AgroBioHeat

Promoting the penetration of agrobiomass in European rural areas

Grant Agreement No 818369

# D5.1: National and European framework conditions

## Part 3: National framework conditions - Croatia

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 818369.

| Deliverable Factsheet | |
|---|---|
| **Full title** | National and European framework conditions. Part 3: National framework – Croatia |
| **Deliverable Number** | D5.1 |
| **Work Package** | WP5 Providing Europe with a strategy and regulations for agrobiomass heat |
| **Task(s)** | T5.1 Monitoring of current national and European framework conditions |
| **Lead Beneficiary** | ZEZ |
| **Main authors** | Lucija Nad, Hajdana Rukavina (ZEZ) |
| **Version** | 1.0 |
| **Date** | 1 June 2020 |

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|---|---|
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| Approvals | |
|---|---|
| **Task Leader** | B.E. |
| **WP Leader** | B.E. |
| **Reviewer** | Manolis Karampinis (CERTH), Alberto Rocamora (B.E.) |

# Document history

| Version | Date | Main modification | Entity |
|---|---|---|---|
| 1.0 | 1 June 2020 | Final version, integrating review comments | ZEZ |

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# Abbreviations

| Abbreviation | Explanation |
|---|---|
| CAP | Common Agricultural Policy |
| CHP | Combined Heat and Power |
| NA | Not Applicable |
| NAPCP | National Air Pollution Control Plan |
| NECP | National Energy and Climate Plan |
| $NO_X$ | Nitrogen Oxides |
| PM | Particle Matter |
| RDP | Rural Development Programme |
| RPR | Residue to Product Ratio |
| VAT | Value Added Tax |

# Project consortium

| # | Full name | Acronym |
|---|---|---|
| 1 | Ethniko Kentro Erevnas kai Technologikis Anaptyxis | CERTH |
| 2 | Fundación Centro de Investigación de Recursos y Consumos Energéticos | CIRCE |
| 3 | Asociación Española de la Valorización Energética de la Biomasa | AVEBIOM |
| 4 | BIOS BIOENERGIESYSTEME GmbH | BIOS |
| 5 | Food & Bio Cluster Denmark | FBCD |
| 6 | Bioenergy Europe | B.E. |
| 7 | Zelena energetska zadruga za usluge | ZEZ |
| 8 | Asociatia Green Energy | GEA |
| 9 | Institouto Agrotikis kai Synetairistikis Oikonomias INASO-PASEGES | INASO-PASEGES |
| 10 | Bioenergy Association of Ukraine | UABIO |
| 11 | White Research Sprl | W.R. |
| 12 | Agronergy | AGRONERGY |
| 13 | Association d'Initiatives Locales pour l'Energie et l'Environnement | AILE |

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# Country: Croatia

Croatia is a small country in the Southeast Europe that has total surface area of 56.594 km$^2$ (consisting of 56,414 km$^2$ of land and 128 km$^2$ of water), and population of around 4 million (2019). Insular Croatia consists of over a thousand islands and islets varying in size, 48 of which are permanently inhabited.

With its position in Europe, the northern part of the country has continental climate, with long and warm summers and cold winters, whereas southern part enjoys in Mediterranean climate. Both suitable for agrobiomass production due to variety of soil types.

With variety of geographical features, continental semi-flat to flat region, to Istria region and Dalmatia, bit hilly and rocky, all with fertile ground for different types of productions, has allowed Croatia big agricultural potential, that is yet to be discovered.

Croatia can be subdivided between a number of ecoregions because of its climate and geomorphology. The country is consequently one of the richest in Europe in terms of biodiversity: Mediterranean, Alpine, Pannonian and Continental. Total territory of 48.8 % is forest land; of that, 81 % is in the ownership of Croatian Forest (ownership of the Republic of Croatia), while the remaining 19 % belongs to private owners. According to the Croatian Forest, 90 % are overgrown forest land, 7 % not overgrown production, 1 % not overgrown unproductive, and 2 % infertile. [1]

According to National Bureau of Statistics, 27.3 % of total territory is agricultural land (of which 54.5 % belongs to arable land and gardens, 40.6 % permanent grassland, 4.8 % to permanent crops, and 0.1 % to vegetable gardens). [2]

Croatia has a huge potential for using agrobiomass in energy, but there are many barriers: lack of awareness, old population, bad habits (ploughing and burning residues), lack of management and undeveloped market, **people always put focus on wood biomass**.

- In the continental area – arable crops production (maize, wheat, soybean, sunflower, rapeseed)
- In the coastal area – viticulture, olive groves and orchards.

**Other key information regarding Croatia:**

- In 2007 started pellet production.
- Typical solid biofuels: firewood (for domestic heating), wood chips (mostly for CHP plants), wood pellets (for domestic heating).
- Solid biofuels: 36.5 MW in 18 power plants (cogeneration).
- Biogas: 36.7 MW in 32 power plants (for electrical energy).

[1] Croatian Forest. Link: https://www.hrsume.hr/index.php/hr/34-sume/sume1/44-sume
[2] Natural Bureau for Statistics. Natural Resources of Croatian Region. 2018. Link: https://www.dzs.hr/hrv/important/Interesting/articles/Prirodna%20bogatstva%20hrvatskih%20regija.pdf

Further details as to the biomass market in Croatia and the status of the potential for biomass production / use, can be found in the following project deliverables:

- Biomasud Plus D2.1 - Residential heating biofuels market state of the art. Available at: http://biomasudplus.eu/wp-content/uploads/2017/09/D2.1-Market_report_Consolitated-6.pdf
- uP_running D2.2 - Sector Analysis and Strategic Plan at National and EU level. ANNEX A9 – Croatia. Available at: https://www.up-running.eu/wp-content/uploads/2016/10/D2.2_Sector-Analysis-and-Strategic-Plan-at-national-and-EU-levels_compressed.pdf

# 1. Agrobiomass availability

Croatia can be divided into four different regions according to geographical and morphological properties (Mountain region was excluded): i) continental region (orientated North-West), ii) Slavonia region (orientated East), iii) Istria region (peninsula) and iv) Dalmatia region. When looking to geographical distribution, abundance exist in Continental (central part of Croatia), Slavonia (vast of agricultural areas, main agricultural production) and Istria and Dalmatia region (main cultivation olive oil and wine production).

Agriculture as one of the key economic features activities contributing about 5 % to the Croatian GDP (2017). Cereal production has a central role in Croatian agriculture. 60 % of them have land lower than 2 ha, only 1.6 % has a land surface over 20 ha. Around 140.000 are just producers of cereals, whilst around 12.000 produce rapeseed. [3] Moreover, the average size of all farms is around 5.6 ha.

