

Regional Profile of Carpathia, Ukraine

1. The Carpathian region and its forestry

The total area of the Carpathian region of Ukraine is 56.5 thousand km² or 9.4% of the territory of Ukraine. About 6.1 million people live here (13% of the population of Ukraine). The Carpathian region of Ukraine borders several member countries of the EU (Romania, Hungary, Slovakia and Poland).

Carpathian region is rich in forest resources and represents the largest continuous forest area in Ukraine. The landscape is hilly, high and mountainous in the south and central parts of the region. Figure 1 shows the forest cover of four Carpathian oblasts (marked in shades of green) and the prevailing tree species (marked in circles).

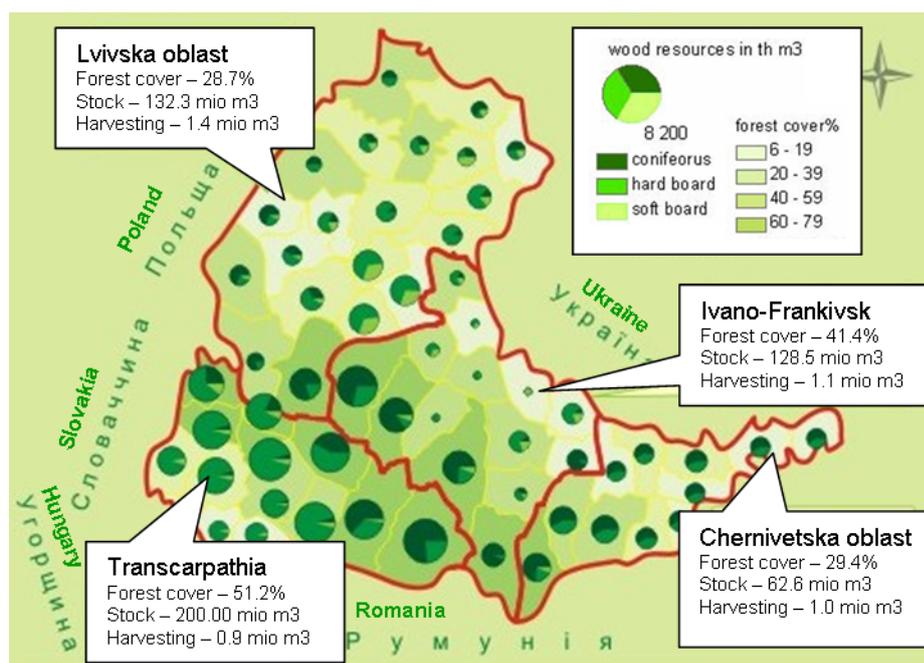


Figure 1 Forest cover and tree species distribution in the Carpathian region

Average forest cover of the area is 39% (Transcarpathian oblast 52%, Ivano-Frankivsk oblast 41%, Chernivtsi oblast 29%, Lviv oblast 29%). The overall standing timber stock is 0.52 billion m³. Average annual growth per hectare of forest land is 4.4 m³/ha/y, thus the Carpathian forests produce about 9 million m³ of wood annually. The premature age groups prevail in the

Carpathian region, area of which is from 44-55%. This is because of the intensive harvesting during the last 60 years¹.

Forests of Lviv, Chernivci, Ivano-Frankivsk and Transcarpathia oblast subordinated to the *State forestry Committee of Ukraine (SFCU)* are certified in accordance with the FSC certification scheme. Almost all the forests in Carpathian region of Ukraine are under public ownership.

In accordance with the data of the Ministry of Nature Protection of Ukraine there are some 7,400 ha of degraded and low-yielding/underproductive land (sand, ravines, stone fields), that can't be used for agricultural purposes, but can be partially used for afforestation and short rotation forestry. Based on expert assessments, the degraded land areas are bigger.

Current harvest in the Carpathian region forests accounts to 5 million m³, or up to 60% of annual increment. At present, the principal method of timber harvesting in the region remain clear-cuts, which accounts for 72%² of all removals, although the country tends to slowly turn to adhering selective systems.

One of the current problems in the forest sector of the Carpathians is the drying up of monoculture spruce stands that take the first position in comparison with other pathological processes in the forest. Based on expert opinion approximately 35% of secondary spruce stands are affected by the root rot (in some enterprises up to 45-77% of forest covered areas and has the character of natural disaster). The situation with drying spruce remains stable but difficult and leads to the loss of high quality timber. That means that over years the share of low-quality timber will grow providing more possibilities and need in sustainable wood biomass projects.

