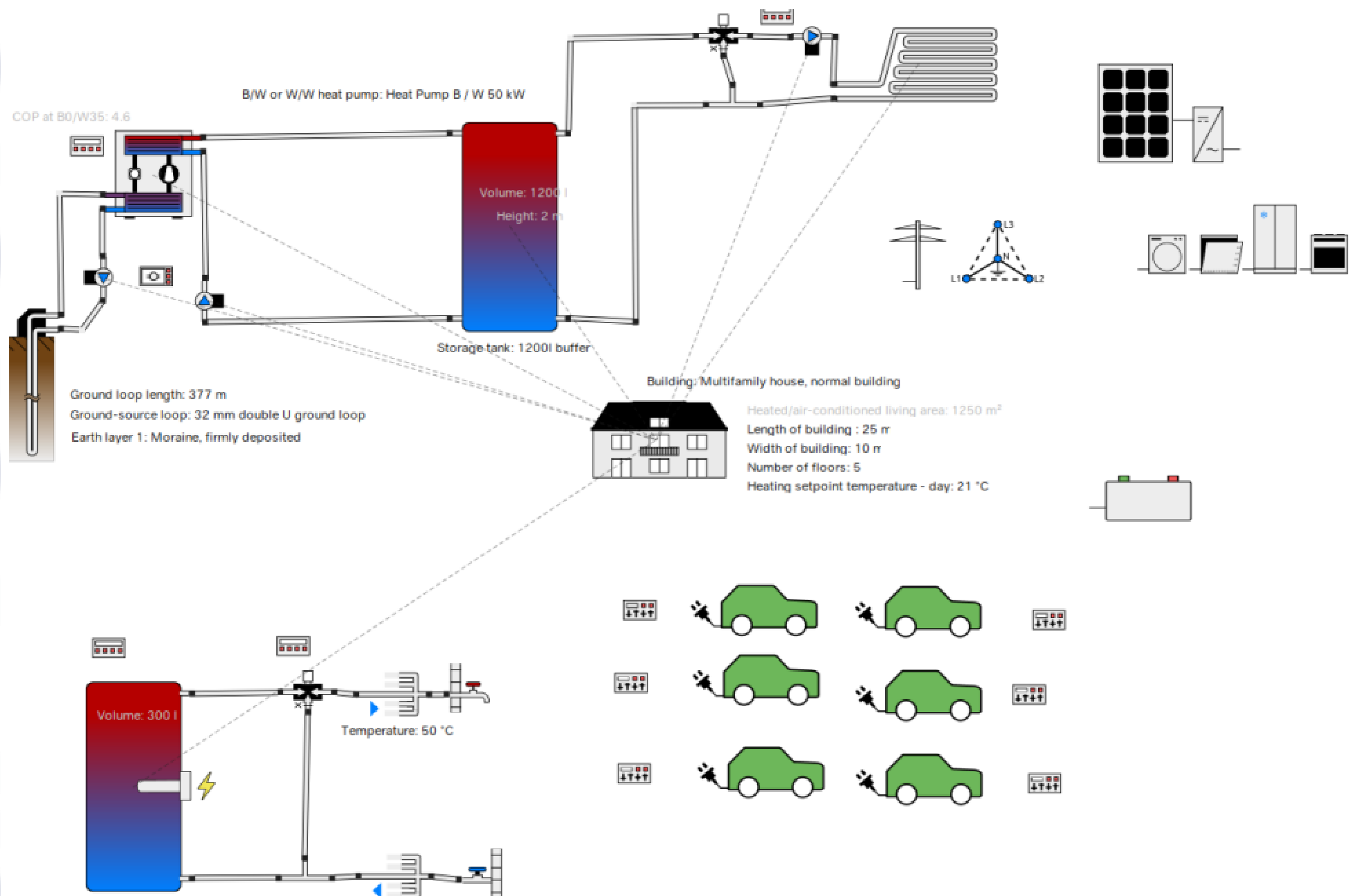**Bachelor's Thesis in Energy and Environmental Systems Engineering**

Energy optimization of an existing terrace building

Summary
The thesis addressed the energy optimization needs of owners of an existing terrace building, aiming to optimize their household energy consumption. Given Switzerland's strategy to achieve CO2 neutrality by 2050, it is crucial for all entities to explore avenues for reducing CO2 emissions.

Methodology:
A model consisting of four main blocks—energy demand, production, optimization, and economic viability—served as the cornerstone. Research involved data analysis and simulations. Polysun software by the Swiss company Velasolaris, and the Swiss Federal Office of Energy's website solardach.ch were employed for simulations and economic assessments. The building was digitally reconstructed in Polysun, utilizing all available information, to simulate energy consumption patterns.

Results and Conclusions:
The research highlighted an expected surge in the building's future energy consumption, underscoring the substantial advantages of installing a PV system on the roof.

Simulations demonstrated that covering 75% of the roof area with solar panels could result in an array with an approximate total nominal power of 41 kW. This configuration could generate an annual production of 42,410 kWh and potentially save 9,900 kg of CO2 emissions yearly. Notably, this PV setup proved to be a lucrative investment, featuring an 8-year payback period across an anticipated 30-year lifespan. It would yield an annual profit of 7,259 CHF for 22 years, resulting in a potential cumulative profit of 159,698 CHF.

Meanwhile, the economic analysis suggested that implementing a battery system might not yield favourable financial returns.

Thesis Focus:
The central focus was on the Energy Optimization of an Existing Terrace Building, addressed through comprehensive exploration of energy demand, production, optimization, and economic aspects.

Frano Ćubela

Supervisor:
Florian Kühlkamp