



Biogas experience in Ukraine

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**Head of the Board, Bioenergy Association of Ukraine
(UABio)**

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Agricultural company “Danosha”



LLC “Boiler Plant Kriger”



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TTS Eko s.r.o., Czech Republic



LLC “Volyn-Kalvis”



LLC “Smelaenergopromptans”



All-Ukrainian heat generating company “Ukrteplo”

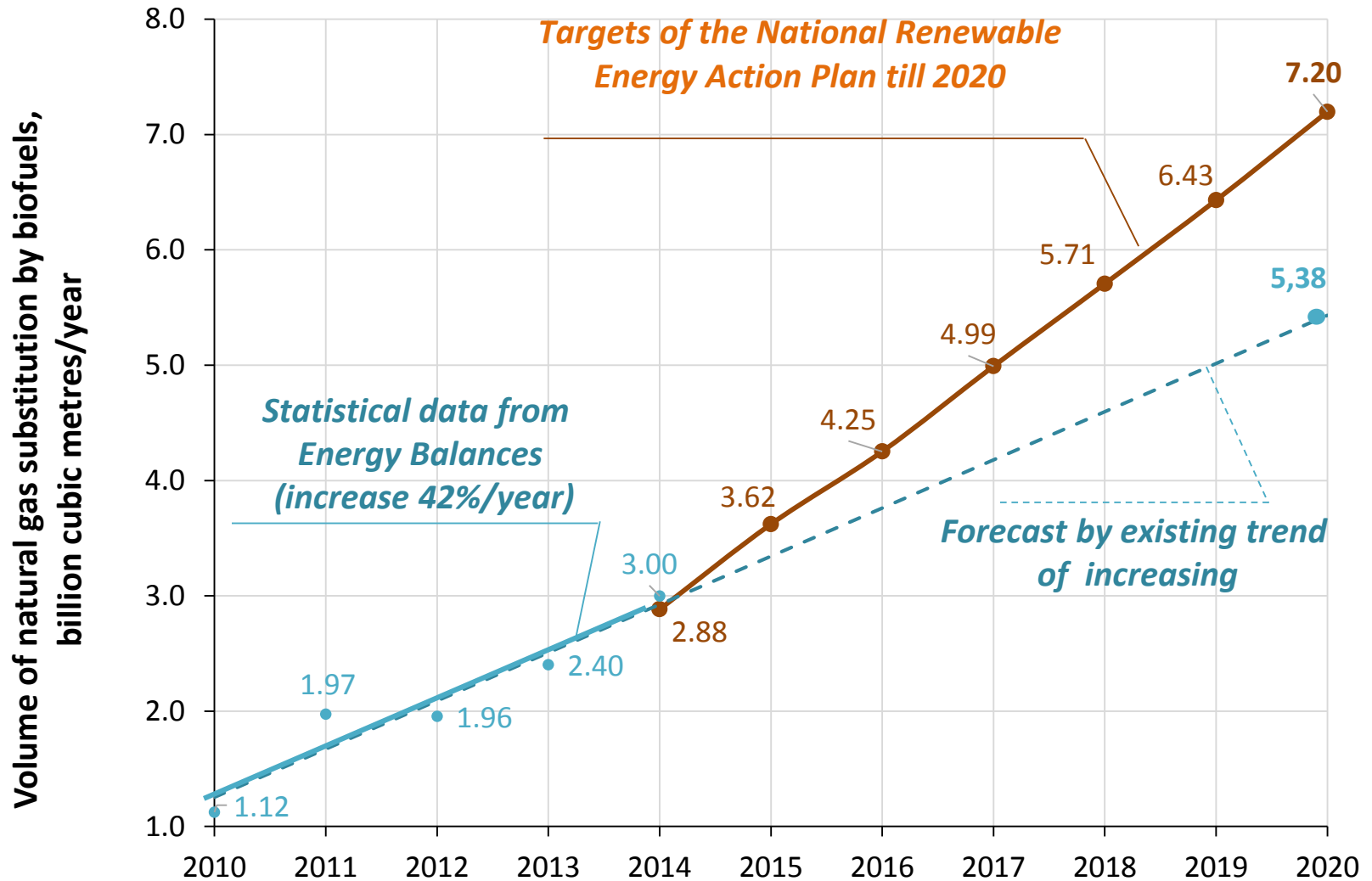
Physical persons:

Maraykin R., Petrov Ya.,
Ilchuk M., Bereznitska M.

