



Promoting the penetration of agrobiomass heating in European rural areas

WBA Webinar Series – Agricultural Residues

Webinar 2: National experiences on feedstock mobilization, policies and regulations

28th January 2020

State of the art and prospects for using agrobiomass for energy in Ukraine

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UABIO

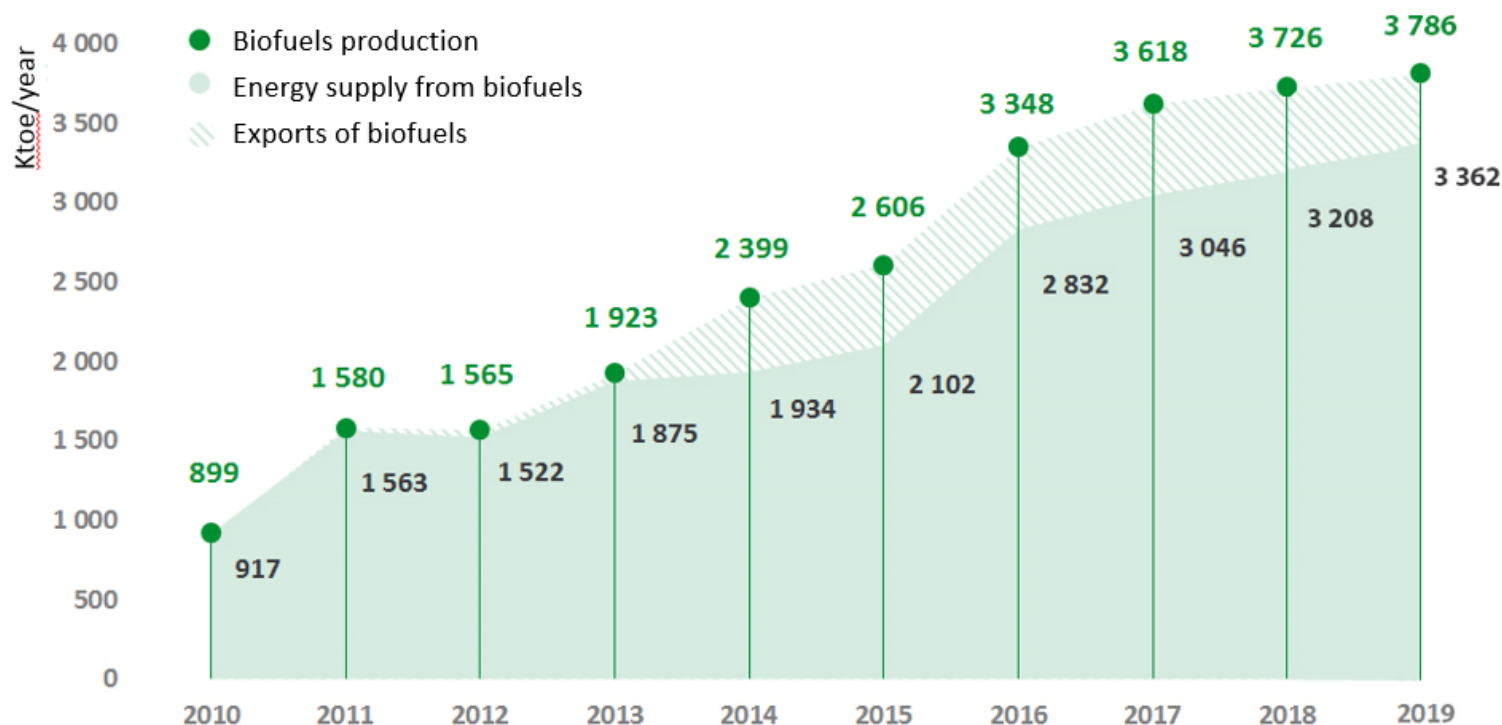
Bioenergy Association of Ukraine



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 818369. This document reflects only the author's view. The Innovation and Networks Executive Agency (INEA) is not responsible for any use that may be made of the information it contains.

