

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Julian Ruddick**

The public defense will take place on **Wednesday 25th February 2026 at 5pm** in room **I.2.01** (Building I, VUB Main Campus)

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**HOW TO EFFECTIVELY MANAGE THE ENERGY OF RESIDENTIAL AND COMMERCIAL SYSTEMS?
DEVELOPMENT AND COMPARISON OF METHODS**

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Abstract of the PhD research

The transition from fossil fuels presents significant challenges in energy management. The era of simply activating gas power plants to meet electricity demand or refuelling vehicles with petrol in a matter of minutes is coming to an end. To ensure a sustainable energy future, it is crucial to reduce energy consumption when possible and to synchronize electricity consumption and storage with the production from sources with low greenhouse gas emissions. This thesis looks at ways to manage energy in homes using batteries, heat pumps, and electric vehicle chargers. It compares simple rules, optimization, and machine learning, and introduces a new method called TreeC. TreeC uses simulations to learn energy management strategies that are both easy to understand and effective. Three simulation cases show the effectiveness of different energy management methods, including TreeC, on various energy systems. A real-world experiment implements the new TreeC method on real house hardware and shows some challenges of moving from simulations to practice. Finally, the thesis analyses how well energy management systems work in electrified Belgian homes, finding that they can save money, especially in homes with electric cars and solar panels, but for most households the savings don't cover the costs of setting up these systems.