Sustainable forest management (SFM) including selective harvesting and close to nature silviculture is a prospective way of forest management that can guarantee sustainability of resources. Close-to-nature silviculture is based on using such forest methods, at which the forest cover does exist continuously, the biotic diversity is preserved, the structure of natural different-age forests is recovered, the forest stand durability is maintained, and the timber is harvested in the amount of the annual increment. Based on the expert opinion annual benefits of 2.0-2.5 million m³ of wood additionally may be received by means of close-to-nature silviculture methods.

Close-to-nature silviculture methods has been field tested in and today have been already beginning to be practiced in the forest management of the Carpathians. Nowadays one of the bottlenecks for wider application of close-to-nature silviculture is the low density of mountain forest roads and very limited use of the low impact harvesting machinery.

Currently, in the Carpathian region outdated and non-appropriate harvesting equipment prevails (skidders). The quantity of low impact harvesting equipment applied in the

¹ IN2WOOD project. Report D2.1 Wood Production. 2010.

² IN2WOOD project. Report D2.1 Wood Production. 2010.

Carpathians is 5% from the needed. While cable harvesting may be more complex and expensive than other harvesting systems, it is a viable solution to harvesting steep and difficult terrain as a means of sustainable forest management and social development.



Timber from dried spruce, energy plantations, additional volumes from close-to-nature silviculture and low-harvesting equipment application → major opportunities to increase biomass volumes

2. Solid biofuels production

2.1 Sources

In Ukraine, the main energy carriers remain natural gas (35% of the total primary energy supply TPES) and coal (37%). **As of 2013, renewable energy sources account only for 2.8% of energy supply and 2% of the final energy consumption.** Main sources of biomass are forestry and agriculture. Both sectors are well developed in Ukraine.

The volume of harvested marketable wood in all regions of Ukraine has been 17.5-18 million m³/yr lately, including firewood 4-5.5 m³/yr. Felling of wood followed by the wood processing and production of finished products is the source of various wastes and residues. **Sustainable potential of wood biomass can be assessed at about 16,282 GWh/yr**, the contribution of firewood being the biggest, 65% of the total. Firewood is completely utilized by population and different enterprises for heating.

Wood biomass in the form of chips is also in high demand in the bioenergy market. Felling residues often remain unutilized and sometimes are combusted in forest. At present wood is the mostly used type of biomass for energy production in Ukraine though its resources are comparatively limited.

Main by-products of wood-based industries are wood processing waste of different types like sawdust, shavings, lump wood and others. Average annual amount of the waste in Ukraine is 700-750 kt. Part of the waste is used for heating and to produce pellets and briquettes³.

³ http://www.bioenergy4business.eu/wp-content/uploads/2015/06/B4B-WP2_Country_Summary_Report_Ukraine_13-08-2015.pdf

