Solar Collector Design for Heating an Indoor Pool in Leuven, Belgium.

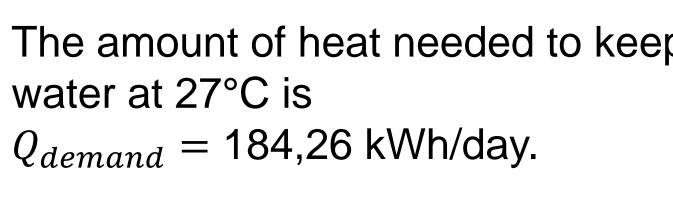


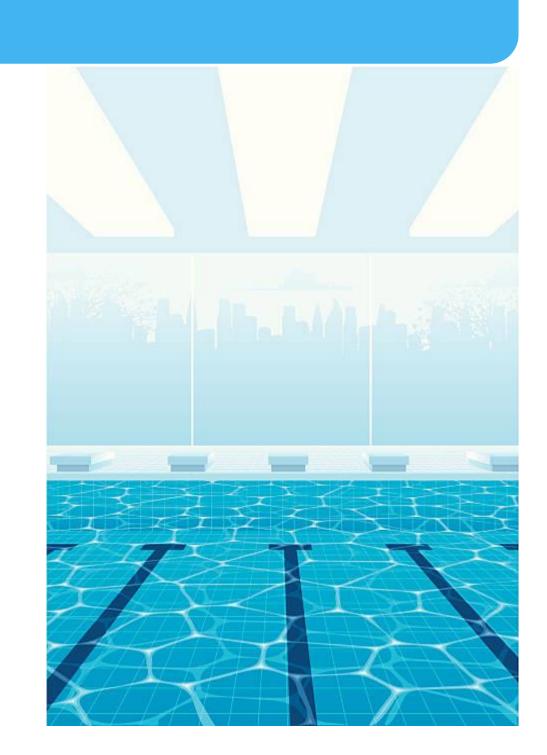
Sofie Casselman



Location & Ambient parameters

- Location is Leuven, Belgium. (50.8798438N, 4.7005176E)
- Pool Size: 10m long, 3m wide, 2m deep \rightarrow Volume = $60m^3 = 60.000$ liters
- The ambient temperature of the room is considered 24°C and the Twater 27°C.
- The amount of heat needed to keep the water at 27°C is







