Biogas from Swiss farms

Switzerland has 57'617 farm sites, of a mean size of 20 ha per farm, spread between 1 and 50 ha for >92% of them.
40'309 farms breed cows (1'545'600 cows, 38 cows per farm on average),
8'234 breed pigs (1'584'400 pigs, 192 pigs per farms on average)
and the country has 10'519 km^2 of agricultural surface (25.5% of the total) from which also straw and other residues are recoverable.

Recoverable power:
205 W per cow from cow manure
40 W per pig from pig manure
120.5 W from 1 ha of agro-waste

a)What is the recoverable yearly Swiss agro-biogas potential (in PJ)?

b)How does this relate to the total final Swiss energy consumption (of ≈800 PJ)?

c)What is the average potential power-size per farm: in kW? In biogas flow (m^3/h)?
(Assume 66% CH_4 in the biogas and 11 kWh per m^3 CH_4)

The reality of Swiss agricultural biogas exploitation in 2018 is a production of 140 GWh in 110 installations in ICE CHP with 35.7% electric efficiency.
d)How does this compare to the theoretical energy potential ?

e)What is the average engine power size per site? (Assume 7000h load per year)

f)What do you conclude from this ? How could the biogas potential be better used ?

Gasoline / Diesel replacement by inland bioethanol / biodiesel production

Inland mobility fuel in Switzerland is ca. 5.1 Mtoe gasoline and ca. 2 Mtoe diesel per year.

(1 Mtoe = 42 PJ)

Assume we want to replace part of it by inland biofuel production and that we can dedicate 1000 km^2 of the Swiss territory (total: 41'000 km^2) to beet plantation and 1000 km^2 to rapeseed plantation.

Bioethanol (21.3 MJ / L) from beet : 2500 L / ha
Biodiesel (33 MJ / L) from rapeseed : 700 L / ha

a)How much (%) of imported gasoline and diesel fuel consumption could we replace this way ?

b)If we were to dedicate instead 2000 km^2 of forest land (there is ca 11'000 km^2 of forest) to bioethanol production (renewable dry wood production of 20 tonne / ha.yr, converting 3 kg wood to 1 kg ethanol), how much gasoline could we replace ? (ethanol density: 0.8 kg/L)

c)If we would instead convert this yearly available wood quantity into methane (wood-to-methane = 70% energy efficiency yield) for mobility (gas vehicles) ? (Assume 16.7 MJ/kg dry wood)

Comment the results.