

# Suggested project topics at Norske Skog Skogn

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## Introduction

Norske Skog Skogn is a pulp and paper mill producing newspaper and improved newspaper grades. The process is energy demanding and the two main sources of energy are electricity ( $\sim 175\text{MW}$ ) and steam ( $\sim 70\text{MW}$ ). At the plant there are two topics suitable for specialization project and a subsequent master thesis concerning steam production and distribution for which the supervisor from Skogn will be Andreas B. Volden<sup>1</sup>. Some common keywords for both topics; mechanistic and empirical modeling using Matlab or similar (Octave or SciLab are preferred alternatives), open and closed loop data, controller tuning, and control structure analysis. As the major part of the plant documentation is written in Swedish and Norwegian the candidate shall handle reading said languages. Below page provide some initial information on both projects. For interested students there is an opportunity to get further information from Andreas by mail or for a plant visit with supervisors during spring.

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## **Topic: Steam boiler analysis and bottleneck identification for moving towards optimal operation**

At the plant two boilers provide superheated high pressure steam and one electrode boiler provide saturated medium pressure steam for heating purposes. The main steam consumers are the drying sections of three paper machines. The primary boiler providing steam is a compact CFB (circulating fluidized bed) which runs on a mixture of sludge from the effluent treatment plant and from the DIP (deinked pulp) plant, bark from the debarking drum, reject (a collective term of miscellaneous plant waste and foreign non-metal materials from the DIP plant) and demolition wood. The rated capacity of the boiler is 50MW, but today's production is constrained in the 33-35MW range. The main subject will be to identify active constraints and bottlenecks, and further investigate if these could be moved in order to increase boiler production. A vital part of this topic will be to analyse today's control structure, suggest changes and perform controller tuning both from modeling and empirical basis. Initially, the candidate shall review literature on the boiler principle, preferably from similar applications of CFB boilers.

## **Topic: Steam network performance and analysis**

To distribute and provide conditioned steam from multiple varying sources is not trivial. There are three groups of steam producers at the plant; two boilers which provide superheated high pressure steam, a boiler which provide saturated medium pressure steam and TMP refiners which produce saturated low pressure steam from the grinding process using re-boilers. The steam producers vary naturally (boiler and TMP refiner loads), and sometimes abruptly changes due to e.g. equipment failure or paper breakage in a paper machine during production. This cause disturbances over the network and decrease steam reliability for other consumers. The steam delivery network is closed and the steam pressure reduction valves and TMP refiners produce low pressure steam that is conditioned and distributed to consumers over the network. Objective of this topic will be to investigate modeling of the network and to use operational data to develop a complete understanding

of the steam network dynamics. Further, an analysis of the control structure and its suitability is of significant interest and shall comprise a major part of the project.