

Multi-energy optimization in Smart Grids: a Deep Reinforcement Learning approach

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The Meridia Smart Energy Smart territory



Figure: The Meridia Smart Energy eco-district

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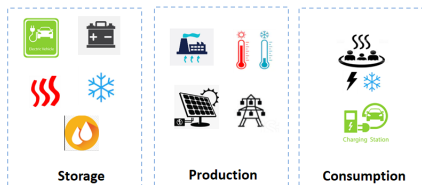


Figure: Energy systems of the MSE Smart Grid

Optimization Objectives

- Maximize self-consumption and energy self-sufficiency

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- Value flexibility potentials of the Smart Grid (ancillary services)

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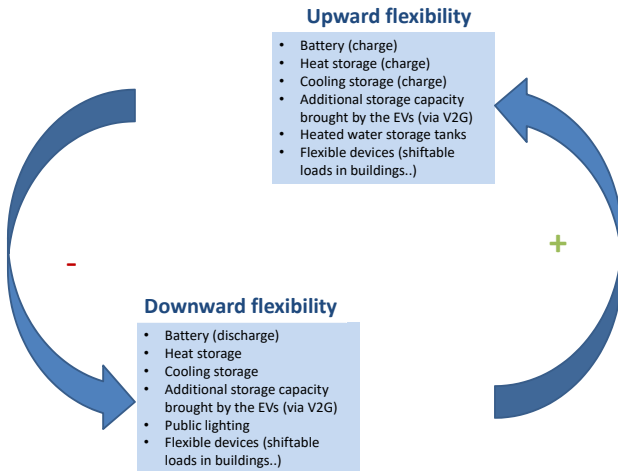


Figure: Flexibility potentials in the MSE Multi-energy Smart Grid

Smart Grids optimal planning and control

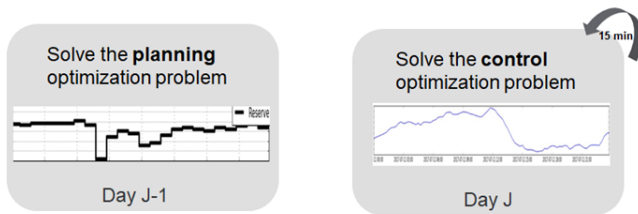


Figure: Flexibility potentials in the MSE Multi-energy Smart Grid

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- **The system:** is thus described partly via a deterministic simulator (a digital twin) and partly from real time series (for PV production, energy consumption..),
- **The environment** of the Smart Grid is modeled as an MDP (Markov Decision Process)
- Traditional methods to solve the MDP (DP, PSO, MPC, etc.): time consuming procedures, not suitable for online optimization

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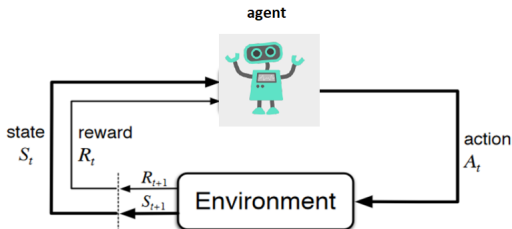


Figure: Reinforcement Learning framework

Deep Q Networks and Deep Policy Gradients

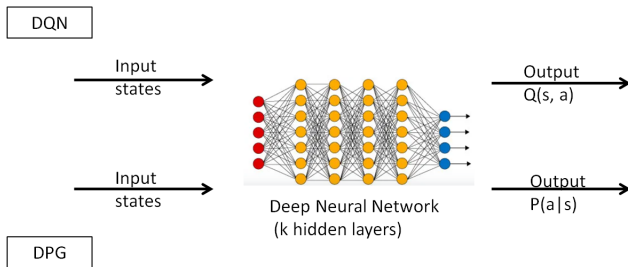


Figure: Two Deep Reinforcement Learning methods

Summary

- This work proposes to develop a strategy for the optimal operation of a multi-energy Smart Grid
- It uses a DRL approach
- Testing two methods: DQN and DPG
- Using a traditional method (MPC) as a benchmark

Thank you for your attention.

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