

## **Sustainable heating and cooling supply of urban area (in Dutch).**

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### **Abstract**

This study focuses on the transformation of the energy system for a reference city in the Netherlands towards a situation with sustainable heat and cold supply.

For this purpose, a simulation model has been created in which the influence of building insulation, other technologies and certain characteristics of an urban area are incorporated in order to simulate the yearly supply and demand of heating and cooling.

Applied technologies include solar panels, both thermal and photovoltaic, wind power, heat pumps, a thermal network including seasonal thermal energy storage and industrial heat surpluses. These technologies were incorporated into a model that was driven by meteorological data to simulate both heating and cooling demand and supply.

The financial investments for the results of the simulation are determined by calculating the annual recurring cost of energy. At current starting points these annual costs are higher for a scenario with a thermal network and seasonal thermal energy storage than the annual costs of an energy system based on fossil fuels. The difference, however, decreases as the insulation of the buildings increases.

The financial perspective improves further if indirect social benefits (lower carbon emissions etc.) are included. It was found that the annual cost of the construction of a thermal network with seasonal thermal energy storage may be lower than the annual cost of continued use of fossil fuels if these externalities are taken into account. It can be concluded that a thermal network with seasonal thermal energy storage is financially viable.