



## **PROSPECTS FOR THE DEVELOPMENT OF BIOENERGY AS AN INSTRUMENT FOR NATURAL GAS REPLACEMENT IN UKRAINE**

UABio Position Paper N 12

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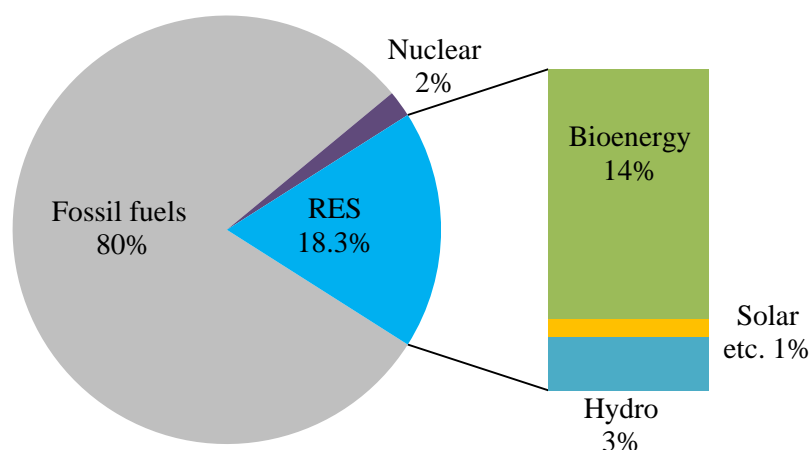
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## Introduction

UABio's Position Paper N 12 covers issues related to the state of the art, support mechanisms and prospects for bioenergy development in Ukraine. The document reflects potentialities of bioenergy as an effective instrument for the replacement of natural gas for heat production in Ukraine. Especial attention is paid to the relevant legislative issues. The Paper includes forecast for increase in the installed capacity of bioenergy equipment in different sectors (population, industry, housing-communal and budget-financed sectors) by 2020 and also assessment of the respective demand of biofuels by type.

## State of the art of bioenergy development in the world

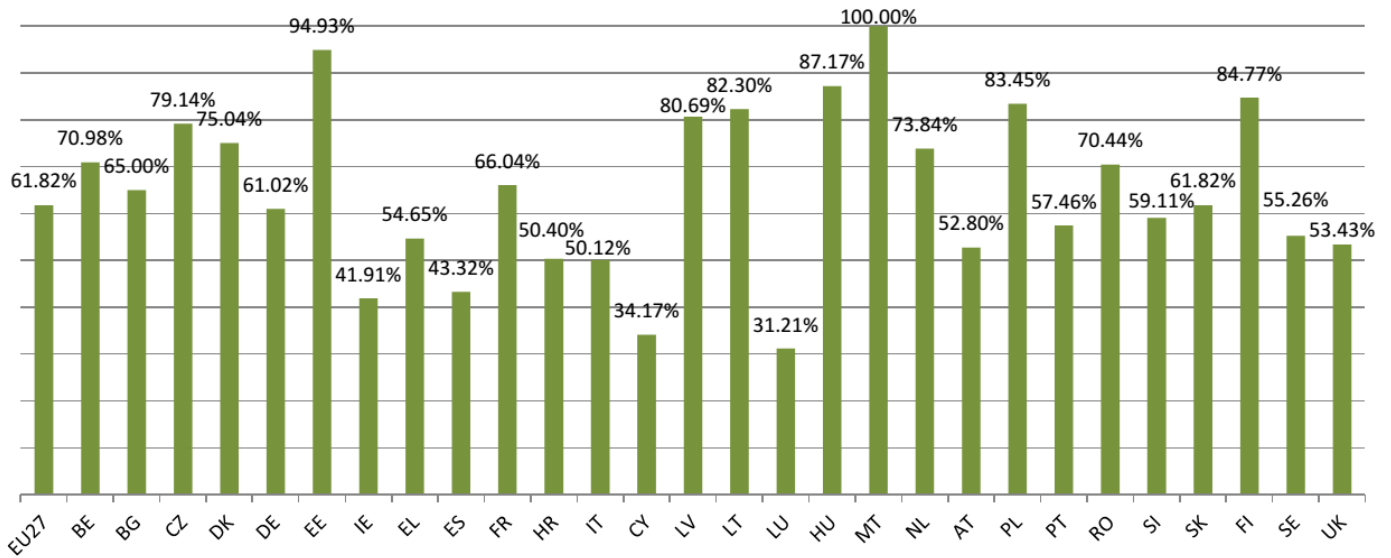
By now renewable energy sources have become rather important part of the world energy. In 2011 their contribution to the gross final energy consumption exceeded 18% including that of biomass 14% or 76% of the contribution of all RES (**Fig. 1**) [1].



**Fig. 1.** Structure of the world gross final energy consumption (in total 339,000 PJ), 2011 [1]

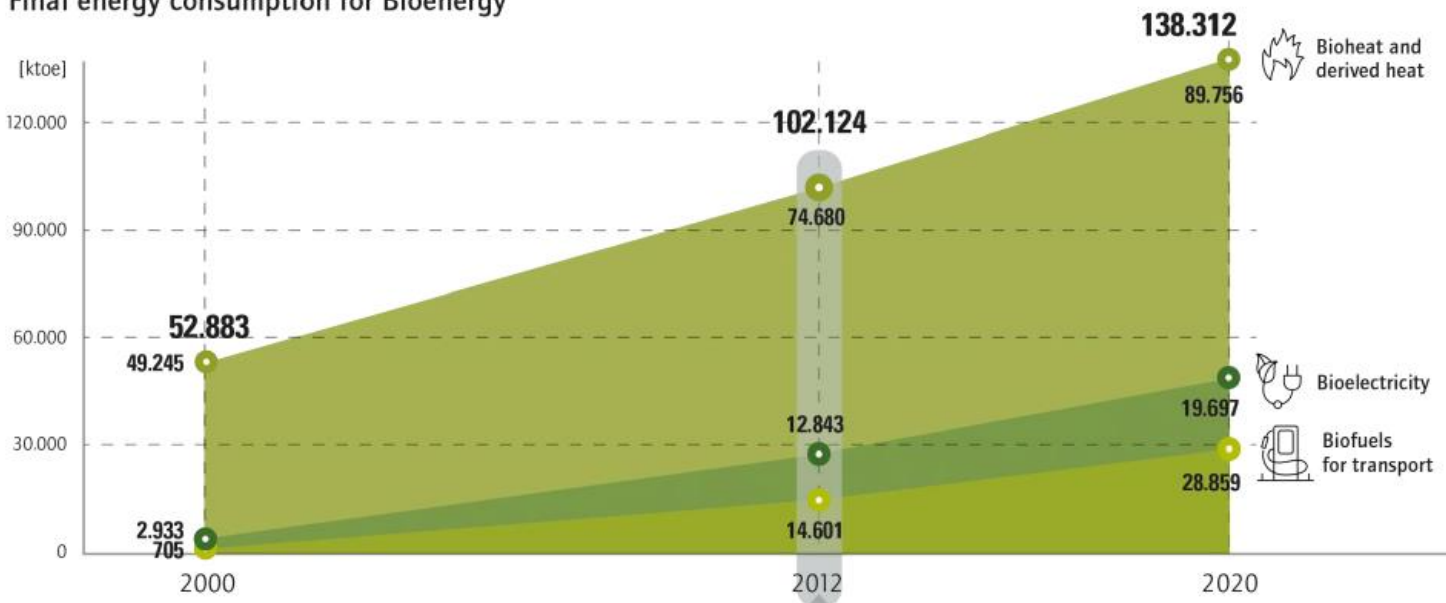
In the European Union the situation is similar: the share of RES in the gross final energy consumption is 15% (2013) including that of biomass about 9% or 62% of the contribution of all RES. In some EU countries the share of biomass in all renewables ranges from 30-40% (Luxemburg, Cyprus, Ireland) to 80-95% (Estonia, Latvia, Lithuania, Hungary, Poland, Finland) (**Fig. 2**) [2]. By 2020 the contribution of RES to the EU's gross final energy consumption is to reach 20% (the binding target), and by 2030 it may rise at least to 27% (a new binding target set by the Council of the European Union in October 2014).

In absolute units, the contribution of biomass to the EU's GFEC is 102 Mtoe (2012) that is almost twice as much as in 2000. At that the lion share of it (74.7 Mtoe) relates to production of heat, second place is occupied by motor biofuels (14.6 Mtoe), and the lowest figure is for electric power sector (12.8 Mtoe) (**Fig. 3**) [3].