Solar Collector Characteristics

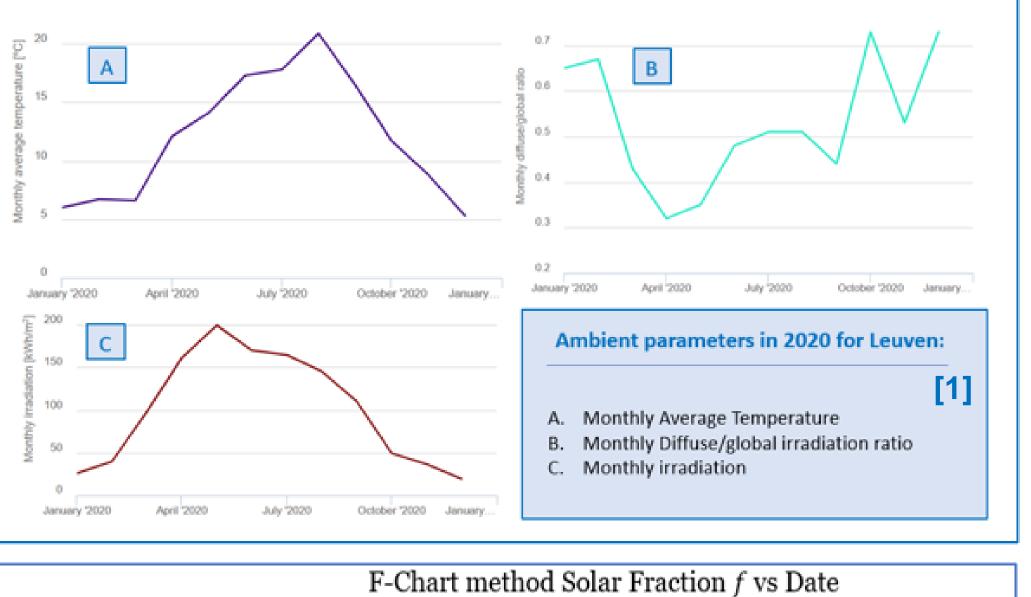


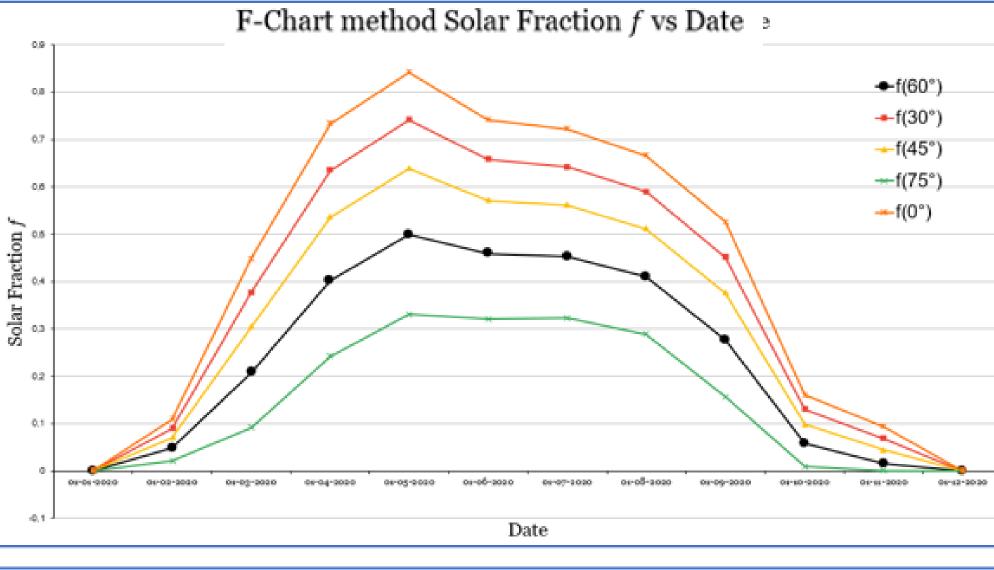


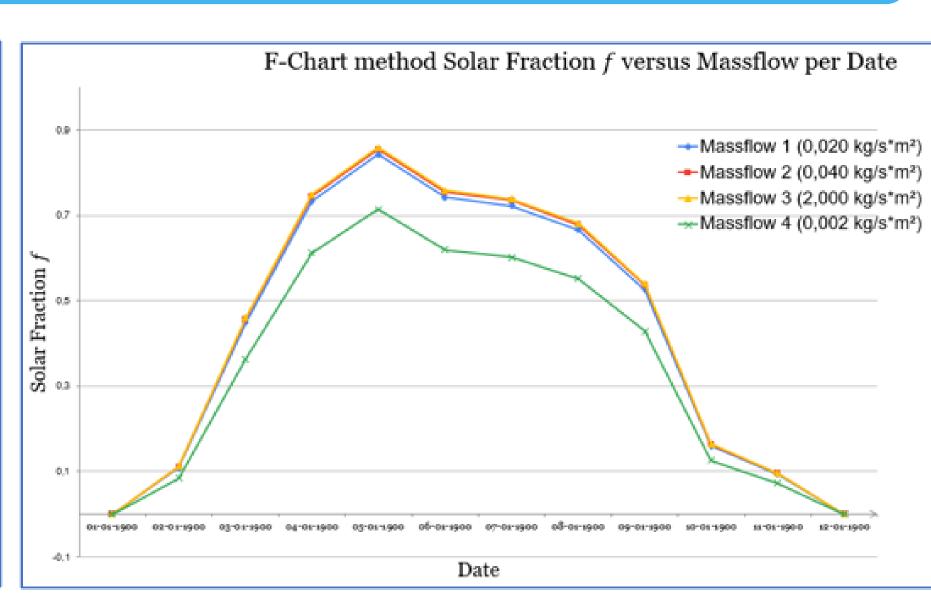
FLAT PLATE COLLECTOR	
NAME	SunRock (STS2800)
License	011-7S439 F
Treference (°C)	100
η ₀	0.674
a1 [W/m²]	2.985
a2 [W/m²]	0.013
Gt [W/m²]	800
Flow Rate [(kg/s)/m²]	0.02
Ac1[m²]	3.11