Average annual growth rate of bioenergy in Ukraine

16%



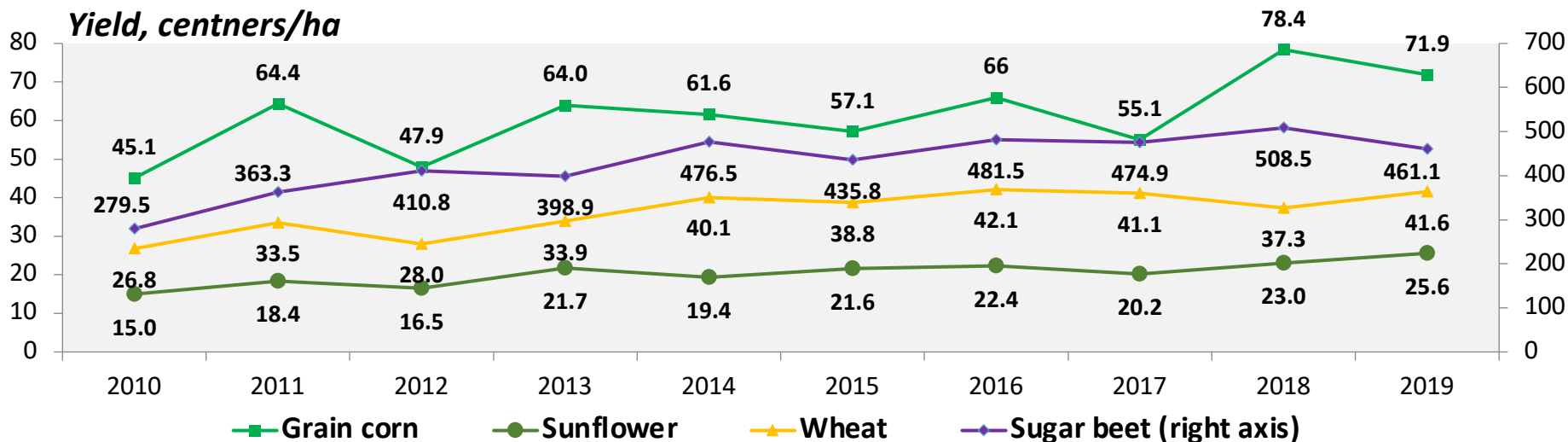
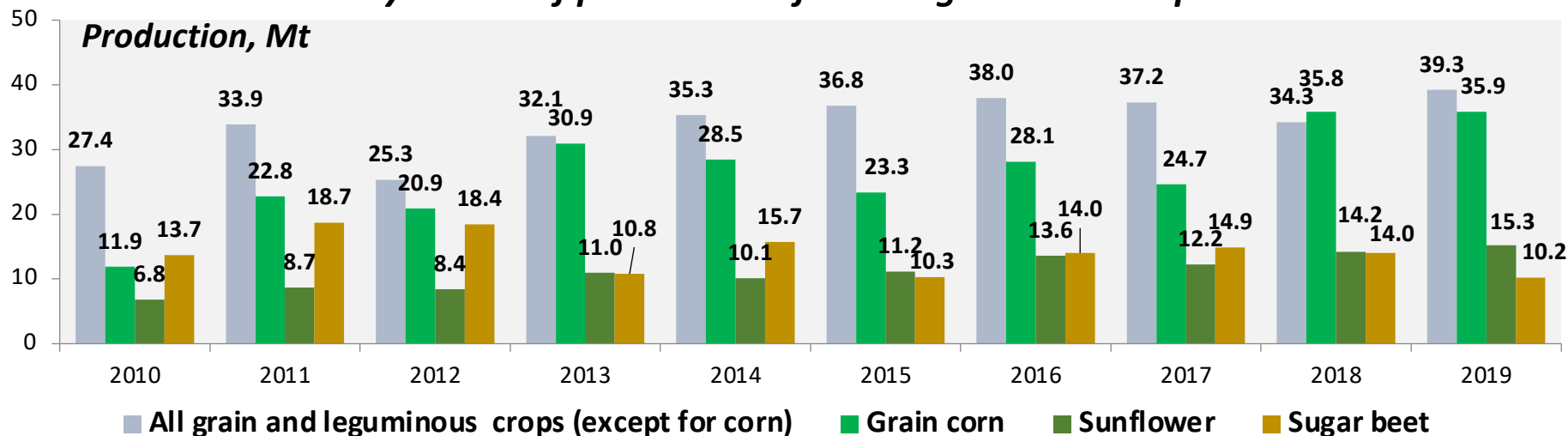
Source: State Statistics Service of Ukraine

