

Improving the performance of District Heating Systems in Central and Eastern Europe

District Heating in Ukraine

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Introduction

Ukraine has a quite developed district heating (DH) infrastructure in all major urban settlements. As a rule, district heating systems (DHS) are managed by municipal district heating companies that provide heat to private and public clients under the supervision of either local municipalities or the National Commission for State Energy and Public Utilities Regulation (hereafter – The National Regulator).

Natural gas still remains the dominant fuel for the district heating sector, while the use of biomass for heating is growing. Ongoing district heating energy efficiency projects aim to balance current reduced heat loads with existing heat generation and transportation facilities, further centralise district heating and upgrade major technological equipment. The scale of investment in these activities throughout the country shall be significantly increased to ensure mid- and long-term reliability of heat energy supply.

Tariffs for heat energy in Ukraine are torn between the need to cover all expenses of district heating operations and the capacity of clients, particularly individual households, to sustain the prices. Overall, general financial conditions of Ukrainian DH companies are often complicated. Many companies have significant debts before Naftogaz of Ukraine – the state natural gas supply company. Hence, local municipalities often subsidise their DHS companies, while international financial institutions continue to be the important investors of DHS renovations, subject to guarantees from municipalities and the Ukrainian state.

At the same time, DHS companies remain the actual monopolies on heat supply at major urban settlements. Limited competition results in sector's inefficiencies and prevents new players (and investment) from entering the sector. Introduction of heat market in the country based on the competitive access to the heat transportation grid shall provide significant impetus for DHS development and modernisation in Ukraine.

Human resources and organisational capacities of the DH sector ought to be improved as well. On-going and coming introduction of modern heat generation and transportation equipment requires a new level of professionalism and skills from key DHS personnel, supported by regular trainings and education. The staff shall be appropriately paid and motivated to be able to execute energy efficiency and renewable energy projects in the district heating sector.

The successful transition toward efficient district heating in Ukraine requires smart modernisation of DHS facilities supported by significant investment, competition and capacity development. A number of ongoing DHS modernisation projects demonstrate the feasibility of DHS reform with the effective support from the EU and International Financial Institutions. Much more shall be done to spread these successes everywhere in the country.

Technology

In 2018 the volume of heat energy supply to final consumers constituted 42 million MWh (36.1 million Gcal).¹ Natural gas has been used as the major fuel.

Heat generation efficiency by boiler houses equalled, on average, 89%. According to the National Regulator, 40% of boilers shall be modernised or replaced. Similar needs exist with regard to the pump fleet and auxiliary equipment. Another challenge is the use of waste heat from DHS heat generation facilities.

In terms of heat transportation facilities, the majority of the pipelines produced of black steel with poor insulation and has been in use for more than 25 years. DHS companies reporting to the National Regulator shall replace 9,400 km of outdated pipes worth EUR 1.9 billion (UAH 56.3 billion).²

The level of investment in DHSs modernisation projects has been far below the demand. According to the investment programmes of DHS operators – the licensees of the National Regulator supplying 51,7% of heat energy in the country – the investment in upgrading heat energy boilers, the pumping fleet and other energy efficiency measures constituted EUR 0.5 million (UAH 15.2 million) while EUR 10.9 million (UAH 326.3 million) has been allocated for supplementing 60 km of pipelines and other grid energy efficiency measures. Although the total sum of EUR 11.4 million (UAH 341.6 million) does not include considerable investment for the same purposes coming from licensees of local municipalities as well as from international financial institutions, the general investment volumes are significantly lower than the estimated investment requirements for the modernisation of heat generation facilities and networks of USD 6 billion (EUR 5.3 billion).³

In recent years, significant progress has been achieved in switching from lump sum billing per square meter of the heated area to consumption-based billing with the share of buildings equipped with heat meters growing from 40% in 2014 to 94% in 2018. Still, most of the buildings connected to the DHSs have only building-level heat metering and control of heat energy supply is performed by adjusting supply temperature of the heat carrier at the generation sources. Such an approach limits the possibility of control over the heat energy demand by final consumers and reduces the attractiveness of energy efficiency improvements in buildings. During recent years, individual heating units have been massively installed at multi-apartment and public buildings in Ukraine to regulate the heat demand and perform localised hot water preparation for the clients, now actively using electrical boilers for this purpose. Moreover, in 2018 the first pilot projects on the installation of heat cost allocators were started in several Ukrainian cities showcasing additional incentives for energy demand control and energy efficiency improvements.

