CLEAR ENERGY











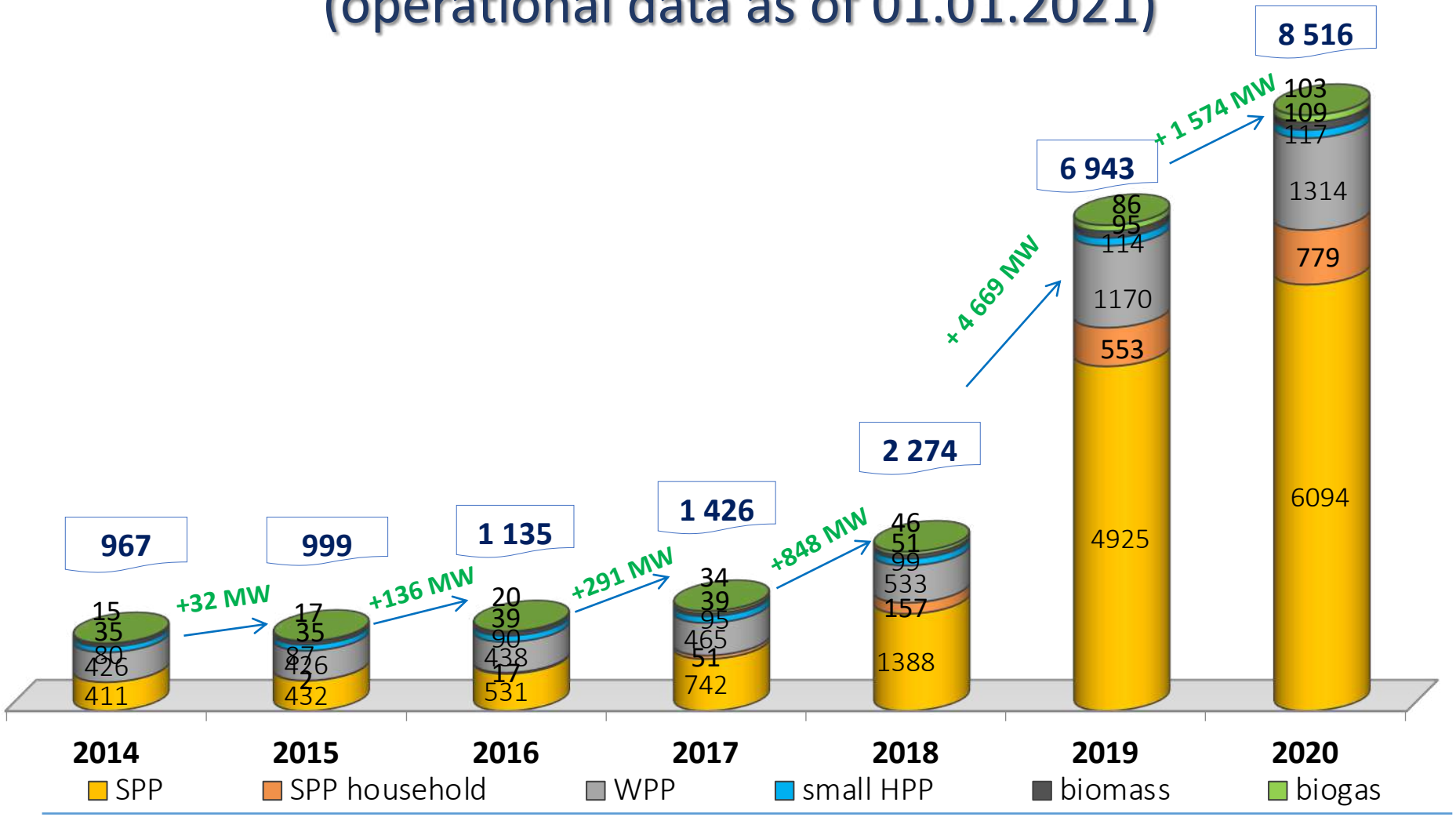




Renewable Energy
Clean Environment
Clear Future

Installed capacity of renewable energy facilities operating at the "green" tariff in Ukraine, MW

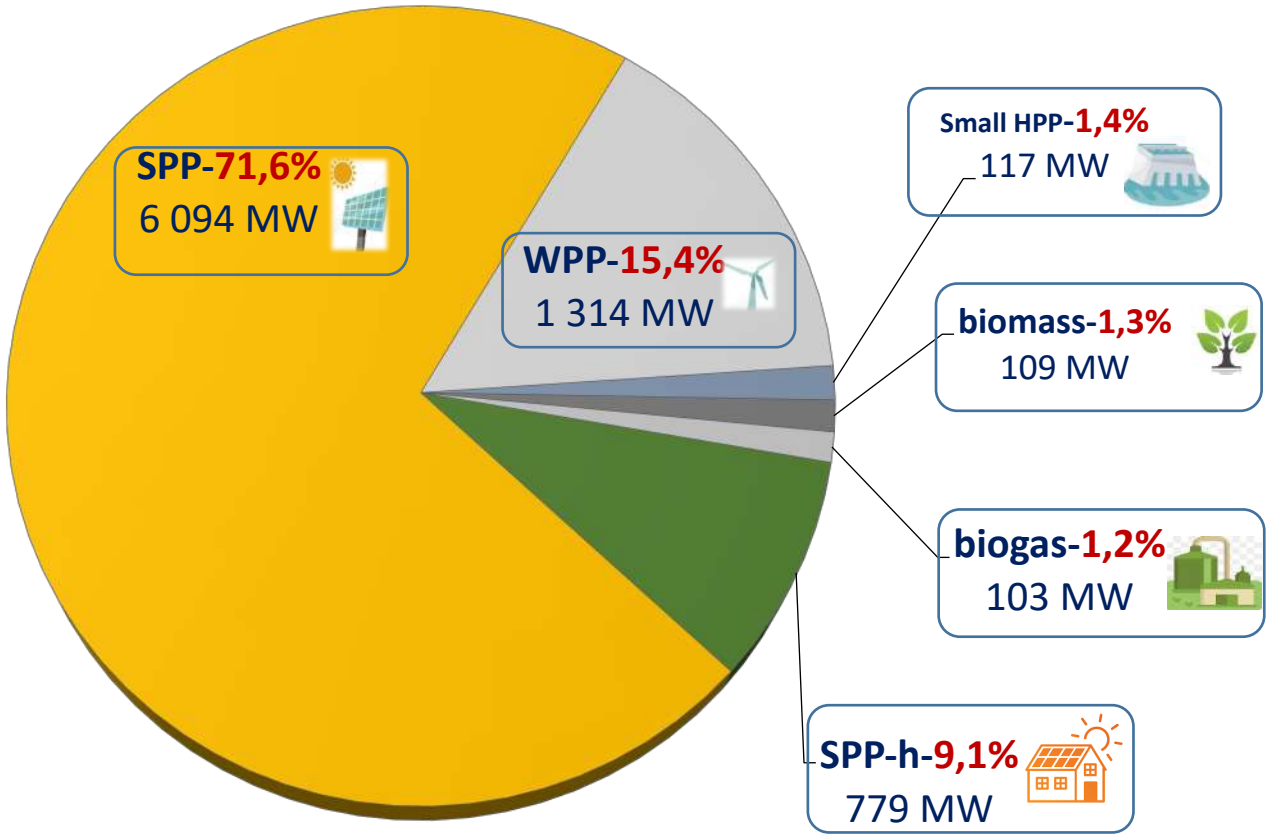
(operational data as of 01.01.2021)



Since the beginning of 2015, 7,549 MW have been commissioned and about € 6.2 billion of investments have been attracted

Installed capacity of renewable energy facilities operating at the "green" tariff in Ukraine, MW

(operational data as of 01.01.2021)



Σ = 8 516 MW

Company overview

Clear Energy LLC is one of the leading companies in Ukraine in renewable energy projects and waste management.

The company was founded in 2015. In a short period the company implemented 18 projects in different regions of Ukraine with total Biomass and Landfill Biogas installed capacity of 20 MW. Annual electricity production is up to 100 million kWh.

