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HEAT FROM BIOFUEL
FOR YOUR FAMILY AND COMMUNITY



HEAT FROM BIOMASS ENERGY

FOR YOUR FAMILY AND COMMUNITY

Do you want to save on utilities? Are you thinking about an alternative to natural gas and how to heat your house in winter?

Own solid fuel boiler on briquettes or pellets (made of straw, sunflower husk, wood chips, etc.) or firewood can become an effective solution.

Benefits of using biomass heat are the following:

- ✦ choice of fuel at your own discretion;
- ✦ autonomy and independence from the gas provider and tariff alternation;
- ✦ money spent within the country and not to pay for imported gas;
- ✦ provide heating independently from heating season
- ✦ no complex authorization procedures for installation of solid fuel boiler;
- ✦ ease of operation and high efficiency of modern boilers at the level of 90-95%;
- ✦ modern design and a high level of automation and comfort.

Clean innovative technologies help you to become energy efficient for the benefit of your family budget and comfort: to analyze energy consumption, conduct energy audits of the house, use electrical appliances of energy efficiency class A and higher, carry out thermal modernization, replace lighting systems with energy-saving ones and introduce other state-of-the-art smart technologies.



RESOURCES DESCRIPTION

Biomass is a biologically renewable substance of organic origin that is biodegradable (waste from agriculture (crop and livestock), forestry and related industries, as well as the organic part of industrial and household waste).

Biomass is a product of organic photosynthesis. When burning biomass, the carbon dioxide balance equals zero. Because in the process of combustion as much carbon dioxide is emitted as the plants had consumed earlier in the process of photosynthesis.

As a fuel for solid fuel boilers, biomass is represented by wood fuels in the form of wood chips, granules and briquettes, straw, sunflower, rice husks etc. In addition, energy crops that are grown specifically for such purposes can be used as fuel.

According to the Bioenergy Association of Ukraine, the following types of biomass are distinguished:

Wooden.

For example: firewood, branches, wood chips.

Agricultural.

For example: wheat straw, corn stalks, sunflower husks; waste from animal farms and fisheries; waste from the food and processing industries, for example: sugar factories;

There are three groups of agricultural biomass:

1. primary, which is a by-product of crop production (straw, sunflower and corn stalks, etc.);
2. secondary, obtained during the processing of basic agricultural products (pulp, oil cake, husk, shell, bonfire, etc.);
3. manure.



Energy crops.

They are trees and plants that grow relatively quickly and are specially grown for energy use. For example: willow, poplar, miscanthus. Energy crops also include traditional crops grown for the production of biodiesel (rapeseed, sunflower), bioethanol (corn, wheat) and biogas (corn).

Waste.

For example: organic matter in household waste.

Cultivation of energy crops in Ukraine

Marginal land: **4 M ha**
Annual growth: **20 t/ha**
Crop yield cycle: **20-25 years**
Substitution potential: **20 Bn m³ of gas**



Fuel quality depends on the type, size, humidity, etc. The lower the moisture content of the wood, the higher the calorific value of solid biofuels.

Characteristics of biofuels (physical and chemical parameters) are usually set in the regulatory and technical documents for fuel, which regulate its production.

Table 1 – Characteristics of biofuels

FUEL	ASH CONTENT, %	BULK DENSITY, KG/M ³	LOWER CALORIFIC VALUE, MJ/KG
Wood chips (relative humidity 20 %)	0,3-1,0	205-250	15,5
Wood chips (relative humidity 40 %)	0,3-1,0	240-300	10,2
Firewood	0,2-0,5	400-500	13,5
Wood pellets	0,2-0,5	550-680	17-17,5
Straw pellets	4-6,5	550-600	15,5-16
Sunflower husk pellets	4-6,5	630-650	18-18,5
Wood (energy crops, willow, poplar)	2	—	12,5-13,5
Cereal straw	4-6,5	—	14,4

Manual "Preparation and implementation of projects to replace natural gas with biomass in the production of thermal energy in Ukraine." Practical guide/Ed. G. Geletuha. - K.: "Polygraph Plus", 2016. - 104

