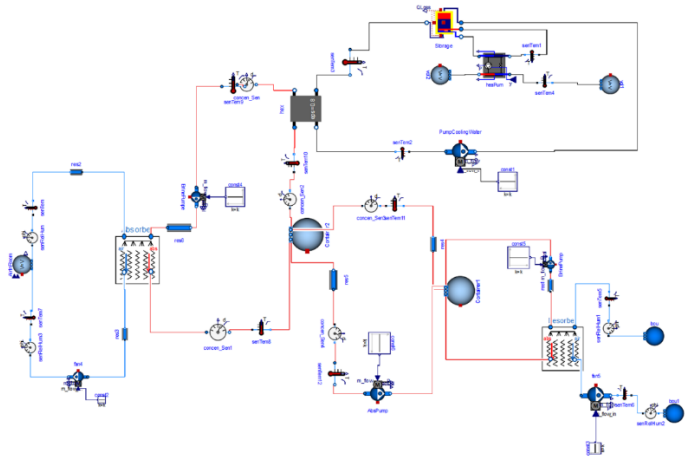
Thermochemical Fluids in Greenhouse Farming

Greenhouse modeling

The overall Greenhouse system model of this project is based on an innovative use of absorption processes in the greenhouse air-conditioning (also referred as sorptive air conditioning). This concept is achieved using the hygroscopic properties of fluid salt solution, here called thermo-chemical carrier fluid (TCF), which has the ability to provide multiple functions and services such as heating, cooling and de-/humidification within a single device, here called the absorber. An aqueous magnesium chloride solution ($MgCl_2$) has been resulted the more appropriate (performance/cost) for the air control in the greenhouses.



To predict and check the behaviour, energy efficiency and further properties of systems using the technology, the use of simulation is inevitable. Therefore, methods for transient simulation of a node-based model are being developed. This system simulation is sufficient for most of practical problems in this project, such as the development and testing of smart control strategies. The aim is to maximize energy efficiency, crop production and water production, and take full advantage of fluctuating renewable energy, by reasonable and intelligent control of variables, such as indoor/outdoor temperature and humidity, etc. For this purpose, the simulation of temperatures and humidity in the greenhouse and its control by the new technology is crucial. The Modelica library of developed component models has already been developed and validated, which includes the absorber model, desorber model and thermal chemical fluid network model. Besides, the CFD simulation is considered, if air conditions in the green house are not constant and there are differences of conditions in greenhouse and at absorber inlet. If necessary, in order to integrate the CFD model and system model, the reduced order model of CFD model will be developed to increase the computational efficiency.

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