The number of employees increased from 5 people (mid-2015) to more than 600 people, half of whom are employed in the field of renewable energy and the other in the field of waste management.

The first stage of the pilot project on gasification of fuel chips has been successfully implemented.

At the stage of construction there are 3 projects for degassing of landfills with total installed capacity of 4,4 MW.

Started development of 5 projects with total capacity of 150 MW (WPP, SPP, gasification, etc.).

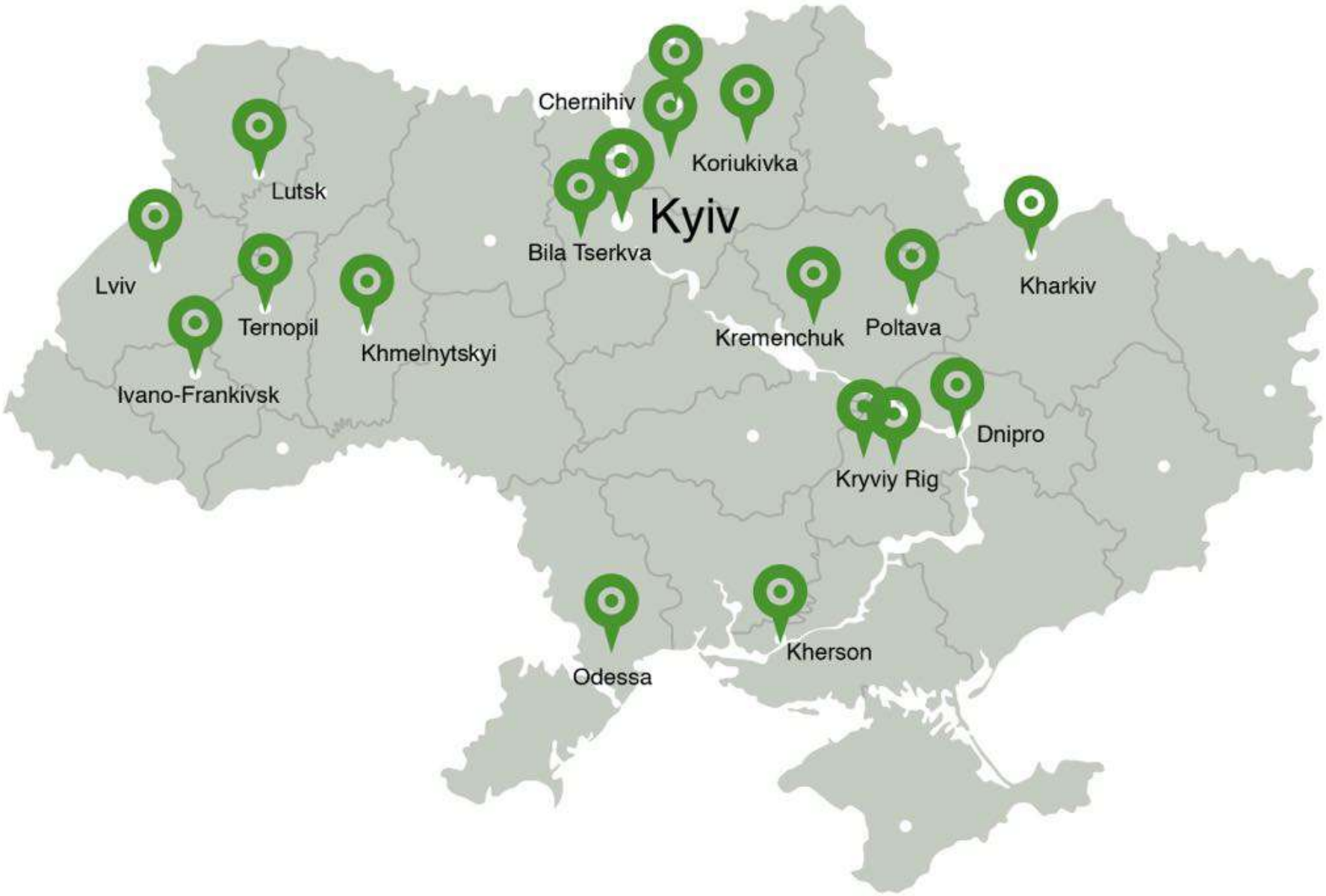
Operations and Maintenance of two landfill sites has begun (Odessa, Ternopil).

Collection and removal of waste in Odessa, trade mark "Soyuz" (park of 58 cars for collection and removal of waste and about 7 thousand containers for collection of solid waste).

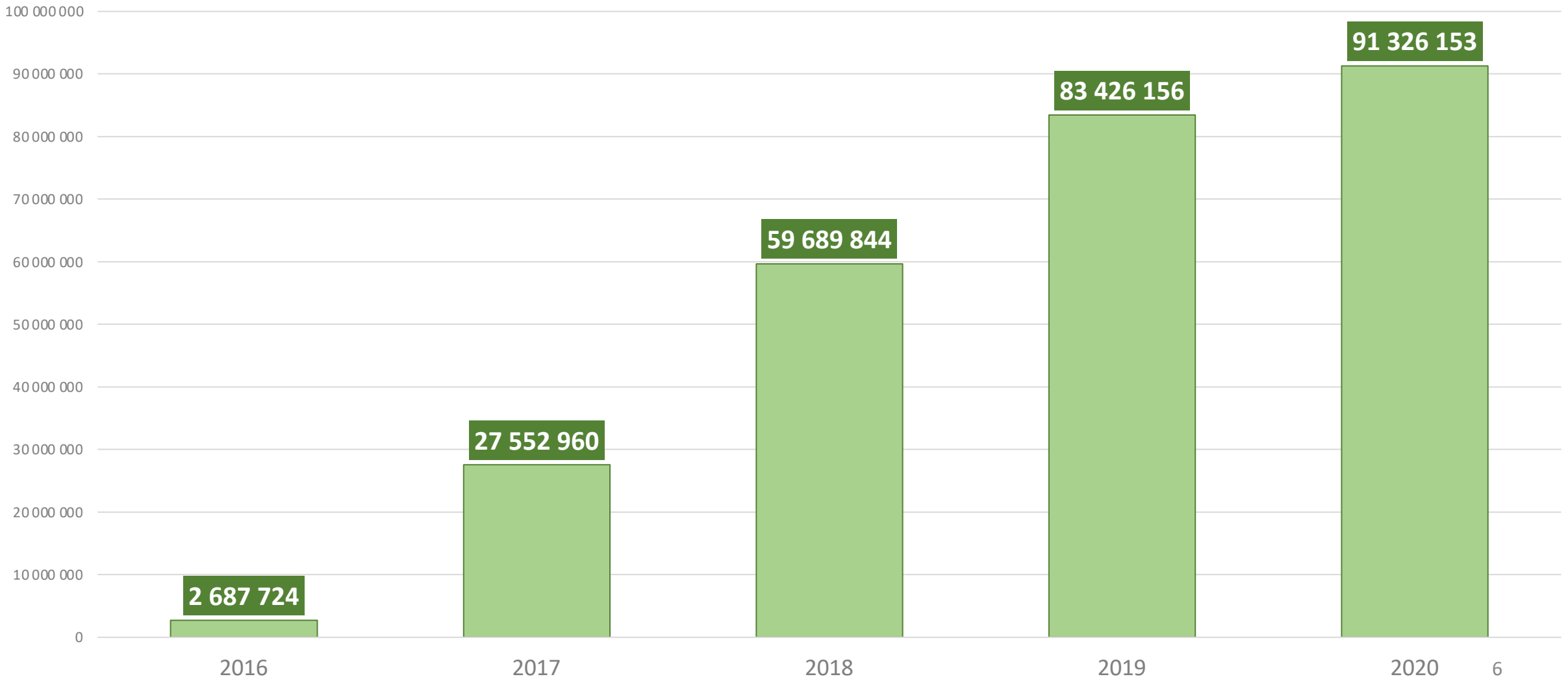




The company produced 91 mln. kW of green energy during 2020.
Facilities are located in 15 cities of Ukraine (by now).