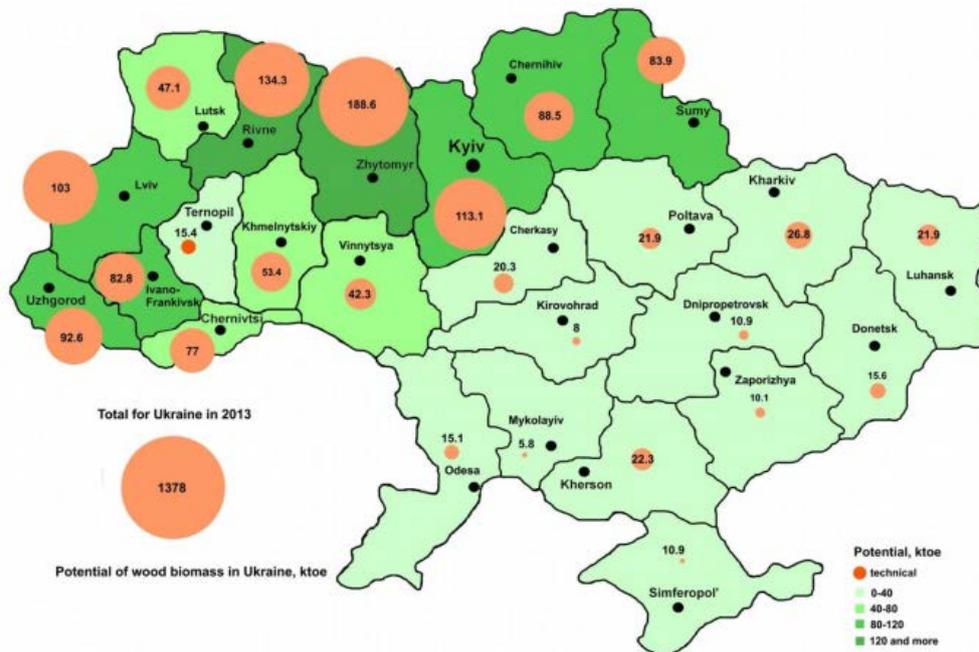


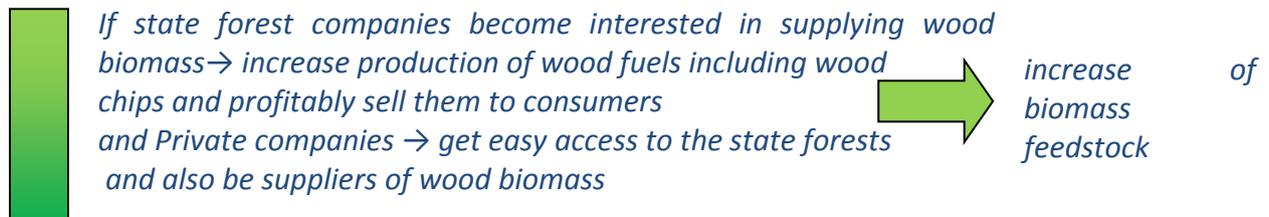
Fig. 2 . Distribution of the wood biomass technical potential in Ukraine, 2013. Source: <http://s2biom.alterra.wur.nl/doc/S2biom---T932---SCS-Ukraine---report.pdf>

Felling of wood followed by wood processing and production of finished products is the source of various wastes and residues. Sustainable potential of wood biomass can be assessed at about 1.4 Mtoe/yr, the contribution of firewood being the biggest, 65% of the total (Fig.2). Major part of the potential is concentrated in the four oblasts of the Carpathian region (table 1).

Ukraine, regions	Felling residues	Wood waste	Firewood	TOTAL
Ukraine	271	209	898	1378
Incl.				
Zakarpatska	17 . 9	6 . 0	68 . 7	92 . 6
Ivano-Frankivska	16 . 7	28 . 9	37 . 2	82 . 8
Lvivska	19 . 1	16 . 5	67 . 5	103 . 0
Chhernivetska	14 . 3	4 . 7	58 . 1	77 . 0

Table 1. Technical/sustainable potential of wood biomass in Ukraine, ktOE (2013) Country, regions F. Based on: <http://s2biom.alterra.wur.nl/doc/S2biom---T932---SCS-Ukraine---report.pdf>

As a rule, the state forestry enterprises can be suppliers of firewood and felling residues while they cannot offer wood chips as most of them do not have chippers (mostly due to financial reasons). Wood chips as well as firewood can be supplied by private companies. The problem is that private companies have rather limited access to the state forests and therefore limited amount of wood biomass.



Competition for biomass resource from both household and industry is growing in the region. Because of the increase of prices for firewood and extremely cold winter of 2016, households tend to combine expensive firewood with chips and wood processing lump wastes from numerous wood based companies in the Carpathian region. another example, according to operators, in 2016 big amounts of chips were exported to the panel factory in Romania, resulting in lower supply of chips for domestic use in Zakarpatka oblast.

Information about solid biomass production in Ukraine is summarized in Table 2:

Production of solid biomass, ton/year, 2016, Ukraine	
Pellets from wood	360 000
Briquette from wood	170 000
Chips	1 100 000
Firewood	1 800 000
Pellets from straw	220 000
Pellets from sunflower	850 000
Briquettes from agrocltures	95 000
TOTAL:	5 185 000
This represents 17% from technically available potential which comprises	30 mio ton per year
Production capacities of existing companies allow producing	8-9 mio tons per year
Export of solid fuel	2.2 mio ton per year
Consumption on domestic market	3 mio ton per year
Increase of consumptopm pf olid biofuel in Ukraine 2013-2015	45-55% a year

Table 2. Summarized information and solid biomass production in Ukraine, based on http://bioenergy.in.ua/media/filer_public/4a/02/4a0236b5-a30b-4167-8c3b-7fd4bcae8926/kompleksnii_analiz_ukrayinskogo_rinku_pelet_z_biomasi.pdf

2.2 Market actors

There are no companies whose core business to provide biomass plants with biofuel. Most reliable and available supply of biomass comes from the state forestry enterprises in form of timber.

