

Energy Study:

- Solar panels produce power. In the Netherlands you get money when you deliver power to the grid (€0.25/kWh). From 2025 this reduces to €0.06/kWh (no more tax return). Furthermore, the power grid is not designed for sudden additions of extra power or losses (due to clouds).
- Suppose a house has a solar grid with maximum power 4 kW (power groups can have maximum $230V * 16A = 3680 W$). Not very uncommon because you won't reach the maximum anyway. The investment for the solar panels is €10,000.
- The energy (in kWh/day) production by the solar panels is given by: $P(d) = 11 - 9 \cos(\frac{2\pi d}{364})$ with d the d of the year (January 1st is the zeroth day). The energy usage (in kWh/day) is given by $U(d) = 5 + 4 \cos(\frac{2\pi d}{364})$. An additional 2 kWh of energy is used every day that cannot be covered by the solar panels because the sun is not shining (but might be covered by a home battery).
- There is a 200 L boiler in the house that starts every day at 40 C and needs to be lifted to 70 C every day. The boiler is used for showering and heating, so there is no additional gas cost.
- You can buy a home battery to store excess energy. The cost for a home battery is €1000/kWh.
- Energy that you have to buy costs €0.25/kWh, energy that you give to the grid is bought from you for €0.06/kWh.

Questions:

1. Would you install a home battery? If yes, how large will it be?
2. What is the energy usage/production and cost/income per year?
3. What is the payback time for the solar panels?
4. Are there ways to improve the house/system? (think about how ineffective heating with simple radiators is and think of alternatives).