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Modern theoretical foundations of international trade of biomass and its implications for Ukraine

Abstract. The energy dependence of Ukraine necessitates finding alternative energy sources, which primarily should take into account the resources available, the possibility of prospective studies and cost-effectiveness of such developments. One of considered alternative sources is the potential of biomass used for processing of different types of fuel. Analysis of international experience of energy use of biomass shows that this fuel cannot compete with conventional (fossil types). In other countries, development of the energy sector takes place with state support in the form of subsidies, grants and tax benefits. In Ukraine now there is no real economic support of bioenergy. But Ukraine has significant potential of biomass in the form of agricultural residues and waste wood processing, which can be used to produce heat and electricity. It should be noted that lack of public funding of these programs can be compensated by attracting foreign investors to increase their interest, and could become the country's competitive advantage in international markets. Given the above, it is reasonable to study the potential competitive advantages that are possible on the basis of international biomass trade between countries. Article objective is to present modern theoretical foundations of international trade with relation to biomass and to deliberate the potential economic benefits from Ukrainian economy.

Key words: biomass, international trade, Poland, Ukraine

Introduction

Modern theoretical principles outlined in international trade have been deliberated by many scientists. Problems of development of alternative energy sources are actively engaged in both domestic and foreign scholars. Considerable is contribution of scientists who mainly explore the effectiveness of alternative energy sources and consider their individual destinations.

The attempts consider the scientific and technological revolution in international trade impact has led to creation of neotechnological theories of foreign trade. Their supporters try to explain the foreign trade relations not by supply or by production factors, which was characteristic for the neoclassical theory, but by spending on research and the invention of technological innovations, by level of average wages and the proportion of skilled labor.

This article will elaborate application of theories on international trade to examine stage of maturity of biomass potential as export product of Ukraine. Poland there is an very important trade partner for Ukrainian State that is why it would be often recalled as comparative material for conducted examination. Research method would be theoretical

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revision of literature and it will try to give answer for problem if theory can define potential benefits of international biomass trade.

Today, the costs of maintaining an apartment, house, or other objects largely depend on their costs to heat the rooms. The unstable market and rising fuel prices in Poland and in the world cause the rise in popularity of pellets and briquettes. With higher prices for basic energy sources such as oil, gas and coal, the number of cheaper, eco-friendly fuel is increasingly rising. They are often used by institutions and individual customers in the newly built facilities, as well in the old but renovated buildings. The Biomass is defined as the product of agricultural origin used directly as a fuel or process combustion to other form prior one, which can be processed for other types of energy as for instance the electricity. As defined by the European Union *biomass* (Directive 2001/77/EC) means the biodegradable fraction of products, waste and residues; or agriculture products (including vegetal and animal substances); from forestry and related industries, as well as industrial waste from urban areas.

Ukraine is the most important, accessible and abundant source of energy with zero CO_2 balance for European Union countries. The need to protect forests and rational use of forest biomass for energy increasing importance biomass to Ukraine, in which agricultural plays still an important role. The Agro-energetics create alternative income opportunities for Ukrainian farmers, while fits perfectly into the concept of a distributed energy policy, therefore have crucial role of increasing safety the country's energy sources and at the same time it gives new platform of economic cooperation between the Poland and Ukraine.

The European Union and Ukraine initialed on July 19 2012, the agreement which established the comprehensive free trade area. Negotiated agreement between the EU and Ukraine is much more wider than other typical free trade agreement signed by EU in the past. It concerns not only the elimination of tariffs and non-tariff, but also, more importantly, acceptance by Ukrainian government the EU legislation and standards. The European Union priorities in the negotiation were primarily: Ukraine's closer integration with the EU single market, opening and liberalization of the Ukrainian market.

Modern theoretical foundations of international trade of biomass

Among such neotechnological theories, the theory of product life cycle (Vernon R.) should be noted. This theory defends the view according to which the development of international trade depends on the life cycle of the product. These stages are: 1) design and production launch, 2) increasing of production, 3) maturity, and 4) decline. In the first stage the product development is a response to the increased need for it. Here there is a small-scale production; the second stage means the growth of demand for this type of product, there are competitors, expanding exports. The third stage is characterized by serial production with competition, where price becomes a dominant factor. In the fourth stage, the significant reduction in demand for the product leads to the fact that the country initiating innovation is only the private importer, and production and markets are mainly concentrated in developing countries. Thus, based on this theory, the product production moves from one country to another, depending on the stage of the cycle. It should be noted that, according to the standards of ISO, the first stage of the product life cycle is a strategic marketing (zero phase), which actually determines and projects the need for this type of product for a particular market.