According to BIOEN "Biomass and waste energy program", the **agrobiomass technical potentials on regional/local level of Croatia is:** ***"****Every year after harvest in the fields of Croatia remains almost 2 million tons of straw of wheat and the same tons of maize. If one-third of that amount were used for energy utilization, they would get about 18 PJ (five-month) energy, i.e. 5 TWh".*[4]

Total biomass energy consumption of 54.42 PJ was permeated through all categories of energy balance, with the highest use in General Consumption - households: 47.22 PJ or 87 %. The production of thermal energy from solid and gaseous biomass, including the production from industrial boilers and the production of heat from heating wood for heating and domestic hot water production, was 50.966 PJ **[reference 5, p. 65].**

According to the Energy Institute Hrvoje Požar "Analyzes and backgrounds for energy strategy development of the Republic of Croatia", in the **Figure 1** it is given assumption of used land for biomass cultivation.

[3] Agroklub – Croatian official agricultural page. Link: https://www.agroklub.com/poljoprivredne-vijesti/hrvatska-poljoprivreda-u-brojkama/23471/
[4] Domac J.: *„BIOEN Biomass and waste energy program",* AZP – Grafis Samobor, Zagreb, June, 2001.
[5] Energy Institute Hrvoje Požar, Analyzes and backgrounds for energy strategy development of the Republic of Croatia, Zagreb, Croatia, 2018. Link: https://www.hup.hr/EasyEdit/UserFiles/Granske_udruge/CRO%20industrija/Marija%20%C5%A0utina/zelena-knjiga.pdf

*Table 1: An assessment of the upper limit of biomass breeding potential for energy needs, along with the known culture and breeding methods **[reference 5, p. 75]***

| Assumption of used land for biomass cultivation | Area [million ha] | Potential [PJ/y] |
|---|---|---|
| Unproductive land for agricultural production | 0,81 | 109,43 |
| Agricultural land out of function | 0,75 | 102,18 |
| Self-sufficiency in food (2011) | 0,08 | 11,90 |
| Self-sufficiency in food (2050) | 1,55 – 1,7 | 81,28 – 101,64 |
| Technical potential (Kajba et al., 2011) | 0,28 | 60 |

In Croatia, so far, exist only one producer of agropellets (bought boilers outside of Croatia for him and his users). As market is not developed, big companies are not interested or in early stage of R&D (i.e. Centrometal company [6]), moreover they need to produce around 10.000 pieces of stoves and boilers on agrobiomass otherwise will not get any profit due to low production of agrobiomass pellets and usage.

**Agrobiomass statistics by Eurostat:**

- Area (production) / 1000 ha /cereals: 486.60 for 2019 year [7]
- Area (production) / 1000 ha / dry pulses and protein corps: 2.39 for 2019 year [7]
- Area (fresh vegetables and strawberries, including melons) / 1000 ha:10.03 for 2018 year [7]
- Area (permanent crops for human consumption) / 1000 ha: 68.77 for 2018 year [7]
- Utilized agricultural area / 2018 year: 1.485,65 [8]
- Arable land / 2018 year: 803.90 [8]
- Permanent grassland / 2018 year: 607.56 [8]
- Permanent crops / 2018 year: 72.34 [8]
- Kitchen gardens / 2018 year: 1.85 [8]
- Olive trees - Area by age and density classes (area in ha): 17.010,87 [9]
- Traded volume for the agrobiomass (if there is a market) – NA
- Market price (if any) - bales of hay usually costs around 25 – 40 €, depends on the quality.
- Agropellets are usually packed in the bags of 15 kg/4€, whereas cca 1kg/0.20-0.30 €, depends on the type. Moreover, 2 kg of pellets are equal to 1 L of fuel oil.

[6] Centrometal, official webpage. Link: https://www.centrometal.hr/
[7] Eurostat. Link: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=apro_cpnh1&lang=en
[8] Eurostat. Link: https://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tag00025
[9] Eurostat table. Olive Trees. Link: eurostat table Croatia_Olive trees

## Agricultural residues – Herbaceous crops

**Technical potential** of agricultural residues was calculated using equation (1) where input parameters are surface area of cultivated crop and agricultural product to express technical potential of agricultural residue as dry matter (detailed in the excel table):

$$surface\ [kha]\ x\ main\ agricultural\ product\ [kt] = agrobiomass\ technical\ potential\ [kt, dry]\ (1)$$

Results given by the equation above, were put in the tables for each agrobiomass residue, respectively, in the column or table called *Technical potential*.

## Agricultural residues – Annual Crops

**Straw (cereal)**

**CEREAL CROP PRODUCTION:** Cereal production has a central role in Croatian agriculture market.

An average of 559.000 hectares are cultivated under cereals, and an average of about 3.1 million tonnes of cereals is produced.[10]
In the observed five-year period from 2013 to 2017, in the total production of cereals, expressed in terms of quantity, corn accounted for 61.6 %, followed by wheat with a share of 26.7 %, barley with 7.2 %, oats with 2.2 %, triticale with 2.1 %, rye with 0.1 % and other cereals with 0.2 %. [11]

**GEOGRAPHICAL DISTRIBUTION:** Cereals cultivation has the most density in the Slavonia and Continental region of Croatia due to plane land with moderate continental climate.

**PRICE: NA**

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 2: Estimation of the technical potential – cereal straw [10]*

| Post-harvest residue | Area [kha] | Agricultural product [kt] | Technical potential [kt, dry] |
|---|---|---|---|
| **Straw** | 559,00 | 3.1000,00 | 1.426,1 |

**Maize**

**MAIZE CROP PRODUCTION:** In 2018, 2.147.275 tonnes of maize were produced on 235.352 ha and the yield per hectare was 9.1 tonnes. In 2018, maize production increased by 37.7 %

[10] Petrač B., Agrarian Economics, Faculty of Economics, Osijek, Croatia. 2002. p. 136.

compared to 2017. Corn yield per acre in 2018 increased by as much as 44.4 % over 2017 yield. Corn is the leading cereal in Croatia, yielding over 60 % of total cereal production. [11]
**GEOGRAPHICAL DISTRIBUTION:** Most of production is in the North-West part (Continental Croatia) and Eastern part (Slavonia region) of Croatia.

