

10TH FSR ANNUAL CONFERENCE | INFRASTRUCTURE INVESTMENT CHALLENGES: RECONCILING COMPETITION, DECARBONISATION AND DIGITALISATION

10 JUNE 2021 – 11 JUNE 2021

Sector coupling of power and gas with combined heat and power plants: an investment to foster the Swiss energy system decarbonization?



[Emilie Simon, University of Lausanne – HES-SO Valais-Wallis, emilie.simon@hevs.ch]



[Francesco Maria Cimmino, HES-SO Valais-Wallis, francesco.cimmino@hevs.ch]



[Stéphane Genoud, HES-SO Valais-Wallis, stephane.genoud@hevs.ch]

11th June 2021

Background:

Switzerland will have to replace 35% of its electricity production

- Nuclear phase-out : replacement of 35% of domestic power production
- Long-run: compensated by development of RE and reduction in consumption
- Short-run: importation ?
- Elcom: dangerous winter dependency :
 - threat to the security of supply
 - majority of imports are of fossil origin
 - a substantial part of this missing winter production continues to be produced in Switzerland

Need a temporary solution to produce electricity during winter in Switzerland

- 1) What effect the deployment of small **CHP** units fuelled with **natural gas** would have on the **hourly carbon footprint** of the **electricity consumed** in Switzerland ?
- 2) How this result would potentially **change** after the **decommissioning** of the **Mühleberg** nuclear power plant?
- 3) What are the economic, regulatory and policy **barriers hindering penetration of CHP** in Switzerland?

