

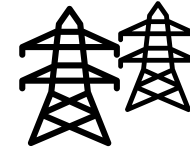


Neural Power – AI in Energy Consumption

European Master Team Project in Cooperation with Babeş-Bolyai University Cluj

Supervisor: Sascha Marton and Lars Hoffmann

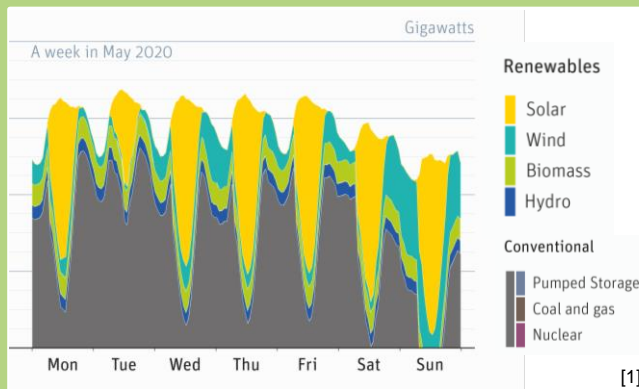
Reviewer: Dr. Christian Bartelt



Motivation: Challenges in the Energy Sector



Renewable Energy Production



Overall share of renewable energy increases, ...

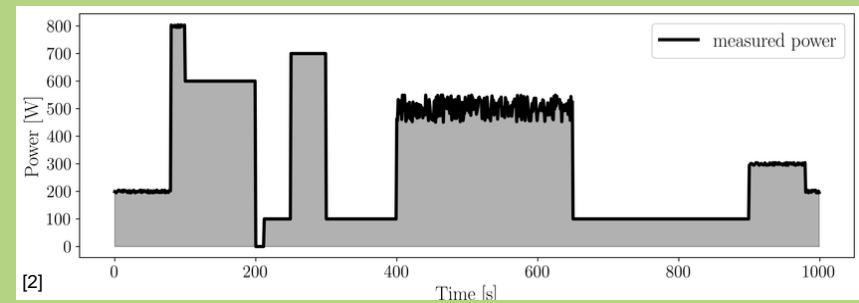
but their amount of produced electricity is highly dependent on external factors (e.g., weather).

- High fluctuations in energy production due to weather and time of day
- Volatile supply and demand ratio on the electricity market
- Electricity price greatly varies over time (e.g., night & day, sunny & rainy, ...)

Ex.: Sunny day results in a lot of solar energy during daytime, leading to a potential oversupply and a lower electricity price for consumers



Household Energy Consumption



- Smart Meters measure the overall (aggregated) power consumed by all appliances in a household
 - No direct mapping to the specific appliances possible (disaggregation)
- Each household has a different and dynamically changing set of appliances as well as willingness to adjust its usage behavior
 - Hard to identify the shifting potential of the energy consumption for each household

Ex.: Household A owns a smart e-car loading station. Household B doesn't own an e-car, but can program its washing machine to start at specific point in time.

How to guide the energy consumption of households to benefit from cheap renewable energy?

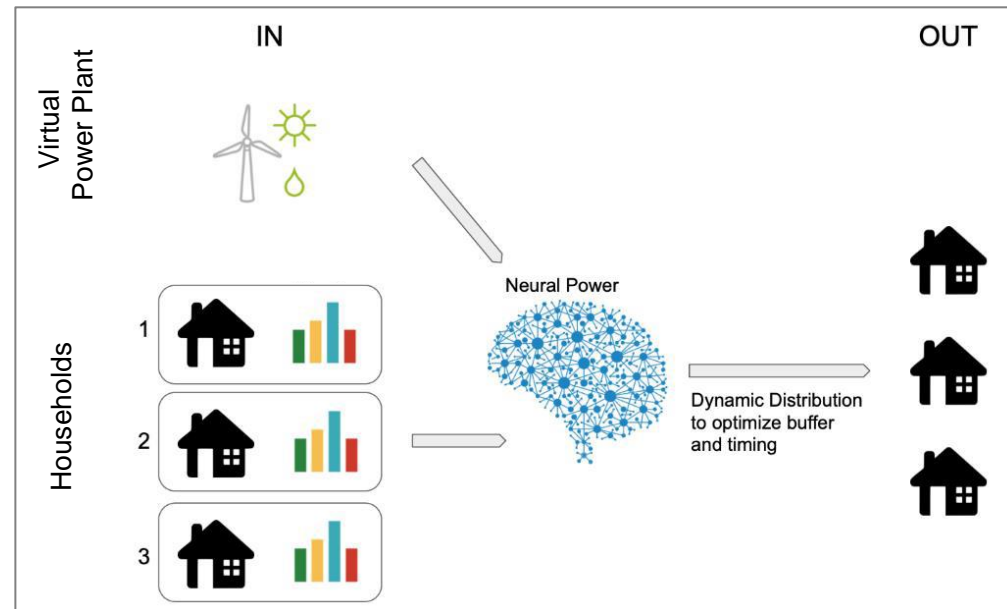
Project Goal

Use Artificial Intelligence to identify and schedule the shiftable energy consumption of households according to the availability of renewable energies based on an aggregated energy signal