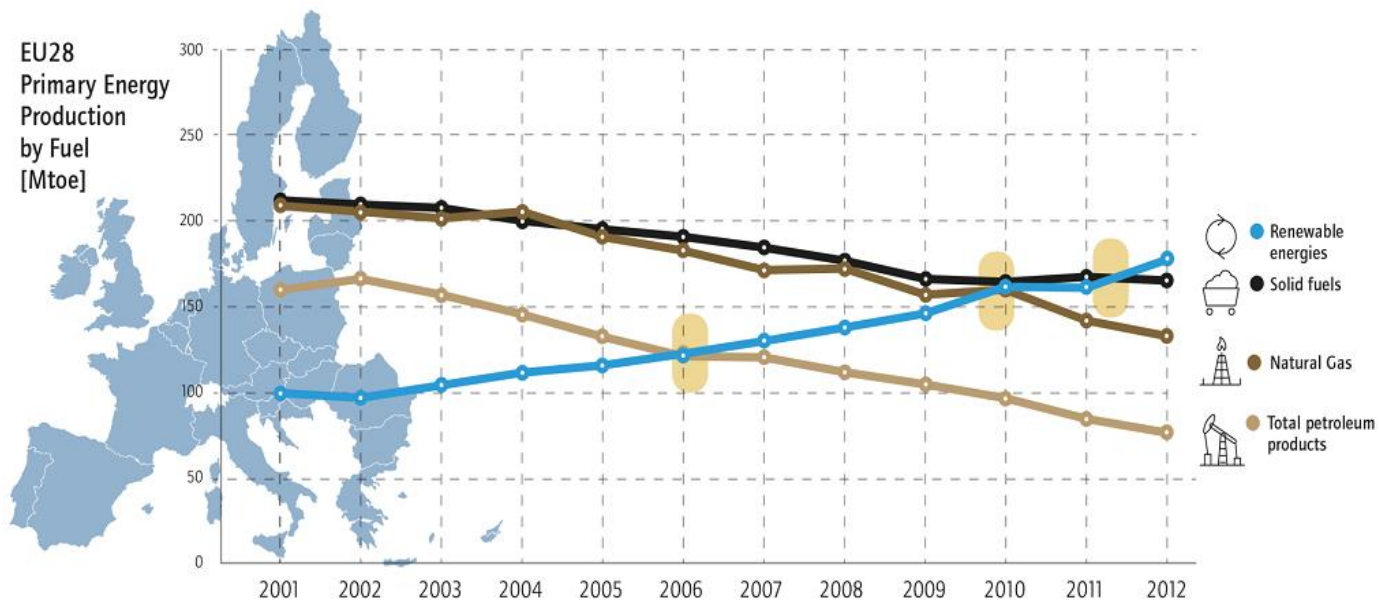
**Fig. 2.** Share of bioenergy in all RES in the EU's final energy consumption [2]

**Final energy consumption for Bioenergy**



**Fig. 3.** Final energy consumption for bioenergy [3]

Dynamics of the primary energy production by fuel in the EU since the beginning of the century is also worth attention (**Fig. 4**). It reflects some positive results of a consistent policy of the EU countries aimed at reducing fossil fuels consumption and developing renewable energy. Owing to that in 2012 the production of primary energy from RES ran up to 177 Mtoe and exceeded that for coal (167 Mtoe), natural gas (133 Mtoe) and petroleum products (77 Mtoe). One can expect the tendency to continue in the future.



**Fig. 4.** EU 28 primary energy production by fuel [3]

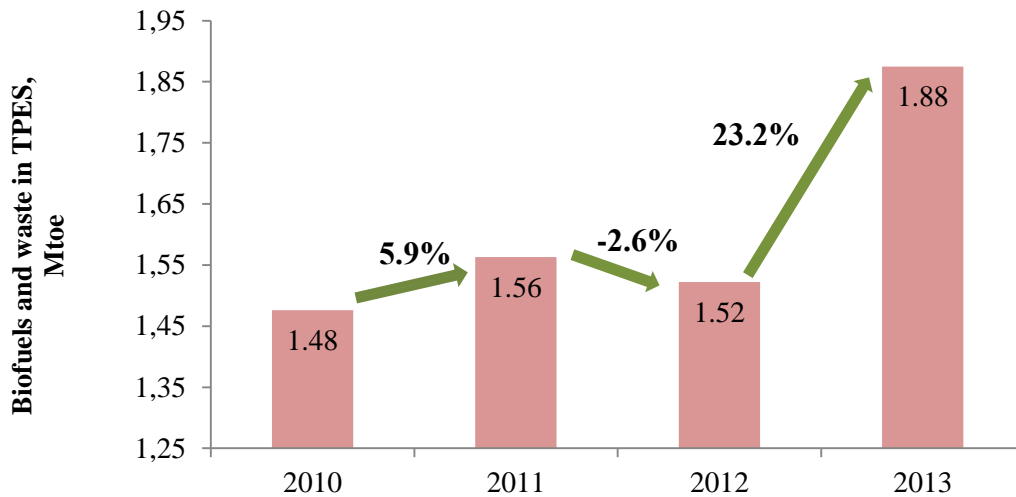
### State of bioenergy development in Ukraine and opportunities for natural gas replacement until 2020

Let us compare the presented above data with situation in Ukraine. According to Ukraine's energy balance for 2013 developed by the State Statistics Service [4], RES share in the gross final energy consumption was 3.62% including that of biomass 2.28% that was 63% of the contribution of all RES or 1.61 Mtoe (**Table 1**). As compared with 2012, one can see a considerable rise in biomass contribution to the total primary energy supply, by 23% from 1.52 to 1.88 Mtoe/yr (**Fig. 5**). For 2014 we forecast even more increase due to existing urgent need to replace natural gas by alternative fuels and implement some supporting measures.

**Table 1.** Contribution of RES to the energy balance of Ukraine

Indexes	2010	2011	2012	2013
RES share in the total primary energy supply	2.00%	1.99%	2.02%	2.73%
RES share in the gross final energy consumption*	2.98%	2.80%	2.95%	3.62%
Biofuels/waste in the total primary energy supply, Mtoe	1.48 (1.12%)	1.56 (1.23%)	1.52 (1.23%)	1.88 (1.62%)
Biofuels/waste in the gross final energy consumption*, Mtoe	1.40 (1.86%)	1.45 (1.88%)	1.47 (1.99%)	1.61 (2.28%)
Share of biofuels/waste in all RES in the gross final energy consumption*	62%	67%	68%	63%

\* Authors' estimation based on the official energy balance of Ukraine for 2010-2013.



**Fig. 5.** Primary energy supply from biomass and waste in Ukraine

The National Renewable Energy Action Plan sets the general target for renewables by 2020, namely 11% of RES in the gross final energy consumption according to obligation of Ukraine as a member of the Energy Community. Biomass is an important part of RES, and according to NREAP its main contribution is planned in the heating/cooling sector: 5000 ktoe/yr in 2020 that will be 85% of contribution of all RES (**Table 2**) [5]. In addition, by 2020 it is planned to install 950 MWe of biomass power equipment and to use 390 ktoe/yr of biofuels (bioethanol and biodiesel) for transport.

**Table 2.** National indicative target for RES in GFEC until 2020 and the calculated path for reaching it [5]

Indexes	2009	2014	2015	2016	2017	2018	2019	2020
RES: heat production, %,	3.4	5.7	6.7	7.7	8.9	10.0	11.2	12.4
- including biomass, ktoe	1433	2280	2700	3100	3580	4050	4525	5000 (85%*)
RES: power production, %,	7.1	7.6	8.3	8.8	9.7	10.4	10.9	11.0
- including biomass, MWe:	0	40	250	380	520	650	780	950
solid biomass		28	175	260	360	455	540	660 (12%*)
biogas		12	75	120	160	195	240	290 (5%*)
RES: transport, %,	1.5	4.1	5.0	6.5	7.5	8.2	9.0	10.0
- including biofuels (bioethanol, biodiesel), ktoe	0	110	150	220	265	300	340	390 (77%*)
<b>Total RES share in GFEC, %</b>	<b>3.8</b>	<b>5.9</b>	<b>6.7</b>	<b>7.4</b>	<b>8.3</b>	<b>9.1</b>	<b>10.1</b>	<b>11.0</b>

\* Biomass share in all RES in the respective sector (assessed by the authors).

The presented figures on energy production from biomass in 2020 correspond to the replacement of natural gas in the amount of 6.25 billion m<sup>3</sup>/yr in the heat sector and 0.95 billion m<sup>3</sup>/yr in the power sector (assuming that 90% of power plants on solid biomass will operate as CHP plants). Subtracting the value of already achieved replacement of natural gas by biomass (1.93 billion m<sup>3</sup>/yr) from the total planned replacement (7.2 billion m<sup>3</sup>/yr) we obtain the volume of NG (5.27 billion m<sup>3</sup>/yr) that additionally must be replaced by biomass by 2020 in accordance with NREAP.

For achieving the set goal Ukraine has a sufficient potential of biomass available for energy, over 27 Mtce/yr (data for 2013) (**Table 3**). Main constituents of the potential are primary agricultural residues (straw, grain maize/sunflower residues) and energy crops, industrial production of which has been actively developing lately. Total economic potential of agro-residues is 12.2 Mtce/yr, the potential of energy crops is 10 Mtce/yr.