PRODUCTION OF ELECTRICITY FOR THE YEAR BY GROUP OF COMPANIES CLEAR ENERGY LLC, kWh



Strategic directions of company development (installed capacity plan)

Electricity production from biomass *(wood chips)*
(35 MW)

Electricity production from wind
(70 MW)

Electricity production from biogas
(Degassing of landfills)
(100 MW)

Electricity generation from Wood Gasification
(30 MW)

Electricity production from Solar
(100 MW)

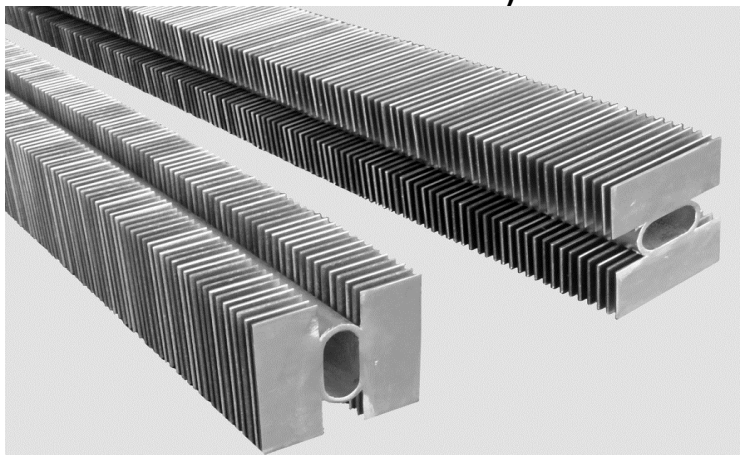
Strategic directions of company development

Bioethanol production
(100 000 t/year)

ESCO
(300 contracts)

EV Charging Stations
(200 stations)

Energy saving equipment
(production and installation
of economizers)



Production of electricity from waste Incineration

Koryukivka TPP 4 MW project

Basic principles of the company

Use equipment from leading manufacturers such as SIEMENS, BIB Cochran, EKOL, Enerstena, Saxlund, Jenbacher;

Used equipment is provided with a high proportion of flue gas protection systems;

A thermal power plant can further refine a very wide range of biofuels, thereby increasing the list of potential suppliers and the ability to choose the most economically viable option.

Koryukivka TPP 4 MW project

- Electric power: **4 MW**;
- Type of fuel: **wood chips**;
- Annual biomass demand: **up to 60 thousand tons per year**;
- Annual electricity production: **up to 29 million kWh**.

Municipal solid waste Landfill degassing projects

Municipal solid waste Landfill degassing projects

The company is actively implementing projects for the degassing of landfill sites and the production of landfill gas (biogas). **Today, Clear Energy is Ukraine's leading company that manages landfill gas.**

Cities: Chernihiv, Kharkiv, Kryvyi Rih (2 objects), Ivano-Frankivsk, Lutsk, Khmelnitsky, Kremenchuk, Poltava, Kherson, Bila Tserkva, Dnipro, Odessa. Also in the development are cities such as: Lviv, Ternopil.

Now, 16 plants have been put into operation that successfully generate and sell electricity to the grid at a feed-in tariff (0,1239 EURO per kW).

These projects were implemented in short terms not exceeding 4 months each.

Total electricity generation up to **70 million kWh annually**.

Advantages of degassing of landfills

Clear Energy successfully degasses Solid Waste Landfills in Ukraine.

Landfills is in third place in the world for man-made emissions of methane.

Methane is a key contributor to global climate change: methane has more than 25 times more impact on global warming than carbon dioxide.

Reducing methane emissions from Solid Waste Landfills is one of the best ways to achieve a positive impact on climate change mitigation in the short term.

Landfill degassing technology not only reduces methane emissions but also reduces associated emissions of volatile organic compounds (VOCs), odors and other local air pollutants.

This is the best way to use methane gas for a cost-effective energy production than to release it into the atmosphere.

It is estimated that our energy projects absorb approximately 60-90% of the methane generated from landfills. The pumped-out methane is utilized (converted to water and much less influential CO2) when burned to produce electricity.

Landfill degassing helps control landfill gas emissions, which can also cause local fires and even landfill explosions.

Degassing of Solid Waste Landfills can help to protect human health and the environment from the dangers of improperly operated and closed landfills, as well as gas emissions.

The process of MSW landfills degassing

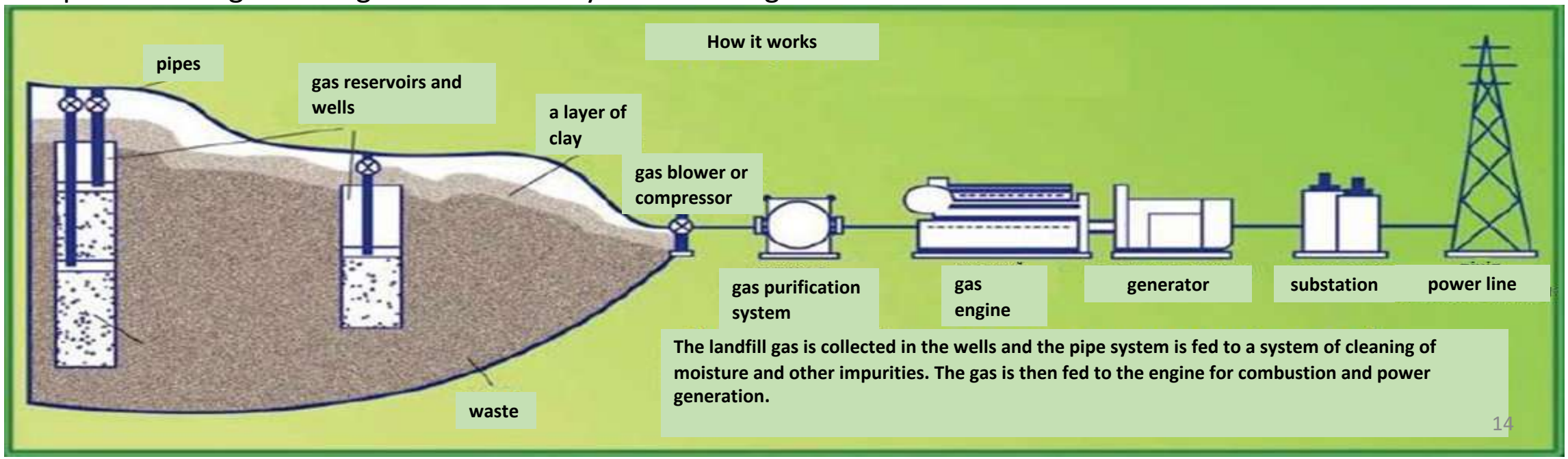
Biogas is produced in landfills during natural decomposition of organic compounds and materials. This process create a steady stream of biogas (methane) for many years.

The biogas is pumped out by a pump from wells that can be drilled both during operation of the landfill and after its closure.

Biogas is transported through the pipelines to gas filters and then fed to cogeneration plants located near or at the landfill.

The cogeneration unit generates clean, renewable electricity and transmits it to the grid.

The degassing of Solid Waste Landfills helps to remove potentially harmful greenhouse gases that pollute the atmosphere while generating useful electricity from existing waste.