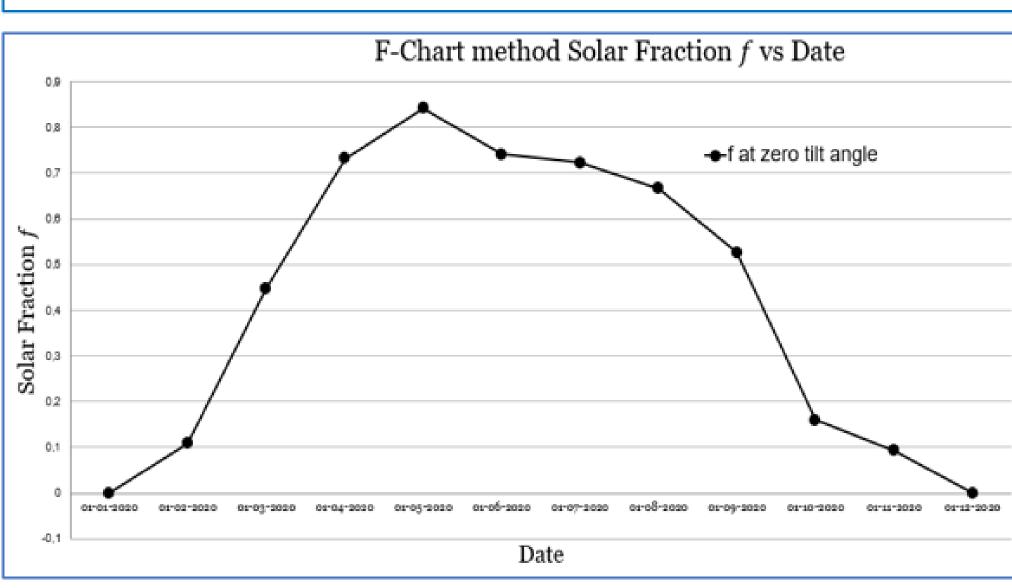


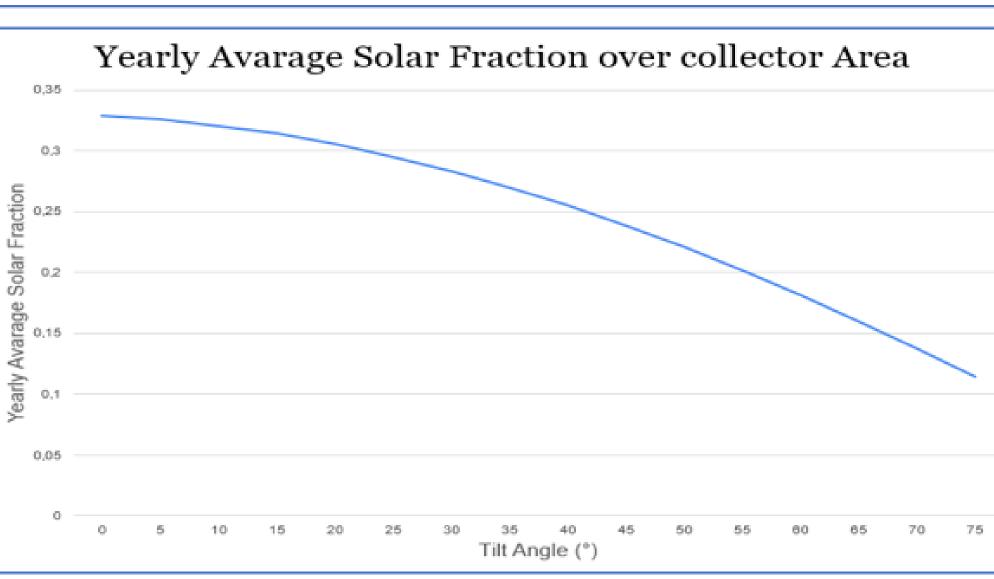
F-Chart Method: Solar Fractions for different tilt angles, roof reflective paints, and Flow rates