**Table 3.** Biomass energy potential (2013)

Biomass type	Theoretical potential, Mt	Share available for energy, %	Economic potential, Mtce
Straw of grain crops	30.6	30	4.54
Straw of rape	4.2	40	0.84
Grain maize residues (stalks, cobs)	40.2	40	4.39
Sunflower residues (stalks, heads)	20.9	40	1.72
Secondary agro-residues (husk, bagasse)	6.8	63	0.69
Wood biomass (firewood, felling residues, woodworking residues)	4.6	96	1.97
Biodiesel (from rapeseed)	-	-	0.47
Bioethanol (from maize and sugar beet)	-	-	0.99
Biogas from waste and byproducts of agro-industrial complex	1.6 billion m <sup>3</sup> of methane (CH <sub>4</sub> )	50	0.97
Landfill gas	0.6 billion m <sup>3</sup> CH <sub>4</sub>	34	0.26
Sewage gas (from industrial and municipal waste water)	1.0 billion m <sup>3</sup> CH <sub>4</sub>	23	0.27
Energy crops:			
- willow, poplar, miscanthus	11.5	90	6.28
- maize (for biogas)	3.3 billion m <sup>3</sup> CH <sub>4</sub>	90	3.68
Peat	-	-	0.40
<b>Total</b>	-	-	<b>27.47</b>

At present only about 10% of the biomass potential (2.7 Mtce/yr) is used for energy in Ukraine (**Table 4**). Mostly it is wood biomass in the form of firewood, chips, pellets/briquettes (on the whole that makes up 86% of the total annual use of biomass for energy) and sunflower husk (8%). Least active is utilizing plant residues for energy, 94 kt/yr of straw that is <1% of the economic potential of straw in Ukraine.

At present there are over 4,000 modern wood fired boilers, over 100 straw fired boilers and about 70 boilers on sunflower husk operating in Ukraine. There are also several CHP plants in operation: one wood plant works in a DH system, three husk plants operate in fat and oil industry. In addition, the population uses several tens of thousands of ovens and domestic boilers for firewood and wood pellets. Total installed capacity of the mentioned bioenergy equipment is 3670 MW<sub>th</sub> plus 14 MW<sub>e</sub> (**Table 5**).



**Table 4.** Use of biomass for energy in Ukraine (2013)

Type of biomass / biofuel	Annual consumption*		Share in the annual consumption	Percentage of utilized economic potential
	natural units	ktce		
Straw of grain crops and rape	94 kt	48	1.8%	0.9%
Firewood (for population)	5.0 mill m <sup>3</sup>	1200	45.1%	>90%
Wood biomass (except for consumption by population)	3.2 Mt	1089	40.9%	
Sunflower husk	380 kt	208	7.8%	41%
Bioethanol	65 kt	60	2.3%	6.1%
Biodiesel	18 kt	23	0.9%	4.8%
Biogas from agricultural waste	22.3 mill m <sup>3</sup>	14	0.5%	4.4%
Landfill gas	31.2 mill m <sup>3</sup>	21	0.8%	8.1%
<b>Total</b>		<b>2662**</b>	<b>100%</b>	

\* Exports of biomass pellets/briquettes is not taken into account.

\*\* It is in line with data of the State Statistics Service of Ukraine: 2.68 Mtce in 2013 [4]

**Table 5.** Energy production from biomass in Ukraine (2013)

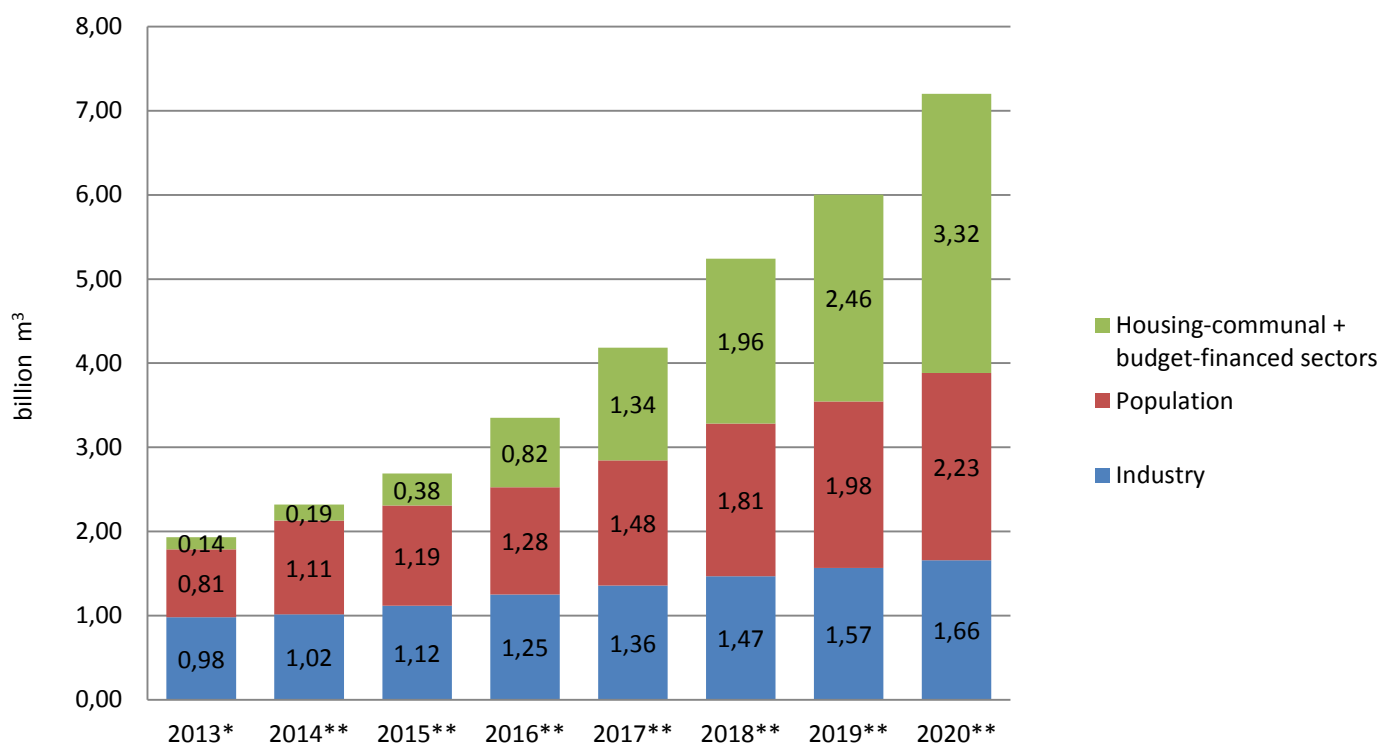
Sector / Type of equipment	Units	Installed capacity, MW <sub>th</sub> (+ MW <sub>e</sub> )	Replacement of NG, bill m <sup>3</sup> /yr	Production of heat, Tcal/yr	Reduction of CO <sub>2</sub> emission, Mt/yr
<i>Population:</i>					
Traditional wood ovens	50000	500	0.20	1718	0.40
Domestic boilers for firewood and wood pellets, 10-50 kW <sub>th</sub>	50000	1500	0.61	5155	1.19
<i>Total for population</i>	<i>100000</i>	<i>2000</i>	<i>0.81</i>	<i>6873</i>	<i>1.59</i>
<i>Housing-communal sector and budget-financed sector:</i>					
Wood boilers, 0.5-10 MW <sub>th</sub>	690	345	0.14	1186	0.27
Wood CHP plants	1	10 (+6)	0.004	69	0.01
<i>Total for housing-communal sector and budget-financed sector</i>	<i>691</i>	<i>355 (+6)</i>	<i>0.144</i>	<i>1255</i>	<i>0.28</i>
<i>Industrial / commercial consumers</i>					
Wood boilers, 0.1-5 MW <sub>th</sub>	2000	1000	0.76	6874	1.50
Straw boilers, 0.1-1 MW <sub>th</sub>	110	55	0.04	378	0.08
Sunflower husk boilers	65	195	0.15	1340	0.29
Sunflower husk CHP plants	3	64 (+8)	0.02	437	0.05
<i>Total for industrial / commercial consumers</i>	<i>2178</i>	<i>1314 (+8)</i>	<i>0.98</i>	<i>9029</i>	<i>1.92</i>
<b>Total</b>	<b>102869</b>	<b>3669 (+ 14)</b>	<b>1.93</b>	<b>17157</b>	<b>3.79</b>



To replace extra 5.27 billion m<sup>3</sup>/yr of NG by biomass by 2020 it is necessary to introduce 12,485 MW<sub>th</sub> + 756 MW<sub>e</sub> for population, in the housing-communal and state-financed sectors, and for industrial and commercial consumers (**Table 6**). The biggest rise in the installed capacity of bioenergy equipment, in volumes of biomass use and therefore replacement of NG is forecasted for the housing-communal and state-financed sectors, by 3.18 bill m<sup>3</sup>/yr (from 0.14 bill m<sup>3</sup>/yr in 2013). Total replacement of natural gas by biomass in the sectors in 2020 is estimated at 3.32 bill m<sup>3</sup>/yr (**Fig. 6**). Population ranks second in the expected NG replacement (2.23 bill m<sup>3</sup> in 2020); the least replacement in 2020 is anticipated in the industry and commercial sector (1.66 bill m<sup>3</sup> in 2020). Dynamics of respective rise in bioenergy equipment installed capacity, creation of new jobs and greenhouse gases emission reduction at the expense of replacement of NG by biomass is presented in **Fig. 7-9**.

