BeyondEE

Integrated Digital Solutions for District Heating Optimisation & Empowering End-Users

LAPPEENRANTA, FINLAND

Emissions domains addressed by the Pilot Activity

- Consumption of non-electricity energy for thermal uses in buildings & facilities
- Consumption of electricity generated for buildings, facilities & infrastructure

Key Terms

Demand response | District heating | Digital twin | IoT optimisation | Peak load reduction | Fossil fuel substitution | Residential energy savings | Replication toolkit

Levers of Change

Data and Digitalisation | Democracy and participation | Governance and policy | Learning and capabilities | Technology/infrastructure

Description of the Pilot Activity

Lappeenranta has been a clean energy pioneer for years. BeyondEE targets the next frontier: using digital twin technology and demand response systems to optimise district heating in real time, reduce peak fossil fuel use, and cut costs for building owners and residents. The pilot installs demand response controls in residential and service buildings connected to the city's district heating network, with a custom-built optimisation application that coordinates building-level flexibility with network-wide production — creating a smart, responsive heating system that replaces gas-fired backup capacity with renewables during peaks.

Year One Highlights

Lappeenranta moved quickly from concept to working system. In year 1, demand response equipment was installed in 12 properties across 23 buildings, with a combined district heating connection capacity of 2.4 MW — exceeding the original pilot scope. The strong uptake from building owners validated the recruitment approach. The municipal energy company, Lappeenrannan Energia, built the optimisation application in-house rather than procuring an external platform — retaining local expertise, enabling rapid iteration, and avoiding vendor dependency. During the year the system reduced 355 MWh energy consumption, avoiding 10 650 kg of CO_2. Buildings achieved an average of 7% energy savings, up to 10% in some cases, with no reported impact on resident comfort — translating to approximately €950 per building per year at current energy prices. Resident satisfaction surveys across two building portfolios returned positive early results, supporting the case for scaling. In year 2, demand response equipment was installed in 10 properties, with a combined district heating connection capacity of 7.3 MW. Overall, after the second phase the total capacity of virtual power plant is 1 MW. The project has been presented at multiple NZC events and conferences, positioning Lappeenranta as a reference case for district heating optimisation.

Innovation Highlights

The in-house application is a municipal asset, not a service subscription — a distinction that matters for long-term scalability and local capability. The system operates at network level, coordinating the collective flexibility of enrolled buildings with district heating production, shifting consumption away from peaks when the network would otherwise fall back on gas.

The pilot also demonstrates a commercially compelling value proposition — IRR estimate for 8 years investment by only energy savings was -10%, but with demand response 27%.

Twinning with Veszprém (Hungary)

The two cities held multiple in person and virtual meetings to understand each city's climate governance structures and energy landscapes. Veszprém's different district heating technology revealed that Finnish demand response solutions cannot be directly transferred — but created valuable dialogue about adapting approaches to different market structures.

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