Highlights

1. **A combined energy and exergy assessment of a data centre–heat pump–thermochemical energy storage–district heating network integration is presented;**
2. **Data-centre waste heat is analysed as a thermal source for a real, third-generation district-heating network (Varna, Bulgaria);**
3. **Thermochemical energy storage enables seasonal decoupling between waste-heat availability and heat demand;**
4. **Recovered waste heat supplies up to 3.0 % of annual DHN demand and over 20 % of peak load;**
5. **The integrated configuration systematically improves overall exergy efficiency.**