✦ A brief description of the operating principles of the technology

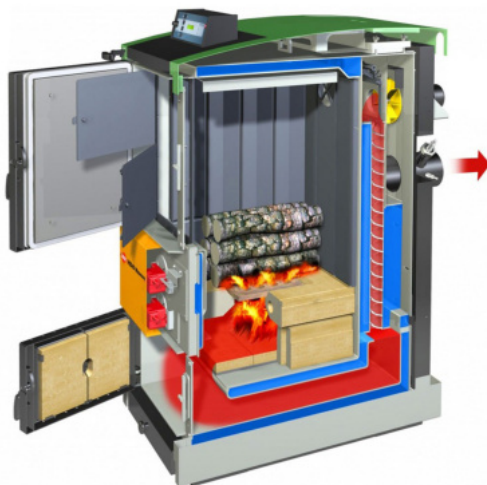
✦ Option 1

Briquette or firewood boiler

STEEL BOILERS

Advantages of steel boilers include low weight of the boiler, low cost, as well as resistance to temperature and pressure changes.

As for disadvantages, steel boilers have noticeably shorter lifespan than cast iron boilers. However, in open systems with natural circulation of the coolant, the lifespan is shorter because the coolant always contains active oxygen which destroys steel from the inside. In closed systems with forced circulation, there is no active oxygen coolant and therefore their service life is longer. In particular, a steel boiler will last from 10 to 20 years depending on the type of heating system and whether it was properly installed. Furthermore, the service life of boilers depends on what fuel you burn and how often you clean the boiler from ash and slag. At long contact of heating surfaces with ash, they are exposed to corrosion that reduces service life of the equipment.



CAST IRON BOILERS

The advantage of cast iron boilers is in their very long service life. In a properly installed heating system with regular maintenance, the iron cast heat exchanger can last up to 50 years. This is due to the thicker wall of the heat exchanger than that of the steel boiler. Corrosion destroys the surface of the heat exchanger slower and cast iron is more resistant to corrosion than ordinary steel.

The cast iron boiler is assembled from sections and in case of destruction of one of the sections, it is replaced by a new one and the boiler is again operational.

Speaking of disadvantages, cast iron boilers weight a lot and are more expensive compared to steel boilers. In addition, cast iron is a brittle material, demanding to the temperature and pressure difference. All these details must be considered when designing the heating system.



<https://vygodnyi.com.ua/uk/tverdoplivnyy-chugunnyy-kotel-viadurs-u-22-cd-6/>

Type of fuel combustion in solid fuel boilers

Boilers are divided by type of fuel combustion. There are boilers of conventional, long-term and pyrolysis combustion.

✦ Conventional combustion solid fuel boiler

In conventional (direct) combustion boilers, when the fuel burns, the entire volume of fuel loaded into the furnace burns. And the power of the boiler is regulated by the amount of air supplied.

✦ Long-term combustion solid fuel boiler

Long-term combustion boilers differ from conventional in that they have expanded combustion chambers. Because of this, fuel burns portion-by-portion (smolders) thus increasing the boiler life at one load.

✦ Pyrolysis combustion solid fuel boiler

The basis of the boiler's work is the principle of pyrolysis combustion or dry distillation of fuel, namely, burning wood under high temperature and without oxygen. During such combustion, pyrolysis gas is released from the wood which passing through the ceramic nozzle mixes with the secondary air and then fully burns in the combustion chamber.



<https://unidim.com.ua/blog/tverdoplivnyy-kotel-na-drovah-briketah>

★ Option 2

Pellet boiler

STEEL BOILERS

Pellet boilers can be divided into three main groups:

- ✦ automatic boilers operating only on pellets;
- ✦ automatic boilers in which, in an emergency (failure of the automation or malfunction of the pellet burner), firewood or briquettes can be used temporarily. For these purposes there are special grate grilles that are included in the complete set of such boilers;
- ✦ automatic combined pellet boilers, in which, as in combined fireplaces, pellets and wood or briquettes can be burned, including the option to burn them simultaneously.