**OTHER USES:** Maize crop residues are used for food for livestock.

**PRICE:** there are no corn pellets in Croatia for heating.

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 3: Estimation of the technical potential- maize **[reference 11, pp. 61-63].***

| Post-harvested residues | Area [kha] | Agricultural product [kt] | Technical potential [kt, dry] |
|---|---|---|---|
| **Maize** | 2.147,3 | 235,4 | 286,1 |

*Table 4: Evaluation of the energy potential of post-harvest residues - maize **[reference 5, pp. 73-74].***

| Post-harvested residues | Quantity [t/y] | Energy value [PJ/y] | Source |
|---|---|---|---|
| **Corn (stem)** | 490 000<br>Theoretical: 1 600 000<br>Technical: 400 000<br>Theoretical: 1 450 000<br>Technical: 350 000 | 7.20<br>29.60<br>7.40<br>13.44<br>6.45 | Ćosić et al. (2011)<br>Ćosić et al. (2008)<br>EIHP<br>Ćosić et al. (2008), EIHP |
| **Corn and wheat residues** | - | 7.35 | Kulišić (2013.) |
| **Corn (maize cobs)** | - | 4.73 | EIHP |

[11] Ministry of Agriculture. Green Report for 2018. Link: https://poljoprivreda.gov.hr/istaknute-teme/poljoprivreda-173/poljoprivredna-politika/agroekonomske-analize/zeleno-izvjesce/189

*Table 5: Evaluation of the energy and technical potential of post-harvest residues – maize* [12]

| | Corn |
|---|---|
| **5 year average production [t]** | 1804.081 |
| **Estimate of residues production based on harvest index [t] A** | 1804.081 |
| **30 % residues needed for soil protection [t] B** | 541.224 |
| **30 % residues for technical potential** | 378.857 or 0.37 mil/t |

**Wheat**

**Wheat cultivation:** In 2017, 135.708 ha were harvested in Croatia, producing 738.363 tonnes of wheat, while nature per hectare was 5.4 tonnes. In the five-year period (2013 to 2017), an average of 809.780 tonnes of wheat was produced, thus reducing production in 2018 by 8.8 % compared to the five-year average. [11]

**Geographical distribution:** Continental and Slavonia region of Croatia.

**USE:** food.

**PRICE:** NA

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 6: Estimation of the technical potential – wheat* ***[reference 11, p. 62]***

| Post-harvested residues | Area [kha] | Agricultural product [kt] | Technical potential [kt, dry] |
|---|---|---|---|
| **Wheat** | 135.7 | 738.4 | 342.1 |

*Table 7: Evaluation of the energy potential of post-harvest residues – wheat* [13]

| Post-harvested residues | Area [ha] | Grain yield [t/ha] | Biomass yield [t/ha] | Available biomass for energy Ab50% [t/ha] | Energy potential Ab50% [MJ/ha] |
|---|---|---|---|---|---|
| **Wheat** | 167.814 | 4.83 | 4.83 | 2.42 | 39.730 |

[12] Kovačić D. et al. Soybean Straw, Corn Stover and Sunflower Stalk as Possible Substrates for Biogas Production in Croatia: A Review, 2017. Link: http://silverstripe.fkit.hr/cabeq/assets/Uploads/01-3-17.pdf

[13] Bilandzija N. et al. Evaluation of Croatian Agricultural Solid Biomass Energy Potential. Faculty of Agriculture. 2018. Link: https://www.sciencedirect.com/science/article/abs/pii/S1364032118303848

*Table 8: Evaluation of the energy potential of post-harvest residues – wheat* ***[reference 5, p. 73]***

| Post-harvested residues | Quantity [t/year] | Energy value [PJ/year] |
|---|---|---|
| **Spelt (type of wheat) – stem and husks** | 19.138 | Total: 0.30<br>Available: 0.09 |

**Rapeseed**

**Rapeseed cultivation:** The harvested area for rapeseed in 2018 was 55.032 ha, 2.8 ha in nature, while total production was 155.842 t. In the five-year period (2013 to 2017), an average of 84.928 tonnes of rapeseed was produced, thereby increasing production in 2018 by 83.5 % over the five-year average. [11]

**Geographical distribution:** North-West Croatia and Slavonia region.
**USE:** oil, food for livestock, biodiesel.

**PRICE:** NA

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 9: Estimation of the technical potential – rapeseed* ***[reference 11, p. 64]***

| Post-harvested residues | Area [kha] | Agricultural product [kt] | Technical potential [kt, dry] |
|---|---|---|---|
| **Rapeseed** | 55 | 155.8 | 147.5 |

*Table 10: Evaluation of the energy potential of post-harvest residues – rapeseed* [14]

| Post-harvested residues | Quantity [t/y] | Quantity of biofuel [t] | Energy value [PJ/y] |
|---|---|---|---|
| **Rapeseed** | 124.082 | 50.646 | 0.000037 |

**Sunflower crop residues (stalks, heads)**

**SUNFLOWER CULTIVATION:** In 2018, 37.128 ha of sunflower were harvested, producing 110.790 tonnes of sunflower seeds with an average yield per hectare of 3 tonnes. In the five-year period (2013 to 2017), an average of 110.117 tonnes of sunflower was produced, thus increasing production by 0.6 % in 2018 compared to the five-year average. [11]

**GEOGRAPHICAL DISTRIBUTION:** Most of sunflower cultivation is located in the Slavonia region (both East and West) in Croatia.

[14] Fištrek, Ž. Biomass Energy Potential in Istria, Primorsko-goranska and in Ličkosenjska county. Energy Institute Hrvoje Požar. 2012.

**USE:** mainly sunflower oil and food for livestock.

**PRICE:** NA

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 11: Estimation of the technical potential – sunflower **[reference 11, p. 65]***

| Post-harvested residues | Area [kha] | Agricultural product [kt] | Technical potential [kt, dry] |
|---|---|---|---|
| **Sunflower** | 37.1 | 110.8 | 133.3 |

*Table 12: Evaluation of the energy potential of post-harvest residues – sunflower crop residues [13]*

| Post-harvested residues | Area [ha] | Grain yield [t/ha] | Biomass yield [t/ha] | Available biomass for energy Ab50% [t/ha] | Energy potential Ab50% [MJ/ha] |
|---|---|---|---|---|---|
| **Sunflower** | 33.359 | 2.77 | 5.54 | 2.77 | 49.191 |

**Barley**

**BARLEY CULTIVATION:** In 2018, 50.988 ha of barley were harvested, producing 227.520 tonnes of barley with an average yield per hectare of 4.5 tonnes. Due to the reduced harvest area, barley production in 2018 compared to the previous 2017 decreased by 12.6 %.
In the five-year period (2013 to 2017), an average of 218.795 tonnes of barley was produced, thus increasing production by 4 % in 2018 compared to the five-year average. [11]

**GEOGRAPHICAL DISTRIBUTION:** Most of barley cultivation is located in the Slavonia region (both East and West) as well as in the Continental part of Croatia.