1 Data of the Ministry of Regional Development and Construction as reported in the Annual Report for 2018 of the National Commission for State Energy and Public Utilities Regulation, http://www.nerc.gov.ua/data/filearch/Catalog3/Richnyi_zvit_NKREKP_2018.pdf

2 Annual Report for 2018 of the National Commission for State Energy and Public Utilities Regulation, http://www.nerc.gov.ua/data/filearch/Catalog3/Richnyi_zvit_NKREKP_2018.pdf

3 Heating in housing and utilities sector: Status and Prospects, <https://www.slideshare.net/ZubkoGennadiy/heating-in-housing-and-utilities-sector>

Balancing Heat Demand with Heat Production and Transportation Facilities

Overall, straight replacement of outdated with modern equipment having the same capacity does not look like a reasonable option in many cases, as DHS heat generation and transportation infrastructure does not match the existing heat demand.

The majority of DHS in Ukraine has been designed and constructed decades ago to satisfy considerable heat demand which existed at those past times. Since then, though, heat loads in many locations have been significantly reduced due to disappearance of big industry clients, reduced demand for heat from existing clients which underwent energy efficiency modernisations, as well as migration of consumers to individual natural gas, electric, and biomass-based heating and hot water supply. As for now, district heating covers 40% of the population, which is approximately 5.5 million households⁴ and is estimated to cover about half of the energy demand for heating purposes.

In turn, the capacity of heat generation and transportation facilities in many cases has not been appropriately adjusted, bringing the excessive technological capacity of DHS and, consequently, operational inefficiencies. Hence, any significant modernisation of the DHS infrastructure must ensure that current and predicted heat loads are met by efficient heat generation and transportation facilities operated with optimal technological conditions. In the majority of cases that means further centralisation of heat generation and transportation facilities, where fewer pieces of DHS infrastructure operate at their optimal technological capacities and satisfy the heat demand, while excessive technological equipment ceases its operations.

The same is true with regard to DHS facilities on hot water provision. Following massive migration of clients to electrical boilers for hot water generation, lengthy hot water pipelines often went out of operation. Instead, hot water preparation may well happen at individual heating units, being massively installed in many urban settlements in Ukraine.

DHS Finances

Financial conditions of major DHS companies in Ukraine are pretty complicated. Many of them spend more money for heat supply than they earn from the heat sales. The inefficient technological equipment and considerable natural gas prices keep the companies' operational expenses at rather high level, while the tariffs for heat, being a politically sensitive issue, are often not high enough to cover the necessary expenses.

In addition, there have often been considerable time gaps between the dates of official increase of natural gas and electricity prices and the actual reflection of these changes in the tariffs. Subsidies, coming to DHS companies from municipalities, as a rule, could only partially fill the gap.

According to the Cabinet of Ministers decision, Naftogaz of Ukraine has a public service

⁴ Heating in housing and utilities sector: Status and Prospects, <https://www.slideshare.net/ZubkoGennadiy/heating-in-housing-and-utilities-sector>

obligations (PSO) to supply natural gas to DHS companies under the regulated prices. Thus, as of 1 November 2018 the price of natural gas for DHS has increased by 22.8% and reached UAH 6968.21 for 1000 cubic meters or EUR 24 per MWh (without VAT).⁵ Overall, the share of natural gas costs in the heat tariffs for households exceeds 86%. The mentioned drastic increase in natural gas prices has not been automatically reflected in heat tariffs, forcing DHS companies during months to further accumulate debts with the Ukrainian state company Naftogaz. The aggregated debts of DHS companies with Naftogaz have reached EUR 1 billion (UAH 31 billion) as of 2 July 2019.⁶

A solution may be found in improving the tariff establishment procedure to get the natural gas/other fuels/electricity price fluctuations automatically reflected in the tariffs, which, in turn, must be economically viable. At the same time, the cooperation between the Ukrainian state company Naftogaz and municipal DHS companies could be better balanced to allow proper management of the debt and its reduction in a foreseeable future. Finally, the potential of utilising other fuel options, like biomass, shall be further developed.