There are up to 20 big producers of biomass pellets and in Ukraine and dozens of middle and small manufacturers of mostly briquettes located almost in all the regions. For many briquette is a by-product, but it is estimated to amount to approximately 254 various-scale producers in Ukraine in 2015⁴ – see table 3.

Pellets became the most important by-product of the sawmilling industry. In 2015 the pellet production capacities already amounted to 360 000 tons.

	Number of producer in Ukraine, 2015	Amount produced, t, 2015
Pellets from timber	254	359 030

Table 3. Pellet production in Ukraine

Examples of producers of biomass based products are: Zakarpatska oblast: Skala-Energy, Intersource (pellets), K'Len, IMP Wood (briquettes), Ivano-Frankivsk: Biopal (pellets), Greenenergy, Uniplyt (briquettes), Lviv: Garant-Teplo, LvivpakChernivtsi: BKM Wood.

These producers are all private companies that can be considered more-or-less reliable suppliers of biofuel.

Production of solid biofuels is a fast developing and very prospective sector of Ukrainian bioenergy. It has grown rapidly during past 5-6 years. At the beginning the main feedstock was wood; then it turned to sunflower, and since 2010 straw has also been used as feedstock for the production of pellets and briquettes.

⁴ http://uabio.org/img/files/docs/kompleksnii_analiz_ukrayinskogo_rinku_pelet_z_biomasi.pdf

Before 2013 up to 90 % of solid biofuels were exported, mainly to European countries. The situation then gradually began to change towards larger use of biofuels in the domestic market⁵.

3. Conditions of the value chain

3.1 Value chain description

As a whole, the market of biomass as fuel in Ukraine can be characterized as undeveloped. The most reliable supply option for a biomass plant therefore is to use own feedstock. Long-term contract for biomass supply are non-existing, resulting in fluctuating pricing. The Fig. 3 Demonstrates the added value chain of the wood raw resource processing in the forest-based industries of the Carpathian region, with red blocks marking the missing sectors of biomass to energy conversion, including:

- There are no well-established and reliable relations between suppliers and consumers;
- There are no companies whose core business is to supply a biomass plant with biofuel
- Collection of felling residues from forest harvesting operation is not carried out, partly because owners – state forest companies – are not motivated to do this, partly because low road density, lack of specialized machines (forwarders, chippers) make its collection expensive, and low market price for biomass make it economically not feasible

⁵ http://www.bioenergy4business.eu/wp-content/uploads/2015/06/B4B-WP2_Country_Summary_Report_Ukraine_13-08-2015.pdf