LANDFILLS DEGASSING PROJECTS IN CITIES: Kremenchuk, Ivano-Frankivsk, Kryvyi Rih, Kharkiv, Kherson

LANDFILLS DEGASSING PROJECTS IN CITIES: Chernihiv, Lutsk, Khmelnytsky, Poltava

IVANO-FRANKIVSK ELECTRIC POWER STATION ON BIOGAS

- **Location:** Rybno, Ivano-Frankivsk region
- **Capacity:** 660 kW
- **Station type:** Biogas power plant – landfill degassing
- **Commissioning:** Launched in May 2017
- To produce gas from the landfill, 28 wells were drilled and two cogeneration units with a capacity of 330 kW / h were installed
- The total area of the plot is 20.8 ha
- The landfill contains about 2.2 million tonnes of MSW (for 2019)

KRYVYI RIH ELECTRIC POWER STATION ON BIOGAS

- **Location:** in the area of mine «Valiavka-South», Kryvyi Rih region
- **Capacity:** 1063 kW
- **Station type:** Biogas power plant – landfill degassing
- **Commissioning:** Launched in July 2017
- The total area of the plot is 21.2 ha
- The landfill contains about 540 thousand tons of MSW (for 2019)

KREMENCHUK ELECTRIC POWER STATION ON BIOGAS

- **Location:** Kremenchug city, Poltava region
- **Capacity:** 845 kW
- **Station type:** Biogas power plant – landfill degassing
- **Commissioning:** Launched in Novemeber 2017
- The total area of the plot is approximately 28 ha
- The landfill contains about 1 million 385 thousand tons of MSW (for 2019)

KHARKIV ELECTRIC POWER STATION ON BIOGAS

- **Location:** the village of Dokuchaevsk in the Kharkiv region
- **Capacity:** 1908 kW
- **Station type:** Biogas power plant – landfill degassing
- **Commissioning:** Launched in June 2017
- The total area of the plot is approximately 28 ha
- **Capacity of the existing landfill:** 197.2 thousands tonnes / year

KHERSON ELECTRIC POWER STATION ON BIOGAS

- **Location:** Kherson city
- **Capacity:** 625 kW
- **Station type:** Biogas power plant – landfill degassing
- **Commissioning:** Launched in 2019
- The total area of the plot is 30.8 ha
- The landfill contains about 4 millions 103 thousand tons of MSW (for 2019)

KHMELNITSKY ELECTRIC POWER STATION ON BIOGAS

- **Location:** Khmelnitsky city
- **Capacity:** 659 kW
- **Station type:** Biogas power plant – landfill degassing
- **Commissioning:** Launched in November 2017

- The total area of the plot is 8.8 ha
- The landfill contains about 4 964 150 tons of MSW (for 2019)

LUTSK ELECTRIC POWER STATION ON BIOGAS

- **Location:** the village of Bryshche of the Volyn region
- **Capacity:** 330 kW
- **Station type:** Biogas power plant – landfill degassing
- **Commissioning:** Launched in November 2017
- The total area of the plot is 8.6 ha
- The landfill contains about 2 millions 183 thousands tons of MSW (for 2019)

POLTAVA ELECTRIC POWER STATION ON BIOGAS

- **Location:** Poltava city
- **Capacity:** 1003 kW
- **Station type:** Biogas power plant – landfill degassing
- **Commissioning:** Launched in December 2018
- The total area of the plot is 17.4 ha
- The landfill contains about 6 millions tons of MSW (for 2019)

CHERNIHIV ELECTRIC POWER STATION ON BIOGAS

- **Location:** Chernihiv city
- **Capacity:** 1131 kW
- **Station type:** Biogas power plant – landfill degassing
- **Commissioning:** Launched in November 2017
- The total area of the plot is 23.8 ha
- **Capacity of the existing landfill:** 130 thousands tonnes / year

Project on degassing of solid waste landfill in Odessa

Capacity of 3.5 MW

Degassing station built in 90 days

Services

- Gas piston power unit **Jenbacher (2,3,4,6 series)**
  - ✓ Scheduled preventive repair
  - ✓ Restoration repair
  - ✓ Scheduled replacement of parts
  - ✓ Implementation of technical inspection
  - ✓ Preventive maintenance, diagnostics
  - ✓ Overhaul
  - ✓ Training of gas piston power unit maintenance personnel

- **Customization to the client's needs**
- **Fast arrival to the facility**

Waste–Management projects

Projects for the collection, transportation, management of Municipal Solid Wastes and landfill management

SOYUZ LLC is a leader in Odessa for the provision of municipal solid waste and bulky waste collection and transportation services.

The company has been working in this field for about 20 years

The total share of Soyuz LLC in the waste collection and transportation market in Odessa is approximately 65%

Main assets of the company include:

- ✓ **46 units** of special machinery (garbage trucks);
- ✓ **14 tractor** units with a boat type container;
- ✓ **about 7000 units landfill containers**.

ЧИСТОТА - НАША ЗАБОТА!

Waste Management Project in Ternopil city

EKO-LEADER T LLC is a company in the city of Ternopil which is providing solid waste collection and disposal services.

Main directions of development:

- Construction of a sorting line in the territory of the landfill;
- Construction of a landfill degassing complex.

Clear Energy – Waste to Energy project

- Clear Energy is ready to implement a project for sorting and processing household waste (MSW) for the production of electricity and heat using the most advanced technologies.
- It is planned to build a power plant in accordance with EU environmental legislation using proven technology supplied by world famous companies.

CLEAR ENERGY

Gasification of wood chips for electricity and heat production – cogeneration technology

Wood Chips Gasification Projects

Clear Energy LLC has implemented a pilot project of green energy and put into operation a mini-thermal power plant that runs on biogas generated from wood chips:

- ✓ The electric power of the station is **490 kW**
- ✓ Thermal power is **800 kW**

The operation of one power plant replaces the use of natural gas with volumes up to 2 million m3 / year and this is only for the needs of hot water supply in one Chernihiv area

Ability to sell heat at a price 25% lower than natural gas combustion.

This process under **conditions of complete automation** and minimization of the human factor during energy generation.

The consumption of fuel chips for the production of a unit of energy is **reduced twice** than for other types of cogeneration, including the steam turbine cycle.

ELECTRIC AND HEAT ENERGY BY FORCED GASIFICATION OF WOOD CHIPS in Chernihiv

- Location of Power plant: Chernihiv reg, Chernihiv, str. Instrumental, 14-a
- Release of heat and electricity
- The work of the gas-generating unit replenishes the energy balance of the region and provides for the needs of one of the large districts of the city of Chernihiv for hot water supply.

Equipment of co-generation gasification plant

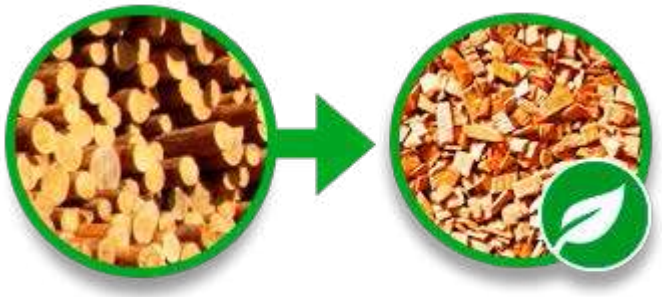
EFFICIENCY OF USED FUEL

Requirements for wood (wood chips):

- Water content <13%
- Maximum content of small fractions (<4 mm grain size) 30%
- Avoid impurities such as metals, stones or earth

Higher efficiency

The combination of patented wood-energy technologies and high-efficiency gas-fired (cogeneration) plants make the gasification system particularly efficient and attractive to businesses.



