# Lessons learnt from Kauno energija, Neveronys case

***Kauno energija, Neveronys case:***

Kauno energija is a regional multi-municipal DH operator. Neveronys DH system is one of many isolated DH systems operated by the enterprise Kauno energija:

1. The Neveronys DH system represents the typical structure and characteristics of many small-scale, fossil-fuel-based DH systems that still operate in Lithuania's smaller towns. These characteristics make Neveronys a valuable frontrunner case for exploring practical and scalable decarbonisation pathways — not only for the Kaunas district, but also for other cities in Lithuania, given the substantial potential for the future integration of RES and waste heat. Several challenges common to many small DH systems in Lithuania which must be overtaken when planning decarbonisation:
    - No available waste heat sources nearby.
    - The only boiler plant is situated close to the apartment buildings inside on a very limited plot of land.
    - Heat consumption or the density of heat consumers are low, so new investments may make heat prices unacceptable.

These and similar features make the decarbonization of such DH systems rather challenging. Technical and economic evaluation of various solutions could provide useful lessons for other DH operators that operate similar boiler plants.

2. The complex integration of $CO_2$ type air-source compression heat pumps with short-term thermal energy storage makes it possible to achieve a greater economic benefit and a higher utilisation factor, allowing operation for more hours at the nominal heat production load compared to a simple heat pump usage and operation without any heat storage options.
3. A comprehensive investigation reveals that policy measures such as financial subsidies and support would facilitate a faster return on investment and prevent an increase in heat production costs, thereby avoiding a burden on end users. This provides a sound basis for discussions with the responsible ministry and agencies regarding state support schemes for decarbonisation of the DH sector in general.
4. The circumstances relevant to heat pump projects in Lithuania: there are relatively high initial investments required for high-capacity electricity grid connections; a significant fixed component of electricity capacity charges; uncertainty regarding the dynamic electricity transmission tariff mechanism; and a lack of reliable indications of future electricity price trends. "Summer-operated" heat pumps effectively complement "winter-operated" biomass boilers, extending their operational lifetime.
5. More flexible electricity market stimulating usage of „cheap" electricity prices would yield additional revenues and increase the financial viability of an optimal investment portfolio. As a result of the investigations at the Neveronys DH frontrunner case, recommendations have been submitted to the responsible institutions, which has initiated a new methodology for dynamic and seasonal electricity transmission and distribution tariffs, making the economics of decarbonisation more attractive.

### *Alytus silumos tinklai case:*

Looking at the Alytus DH frontrunner case, the integration of thermal energy storage into biomass CHP demonstrates many lessons learnt:

1. First of all, there are no thermal energy storages in the Lithuanian biomass based CHP plants. Therefore, all information related to the introduction of such equipment is of great interest to other CHP owners.
2. Reduction of natural gas consumption by meeting peak heat demand using thermal energy stored in a storage tank, is a very interesting solution for archieving full decarbonisation, because all investments in the final decarbonization of DH process are very expensive. So, results could provide useful indications for other DH operators.
3. The volume of efficient „green“ electricity generation is increased during peak hours by storing the generated „green“ heat in a heat storage facility. This is not only improves the company's overall financial performance but also provides the country with more essential “peak” and „green“ electricity. This example might encourage other CHP owners to follow this approach.
4. CO2 emissions are reduced, resulting in savings on emission allowances under the EU Emissions Trading System (ETS). This factor important for many DH operators who participate in the ETS scheme.
5. More accurate regulation of the DH system's temperature profile and improved heat supply quality can be achieved, addressing a challenge faced by many DH operators.
6. Biomass-fired boilers, in combination with a heat storage tank, can operate more steadily without fluctuations in heat output, which increases their reliability and longevity.
7. A bioCHP plant equipped with a heat storage tank would have a greater commercial advantage over other similar heat producers in the city that do not have storage tanks. This solution can stimulate similar investments in efficiency by other competing CHP owners.
8. In the event of a boiler failure and its temporary shutdown, heat can be supplied from the TES while repair work is in progress.
9. TES provides indirect benefits, including the ability to use the accumulated volume of softened water for emergency network replenishment or firefighting.
10. It is also expected that the operational lifetime of the existing biomass boilers will be extended by the integration of TES.
11. The investment appraisal for TES must reflect the heat market model. The same storage asset may have a different value depending on whether the DH operator controls most production directly or competes with independent heat producers through auction-based heat procurement.
12. The Alytus case shows that systems with a high share of renewable heat still need further transformation. Since Alytus already produces almost all heat from biomass, the next step is not only additional RES capacity, but better use of existing assets, lower peak fossil fuel use and higher flexibility in heat and electricity markets.

### *Both Lithuanian cases confirmed that:*

- reliable decarbonisation planning requires detailed operational data and well-calibrated modelling. Without such modelling, the value of heat pumps, thermal energy storage or other flexibility measures may be significantly overestimated or underestimated
- early and continuous operator engagement is necessary to define realistic support needs, validate modelling assumptions and ensure that project outputs are useful for investment planning.