<https://teplospec.com/tverdotoplivnoe-otoplenie/kakie-kotly-na-pelletakh-luchshe-konstruksiya-preimushchestva-i-vedostatki-rekomendatsii-po-vyboru-.html>

Such boilers have several combustion chambers. If necessary, the pellet burner is removed in 20 minutes, and the pellet boiler can operate as a regular manually loaded solid fuel boiler (on coal, firewood, etc.).

The pellet boiler is equipped with a special burner which provides higher efficiency when burning granules than the efficiency of other categories of solid fuel boilers. The type of burners is chosen depending on the type of fuel and can be of a retort or torch type and can be equipped with movable bar or grate. The design of the burner must provide efficient combustion without slag in the range of 30-100% of the load.

An important factor determining the demand for pellet boilers is the lifetime, which for premium pellet boilers is more than 20 years.

The pellet boilers have a high level of automation and maintain the set temperature. Fuel delivery from the hopper is also carried out automatically, as needed, allowing the pellet boiler to function without human involvement: for example – until there are pellets in the operational bunker (for up to seven days and longer), and if there is a special fuel warehouse (a well with waterproofing, a container near the house or a specially designated isolated room in the building) – for the whole heating season.

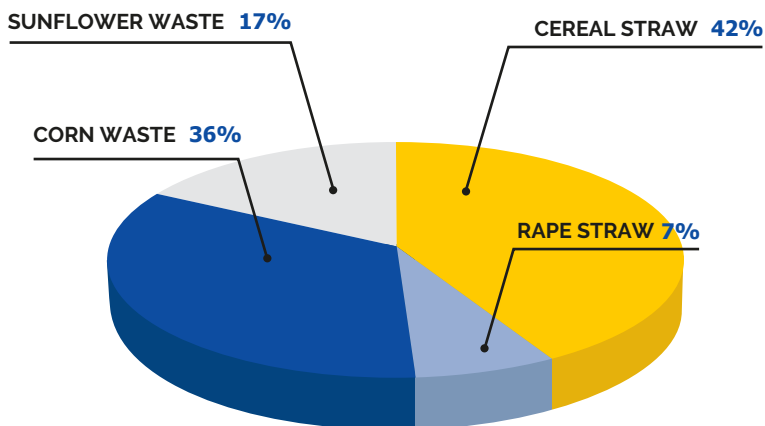
✦ ENERGY PRODUCTION POTENTIAL IN REGIONS OF UKRAINE

The highest potential of solid biomass is concentrated in Poltava, Dnipropetrovsk, Vinnytsia and Kirovohrad oblasts and is over 1.0 million toe per year. To determine the yield of straw and plant residues the waste coefficient is used – the ratio of straw yields or stems of plants to grain yield. It is estimated that 1.5-2.0 tons of straw or vegetable residues can be obtained for each ton of grain. 50-60% of wheat, barley, rye straw is used to keep livestock and fertilize soils, while corn and sunflower stems remain in the fields after harvest.

ANNUAL STRUCTURE AND VOLUMES OF AGRICULTURAL WASTE

	Total volume, mln tons	Available share for energy production, %	Economic potential, mln tons
Cereal Straw	33,5	30%	10,05
Rape Straw	3,9	40%	1,56
Corn Waste	37,0	40%	14,5
Sunflower Waste	19,1	40%	7,64
Total:	93,5	37%	34,05

SUBSTITUTION POTENTIAL
9,3 bln m³ natural gas



Ukraine has sufficient energy potential from straw and vegetable waste equal to roughly 34 million tons. Much of the straw after harvesting is pressed into bales, briquettes and pellets and used for heating.

At 14 enterprises of the oil industry more than 500 thousand tons of sunflower husk are burnt and 120 thousand tons of it are granulated.

The forested area of Ukraine is about 16% of its total area. 16-17 million cubic meters of industrial wood are harvested annually; wood processing waste is up to 10 million cubic meters.

Let us take a look at the calculation of savings achieved by the use of biofuel (firewood/pellets) in case of replacement of gas boiler.

