



Investigation of Thermal Energy Operational Strategies in TU/e Main Building Atlas in Connection with ATES System

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Background

Buildings are responsible for 1/3rd of global GHG emission and 40% of energy consumption which can be reduced from 20-80% using commercially viable technologies [1]. Therefore to improve energy performance TU/e has made a Campus 2020 plan under which approximately 120,000 m² area will be renovated and 20,000 m² will be demolished. Major energy consumption in buildings are due to heating and cooling. Aquifer Thermal Energy Storage (ATES) system is one of the efficient solutions which can reduce energy consumption for 40% of heating, 65% of cooling and 90% reduction in peak power alone in Netherlands by 2020 [2]. Right now ATES system of TU/e campus is running at thermal imbalance with higher cooling demand.

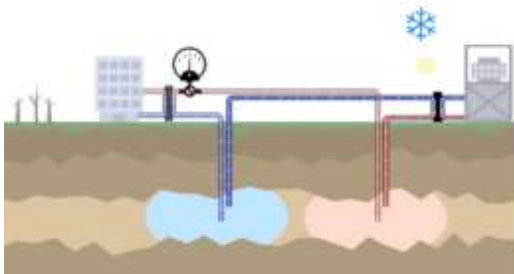


Figure 1. ATES system operation

Two cooling towers are in operation to balance the system by releasing the excess heat towards ambient. We need to see how different building operation techniques of Atlas contribute towards thermal balance of the ATES system and reduce or omit the operation of the cooling towers.



Figure 2. TU/e campus Main Building Atlas after renovation

Problem definition

Under the Dutch policy on ATES system, it is mandatory that during winter no excess heat is extracted from the subsurface compared to heat that is pumped during summer [2]. At present the ATES system of TU/e has more cooling demand than heating and hence created thermal imbalance in the aquifers.

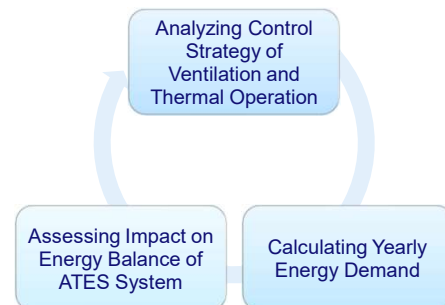
Objective

The aim of this project is to develop operation strategy of TU/e Main Building Atlas in connection with ATES system and improve existing thermal balance through yearlong operation. The operation strategy should focus on following issues mainly:

- How the ventilation and thermal operation should perform in Atlas building energy management system?
- How the indoor climate should be maintained to comply with the comfort zone of inhabitants?
- What will be the impact on ATES system thermal balance through yearlong operation in the campus of TU/e with different operational strategies of Atlas building?

Research plan

Understanding the imbalance problem of the ATES system. Then the renovation design and strategy of the Atlas building to be analyzed. Accordingly the thermal output by Atlas building to be measured for impact measurement on ATES system. The methodologies are developed as following:



References

- [1] United Nations Environment Program Report
- [2] Dutch-ATES, "Dutch Policy on ATES Systems," no. 3, pp. 1–3, 2016