Type of biomass	Theoretical potential, Mt	Potential available for energy (economic potential)	
		% of the theor. potential	Mtoe
Straw of grain crops	32.8	30	3.36
Rapeseed straw	4.9	40	0.68
By-products of grain maize production (stalks, cobs)	46.5	40	3.56
By-products of sunflower production (stalks, heads)	26.9	40	1.54
Secondary agricultural residues (sunflower husk)	2.4	100	1.00
Wood biomass (fuel wood, felling residues, wood processing waste)	8.8	96	2.06
Wood biomass (deadwood, wood from shelterbelt forests, biomass from agrarian plantations pruning and removal)	8.8	45	1.02
Biodiesel (from rapeseed)	-	-	0.39
Bioethanol (from maize and sugar beet)	-	-	0.82
Biogas from waste and by-products of the agro-industrial complex	2.8 bln m ³ CH ₄	42	0.99
Landfill gas	0.6 bln m ³ CH ₄	29	0.14
Sewage gas (industrial and municipal wastewater)	0.4 bln m ³ CH ₄	28	0.09
Energy crops:			
- willow, poplar, miscanthus (on 1 Mha of unused agricultural land)	11.5	100	4.88
- maize for biogas (on 1 Mha of unused agricultural land)	3.0 bln m ³ CH ₄	100	2.57
Total	-	-	23.10