In theoretical considerations of international trade of biomass as a feedstock for energy production, Poland currently is in the second phase of the product life cycle. In 2012, had been observed high increase of supply for biomass, especially thanks to significant investments using European Union funds for labels, briquettes and pellets from straw and imports of resources from the East Europe and ACP countries. Contrary, Ukraine is on zero stage and partly on first stage of the life cycle, and this requires clear identification of the need for such resources and forecasting of demand.

The disadvantage of the theory it the following: many products do not develop according to the logic-based approach to the life cycle. These products have: too short life cycle; high transport costs; narrow range of potential customers, etc. But these flaws are minor concerning international trade of biomass, since the life cycle of these products is long (due to the constant energy dependence), moderate transportation costs, and the number of potential customers will likely expand. According to the State Agency for Investment and National Projects of Ukraine, the potential capacity of the market to grow, and the potential power generation of 400 MW of electricity and 9000 MW thermal [Shurinh 2013]. Only 1 million tons of standard fuel in the form of biomass is used in Ukraine today, but capacity is 30 million tons of standard fuel, and that can replace 26 billion m³ of natural gas and 40% of its consumption in Ukraine [Doroshenko 2013]. Given that investment projects in Ukraine are implemented very slowly, and their payback periods are up to 5-7 years, there is a feasibility of sale of part of biomass potential to other countries demonstrating demand for it, and where the industry is evolving more rapidly, for example to Poland. The demand for biomass energy in Poland may reach this year 6.5-7 million tons of biomass, of which about 4-6 million tons in this country can be produce from straw, and the rest - from energy plantations or residues of food industry [Doroshenko 2013]. It's important to underline that the strong demand for biomass, which generates energy industry, creates opportunities for producers.

Another very common theory is the theory of scale effect. It argues that countries specialize in production of certain goods, after meeting the demand of the domestic market expanding production through expansion into foreign markets. In this case, the unit costs of production are reduced as a result of scale effects. In applying this theory on Ukraine, one could argue that Ukraine, not having the sufficient processing capacity, carrying out foreign economic activities towards the implementation of biomass, can at least reduce the loss and gain additional profit.

Supporters of neotechnological directions claim that the cause of trade between industrialized countries is the advanced technological gap that occurs in certain areas and allows succeeding countries to conquer foreign markets for this product. Technological theories include theories of intra-industry trade, including S. Linder theory which explains the trade desire to expand the range of products offered in the market in different countries.

One of the known theories of this school is the technological gap theory, the basis of which was founded by the British economist M. Posner in the early 60's of XX century. According to this theory, trade arises from differences between several countries according to the pace and nature of innovations [Posener 1961]. M. Posner suggested that one of developed countries due to the discovery receives a fundamentally new technology or a new product that are in demand in other countries. So trade of this product will take place even between countries that have the same endowments. Due to the preferential position of one country there is a technological gap between countries. However, technological innovations cannot be usurped by one or another country: they gradually become the

property of other countries too. As a result, the previously formed technological gap is overpassed, and the initial benefits are lost. However, until a gap exists, it has a positive impact on the export of products, production of which includes new technologies. At the same time it stimulates the economy of the importing country. In the first case there is a kind of "technological rents", in the latter case more technically advanced products are acquired, the use of which improves economy efficiency.

Technological gap theory can be taken as a basis for interpreting the importance of using renewable energy in Ukraine, the most attractive destination of which, according to experts, is the use of biomass and waste (Fig. 1).

