consequences is having political will to take a decision for action. Crystallized political direction is subsequently transferred into legal form with possibility and/or obligation to implement measures in practice. The Ministry of Economics already announced support for development of the next generation biofuels in the project of Long-term Energy strategy of Latvia 2030 as a precondition in the point: “26) to develop national support mechanism for promotion of second generation biofuels”. This point is too limited mentioning only second generation biofuels. Therefore, it should be amended giving broader amplitude for action: “26) to develop national support mechanism for

¹⁷⁷ *Advanced Biofuels Study* (2011), p.13.

¹⁷⁸ *Supra*. p.16-17.

promotion of the next generation biofuels (particularly second, third and fourth generation)”.

It is obvious and doubtless from the international experience in the first generation biofuels development that there is no possibility to make a successful transfer to next generation biofuels without political and strategic decision and substantial state support.¹⁷⁹ Therefore, the second step is to carry out a special government study on the future perspectives of advanced biofuel in Latvia similar to e.g., already successful Australian example of Advanced Biofuels Study. The aim of this study would be to produce special roadmap for Latvia. That would include assessment of most suitable development pathway, non-food feedstock availability and mapping, exploration of areas, land use planning, international cooperation possibilities, economic analysis of general development costs etc.¹⁸⁰ The study should be elaborated under responsibility of the Ministry of Economics and by the scientists from different fields of science together with the representatives of related industries, biofuel producers, oil and fuel retail companies, environmental specialists, economists, NGOs, independent experts.

The next step based on assessment of Advanced Biofuel Study would comprise adoption of national strategy according to the conclusions of 2007 Biofuel Progress Report¹⁸¹ and Canadian Renewable Fuel Strategy example. The strategy should contain a long-term programme of connected and consistent measures in short term, middle term and long term period for advanced biofuels development in Latvia until 2030. Thereby this national strategy adopted by the Government in the form of a legal document would reflect national policy and strategy for action. Latvia's national policy strategy with measures should be coherent with EU's general policy positions and coordinate with EC. However, for each country, there should be left enough space for the most flexible and suitable stimulating measures. Therefore it could be considerable to amend Article 2 of Biofuel Law and add that: *“The purpose of this Law is to promote the trade in biofuel, especially transfer from first generation to the next generation*

¹⁷⁹ *Advanced Biofuels Study* (2011), p.14.

¹⁸⁰ *Supra*. p.17,18.

¹⁸¹ *Biofuels Progress Report*, p.13. Emphasizing establishment of framework providing market-based initiatives.

biofuels according to National Advanced Biofuels Strategy, thereby supporting the utilisation of environmentally friendly and safe in supply renewable energy resources.”

At the same time, there should be evaluated necessity to establish special, more independent institution in Latvia taking Australian Biofuels Research Institute and Advisory Council as an example. Although, in Latvia, already exists trans-sectoral Biofuels Development Advisory Board, this entity in practice is more advisory body for the Ministry of Economics and holds meetings only once a quarter.¹⁸² In 2008 there was established Latvian Renewable Energy Association as a non-governmental organization with greater focus on promotion of renewable energy producers and sources.¹⁸³ Therefore, it could be essential to establish Advanced Biofuels Center that could be more non-governmental and an independent entity dealing specifically with the next generation biofuels development in Latvia as similarly to Australia’s model. Advanced Biofuels Center could function as an advisory and coordinating body for public government institutions and private entrepreneurs, investors, producers for start-up projects. Without excluding the possibility that Advanced Biofuels Center could be as separate branch of Latvian Renewable Energy Association. Therefore, Chapter IV of Biofuel Law new Article 10 should be supplemented with determining that: *“The Government together with the Biofuels Development Advisory Board works in cooperation with Advanced Biofuels Center to promote advanced biofuels development in Latvia according to adopted National Advanced Biofuels Strategy.”*

Taking into account description of the next generation biofuels in section 2.2., it is necessary to add in Biofuel Law more explicit term of advanced biofuels¹⁸⁴, taking example from international experience, particularly definition in the U.S. Code, Canadian Renewable Fuels Regulation, and EU Proposal COM(2012), 595 final:

Article 1 of Biofuel law:

The following terms are used in this Law: “7) advanced biofuel - liquid or gaseous fuel derived from renewable biomass other than cereal and other starch rich crops, sugars

¹⁸² On the Biofuels Development Advisory Board. The Cabinet Instruction No.69.

¹⁸³ Latvian Renewable Energy Association, homepage. <http://www.aea.lv/lv/about-us>

¹⁸⁴ *Latvian Energy Policy: Towards a Sustainable and Transparent Energy Sector*. Edited by Andris Sprūds. Riga, (Soros Foundation) 2010, p.56.
http://www.sfl.lv/upload_file/2010%20gads/LatvianEnergyPolicy.pdf

and oil crops with greenhouse gas emission saving at least 50 percent. The term “advanced biofuel” includes biofuel derived from non-food - cellulose, hemicellulose, lignin, straw, waste material, including crop residue, other vegetative waste material, animal waste, food waste, mixed municipal waste, yard waste, industrial waste, vegetable oil and animal fat, algae, bagasse. Listed feedstock should be updated and adapted in light of scientific developments”.

6.2 Direct v. Indirect State Support for Advanced Biofuels Industry in Latvia

The main question is how much and what kind of state support will be necessary for biofuel industry to transfer from crop-based to advanced and more sustainable biofuels production. The problem can be solved by, firstly, reassessing previous policy and avoiding previous unsuccessful elements. The producers of first generation biofuels received direct state’s financial support from 2005 – 2010, additionally to indirect support measures. Although direct support was sufficient (in total amount 67.3 million lats (LVL)) to stimulate creation of new biofuel industry in Latvia, the result of production and consumption did not prove to be satisfactory enough.¹⁸⁵ In 2011 the total production of biofuels reached 55.8 thousand tons (53.9 thousand tons biodiesel and 1.9 thousand tons ethanol) comparing to 58.3 thousand tons in 2010.¹⁸⁶ In 2011 biofuels constituted only 4% of fuel in final consumption in transport sector¹⁸⁷ not reaching national target 5.75 % by December 31, 2010¹⁸⁸.

According to the Article 108, EC is a body which is constantly reviewing system’s protection and measures in the member states. The resulting assessment also largely depends on the general policy position of the EU institutions about support for biofuel industry and interpretation of measures. In 2005 EC accepted Latvia’s measures to develop first generation biofuels and admitted that annual direct support quota for producers proportionally to production capacities so called “necessary annual

¹⁸⁵ The Informative Report on the Situation of Biofuels Industry (2012), p.23.

¹⁸⁶ Supra. p.4,5.

¹⁸⁷ Supra. p.3.

¹⁸⁸ Article 4(3), Biofuel Law.

minimum” of biofuel is compatible with the rules of the EC Treaty.¹⁸⁹ Compatibility means that national measures of support consist of the rules of protection of competition within the internal market (Article 101, 102) and rules about granted states` aid (Article 107) of the Treaty on the Functioning of the EU. Article 107.3 (a, b, c, e) provides suitable exemptions for biofuel production from the general rule in the part I of Article 107 that state aid distorting and threatening to distort competition and affecting trade is incompatible with the internal market. Nevertheless, the question about state aid is a separate and broader issue which will not be analyzed in this study in details.