**USE:** mainly for food.

**PRICE:** NA

*Table 13: Estimation of the technical potential – barley **[reference 11, p. 63]***

| Post-harvested residues | Area [kha] | Agricultural product [kt] | Technical potential [kt, dry] |
|---|---|---|---|
| **Barley** | 51 | 227.5 | 103 |

**Oat**

**OAT CULTIVATION:** In 2018, 15.885 ha of oat were harvested, producing 44.827 tonnes of oat with an average yield per hectare of 2.8 tonnes. [11]

**GEOGRAPHICAL DISTRIBUTION:** Most of oat cultivation is located in the Slavonia region and in the Continental part of Croatia.

**USE:** mainly for food.

**PRICE:** NA

*Table 14: Estimation of the technical potential – oat **[reference 11, p. 187]***

| Post-harvested residues | Area [kha] | Agricultural product [kt] | Technical potential [kt, dry] |
|---|---|---|---|
| **Oat** | 15.9 | 44.8 | 23.2 |

**Rye**

**RYW CULTIVATION:** In 2018, 1.292 ha of rye were harvested, producing 4.100 tonnes of rye with an average yield per hectare of 3.2 tonnes. [11]

**GEOGRAPHICAL DISTRIBUTION:** Most of rye cultivation is located in the Slavonia region and in the Continental part of Croatia.

**USE:** mainly for food.

**PRICE:** NA

*Table 15: Estimation of the technical potential – rye **[reference 11, p. 187]***

| Post-harvested residues | Area [kha] | Agricultural product [kt] | Technical potential [kt, dry] |
|---|---|---|---|
| **Rye** | 1.3 | 4.1 | 2.2 |

# Agro-industrial residues – Permanent Crops

## Agricultural residues – Permanent Crops

**Olive tree prunings**

**OLIVE TREE CULTIVATION:** According to National Bureau of Statistics data, in 2018, there were 18.697 ha under olive groves. The total production of olive fruit was 28.418 t, and in the same year 36.573 hl of olive oil was produced. Compared to the previous year, when 28.947 t of olives and 37.463 hl of olive oil were produced, a decrease of 1.8 % was recorded, as well as a drop in the amount of oil produced by 2.4 %.
Fruit processing, i.e. olive oil production is gradually increasing, and Croatian olive oil is increasingly becoming an economically important potential in the agricultural production of Mediterranean Croatia, with significantly improved quality **[reference 11, p. 69].**

**GEOGRAPHICAL DISTRIBUTION:** Olive tree production is concentrated in the Istria region (peninsula) and Dalmatia region in Croatia.

**USE:** NA

**PRICE:** NA

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 16: Evaluation of energy potential of olive tree prunings* [13]

| Post-harvested residues | Area [ha] | Pruned biomass [t/ha] | Energy potential [MJ/ha] | Technical potential [kt, dry] |
|---|---|---|---|---|
| **Olive prunings** | 18.195 | 2.524 | 38.420 | 46 |

**Other fruit tree prunings**

**FRUIT TREE CULTIVATION:** In fruit production, in 2018, the majority of production is occupied by intensive production, which amounted to 213.910 tonnes on an area of 33.444 ha, while a much smaller part is produced by extensive production on family farms producing 7.674 tonnes of fruit. The most common fruit species produced in the Republic of Croatia during 2018 were apples, tangerines, watermelons, plums and cherries **[reference 11, p. 67].**

**GEOGRAPHICAL DISTRIBUTION:** Fruit tree cultivation is common in all national territory with regional specificities: citrus is concentrated in the southern regions, apples in the North, olive in the Istria region, grapes in all regions **[reference 11, p. 68].**

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 17: Evaluation of energy and technical potential other fruit tree prunings.*

| Post-harvested residues | Area [ha] | Pruned biomass [t/ha] | Energy potential [MJ/ha] | Technical potential [kt, dry] | Source |
|---|---|---|---|---|---|
| | / | / | **0.7 – 4.21 PJ** | / | Reference 5, page 75 |
| **Apple** | 6035 | 5.557 | 85.317 | 33.54 | Reference 13 |
| **Plum** | 5220 | 2.055 | 31.672 | 10.73 | |
| **Walnut** | 4006 | 0.539 | 7910 | 0.002 | |
| **Sour cherry** | 2746 | 2.169 | 33.438 | 5.96 | |
| **Hazelnut** | 2686 | 1.848 | 29.053 | 4.96 | |
| **Peach and nectarine** | 1460 | 2.870 | 45.797 | 4.19 | |
| **Pear** | 1092 | 5.819 | 87.772 | 6.35 | |
| **Sweet cherry** | 810 | 1.988 | 29.984 | 1.61 | |
| **Apricot** | 307 | 1.621 | 25.080 | 0.50 | |
| **Fig** | 312 | 1.282 | 18.002 | 0.40 | |
| **Mandarin** | 1946 | 3.400 | 53.244 | 6.62 | |
| **TOTAL** | | | | 74,85 | |

**Vineyard prunings**

**VINEYARDS:**

**Grape** - there were 20.512 ha of agricultural land under vineyards in 2018. Grapes production in 2018 amounted to 146.242 tonnes with an average yield of 7.1 tonnes. Thus, due to favourable agro-ecological conditions, grape production in 2018 increased by 30 % compared to the previous year 2017 **[reference 11, p. 69].**

**Wine** - According to National Bureau of Statistics data, wine production in 2018 amounted to 952.000 hl of wine, which is a 31.1 % increase over 2017. According to National Bureau of Statistics data, wines worth EUR 30.5 million were imported in 2018, an increase of 6.2 % compared to 2017. The volume of imports amounted to 24.087 t, which is a decrease of 10.3 % compared to 2017. Wine exports in 2018 amounted to 16.1 million euros, an increase of 23.1 % compared to 2017. The volume of exports amounted to 5.672 tonnes, an increase of 10.4 % over 2017 **[reference 11, p. 70].**

**GEOGRAPHICAL DISTRIBUTION:** Cultivation is present in all regions of Croatia.

**MARKET:** Prunings from vineyards are already used especially on-farm and in areas where viticulture is intensive and mechanized.

