

Study on Integrating a 50 kW Alkaline Electrolyser into a Weak Grid with a Grid-Forming Energy Storage System

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Goal:

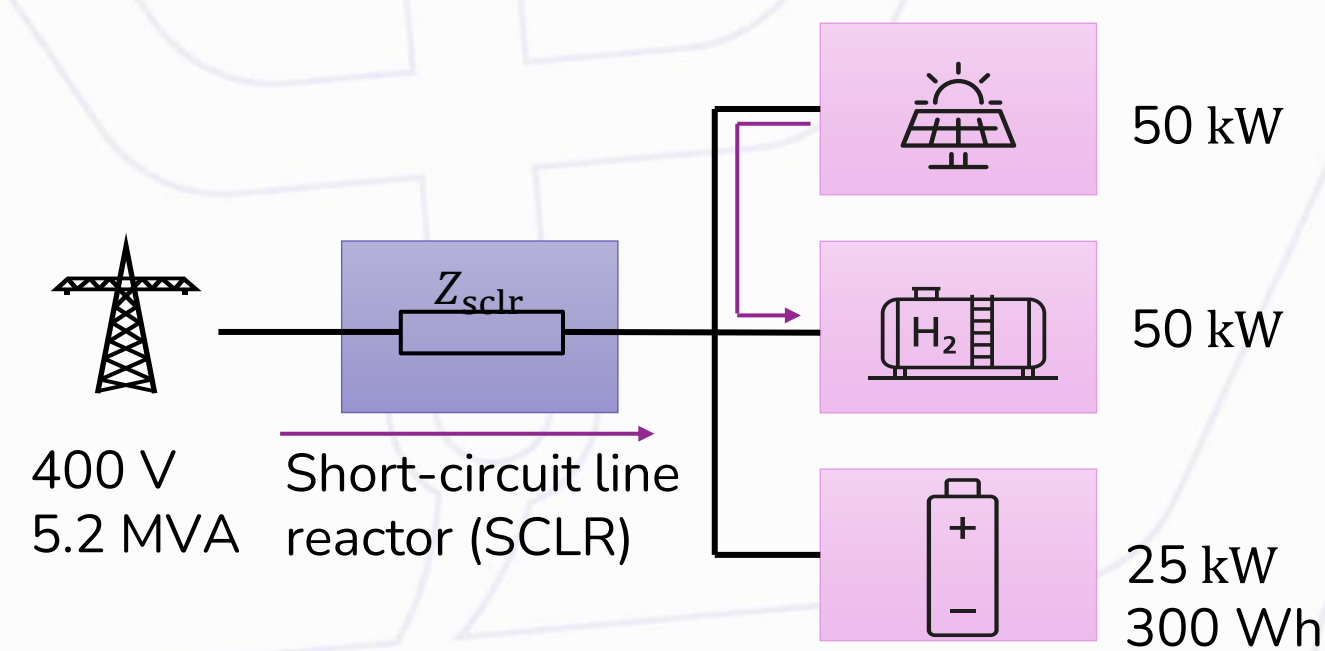
Reduce contracted grid connection to reduce grid connection fees

AGISTIN Case Study

- Short circuit ratio (SCR)

$$\text{SCR} = \frac{S_{\text{ac,grid}}}{P_{\text{rated}}}$$

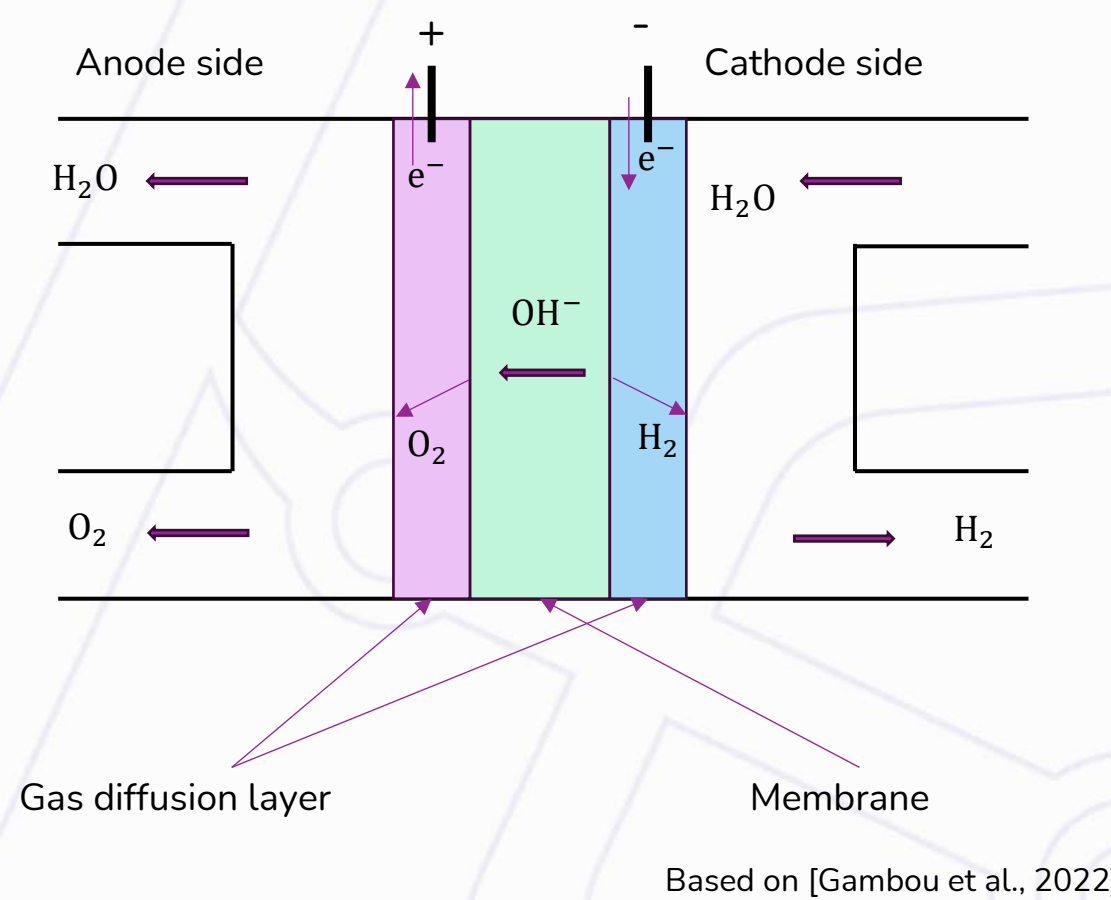
- Weak grid connection if $\text{SCR} \leq 5$
- SCLR can vary coil rating from 25 - 1 kVA
- Corresponding to an SCR from 5 to 0.5