Another issue is obligation to ensure fair competition in the EU internal market. National regulations providing support for biofuel industry should be consistent with EU law. There should be no discrimination rules in relation to the production in other EU countries as it was the case in 2010 when discriminatory taxation rules gave a lower rate of excise duty for biofuel blended on Latvian territory.¹⁹⁰ On EC request discriminatory rules in Law on Excise Duties were operatively amended¹⁹¹ and all following planned measures were implemented under coordination with EC.

Another aspect includes economic advantage of investment in biofuels industry in Latvia. Latvia as EU member country with improving economical results (GDP grow for more than 5%) after 2008 economical crisis¹⁹² can be an attractive place for investment in the future fuel industry. Latvia has a small economy, but its business environment (economically, politically, legally) is more stable and developed than in the countries with developing state institutions and legal system. Latvia could be suitable place for the development of green and more carbon neutral fuels because

¹⁸⁹ Decision EC, C 2006) 1951, Support to production of biofuel – Latvia, N 540/2005, 05.05.2006, p.9. http://ec.europa.eu/competition/state_aid/cases/201922/201922_671472_22_1.pdf

¹⁹⁰ Excise duty: Commission request Latvia to amend discriminatory rules on bio-fuel from other Member States. Press release IP/10/1243, 30/09/2010. http://europa.eu/rapid/press-release_IP-10-1243_en.htm?locale=en

¹⁹¹ Amendments in Law on Excise Duties. Latvian Law. *Latvijas Vēstnesis* No. 206(4398), 30.12.2010, Article 14. <http://www.likumi.lv/doc.php?id=223540>

¹⁹² *Latvia: An economic success story in the making*. EC, Economic and Financial Affairs, news, 01.03.2012. http://ec.europa.eu/economy_finance/articles/financial_operations/2012-03-05_latvia_economic_en.htm

timber and wood export industry¹⁹³ is productive enough to produce residues necessary for second generation biofuel feedstock.

Another reason was emphasized in the 2010 International Energy Agency (IEA) report about bioenergy potential and perspectives for second generation biofuel production in the Baltics due to low productivity of agriculture in this region.¹⁹⁴ Therefore, taking into account all advantages the whole Baltic region and precisely Latvia can be an attractive place for future investment in more sustainable fuel production, particularly in the development of advanced biofuels.

Although Latvia's low budget financing possibilities and lack of high-tech research centers are the main limiting factors, Latvia should not be exception in the movement towards more sustainable and carbon neutral fuel for transport. Therefore state's support programme in the initial phase should consist of direct and indirect support to for new advanced biofuels industry.¹⁹⁵

Direct government support should be firstly and mainly diverted for financing research programmes and scientific centers to develop the most suitable technologies in Latvia. There should be provided support to already existing science centers at universities: (the Innovation and Technology Transfer Centre) at Riga Technical University, scientific and research institutes at the Latvia University of Agriculture and other institutions. The National Energy Research & Development Center for Non-food Biomass Feedstocks at China Agricultural University and the Australian Government's grant to James Cook University algae biofuel project can serve as an example of such kind cooperation and funding. Such kind of state funding for university science centers will increase and enrich connection among Latvian science academicians, science students and entrepreneurs/private investors following Denmark's practice. Therefore, firstly, this direct financing would promote the development of science and the future technologies and, secondly, the next generation biofuels industry development.

¹⁹³ Forestry and Woodworking. Industry Profiles. Investment and Development Agency of Latvia. http://www.exim.lv/uploaded_files/catalogue_files/Forestry%20&%20Wood%20Processing.pdf

¹⁹⁴ Eisentraut, Anselm. *Sustainable Production of Second-Generation Biofuels. Potential and perspectives in major economies and developing countries*. IEA, February 2010, p.45.

http://www.iea.org/publications/freepublications/publication/second_generation_biofuels.pdf

¹⁹⁵ *From 1st to 2nd Generation Biofuel Technologies* (2008), p.98.

Additional argument for state's direct funding of research and the development of advanced biofuels is so called risk sharing. The risk of failure and high costs not reaching cost-effectiveness in project frequently prevent or delay the private sector participation in the research.¹⁹⁶ If Latvia's government with direct participation takes part of financial risk from private sector, it will increase the security and importance of the research area.

Under the Green Industry Innovation programme, new Green Industry Innovation Center¹⁹⁷ can play a significant role in the near future due to the financial assistance of European Economic Area (EEA) and Norway Grants.¹⁹⁸ Financial funding (97% from Norway), under general aim of greening Latvia's economy, could also contribute to the development of advanced biofuels. Taking into account the fact that many international oil companies like "Statoil"¹⁹⁹ makes investments in the technologies of advantage biofuel it would be essential for Latvia to employ these investment possibilities. In this situation, Green Industry Innovation Center together with the Investment and Development Agency of Latvia (LIAA) could be one of the instruments for establishing contacts between Latvian and Norwegian companies for future cooperation possibilities in the biofuel industry. Participation in the Seventh framework programme through cooperation and information sharing with other EU/European states, especially the Baltic Sea region countries, is also an important factor in research development.

Considering international practice, IEA recommendations²⁰⁰ and National Advanced Biofuel Strategy, direct funding of the research and development should be provided at the initial phase of advanced biofuels. The amount of funding proposed by the Ministry of Economics and adopted by the Government of Latvia should be allocated to the work of science centers in close cooperation and involving private sector/investors, including

¹⁹⁶ *From 1st to 2nd Generation Biofuel Technologies* (2008), p.12.

¹⁹⁷ Green Industry Innovation Center. Norwegian Financial Instruments 2009-2014. The Ministry of Economics homepage, updated 23 October 2012.

http://www.em.gov.lv/images/modules/items/Latvia_MoE_Green_Industry_Innovation.pdf

¹⁹⁸ EEA Financial Mechanisms – Norwegian Financial Mechanisms, Latvia.

<http://www.eeagrants.org/id/43>

¹⁹⁹ *Motor fuel from the sea.* „Statoil” homepage, news, 18 December 2009.

<http://www.statoil.com/en/NewsAndMedia/PressRoom/Pages/MotorFuelFromTheSea.aspx>

²⁰⁰ *From 1st to 2nd Generation Biofuel Technologies* (2008), p.12.

oil companies. Therefore, Article 8(1) of Biofuel Law should be amended providing that: *“the Cabinet in accordance with the Ministry of Economics proposal annually decides on funding and tax relief proposal for research and development centers and institutes for advanced biofuel technologies”*.

6.3 Implementation of Economic and Market-based Support Mechanisms in Latvian Legal Framework

The main government’s objective is to make economically favorable conditions for new advanced biofuel industry, creating a productive public and private partnership model. Firstly, if the new EU Proposal COM(2012), 595 final (by 5% limiting crop-based biofuels) is adopted, it will become the main factor for the growth of advanced biofuels production.