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 18: Evaluation of the energy potential of post-harvest residues – vineyard prunings* [11]

| Post-harvested residues | Area [kha] | Agricultural product [kt] | Agrobiomass technical potential [kt, dry] |
|---|---|---|---|
| **Vineyard prunings** | 20.5 | 146.2 | 28.7 |

**Cleaning of mountain/ hilly pastures, meadows**

According to the Annual Report on Agriculture for 2018 utilized agricultural area was, 1.485.645 ha, by use, of which permanent grassland (meadows and pastures), make up to 40.9 % of the utilized agricultural land. **[reference 11, p. 6]**

**MEADOWS/PASTURES:** is it estimated that karst pastures could offer around 400.00 ha of surface.

**GEOGRAPHICAL DISTRIBUTION:** mountain area.

**MARKET:** NA

# Agro-industrial residues

## Agro-industrial residues

**Sunflower Husks**

**SUNFLOWER CULTIVATION:** Already mentioned above for sunflower residues.
**GEOGRAPHICAL DISTRIBUTION:** Most of sunflower cultivation is located in the Slavonia region.
**PRICE:** NA

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 19: Evaluation of energy potential of sunflower husks* [13]

| Post-harvested residues | Production yield [t/ha] | Biomass yield [t/ha] | Available biomass for energy Ab50% [t/ha] | Energy potential [MJ/ha] |
|---|---|---|---|---|
| **Sunflower (shell)** | 2.77 | 0.526 | 0.500 | 9.375 |

**Rice Husks**

**RICE CULTIVATION:** there is only one known producer that just started planting rice in 2019.

**GEOGRAPHICAL DISTRIBUTION:** Slavonia region.

**PRICE:** NA

**Olive stones**

**PRICE:** NA

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 20: Evaluation of energy potential of olive stones* ***[reference 5, p. 75]***

| Post-harvested residues | Energy potential [PJ] |
|---|---|
| **Olive stones** | 0.02 – 0.12 |

**Exhausted olive cake**

For now, there are no known pomace mills in Croatia. Few have expressed an interest but it is still in the early stage (exploring the terrain, technical and operational analysis).

**Nut shells (almonds, walnuts, pistachios, etc.)**

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 21: Estimation of the theoretical and technical potential – nuts* [15]

| Post-harvested residues | $Bio_{TH}$ (tDM*yr$^{-1}$) | $Bio_{T}$ (tDM*yr$^{-1}$) |
|---|---|---|
| **Nuts** | 6 526 | 5 859 |

*Table 22: Evaluation of energy potential of nut shells* [13]

| Post-harvested residues | Production yield [t/ha] | Biomass yield [t/ha] | Available biomass for energy Ab95% [t/ha] | Energy potential [MJ/ha] |
|---|---|---|---|---|
| **Walnut (shell)** | 0.42 | 0.202 | 0.192 | 3633 |
| **Hazelnut (shell)** | 0.55 | 0.292 | 0.277 | 5372 |

**Other fruit stone**

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 23: Estimation of the theoretical and technical potential – fruits* [15]

| Post-harvested residues | $Bio_{TH}$ (tDM*yr$^{-1}$) | $Bio_{T}$ (tDM*yr$^{-1}$) |
|---|---|---|
| **Fruits (general)** | 54 945 | 49 592 |

*Table 24: Evaluation of the energy potential of post-harvest residues – other fruit stones* [13]

| Post-harvested residues | Production yield [t/ha] | Biomass yield [t/ha] | Available biomass for energy Ab95% [t/ha] | Energy potential [MJ/ha] |
|---|---|---|---|---|
| **Peach (stone)** | 3.90 | 0.268 | 0.255 | 4992 |
| **Sour cherry (stone)** | 2.38 | 0.238 | 0.226 | 4719 |
| **Plum (stone)** | 3.18 | 0.159 | 0.151 | 2269 |
| **Sweet cherry(stone)** | 2.42 | 0.097 | 0.092 | 1835 |
| **Apricot (stone)** | 1.40 | 0.140 | 0.133 | 2898 |

[15] Dyjakon A., Garcia-Galindo D. Implementing Agricultural Pruning to Energy in Europe: Technical, Economic and Implementation Potentials. Article, 2019. Link: https://www.mdpi.com/1996-1073/12/8/1513/htm

**Citrus**

*Table 25: Estimation of the theoretical and technical potential – citrus* [15]

| Post-harvested residues | $Bio_{TH}$ (tDM*yr$^{-1}$) | $Bio_{T}$ (tDM*yr$^{-1}$) |
|---|---|---|
| **Citrus (general)** | 2 495 | 2 133 |

## Energy crops

Energy crops in Croatia started to be used in the past few years, according to BEECO (Bio Eco Energy Company in Croatia dedicated to the commercial cultivation of energy crops). According to the BioEnergy Europe reports for Biomass Supply, there is only present energy crop (miscanthus x giganteus) on the 500 ha surface area **(Table 28).** Which indicates, market for the energy crops for heating is still not developed in the country, following compliance of the legal framework. Several studies started to test potential of the short rotation coppice, which is presented in the **Table 25 and 29.**

According to the Kajba D. et al, *Estimation of Short Rotation Crops Potential in the Republic of Croatia: Illustration Case Within FP7 Project Biomass Energy Europe*, theoretical and technical potential of SRCs are presented in **Tables 26 and 27.**

## Energy crops

**Woody varieties - SRC (Poplar, Willow, Robinia, etc.)**

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 26: Evaluation of the energy potential of post-harvest residues – woody varieties* [16]

| Energy crop | Dry biomass (DB) yield [tDB/ha/year] | Lower calorific value [MJ / kg DB] | Energy production per ha [GJ/ha] | Amount of water during harvest | Amount of ashes [%] |
|---|---|---|---|---|---|
| **Willow** | 8 - 15 | 18.5 | 280 - 315 | 53.0 | 2.0 |
| **Poplar** | 9 - 16 | 18.7 | 170 – 300 | 49.0 | 1.5 |
| **Wild millet** | 9 - 18 | 17.0 | NA | 15.0 | 6.0 |
| **Robinia** | 5 - 10 | 19.5 | 100 - 200 | 35.0 | NA |

*Table 27: Theoretical potential for SRCs in Croatia* [17]

| Area | Surface area [ha] | $Bio_{TH}$ ($tDM*yr^{-1}$) | Energy value [PJ] |
|---|---|---|---|
| **Forest area** | 51 200 | 470 200 | 8.7 |
| **Agricultural area with moderately suitable soils and limited soil suitability** | 617 000 | 7 404 000 | 136.2 |

