Decision support tool for the optimization of Membrane Distillation modules and systems

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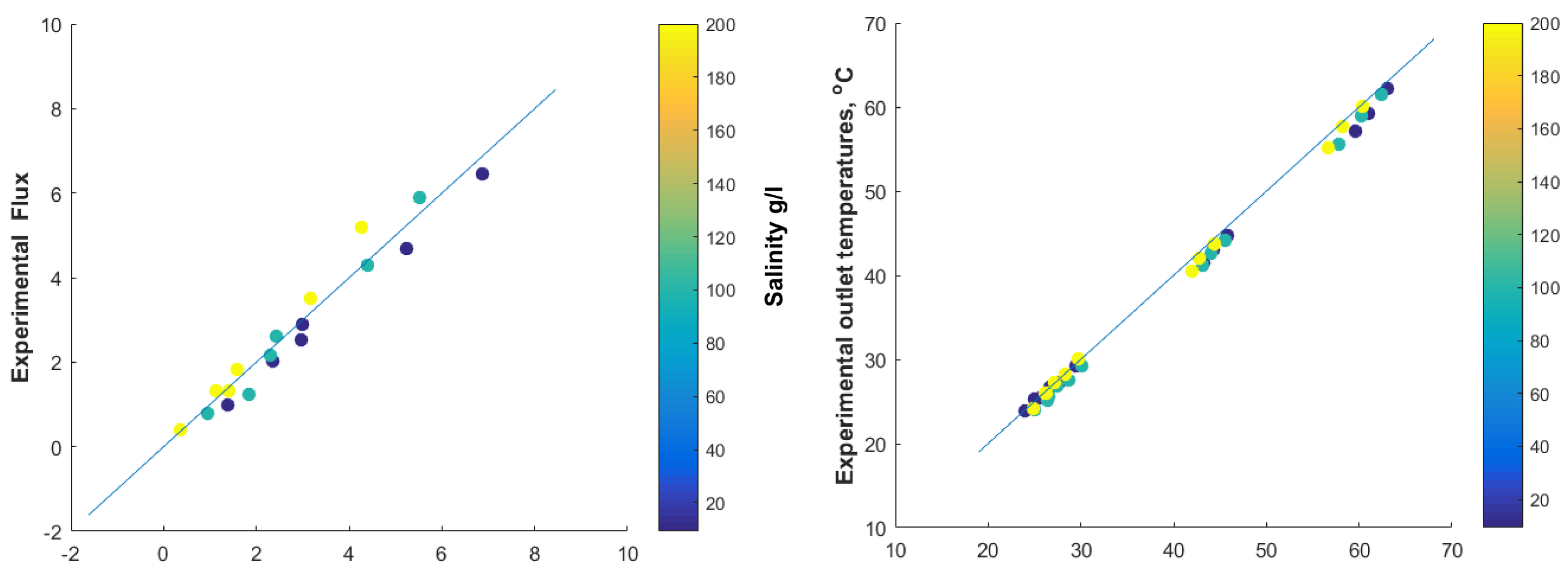
INTRODUCTION

- Membrane distillation (MD) is an interesting technology mainly aimed at separation of non-volatile components from an aqueous feed stream. The principle is based on a temperature difference across a hydrophobic membrane between the feed side and the permeate side which results in different partial pressures of water vapor
- In this study a tool for optimization of modules and MD systems is presented
- The tool can simulate different system configurations – DCMD, PGMD and AGMD
- The DCMD configuration is completely predictive on full scale, no calibration parameters are used, while only two calibration parameters are used for the AGMD configuration
- The tool can be used to optimize the system for each particular case, resulting in a minimal CAPEX and OPEX price per cubic meter of distillate