Considering international practice, for example, the U.S. Advanced Biofuel Technologies Program, Australian Advanced Biofuels Readiness Program, Canada’s NextGen Biofuels Fund, Denmark’s grants, IEA recommendations²⁰¹ demonstration projects/plants, Latvia should also receive a financial support from the state. A possibility to receive direct funding for very expensive demonstration projects is one of the most significant factors in order to lay foundation for the new industry. Therefore, National Advanced Biofuels Strategy should provide direct funding for demonstration projects/plants during the initial period. Thus Article 8 (2) of Biofuel Law should be amended providing that: *“The Cabinet specifies and adopts regulation and procedure for financial grant and tax relief for advanced biofuels late-stage pre-commercial demonstration (pilot) projects/plants. The Cabinet establishes amount of funding scheme for two years period.”*

One of the basic and most important stimulating measures in EU is amount of mandatory 10% renewable fuel target in transport sector which is not directly defined in Biofuel Law. Thus now Article 4(1) 3) of Biofuel Law should be amended, specifying

²⁰¹ *From 1st to 2nd Generation Biofuel Technologies* (2008), p.98.

competence of the Cabinet in time frame until 2020: “3) *determine the measures to ensure that by 31 December 2019 biofuels constitutes not less than 10 percents of the total economy of the existing transportation fuel quantity.*”

Blending percentage of biofuels should rise progressively with strict control over increased percentage of GHG emission savings. It could be considerable to take Finland step by step approach from paragraph 5 of Finland Act on the Promotion of the Use of Biofuels as an example due to necessity to adapt changes in regulation in a limited time period. Therefore, instead of the Ministry of Economics proposal to increase current biofuel blending level to fuel from 5% to 7 % starting from April 1, 2013, it would be more appropriate to amend rules allocating more time for increase. Point 8¹ in the Cabinet Regulation No.332 Requirements for Conformity Assessment of Petrol and Diesel Fuel could also be amended with the following: “[...] *ethanol content of 6 percent by 2014, 7 percent by 2015, 8 percent by 2017, 10 percent by 2019 volume of the total volume of petrol (if necessary, stabilizers are added to ethanol-based petrol).* The same Cabinet regulation Point 9¹ should be amended providing that: “[...] *biodiesel content of 6 percent by 2014, 7 percent by 2015, 8 percent by 2017, 10 percent by 2019 by volume of the total end product*”.

Another measure with fundamental impact on biofuel industry is supportive tax mechanisms. To create development of advanced biofuels industry there need to be more favorable tax conditions than for first generation biofuels (IEA recommendation).²⁰² Therefore, the Law on Excise Duties should provide tax exemption not tax relief as it was in the case of first generation biofuels. The Law on Excise Duties should be amended adding to Article 18 part (10) that: “*Advanced biofuels defined in Article 1 part 7) of Biofuel Law shall be exempt from the duty.*”

The next step of the strategy would be rising public awareness about green, advanced fuel and raise demand and consumption by explaining importance of advanced biofuel development.²⁰³ An additional measure could be guided by Sweden’s Verified Sustainable Ethanol Initiative to create Advanced Biofuels Label Programme for Latvia.

²⁰² *From 1st to 2nd Generation Biofuel Technologies* (2008), p.98.

²⁰³ *Supra.* p.98-99.

Firstly, this programme could serve as a certification system for advanced biofuels under one of certification schemes meeting sustainability criteria at least 50% CO₂ emission savings. Other significant certification requirements can include, for example, no harmful environmental impacts from production process, etc.²⁰⁴ Secondly, within the programme, there could be created a new label “Green and Innovative – Advanced Biofuel” (little similarity with already established movement in Latvia with label “GMO free”²⁰⁵). This label could be issued to fuel retailers who will prefer purchasing advanced biofuel at the same time increasing consumer interest and demand for advanced biofuel. Thirdly, in longer-term perspective, after broader and larger-scale production of advanced biofuels, this programme could be expanded by providing consumers with tax refund mechanism in case of choosing labeled advanced biofuel. Thereby Article 7 (3) should be added to Biofuel Law providing that: *“The Cabinet together with Advanced Biofuel Center specifies procedure and requirements for Advanced Biofuels Label Programme for Latvia and new label “Green and Innovative–Advanced Biofuel””*.

Article 9(2) of Biofuel law already contains possibility to receive the State guarantee for merchants who produce or blend biofuel with fossil fuel. According to the special programme of Advanced Biofuels Strategy it would be appropriate to provide special state guarantees for advanced not conventional first generation biofuels producers. Therefore, wording in Article 9(2) of Biofuel Law should be changed to: *“Merchants who have a valid special permit (licence) for the activities of a tax warehouse-keeper and who produce advanced biofuel or blend such advanced biofuel with fossil fuel may receive a State guarantee according to Advanced Biofuels Strategy program within the framework of the annual State budget and in accordance with the procedures specified by the Law On Budget and Financial Management.”*

The Ministry of Economics have already published proposal to evaluate possibilities to choose vehicles using pure biofuel or fuel with higher biofuel blend as a priority to

²⁰⁴ Requirements for sustainable ethanol. Verified Sustainable Ethanol Initiative homepage.

<http://www.sustainableethanolinitiative.com/default.asp?id=1173>

²⁰⁵ About „GMO-free” movement. NGO „Friends of the Earth”. <http://www.brivsnogmo.lv/english>

government and public transport purchases.²⁰⁶ Additionally, taking into account Brazil's practice, Sweden's Road Tax Act, Finland's Vehicle Tax Act and other studies consumers' willingness to obtain flex-fuel or cars running on pure biofuel can be achieved by exempting these cars from some taxes²⁰⁷. In Latvia it could be Vehicle Operating Tax and Company Car Tax²⁰⁸. Although this tax measure is not directly associated with advanced biofuels, it would have generally positive and indirect impact on advanced biofuel development. Therefore, Law on the Vehicle Operation Tax and Company Car Tax should be amended by adding to Article 16 subparagraph 17. (1) The vehicle operation tax shall not be paid for: [...] *"17) vehicles running on pure biofuel or flex-fuel cars (E85) using 85% biofuel blend with fossil fuel."* The same amendment should be added to Article 14 (1) the company car tax shall not be paid: *"13) for vehicles running on pure biofuel or flex-fuel cars (E85) using 85% biofuel blend with fossil fuel."*

²⁰⁶ The Informative Report on the Situation of Biofuels Industry (2012), p.34.

²⁰⁷ *Latvijas iespēju izvērtējums sasniegt 10% biodegvielas patēriņu no kopējās degvielas patēriņa transportam līdz 2020.gadam.* The research by Baltic Consulting Ltd., 14.12.2007, p.64.
<http://www.em.gov.lv/em/2nd/?cat=30179>

²⁰⁸ Law on the Vehicle Operating Tax and Company Car Tax. Latvian law. *Latvijas Vēstnesis*. No.206(4398), 30.12.2010., Article 1(1). <http://www.likumi.lv/doc.php?id=223536>

7 Conclusions

Considering analysis of supportive biofuels policy internationally and in the EU countries, it is important to create long-term sustainable fundament for the development of advanced biofuel industry in Latvia, starting preferably from 2013. In the result of the study, there emerged several main suggestions for initiatives and economic mechanisms intend to promote production start-up in Latvia.

1. The first step is a political will and the Ministry of Economics has already announced the support for development of the next generation biofuels in the project of Long-term Energy strategy of Latvia 2030 as a precondition in Point 26, but because of too limiting focus on second generation biofuels it should be amended giving broader amplitude for action: *“26) to develop national support mechanism for promotion of the next generation biofuels (particularly second, third and forth generation)”*.

2. The second step is to carry out a special government study on advanced biofuel future perspectives in Latvia similar to, e.g., already successful Australian example of Advanced Biofuels Study. The aim of this Advanced Biofuels Study under responsibility of the Ministry of Economics would be producing special and the most convenient roadmap for Latvia.

3. The next important step considering conclusions of 2007 Biofuel Progress Report and international examples like Canadian Renewable Fuel Strategy would be adoption of national strategy for advanced biofuels. The strategy should contain long-term programme of action for advanced biofuels development in Latvia until 2030 with measures in short term, middle term and long term period. Amending Article 2 of Biofuel Law and adding that: *“The purpose of this Law is to promote the trade in biofuel, especially transfer from first generation to the next generation biofuels according to National Advanced Biofuels Strategy, thereby supporting the utilisation of environmentally friendly and safe in supply renewable energy resources”*.