[16] Miscanthus x giganteus. Bio Eco Energy Company (BEECO). Link: http://beeco.hr/miscanthus-x-giganteus/o-miscanthusu/
[17] Kajba D. et al. Estimation of Short Rotation Crops Potential in the Republic of Croatia: Illustration Case Within FP7 Project Biomass Energy Europe. Article, 2011. Link: https://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=106691

*Table 28: Technical potential for SRCs in Croatia [17]*

| Area | Surface area [ha] | $Bio_T$ ($tDM*yr^{-1}$) | Energy value [PJ] |
|---|---|---|---|
| **Forest area** | 46 850 | 430 000 | 7.9 |
| **Agricultural area with moderately suitable soils and limited soil suitability** | 235 650 | 2 827 800 | 52.1 |

**Grassy Varieties (ARUNDO DONAX, Miscanthus, Switch grass, etc.)**

**Miscanthus:** Miscanthus x giganteus is the most investigated energy crop in Croatia.
**Alternative use:** as an energy crop for heating [18]
**GEOGRAPHICAL DISTRIBUTION:** Croatia

**ESTIMATION OF BIOMASS PRODUCTION:**

*Table 29: Estimation of the technical potential of the energy crop – miscanthus x giganteus [19]*

| Energy crop | Area [ha] | Year | Source |
|---|---|---|---|
| **Miscanthus x giganteus** | 500 | 2016 | BEECO |

*Table 30: Yields from herbaceous energy crops [16]*

| Energy crop | Dry biomass (DB) yield [tDB/ha/year] | Lower calorific value [MJ / kg DB] | Energy production per ha [GJ/ha] | Amount of water during harvest | Amount of ashes [%] |
|---|---|---|---|---|---|
| **Miscanthus x giganteus** | 18 - 32 | 17.5 | 300 - 560 | 15.0 | 3.0 |
| **Common reed (lat. Arundo donax)** | 15 - 35 | 16.3 | 245 - 570 | 50.0 | 5.0 |

**Estimations of biomass production** - by aggregate by main categories, biomass potential in the Republic of Croatia is estimated, but not limited to, 78.56 – 148.81 PJ/year **[reference 5, p. 74 and 87]:**

[18] Bilandzija, N. Faculty of Agriculture, University of Zagreb, 2014. Link: https://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=195971
[19] BioEnergy Europe. Biomasssupply. Statistical Report. 2019. Link: https://bioenergyeurope.org/index.php?option=com_content&view=article&id=178

- Wood biomass: 3.75 – 6.44 million m3/y or 35.5 - 68 PJ/y and over 100 PJ if the mobilization measure will be applied,
- Tree branches from maintenance of permanent corps: 0.7 - 4.21 PJ/y,
- Agro-residues: 22.93 PJ/y
- Post-harvest residues: 18.44 – 57.93 PJ/y,
- Biogas and biomethane: 5.83 – 11.5 PJ/y,
- Waste: 18.09 – 20.11 PJ/y.

# 2. Rural Development

| Rural Development | |
|---|---|
| How is Rural Development managed? | In 2018, the implementation of rural development measures within the framework of the Rural Development Program of the Republic of Croatia for the period 2014-2020 continued. Eligible investments within the measures of the Rural Development Program of the Republic of Croatia are largely co-financed by European Union funds through the European Agricultural Fund for Rural Development, while the rest is co-financed by the State Budget of the Republic of Croatia. The program contains 18 measures aimed at increasing the competitiveness of Croatian agriculture, forestry and the processing industry, as well as improving living and working conditions in rural areas in general**. [reference 11, p. 10, reference 20].**<br><br>**Rural development measures (subsidies) related to agrobiomass (ongoing or announced) are:**<br>i) 3.1.1. Support for the participation of farmers in quality systems (Plant Breeding, Livestock, Olive Growing, Viticulture, Fruit Growing, Vegetable Growing)<br>ii) 4.1.1. Restructuring, modernization and increasing the competitiveness of agricultural holdings (restructuring of existing and / or establishment of new perennial plantations (excluding restructuring of existing vineyards for the production of wine grapes))<br>iii) 5.2.1. Restoration of agricultural land and production potential<br>iv) 4.1.2. Disposal, handling and use of barn manure in order to reduce the harmful impact on the environment<br>v) 4.2.1 Increasing the added value of agricultural products |

[20] Rural Development Programme of the Republic of Croatia for the Period 2014-2020, final version, version 7. Ministry of Agriculture. Link: https://ruralnirazvoj.hr/program/

| Rural Development | |
|---|---|
| | vi) 4.2.2. / 4.1.3. Usage of RES<br>vii) 16.4.1. Short supply chains and local markets<br>viii) 9.1.1 Establishment of producer groups and organizations (to penetrate the market, creating competitiveness of agricultural holdings; users: production organizations)<br>ix) 6.4.1. Development of non-agricultural activities in rural areas |
| Are agrobiomass feedstocks suitable for bioheat included in the Ecological Focus Area? (for example, Short Rotation Coppice, Miscanthus, Silphium perfoliatum) | According to the *Law on the Wood Short Rotation Coppice (National Newspapers "*NN" 15/2018), **art. 1.**, the purpose of this Act is to contribute to the energy and economic development of the Republic of Croatia by enhancing security of supply through the use of additional national energy sources, the development of rural areas by stimulating economic activity at the local level by utilizing the additional production potential of agricultural and forest land, and **art. 2.**, crops are considered to be intensive plantations of fast-growing tree species or other plant species grown on agricultural or forest land for a short period of up to eight years between the two fellings or harvest, in order to achieve high biomass yield for energy purposes. [21]<br>Furthermore, documents prepared within the framework of the *Agriculture and Fisheries Development Strategy of the Republic of Croatia 2020* consider the possibilities and benefits of growing energy crops in the territory of Croatia, and it is expected that the new agricultural strategy after 2020 will encourage the use of these crops. [22] |
| Are there any restrictions on the cultivation of dedicated energy crops (woody or grassy varieties)? | According to the *Law on the Wood Short Rotation Coppice (*NN 15/2018), **art 5.,** SRCs can be cultivated exclusively on [21]:<br>**i)** forest land, if this is not contrary to the forest management plan, |

