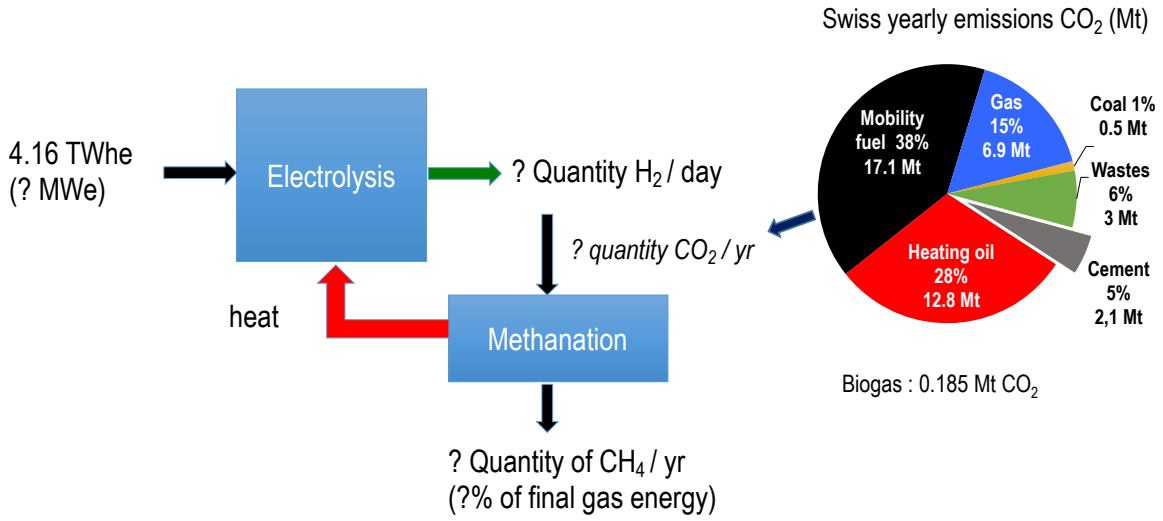
1. H_2 filling station

How big an electrolyser is needed to produce the daily amount of H_2 for a filling station (HRS: hydrogen refuelling station)), under the following assumptions?:

- 1000 cars/day, equivalent energy tanked of 50 L gasoline/car ($LHV_{gasoline}$: 33 MJ/L)
- car average consumption : 7 L gasoline/100 km
- a FCEV (fuel cell electric vehicle) consumes 1 kg H_2/100 km (LHV_H_2 : 120 MJ/kg)
- water electrolyser efficiency (electricity → H_2): 68% LHV
- compression energy needed to 400 bar (estimated as 9 % of LHV)
- the electrolyser operates 50% of the time
- Extrapolate the electrolysis power needed for 150 HRS, which is ~the quantity of existing natural gas filling stations in Switzerland, enough to cover most of the national territory. Please comment.

2. Power-to-gas



Switzerland stores yearly about 4 TWhe of electricity via hydro-pumping. Assume instead that this amount of electricity were used to generate H_2 via electrolysis, which would then be combined with CO_2 in a methanation reaction to produce synthetic methane CH_4 for injection into the natural gas grid.

- Assume ~continuous operation: what is the installed electrolysis power? (MWe)
- Using 90% efficiency for steam electrolysis, how much H_2 is generated per day? (m^3/day)
- How much CO_2 is needed for methanation? (4 H_2 + CO_2 ⇔ CH_4 + 2 H_2O)
- How does this compare with Switzerland's CO_2 emissions?
- How much CH_4 would be generated per year?
- How does this compare to the yearly Swiss natural gas consumption of 35 TWh (126 PJ)?