4. It could be appropriate to establish Advanced Biofuels Center taking example from Australian Biofuels Research Institute and Advisory Council. This center could be a

non-governmental, independent entity with advisory and coordination functions in the process of advanced biofuels development in Latvia. Therefore, new Article 10 Chapter IV of Biofuel Law should be added determining that: *“The Government together with the Biofuels Development Advisory Board works in cooperation with Advanced Biofuels Center to promote advanced biofuels development in Latvia according to adopted National Advanced Biofuels Strategy”*.

5. Taking into account proposed measures, it would be necessary to add to Biofuel Law more explicit term of advanced biofuels and taking as an example international experience, particularly the U.S. Code, Title 7, Chapter 107, Section 8101, Canadian Renewable Fuels Regulation section 1(1), EU proposal COM(2012), 595 final and amending Article 1 of Biofuel law:

The following terms are used in this Law: “7) advanced biofuel - liquid or gaseous fuel derived from renewable biomass other than cereal and other starch rich crops, sugars and oil crops with greenhouse gas emission saving at least 50 percent. The term “advanced biofuel” includes biofuel derived from non-food - cellulose, hemicellulose, lignin, straw, waste material, including crop residue, other vegetative waste material, animal waste, food waste, mixed municipal waste, yard waste, industrial waste, vegetable oil and animal fat, algae, bagasse. Listed feedstock should be updated and adapted in light of scientific developments”.

6. Latvia’s support programme in the initial phase should consist of direct and indirect support for building new advanced biofuels industry. Considering international practice, IEA recommendations and National Advanced Biofuel Strategy, direct funding for research and development should be provided at the initial phase for advanced biofuels. The amount of funding proposed by the Ministry of Economics and adopted by the Government of Latvia should be allocated to scientific centers and university science centers (like at China Agricultural University or Australian James Cook University). Therefore, Article 8(1) of Biofuel Law should be amended providing that: *“the Cabinet in accordance with the proposal of the Ministry of Economics annually decides about funding and tax relief for research and development centers and institutes for advanced biofuel technologies”*.

7. Considering international practice from the U.S. Advanced Biofuel Technologies Program, Australian Advanced Biofuels Readiness Program, Canadian NextGen Biofuels Fund, Denmark's grants, IEA recommendations demonstration projects/plants in Latvia should also receive state financial support. A possibility to receive direct funding for expensive demonstration projects is one of the most significant factors to help private sector implement advanced technologies and create foundation for the new industry. Therefore, National Advanced Biofuels Strategy should provide direct funding for demonstration projects/plants in the initial period. Thus Article 8 (2) of Biofuel Law should be amended providing that: *"The Cabinet specifies and adopts regulation and procedure for financial grant and tax relief for advanced biofuels late-stage pre-commercial demonstration (pilot) projects/plants. The Cabinet establishes amount of funding scheme for two years period."*

8. One of the basic stimulating measures in EU is the amount of mandatory 10% renewable fuel target in transport sector which is not directly defined in Biofuel Law. Thus Article 4(1) 3) of Biofuel Law should be amended, specifying competence of the Cabinet in tame frame until 2020: *"3) determine the measures to ensure that by December 31, 2019 biofuels constitute not less than 10 percents of the total economy of the existing transportation fuel quantity"*.

9. It could be advisable to use Finnish step by step approach set in paragraph 5 of Finland Act on the Promotion of the Use of Biofuels as an example instead of the Ministry of Economics proposal to increase current biofuel blending level to fuel from 5% to 7 % starting from April 1, 2013. Therefore, it would be more appropriate to amend rules providing longer time period to adapt changes and amend Point 8¹ in the Cabinet Regulation No. 332 Requirements for Conformity Assessment of Petrol and Diesel Fuel: *"[...] ethanol content of 6 percents by 2014, 7 percents by 2015, 8 percents by 2017, 10 percents by 2019 volume of the total volume of petrol (if necessary, stabilizers are added to ethanol-based petrol). Point 9¹ of the above mentioned Cabinet Regulation should be amended providing that: "[...] biodiesel content of 6 percents by 2014, 7 percents by 2015, 8 percents by 2017, 10 percents by 2019 by volume of the total end product"*.

10. Another measure which would have a fundamental impact on industry is supportive tax mechanisms. For development of advanced biofuels industry, there should be created more favorable tax conditions than to first generation biofuels (IEA recommendation). Therefore, the Law on Excise Duties should provide tax exemption not tax relief as it was for first generation biofuels. *Law on Excise Duties should be amended adding to Article 18 part (10) that: “Advanced biofuels defined in Article 1 part 7) of Biofuel Law shall be exempt from the duty.”*

11. An additional measure guided by Sweden’s Verified Sustainable Ethanol Initiative to increase production and consumption could be creating Advanced Biofuels Label Programme for Latvia. Firstly, it could serve as certification for advanced biofuels under one of the certification schemes to meet sustainability criteria. Secondly, a new label “Green and Innovative – Advanced Biofuel” could be created within the programme. Thirdly, from a longer-term perspective, the programme could be expanded by providing consumers with tax refund mechanism by choosing labeled advanced biofuel. Thereby Article 7 (3) should be added to Biofuel Law providing that: *“The Cabinet together with Advanced Biofuel Center specifies procedure and requirements for Advanced Biofuels Label Programme for Latvia and new label “Green and Innovative – Advanced Biofuel””*.

12. Article 9(2) of Biofuel Law already contains possibility for merchants who produce or blend biofuel with fossil fuel to receive the State guarantees. According to Advanced Biofuels Strategy, it would be appropriate to create a programme to provide a special state guarantee for advanced not conventional first generation biofuels producers. Therefore, wording in Article 9(2) of Biofuel Law should be changed to: *“Merchants who have a valid special permit (licence) for the activities of a tax warehouse-keeper and who produce advanced biofuel or blend such advanced biofuel with fossil fuel may receive a State guarantee according to Advanced Biofuels Strategy program within the framework of the annual State budget and in accordance with the procedures specified by the Law On Budget and Financial Management.”*

13. The proposal based on Brazil’s, Sweden’s, and Finland’s practice and other studies to increase consumer willingness to obtain flex-fuel or cars running on pure biofuel, by

exemption them from some taxes. In Latvia it could be Vehicle Operating Tax and Company Car Tax. It would have more general and supplementary-indirect impact on advanced biofuel development. Therefore Law On the Vehicle Operation Tax and Company Car Tax should be amended by adding to Article 16 subparagraph 17. (1) The vehicle operation tax shall not be paid for: [...] *“17) a vehicles running on pure biofuel or flex-fuel cars (E85) using 85% biofuel blend with fossil fuel.”* The same amendment should be add to Article 14 (1) the company car tax shall not be paid: *“13) for vehicles running on pure biofuel or flex-fuel cars (E85) using 85% biofuel blend with fossil fuel”*.

Bibliography

Literature

Books, articles, reports, online sources

About „GMO-free” movement. NGO „Friends of the Earth”.

<http://www.brivsnogmo.lv/english> [Visited 16 November 2012].

Altieri, Miguel A. *The Myth of Coexistence: Why Transgenic Crops Are Not Compatible With Agroecologically Based Systems of Production*. In: Bulletin of Science, Technology & Society. Vol.25, No.4 (2005), p.361-371.

http://www.odg.cat/documents/formacio/7juny_Rosa_Binimelis.pdf [Visited 18 November 2012].

