Sustainable Optimization of the Electricity System

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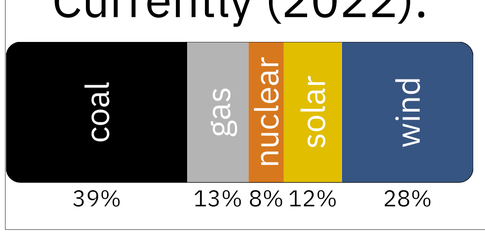
Poster Presentation in context of Reinforcement Learning Lecture

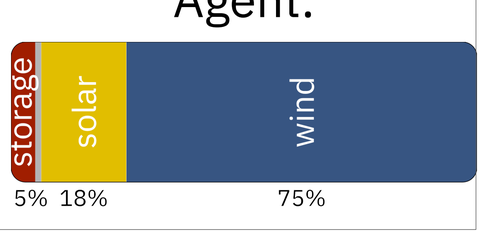
1 Summary

- Agent chooses supply technologies
- Model rewarded by minimizing costs (LCOE) and stabilizing system

Currently (2022):



Agent:



3 Approach

Actions

- Building and dismantling production and storage

Observations

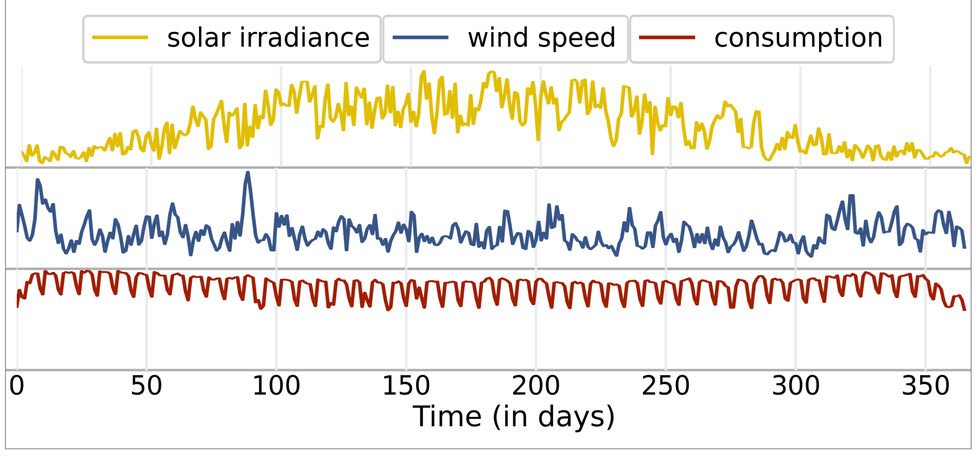
- State of production and storage
- Current power consumption

Reward

- Negative balance loss L^b (MSE)
- Cost loss L^c (MSE)
  - Carbon cost (€)
  - Production cost (€)
  - Storage cost (€)

$$L = \alpha \cdot L^b + \beta \cdot L^c$$

$$R_n = L_n - L_{n-1}$$



5 Future Works

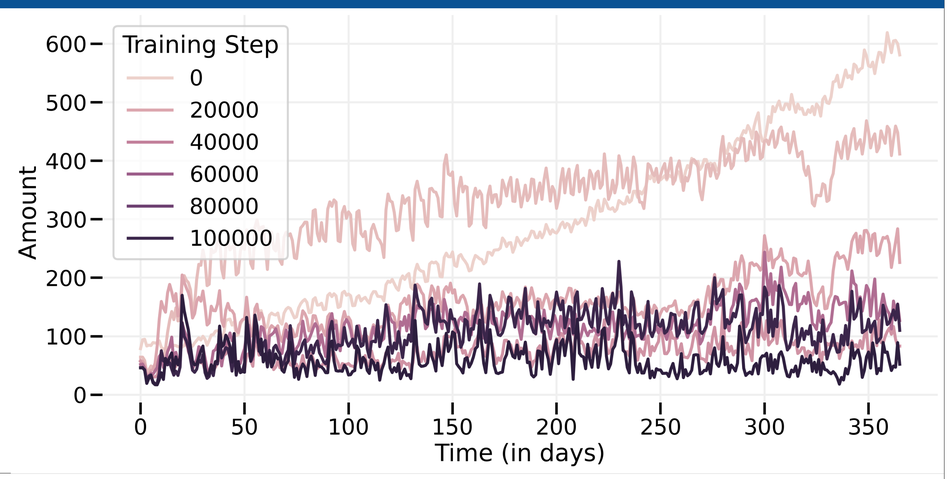
- Power control of plants
- Delays for building and controlling
- International power trade
- Locality in electricity grid
- Limits of production per technology