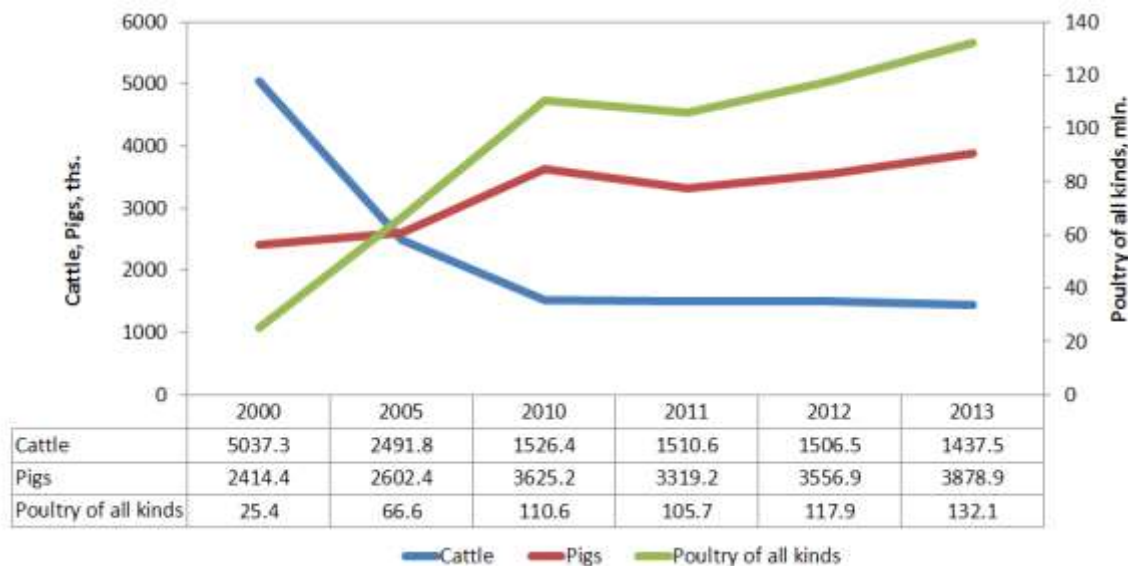
National RE Action Plan till 2020 (approved by the CMU Decree 01.10.14 No. 902-p)

Index	2009	2014	2015	2016	2017	2018	2019	2020
RES – heating, %	3,4	6,5	7,1	8,0	8,8	9,7	10,8	12,2
<i>including biomass, k toe</i>	1433	2280	2700	3100	3580	4050	4525	5000
RES – power generation, %	7,1	7,6	8,3	8,7	9,4	10,2	10,9	11,5
<i>biomass, MW_e, including:</i>	0	40	250	380	520	650	780	950
<i>solid</i>		28	175	260	360	455	540	660
<i>biogas</i>		12	75	120	160	195	240	290
RES – transport, %	1,5	4,1	5,0	6,5	7,5	8,2	9,0	10,0
<i>including biomass, k toe</i>	0	110	150	220	265	300	340	390
Total RES share in GFEC, %	3,8	6,1	6,8	7,5	8,2	9,0	9,9	11,0