A quick look at 'fourth generation' biofuels. Biopact, 8 October 2007.

<http://news.mongabay.com/bioenergy/2007/10/quick-look-at-fourth-generation.html> [Visited 31 October 2012].

Barros, Sergio. *Biofuels Annual report Brazil 2011*. USDA Foreign Agricultural Service, 27 July 2011.

http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Sao%20Paulo%20ATO_Brazil_7-27-2011.pdf [Visited 12 November 2012].

Biodiesel Basics. Biodiesel, America's Advanced Biofuel webpage.

<http://www.biodiesel.org/what-is-biodiesel/biodiesel-basics> [Visited 28 September 2012].

Biodiesels pollute more than crude oil, leaked data show. EurActiv Network. updated 30 January 2012. <http://www.euractiv.com/climate-environment/biodiesels-pollute-crude-oil-lea-news-510437> [Visited 15 October 2012].

Bioenergy Strategy: Sustainable Industrial Conversion and Productive Use of Bioenergy. UN Industrial Development Organization.

http://www.unido.org/fileadmin/media/documents/pdf/Energy_Environment/rre_bioenergyStrategy_latest.pdf [Visited 27 October 2012].

Biofuels: The Next Generation. EurActiv Network, published 18 September 2007, updated 13 July 2009. <http://www.euractiv.com/energy/biofuels-generation-links dossier-188433> [Visited 20 November 2012].

Brennan, Liam and Philip Owende. *Biofuels from microalgae — A review of technologies for production, processing, and extractions of biofuels and co-products*. Renewable and Sustainable Energy Reviews (2009), [1-21].

https://wiki.umn.edu/pub/Biodiesel/WebHome/An_intensive_continuousnext_term_culture_system_using_tubular_photobioreactors_for_producing_previous_termmicroalgae.pdf [Visited 29 October 2012].

Carrquiry, Miguel A., Xiaodong Du & Govinda R Timilsina. *Second – Generation Biofuels: Economics and Policies*. The World Bank, Policy Research Working Paper 5406, August 2010. http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2010/08/30/000158349_20100830090558/Rendered/PDF/WPS5406.pdf [Visited 28 October 2012].

Case studies on bioenergy policy and law: opinions for sustainability B.Brazil. UN Food and Agriculture Organization, [Rome, 2009]. <http://www.fao.org/docrep/012/i1285e/i1285e03.pdf> [Visited 11 November 2012].

Chestney, Nina. *Aqualia eyes large-scale algae biofuel production*. Reuters, London, 5 March 2012. <http://www.reuters.com/article/2012/03/05/us-algae-biofuels-idUSTRE8241DT20120305> [Visited 31 October 2012].

Chisti, Yusuf. *Biodiesel from microalgae*. *Biotechnology Advances* 25 (3), 13 February 2007, p.294–306. <http://www.tamu.edu/faculty/tpd8/BICH407/AlgaeBiodiesel.pdf> [Visited 29 October 2012].

Congestion tax in Stockholm. Swedish Transport Agency homepage.

<http://www.transportstyrelsen.se/en/road/Congestion-tax/Congestion-tax-in-stockholm/>
[Visited 13 November 2012].

Creating Markets for Renewable Energy Technologies EU RESTMAC. Bioethanol Production and Use. European Biomass Industry Association. Brussels.

http://www.erec.org/fileadmin/erec_docs/Projcet_Documents/RESTMAC/Brochure5_Bioethanol_low_res.pdf [Visited 26 September 2012].

EEA Financial Mechanisms – Norwegian Financial Mechanisms, Latvia.

<http://www.eeagrants.org/id/43> [Visited 18 November 2012].

Eisentraut, Anselm. *Sustainable Production of Second-Generation Biofuels. Potential and perspectives in major economies and developing countries.* IEA, February 2010.

http://www.iea.org/publications/freepublications/publication/second_generation_biofuels.pdf [Visited 7 November 2012].

Ethanol fuel in Brazil. UN-Energy, 8 January 2011. [http://www.un-](http://www.un-energy.org/stories/38-ethanol-fuel-in-brazil)

[energy.org/stories/38-ethanol-fuel-in-brazil](http://www.un-energy.org/stories/38-ethanol-fuel-in-brazil) [Visited 12 November 2012].

Exemptions. Green cars – new rules (1 January 2009). Swedish Transport Agency

homepage. <http://www.transportstyrelsen.se/en/road/Congestion-tax/Congestion-tax-in-stockholm/Exemptions/> [Visited 13 November 2012].

Forestry and Woodworking. Industry Profiles. Investment and Development Agency of Latvia.

http://www.exim.lv/uploaded_files/catalogue_files/Forestry%20&%20Wood%20Processing.pdf [Visited 7 November 2012].

From 1st to 2nd Generation Biofuel Technologies. Ralph Sims ... [et al.] IEA. November 2008. http://www.ftsnet.it/documenti/419/2nd_Biofuel_Gen.pdf [Visited 27 October 2012].

Gene-modified eucalyptus ingest more CO₂. The China Post, updated 14 September 2007. <http://www.chinapost.com.tw/taiwan/2007/09/14/122524/Gene-modified-eucalyptus.htm> [Visited 1 November 2012].

Genetically Engineered Algae for Biofuel Pose Potential Risks. Science Daily, 20 August 2012. <http://www.sciencedaily.com/releases/2012/08/120820121044.htm> [Visited 31 October 2012].

Global carbon-dioxide emissions increase by 1.0 Gt in 2011 to record high. IEA, news, 24 May 2012. <http://www.iea.org/newsroomandevents/news/2012/may/name,27216,en.html> [Visited 17 November 2012].

Green Industry Innovation Center. Norwegian Financial Instruments 2009-2014. The Ministry of Economics homepage, updated 23 October 2012. http://www.em.gov.lv/images/modules/items/Latvia_MoE_Green_Industry_Innovation.pdf [Visited 18 November 2012].

Increasing Security and Reducing Carbon emissions of the U.S. Transportation Sector: A Transformational Role for Coal with Biomass. Department of Energy, National Energy Technology Laboratory and the Department of Defense, Air Force. August 24, 2007. <http://www.netl.doe.gov/energy-analyses/pubs/NETL-AF%20CBTL%20Study%20Final%202007%20Aug%2024.pdf> [Visited 1 November 2012].

IPCC Plenary XXVII. *Forth Assessment Report: Climate Change 2007*. Summary for Policymakers. Valencia, 2007. http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf [Visited 21 September 2012].

Japanese scientists develop hybrid larch trees with 30% greater carbon sink capacity. Biopact, 3 October 2007. <http://news.mongabay.com/bioenergy/2007/10/japanese-scientists-develop-hybrid.html> [Visited 1 November 2012].

Kumar Saxena, Anil. *Greenhouse Gas Emissions: Estimation and Reduction*. Asian Productivity Organization, India, 2009. <http://www.apo-tokyo.org/publications/files/gp-19-gge.pdf> [Visited 17 November 2012].

Laborde, David. *Assessing the Land Use Change Consequences of European Biofuel Policies*. IFPRI, Final report, October 2011. http://trade.ec.europa.eu/doclib/docs/2011/october/tradoc_148289.pdf [Visited 15 October 2012].

Lane, Jim. *Sapphire completes construction of the Green Crude Farm: algae biofuels heads for the next level*. Biofuels Digest, 28 August 2012. <http://www.biofuelsdigest.com/bdigest/2012/08/28/sapphire-completes-construction-of-the-green-crude-farm-algae-biofuels-heads-for-the-next-level/> [Visited 31 October 2012].