Heating of a typical private **house of 150 m²** with a monthly electricity in Kyiv city where 2-3 persons live

OPTION 1

a briquette and firewood boiler

OPTION 2

a pellet boiler

INDICATORS	GAS BOILER*	FIREWOOD BOILER*	PELLET BOILER*
Technical parameters:			
● Installed power, kW	22	22	22
● Boiler's efficiency, %	92	78	84
● Heating demand, Gcal	37	37	37
● Calorific value of fuel (gas - Gcal/thousand m ³ , biofuel - Gcal/t)	8,0	3,0	4,1
● Volume of fuel use per year, (gas - thousand m ³ , biofuel - tons)	5,0	15,8	10,7
Economic parameters:			
● Price (tariff) for the population (gas - UAH/ thousand m ³ , biofuel - UAH/t)	7 274,2	1 500	2 500
● Heating costs for the season (UAH), including	36 371	23 700	29 218
– fuel, UAH	36 371	23700	26 750
– electricity for automatic supply of pellets to the boiler, UAH	—	—	2 468
● Savings from the use of biofuel, UAH	—	12 671	7 153
● Cost of equipment (UAH), including	—	35 727	73 528
– cost of the boiler, UAH	—	25 519	63 937
– costs of boiler delivery and installation, UAH	—	10 208	9 591
● Payback period, years	—	≈ 3	≈ 10

* the above-mentioned comparison of the use of equipment is for informational purposes only and should not be considered as an economic justification.

The technical and economic parameters may differ from the actual operating conditions of the equipment.

Please note!

While choosing a solid fuel boiler, pay attention to the technical characteristics in accordance with EU standards.

⚡ HOW TO INSTALL A SOLID FUEL BOILER AND WHAT SHOULD BE TAKEN INTO ACCOUNT IN THE FIRST PLACE?

While planning to install a solid fuel boiler, first of all, it is necessary to find out whether the solid fuel CHP/TPP operates in your city/region providing district heating services and to connect to the existing heating networks. In the absence of such a CHP/TPP, before choosing solid fuel equipment for a private house, it is necessary to conduct an energy audit of the building and determine the consumption of heat and/or electricity. If you plan to install a solid fuel boiler in a private house or cottage for your own needs - with a boiler capacity of up to 100 kW, the boiler room is considered to be a furnace room according to current legislation and does not require any special permits or authorizations.



Technical requirements for the premises when installing a boiler in a private house

(according to state standard ДБН В.2.5-67:2013 "Heating, ventilation and air-conditioning")

- ⚡ room for an under 30 kW boiler - not less than 7.5 m³;
- ⚡ floor at a distance of one meter from each side of the boiler is covered with sheet protective material at least 0.7 mm thick;
- ⚡ distance between the walls is not less than 30 cm, for the front side - at least a meter;
- ⚡ distance from the upper border to the ceiling - at least 1.5 m;
- ⚡ air duct, air inlet and exhaust vents: not less than 15 cm² for a 30-kW boiler;
- ⚡ for powerful heat generators the parameters of the exhaust openings range from 20 cm².

In addition to regulatory requirements, care must be taken to store fuel and other equipment.

The standards depend on dimensions of the unit, the room and the features of the boiler.

It should also be noted that the greatest effect from the use of renewable energy sources can be achieved undertaking energy efficiency measures in the house.

⚡ CO-FUNDING PROGRAMS FOR SUCH INSTALLATIONS

Effective support in the implementation of energy efficiency projects and solutions can be provided by a state/local program, fund, programs of international organizations, banking institutions, etc.

For example, the Energy Efficiency Fund has been established in Ukraine. The Fund (<https://eefund.org.ua>) provides grants and introduces comprehensive technical solutions for energy efficiency of buildings, taking into account the best European practices. As a result, the co-owners of such buildings will be able not only to save money on utilities but also to increase the level of comfort and quality of life.

You can also ask local support programs when planning energy efficiency measures or using renewable sources. Does such a program work in your city, district, region? Find out the details here:



IN OBLAST STATE ADMINISTRATIONS:



ON THE MAP OF LOCAL PROGRAMS:



In addition, some banks in Ukraine also offer financing programs for energy-efficient equipment and RES technologies.

✦ SUCCESS STORIES



A solid fuel boiler in the school in Cherkassy region

New solid fuel boilers have been installed in the school of Krymky village, which is part of the Shpola amalgamated community of the Cherkasy oblast.