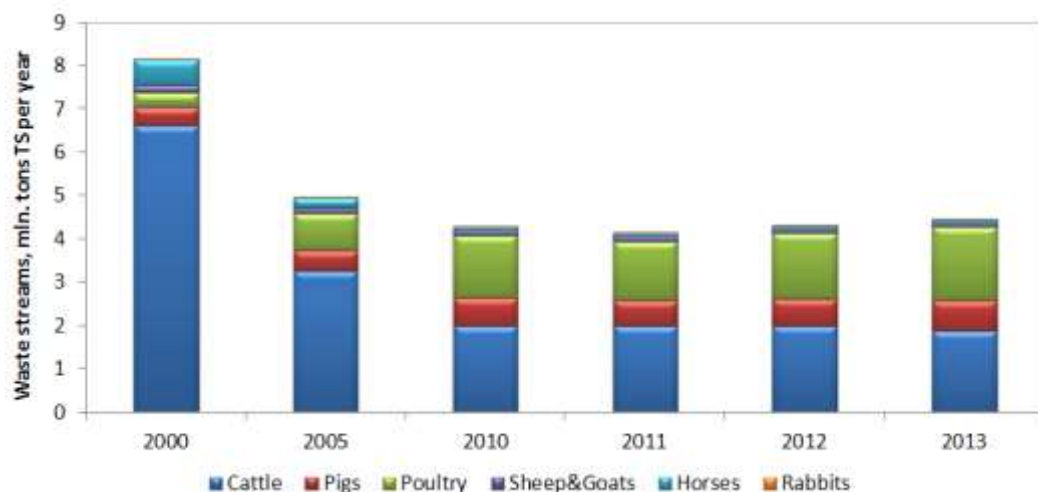
Bioenergy development in Ukraine



Animal husbandry residues



Animal livestock at agricultural enterprises of Ukraine in 2000-2013



Residues from animal husbandry of Ukraine, mln. tons of TS /year

The main branches of animal husbandry in Ukraine include cattle, pig, and poultry breeding

There is a tendency of constant reduction of the number of cattle on agricultural enterprises during last decade. However the rate of reduction decreased significantly during last five years.

Pig farming shows constant increasing in production in last decade. There is a tendency of enlargement of capacity of individual enterprises.

During the period from 2000 to 2013 the overall poultry population at enterprises increased by factor 5.2. Further growth of poultry population is expected.