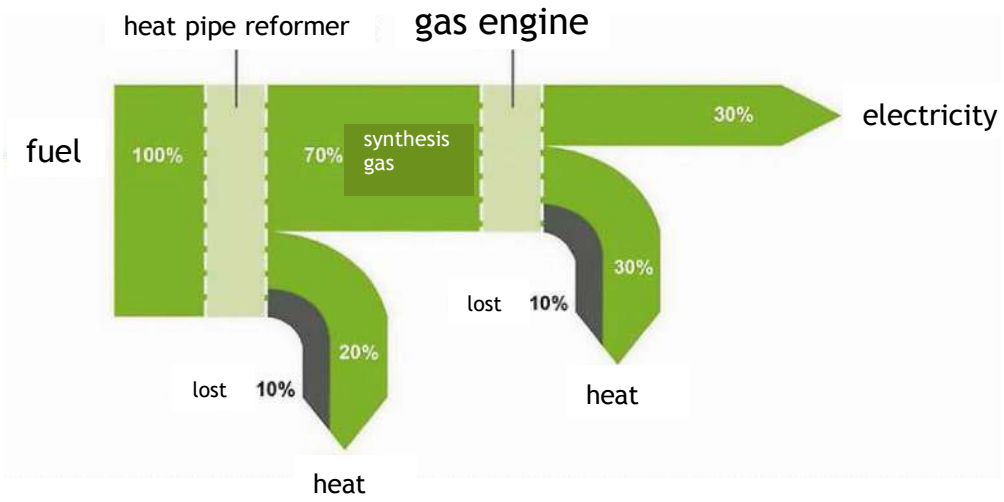
INDUSTRIAL GASIFICATION TECHNOLOGY BIOMASS (WOOD CHIPS)

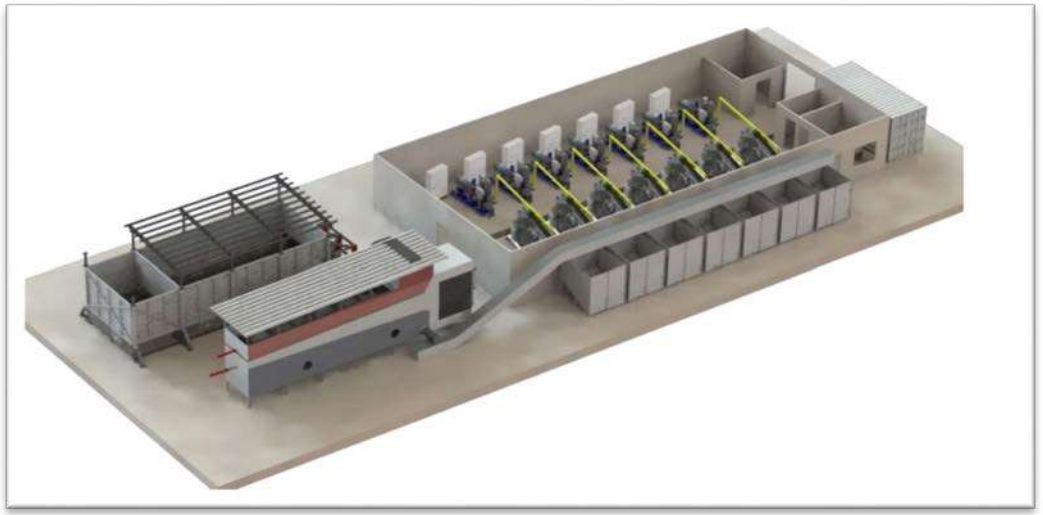
Unit specifications:
Model HKA 70
Electric power of 70 kW
Heat output is 123 kW
Fuel: Natural wood
Max. moisture content <13%
Max. The content of small fraction (grain size <4 mm)
The flow temperature is 85 ° C
The return temperature is 65 ° C

Advantages of gasification technology:

- Low emissions (close to zero);
- Clean technology without harmful waste;
- Minimum requirement of wood chips (0.9 kg) for production of 1 kW;
- The supply of heat to consumers is 30% cheaper than the current tariff using natural gas.

INDUSTRIAL GASIFICATION TECHNOLOGY BIOMASS (WOOD CHIPS)





Higher efficiency

The combination of wood-energy technology and high-efficiency large-scale cogeneration units makes the system particularly efficient, which is also reflected in an increase in efficiency of about 6% compared to the average power segment.

System components

Our wood-fired power plants are designed in such a way that the components of the plants are reduced compared to individual systems, which significantly reduces investment and operating costs.

Turnkey solution

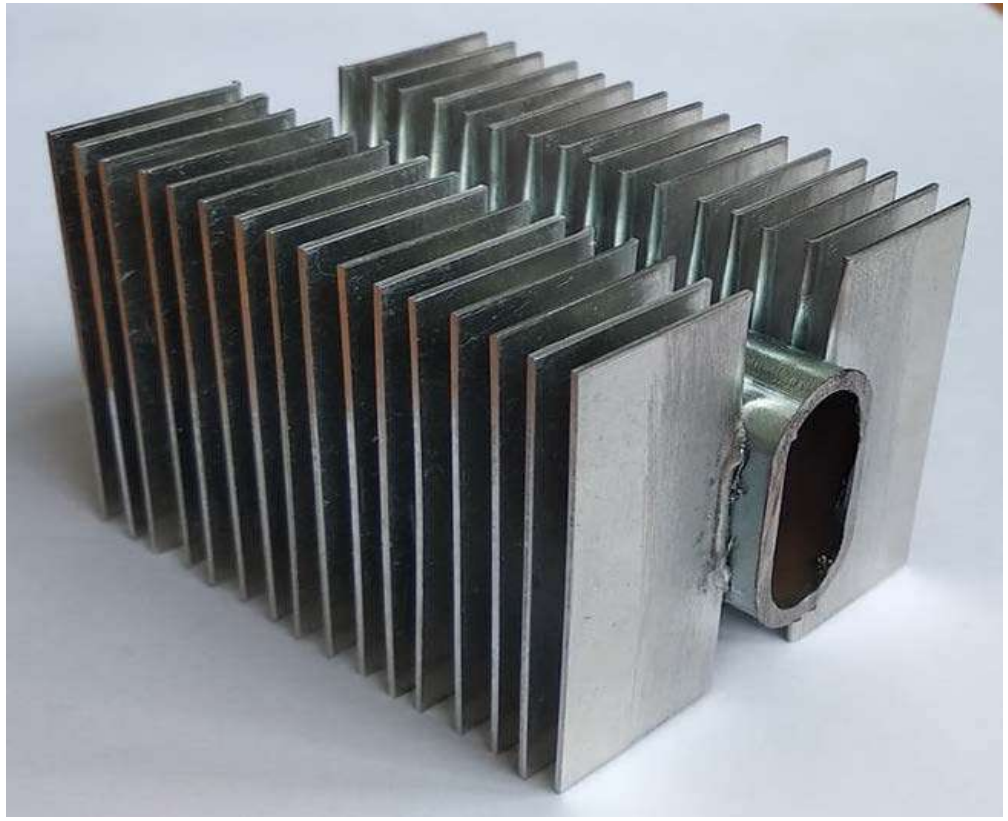
As a full-service provider of electricity and heat from wood, we offer a complete integrated approach for a project for the production of combined heat and energy resources on wood: from filing systems, conveyors, proprietary woodworking technology to customized procurement - we provide everything that can be from one vendor.

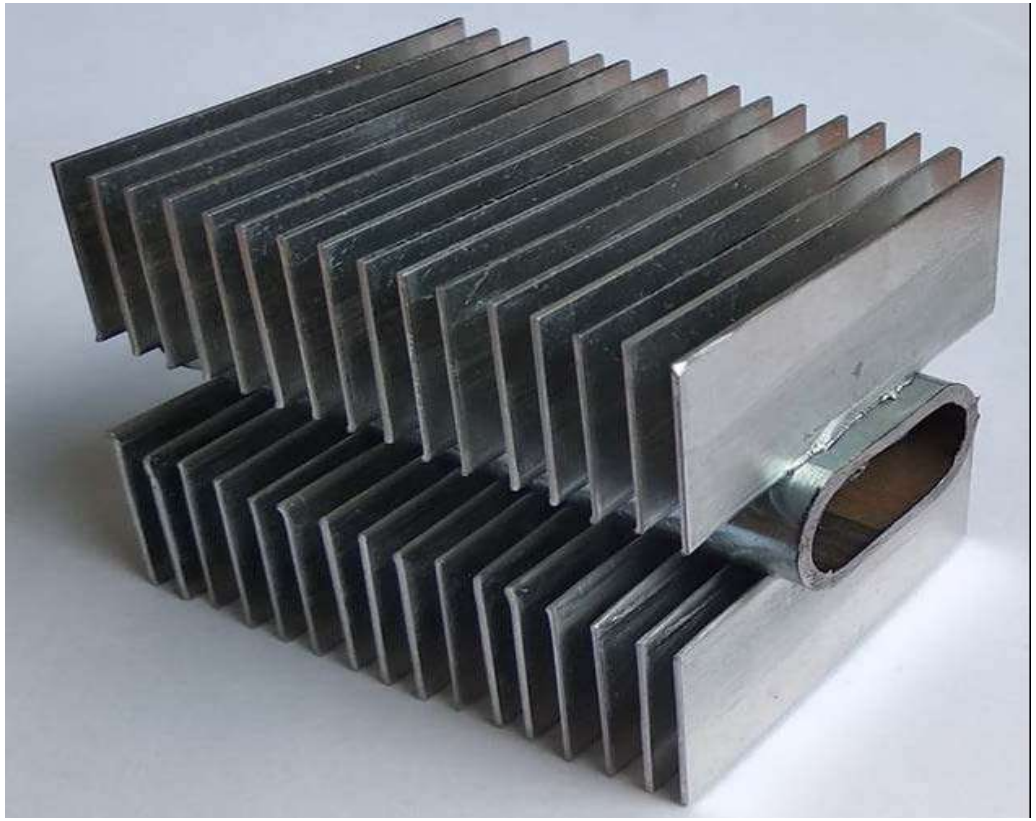
We guarantee 8200 working hours per year.