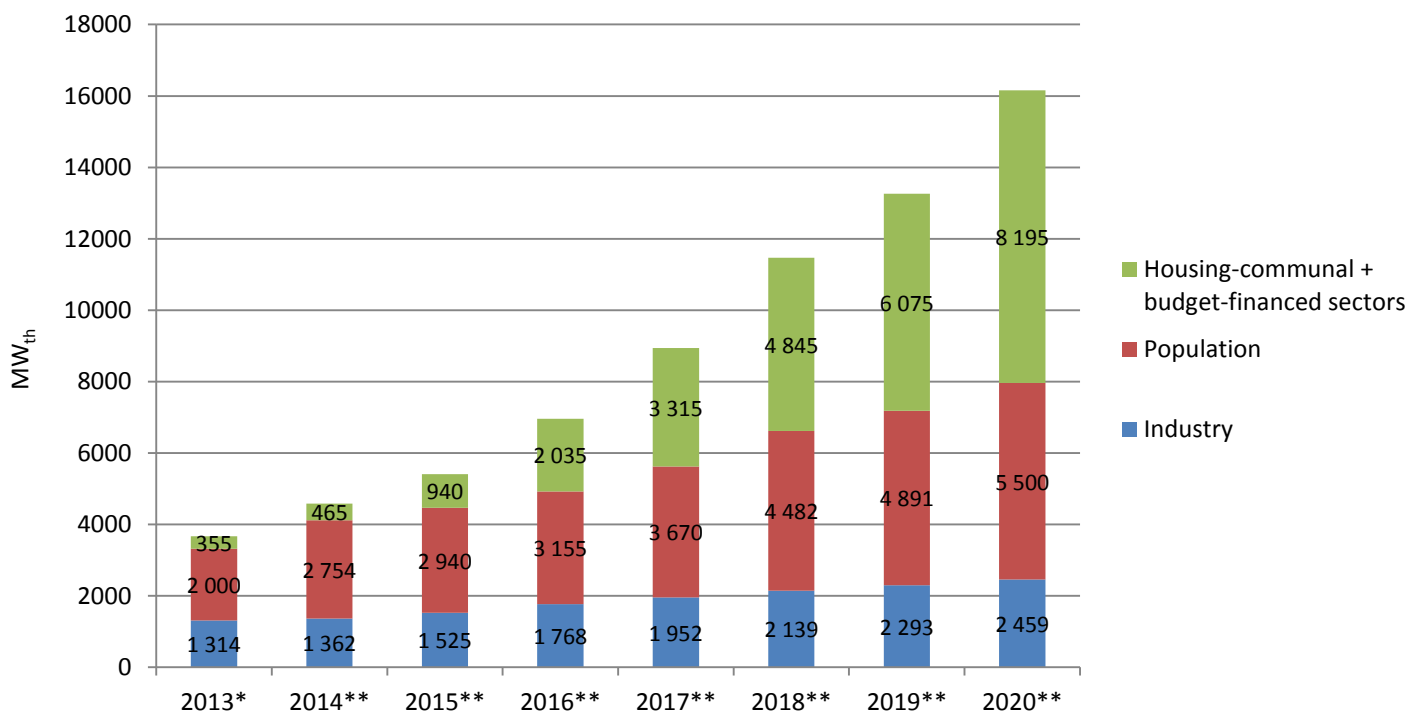
**Table 6.** Introduction of additional bioenergy equipment for energy production in Ukraine until 2020 (as compared with 2013)

Sector / Type of equipment	Units	Installed capacity, MW <sub>th</sub> (+ MW <sub>e</sub> )	Replacement of NG, bill m <sup>3</sup> /yr	Production of heat, Tcal/yr	Reduction of CO <sub>2</sub> emission, Mt/yr
<i>Population:</i>					
Domestic boilers for firewood and wood pellets, 10-50 kW <sub>th</sub>	30000	900	0.36	3093	0.71
Switchover of population from individual heating to moderately centralized DH: Boilers for straw/stalks, 1-10 MW <sub>th</sub>	1300	2600	1.05	8936	2.06
<i>Total for population</i>	<i>31300</i>	<i>3500</i>	<i>1.41</i>	<i>12029</i>	<i>2.78</i>
<i>Housing-communal sector and budget-financed sector:</i>					
Wood boilers, 0.5-10 MW <sub>th</sub>	560	280	0.11	962	0.22
Boilers for straw/stalks, 1-10 MW <sub>th</sub>	1500	3750	1.52	12888	2.97
Wood CHP plants	9	270 (+54)	0.11	1856	0.21
CHP plants on straw/stalks	50	1770 (+300)	0.72	12166	1.40
CHP plants on energy crops	50	1770 (+300)	0.72	12166	1.40
<i>Total for housing-communal sector and budget-financed sector</i>	<i>2169</i>	<i>7840 (+654)</i>	<i>3.18</i>	<i>40038</i>	<i>6.22</i>
<i>Industrial / commercial consumers</i>					
Boilers for straw/stalks, 0.1-1 MW <sub>th</sub>	1190	595	0.45	4090	0.89
Sunflower husk boilers	5	40	0.03	275	0.06
Wood CHP plants	10	300 (+60)	0.11	2062	0.22
Sunflower husk CHP plants	7	210 (+42)	0.08	1443	0.16
<i>Total for industrial / commercial consumers</i>	<i>1212</i>	<i>1145 (+102)</i>	<i>0.68</i>	<i>7870</i>	<i>1.33</i>
<b>Total</b>	<b>34681</b>	<b>12485 (+ 756)</b>	<b>5.27</b>	<b>59937</b>	<b>10.33</b>



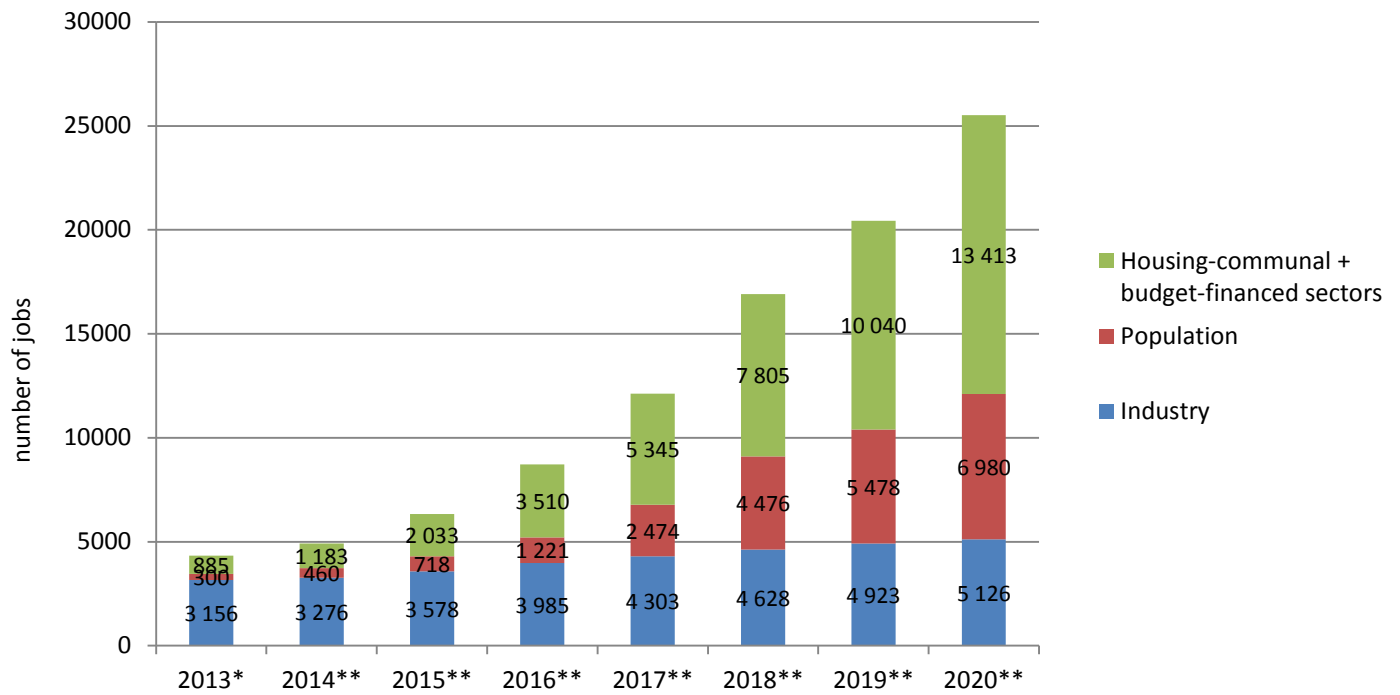
\* Estimation based on Ukraine's energy balance. \*\* Forecast based on NREAP and UABio's assumptions