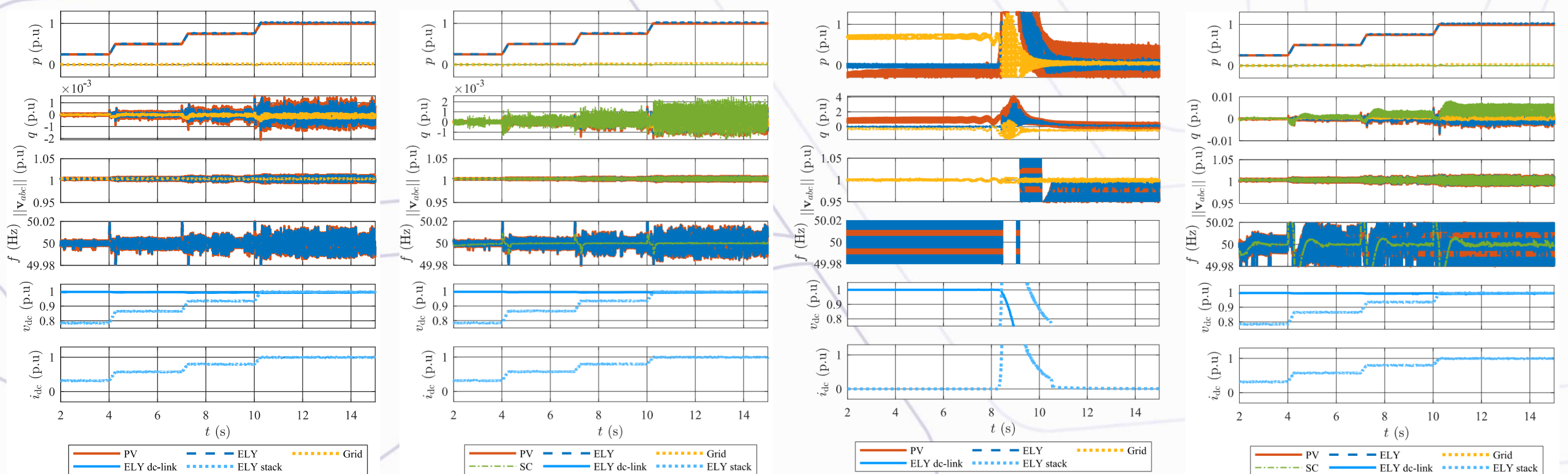
Modeling:

- Photovoltaic plant and electrolyzer operate in grid-following mode
- Energy storage system (super capacitor) operates in grid-forming mode (GFM-SC)
- Tuning based on literature, switching of bridges of AC/DC converters are neglected

Alkaline Electrolyzer Stack Model



Comparison without and with GFM-SC at SCR=5 Comparison without and with GFM-SC at SCR=0.5



[Kaufmann et al., 2025]

References

- [Gambou et al., 2022] F. Gambou, D. Guilbert, M. Zasadzinski, and H. Rafaralahy, "A Comprehensive Survey of Alkaline Electrolyzer Modeling: Electrical Domain and Specific Electrolyte Conductivity," *Energies*, vol. 15, no. 9, p. 3452, 2022.
- [Kaufmann et al., 2025] Kaufmann, C., Ganesh, S., Luxa, A., Pangalos, G., "Grid integration study of a 50kW alkaline electrolyser into a weak grid with a grid-forming energy storage system", 24th Wind & Solar Integration Workshop, Berlin, 2025.

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