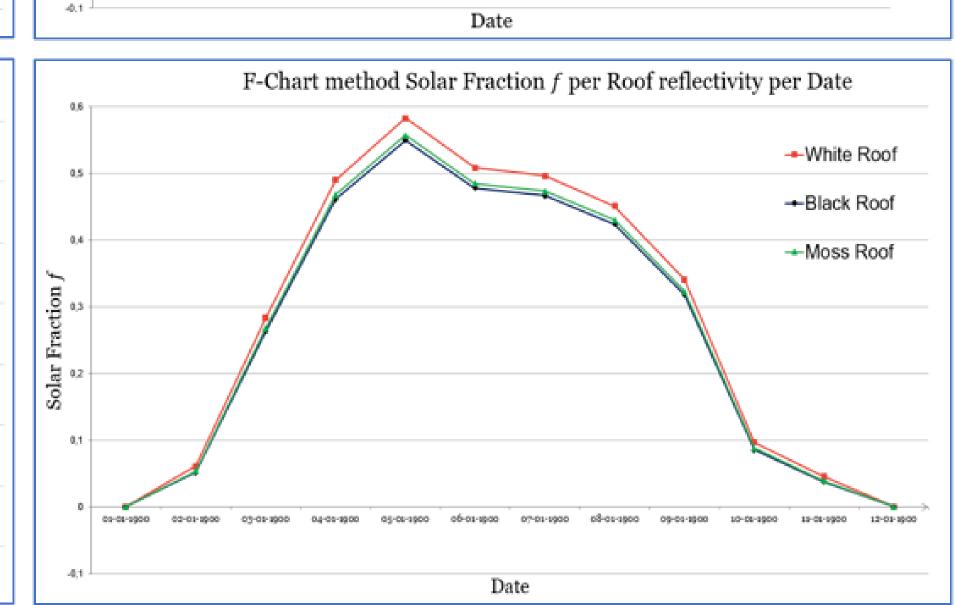












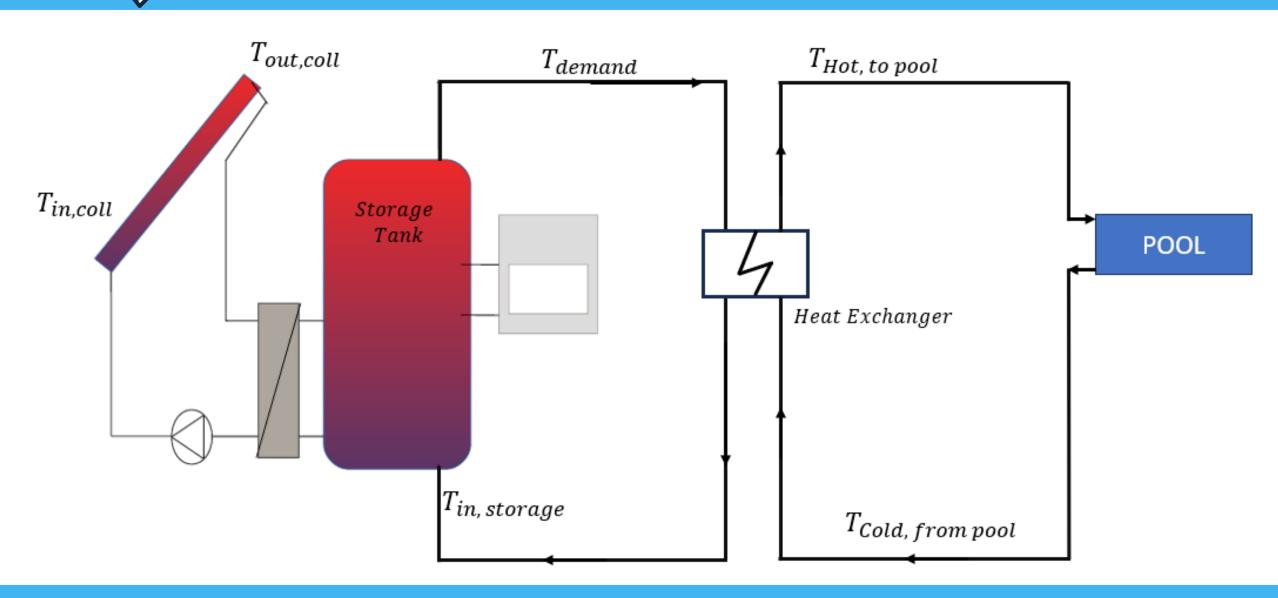


Selected Solar thermal Heating system

- High Flow system with mass-flow 0,04kg/s*m²
- Parallel connections, Fixed Collector area of 40m²
- Roof painted with white reflective paint and solar and tilt angle of 30°, or normal roof with 0° tilt angle.
- Storage tank with a volume of 3000 Liter.
- Best yearly average performance/Solar Fraction: 33%



Sketch of heating system





Conclusion

- Heating system provides 67-84% of the heating demand in summer and 0-45% in winter, the system can thus be very helpful in decreasing the need for additional heating systems such as heat pumps or gas boilers.
- Because the demand for the pool is constant over the year, the optimum tilt angle for this pool in Belgium is not 35°, but the solar fraction has higher values for collectors closer to 0°. This is mostly to use as much of the solar energy available in summer to get to the 84% maximum solar fraction.^[2]
- Because the area that can be used for the solar collector is fixed, more creative strategies can be implemented like reflective roof painting at tilt angles of more than 0°.
- In the future, hydronic balancing should be used when the rest of the houses DHW is also connected to this collector field and possibly more collectors. Also, the demand should be calculated by day, which would lead to the best energy-saving strategy. [3]