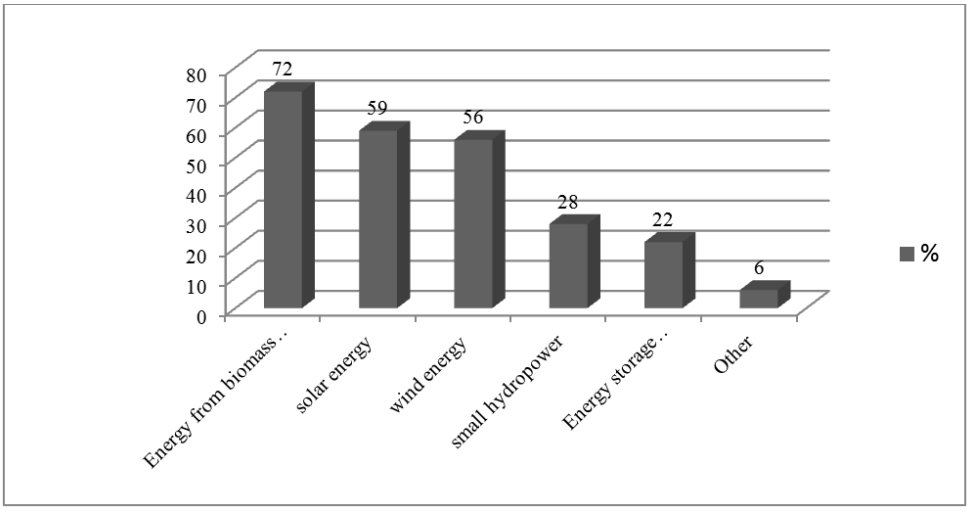

Fig. 1. The most attractive areas for renewable energy investors in Ukraine

Source: [Zarrill 2010].

The potential effectiveness of biomass can be estimated, taking into account the potential theoretical, technical and economic data. Theoretical size of the biomass resources size that does not have a practical significance, because given only the size of the raw material. The technical potential shows how much you can spend for energy, taking into account the technical possibilities of acquiring, while the economic potential is part of the technical potential and has a certain value. Ukrainian specifics are presented in the table below (1 PJ = 1015 Joules, 1Mt = 106 tons).

Table 1. Potential of forest biomass in Ukraine (2008)

Type of forest biomass	Theoretical potential		Technical potential	
	PJ	Mt	PJ	Mt
Stemwood	263,72	14,7	49,95	2,79
Primary forest residues	28,70	1,79	22,63	1,41
Secondary forest residues	19,82	1,11	16,50	0,92
Total	312,24	17,6	89,08	5,12

Source: [Böttcher 2010].

We may also extract the market potential production from wood stock biomass, which can be purchased for specific industrial, like biomass resources for energy purposes. Polish example is presented in in the table below:

Table 2. Wood stock production in State Forests in 2006-2008 (in tones)

Trading sort	2006	2007	2008
small dimension heating wood	929	1 109	1 394
heating wood	2 170	2 087	2 190
general purpose industrial wood	13 363	14 601	14 493
Wood chips	180	149	164

Source: [Burczy 2010].

In the early 80's of XX century Krugman [Krugman 2008] suggested an alternative to the classical explanation of international trade based on economies of scale. According to the perspective of this theory, many countries (including industrialized) are provided with the basic factors of production in similar proportions, and in such conditions it would be profitable for them to trade with each other, upon specialization in industries that are characterized by the effect of mass production. In this case, specialization can expand output and produce a product with less cost and therefore with lower price. In order to realize this effect, companies require a fairly large market. International trade plays a crucial role in this case because it allows expanding the market. In other words, international trade allows to create a common integrated market that is bigger than the market of any separate country, thus it makes possible to offer customers better products at lower prices.

Thus, the theory of scale economy argues that countries specializing in production of certain goods, after meeting the demand of the domestic market expand their production through expansion into foreign markets. In this case, the unit costs of production reduce, as a result of positive action of scale effects. When applying this theory to Ukraine, it can be claimed that even without sufficient processing capacity Ukraine, carrying out foreign economic activities towards the realization of biomass, can at least reduce the loss and gain additional profit.

However, realization of scale economy usually leads to disruption of perfect competition, since it is related to concentration of production and consolidation of companies. Accordingly, changes in market structure take place, and markets become either oligopolistic with domination of inter-industry trade in homogeneous products, or markets with monopolistic competition with developed intra-industry trade in differentiated products. In this case, international trade increasingly concentrates in the hands of giant multinational companies, multinational corporations, which inevitably leads to increase in intra-company trade which is often determined not by the principle of comparative advantage or differences in the factors of production, but by strategic goals of the company itself.

Polish-born British economist Rybczynski specified the conclusions of the value inputs theory of Heckscher-Olin model. He proved the theorem, according to which, at constant world prices and the availability of only two sectors in the economy, increased use of excessive factor in one of them leads to reduction in production and release of goods in another sector [Rybczynski 1955]. This theorem allows to explain the challenges in the last

decade of the XX century in many countries, which began intensive development of new export raw resources: oil, gas, etc., so-called "Dutch disease".