To this end, the community allocated over UAH 300,000. The heating system has been upgraded here for the first time since the building was constructed, and that was almost 60 years ago.

The school boiler-house has been reequipped, with two newly installed boilers ("Kronos Unik-New35") with a total capacity of 70 kW working on solid fuel. In all classrooms, corridors, bathrooms, school cafeteria, pipelines have been laid, modern heating radiators installed.

You can find more information on the site of the Cherkasy Oblast State Administration: <http://ck-oda.gov.ua/>



Mykola Bibikov from Kyiv region

I value autonomy and savings, so I installed a modern solid fuel boiler with a capacity of 25 kW to heat a 160 m² house. It allows to provide heat independently of gas supply and, therefore, gas tariffs, and save money.

During the heating season, owing to such a boiler, our family saves about 15 thousand hryvnias compared to the use of electricity for heating.

In addition, the boiler comes in handy in the household when it comes to waste management. For example, every spring you need to prune trees and already cut branches can be used as raw material for the boiler. After all, it is a renewable energy source, so if you act wisely, you will benefit both yourself and the environment.

USEFUL SOURCES OF INFORMATION



State Agency on Energy Efficiency and Energy Saving of Ukraine

State Agency on Energy Efficiency and Energy Saving of Ukraine

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E-mail: saee@sae.gov.ua vde@sae.gov.ua

We are in social media:
<https://www.facebook.com/saeUA>
https://twitter.com/SAEE_Ukraine
https://t.me/SAEE_UA



→ UA MAP



Interactive investment map of renewable energy and energy efficiency projects in Ukraine

uamap@sae.gov.ua

→ Find out about clean energy development in your area through relevant contacts of oblast state administrations:

<http://sae.gov.ua/uk/content/regional-contacts>

→ National Commission for the State Regulation of Energy and Utilities

<https://www.nerc.gov.ua> box@nerc.gov.ua
www.facebook.com/nerc.gov.ua

→ Energy Efficiency Fund

+38 044 222 95 90 pr@eefund.org.ua
<https://eefund.org.ua> info@eefund.org.ua

→ Bioenergy Association of Ukraine

+38 (044) 453 28 56 <http://www.uabio.org>
<https://www.facebook.com/uabio>

→ Ukrainian Renewable Energy Association

+38 (044) 379 12 95 info@uare.com.ua
<https://uare.com.ua>

→ Institute of Renewable Energy of the National Academy of Sciences of Ukraine

+38 (044) 206 28 09 info@ive.org.ua
<http://www.ive.org.ua/renewable@ukr.net>

→ Institute of Bioenergy Crops and Sugar Beets

+38 (044) 275 50 00 sugarbeet@ukr.net
<https://bio.gov.ua>

→ Global 100% RE Ukraine

<https://100re.org.ua> info@100re.org.ua
<https://www.facebook.com/100REUA>

There are numerous portals on the Internet where you can also find relevant information, including:

→ Firewood twice as hip: the unexpected benefit of pellets:

<https://www.obozrevatel.com/ukr/green/pellets/scho-take-peleti-top-5-perevag-tsogo-vidu-paliva.htm>

→ How Vesele village became the first energy-independent community in Ukraine:

<https://decentralization.gov.ua/news/10438>

→ Odesa oblast resident transforms vegetable waste into biofuel:

https://glavcom.ua/new_energy/news/zhitel-odeshchini-peretvoryuje-roslinni-vidhodi-na-biopalivo-foto-video-661562.html

→ New equipment of a school in Chynadyivoy:

<https://www.youtube.com/watch?v=5Kojtrs4ZIQ>

→ In Myrhorod, a straw boiler house started operating:

<https://www.youtube.com/watch?v=gDQJKPlphHA>

→ Ukrainian farmers are moving from gas to straw:

<https://www.youtube.com/watch?v=skgizFVNknQ>

→ Kamianets-Podilskyi opened Ukraine's first bio-thermal power plant:

<https://www.youtube.com/watch?v=gxHvc4Vzdm0>



Be energy efficient and energy independent!

Use CLEAN energy!



**MOVING FORWARD
TOGETHER**

← THIS PROJECT IS FUNDED BY THE EUROPEAN UNION



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