Food processing residuals

Sugar factories

- Sugar Beet Pulp
- Molasses
- Haulms
- Defecation mud
- Roots, tops

Oil production byproducts

- Husks
- Extraction cake

Breweries

- Spent grain (BSG)
- Spent hop
- Spent yeast
- Kieselguhr sludge

Dairy industries

- Whey
- Buttermilk

Meat production

- Carcasses
- By-products
- Intestines content

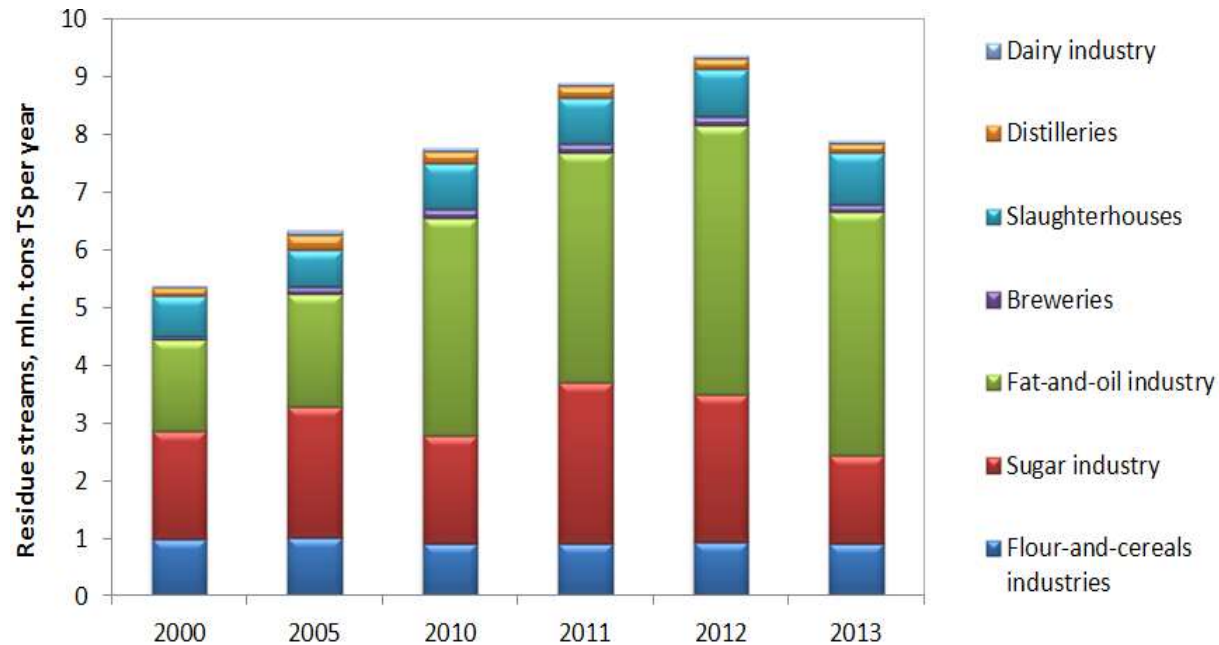
Distilleries

- Stillage
- Surplus yeast

Flour and cereal industry

- Shorts
- Bran
- Husks, etc.

Residues streams from some main food processing industries of Ukraine, mln. tons of TS per year



Four most valuable residues are sugar beet pulp, sunflower oil extraction cake, sunflower husks, and flour production byproducts

Potential of biomass available for energy in Ukraine (2014)

Type of biomass	Theoretical potential, mln. t	Share, available for energy, %	Economic potential, Mtoe	
Straw of grain crops	33.5	30	3.49	} 8 Mtoe (38%)
Straw of rape	4.0	40	0.55	
By-products of grain corn production (stalks, cobs)	37.0	40	2.83	
By-products of sunflower production (stalks, heads)	19.1	40	1.10	
Secondary agricultural residues (husk, bagasse)	8.8	80	0.84	
Wood biomass (firewood, felling residues, wood processing waste)	6.0	97	1.45	
<i>Wood biomass (dead wood, wood from shelterbelt forests)</i>	10.6	57	1.72	
Biodiesel (rapeseed)	-	-	0.25	
Bioethanol (corn and sugar beet)	-	-	0.68	
Biogas from waste and by-products of agriculture	1.6 billion m ³ CH ₄	50	0.68	
Landfill gas	0.6 billion m ³ CH ₄	34	0.18	
Sewage gas (industrial and municipal wastewater)	1.0 billion m ³ CH ₄	23	0.19	
Energy crops:				
- willow, poplar, miscanthus (from 1 mill ha)	11.5	90	4.40	} 7 Mtoe (33%)
- corn for biogas (from 1 mill ha)	3.3 billion m ³ CH ₄	90	2.58	
Peat	-	-	0.28	
TOTAL	-	-	21.20	

Legal and regulatory incentives

- Draft law 2010-d dated 19.05.2015 «On amendments to some laws of Ukraine to provide competitive conditions for the production of electricity from alternative energy sources». Was adopted as the **Law of Ukraine [514-VIII](#)** dated 04.06.2015.
 - deleted requirement of local content, corrected term "biomass", increased **Green Tariff for biomass and biogas** by 10% (**12,39 Eurocents/kW*h without VAT**).
- **Draft law 4334** dated 30.03.2016 «On amendments to Law of Ukraine “On Heat Supply” on stimulation of heat energy production from alternative energy sources”.
- Started work on establishment of **competitive market of heat**.

Agriculture based biogas plants under operation

Company, region	Start up	Feedstock type	Feedstock amount, t/day	Digester, m ³	Power capacity, MW _e	Biogas use	Biogas production, m ³ /h	Technology
Pig farm "Zaporizhstal", Zaporizhzhya region	1993	Pig manure	20...22	595	0	Heat for own needs	30	Bigadan Ltd, Denmark
Pig farm of corporation "Agro-Oven", Dnipropetrovsk region	2003	Pig manure, poultry treatment waste	80	2 x 1000	0,16	Electricity production and partly heat for own needs	140	BTG, the Netherlands
Agricultural company «Zeleny Gay», Kherson region	2008	Maize silage	10	1150	0,25	Electricity production and sale by GT	70	Zorg, Ukraine/Germany
Agricultural company «Elita», Kiev region	2009	Manure (90% cattle+10% pig)	60	1500	0,25	Electricity production and sale by special tariff	80	LIPP, Germany
Cattle farm of "Ukrainian dairy company", Kiev region	2009	Milk cows manure	400	3 x 2400 + 1000	0,625	Electricity production and sale by special tariff	300	Zorg, Ukraine/Germany
Pig farm «Danosha», Ivano-Frankivsk region	2013	Pig manure and maize silage (any green residuals)	245 t manure + 27 t silage	2 x 5500	1,063	Electricity production and sale by GT	400	Poldanor, Denmark/Poland
PJSC "Myronivsky Hliboproduct", Poultry farm "Orel-Lider", Dnipropetrovsk region	2013	Poultry litter and sugar sorgo silage	140 t (poultry litter) + 80 t (silage)	10 x 3500	5,0	Electricity production and sale by GT	3000	NVT, the Netherlands
Agri-industrial holding "Astarta-Kyiv", Globino sugar factory, Poltava region	2014	Sugar beat pulp, grain and soya treatment residuals	120 000 t/a	4 x 8000 + 2 x 5000	0,5	Own boiler for technology needs, small CHP, delivery to neighbour industry	6500	OHBE, the Netherlands
Rokitne sugar factory, Kiev region	2015	Sugar beat pulp and maize silage		4 x 3600	2,378	Electricity production and sale by GT	951	Zorg, Ukraine/Germany

