

## Popular science summary of the PhD thesis

PhD student	Reza Mokhtari
Title of the PhD thesis	Dynamic Heat Price: a Key Solution to Unlock Demand-side Flexibility of District Heating Systems
PhD school/Department	DTU Construct

### Science summary

Heating our homes and cities is responsible for a large share of energy use and carbon emissions. Today, many district heating systems still rely on gas and oil boilers, especially during peak demand hours. My PhD research explores how we can move away from these fossil fuels by making heating systems smarter, more flexible, and climate-friendly. The key lies in “demand response” – the ability of buildings to adjust their heating needs in response to signals from the operators. Just as electricity markets have successfully used dynamic pricing to encourage flexible consumption, my work investigates how similar ideas can be applied to district heating. By designing dynamic heat prices that reflect both the energy supply and the flexibility of buildings, we can encourage consumers and building controllers to shift heat demand to times when clean energy is more available.

To study this, I developed a simulation model of a neighborhood, representing a real neighborhood in Sønderborg, Denmark, where different scenarios of consumer behavior and control strategies were tested. These simulations showed that consumer engagement and smart controllers play a decisive role in unlocking flexibility. Finally, I designed and tested an advanced, AI-based controller in a real building. A new method, called Temporally-weighted State Difference, was proposed to improve controller performance with minimal computational effort, enabling it to anticipate future price changes more effectively. The results highlight the strong potential of dynamic pricing to transform district heating into a flexible and low-carbon energy system. In the future, this approach could help cities reduce their reliance on fossil fuels, integrate more renewable energy, and provide residents with affordable, sustainable comfort.



# Popular science summary of the PhD thesis

PhD student

Reza Mokhtari

---

Please submit the summary to the department PhD coordinator together with your thesis