Latvia: An economic success story in the making. EC, Economic and Financial Affairs, news, 1 March 2012. http://ec.europa.eu/economy_finance/articles/financial_operations/2012-03-05_latvia_economic_en.htm [Visited 7 November 2012].

Latvian Energy Policy: Towards a Sustainable and Transparent Energy Sector. Edited by Andris Sprūds. Riga, (Soros Foundation) 2010. http://www.sfl.lv/upload_file/2010%20gads/LatvianEnergyPolicy.pdf [Visited 14 November].

Latvian Renewable Energy Association, homepage. <http://www.aea.lv/lv/about-us> [Visited 14 November 2012].

Latvijas iespēju izvērtējums sasniegt 10% biodegvielas patēriņu no kopējās degvielas patēriņa transportam līdz 2020.gadam. The research by Baltic Consulting Ltd., 14.12.2007. <http://www.em.gov.lv/em/2nd/?cat=30179> [Visited 16 November 2012].

L.E.K. Consulting. *Advanced Biofuels Study*. Strategic Directions for Australia. 14 December 2011. <http://www.arena.gov.au/documents/abir/advanced-biofuels-study.pdf> [Visited 9 November 2012].

Macalister, Terry. *Biofuels fails EU sustainability test, German researchers claim*. Guardian.co.uk, 19 August 2012. <http://www.guardian.co.uk/environment/2012/aug/19/biofuel-fails-eu-sustainability-test> [Visited 14 October 2012].

Mark, Monika. *Nigeria floats idea for life on the water*. Guardian.co.uk, Lagos, 4 October 2012. <http://www.guardian.co.uk/global-development/2012/oct/04/nigeria-floats-idea-for-life-on-water> [Visited 17 November 2012].

Michaelides, Efstathios E. (Stathis). *Alternative Energy Sources*. Berlin, (Springer) 2012.

Motor fuel from the sea. „Statoil” homepage, news, 18 December 2009. <http://www.statoil.com/en/NewsAndMedia/PressRoom/Pages/MotorFuelFromTheSea.aspx> [Visited 18 November 2012].

National Algal Biofuels Technology Roadmap. The U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Biomass Program. May 2010. http://www1.eere.energy.gov/biomass/pdfs/algal_biofuels_roadmap.pdf [Visited 29 October 2012].

Nigam, Poonam Singh, Anoop Singh. *Production of liquid biofuels from renewable resources*. Progress in Energy and Combustion Science (2010) p.1-17. <http://helhaph12010-02.wikispaces.com/file/view/Production+of+liquid+biofuels+from+renewable+resources.pdf> [Visited 31 October 2012].

Novozymes to supply first advanced biofuels factory in Brazil. News, Novozymes.com, 23 May 2013. <http://www.novozymes.com/en/news/news-archive/Pages/Novozymes-to-supply-first-advanced-biofuels-factory-in-Brazil.aspx> [Visited 12 November 2012].

Obama Administration Announces New Investments to Advance Biofuels Industry and Enhance America's Energy Security. The U.S. Department of Energy, 2 July 2012. <http://energy.gov/articles/obama-administration-announces-new-investments-advance-biofuels-industry-and-enhance-0> [Visited 8 November 2012].

Olivares, Jose interview by Jonathan Williams. *Who's in the lead? Algae around the world.* January 12, 2012. <http://www.biofuelsdigest.com/bdigest/2012/01/12/whos-in-the-lead-algae-around-the-world/> [Visited 29 October 2012].

Pasolini, Antonio. *Austrian algae biofuel-production technology to debut in Brazil.* Gizmag.com, 20 July 2012. <http://www.gizmag.com/algae-biomass-plant-brazil/23378/> [Visited 31 October 2012].

Paul, Bill. *Future Energy: How the New Oil Industry Will Change People, Politics, and Portfolios.* New Jersey, (John Wiley & Sons, Inc.) 2007.

Reijnders, Lucas and Mark A.J. Huijbregts. *Biofuels for Road Transport: A Seed to Wheel Perspective.* London, (Springer) 2010.

Requirements for sustainable ethanol. Verified Sustainable Ethanol Initiative homepage. <http://www.sustainableethanolinitiative.com/default.asp?id=1173> [Visited 16 November 2012].

Scot, Ryan and Jiang Junyang. *Biofuels Annual report Peoples Republic of China 2012.* USDA Foreign Agricultural Service. http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Beijing_China%20-%20Peoples%20Republic%20of_7-9-2012.pdf [Visited 12 November 2012].

SD Tech Fund, NextGen Biofuels Fund. Sustainable Development Technology Canada homepage, 2012. http://www.sdtc.ca/index.php?page=about-our-funds&hl=en_CA [Visited 11 November 2012].

Snow, Allison A. and Val H. Smith. *Genetically Engineered Algae for Biofuels: A Key Role for Ecologists*. In: BioScience. Vol.62 No.8 (2012), p.765-768. <http://www.biosci.ohio-state.edu/~asnowlab/Snow%20%20Smith%20BioScience%202012%20REPRINT.pdf> [Visited 31 October 2012].

Sperling, Daniel and Deborah Gordon. *Two Billion Cars: Driving Towards Sustainability*. Oxford, (Oxford University Press) 2009.

Tanner, Simon. *Biofuels of the Third Generation – Do Microalgae Solve the Energy Problem?* Swiss Federal Institute of Technology Zurich, Department of Environmental Science, ETH Zurich, 18 December 2009. http://www.ibp.ethz.ch/research/aquaticchemistry/teaching/archive_past_lectures/Term_Paper_HS2009/TANNER_termpaper_msHS09.pdf [Visited 29 October 2012].

The U.S.-Canada Clean Energy Dialogue. Canada's Action on Climate Change. Government of Canada homepage. <http://www.climatechange.gc.ca/dialogue/default.asp?lang=En&n=E47AAD1C-1> [Visited 11 November 2012].

The vanishing north. The Economist homepage, 16 June 2012. <http://www.economist.com/node/21556921?fsrc=scn/tw/te/ar/thevanishingnorth> [Visited 17 November 2012].

Wang, Huanhuan. *Building a regulatory framework for biofuels governance in China: Legislation as the Starting point*. Natural Resources Forum Vol.35 (2011) p.201–212. <http://onlinelibrary.wiley.com/doi/10.1111/j.1477-8947.2011.01390.x/pdf> [Visited 12 November 2012].

World's largest Cellulosic Ethanol Plant. The BioenergySite, 9 July 2010.
<http://www.thebioenergysite.com/news/6550/worlds-largest-cellulosic-ethanol-plant>
[Visited 12 November 2012].

Legal sources

International legal sources

The Charter of the United Nations, ATS 1/59 Stat. 1031; TS 993; 3 Bevans 1153, 26 June 1945.

United Nations Framework Convention on Climate Change (UNFCCC), 1771 UNTS 107/ [1994] ATS 2/31 ILM 849 (1992).

Rio Declaration on Environment and Development. UN Doc. A/CONF.151/26 (vol. I)/31 ILM 874 (1992), 14 June 1992.

EU legislation

Consolidated version of the Treaty on European Union and the Treaty on the Functioning of the European Union. OJ C 83, 30.03.2010, p.47-199.

Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport, OJ L 123, 17.05.2003, p.42-46.

Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, OJ L 283, 31.10.2003, p.51-70, Article 16.