ГАНЗА
Науково виробнича фірма

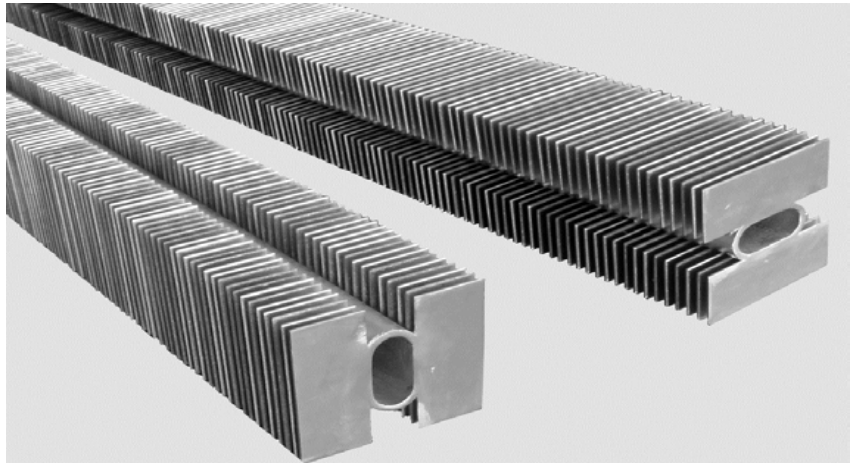
A NEW KIND OF HEAT EXCHANGE SURFACES IN ENERGY SAVING EQUIPMENT

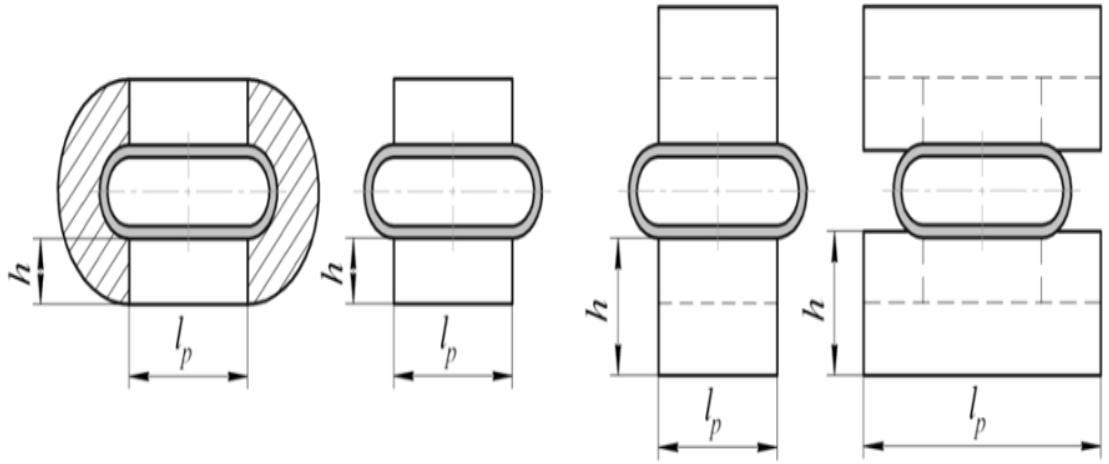
Composite flat-tube pipes with incomplete ribbing





Flat-tube tubes with incomplete ribbing

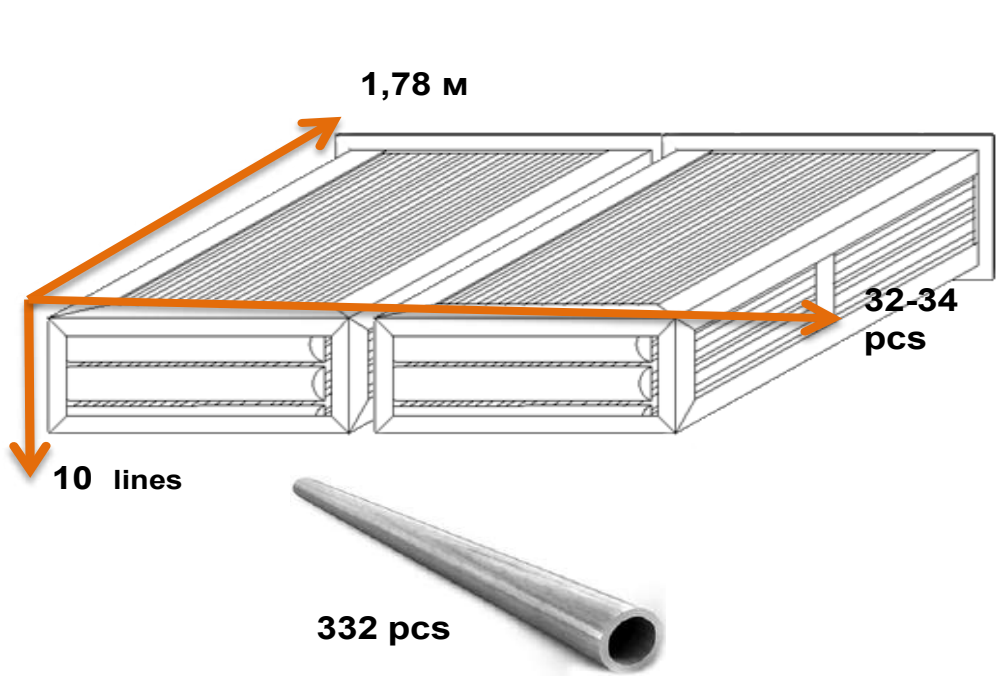


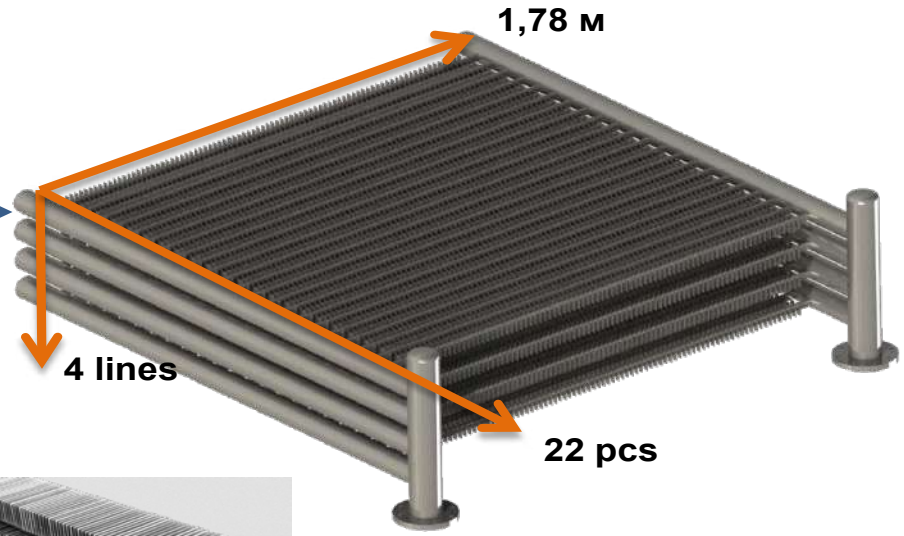


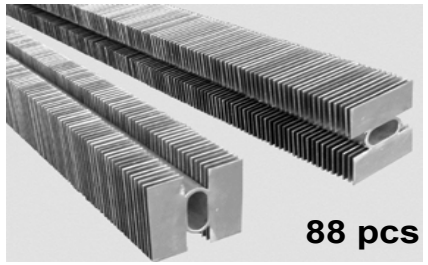
As a result of a complex of studies, NTUU "KPI" has offered heat exchanging surfaces of incomplete ribbed oval tubes, which have several significant advantages over the finned tubes used in industry at present:

- High adaptability;
- Almost perfect contact between the rib and the carrier pipe;
- High intensity of convective heat transfer;
- Low aerodynamic resistance;
- Lower, compared to round pipes, thermal resistance of heat transfer during condensation inside the pipes of the vapor of process liquids.