Research questions 1 and 2

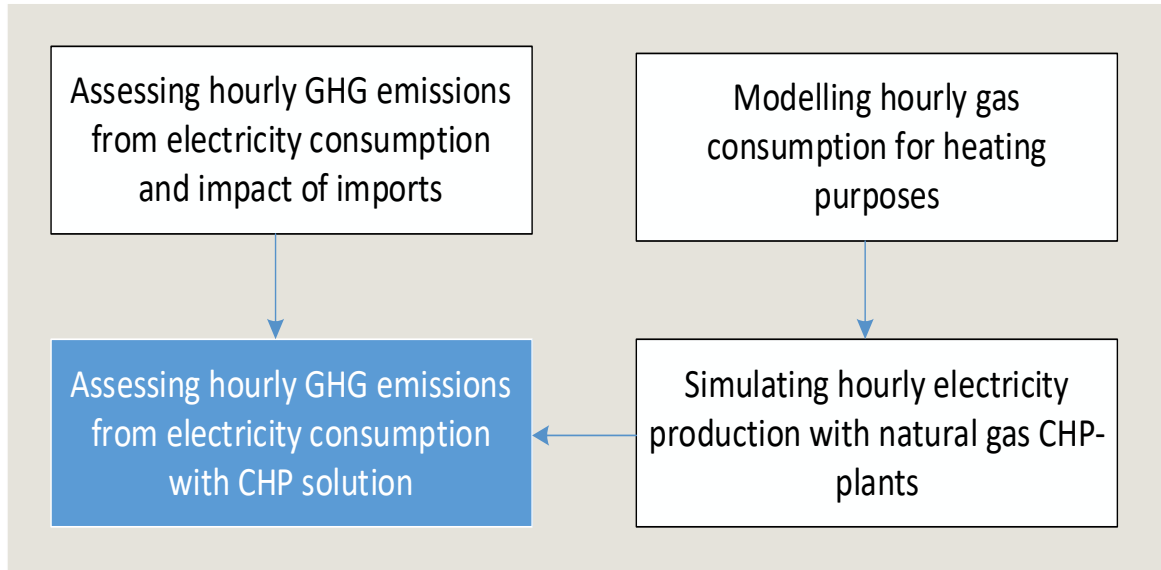


Figure 1 : The four parts of the research process



Research question 3

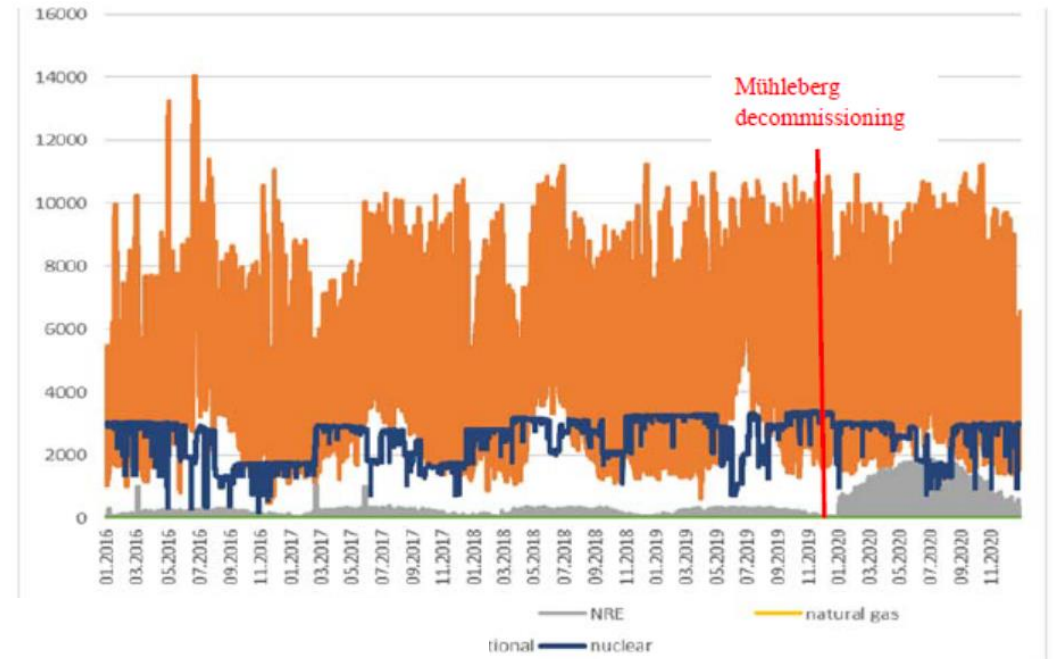
Documentary research enriched with exchanges with experts

Results

Research questions 1 & 2

Table 1 - Actual emission factor of the electricity consumed and results of the CHP simulation (first and second ring countries)

Year	Emission Factor Actual (gCO ₂ eq/kWh)	Emission Factor After CHP simulation (gCO ₂ eq/kWh)	Variation (%)
2016	149.30	138.09	-7.51 %
2017	155.46	144.49	-7.06%
2018	121.24	116.63	-3.81%
2019	96.85	97.12	0.28%
2020	80.58	87.56	8.67%



domestic generation mix of Switzerland

Table 3
Emission Factor after simulation with different proportions of biogas

Year	EF After sim. 10% biogas (CO ₂ eq/kWh)	Var. (%)	EF After sim. 30% biogas (CO ₂ eq/kWh)	Var. (%)
2016	135.51	-9.42%	130.35	-12.69%
2017	142.04	-8.63%	137.14	-11.78%
2018	114.50	-5.56%	110.26	-9.06 %
2019	94.98	-1.94%	90.69	-6.37 %
2020	85.45	6.06%	81.25	0.83 %

1) Legal barriers:

improvement of the framework conditions but not enough

2) Financial barriers:

small CHP plant fuelled with natural gas are barely profitable

3) Historical barriers:

Swiss utilities never fully adopted this technology

4) Technical barriers:

wide range of type of installations and size makes harder to communicate and train operators

- could **lower** the GHG footprint of the electricity consumed in Switzerland up to **7.51%**
- effect is **fading through time** as power generation mix of Germany is getting cleaner (increase GHG footprint by 8.67% in 2020)
- results improved significantly when the CHP are fuelled with a proportion of **biogas**
- CHP technology is facing **many barriers**: without clear federal and cantonal strategy → market penetration seems compromised
- **Further research**: effect of the **phase-out of nuclear** power, comparing **alternative solutions** to produce power in winter

Acknowledgements

The authors acknowledge Holdigaz SA for support of this work.

Questions and answers



Emilie Simon
HES-SO Valais-Wallis,
Institut Entrepreneuriat et management
Techno-Pôle 3
3960 Sierre

emilie.simon@hevs.ch