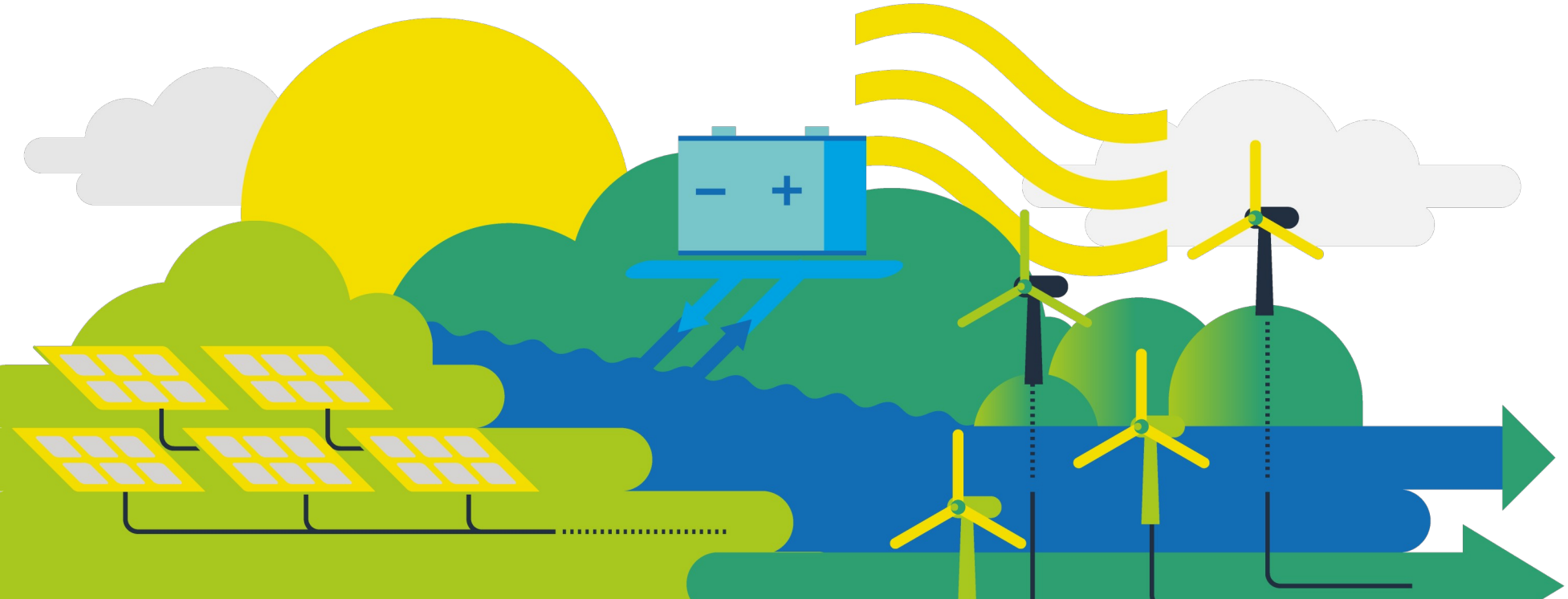
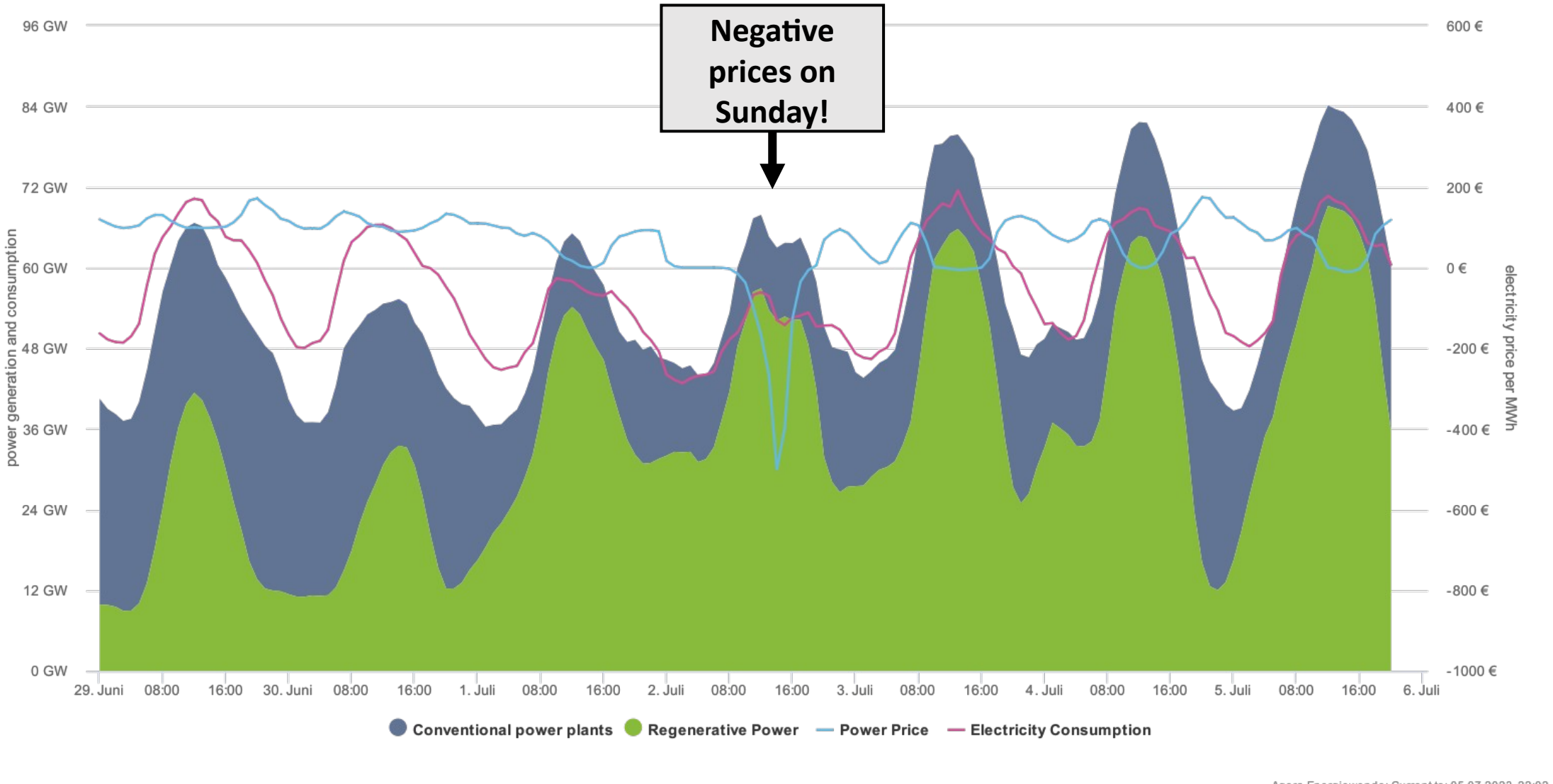
Predicting Fluctuations in Renewable Energy Generation