**Fig. 6.** Dynamics of NG replacement by biomass in Ukraine



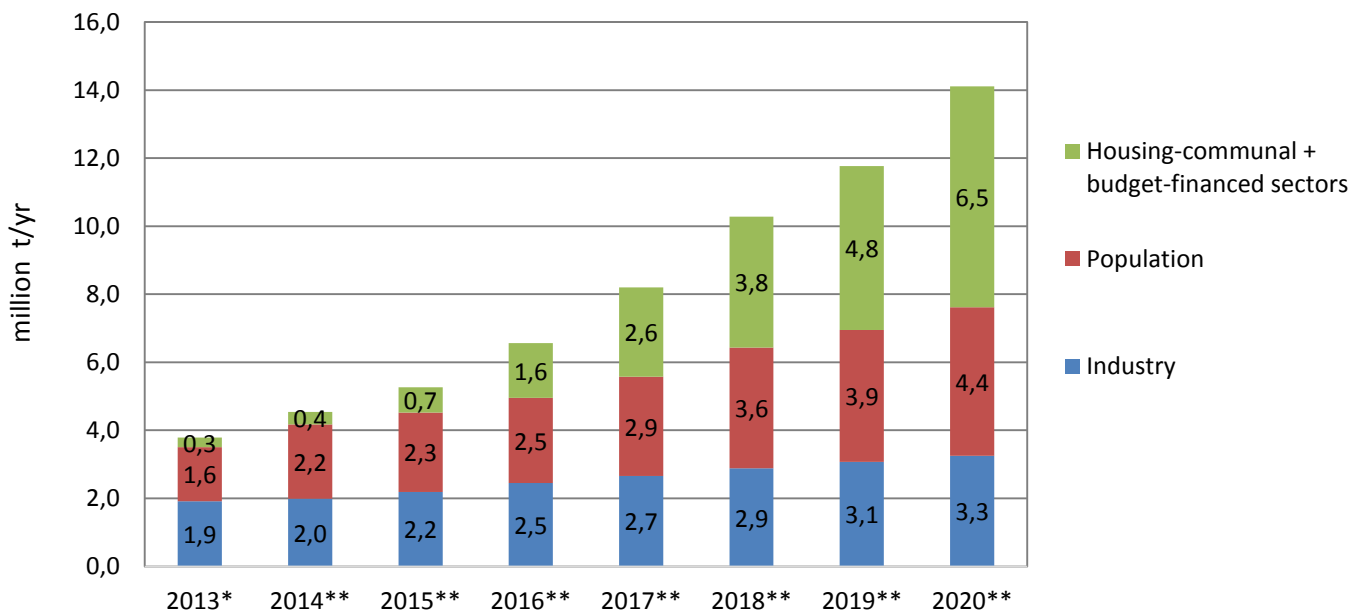
\* Estimation based on Ukraine's energy balance. \*\* Forecast based on NREAP and UABio's assumptions

**Fig. 7.** Dynamics of rise in bioenergy equipment installed capacity in Ukraine



\* Estimation based on Ukraine's energy balance. \*\* Forecast based on NREAP and UABio's assumptions

**Fig. 8.** Dynamics of the creation of new jobs at the expense of bioenergy equipment introduction in Ukraine



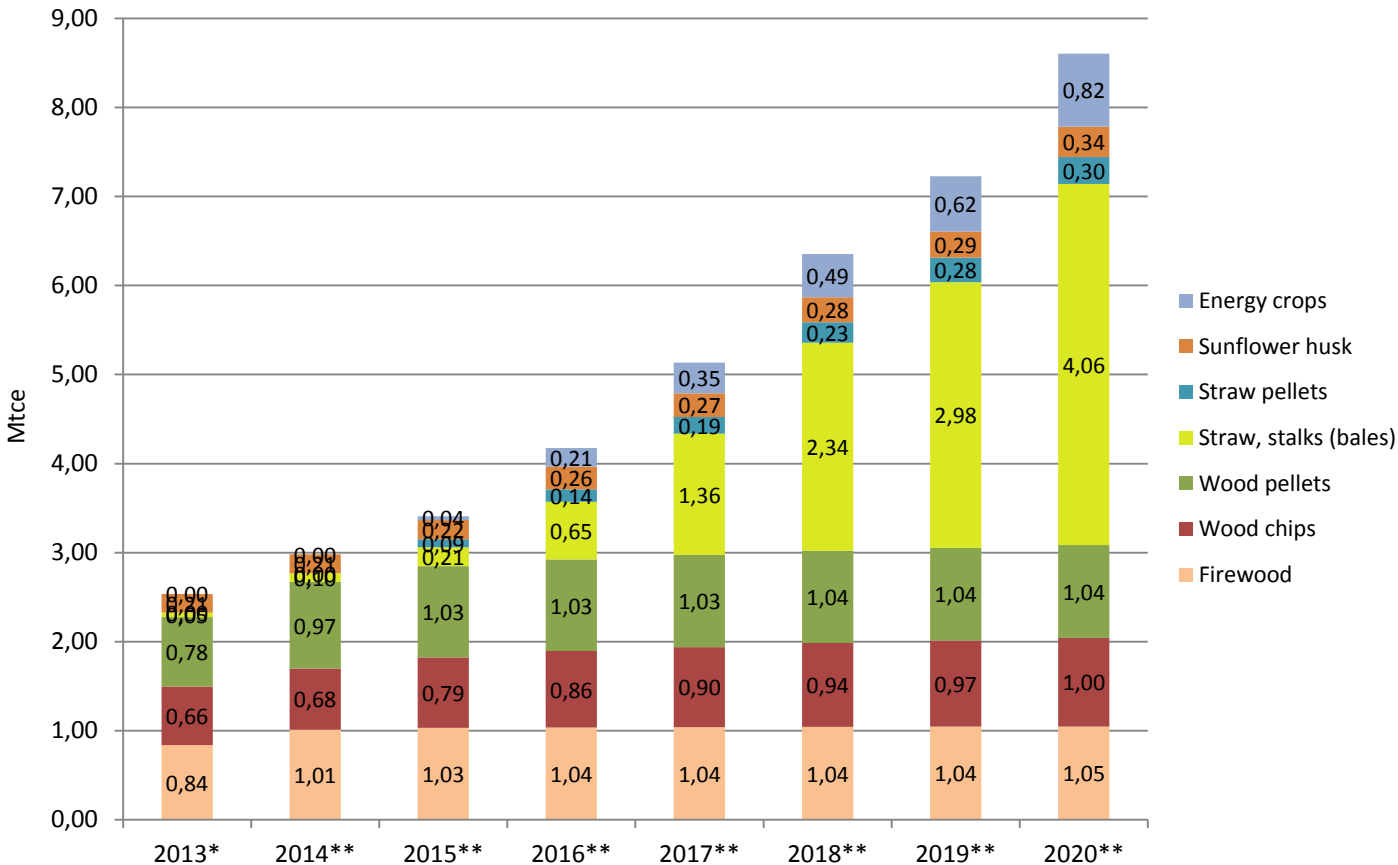
\* Estimation based on Ukraine's energy balance. \*\* Forecast based on NREAP and UABio's assumptions

**Fig. 9.** Reduction of CO<sub>2</sub> emission due to replacement of NG by biomass in Ukraine

An exceptionally important issue is providing all the planned bioenergy installations with required amount of biofuel. Assessment of quantity of the required biofuels by types is shown in **Fig. 10.**

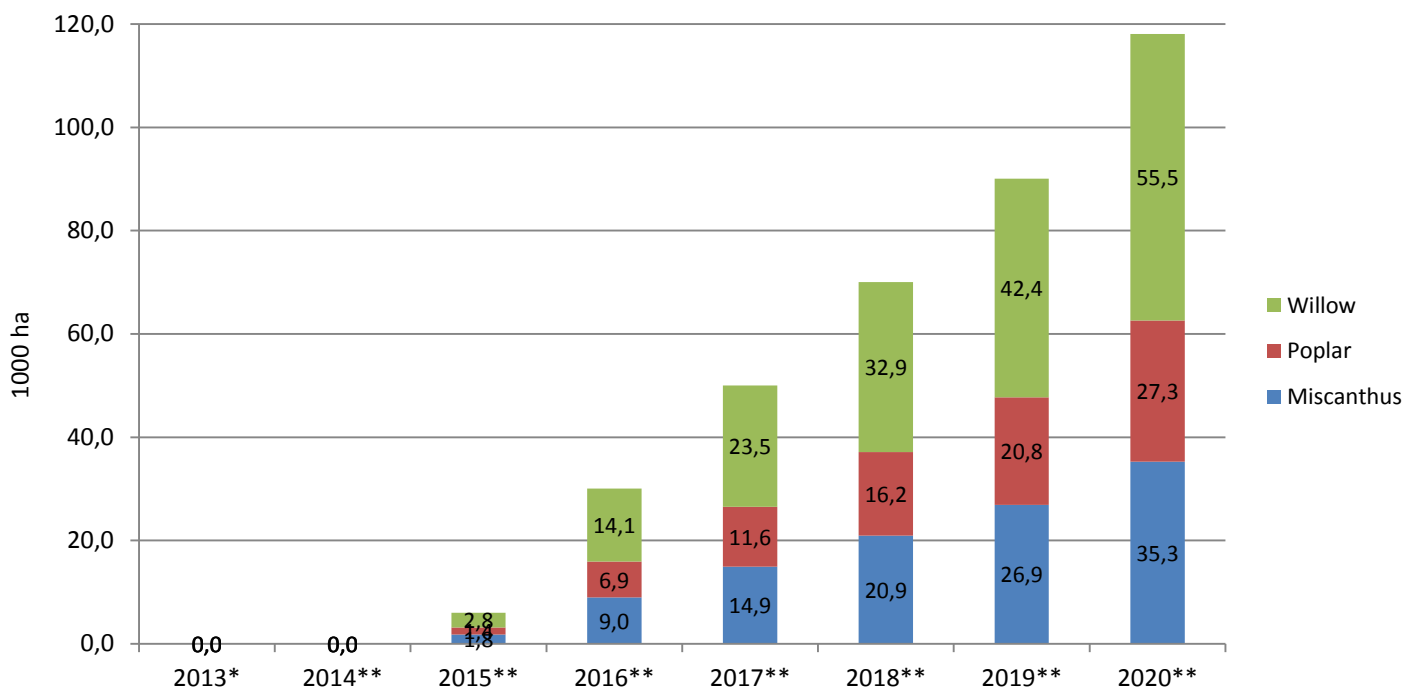
One can see that to attain the aim on biomass use for energy it is necessary to widely involve agricultural residues (straw, stalks of maize/sunflower) and energy crops in the fuel-energy balance of the country in the near future. It is predicted that about 0.82 Mtce of biomass from energy crops will be used for energy in 2020. For Ukraine’s conditions, the most suitable energy crops (for solid biofuels production) are willow, miscanthus and poplar. To obtain the required amount of solid biofuels, the area under energy crops must be over 118,000 ha in 2020 (Fig. 11). That will make up only 3% of the unused agricultural land in Ukraine.