[21] Law on the Wood Short Rotation Coppice. Link: https://narodne-novine.nn.hr/clanci/sluzbeni/2018_02_15_313.html
[22] Agriculture and Fisheries Development Strategy of the Republic of Croatia 2020. Link: https://poljoprivreda2020.hr/

| Rural Development | |
|---|---|
| | **ii)** agricultural land that is valued as other agricultural land (PS) and<br>**iii)** other arable agricultural land (P3), which is plowed and overgrown with perennial vegetation, with the approval of the Croatian Agricultural and Forestry Advisory Service.<br><br>For the **ii) and iii)** labels, it is mandatory after the end of the twentieth year since the establishment of the crop, to return land to agricultural production. |
| Are there any restrictions or mandated practices covering agricultural residues collection? | According to the *Law on the Wood Short Rotation Coppice* (NN 15/2018), **art. 6.,** you just have to be registered in the Register of Producers of Wood Short Rotation Coppice. [21] |
| Is there any support for the valorization of agricultural residues at national level? Or at local level? | Measures written in the first question regarding Rural Development.<br>Among that, no other supports exists in Croatia. |
| Is there a ban on burning stubbles, prunings or other agricultural residues? | According to the *Agricultural Land Law* (NN 20/18, 115/18, 98/19), **art. 10.** and **art. 11.**, *Regulation on Agrotechnical Measures* (NN 20/18, 115/18), **art. 4.** and **art. 9.,** it is said that harvesting residues must not be incinerated and their incineration is permitted only for the purpose of preventing the spread or suppression of organisms harmful to the plants by implementing fire protection measures in accordance with special regulations. [23, 24]<br><br>During the summer when the risk of fires is higher, burning agricultural residues is generally prohibited. Municipalities and other local authorities have the right to ban or postpone burning of agricultural residues for the following reasons: adverse weather/climatic/environmental conditions, risks to public safety and health. Also, each municipality, city, county has made decision according to the above mentioned laws on which they define deadlines and conditions. |

[23] Agricultural Land Law. Link: https://www.zakon.hr/z/133/Zakon-o-poljoprivrednom-zemlji%C5%A1tu
[24] Regulation on Agrotechnical Measures. Link: https://narodne-novine.nn.hr/clanci/sluzbeni/2019_03_22_452.html

# 3. Logistics and other market considerations

| Logistics | |
|---|---|
| Are harvesters/balers for agricultural residues readily available in the market? | There are foreign companies that produce such balers / collectors and can also be procured through Croatia through intermediaries. |
| Is there an investment support available to cover the cost of these machines? | Yes. On the official page called Rural development such supports can be found. Particularly for this, it is called *Measure 4.1.1. '' Restructuring, modernization and scale-up agricultural competitiveness '' - the fruit and vegetable sector and the livestock and poultry sector*.<br>Rural development funds are usually for all types of measures for agriculture development. |
| Are there any specialized service companies for agricultural residues harvesting and logistics? | There are several specialized service companies, i.e. collection and logistic centres, but for the forest / wood biomass and the establishment of new ones is underway (especially by the Croatian Forests). As for now, there's no information on establishing centres for agricultural biomass. |
| How does the biomass market usually operate? | Manufacturers of biomass, i.e. wood biomass pellets, are finding a market, but most often export to neighbouring countries. There is no big interest in public institutions in Croatia, since such heating systems are relatively new and additional investments are needed to move from the current way of heating to agrarian biomass heating. Wood-heated households also use residual residues. Agricultural residues are mostly burned or plowed.<br><br>**Case study**: power plant *Uni Viridas* on the biomass of the 10 MW capacity. [25] |
| Are there companies producing agro-pellets? | Yes, so far, just one is known (EURO-tim). [26] Producer of agropellets from soya and rapeseed. Through a stakeholders meeting ZEZ found one that just opened olive oil production and plans to use olive stones in the facility |

[25] Power plant on biomass. Link: https://www.valmet.com/pt/media/news/press-releases/2019/valmet-and-uni-viridas-renew-their-cooperation-by-signing-a-ten-year-operation-and-maintenance-agreement-for-the-biomass-power-plant-in-croatia/?fbclid=IwAR3XBEYA8J9v3VT30P8YBtnnhyGrVcZh_s-UsUS4NrrCSDM_6oy5CrV_xIc
[26] EURO-tim d.o.o. Official webpage. Link: https://www.euro-tim.com/

| Logistics | |
|---|---|
| | for heating. As meetings are continuing with new stakeholders, ZEZ has found in Croatia that there is a lot of agrobiomass from agriculture but people are not using it aside for land covering or to burn. |
| Are there any resistance in the market for this kind of product? | Usually, when you say “agrobiomass” in Croatia, people still think of wood biomass, but are familiar with the term agricultural and prunings residues. |

# 4. Air quality

<table>
<tr><th colspan="2">Air quality</th></tr>
<tr><td>Has the state submitted a NAPCP? (National Air Pollution Control Programme)</td><td>Yes, available on Croatian, waiting for confirmation for English version. [27]</td></tr>
<tr><td>Competence over air quality related issues is at National or at Local level?</td><td>Competence is shared between the national government which sets the limits and provides a framework and regional authorities. Regions have the obligation to monitor quality of air and put in place measures to respect the limits (Croatian Agency for Environment and Nature). [28]</td></tr>
<tr><td>Are performance standards and/or emission limits a possible barrier to deployment of agrobiomass heating systems up to 500 kW?</td><td>In the legal framework it is not specified agrobiomass or biomass, it’s just said biomass. According to the Air Quality Law (NN 127/19), art. 39. [29], Government of Croatia has brought Assize on Limit Values of Emissions of Pollutant Substances into Air from Fixed Sources (NN 87/2017) [30], which states, art. 74. and appendix 7. (tables 1 and 2 below):<br><br>Table 31: Categorization of installations.<br><table><tr><th>Size of installation</th><th>Solid biofuels and fuel from biomass</th></tr><tr><td>Small</td><td>≥ 0.1 - 1 MW</td></tr><tr><td>Medium</td><td>≥ 1 - 50 MW</td></tr><tr><td>Big</td><td>≥ 50 MW</td></tr></table><br>Table 32: Limit Values of Emissions – small installations/<br><table><tr><th>Small installations</th><th>Gas emissions limit (mg/m$^3$)</th></tr><tr><td>Chimney blackening (Bacharach scale)</td><td>1</td></tr><tr><td>CO</td><td>1000</td></tr></table>* Volume fraction: Oxygen 11%.</td></tr>
</table>

[27] National Air Pollution Control Programme, 2019, Croatia. Link: https://ec.europa.eu/environment/air/pdf/reduction_napcp/HR%20Draft%20NAPCP%20EN%20-%20w%20cover.pdf
[28] Quality of Air in Republic of Croatia. Croatian Agency for Environment and Nature. Link: http://iszz.azo.hr/iskzl/index.html
[29] Air Quality Law. Link: https://www.zakon.hr/z/269/Zakon-o-za%C5%A1titi-zraka

