Thermal performance analysis of a CPC solar collector array with series connection to the flat plate solar collector field in Sæby solar heating plant

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Thermal performance analysis of a CPC solar collector array with series connection to the flat plate solar collector field in Sæby solar heating plant

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A novel Compound Parabolic Collector (CPC) :
• Four identical parabolic-troughs are placed inside the flat panel
• Automatic one-axis tracking
• Designed for operating in solar heating plants at the temperature range of 60 - 120 °C

CPC collector testing:
The CPC collectors were tested at Technical University of Denmark (DTU) in 2016 according to the Quasi-Dynamic Testing (QDT) method. The test results are shown in the Table below. The parameters of the flat plate solar collector operating in Sæby solar heating plant were also added in the table below for comparison. The data was extracted from the data sheet.

Predicted annual thermal performance comparison:
On a typical sunny day

Monthly thermal performance summary for both collectors:

Conclusions:
• The developed QDT model for both the CPC solar collector array and the flat plate collector array is valid.
• The annual thermal performance of the CPC collector is higher than that of the flat plate collector if the mean fluid temperature is higher than 78 °C in theory, in practice if the temperature is higher than 55 °C.