As shown above, resources of wood biomass available for energy in Ukraine are comparatively limited and already actively used. Taking into account this fact, the presented conception for bioenergy heat sector development envisages relatively low rise in the installed capacity of equipment running on wood as compared with other biomass types (first of all agricultural residues). Nevertheless in 2020 the equipment on wood will require over 3 Mtce of wood fuel that is over 1.5 times as much as the available now potential. That is why we consider it necessary to increase the volume of wood felling in Ukraine from the current 55-60% of the annual wood increment to 85-90% as it is in a number of European countries and is considered to be environmentally friendly.



\* Estimation based on Ukraine’s energy balance. \*\* Forecast based on NREAP and UABio’s assumptions

Fig. 10. Biofuels for heat production in Ukraine by fuel type



\* Estimation based on Ukraine's energy balance. \*\* Forecast based on NREAP and UABio's assumptions

**Fig. 11.** Area under energy crops in Ukraine

### Mechanisms to promote bioenergy development in Ukraine

In 2014 there were adopted a number of governmental regulations aimed to encourage natural gas replacement with alternative fuels and energy forms, as well as to harmonize renewable energy sector of Ukraine with the EU one. The most significant documents reviewed in this section.

Mechanisms to promote natural gas replacement within the heating sector for population and budget organizations were entered by the **Cabinet of Ministers of Ukraine Resolutions No. 293** (d/d 2014/09/07) [6] and **No. 453** (d/d 2014/09/10) [7], respectively. In fact, this mechanism is an introduction of “incentive” tariffs for thermal energy produced “not from gas”.

According to the Resolution No. 293, in case of thermal energy production for population “not from gas”, the tariffs difference between thermal energy from heat generating units and thermal energy for population needs from these units is liable for compensation from the state budget.

The rate of tariffs difference compensation cannot be higher than the difference between an actual published tariff for thermal energy for population and its cost regarding the threshold profitability level of 21%. The tariff for heat manufactures “not from gas” for population needs is set for heat production at 90% of average weighted rate for public and other consumers.

It should be noted that, unfortunately, in practice, this mechanism does not work because of its weaknesses. Among the main *disadvantages* are the following:

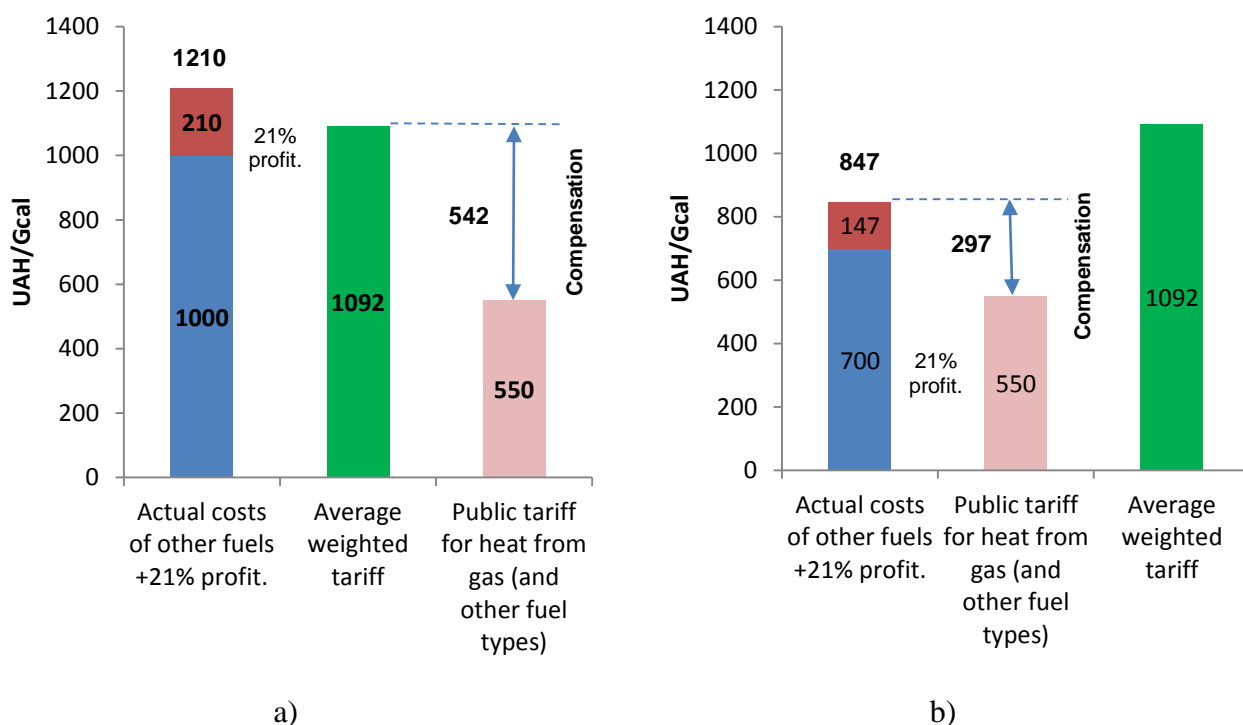
- Tariffs for heat production imposed, while the majority of district heating providers of Ukraine have approved “combined” tariff, namely for production, transportation and supply, without a

separate allocation of tariff for production. Thus, only those producers benefited from the current Regulations who have published structured tariff for heat energy.

- In technical sense, under the action of Regulation falling the existing heat generating units on coal and other fuels and energy, and does not provide an additional replacement of natural gas.
- The payment for heat energy transportation through heating networks of other market participants is not settled.
- Tariff settlement in case of heat supply for new customers (e.g., new construction) is not resolved.
- Not specified, how often an “average weighted” tariff should be reviewed.
- CHP plants on alternative fuels, which, if implemented, also provide an additional substitution of natural gas, are not under the action of Regulation.

A new version of the Cabinet of Ministers of Ukraine Resolution No. 293 was developed to correct these weaknesses. Its features are:

- Tariffs *for heat energy* “not from gas” (in the current version - for thermal energy *production*) are set.
- The tariff on heat energy “not from gas” is set as **100%** of an “average weighted” thermal energy tariff from gas for public and other consumers (1092.12 UAH/Gcal excluded VAT, according to National Commission of Power and Municipal Services Regulation No. 907 d/d 2014/12/19 [11]). The compensation rate to heat energy “not from gas” manufacturers, as before, is limited by profitability level of 21% (**Fig. 12**).



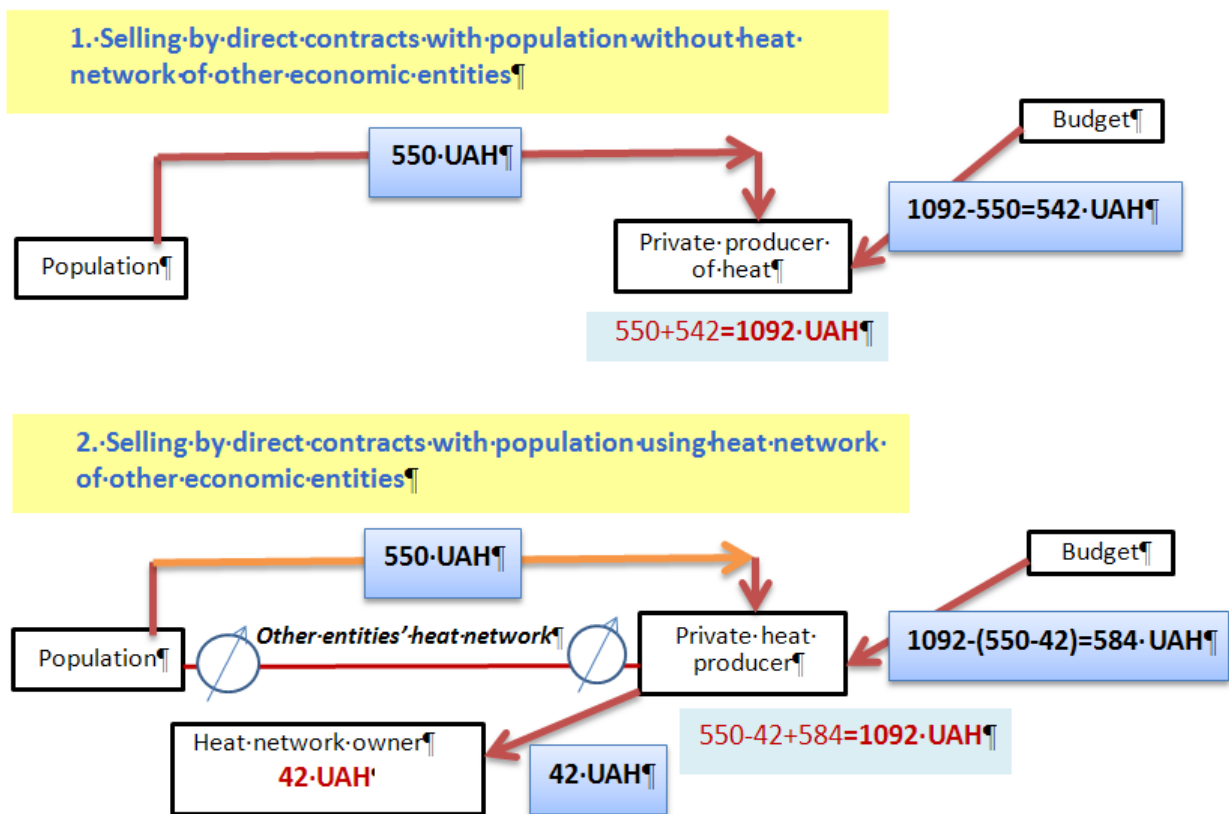
a – Actual cost + 21% (profitability level) **higher** than an average weighted tariff “not from gas”

b – Actual cost + 21% (profitability level) **lower** than an average weighted tariff “not from gas”