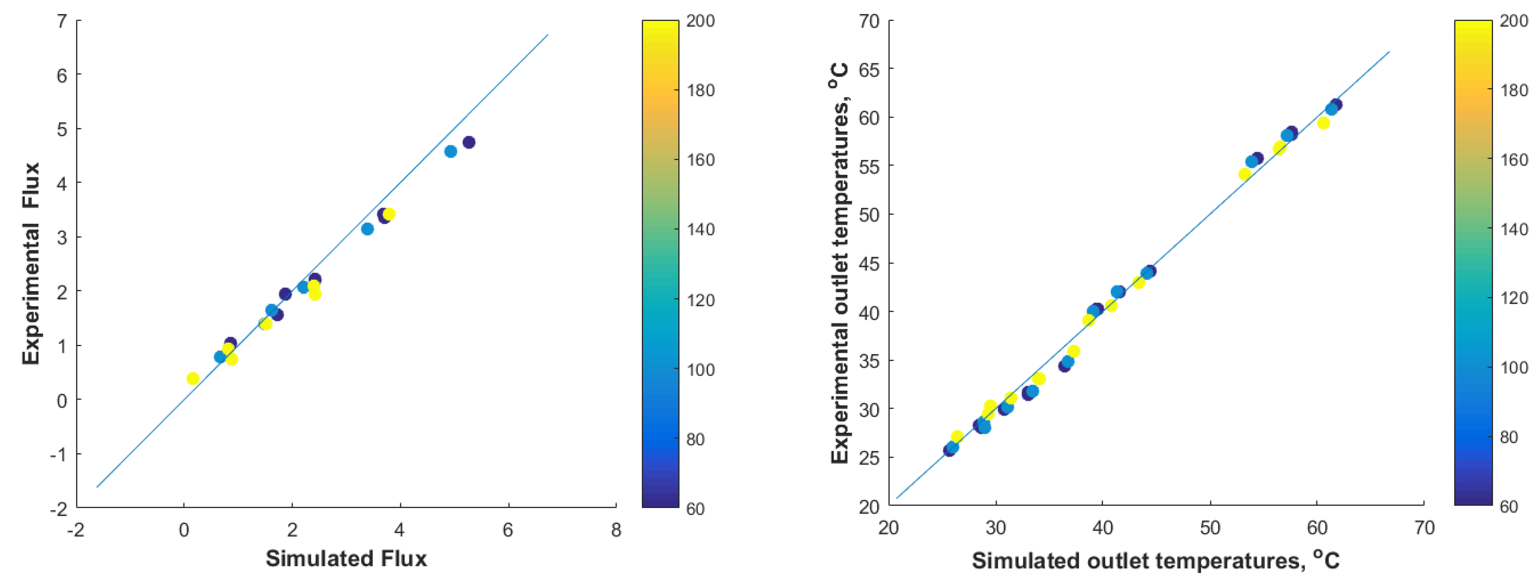
Full scale modeling validation

Direct contact validation, without calibration parameters



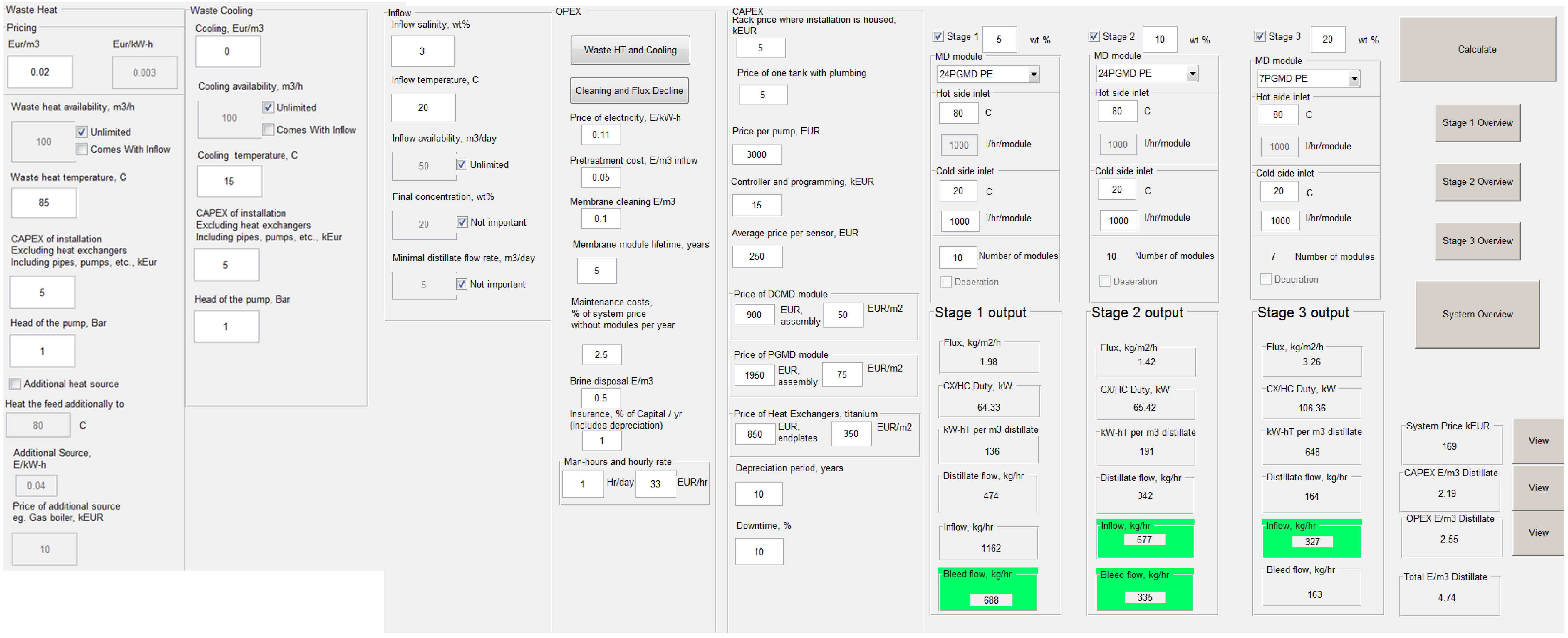
Full-scale validation: Simulated versus experimental fluxes and outlet temperatures for the full-scale DCMD module (7.2 m²). Combination of conditions: flow rates 500, 1000 and 1500 l/hr, permeate temperature 20°C, feed temperature 50 and 70°C, salinity 60, 100 and 200 g/l

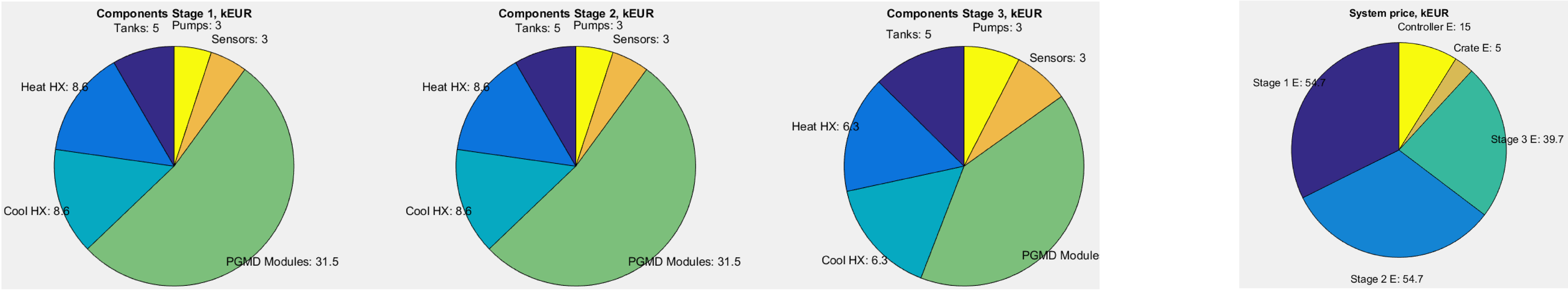
Air gap validation, two calibration parameters



Full-scale validation: Simulated versus experimental fluxes and outlet temperatures for the full-scale AGMD module (7.2 m²). Combination of conditions: flow rates 300, 600 and 900 l/hr, permeate temperature 20°C, feed temperature 50 and 70°C, salinity 60, 100 and 200 g/l

Results





Conclusions

- A decision support tool is presented that can be used for smart system design
- The tool can simulate most major Membrane Distillation configurations – DCMD, AGMD and PGMD
- Since no calibration parameters were used in the DCMD model the tool can be used with confidence to design systems and modules, specialized for each particular application
- Only two calibration parameters were used for the simulation of the Air Gap configuration, however more experiments are planned with larger modules to build further trust in the Air Gap modelling
- The tool is built as an executable and can be executed on any computer, without the installation of other commercial software

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