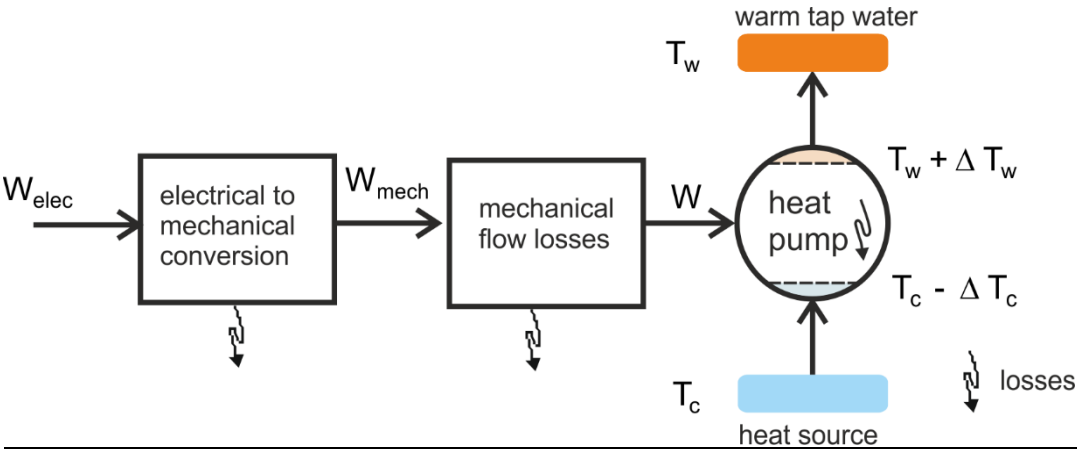
Comparative assessment of heat pump cycles for upgrading waste heat from low-temperature sources

Dutch government has set up a very ambitious target of making the built environment energy neutral by 2050. Added to this, the recent trend is the development of new housing projects without natural gas (aardgasvrije woonwijken), heat networks, where possible community thermal buffers, and compact thermal storage for homes. In the TKI Urban energy program, the need for efficient heat pumps to provide heat to the households by harnessing low quality heat resources is highlighted. To decarbonize the urban energy needs of our society, use of low grade heat among others (1) from data centers, (2) heat storage in locality reservoirs (3) compact heat storage in houses from renewable sources are being pursued. The temperature of this heat will be mostly in the range of 20-35 °C, which could meet the heating requirements of well insulated houses, mostly new houses. For hot tap water requirements in the house a minimum temperature of 60 °C is required to prevent the growth of legionella. Therefore, a heat pump preferably driven by electricity is necessary to upgrade low temperature heat sources.



Assignment:

This assignment includes the thermodynamic assessment of various heat pump solutions and their integration with the complete process. The thermodynamic models will be developed and used to perform parametric studies and optimization of the proposed system. The assignment also includes cost analysis of the complete system. The final assignment tasks will be defined after consultation with the student.

Your background: We are looking for excellent master students with a Mechanical Engineering or Sustainable Energy Technology background with a willingness to learn Modelica/Matlab.

Contact: Prof. Dr. ir. S. Vanapalli (s.vanapalli@utwente.nl),

Dr. ir. A.K. Singh (a.k.singh@utwente.nl)