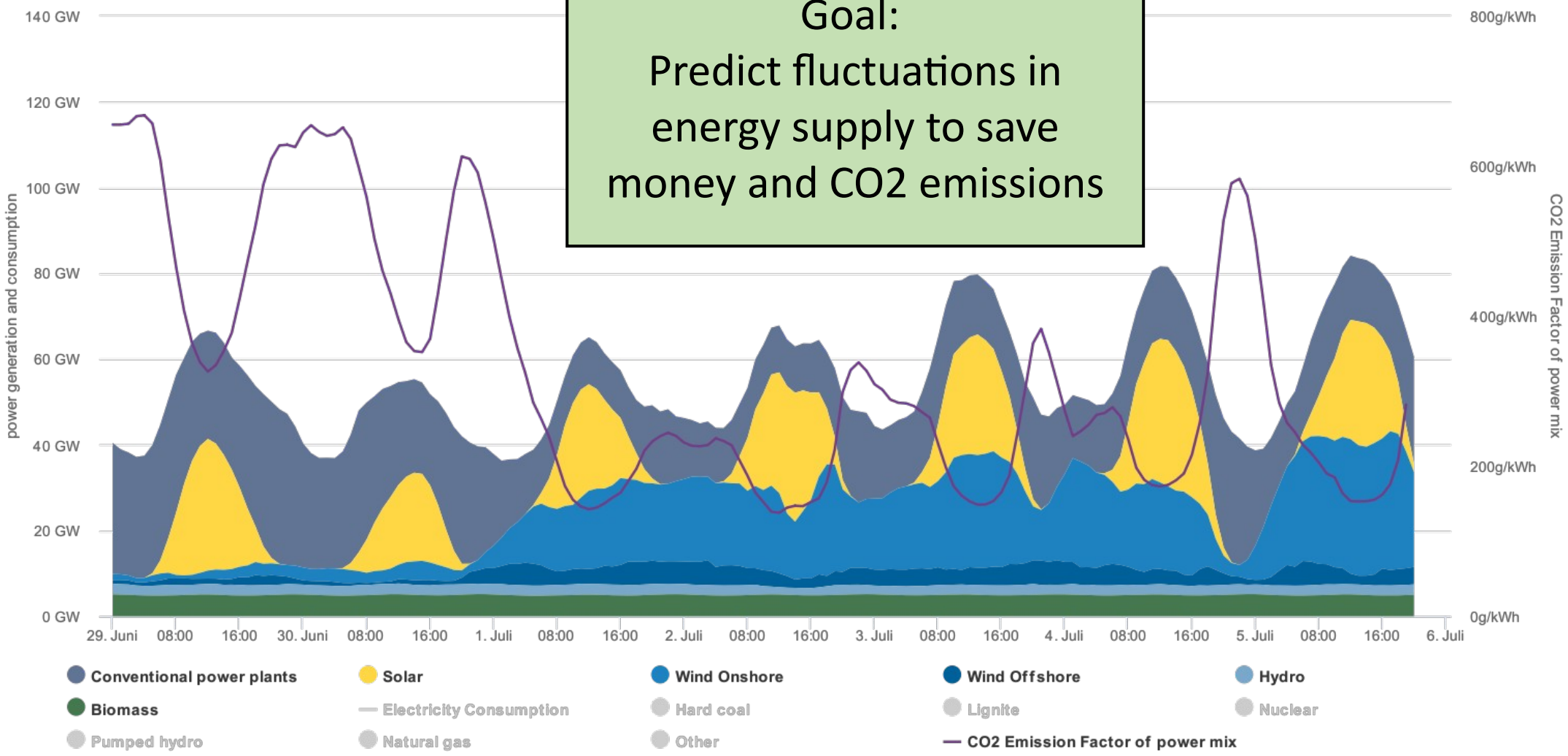
Energy prices fluctuate with RE supply



Source: Agora Energiewende

CO2 Emissions fluctuate with RE supply

Goal:
Predict fluctuations in energy supply to save money and CO2 emissions



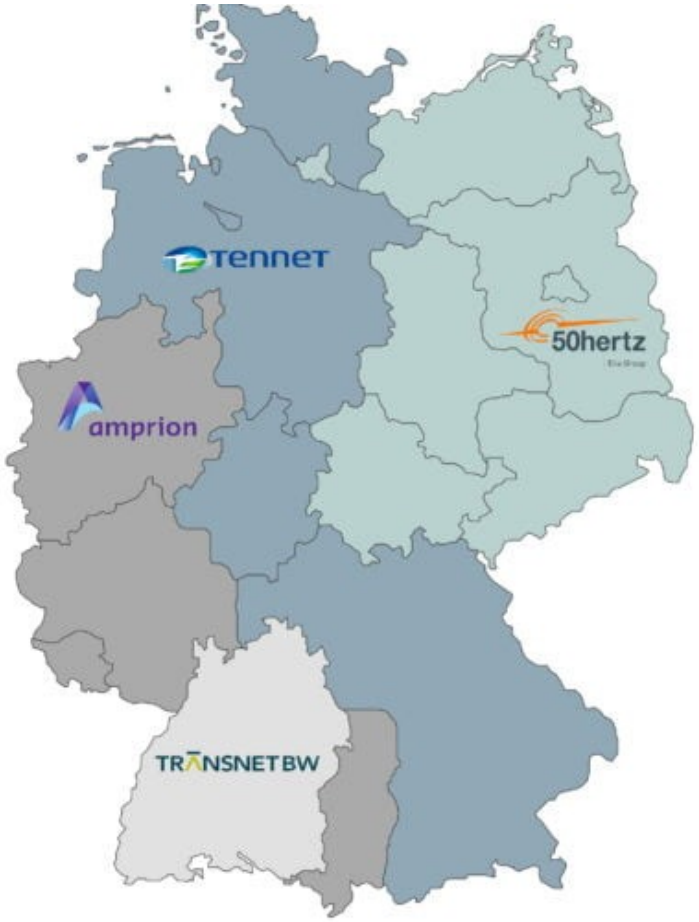
Source: Agora Energiewende

Data Engineering