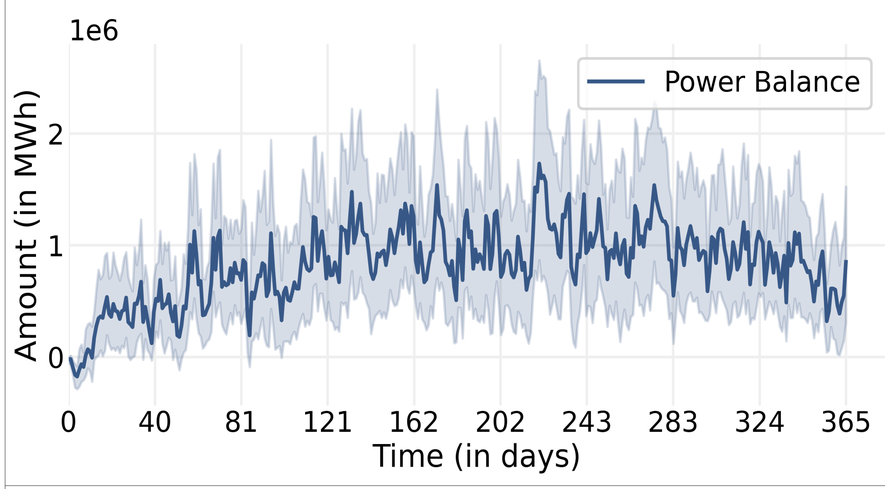
3 Motivation & Problem Setting

- Current carbon emissions too high
- Electricity supply major contributor to climate change
- Renewable energies fluctuate significantly
- Let RL agent manage power supply composition

4 Key Insights

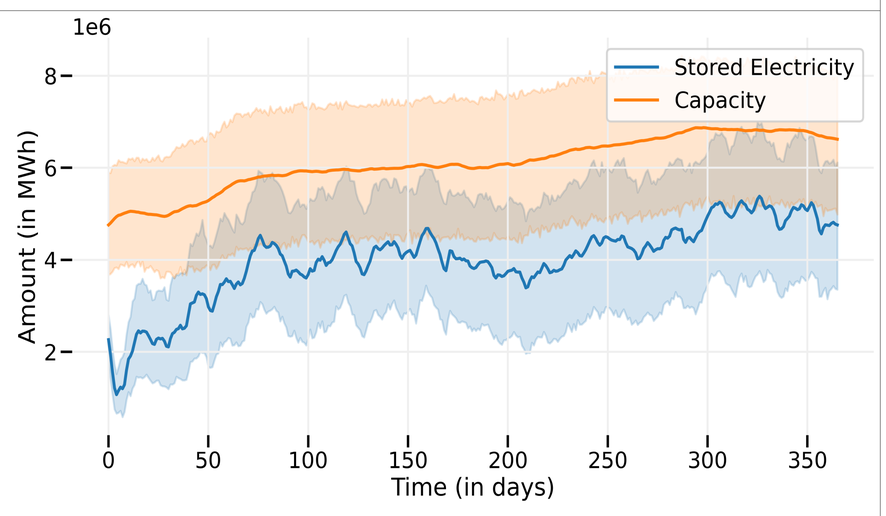
Evaluation losses at different training steps



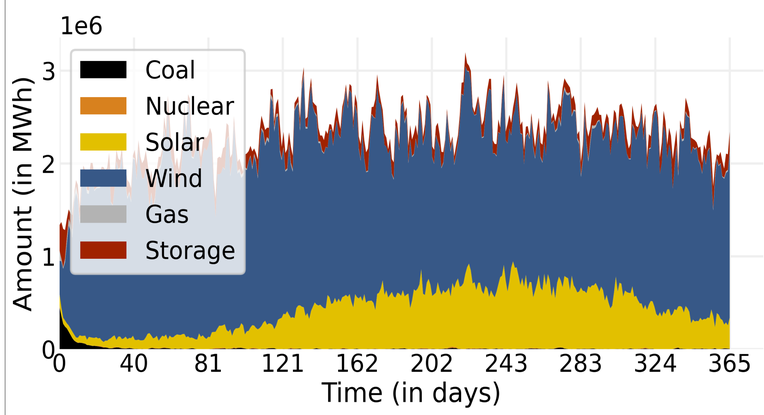


Balance of produced and consumed electricity

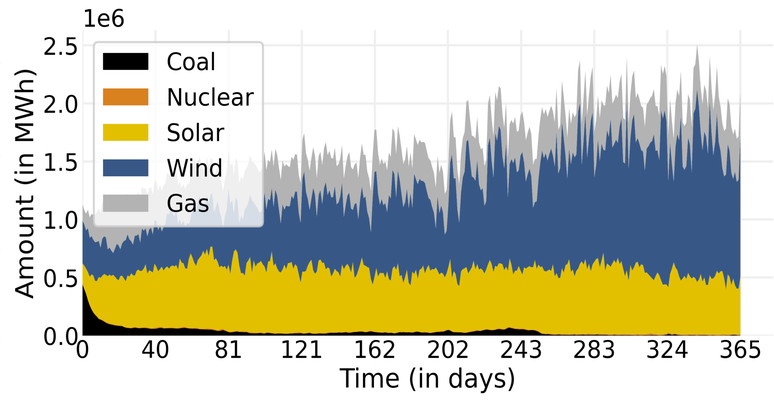
Storage capacity and utilization



With storage



Without storage



- Overproduction to compensate renewable fluctuation
  - Still power shortages
- Storage is key for a sustainable and reliable system
  - Weather conditions across Germany are similar
  - Distributed system cannot compensate