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and

subsequently repealing Directives 2001/77/EC and 2003/30/EC, OJ L 140 of 05.06.2009, p.16-62.

Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC, OJ L 140, 05.06.2009, p. 88-113.

Decision EC, C 2006) 1951, Support to production of biofuel – Latvia, N 540/2005, 05.05.2006.

http://ec.europa.eu/competition/state_aid/cases/201922/201922_671472_22_1.pdf
[Visited 3 November 2012].

Decision No. 1982/2006/EC of the European Parliament and of the Council of 18 December 2006 concerning the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013), OJ L 412, 30.12.2006, p.1-41.

Decision EC, C(2011) 5399, State aid/Finland No.33203. Refund of biofuel oil excise duty for agriculture and greenhouse cultivation, 25/07/2011.

http://ec.europa.eu/competition/state_aid/cases/241052/241052_1242007_65_2.pdf
[Visited 13 November 2012].

Documents from the EU institutions

Green Paper: Towards a European strategy for the security of energy supply.
Commission of the European Communities. COM(2000) 769 final, 29.11.2000.

Biomass Action Plan. Communication from the Commission, COM(2005) 628 final, 07.12.2005.

An EU Strategy for Biofuels, Communication from the Commission, COM(2006) 34 final, 08.02.2006.

Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy, Commission of the European Communities. COM(2006) 105 final, 08.03.2006.

Biofuels Progress Report, Communication from the Commission to the Council and the European Parliament, COM(2006) 845 final, 10.01.2007.

A European strategic energy technology plan (SET Plan) - Towards a low carbon future, Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, COM(2007) 723 final, 22.11.2007.

The Renewable Energy Progress Report: Commission Report in accordance with Article 3 of Directive 2001/77/EC, Article 4(2) of Directive 2003/30/EC and on the implementation of the EU Biomass Action Plan, COM(2005)628, Communication from the Commission to the Council and the European Parliament, COM(2009) 192 final, 24.04.2009.

Energy 2020: A strategy for competitive, sustainable and secure energy, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2010) 639 final, 10.11.2010.

Report from the Commission on indirect land-use change related to biofuels and bioliquids. European Commission, COM(2010) 811 final, 22.12.2010.

Innovating for Sustainable Growth: A Bioeconomy for Europe. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2012) 60 final, 13.02.2012.

Impact Assessment. Commission Staff Working Document. SWD(2012) 343 final, 17.10.2012.

http://ec.europa.eu/energy/renewables/biofuels/doc/biofuels/swd_2012_0343_ia_en.pdf

[Visited 21 November 2012].

Proposal for a Directive amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EC and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources, COM(2012) 595 final, 17.10.2012

http://ec.europa.eu/energy/renewables/biofuels/doc/biofuels/com_2012_0595_en.pdf

[Visited 19 November 2012].

National legislation, documents, programs

Australia

Energy Grants (Cleaner Fuels) Scheme Act. No.41 of 2004.

<http://www.comlaw.gov.au/Details/C2006C00429> [Visited 9 November 2012].

Australian Renewable Energy Agency Act. No.151 of 2011.

<http://www.comlaw.gov.au/Details/C2012C00629> [Visited 9 November 2012].

Advanced Biofuels Investment Readiness Program. Program Administrative Guidelines. Australian Government. The Department of Resources, Energy and Tourism. 16 February 2012. <http://www.arena.gov.au/documents/abir/ABIR-Program-Administrative-Guidelines.pdf> [Visited 9 November 2012].

Brazil

Reduction of Pollutant Emissions from Automobiles - Law No. 8.723. National Congress of Brazil, 28.10.1993. <http://repository.unm.edu/handle/1928/12644> [Visited 11 November 2012].

Introduction of Biodiesel in the Brzilian Energy Mix – Law No. 11.097. National Congress of Brazil, 13.01.2005. <http://repository.unm.edu/handle/1928/12656> [Visited 11 November 2012].

Canada

Renewable Fuels Regulation. SOR/2010-189. <http://laws-lois.justice.gc.ca/PDF/SOR-2010-189.pdf> [Visited 9 November 2012].

Canadian Renewable Fuels Strategy. Canadian Renewable Fuels Asociation. July 25, 2006. <http://www.saaep.ca/CanadianRenewableFuelsStrategy.pdf> [Visited 9 November 2012].

China

The Renewable Energy Law of the People’s Republic of China. Approved by the Standing Committee of the National People's Congress (NPC) of the People's Republic of China in the 14th Session on February 28, 2005. China Climate Change Info-Net, English version. <http://www.ccchina.gov.cn/en/NewsInfo.asp?NewsId=5371> [Visited 12 November 2012].

Circular 118 on Exempting Pure Biodiesel Oil Made from Waste Animal and Vegetable Oil from Consumption Tax Collection, 17 December 2010. China State Administration of Taxation. <http://www.chinatax.gov.cn/n8136506/n8136593/n8137537/n8138502/10514634.html> [Visited 12 November 2012].

Denmark

Law amending the Act on the carbon dioxide tax on certain energy products (No.1391 of 20 December 2004). <https://www.retsinformation.dk/Forms/r0710.aspx?id=16678> [Visited 12 November 2012].

Act on biofuels (No.468 of 2009). Consolidated text in Act on sustainable bio-fuels and reduction of transport greenhouse gas emissions (No. 674 of 2011).

http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=103622&database=faolex&search_type=link&table=result&lang=en&format_name=@ERALL [Visited 12 November 2012].

Act on energy taxation of petroleum-originating products (No. 313 of 2011).

http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=114787&database=faolex&search_type=link&table=result&lang=en&format_name=@ERALL [Visited 12 November 2012].

A visionary Danish energy policy 2025. Danish Energy Authority, January 2007.

<http://ec.europa.eu/ourcoast/download.cfm?fileID=986> [Visited 12 November 2012].

Danish annual report under the Biofuels Directive (Directive 2003/30/EC). Danish Energy Agency, 30 June 2009. [http://www.ebb-](http://www.ebb-eu.org/legis/MS_6thReport2009/denmark_2009_en.pdf)

[eu.org/legis/MS_6thReport2009/denmark_2009_en.pdf](http://www.ebb-eu.org/legis/MS_6thReport2009/denmark_2009_en.pdf) [Visited 12 November 2012].

Finland

Act of Excise Duty on Liquid Fuels No.1472, 29 December 1994.

<http://www.finlex.fi/fi/laki/ajantasa/1994/19941472> [Visited 13 November 2012].

Vehicle Tax Act No.1281, 30 December 2003.

<http://www.finlex.fi/fi/laki/ajantasa/2003/20031281> [Visited 13 November 2012].

Act on the Agricultural Use of Certain Energy Products No.1403, 30 December 2010.

<http://www.finlex.fi/fi/laki/alkup/2010/20101403> [Visited 13 November 2012].

Act on the Promotion of the Use of Biofuels No.1420, 30 December 2010.

<http://www.finlex.fi/fi/laki/alkup/2010/20101420> [Visited 13 November 2012].

Latvia

The Constitution of the Republic of Latvia (Satversme). Latvian Law. *Latvijas Vēstnesis* No. 43, 01.07.1993. <http://www.saeima.lv/en/legislation/constitution> [Visited 1 October 2012].

Law on Excise Duties. Latvian Law. *Ziņotājs* No. 161 (2926), 14.11.2003. <http://www.likumi.lv/doc.php?id=81066&from=off> [Visited 1 October 2012].