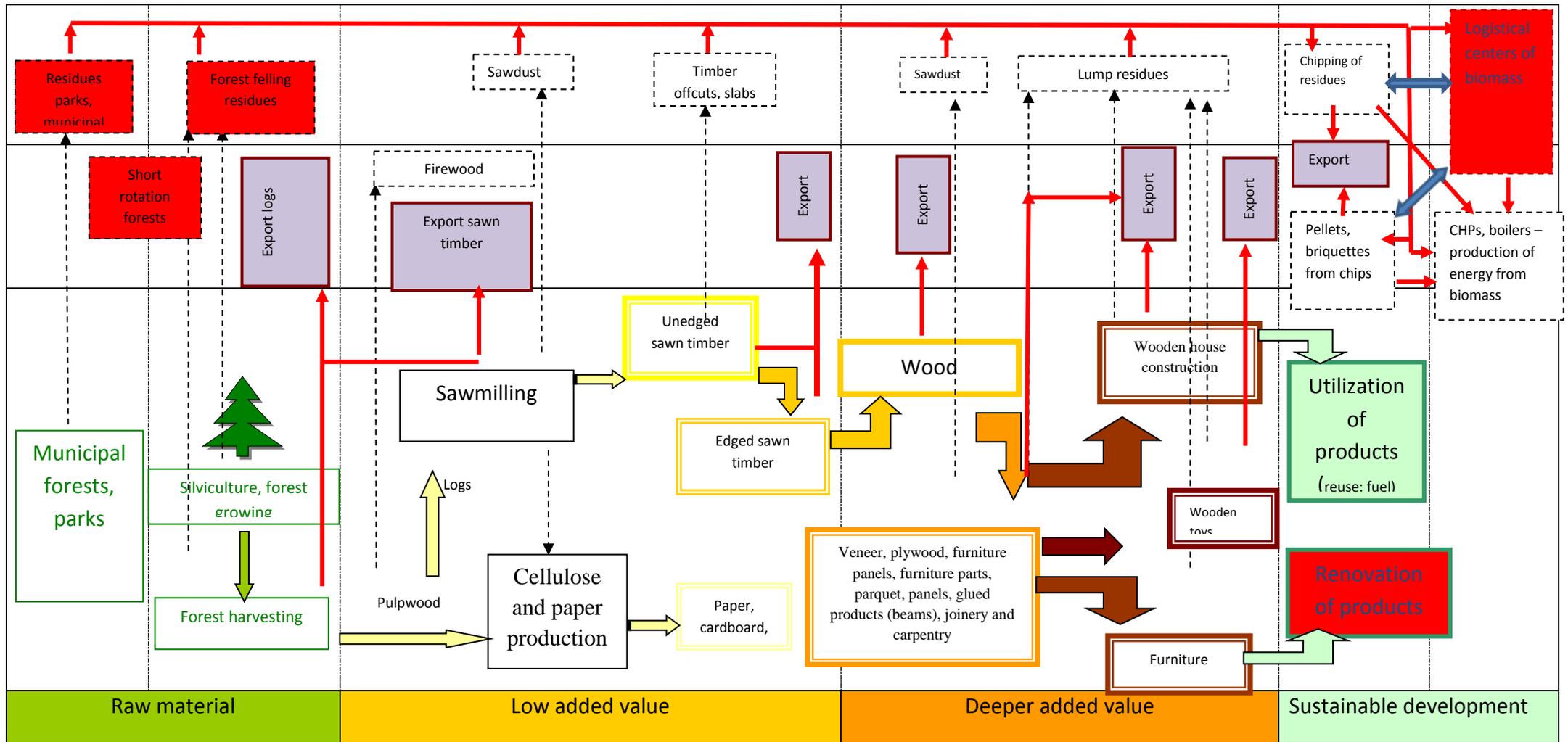


Fig.3. Added value chain in the wood-based sector in the Carpathian region and the missing sectors of biomass to energy conversion marked in ed blocks

3.2 Market actors

Basic information on the location and technical characteristics of pellet and briquette producers, boiler houses, thermal power stations and CHPs using biomass and biogas as fuel is provided on the maps in Figure 4 <http://uabio.org/activity/maps/1519-res-map-ukraine> (clickable).