Task

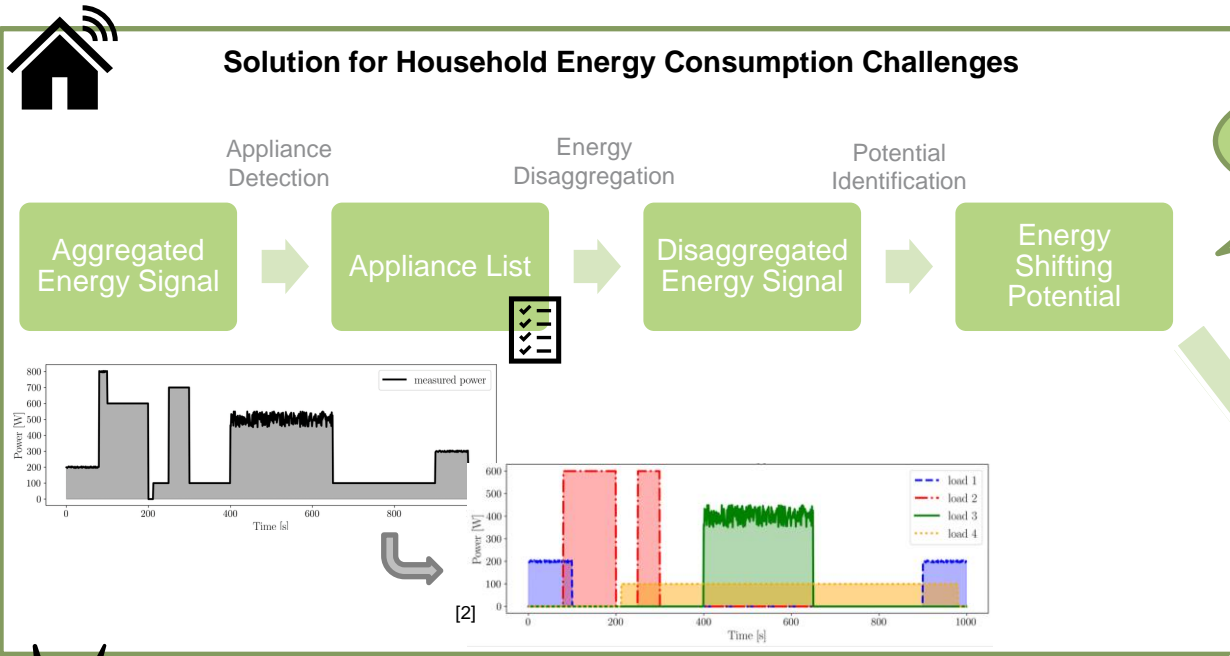
- Gain hands-on experience with the application of state-of-the-art AI concepts in the context of a real research project
- Implement a running prototype with AI-based modules to solve real-world challenges in energy consumption planning
- Focused tasks for applying AI:
 - Appliance Detection
 - Energy Signal Disaggregation
 - Electricity Price Forecasting

Big Picture for Applying AI in the Energy Domain

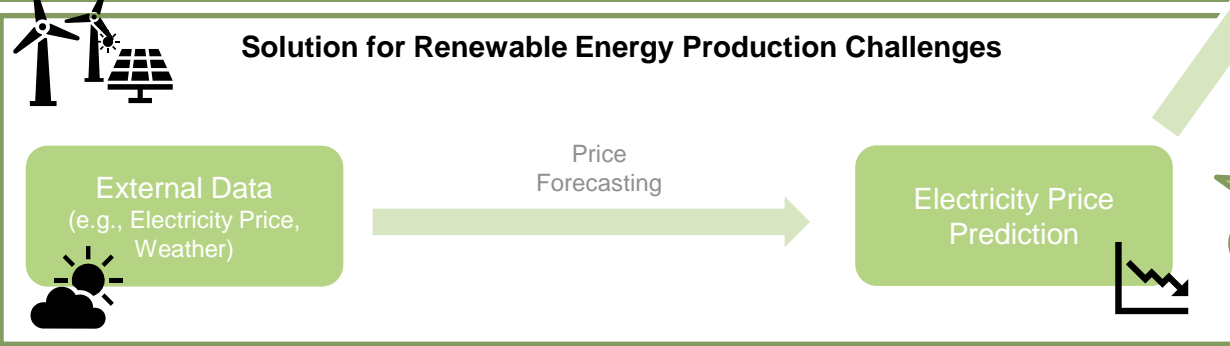




Overview of Application Workflow to be implemented



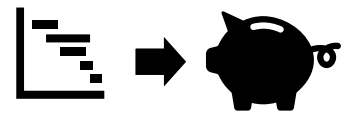
How much and which energy consumption can be shifted? ✓



Where to shift future energy consumption? ✓

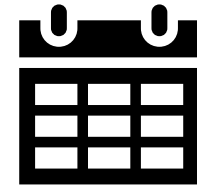
Appliance Scheduling

Cost-efficient Appliance Schedule for a Household



Organization

- Course of studies: M.Sc. Business Informatics or Data Science
- Language: English
- Timeframe (tentative): 13.09.2021 – 28.03.2022
- Duration: 6 months (1 semester)
- Team: 2-3 Mannheim students and 2-3 Cluj students



Cluj Cooperation:

- Cluj students participate in project for 3-4 months
 - September 2021 – January 2022
- Exchange trips depend on travel regulations (COVID-19), but are desired and **fully sponsored** by the organizers



Requirements

- Programming skills mandatory (Python preferred)
- Experience in version control systems (e.g., Git)
- Beneficial: Know-How in Machine Learning

- Desirable soft-skills:
 - Open-minded character
 - Outstanding teamwork
 - Great communication skills

- Last but not least: High motivation and interest in the topic!



Thank you for your attention!



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References

- [1] http://wiki.energytransition.org/files/2018/10/BL_ET_update_2018_Renewables-need-flexible-backup-not-baseload-.png
- [2] https://www.researchgate.net/figure/Graphical-representation-of-energy-disaggregation-Upper-illustration-shows-the-total_fig1_342409333