Biofuel Law. Latvian Law. *Ziņotājs* No. 52 (3210), 01.04.2005. <http://www.likumi.lv/doc.php?id=104828> [Visited 25 September 2012].

Law on Circulation of Genetically Modified Organisms. Latvian law. *Latvijas Vēstnesis* No. 195 (3771), 15.11.2007. <http://www.likumi.lv/doc.php?id=167400> [Visited 21 November 2012].

Amendments in Law on Excise Duties. Latvian Law. *Latvijas Vēstnesis* No.206 (4398), 30.12.2010. <http://www.likumi.lv/doc.php?id=223540> [Visited 3 November 2012].

Law on the Vehicle Operating Tax and Company Car Tax. Latvian law. *Latvijas Vēstnesis* No. 206 (4398), 30.12.2010. <http://www.likumi.lv/doc.php?id=223536> [Visited 16 November 2012].

Regulation for Conformity Assessment of Petrol and Diesel Fuel. The Cabinet Regulation No. 332, *Latvijas Vēstnesis* No. 341/343 (2252/2254), 29.09.2000. <http://www.likumi.lv/doc.php?id=11217> [Visited 2 October 2012].

Regulation Regarding Requirements for Biofuel Quality, Conformity Assessment, Market Supervision and Procedures for Consumer Information. The Cabinet Regulation No. 772, *Latvijas Vēstnesis* No. 168 (3326), 21.10.2005. <http://www.likumi.lv/doc.php?id=119463&from=off> [Visited 2 October 2012].

Statute of the Biofuels Development Advisory Board. The Cabinet Regulation No. 830, *Latvijas Vēstnesis* No. 163(3531), 12.10.2006.

<http://www.likumi.lv/doc.php?id=145503&from=off> [Visited 2 October 2012].

Regulation Regarding Financial Supply Quotas for Biofuels. The Cabinet Regulation No. 280, *Latvijas Vēstnesis* No. 63 (3847), 23.04.2008.

<http://www.likumi.lv/doc.php?id=174321> [Visited 2 October 2012].

Regulation Regarding the Sustainability Criteria for Biofuels and Bioliquids, the Mechanism for Introducing Thereof, and the Procedure by Which They Shall Be supervised and Monitored. The Cabinet Regulation No. 545, *Latvijas Vēstnesis* No.111 (4509), 19.07.2011. <http://www.likumi.lv/doc.php?id=233225> [Visited 2 October 2012].

On the Biofuels Development Advisory Board. The Cabinet Instruction No. 69, *Latvijas Vēstnesis* No. 32 (4430), 25.02.2011. <http://www.likumi.lv/doc.php?id=226346> [Visited 5 October 2012].

Sustainable Development Strategy of Latvia until 2030/„Latvija 2030”. Approved by the Latvian Parliament in 10 June 2010.

http://www.latvija2030.lv/upload/latvija2030_en.pdf [Visited 16 October 2012].

The Informative Report on the Situation of Biofuels Industry. Project developed by The Ministry of Economics of the Republic of Latvia, 2 August 2012.

<http://mk.gov.lv/lv/mk/tap/?pid=40248005&mode=mkk&date=2012-08-27> [Visited 16 October 2012].

Long-term Energy Strategy of Latvia 2030. Project developed by The Ministry of Economics of the Republic of Latvia, 25 September 2012.

<http://www.em.gov.lv/em/2nd/?id=32707&cat=621> [Visited 16 October 2012].

Sweden

Act on the Taxation of Energy No.1776, 20 December 1994.

<http://www.notisum.se/rnp/sls/lag/19941776.htm> [Visited 13 November 2012].

Congestion Tax Act No.629, 17 June 2004. [http://www.riksdagen.se/sv/Dokument-](http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Lag-2004629-om-trangselskat_sfs-2004-629/)

[Lagar/Lagar/Svenskforfattningssamling/Lag-2004629-om-trangselskat_sfs-2004-629/](http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Lag-2004629-om-trangselskat_sfs-2004-629/)

[Visited 13 November 2012].

Road Tax Act No.227, 30 March 2006.

<http://www.notisum.se/rnp/sls/lag/20060227.htm> [Visited 13 November 2012].

Amendment to Congestion Tax Act No.229, 7 April 2009.

<http://www.lagboken.se/files/SFS/2009/090229.PDF> [Visited 13 November 2012].

Swedish Energy Research 2009. The Swedish Energy Agency, 2009.

<http://webbshop.cm.se/System/TemplateView.aspx?p=Energimyndigheten&view=all&i>

[d=ad51a77209854b06adabfb1568b6e023](http://webbshop.cm.se/System/TemplateView.aspx?p=Energimyndigheten&view=all&i) [Visited 13 November 2012].

The U.S.

Internal Revenue Code. Public law 16 August 1954, Title 26 of the U.S. Code.

<http://www.gpo.gov/fdsys/pkg/USCODE-2011-title26/html/USCODE-2011-title26->

[subtitleA-chap1-subchapA-partIV-subpartD-sec40.htm](http://www.gpo.gov/fdsys/pkg/USCODE-2011-title26/html/USCODE-2011-title26-) [Visted 8 November 2012].

The Clean Air Act. Public Law 31 December 1970, included in the U.S. Code, Title 42.

<http://www.law.cornell.edu/uscode/text/42/7545> [Visted 9 November 2012]

Agriculture Risk Protection Act of 2000. Public Law 106-224, June 20, 2000.

<http://www.gpo.gov/fdsys/pkg/PLAW-106publ224/pdf/PLAW-106publ224.pdf> [Visited

8 November 2012].

Energy Policy Act of 2005. Public Law 109-58, August 8, 2005.

<http://www.gpo.gov/fdsys/pkg/PLAW-109publ58/pdf/PLAW-109publ58.pdf>

Energy Independence and Security Act of 2007. Public Law 110-2007, December 19, 2007. <http://www.gpo.gov/fdsys/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf>

[Visted 9 November 2012]

The Code of Laws of the United states of America (the U.S. Code), Tiltle 7 Agriculture.

<http://us-code.laws.com/title-7-agriculture/chapter-107-renewable-energy-research-and-development/8101-definitions> [Visited 8 November 2012].

EPA Finalizes 2012 Renewable Fuel Standarts. The U.S. Environmental Protection Agency, December 2011.

<http://www.epa.gov/otaq/fuels/renewablefuels/documents/420f11044.pdf> [Visted 8

November 2012].

Press releases

Excise duty: Commission request Latvia to amend discriminatory rules on bio-fuel from other Member States. Press release IP/10/1243, 30/09/2010.

http://europa.eu/rapid/press-release_IP-10-1243_en.htm?locale=en [Visited 2

November 2012].

The U.S.-China Clean Energy Announcements. The White House press release,

November 17, 2009. <http://www.whitehouse.gov/the-press-office/us-china-clean-energy-announcements>

[Visited 12 November 2012].

Acknowledgments

I would like to thank,

Dr. Juris Christina Voigt, Associate Professor at the Department of Public and International Law at the University of Oslo for her excellent supervision, the best advice during the process of writing thesis and giving fundamental understanding of International Climate Change and Energy Law.

The University of Oslo in general for opportunity to study in the Master Programme in Public International Law with interesting programme option International Environmental and Energy Law. And in the result of studies gain specific, exclusive and valuable legal knowledge and understanding with possibility to dedicate my thesis to study on renewable fuel future perspectives and development strategy in Latvia.

My family for love and the biggest support.

Renate Stale

Oslo, Norway

23rd November 2012

