ETH zürich

Center for Sustainable Future Mobility (CSFM)

Integrating EV charging in electric railways: The case of Switzerland

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PSL Power Systems Laboratory

1 Introduction

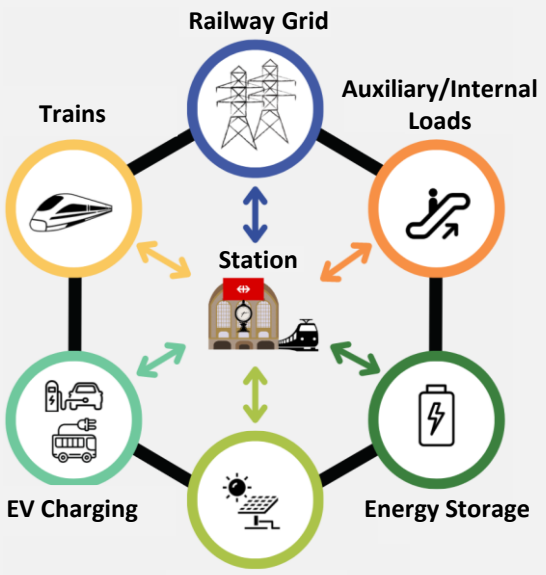
Transportation electrification is expected to have increasing importance on power system operation. The **RailPower** project aims to investigate the vision of electric railway stations becoming future Energy Hubs, leveraging the opportunity for optimal electric vehicle charging by utilizing renewable energy and energy storage.

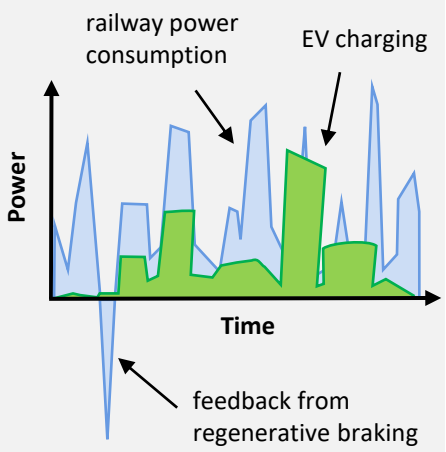
2 Background

- **Electric Railway Stations as Energy Hubs:**

→ Electric infrastructure design connecting photovoltaic (PV) energy, energy storage (ESS), and electric vehicle (EV) chargers to the railway grid.

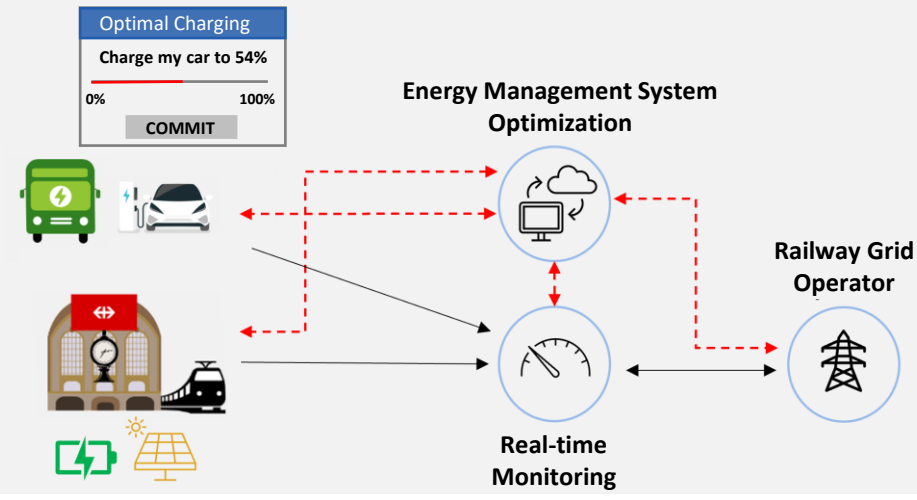
→ Coordination of EVs with PV generation, ESS, railway demand.





3 The Proposed Method

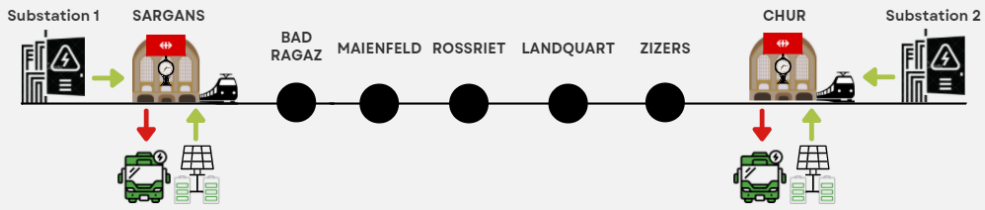
- An **Energy Management System** (EMS) for **optimal EV charging** considering trains, EVs, PV, ESS:

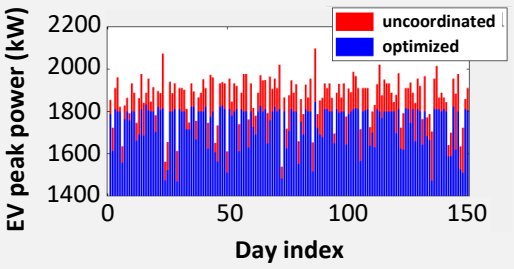


4 Results and discussion

Case study:

Route from **Sargans** to **Chur, Switzerland**





	Cost Savings	Peak Power Savings
Base Case	–	–
Proposed EMS	17.29%	14.01%

5 Conclusion and expected impact

- An **optimal EMS** of a **Railway Station** integrating **EVs, PV, ESS** is proposed:

→ EV charging schedules are optimized.

→ Operating costs are minimized.

→ PV uncertainty is incorporated in the scenarios considered.

→ ESS is activated to avoid system stress caused by EV charging during train rush hours.

	Train	EV	PV	ESS
Base Case	✓	–	–	–
Proposed Case	✓	✓	✓	✓

- **Stay in touch and download the full poster here:**

Acknowledgements

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References

1. G. Pierrou, Y. Zwirner, and G. Hug, “An Optimal Energy Management Algorithm Considering Regenerative Braking and Renewable Energy for EV Charging in Railway Stations,” in IEEE PES General Meeting, Orlando, FL, USA, 2023.
2. G. Pierrou and G. Hug, “Integrating Optimal EV Charging in the Energy Management of Electric Railway Stations,” in IEEE PowerTech, Belgrade, Serbia, 2023.

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