**Fig. 12.** Mechanism of compensation rate calculation according to the Cabinet of Ministers of Ukraine Regulation No. 293

- Tariff for heat energy “not from gas” transportation is set at the level of an average weighted tariff for heat energy “not from gas” transportation (currently about 42 UAH/Gcal excluding VAT) for enterprises without structured tariff.

- In case of heat “not from gas” supply not to the ultimate customer, but for example, to the municipal enterprise, such heat manufacturer receives from the municipal enterprise the difference between installed thermal energy tariff on the enterprise (e.g., current tariffs level is 550 UAH/Gcal) and heat “not from gas” transportation tariff:  $550-42=508$  UAH/Gcal. Manufacturer receives the rest (i.e.  $1092-508=584$  UAH/Gcal) as a compensation from the budget (Fig. 13).



**Fig. 13.** Mechanisms for heat energy selling and compensation obtaining

- When heat delivered to the population by direct contracts through other entities heating systems, transportation to these entities is paid according to the transportation tariff for the heat “not from gas”, that is 42 UAH/Gcal.

- Current Regulation extends to power and cogeneration plants on alternative fuels.

- Clarified definition “in case of natural gas replacement by thermal energy production for public needs on any other raw materials, including waste as a secondary raw material, fuel and energy” allows extending the Regulation for a wide range of fuels including solid waste.

- Maximum term for revision of heat energy “not from gas” tariffs for public needs by heat producing and supplying enterprises is set – **one month** from the date of corresponding thermal energy tariff for public change, made using natural gas of heat supply enterprise, whose thermal energy for public needs is replaced.



- Regulation extends to the natural gas substitution after the heating season 2013-2014 expiry.

*The issue of tariffs establishment remains unresolved, if thermal energy supply occurs for new customers (e.g., new construction).*

Regulation No. 453 is setting a tariff for heat producers “not from gas” for public institutions and enterprises at the level of 100% of an average weighted tariff for heat production from gas for public customers. Currently it is **1097.24** UAH/Gcal excluding VAT (according to the National Commission of Power and Municipal Services Regulation No. 906 d/d 2014/12/19 [10]). The main weaknesses of the current edition are largely coinciding with weaknesses of the Regulation No. 293.

Definition “average weighted” tariff is out of use in the new version of the Regulation No. 453. It sets the “public” consumers tariff of heat supplying enterprise, which are replacing thermal energy (from gas). Other provisions of the Regulation are similar to those applied in the new edition of the Regulation No. 293 (transportation tariff, tariff revision terms, extension on cogeneration plants on alternative fuels, applicability of municipal solid waste, and natural gas substitution after the heating season 2013-2014 expiry). *The issue of tariffs establishment remains unresolved, if thermal energy supply occurs for new customers (e.g., new construction) or if thermal energy supplier, which is replacing thermal energy, cease to exist.*

***We consider it is necessary to accept the new edition of the Cabinet of Ministers of Ukraine Regulations No. 293 and No. 453 as soon as possible, as it will significantly increase the practical implementation effectiveness of the worded tool for heat generation support.***

The mechanism stimulating population to introduce energy efficiency measures brought by the Cabinet of Ministers Regulation No. 491 (d/d 2014/10/01) [8]. This mechanism is a part of the loan compensation, borrowed for purchase of boilers using any fuels and energy sources (excluding natural gas). Partial loan reimbursement is carried out once per each borrower - individual for 20% of loan value attracted by one credit agreement with an authorized bank for boiler purchase, but not more than 5000 UAH per each credit agreement. According to the State Agency for Energy Efficiency and Energy Saving of Ukraine, as of 2015/4/1 2,339 households obtained loans in amount of more than 41 Mio UAH.

A significant factor for biofuels usage widening is a substantial growth of natural gas prices for households and public utilities. Thus, from March 1, 2015 the natural gas prices for individual heating changed. Within the period from May to September - 7188 UAH/1000 m<sup>3</sup> (including VAT); in the period from October to April - 3600 UAH/1000 m<sup>3</sup> (including VAT) for consumed gas volume of up to 200 m<sup>3</sup>/month (inclusive); and 7188 UAH/1000 m<sup>3</sup> (including VAT) for consumed gas volume of more than 200 m<sup>3</sup>/month. Natural gas price for housing and utilities from April 1, 2015 is 2994.3 UAH/1000 m<sup>3</sup> (including VAT).

Positive changes within the renewable energy sector related to the implementation of an Action Plan on implementation of the European Parliament and Council Directive 2009/28/EU, ratified in September 2014 [9]. The Plan intends on Ukrainian and European legislation on renewable energy sources harmonization. Among others, the document devotes considerable attention to the issues of sustainable development. It foresees the development of sustainability criteria for liquid and gaseous fuel, produced from biomass and used for transport as well as for liquid fuel, produced from biomass and intended for energy usage. Action Plan provides technical requirements development for biofuels and bioliquids production and use, with greenhouse gas emissions reduction, starting from 2017/01/01, no less than 50%, and from 2018/01/01 – at least 60% for biofuels and bioliquids, produced on plants, set in operation after 2017/01/01.

Revisions to the Law of Ukraine “On Power Industry” concerning “green” tariff for electricity produced from renewable energy sources were prepared through an active participation of Bioenergy Association of Ukraine<sup>1</sup>.

**The relevant law passed on June 4, 2015.**

Among the positive changes amended by the law are the following:

- Definition “biomass” includes not only wastes, but also products from appropriate industries. It corresponds to European definition:

*“Biomass is a non-fossil biologically renewable biodegradable organic substance, in form of **products, wastes and residues** of forestry and agriculture (crops and livestock), fisheries and technologically related industries, as well as biodegradable components of industrial and household wastes”*

- For energy from biomass and biogas, the “green” tariff is set in recognition of the factors provided for facilities brought into operation until 2014/12/31, i.e. increasing on 10% compared to the current tariff.
- Essential requirement concerning “local component” canceled and replaced on the **rate charge** to the “green” tariff for Ukrainian equipment usage. The charge composes 5% and 10% if using, respectively, 30% and 50% of locally manufactured equipment.

There were also developed proposals to simplify the land permission procedure for construction of heat and/or electricity production facilities using renewable energy and/or biofuels (the relevant proposal is in the registration process). Particularly, the renewable energy facilities could be located on the lands of all categories without their purpose changing. Furthermore, it is appropriate to allow the power facilities construction until 2018/01/01 on the lands without approved zoning plans or detailed territory plan (currently, according to the Law of Ukraine “On regulation of urban planning”, property development is prohibited).

Despite some progress in bioenergy technologies development within last year, there are a number of barriers and unresolved issues requiring a prompt decision. The main problems are:

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<sup>1</sup> [http://w1.c1.rada.gov.ua/pls/zweb2/webproc4\\_1?pf3511=55219](http://w1.c1.rada.gov.ua/pls/zweb2/webproc4_1?pf3511=55219)

- Heat producers from alternative fuels (including biomass) need untrammled access to heating networks. Currently, local heating utilities are not interested in linking-up of alternative heat generation facilities preventing issuance of technical specifications for connection. Changes to the Law of Ukraine “On Heat Supply” are necessary, giving the priority access to the alternative heat generation facilities to heating networks.
- Most of energy crops are not included to the category of agricultural crops, so their cultivation on agricultural lands is impossible. The current procedure for inclusion into the register of agricultural crops is too long (requires field trials during more than 3 years). It is necessary to simplify the procedure for entry into energy crops register.
- State Forestry Enterprises do not have enough equipment, motivation and actually rights for significant increase in wood fuel harvesting. However, there are a number of restrictions for private companies in this type of activity. It must be resolved the issue of wood fuel harvesting by private companies with relevant equipment, in state-owned forests. It is necessary to simplify the procedure for amending an annual allowable cut to obtain permission to increase logging and, consequently, the volume of wood fuel harvesting.

