VIPP VALUES CREATED IN
FIBRE-BASED PROCESSES
AND PRODUCTS

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DOCTORAL THESIS MAJ 5 2017

APPLYING HEAT PUMP SYSTEMS IN COMMERCIAL HOUSEHOLD PRODUCTS TO REDUCE ENERGY USE AND ENVIRONMENTAL IMPACT

HOW TO HALVE THE ELECTRICITY CONSUMPTION FOR A HOUSEHOLD DISHWASHER

Peder Bengtsson is employed at ASKO Appliances AB, Lidköping since 2000. His work incorporates knowledge how to decrease the electricity usage of household products by adding a heat pump system. Peder Bengtsson obtained a Master of Science in Engineering Design at KTH in 1998.

In the household appliance industry, heat pump systems have been used for a long time in refrigerators and freezers to cool food, and the industry has driven the development of small, high-quality, low-price heat pump components. In the last few decades, heat pump systems have been introduced in other household appliances, with the express purpose of reducing electricity consumption. Heat pump tumble dryers have been on the market since 2000 and dominate the market today. A heat pump dishwasher was introduced on the market in 2014 and a heat pump washing machine in 2016. The purpose of adding a heat pump system in these three products was to decrease electricity consumption.

Papers I and II used a methodology where transient simulation models were developed and used to increase knowledge about how to decrease electricity consumption for a tumble dryer and a dishwasher by adding a heat pump system. Papers II to V showed that a lower electricity consumption and lower global warming potential together with an energy-efficient drying method, where no humid air evacuates to the kitchen, give a heat pump dishwasher competitive advantages compared to any conventional dishwasher currently on the market. Using simulations, this dissertation concludes that a future commercial heat pump dishwasher, using R600a as a refrigerant, will reduce electricity consumption and total equivalent warming impact (TEWI) by 50% compared to the conventional dishwasher.

The willingness from the customer chain to pay extra for this heat pump dishwasher is because of the decreases electricity consumption and the fact that no humid air evacuates to the kitchen. This willingness makes the heat pump dishwasher to a variant which have possibility to succeed on the future market.

The challenge for the manufacturer is to develop and produce a high-quality heat pump dishwasher with low electricity consumption, predict future willingness to pay for it, and launch it on the market at the right moment with the right promotion in order to succeed.

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VIPP GRADUATE SCHOOL HOLDS ITS SPRING MEETING IN SÄFFLE

The 2017 VIPP spring meeting was hosted by BTG Instruments AB in Säffle on 24 and 25 April. The VIPP graduate school has now been active for six years and includes 12 doctoral students doing research on processes, energy, environment and service development in some of Sweden's significant basic industries.

The spring meeting started with a workshop for doctoral students, giving them an opportunity to network, and to take advantage of the cross-disciplinary breadth offered by VIPP.

Research presentations and study visits
On the second day, doctoral students presented their ongoing research projects. BTG Instruments, the hosts, also presented their company and offered participants a guided tour. Participants also visited Nordic Paper and UMV Coating Systems AB, which both are located in Säffle.

Coproduction between industry and the academy
VIPP (value-creation in fibre-based processes and products) is unique in the Swedish higher education sector, and aims to invigorate the university's research environments while developing the skills of those in the participating industries.

The VIPP graduate school is a partnership between chemical engineering, chemistry, environment and energy systems, physics, mechanical and materials engineering, and the Service Research Centre at Karlstad University, and a number of Swedish and Finnish businesses, particularly in the forestry industry. The project is financed by the large participating companies, the Knowledge Foundation, and Karlstad University.

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PLANNED LICENTIATE SEMINARS AND DISSERTATIONS

PLANNED DISSERTATIONS

Caroline Wilke, BTG Instruments AB (Q1 2018)
Pyry Hämäläinen, Kemira Kemi AB (Q1-2 2018)
Aron Tysén, Innventia AB (Q1 2018)
Asif Javed, Billerudkorsnäs AB (Q1 2018)
Sofia Thorman, Innventia AB (Q3-4 2018)
Lisa Mattson, BillerudKorsnäs AB, (Q2 2019)

COMPLETED DISSERTATIONS

Peder Bengtsson, Asko Appliances AB 2017-05-05
Åsa Nyflött, Stora Enso AB, 2017-02-10
Raghu Deshpande, Domsjö/MoRe Research, 2016-12-15
Christer Gustavsson, Pöyry, 2016-12-08

PLANNED LIC SEMINARS

Daniel Ekbåge, Stora Enso Group R&D (Q4 2017)
Helena Cider Johansson, Härjeåns Energi AB (Q3 2018)
David Joelsson, SP (Q3 2018)
Jonas Kihlman, Pöyry (Q4 2019)

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