Comparison of modules of heat utilizers from smooth pipes and from flat-tube pipes with incomplete finishes for the gas turbine GT 750-6 installation





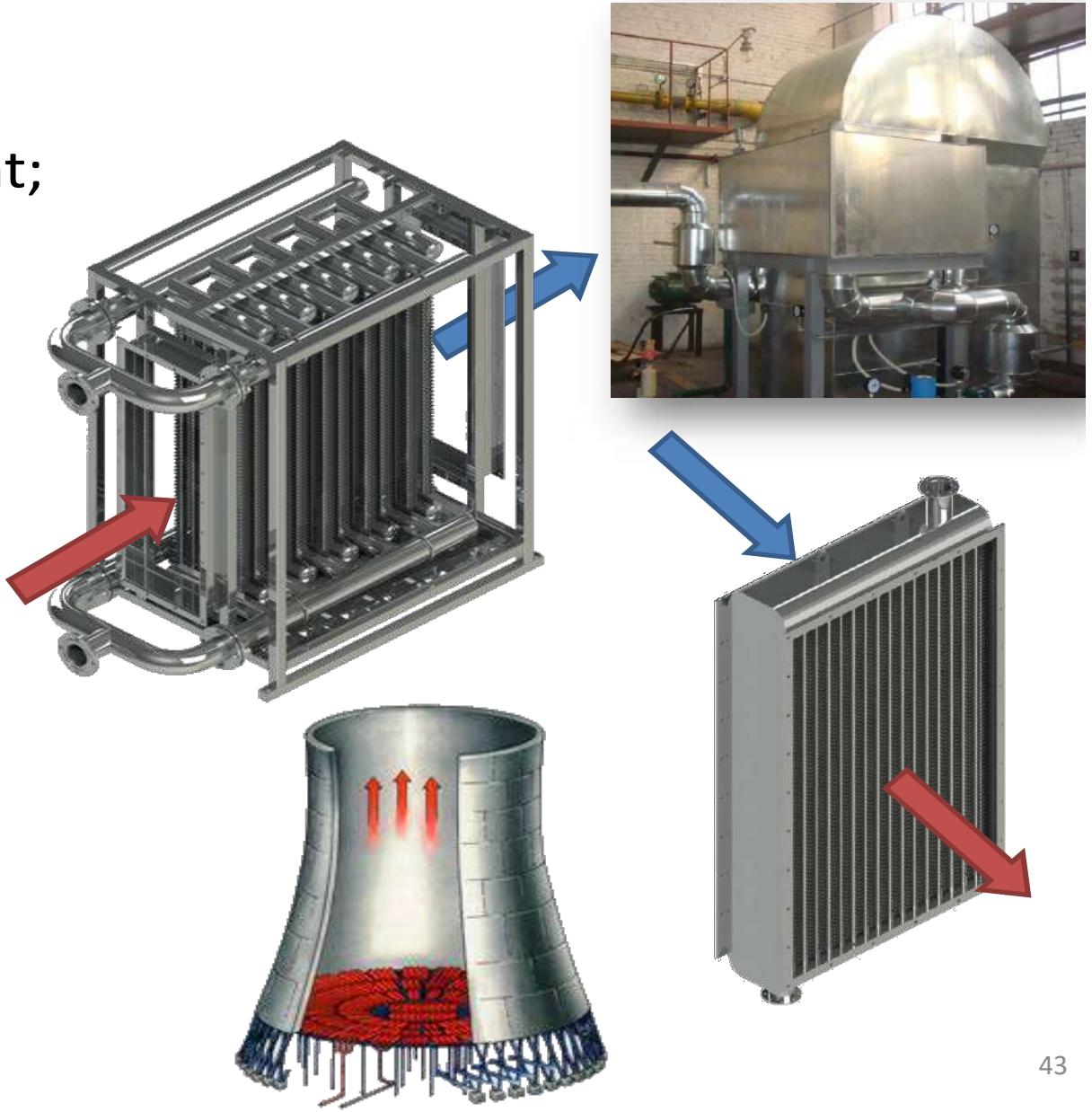


Advantages of heat utilizers based on flat-tube pipes

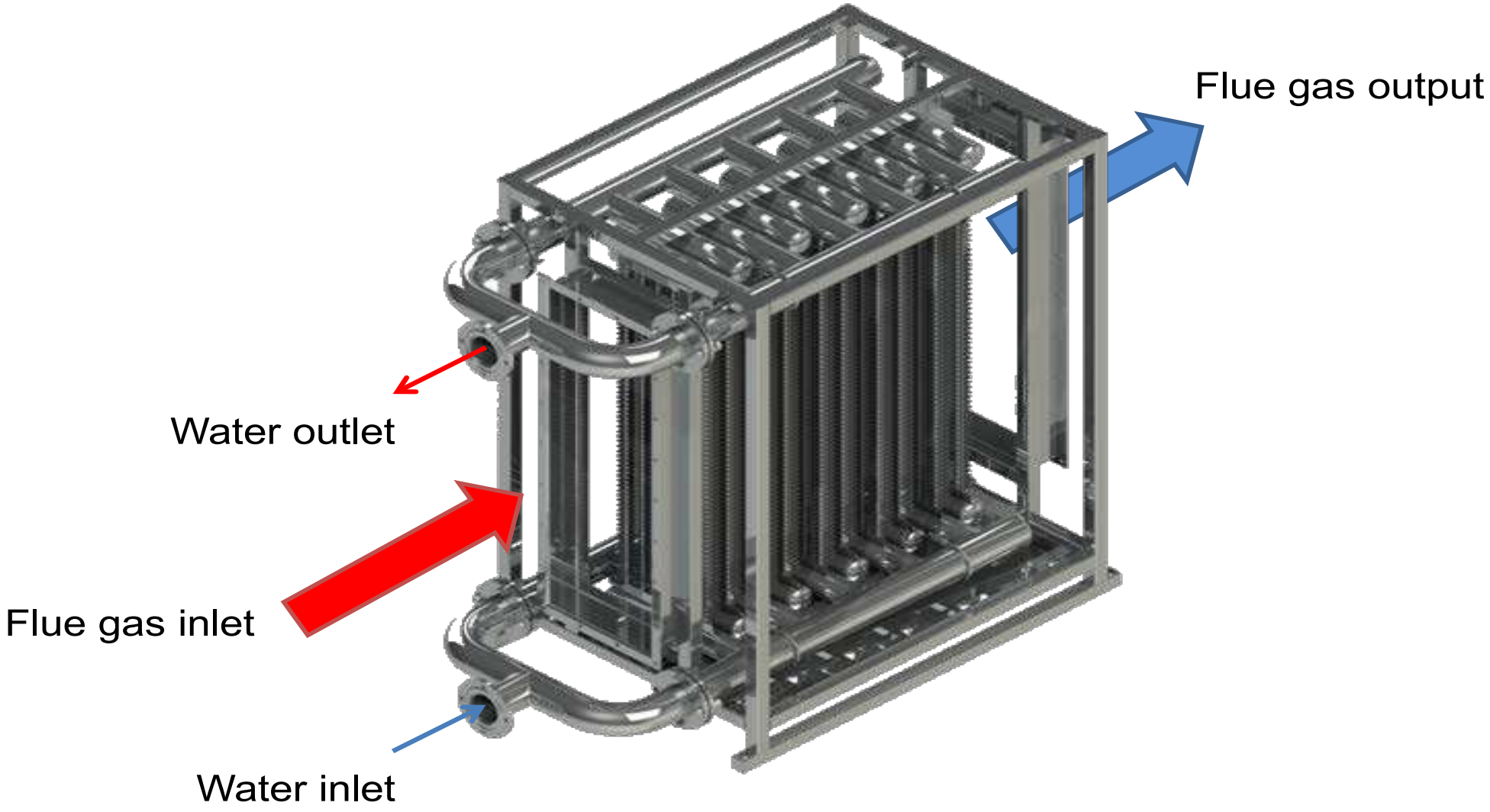
- Simple design;
- Low metal content;
- Reduction of length and number of heat exchange pipes.
- Low aerodynamic drag
- Improved reliability;
- Installation simplification;
- Reducing the cost of welding and installation work;
- Improving adaptability and maintainability;
- Improvement of equipment efficiency