Biomass – an alternative to natural gas

Ukraine has significant biomass resources, both wood and agricultural, which makes biomass the major competitive fuel for natural gas for the DHS Ukrainian sector. Also, there is already legislation in place imposing specific tariffs for biomass based electricity and heat. The latter constitutes 90% of the natural gas-based heat tariff. Overall, the share of biomass-based heat generation in Ukraine (within and outside DHS) has already reached 22.5% (+3.1% in comparison to 2017) and the share of alternative fuel boilers in the country constitutes 14.2% (+2.5% in comparison with 2017) of the total installed capacity.⁷

Currently, dozens of big biomass to heat boiler houses and CHPs have being developed in Ukraine; few of such projects have already been built and operated, demonstrating the feasibility and reliability of such activities in Ukraine. The DHS company of Kamyanets-Podiskii – a Ukrainian city with 100,000 inhabitants – has already secured 20% of its heat generation based on biomass.

The further spread of biomass fuel use in the Ukrainian DH sector greatly depends on the success of dealing with sustainable biomass growth and logistics as well as market-based regulation of biomass prices. Effective production and logistics of biomass resources, including biomass imports, shall ensure its availability at consumption locations throughout Ukraine already in the near future. Competitive market prices are

5 Annual Report for 2018 of the National Commission for State Energy and Public Utilities Regulation, http://www.nerc.gov.ua/data/filearch/Catalog3/Richnyi_zvit_NKREKP_2018.pdf

6 Naftogaz of Ukraine, <http://www.naftogaz.com/www/3/nakweb.nsf/0/6353C39751338A8DC225842C003D8C62?OpenDocument&year=2019&month=07&nt=%D0%9D%D0%BE%D0%B2%D0%B8%D0%BD%D0%B8&>

7 Data of the Ministry of Regional Development, Construction and Utilities Sector, <http://www.minregion.gov.ua/press/news/viznachenolideriv-sotsekonomicznogo-rozvitku-regioniv-za-2018-rik-zubko/>

required to stabilise the price of this fuel considering seasonal and geographical discrepancies. Finally, generation of heat and electricity from biomass shall be exempt from CO₂ taxation, which is currently the case in Ukraine.

Competitive District Heating Market

The Ukrainian Law “On Natural Monopolies” recognises the transportation of heat as a natural monopoly activity, while heat generation and supply are the activities at adjacent markets.⁸ In reality though, all three types of activities are executed by the same companies, creating few, if any, market incentives to improve the quality and prices of the delivered services.

The breakthrough could be found in the introduction of competitive heat markets in Ukraine. Here the transport of heat within DHS may be executed by a municipal monopoly, while heat generation and supply could be covered by different market players, able to provide to clients the most competitive conditions in terms of cost of heat, its quality, type of fuel used, etc.

Draft legislation enabling such course of affairs is already in the Ukrainian Parliament, while its adoption is subject to further discussion as well as testing (pilot) trials.

Human Resources in District Heating Sector

Ten thousands of people work in Ukrainian DHS companies throughout the country and the companies manage to keep the core staff in house, providing major services on heat supply at an acceptable level. Yet, many DHS companies experience considerable deficit of professional employees, caused mainly by not competitive salary levels. At the same time, many DHS companies install high-tech modern equipment, which requires a high level of professional services.

The situation requires improving tariff regulations to make it possible to pay market level salaries to DHS personnel. At the same time, the structure of DHS companies' personnel ought to be revised to be able to cope with new high-tech equipment being installed within the companies' renovation activities. At the country level the creation of a DHS operations' centre of excellency could be launched to train DHS employees to deal with major kinds of new equipment being installed in the sector (modern boilers and CHPs, individual heating units, etc.).

⁸ <https://zakon.rada.gov.ua/laws/show/1682-14>