The name of this phenomenon is attributed to the late 60's - early 70's of last century, when the Netherlands began to develop natural gas in the North Sea with further expansion of its exports. Economic resources moved to gas production. The dominant orientation of resources on oil worsened economic conditions of machine building industry and the expansion of imports of missing goods. The “Dutch disease” in different periods attacked Norway, the UK, Mexico and other countries. Further reduction in commodity prices triggered a new phase of the “Dutch disease”. Decreased incomes, reducing production of non-traded goods, outflow of resources form commodity export sectors. The position of traditional export manufacturing industries was again strengthened, and this led to social problems. But this theory of international trade does not apply to our object of study, because in Ukraine there is a surplus of biomass and lack of energy.

Modern theories of firms indicate the strengthening of the role of individual businesses and corporations in international trade. Eventually, comparative advantages are always achieved not by a nation, but by a separate company, an exporter of a certain commodity. The studies revealed that technologically complicated products are created by individual firms based on the needs and demand that exist in the domestic market. The firm can enter the foreign market only after expansion of production and saturation of the domestic market. But in order to sell manufactured products, it is necessary to find a purchasing country, in which the structure of demand in the domestic market would be most close to the demand structure of the exporting country. This explains the possibility of trading between countries that have similar levels of economic development. This concept was first proved by American economist E. Linder [Linder 1965].

A kind of generalization of modern theories of foreign trade is a theory of international competitiveness, developed by American researcher M. Porter. Based on the analysis of significant statistical data, Porter created an original theory of achievement of competitive advantages of the country. According to him, under the conditions of intensification, expansion and deepening of internationalization of production that became global, the structure of international competition complicated, and new factors of influence appeared.

The most comprehensive formulation of essence of the new approach to the competitiveness and capabilities of their specialization in international division of labor was made by M. Porter, who along with the main determinants of competitive diamond, highlighted the following four stages of competitiveness of the national economy: stage driven by factors; stage driven by investments; stage driven by innovation and stage driven by wealth [Porter 1990].

But the principal, in his view, is an innovative technological component of competitiveness. Ukraine faces the task of raising the country's competitiveness and strengthening its position in international trade by switching from traditional exploitation of comparative advantages (natural resources, labor, etc.) to the use of competitive advantages based on diversification through unique products and more efficient processes. In a broad sense, this is a shift to innovation, which involves intensive development of new products and processes that will enable the country to outrun other countries in terms of technology. This activity requires Ukrainian business entities, firstly, to have clear and deep understanding of the nature and organizational mechanisms of international cooperation; secondly, to develop the mechanisms of support and use of the benefits of economic globalization in order to form a new quality management component of the national

economy; thirdly, to organize investment processes for innovative development through attracting both domestic and foreign investments.

The promising direction of further research could be the study of influence of basic functions of international trade on the socio-economic development of Ukraine and Poland, in particular, complementary, substitution function of consciousness of additional demand, when aggregate demand of domestic production and consumption increases by the amount of exporter's demand, and decreases by the amount of importer's demand.

To succeed on the global market, a combination of properly chosen competitive strategy of the company with competitive advantages of the country is requires, because on the global market, according to Porter, firms compete, but not countries. Along with traditional factors of production, Porter highlights such factors as knowledge resource, i.e. the amount of scientific, technical and market information affecting the competitiveness of goods and services, and infrastructure. With regard to biomass use, Poland has significant competitive advantages in technology of biomass processing and its further market promotion. For the needs of individual customers and small biomass heating systems processed to form briquettes or pellets. Briquettes usually do not contain any binding substances - produced by compression of sawdust or wood chips under high pressure. Most commonly, briquettes and pellets are produced from energy willow chips. These plants grow quickly and produce yields as long as 30 years. The estimated crop of wood chips that may be obtained out of an 1 hectare is varied from 25 to 45 tones. Prior to pressing the chips undergo drying to a moisture content of about 15%. Wood shavings are pressed into close, small rollers, containing no additives due to their natural properties [Kowalik 2003]. Besides, straw in the form of briquettes is also a very attractive product used for heating purposes. Its energy value does not significantly differ from calorific value of wood chips or willow [Niedziółka 2006]. Instead, in Ukraine such benefits and experience are still insufficient.

Great importance in the theory of M. Porter is devoted to division of factors into general (transportation network, staff with higher education, etc.), which create competitive advantages for a wide range of industries, and specialized factors (eg. staff with narrow specialization in a particular database field of expertise, etc.), which are generally applicable to a limited number of industries or even to one single area. Such specialized factors, providing a long-term and sustainable competitive advantage to firms involved sectors in the global market, simultaneously require significant and long-term investment.