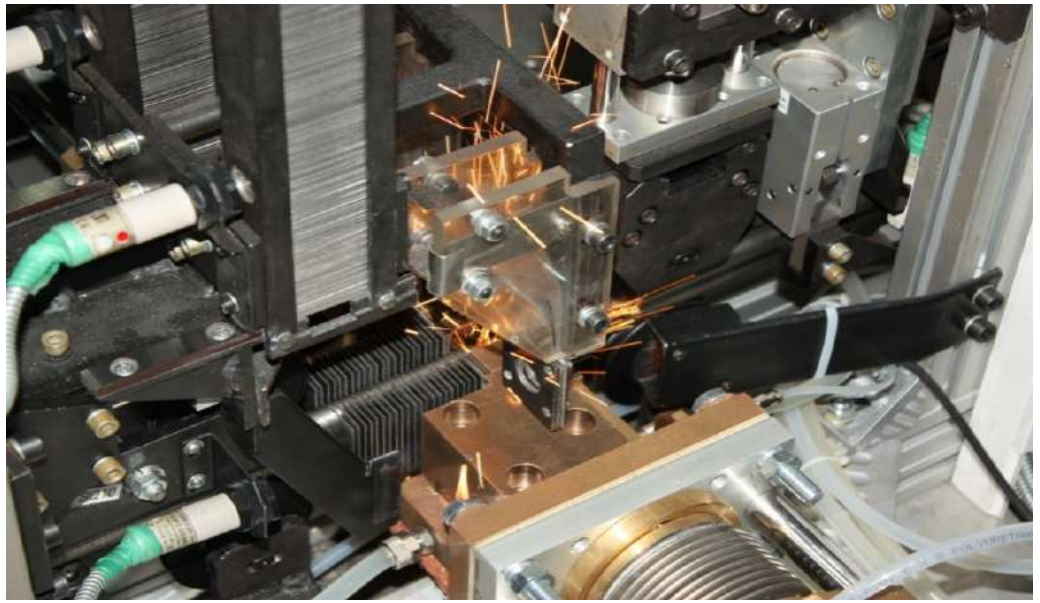
Types of heat exchange equipment

- Heat exhaust flue gas utilizers for fuel equipment;
- Calorific equipment;
- Air cooling apparatus;
- "Dry" cooling towers;
- Oil coolers;
- Other gas-liquid heat exchange equipment.



Typical modular design of heat exhaust flue gas utilizer





Production of incompletely finned flat-oval tubes became possible thanks to the fruitful cooperation of SE “Experimental Design-Technological Office of the E.O. Paton Electric Welding Institute of the National Academy of Sciences of Ukraine”, “National Technical University of Ukraine “Kyiv Polytechnic Institute”, Scientific and Production Company “Ganza” and Clear Energy LLC.

Project implementation efficiency

Type of heat recovery	Type of boiler	Heat capacity of the utilizer, kW	Boiler efficiency in rated load,%	Volume saving per boiler *	Payback for the project, years
				Gas, thousand m3	
PU-1	Колві 3000, КСВ-2,9Г	200	4,5%	36	2,4
PU-2	ДКВР-10/13, КВГ-6,5	400	4,8%	120	1,4
PU-3	ТВГ-8М, ДЕ-16-14	500	5,5%	132	1,5
PU-4	ПТВМ-30М, КВ-ГМ-30	1200	4,7%	252	1,1
PU-5	КВ-ГМ-50, ПТВМ-50	1600	3,2%	360	1,0

•The amount of savings per boiler is calculated based on the boiler load at 60% load during 4000 hours in the heating season.

PJSC "Kyivenergo“
waste heat utilizer after the boiler TVG-8M

The value name	Value
Boiler calorific value, Gcal / g	8,3
The calorific value of the utilizer, kW	490
Aerodynamic resistance of the utilizer, Pa	135
Weight of the utilizer, kg	850
Dimensions of the utilizer (length, width, height), m	1,7 x 1,4 x 1,1
Savings of natural gas, m3 / h	57,4

Efficiency +4,55%

Natural gas savings for one heating the season is up to 229 600 m3

State Enterprise "Ivano-Frankivskteplocomunenergo" utilizers for the TVG-8M boilers

The value name	Value
Boiler calorific value, Gcal / g	8,3
The calorific value of the utilizer, kW	348
Aerodynamic resistance of the utilizer, Pa	230
Weight of the utilizer, kg	954
Dimensions of the utilizer (length, width, height), m	1,71 x 1,27 x 1,0
Savings of natural gas, m3 / h	38,1

Efficiency +4,55%

Natural gas savings for one heating the season is up to 304 800 м^3

KP "Brovaryteplovodoenergy" utilizer for the boiler Viessmann Vitomax LW 64A002

The value name	Value
Boiler calorific value, Gcal / g	10
The calorific value of the utilizer, kW	360
Aerodynamic resistance of the utilizer, Pa	180
Weight of the utilizer, kg	1180
Dimensions of the utilizer (length, width, height), m	1,3 x 1,2 x 1,6
Savings of natural gas, m3 / h	41,7

Efficiency +4,55%

Natural gas savings for one heating the season is up to 166 800 м³

“Kraft Foods Ukraine” Boiler Disposal Standardkessel HD0101-11

The value name	Value
Boiler calorific value, Gcal / g	8
The calorific value of the utilizer, kW	410
Aerodynamic resistance of the utilizer, Pa	74
Weight of the utilizer, kg	700
Dimensions of the utilizer (length, width, height), m	1,7 x 1,6 x 1,8
Savings of natural gas, m3 / h	51

Efficiency +4,55%

Natural gas savings for one heating the season is up to 204 000 м^3

Patenting and certification


УКРАЇНА

ПАТЕНТ

НА КОРИСНУ МОДЕЛЬ

№ 75151

УСТАНОВКА ДЛЯ ВИГОТОВЛЕННЯ РЕБРИСТИХ ТРУБ

Видано відповідно до Закону України "Про охорону прав на винаходи і корисні моделі".

Зареєстровано в Державному реєстрі патентів України на корисні моделі 26.11.2012.

Голова Державної служби інтелектуальної власності України


УКРАЇНА UKRAINE

ПАТЕНТ

НА КОРИСНУ МОДЕЛЬ

№ 25025

ТЕПЛООБМІННА ТРУБА

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Голова Державного департаменту інтелектуальної власності


УКРАЇНА

ПАТЕНТ

НА ВИНАХІД

№ 104913

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Голова Державної служби інтелектуальної власності України


УКРАЇНА

ПАТЕНТ

НА КОРИСНУ МОДЕЛЬ

№ 96194

ТЕПЛОУТИЛІЗАТОР

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