ETH zürich

Center for Sustainable Future Mobility (CSFM)

Integrating EV charging in electric railways: Uncertainty and flexibility

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1 Introduction

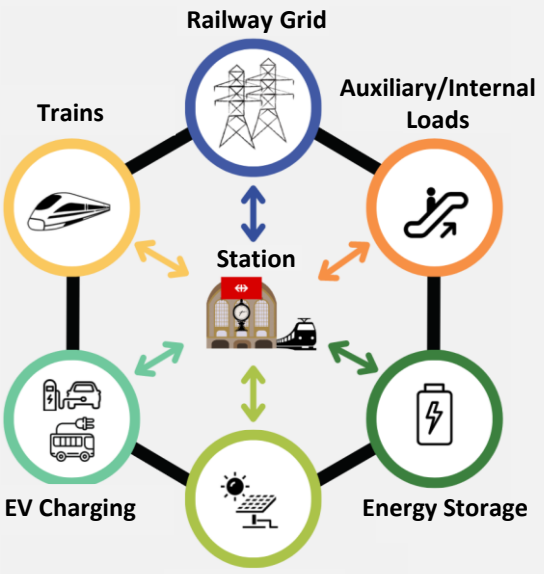
Transportation electrification is expected to have increasing importance on power system operation. The **RailPower** project aims to investigate the vision of electric railway stations becoming future Energy Hubs, leveraging the opportunity for optimal electric vehicle charging by utilizing renewable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

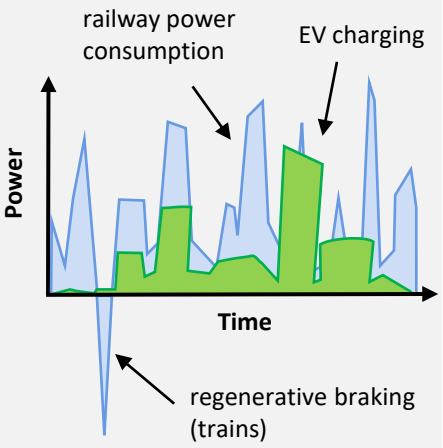
2 Background

- **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.

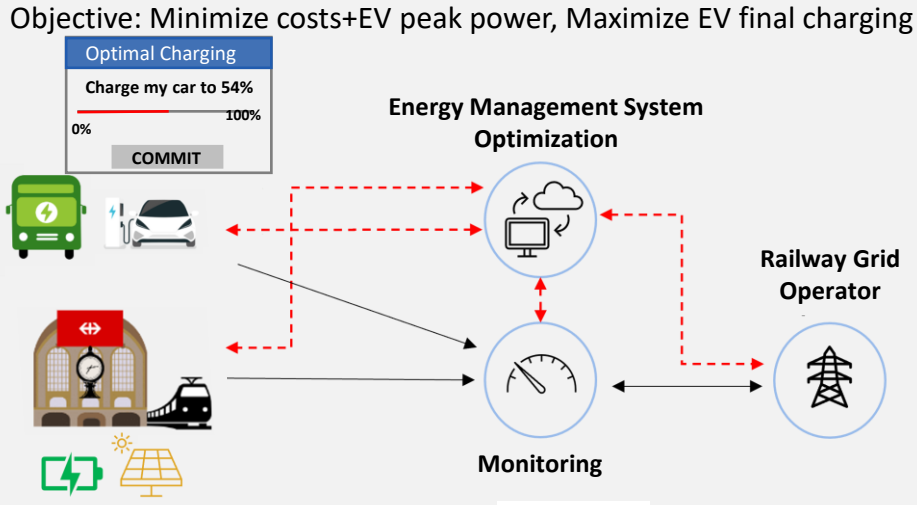
→ Coordination of EVs with PV generation, ESS, railway demand.





3 The Proposed Method

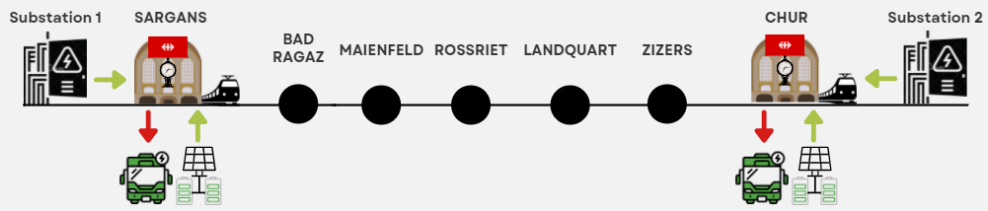
- An **Energy Management System** (EMS) for **optimal EV charging** considering trains, EVs, PV, ESS
- Objective: Minimize costs+EV peak power, Maximize EV final charging

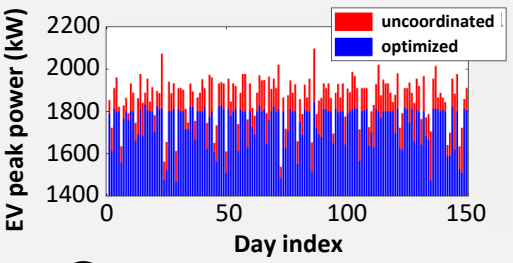


4 Results and discussion

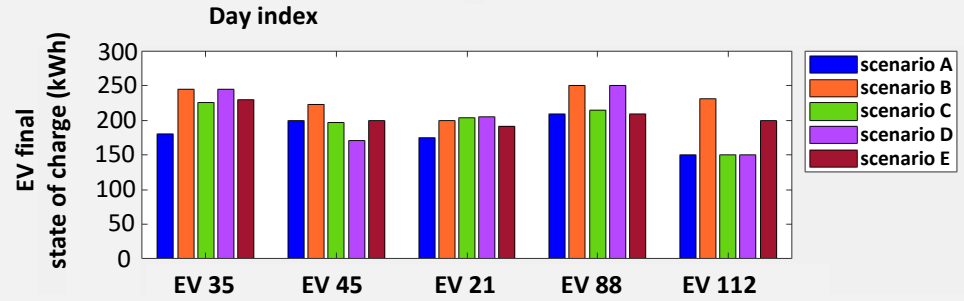
Case study:

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





	Cost Savings	Peak Power Savings
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	✓	✓	✓	✓

Acknowledgements

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References

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