Specific project updates (agriculture and food industry)

- Feedstock
 - Pig and cattle manure
 - Chicken litter
 - Sugar beet pulp
 - Maize and sugar sorgo silage
 - Food industry wastewater
- Biogas use
 - Electricity (feed-in-tariff)
 - Heat
- Capacity
 - Up to 5.0 MW_e
 - Up to 6000 m³/h
- Technology
 - Germany
 - The Netherlands
 - Denmark
 - Ukraine



Technical and economic parameters of biogas plants at agriculture enterprises

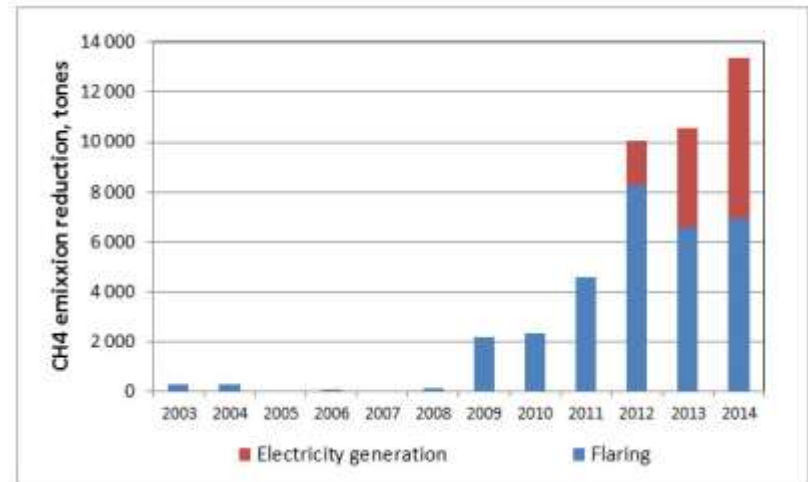
Type	Pig farm	Cattle farm	Poultry farm
Substrates	Pig manure, silage or other agro residuals	Cattle slurry	Poultry litter (1), flotation sludge (2), sorgo silage (3), waste water (4)
Consumption of substrates,	90 ths. t/yr manure, 10 ths. t/yr maize silage	300 t/day	137 t/day (1), 42 t/day (2), 100 t/day (3), 500 t/day (4)
Biogas production, m ³ /day	12 500	7 500	60 000
CHP electric capacity, MW	1.0	0.6	5.0
Net electricity production, MWh/yr	7 878	4 650	30 400
CHP heat utilization, MWh/yr	2 148	2 100	16 800
Capital costs, mln. EUR	3.8	2.13	11.0
Operating costs, mln. EUR/yr	0.35	0.09	1.1
Loan share/period/rate	50% / 7yrs / 10%	50% / 7yrs / 10%	50% / 7yrs / 10%
Gross income electricity sale (green tariff 0.1239 EUR/KWh) + heat (tariff 0.046 EUR/KWh), mln. EUR/yr	1.07	0.376	4.54
SPP, years	7.3	9.9	4.4
DPP (discount rate 12%), years	16.1	> 20	6.4