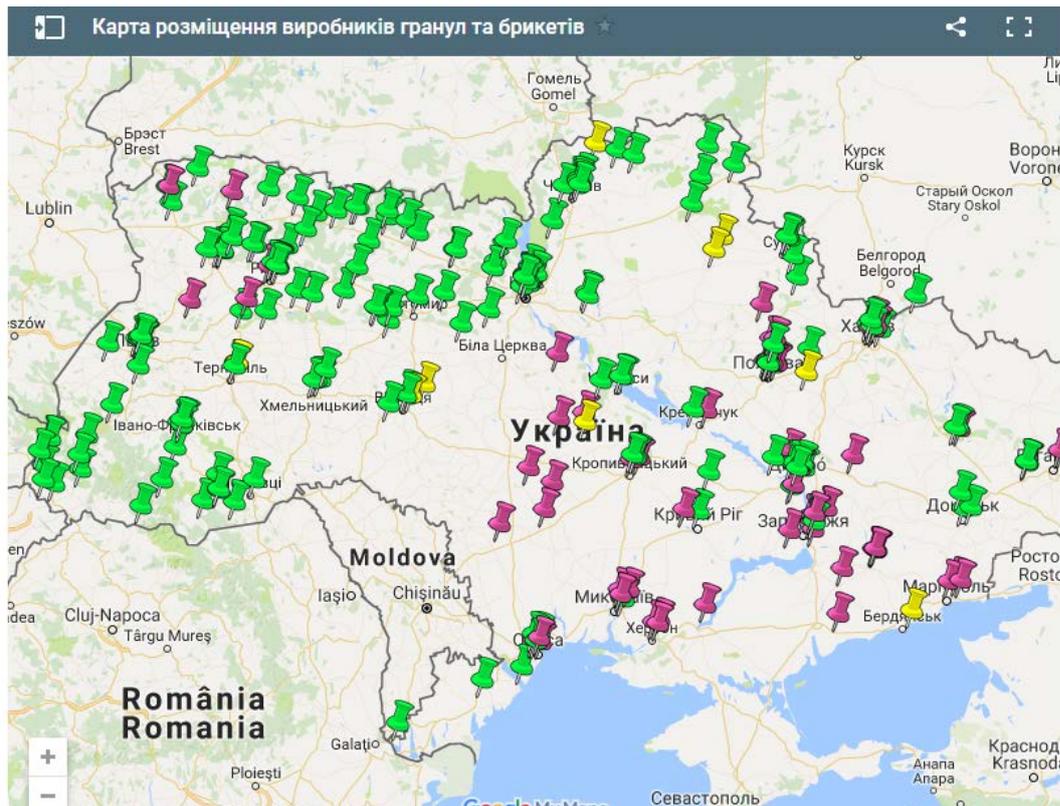


Fig. 4. Map of pellet and briquette producers, CHPs in Ukraine

Institutionalized players like forest owner associations, forest authorities, chambers etc. with high interest in the development of sustainable business models are evolving, including all Ukrainian:

- Bioenergy Association of Ukraine <http://uabio.org/>
- Ukrainian Pellet Union <http://www.uup.org.ua/>
- State Agency for Energy Efficiency and Energy Conservation of Ukraine
- Association of Alternative Fuel and Energy Market of Ukraine

Strong regional players are yet to emerge.

4. End-users

The **supply** side of the market is represented by the forestry, wood processing companies, crop and animal farms that are sources of biomass – raw timber, firewood, pellet, lump wastes from wood processing. Pellet producers process available waste into pellets. Boilers for burning biomass are available in the market from either local producers or importers.

Biomass-to-energy facilities to produce electricity and/or heat for a variety of users (industrial, commercial, and residential). In some cases, users generate electricity and/or heat for their own use. In others, (private or municipal) electricity/heat producers sell to end-users directly or through the power grid. Biomass-to-energy facilities may use biomass only or in combination (co-fired) with other fuels (oil, gas, or coal).

The end-users include:

- Companies or individual users that burn biomass to produce energy (electricity or heat) for in-house consumption. This segment in Ukraine includes industrial companies, crop and animal farms, individual households, schools, and hospitals
- that install biomass-burning boilers to receive energy. They may use own-sourced biomass or procure it, particularly from pellet suppliers. In the Carpathian region, prominent users are greenhouses and bakeries that use pellets.
- Private and municipal heat suppliers where the former install biomass boilers and sell heat to customers such as schools, hospitals, and small industrial plants. The latter use biomass boilers together with traditional fuel (mainly, natural gas) boilers to reduce the cost of energy.

A few examples in the Carpathian region include projects of *Kolbe Group* that took two hospitals in Zakarpattya (Tyachiv and Berehovo) in the concession and transferred their boilers from gas to chips, resulting in reduced energy costs for the hospital.

- Electricity generators. These companies implement projects with the objective of selling electricity to the national grid.

Electricity generation projects are very rare in Ukraine. The key to the implementation for the implementation of these projects are the large initial investment in equipment, additional investment in the electricity grid, technical risks, significant operation costs, and the instability of green tariff regulation. In addition, co-firing of biomass with other fuels does not qualify for the renewable feed-in tariff

There are several examples of biomass fired energy stations in Ukraine – see the map <http://uabio.org/activity/maps/1519-res-map-ukraine> and the printscreen on available biomass CHPs in Ukraine (Figure 5).