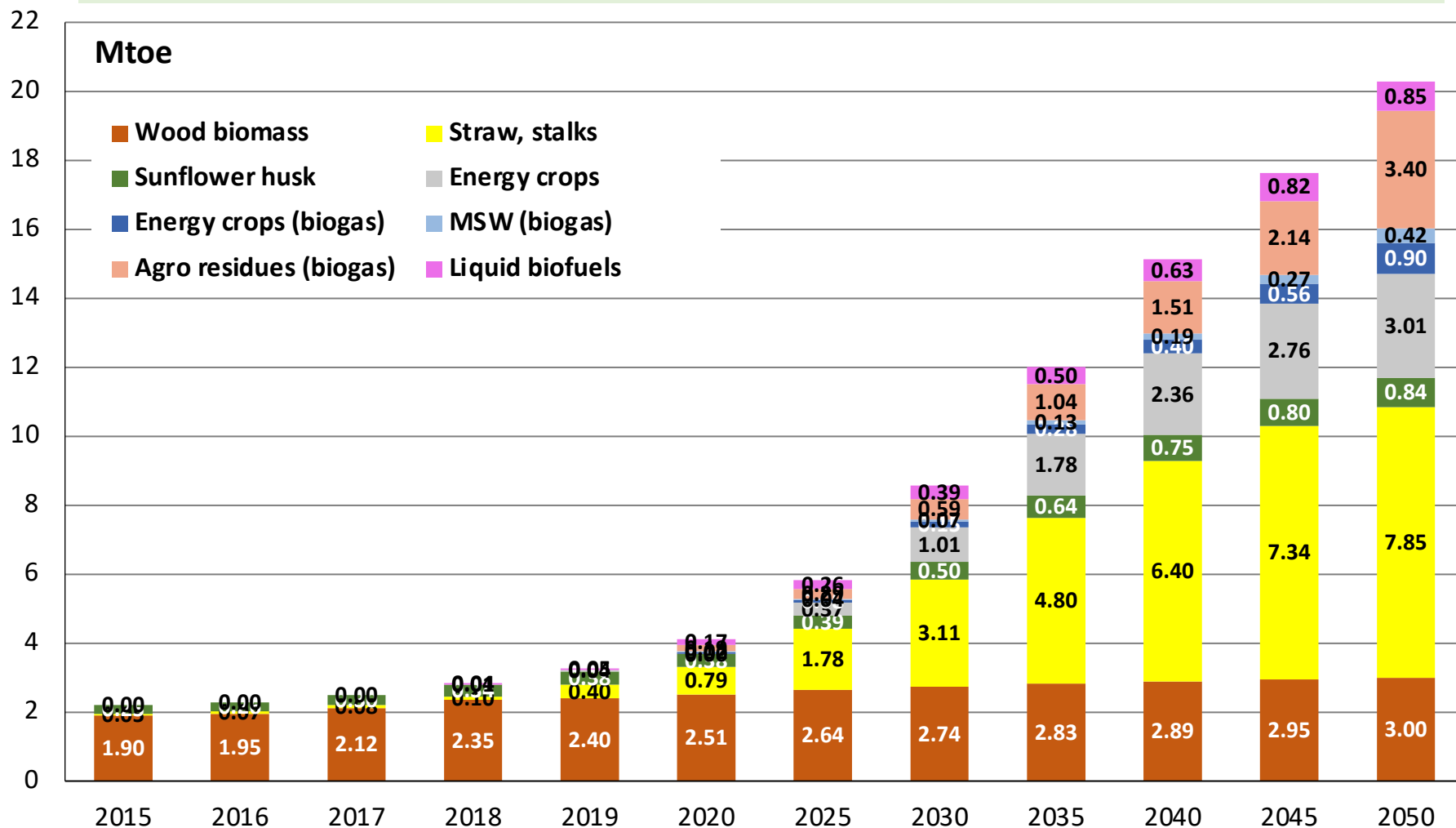
44%

32%

Dynamics of production of main agricultural crops in Ukraine



The forecast is according to the Roadmap for bioenergy development in Ukraine until 2050 elaborated by UABIO <https://uabio.org/en/materials/9115/>



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Year	Installed capacity of bioenergy equipment		Consumption of biofuels* Mtoe	Replacement of NG bln m ³	Replacement of petrol and diesel Mt	Reduction of CO ₂ emission Mt/yr	Investments, bln EUR		Creation of new jobs
	MW _{th}	MW _{el}					min	max	
2020	8206	202	3.77	4.34	0.17	8.90	1.52	2.52	16914
2025	12276	844	5.83	6.35	0.25	14.31	3.73	6.06	31438
2030	19087	1846	8.57	9.11	0.39	21.35	7.07	11.44	54302
2035	30237	2804	12.01	12.62	0.50	30.37	10.78	17.43	86237
2040	39338	3609	15.13	15.77	0.67	38.66	14.15	22.85	115439
2045	45351	4299	17.64	17.98	0.96	45.79	16.94	27.38	139013
2050	49655	5230	20.28	19.92	1.23	54.40	19.70	31.81	162710

