

INTEGRATION OF RENEWABLE ENERGY SOURCES INTO DISTRICT HEATING SYSTEMS

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Abstract

The paper analyzes modern approaches to integrating renewable energy sources (RES) into centralized district heating (DH) systems in Ukraine. It provides statistical data on the current share of RES in Ukraine, thoroughly evaluates technological and economic aspects of implementation, describes international experiences, and provides specific recommendations for enhancing RES efficiency.

Introduction

Amid rising prices for conventional energy carriers and the necessity to reduce greenhouse gas emissions, the integration of renewable energy sources into district heating systems is particularly relevant for Ukraine. Currently, about 45% of Ukraine's population relies on district heating, yet the share of RES in this sector stands at only about 8%. According to forecasts by Ukraine's Ministry of Energy, this figure could rise to 25% by 2030.

RES technologies and their potential in Ukraine's DH systems

Ukraine possesses substantial biomass resources – over 20 million tons of agricultural residues annually – which can generate approximately 18 million tons of conventional fuel equivalent. Experts estimate geothermal energy potential at around 12 million tons of conventional fuel per year. Additionally, solar thermal installations demonstrate significant potential, especially in the southern regions.

Technical and economic aspects of RES integration

Essential aspects include upgrading heating networks to operate at lower temperature regimes (55-70°C instead of traditional 90-110°C), reducing heat losses by 15-20%. Introducing heat accumulators can mitigate peak loads and optimize heat generation, achieving operational savings of up to 20%. Heat pumps, with coefficient of performance (COP) values reaching up to 4, significantly reduce heat generation costs compared to conventional sources.

International experience

Denmark and Sweden lead in utilizing RES in district heating systems. In Denmark, over 70% of heating is derived from RES, including biomass and solar energy. Sweden achieves approximately 75%, primarily through biofuels and geothermal energy.

Challenges and recommendations

Challenges to RES integration include high initial investment, inadequate legislative frameworks, and outdated infrastructure. Recommendations to address these issues include:

- Developing state financial support programs (grants, subsidies) for RES projects;
- Modernizing legislative frameworks to expedite new technology implementation;
- Enhancing international collaboration and attracting investments through public-private partnerships.

Conclusions

Integrating RES into district heating systems is essential for Ukraine's sustainable development and energy security. Further research and implementation of advanced heat storage and energy optimization technologies are necessary, alongside with political measures that encourage investment and innovative solutions in district heating.

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IMPROVING THE OPERATIONAL PERFORMANCE OF STRUCTURES USING FIBERGLASS WRAPS

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The construction of main pipelines in various regions of Ukraine requires an increase in their reliability and durability, as this is a crucial national economic task. Solving this problem is associated not only with the need to minimize metal losses due to corrosion but also with ensuring the uninterrupted operation of pipelines. Structural materials used in pipe manufacturing inevitably contain defects, including microcracks; however, under proper operating conditions, they