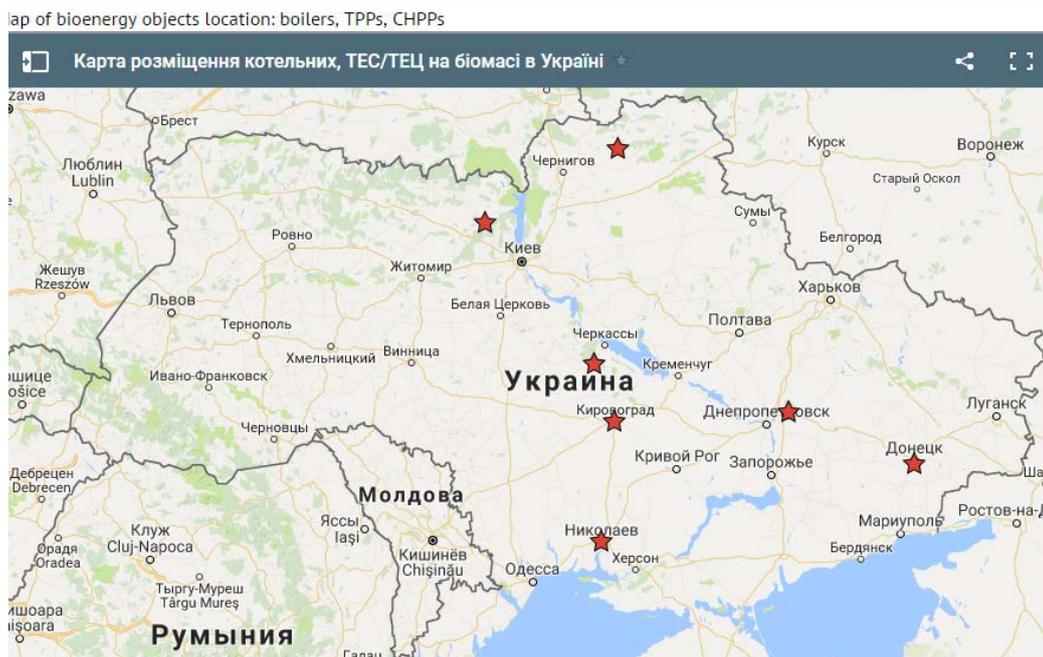


Fig. 5. Bioenergy object location in Ukraine

In the Carpathian region, there so far no biomass CHP. However, there is one planned in Kovel in the region Volyn (implementing company *Kolbe*) and one is under construction in Rakhiv in region Zakarpattya (implementing company *Biotes*).

The most robust segment of the market is that of municipal heat supply. Heat-supplying companies, both municipal and private, are the most active users of biomass for energy generation. There are up to 100 domestic producers of wood fired boilers in Ukraine. Over 100 of foreign brands are on the market as well.

Export from the Carpathian region of biomass has significant portion of the market. Export flows data are not available, but according to expert estimates, the top exported products include:

- Wood pellets production is export-oriented, with Poland, Germany, Italy and Czech Republic and as prevailing countries.
- Although most companies stick to the economically reasonable distance for chips collection within 50 km radius, there are cases of exporting big amounts of chips on longer distances to the panel production companies in neighboring regions of Ukraine (for ex., from Teresva in Zakarpatska to Nadvirna (Uniplyt) in Ivano-Frankivsk region) or to Romania.

- Firewood is exported a lot from the Carpathian region of Ukraine. Raw timber in form of logs is exported to a minimal extent because of recent ban to export some species / assortments from Ukraine.

5. Regional priorities and funding schemes

5.1 Priorities and potentials

Specific needs in the biomass sector include:

- Informational support
Some market players are still not aware or have wrong impression of the opportunities
→ useable knowledge about solutions
- Woody biomass mobilization → demonstrate cooperation strategies (logistic centers, clusters)
- Stimulation of demand (consumer awareness, government subsidies) and supply (residues from the forest)
- Mechanism of collection and selling of logging residues from the state-owned forests to private companies

To arrange a feasible mechanism of supplying felling residues, we should tackle the legislative challenges (state floristries are owners of felling residues but no capacities to process them and to sell); economic challenges (high logistical costs, low price of felling residues/chips on the market); environmental challenges (possible impact on some types of soils, esp. on steep slopes, mechanism to return ash after burning to fertilize the forest)

- Acceleration of next-generation technologies

5.3 Funding schemes

There are several incentives introduced by Ukrainian government:

- feed-in-tariff for electricity from renewables
- special tariff for heat energy from renewables – 90% from the tariff on the heat from gas

A special tariff for the heat produced from biomass (and all the other fuels/energy carriers which are different from natural gas) and supplied to population and budget-financed institutions (like schools, hospitals) was introduced in Ukraine in October 2014. The tariff is applied to boiler plants and does not apply to CHP plants.