Landfill gas systems under operation

Landfill (town)	Start of LFG recovery	Disposed waste amount, mln t	Landfill area, ha	LFG flow	LFG use	Power capacity, MW _e	Technology
Alushta, AR Crimea	2008	1,0	3,2	300-500	flaring	-	Flare installation HOFGAS-Ready 500
Yalta, AR Crimea	2008	1,3	5	500-800	flaring	-	Flare installation HOFGAS-Ready 800
Lviv	2009	4,0	26	1500-2000	flaring	-	Flare installation HOFGAS-Ready 2000
Mariupol, Donetsk region	2010	2,5	14	300-500	Electricity production and sale by GT	0,2	Flare installation HOFGAS-Ready 800, Internal combustion engine 170 kW
Krementchug, Poltava region		2,8	15		Flaring	-	Flare installation Haase
Luhansk	2011	2,0	11,6	200-600	Flaring	-	Flare installation Biogas Ltd, UK, 600 m ³ /h
Zaporizhzhya	2011	3,2 (from 1974)	11	2000	Flaring	-	Flare installation Haase
Vinnitsia	2012	3,0	10		flaring	-	Flare installation Haase
Kiev (landfill #5)	2012	7,0	36	1160	Electricity production and sale by GT	1,06 (1,95)	JGC 320 GS-LL GE Jenbacher(Austria)
Borispol, Kiev region	2013	1,0			Electricity production and sale by GT	0,8	Internal combustion engine TEDOM 5x177 kW
Brovary, Kiev region					Electricity production and sale by GT	1,06	JGC 320 GS-LL GE Jenbacher(Austria)
Zhitomir					Electricity production and sale by GT	1,06	JGC 320 GS-LL GE Jenbacher(Austria)
Mykolaiv					Electricity production and sale by GT	1,06	JGC 320 GS-LL GE Jenbacher(Austria)

Specific project updates (MSW landfills and waste dumps)

- Project types
 - *Demo projects - SCS Engineers, USA (within M2M/GMI activities)*
 - *Flaring under Kyoto JI Projects*
 - *Green tariff system*
- Capacity
 - *Up to 2.0 MW_e*
 - *Up to 2000 m³/h*
- Technology
 - *HOFGAS flaring, Switzerland*
 - *Biogas Ltd. UK*
 - *GE Jenbacher*
 - *Ukrainian developers*



Existing barriers for energy production from biomass

- Underdeveloped market of biomass as fuel;
- Uneffective tariff system for the heat production from biomass (self cost + 6%);
- No market of organic fertilizers;
- Lack of legislation for the production of biomethane;
- Complicated procedure for allocating land for bioenergy plants.

Conclusions

- Bioenergy sector actually replaces **3.0** billion m³/year of natural gas in Ukraine. About **5000** MW thermal on biomass is operated, including **2500** MW in private houses, **500** MW in public sector, **2000** MW in industry.
- National Action Plan on RE up to 2020, sets the task to achieve total gas replacement by biomass on **7.2** billion m³/year in 2020.
- Law [514-VIII](#) (in force from July 2015) has removed most of barriers for development of RE power projects and settings of “green tariffs” for them.
- Market is open and projects are mostly feasible in the next sectors:
 - heat production from biomass for private buildings;
 - heat production from biomass for public, industrial and commercial consumers;
 - heat production and CHP on biomass in DH sector;
 - power production from biomass (CHP is more feasible option);
 - large scale biogas projects with existing heat consumption.

HOW TO PREPARE AN ABSTRACT

The abstract, single spaced in English (11 size Times New Roman font), should include:

Applicable subject number (1 to 5 above)

Full title

Full name and address of one author for all correspondence

For each author and co-authors, full name, affiliation, address, phone/fax/e-mail

Purpose of the work

Approach

Scientific innovation and relevance

Results

Conclusions

An abstract should not exceed 1 page of A4 format (210 x 297 mm).

**Deadline for receipt of abstracts:
1 August 2016**

The Proceedings of the Conference in English and Ukrainian/Russian and presentation materials will be provided to all the participants after the Conference.

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Abstracts and registration forms should be sent to e-mail: conference@uabio.org

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Thank you for attention!

Welcome to Ukraine and to UABio!

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