It is important to note, that recently adopted law “On zoogenic by-products not for human consumption” [12], could create an additional barrier to biogas technology implementation in Ukraine. The law purpose was the harmonization of national legislation in the sphere of animal wastes according to the requirements of international law (EU Regulations No. 1069/2009 and No. 142/2011). Bioenergy Association of Ukraine considers that the requirements implementation of this document will certainly raise the food level, environmental and sanitary-epidemiological security in our country and will contribute to the further integration into the EU.

However, certain provisions of the Law have substantive remarks. In particular, an asset 15 requires obliging processing animal by-products of 2-nd category, including manure, through sterilization under pressure (133°C, 20 minutes, and 3 bar). We believe, this step is an unnecessary action as to ensure the safety of further manure management there are other biological treatment (composting, biogas production) foreseen, as confirmed by the operation of about 14,500 biogas plants in EU.

The current practice of manure waste handling on the most livestock farms in Ukraine is unacceptable and requires more strict claims. However, the requirement of compulsory sterilization of the entire produced manure volume, which humidity is often 90-95% considered as unreasonable and so that will certainly reduce the competitiveness of domestic livestock products manufacturers. Furthermore, the requirement of manure sterilization treatment before its conversion into biogas creates an additional serious barrier for biogas technology spreading and, consequently, for biogas production capacity increase in Ukraine negating energy and economic benefits of traditional biogas production.

The Law of Ukraine “Zoogenic by-products not for human consumption” enters into force on May 9, 2016. Before the entry of the Law into force, UABio proposes to update the text of certain assets to avoid the obliging manure sterilization treatment under pressure. A possible solution represents

the EU Regulation No. 178/2002, allowing the biogas production from manure, compost, or its ground application without prior treatment if the manure is not a threat for disease spreading. The problem situation can be corrected through including manure not into the 2-nd, but into a 3-rd category of wastes.

## **Conclusions**

Today bioenergy sector actually replaces more than 1.93 billion m<sup>3</sup>/year of natural gas in Ukraine. About 3,670 MW of thermal power on biomass operated, including 2,000 MW in household, 355 MW in public utilities sector, more than 1,300 MW in the industry.

National Action Plan on renewable energy up to 2020, settled by the Government, sets the task to replace further 5.27 billion m<sup>3</sup>/year of natural gas and solid biofuels to achieve total gas replacement in the rate of 7.2 billion m<sup>3</sup>/year in 2020. This requires a significant increasing of biomass usage for heat generating equipment: from 3670 MW in 2013 to 16150 MW in 2020 and will reflect an actual capacity increase in 4.4 times.

Set objectives implementation need a rapid increase of energy consumption from agricultural waste and biofuel energy plantations. Installed capacity of boilers working on agricultural wastes and energy crops will increase from more than 310 MW (9% of the total installed biomass capacity) in 2013 up to 11050 MW (68%) in 2020. In fact, it is equivalent to an increase of this biomass type's consumption in 35 times over the next 5 years.

In 2014, the Government signed into power a number of important Regulations to stimulate bioenergy sector development. Further steps in this direction are required; in particular, development and support of an internal market for biomass as fuel, production increase of boilers on biomass, existing legislation improvement.

*We consider it is necessary to accept the new edition of the Cabinet of Ministers of Ukraine Regulations No. 293 and No. 453 as soon as possible, as it will significantly increase the practical implementation effectiveness of the worded tool for heat generation support.*

## **REFERENCES**

1. WBA Global Bioenergy Statistics, 2014.
2. European Bioenergy Outlook. Statistical report. AEBIOM, 2013.
3. European Bioenergy Outlook. A growing sector in figures. AEBIOM, 2014.
4. Energy balance of Ukraine in 2013. Express issue of the State Statistics Service of Ukraine (d/d 2014/11/28) No. 510/0/08/4вн-14 // Енергетичний баланс України за 2013 рік. Експрес-випуск Державної служби статистики України від 28.11.2014 № 510/0/08.4вн-14.
5. Cabinet of Ministers of Ukraine Regulation No. 902-p (d/d 2014/01/10) "National Action Plan on Renewable Energy until 2020" // Постанова КМУ № 902-р від 1.10.2014 «Про Національний план дій з відновлюваної енергетики на період до 2020 року»; <http://zakon4.rada.gov.ua/laws/show/902-2014-%D1%80>

6. Cabinet of Ministers of Ukraine Regulation No. 293 (d/d 2014/07/09) “Stimulating of natural gas substitution in heating sector” // Постанова КМУ № 293 від 9.07.2014 «Про стимулювання заміщення природного газу у сфері тепlopостачання»; <http://zakon2.rada.gov.ua/laws/show/293-2014-%D0%BF>
7. Cabinet of Ministers of Ukraine Regulation No. 453 (d/d 2014/09/10) “Stimulating of natural gas substitution within heat energy production for state- and local-financed institutions and organizations» // Постанова КМУ № 453 від 10.09.2014 «Про стимулювання заміщення природного газу під час виробництва теплової енергії для установ та організацій, що фінансуються з державного і місцевих бюджетів»; <http://zakon2.rada.gov.ua/laws/show/453-2014-%D0%BF>
8. Cabinet of Ministers of Ukraine Regulation No. 491 (d/d 2014/10/01) “Amendments to procedure of funds using, provided by the state budget for an efficient energy resources usage and energy efficiency measures implementation” // Постанова КМУ № 491 від 1.10.2014 «Про внесення змін до Порядку використання коштів, передбачених у держбюджеті для здійснення заходів щодо ефективного використання енергетичних ресурсів та енергозбереження»; <http://zakon4.rada.gov.ua/laws/show/491-2014-%D0%BF>
9. Cabinet of Ministers of Ukraine Ordinance No. 791-p (d/d 2014/09/03) “Approval of an Action Plan on the European Parliament and Council Directive 2009/28/EU implementation” // Розпорядження КМУ № 791-р від 3.09.2014 «Про затвердження плану заходів з імплементації Директиви Європейського Парламенту та Ради 2009/28/ЄС»; <http://zakon1.rada.gov.ua/laws/show/791-2014-%D1%80>
10. NCPMSR Regulation No. 906 (d/d 2014/12/19) “Amendments to the Regulation of National Commission exercising the state regulation in energy sector and utilities from October 16, 2014 No. 119” // Постанова НКРЕКП № 906 від 19.12.2014 «Про внесення зміни до постанови Національної комісії, що здійснює державне регулювання у сферах енергетики та комунальних послуг, від 16 жовтня 2014 року № 119»; <http://www.nerc.gov.ua/index.php?id=12882>
11. NCPMSR Regulation No. 907 (d/d 2014/12/19) “Determination of an average weighted tariff for heat energy production (except heat and power plants, thermal power plants and nuclear power plants) with natural gas for public institutions and organizations, and other consumers (except population)” // Постанова НКРЕКП № 907 від 19.12.2014 «Про визначення середньозваженого тарифу на виробництво теплової енергії (крім теплоелектроцентралей, теплоелектростанцій і атомних електростанцій) з використанням природного газу для бюджетних установ та організацій, інших споживачів (крім населення)»; <http://www.nerc.gov.ua/index.php?id=12883>
12. Law of Ukraine “Zoogenic by-products not for human consumption” (No. 287-VIII from 2015/04/07) // Закон України «Про побічні продукти тваринного походження, не призначені для споживання людиною» (№ 287-VIII від 07.04.2015); <http://zakon2.rada.gov.ua/laws/show/287-19>

### **Abbreviations**

RES – renewable energy sources

GFEC – gross final energy consumption

TPES – total primary energy supply

NCPMSR – National Commission of Power and Municipal Services Regulation

NREAP – National Renewable Energy Action Plan

NG – natural gas

CHP – combined heat and power

DH – district heating

tce – tons of coal equivalent

### ***Previous publications by UABio***

<http://www.uabio.org/activity/uabio-analytics>

1. *Position Paper N 1* (2012) “Position of bioenergy in the draft updated energy strategy of Ukraine till 2030”.
2. *Position Paper N 2* (2013) “Analysis of the Law of Ukraine “On amending the Law of Ukraine «On Electricity” No5485-VI of 20.11.2012”.
3. *Position Paper N 3* (2013) “Barriers to the development of bioenergy in Ukraine”.
4. *Position Paper N 4* (2013) “Prospects of biogas production and use in Ukraine”.
5. *Position Paper N 5* (2013) “Prospects for the electricity generation from biomass in Ukraine”
6. *Position Paper N 6* (2013) “Prospects for heat production from biomass in Ukraine”
7. *Position Paper N 7* (2014) “Prospects for the use of agricultural residues for energy production in Ukraine”.
8. *Position Paper N 8* (2014) “Energy and environmental analysis of bioenergy technologies”
9. *Position paper N 9* (2014) “State of the art and prospects for bioenergy development in Ukraine”
10. *Position paper N 10* (2014) “Prospects for the growing and use of energy crops in Ukraine”
11. *Position paper N 11* (2014) “Prospects of biomethane production and use in Ukraine”

Civic union "Bioenergy Association of Ukraine" (UABio) was established to create a common platform for cooperation on bioenergy market in Ukraine, as well as to provide the most favorable business environment, accelerated and sustainable development of bioenergy. General constituent assembly of UABio was held on September, 25, 2012 in Kyiv. The Association was officially registered on 8 April 2013. Among UABio members there are over 10 leading companies and over 20 recognized experts working in the field of bioenergy.

<http://uabio.org>