**Including liquid and gaseous biofuels for transport.*

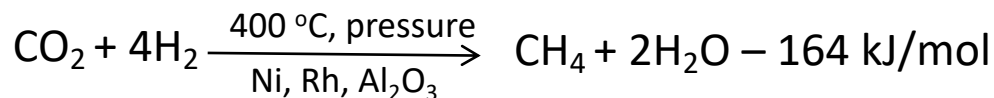
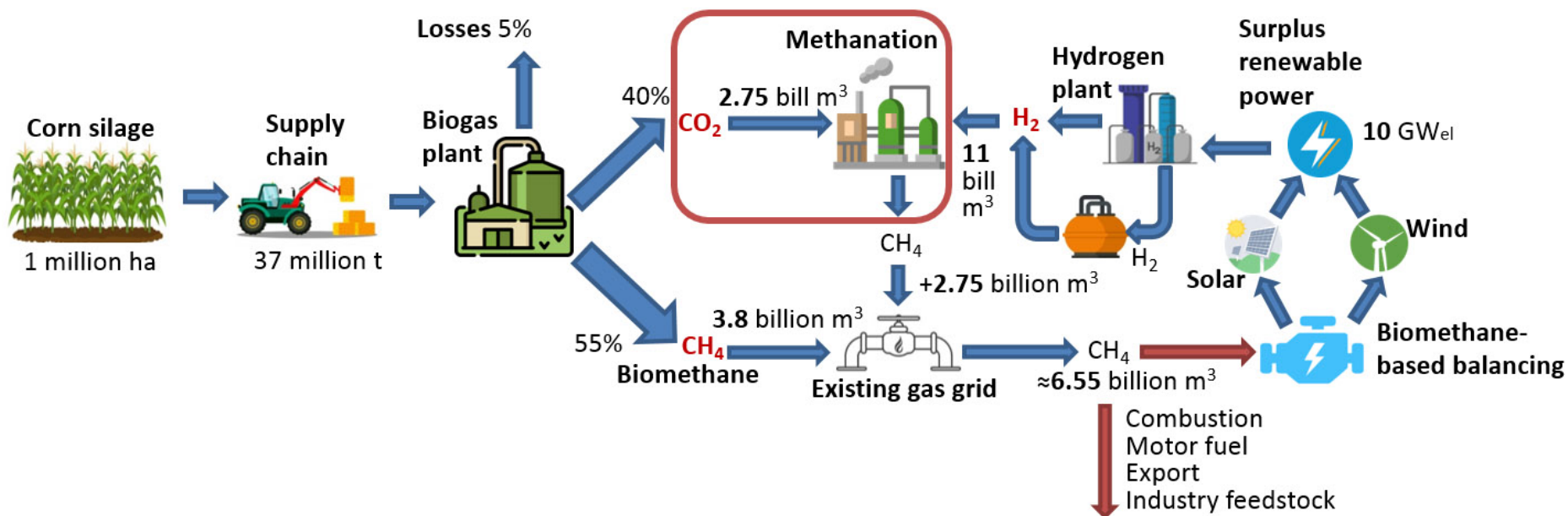
Collection, treatment, sale of agribiomass	1) Collection, baling, sale of wheat straw (yield is 4.5 t d.m./ha; corn stalks (yield is 3.5 t d.m./ha)			2) Production and sale of agribiomass pellets on Ukrainian market	
Investments	wheat straw: 254 th. €*; corn stalks: 280 th. €*			2.6 million € (productivity: 5 t/h)	
IRR	wheat straw: 27% ; corn stalks: 24%			corn stalks: 19.3%*** ; sunflower husk: 36%	
Simple payback period (PBP)	wheat straw: 4.4 years; corn stalks: 4.7 years			corn stalks: 5.2 years*** sunflower husk: 2.8 years	
Energy production from agribiomass	3) Boiler plant on straw bales	4) CHP plant on straw bales	5) Boiler plant on corn stalks	6) CHP plant on corn stalks	7) Thermal power plant on corn stalks
Investments**	2.5 mill EUR	23.1 mill EUR	2.2 mill EUR	16.2 mill EUR	15.9 mill EUR
IRR	28%	17%	32%	26%	16%
Simple PBP	3.4 years	5.1 years	3.1 years	3.7 years	5.3 years
	8) Boiler plant on sunflower husk pellets	9) CHP plant on sunflower husk pellets	10) Biogas plant on sugar beet pulp	11) Biogas plant on maize silage (80%) and manure (20%)	12) Production of II-gen. bioethanol from straw/stalks
Investments**	1.4 mill EUR	16.2 mill EUR	11.2 mill EUR	25.9 mill EUR	105 mill EUR
IRR	53%	26%	18.8%	21.8%	27% (sale on the European market)
Simple payback period	1.9 years	3.6 years	5.2 years	4.5 years	3.8 years (sale on the European market)

* Taking into account the share of the equipment usage time. ** Boiler plant: 10 MW, CHP plant: 6 MW_e+18 MW_{th}, TPP: 6 MW_e, biogas plant: 3 MW_e (pulp), 10 MW_e (silage + manure), bioethanol production: 55 kt/yr. *** Sale price of the pellets: 90 EUR/t with VAT.

Chemical composition and properties of different types of biomass

Parameters	Yellow straw	Grey straw	Straw of winter wheat	Corn stalks*	Sunflower stalks*	Wood chips
Moisture, %	10-20	10-20	11.2	45-60 (after harvesting) 15-18 (air dried)	60-70% (after harvesting) ~20 (air dried)	40
Lower heating value, MJ/kg	14.4	15	14.96	16.7 (d.m.) 5-8 (W 45-60%) 15-17 (W 15-18%)	16 (W<16%)	10.4
Volatile components, %	>70	>70	80.2	67	73	>70
Ash, %	4	3	6.59	6-9	10-12	0.6-1.5
Elementary composition, %:						
carbon	42	43	45.64	45.5	44,1	50
hydrogen	5	5.2	5.97	5.5	5.0	6
oxygen	37	38	41.36	41.5	39.4	43
chlorine	0.75	0.2	0.392	0.2	0.7-0.8	0.02
potassium (alkali metal)	1.18	0.22	–	cobs: 6.1 mg/kg d.m.	5.0	0.13-0.35
nitrogen	0.35	0.41	0.37	0.69; 0.3	0.7	0.3
sulphur	0.16	0.13	0.08	0.04	0.1	0.05
Ash melting temperature, °C	800-1000	950-1100	1150	1050-1200	800-1270	1000-1400

W – moisture. * Volatile components, ash, and elementary composition are given as d.m. (dry matter) mass %.