## Air quality

| | |
|---|---|
| Are performance standards and/or emission limits a possible barrier to deployment of agrobiomass heating systems from 500 kW to 1 MW? | According to *Assize on Limit Values of Emission of Pollutant Substances into Air from Fixed Sources* (NN 87/2017), **art. 91.2.** and **appendix 8, 9.** [30] (**tables 3 and 4** below), below tables indicate limit values of emission for installations on biomass, not agrobiomass (legal framework does not yet exists). |

*Table 33: Limit Values of Emissions – for new installations on biomass.*

| Pollutant | Gas emissions limit ($mg/m^3$) |
|---|---|
| $SO_2$ | 200 |
| NOx | 300 |
| PM | 20 |

*Table 34: Limit Values of Emissions – for existing installations on biomass.*

| Medium installations | Gas emissions limit ($mg/m^3$) |
|---|---|
| PM | 150 |
| Sulfur oxides expressed as $SO_2$ | 2000 |
| CO | 500 |
| NOx expressed as $NO_2$ | 500<br>Vortex deposition: 300 mg/m3 |

* Volume fraction: Oxygen 11%.

[30] Assize on Limit Values of Emissions of Pollutant Substances into Air from Fixed Sources. Link: https://narodne-novine.nn.hr/clanci/sluzbeni/2017_08_87_2073.html

# 5. Tax breaks

| Tax breaks | |
|---|---|
| What is the VAT applicable to agrobiomass feedstock? | Acco*rding* the *Law on the Added Value Tax* (NN 79/13, 85/13 - correction, 160/13, 35/14, 157/14, 130/15, 1/17, 41/17, 128/17 and 1/19)*,* **art. 47.** [31] it is still not clarified nor written VAT for heating oil, pellets and firewood, hence it is subject to VAT of 25 %. |
| For comparison, what is the standard VAT rate and the one applicable to fuels used for heating (e.g. heating oil, LPG, natural gas, firewood, pellets, etc.)? | Croatia standard VAT: 25 %<br>Natural Gas: 25 %<br>Fire wood: 25%<br>LPG: 25 %<br>Heating Oil: 25 %<br>Pellets: 25 % |
| Are there any tax detraction on refurbishment of buildings/replacement of heating system that can be potentially applied to agrobiomass heating? | No. In Croatia, the incentive system is through subsidies, not taxes. |

[31] Law on the Added Value Tax. Link: http://porezi.net/zakoni/a_pdv/Pravilnik_o_porezu_na_dodanu_vrijednost_01012019.htm

# 6. Other support measures targeting heating

| Other support measures targeting heating | |
|---|---|
| Are there any rural development measure in place to support the production of bio-heat on-farm? | On the official page called Rural development such supports can be found. Particularly for this, it is called *Measure 4.1.3. Usage of Renewable Energy Sources*, where only can apply family farms, crafts registered for agricultural activity and agricultural business Companies. [32] (this Public call is currently open). |
| Are there national or local incentives to substitute old fossil fuel boilers (investment support)?<br><br>Are they applicable to agrobiomass heating solutions? | Not yet, but there is a strong interest at local levels to introduce into the public consumption systems (kindergartens, schools, hospitals) such a heating system that would be supplied by biomass from the environment.<br><br>NA. |
| Are there any specific measures in support of energy communities / renewable energy cooperatives that could be applicable to agrobiomass heating? | NA. |

[32] Rural development – Measure 4.1.3. Usage of RES. Link: https://ruralnirazvoj.hr/natjecaj-za-tip-operacije-4-1-3-koristenje-obnovljivih-izvora-energije-3/

# 7. Buildings Efficiency

| Buildings Efficiency | |
|---|---|
| Are there any incentives to renovate buildings integrating renewable heat? | *Environmental Protection and Energy Efficiency Fund*, opened Public call for energy renewal of the buildings, with primary focus on the outer layer of the house (roof, thermal facade, windows), accompanying secondary focus on heating on pellets, heat pumps and PV installations. In the last two years, in general, Croatia started to open more Public calls just for RES and EE implementation. [33]<br><br>Also, subsidies are coming from Operational Program of Competitiveness and Cohesion, as well as from trading emission units on auction. [34] |
| Are agrobiomass systems eligible for support under such schemes? | Usually in the public calls, it is said biomass for heating, it is not explicitly divided biomass and agrobiomass as legal framework in that matter does not yet exist. |

[33] Environmental Protection and Energy Efficiency Fund. Link: http://www.fzoeu.hr/
[34] Operational Program of Competitiveness and Cohesion 2014-2020. Link: https://strukturnifondovi.hr/eu-fondovi/esi-fondovi-2014-2020/op-konkurentnost-i-kohezija/

# 8. Policy Coherence

| Policy Coherence | |
|---|---|
| Are policy instruments impacting agrobiomass designed in a coherent way? | |
| *1. Soil considerations vs. Valorisation of residues* | There are researches, however, there is no legal framework regulating how much residual residues should be placed on the ground and the criteria for certification of agrobiomass. |
| *2. Definition of waste vs. co-products/agri residues* | No legal background. There are no definitions nor formal classification to what is and what is not agrobiomass and biomass.<br>Hence, different interpretations and inaccurate definitions of the term biomass lead to a serious threat to the system of stimulating the production of energy from renewable sources and high-efficiency cogeneration, which also results in court proceedings, we believe that a clear and unambiguous rulebook on biomass should be drawn up.<br>We consider the precise definition very important in the context of the future application of the premium system, as a significant number of investments in biomass plants are expected. Such an approach gives legal certainty to future investors, since arbitrariness in interpreting them is the biggest obstacle to making investments. |
| *3. Is the Common Agricultural Policy Strategic plan being developed in harmony with the National Energy and Climate Plan?* | Given that the Agricultural Development Strategy is under development, as well as the CAP Strategic Plan, it is unknown to what extent it is aligned with the National Energy and Climate Plan. |
| *4. NECPs: 5 dimensions are developed in harmony?* | According to the NECP Croatia, strategic plans of Croatia for 5 dimensions are in correlation with the five dimensions of the EU **[reference [35], p. 8].** |
| *5. Is there a national bioeconomy strategy? Are there any measures targeting agrobiomass for energy? Are* | Currently it is being developed. |

[35] Integrated National Energy and Climate Plan for the Republic of Croatia for the period of 2021 - 2030. Link: https://ec.europa.eu/energy/sites/ener/files/documents/hr_final_necp_main_en.pdf

| | |
|---|---|
| *those measures coherent with rural development and energy and climate related policies?* | |