In the system of competitive advantages Porter also devotes a significant role to random events and the government. Random events are usually not connected with the conditions of the economy, and often neither company nor the government can affect them. The most important events of this kind include new inventions, major technological changes (breaks), abrupt changes of input prices (such as prices for oil and gas), significant changes on global financial markets or exchange rates, global or local spikes in demand, political decisions of governments, wars and other unforeseen circumstances. Random events can change the position of competing countries. They can negate the benefits of powerful old competitors and enhance the export potential of other states.

The role of government in forming of national competitive advantage is to provide significant impact on all major factors, and this impact can be either positive or negative. The parameters of production and demand factors are affected by government through monetary, fiscal and customs policy. In most countries government itself is the buyer of goods for military, transportation, communication, education, healthcare and other

industries. Providing the antitrust regulation, government has an effect on maintenance of optimal competitive environment in key sectors and industries of national economy. Finally, in many countries the government contributes to the development of related industries and communicating, interacting with leading export sectors.

Porter notes that in many companies, successfully acting in the global markets, cover with their activities and determine the level of development of a range of industries, so-called cluster. Reflecting the dynamics of the country's competitive advantages, clusters are formed, expanded, but they also may wind down and fall apart.

Thus, according to the theory of M. Porter, competition, including on the world market, is a dynamic, evolving process, which is based on constant innovation and modernization [Porter 1990]. Therefore, in order to explain the competitive advantage in the global market it is necessary to find out how companies and countries improve quality factors, increase the efficiency of their application and create new ones.

Theories of international trade, both classic and modern, though they cannot provide answers to all the complex issues that arise in the development of trade relations, demonstrate the conditions of uprising of benefits due to which individual countries and companies are gaining strong positions on the global market.

The distribution of benefits between countries depends on changes of domestic prices under the influence of foreign trade. Usually more profit is gained by the country whose prices have changed more significally. This rule reflects the distribution of benefits, which suggests that benefits of foreign trade are distributed in direct proportion to changes in prices in both countries.

Obtaining and increasing of competitive advantages by Ukraine and Poland are possible in the process of efficient use of biomass potential of Ukraine. The main competitive advantage of Poland is the opportunity to reduce dependence on traditional energy. Thus, the use of biomass in Poland will increase due to the adopted European directive on renewable energy share in total energy production in all Member States. To meet these requirements, Poland needs to develop the biomass in the form of surplus straw for the production of grain, the energy crop plant species. The main competitive advantages of Ukraine will be determined largely by biomass energy, and benefits of specific companies on international trade of this production.

Use of biomass has significant government support in many countries. Therefore, one of the first major obstacles for biomass market is national and regional protectionist policies of some countries and custom tariffs. The biggest driving force behind the implementation of this policy is energy independence, improvement of the environment and rural development. Thus, countries, particularly developed, began to introduce the schemes, the outcome of which became protection of domestic producers from foreign competition and impediment of international trade. Overall, the countries support domestic producers by means of three basic tools [Junginger 2010]:

- Measures to promote domestic biomass of energy designation;
- Import tariffs for biomass;
- Export subsidies for domestic biomass.

In Ukraine, where the potential of biomass firm is 25-38 million tons of fuel annually, green energy producers face the problem of raw material acquisition. At present, the specialized trade of bio resources in Ukraine is at its early stages.

Conclusions

Theories of international trade, both classic and modern, cannot provide answers to all the complex issues that arise within development of trade relations, but they demonstrate the conditions of uprising of benefits due to which individual countries and companies are gaining strong positions on the global market.

Models of neotechnological theories more adequately than neoclassical ones reflect the actual processes of modern development of the international labor differentiation, in particular, from the 70's intra-industry exchange between different countries is expanding more rapidly. Supporters of neotechnological direction determine structure of international labor differentiation, they attempt to explain its nature with technological factors.

While the main variables of modern neoclassical models are, like in the Heckscher--Ohlin theory, the availability of productive factors and intensity of cost factors, the main variables in neotechnological approach are expenses on research and development (as a percentage of cost of sales), wages per worker and percentage of skilled labor force.

Among the neotechnological theories, the theory of product life cycle it should be noted. This theory defends the view according to which the development of international trade depends on the life cycle of the product. When considering international trade of biomass as a feedstock for energy production, in the framework of this theory, Poland is currently on the second phase of the product life cycle, and Ukraine is on zero and first stage of the life cycle, and thereby requires clear identification of the need for such resources, as well as forecasting of demand.

Based on our review of the literature, an outcome can be formulated that biomass energy through its properties is an alternative source of energy that may successfully replace the existing heating technologies based on traditional fossil fuels in future.

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