Boilers UTEM of 150-860 kW for straw bales provide heat supply for agricultural enterprises, farms, schools and other educational institutions

<http://utem-bioenergy.com/>



Boiler RAU-2-301 (250 kW)

Heat generators BRIG of 500 kW and 650 kW for straw bales are used as part of grain drying complexes

<http://www.brig-zerno.com.ua/uk/produksiia>



Heat generator TGS-500 (500 kW)

Heat generator TGS-650 (650 kW)



The largest in Ukraine biomass TPP started operation in Dnipro city in summer 2020.

Installed capacity: 16 MW_{el}

Location: Near the Potoky oil extraction plant.

Fuel: sunflower husk and sunflower husk pellets.

Equipment:

- two steam boilers of 35 t/h each manufactured by “Kotloenergoproekt” (Ukraine);
- turbogenerator Siemens of 16 MW_{el} ;
- two electrostatic precipitators.

Environmental performance of the boilers:

NO_x - 100 ppm; CO - 50 ppm; dust – 20 mg/m³.

Efficiency of the boilers is 90%.

Load control range is 30% to 110%.



Private Enterprise "Briquetting Technologies" (Ukraine, Zhytomyr region; UABIO's member) has been manufacturing biomass briquetting/pelletizing presses, drying and crushing equipment for more than 10 years.

Briquettes and pellets can be produced from agricultural and forest biomass, processing residues and waste.

The number of produced and installed equipment exceeded **630 units**, including **236 projects implemented in Ukraine** and 220 projects in Romania. Many of the projects use different types of agrobiomass: sunflower husk, straw, corn stover, grain residues, miscanthus.

Equipment:

- mechanical briquetting presses with productivity 150 to 1000 kg/hr;
- pelletizing presses with productivity 200 to 1200 kg/hr;
- straw bales shredders;
- airflow dryers.



“Oril-Leader” biogas complex (agro-holding MHP)

Type of the project: Biogas plant of 5.7 MW_{el} installed capacity started its operation in 2013.

Location: battery farm “Oril-Leader”
(Dnipropetrovsk region).

Main indices of the biogas complex operation for 2013-2018:

- Chicken litter utilized – 300 000 tonnes
- Sewage utilized – 700 000 m³
- Biogas produced – 100 million m³
- Electricity generated – 200 million kWh
- GHG emission reduction – 700 000 t of CO_{2-eq.}

Biogas is used for the production of electricity and heat. About 95% of the generated electricity is sold to the power grid by "green" tariff; the rest is used for own needs of the enterprise. The produced heat is utilized for the heating of offices and poultry-houses, production of hot water.



Biogas complex at Vinnytsia battery farm (agro-holding MHP)

Type of the project: Biogas plant of 24 MW_{el} total installed capacity. The first unit of the plant of 12 MW_{el} was put into operation in 2019; the second unit is under construction.

Location: Vinnytsia battery farm (Vasylivka village, Vinnytsia region).

Biogas is used for the production of power and heat.

Main indices of the 1st unit of the biogas complex:

- Processing of chicken litter – 460 t/day
- Production of power – 870,00 MWh/yr
- GHG emission reduction – 100 kt of CO_{2-eq.}/yr
- Investment – 27 million USD.



Sector	Instrument	Eligible technologies	Start year / Period of validity	Key figures
Power production	Feed-in tariff (Green Tariff)	RES plants except for those that are obliged to take part in auctions	2009 / Until 31.12.2029	12.39 €cents/kWh without VAT for biomass and biogas
Power production	Auctions on the state support for power production from RES	Obligatory participation for: <ul style="list-style-type: none"> • New wind plants >5 MW • New solar plants >1 MW • Biomass and biogas plants that started operation from 01.01.2023. Voluntary participation for other RES plants	2021* / 20 years from the date of providing documents that confirm the readiness for operation and connection to the power network. <i>* Planned, but actually not started yet</i>	
Heat production	Incentive tariff. Simplified procedure for setting the tariff.	RES	2017 / Unlimited	0.9 × gas-based heat tariff for population and public organizations.



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Thank you for your attention!

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