For the case of biomass heat supply to population, the duration of validity period of the special heat tariff is not limited. For biomass heat supply to budget-financed institutions, the special heat tariff is valid until 1 October 2019. It should be noted that due to some inaccuracy in the legal documents that introduced the special heat tariff (the governmental Resolutions N 293 of 09.07.2014 and N 453 of 10.09.2014), the practical application of the special heat tariff has been rather limited by now.

Sources of funding for bioenergy projects (mostly for population):

- Regional development fund
- State and regional energy saving programs
- State program “warm loans”
- International assistance projects
- Bank loans
- Private investments
-

Few banks in Ukraine have experience in financing bioenergy projects. As usual the banks operate within credit lines opened by international financing organizations (like EBRD, IFC) for RE projects⁶. At present there are no incentives for biomass heat except for partial state compensation when purchasing domestic biomass boilers (with bank credit) for population.

6. Summary

Given Ukraine’s and especially Carpathian regions’ rich forest resources, supply of wood biomass represents a strong market opportunity for the region from the viewpoints of energy security, energy generation, and integration into the biomass supply chain.

Wood, including raw wood, unprocessed wood, and wood pellets, is the main type of biomass currently used in Ukraine. The use of agricultural and forestry wastes is limited. Despite its substantial potential, the Ukrainian biomass market has just started to evolve.

⁶ http://www.bioenergy4business.eu/wp-content/uploads/2015/06/B4B-WP2_Country_Summary_Report_Ukraine_13-08-2015.pdf



Main challenges that prevent smooth operation of the biomass-to-energy chain include a rather fragmented biomass market, where harvesting, gathering, processing and transportation of wood biomass lack efficiency, and links between them are missing.

Currently only approx 60% of the growing resource wood is harvested in Carpathian region. There is a high potential that needs to be made accessible. Co-operations need to be developed in order to ease the hard work. Sensibilisation campaigns for biomass energy can be useful as a basis to develop new strategies of how to approach the society and strengthen the woods image.

Further more people need to be aware of the importance of local material as resource instead of imported gas.

Strengths	Weaknesses
<p>Available forest resources ($\approx 25\%$ of Ukrainian wood sources are harvested in the Carpathian region of Ukraine)</p> <p>Available high quality timber resource</p> <p>Ukrainian biomass markets remain attractive for businesses and municipal enterprises</p> <p>High demand on low-cost energy from biomass both on domestic and EU market</p> <p>Feed-in tariff for “green” energy</p> <p>Ukrainian pellets of various quality are welcomed on the European market</p> <p>Relatively close supply distances to EU</p> <p>High economic potential of biomass feedstock in Ukraine, although still untapped in many areas</p> <p>Sensibilisation campaigns to increase awareness of opportunities of using biomass</p>	<p>Insufficient mobilisation of wood fuel from forest (especially forest residues)</p> <p>High logistical costs of woody biomass collection, handling and transportation</p> <p>Lack of knowledge by decision-makers, planners, building owners and craft industries relating to technical concepts and installation of biomass combustion plants</p> <p>Level of infrastructure (forest roads, forestry mechanization, logistics) that supports biomass collection and handling</p> <p>No biomass to energy plants in the Carpathian region, two in the preparation process</p> <p>Biomass supply undeveloped</p> <p>No motivation and technological capacities of state forest to supply woody biomass</p> <p>No companies whose core business to provide biomass plants with biofuel</p>

Opportunities	Threats
<p>National Renewable Energy Action Plan (NREAP) 2014-2020 sets energy targets</p> <p>Wood biomass market showed continuous growth over past years</p> <p>Adaption of forest management methods to increase the production and profitability of Biomass</p> <p>Supply chain management systems for biomass</p> <p>Strong institutionalized players like forest owner associations, forest authorities, chambers of agriculture, etc. with high interest in the development of sustainable business models</p> <p>Heat derived from biomass residues could be obtained locally and satisfy people's needs in the rural areas</p> <p>Energy plantations, despite low availability of land in the Carpathian region, are still an option for additional woody feedstock</p> <p>Development of domestic wood-based industries and markets</p>	<p>Continuous supply of biomass to meet the increasing demand</p> <p>Ban or limitation of harvesting or use of felling residues</p> <p>High upfront investment costs for efficient biomass heat technologies have and lack of affordable financing</p> <p>Low availability of financial assistance in the form of low-interest or no-interest loans</p> <p>Social-political instability</p>

The project Secvalchain is financed by Svenska Institutet, SI.