Supply of excess heat from steel melting furnace to district heating

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Höganäs AB is the world's largest producer of powdered metals. This powder is found in, amongst other things, electric bicycle engines, gearboxes and iron-fortified cornflakes. In the process of producing this powder large amounts of excess heat is generated. Höganäs AB now wishes to deliver much of this heat to Halmstad Municipality's district heating system.

In order to produce the powder Höganäs AB melts large amounts of scrap iron in a large furnace. This produces significant amounts of really hot gas, which has to be cooled using water. As part of replacing the duct through which this gas is transported, which will be done during the summer of 2016, Höganäs AB now wishes to deliver this heat to Halmstad Municipality's district heating system.

Heat is delivered to the district heating system in the form of hot water. In order to be useful for district heating, the water has to be of high enough temperature. Specifically, the water has to have a temperature of around 125 °C. The pipes through which the water is transported are pressurised to prevent the water from boiling.

The simplest method of water-cooling is to circulate large amounts of cold water in the gas-duct. This is effective in cooling the gas, but does not heat the water enough to be useful for district heating. The key is to use just the right amount of cooling water to heat it up to 125 °C. However, if the water is allowed to get much hotter than that, it will boil and damage the water-pipes.

The appropriate amount of water-cooling varies depending on the temperature of the hot gas. The temperature of the gas can vary between 100 °C and 1200 °C, which naturally makes a massive difference in the water-temperature. The goal of our thesis has been to devise an algorithm that decides how much water-cooling to use at each instant, based on temperature readings of water and gas at different locations.

Our work has been based on experiments on a simulated version of the furnace and water cooling system. The simulation is based on a simplified physical model of the process. When the real system is put in place in August 2016, the cooling will be controlled by a version of our algorithm. Since the real system with all likelihood will behave somewhat differently than our simulated model, the algorithm will have to be tweaked based on the results of using it in the real world.

If all goes well, our work will lead to energy being effectively delivered to the district heating network, which is good for both Halmstad Municipality, Höganäs AB and the enviroment. A true win-win situation!