

Analysis and Optimization of Heating and Ventilation Systems for the Industry

H. B. Hansen and J. F. Hovmand

DTU Mechanical Engineering, Technical University of Denmark

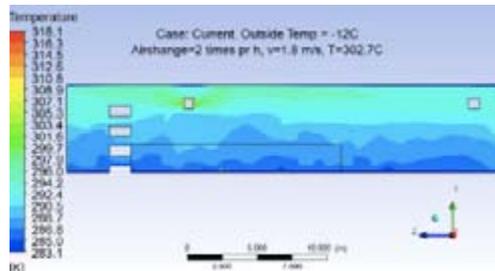
INTRODUCTION

The project has been created in collaboration with Aasted ApS and Force Technology. The project has focused on how to improve the heating systems in factory facility with outdated heating systems (heating the ventilation air) to reduce waste of energy in an economical beneficial manner for the facility owner. The project has been two faced: Firstly, it has addressed how to select a new heating system for the site. It has investigated different possibilities, how these possibilities compare economically and in energy efficiency, and solution for the facility has been proposed. Secondly, the project has investigated how the fresh air will be distributed in an optimal manner in the manufacturing facility by using Computational Fluid Dynamics and experiments. The project is also generalized to alike situations.

THEORY

In this project mainly three theories are used: The theory of indoor environment, the theory of heat transfer and the theory of computational fluid dynamic. A large part of this project is based on analytical heat transfer calculations. These are based on Fourier's law of conduction, Newton's law of cooling and Stefan-Boltzman's law of radiation.

RESULTS



Figur 1: Temperature distribution on existing facility simulated with CFD

As the results show, there is a notable vertical temperature difference, where the cold air is located in the bottom of the room. This is also what we have been measuring in a room with similar dimensions and heating system.

CONCLUSION

It is not possible to develop a simple model for choosing heating and ventilation systems. It has been shown that heating and ventilation should be based on occupied zones. It was proposed that the specific facility should adopt radiation heating combined with fresh air ventilation in high levels.