Summary: The Costs and Benefits of Heat Stress Mitigation in Rotterdam's Social Housing

Due to climate change, global temperatures are rising, leading to more frequent and severe heatwaves. These extreme events, alongside the overall warming trend, pose significant risks to public health, energy systems, the economy and urban infrastructure. Urban areas are particularly vulnerable because of the Urban Heat Island (UHI) effect, which amplifies heat through dense built environments. In the Netherlands, social housing tenants face heightened risks of heat stress, as many social housing dwellings are older, poorly insulated and prone to retaining heat. Low-income households are additionally disadvantaged, as they often lack the financial resources to adopt protective measures. Without effective interventions, health problems, rising cooling costs, and deepening social inequalities are likely to intensify. Housing corporations are under pressure to enhance the heat resilience of their housing stock, but face budget constraints that limit their capacity to take measures. These combined challenges of climate change, social vulnerability and financial constraints emphasize the demand for socially responsible and financially feasible strategies for heat stress resilience in the social housing sector. Therefore, this thesis investigated the long-term costs and benefits of mitigating heat stress in the existing social housing stock, focusing on Rotterdam as a case study.

The research was guided by four sub-questions, examining the risks of inaction, identifying the most vulnerable areas, evaluating feasible mitigation measures and assessing their societal and economic value. A mixed-method approach was applied, combining literature review, expert interviews, vulnerability mapping and a societal cost-benefit analysis (SCBA). Rotterdam was chosen as the case study because of its exposure to high temperatures and large share of social housing.

The findings revealed that if indoor heat stress is not addressed, the health, energy and financial sectors will face high risks and costs, particularly from heat-related hospitalizations, mortalities and increased cooling demand. Vulnerability mapping identified Delfshaven, Oude Noorden and parts of South Rotterdam as the most at-risk neighborhoods. Moreover, the research revealed that there is climate inequity, as social housing tenants are disproportionately exposed to and dependent on housing corporations for solutions.

Furthermore, for the mitigation of heat stress shading, ventilation and installations (e.g., air conditioning) were found to be the most effective mitigation measures. The interviews with Rotterdam's housing corporations revealed that approximately 15.000 dwellings in Rotterdam's social housing stock are highly vulnerable to heat stress and in need of heat stress mitigation measures, yet large-scale interventions are hindered by the absence of financial incentives.

The SCBA showed that under both low and high climate scenarios, the long-term societal benefits of mitigation outweigh the costs. However, the benefits of heat stress mitigation lie with different sectors than the costs, of which the responsibility lies with the housing corporations. This split incentive creates a large barrier to implementation.

In conclusion, mitigating heat stress in Rotterdam's social housing is both socially and economically beneficial in the long run. However, misaligned costs and benefits require policy support, such as introducing thermal comfort standards for existing dwellings or integrating mitigation measures into the housing valuation system (woningwaarderingsstelsel). Moreover, broader policy coordination with healthcare, energy and municipal stakeholders could further enhance financial feasibility and social equity. Ultimately, this thesis aimed to demonstrate that addressing indoor heat stress in social housing is not only a matter of climate resilience, but also of social justice, requiring collective action to protect vulnerable populations.

Merle Blom