

УДК 339.944:620.621.31:621.311:697.34

STRUCTURE-FUNCTIONAL FEATURES OF RENEWABLE ENERGY SOURCES INTEGRATION INTO MUNICIPAL HEAT SUPPLY SYSTEMS

O.Kovalko¹, O.Novoseltsev², T.Eutukhova³

¹ Naftogaz of Ukraine,

6, Bogdana Khmel'nitskogo St., Kyiv, 01601, Ukraine,
tel. : +38 (050) 441-67-34, e-mail: omkovalko@gmail.com ;

² Institute of Engineering Thermophysics of NAS of Ukraine,
2a, Maria Kapnist St., Kyiv, 03057, Ukraine,
tel. : +38 (067) 607-16-84, e-mail: anovos@i.com.ua ;

³ Interregional Academy of Personnel Management,
2, Frometovskaya St., Kyiv, 02000, Ukraine,
tel. +38 (096) 683-82-61,
e-mail: tatyana.eutukhova@gmail.com

The paper considers the feasibility of using a flexible portfolio of generation technologies with the optimal ratio of fossil and renewable energy sources, as well as substantiates the need for carrying out the district heating systems unbundling and the use of complex energy services.

Keywords: combined energy supply systems, unbundling, smart energy services.

СТРУКТУРНО-ФУНКЦІОНАЛЬНІ ОСОБЛИВОСТІ ІНТЕГРАЦІЇ ВІДНОВЛЮВАНИХ ДЖЕРЕЛ ЕНЕРГІЇ В МУНІЦИПАЛЬНІ СИСТЕМИ ТЕПЛОПОСТАЧАННЯ

О. М. Ковалко¹, О. В. Новосельцев², Т. О. Евтухова³

¹ Нафтогаз України,

вул. Богдана Хмельницького, 6, Київ, 01601, Україна,
тел.: +38(050) 441-67-34, e-mail: omkovalko@gmail.com;

² Інститут технічної теплофізики НАН України,
вул. Марії Капніст, 2а, м. Київ, 03057, Україна,
тел.: +38(067) 607-16-84, e-mail: anovos@i.com.ua;

³ Міжрегіональна академія управління персоналом,
вул. Фрометівська, 2, Київ, 02000, Україна,
тел. +38(096) 683-82-61,
e-mail: tatyana.eutukhova@gmail.com

ORCID: ¹0000-0002-4132-8438; ²0000-0001-9272-6789;
³0000-0003-4778-2479.

У роботі розглядається техніко-економічна доцільність застосування гнучкого портфеля технологій генерації з оптимальним співвідношенням викопних та відновлюваних джерел енергії, обґрунтовується необхідність проведення анбандлінгу муніципальних систем централізованого теплопостачання та застосування комплексних енергосервісних послуг.

Ключові слова: *комбіновані системи теплопостачання, анбандлінг, енергосервісні послуги.*

According to sustainable development plans, more than 2/3 of the installed capacity of EU electricity generation equipment in 2050 will use renewable energy sources (RES) as the main fuel. Such a significant share of unstable generation will require a corresponding increase in the balancing capacities of traditional fossil fuels technologies. They must be provided by both cogeneration and storage units that directly use electricity (hydropower stations, electric

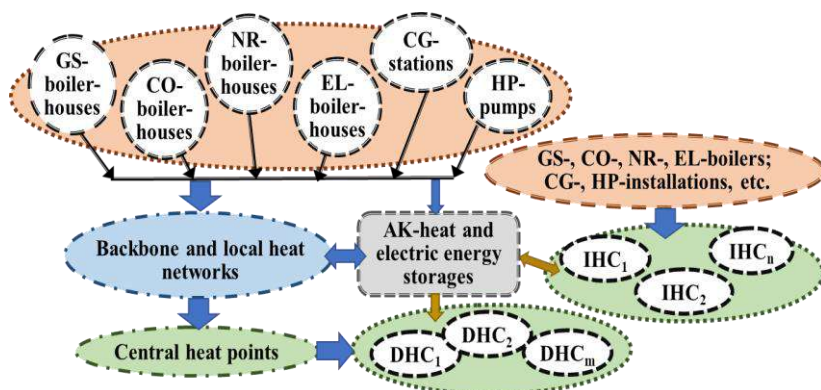
vehicle batteries, compressed air storage devices, etc.), as well as by units converting electrical energy into thermal energy (heat pumps, electric boilers, thermal energy storages, etc.). Herewith, it should be noted that the organizational and functional structure of municipal heat supply systems (MHS) is much more conservative and vertically integrated than electricity systems. Foremost, this is because the heat supply systems consist of separate, practically independent local (municipal) systems, unlike the nationally integrated electricity system.

The most influential in the process of integrating RES into the structure of primary fuel balance of the MHS are several factors, first:

- the feasibility (possibility, etc.) of simultaneous use of fossil and renewable energy sources, their availability at the local level;
- the impact on the weighted average prices and the environment;
- the volumes of expedient renewable energy production;
- the necessary economic incentives and their financial and legal support, etc.

At the same time, the significance and changes of the systems of accumulation and regulation of variable production, transportation and supply of renewable energy and its dispatching are significantly increasing.

The availability of a flexible portfolio of complementary generation technologies with the optimum ratio of fossil and renewable energy sources (combined energy supply systems) is one of the solutions to the problem of reducing the risks and cost of RES integration. This portfolio usually includes a package of measures for the unbundling of district heat (DH) supply systems as well as for the systematically coordinated provision of smart energy services.



The structure-functional scheme of integration of RES into the municipal heat supply systems, considered in the paper, is presented in the diagram, which shows:

- GS, CO, NR, and EL, – energy plants (stations) on natural gas, coal, RES and electricity, respectively;
- CG, HP and AK – cogeneration units, heat pumps, and heat and electricity storages;
- DHC – consumers of the DH system; and
- IHC – consumers of autonomous / individual heat supply systems.