Facilities

Location
Capacity

Marktstamm-datenregister

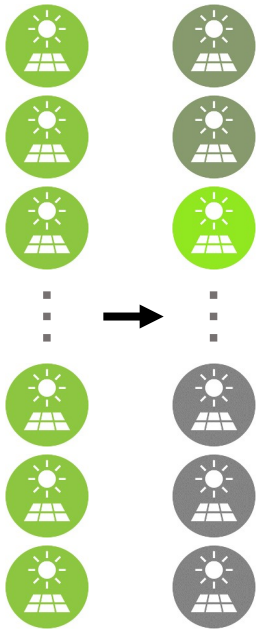


Data Engineering

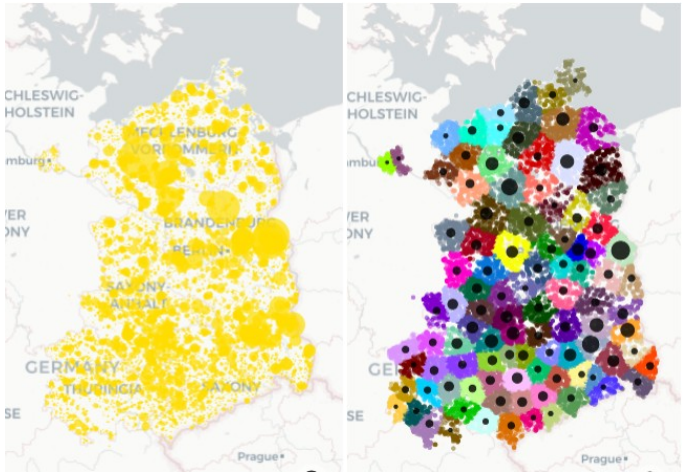
Facilities

Location
Capacity

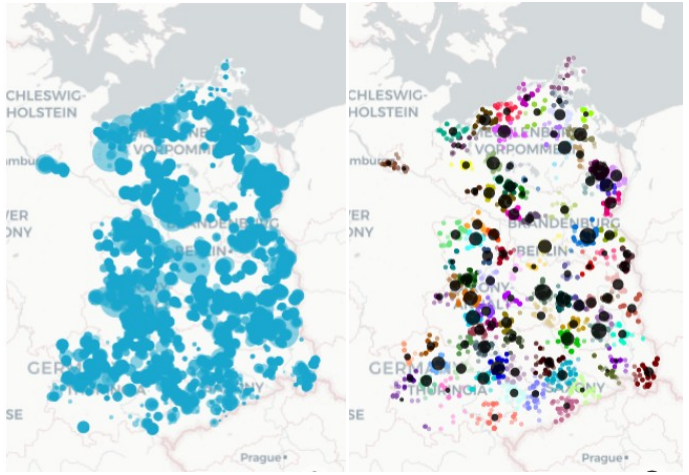
Marktstamm-datenregister



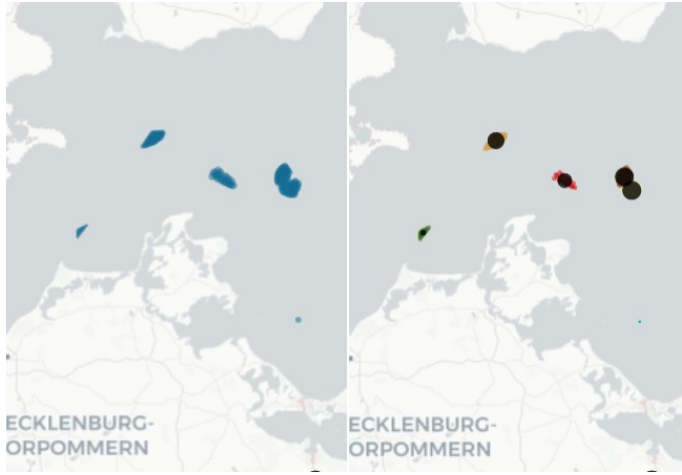
Solar
>350k units



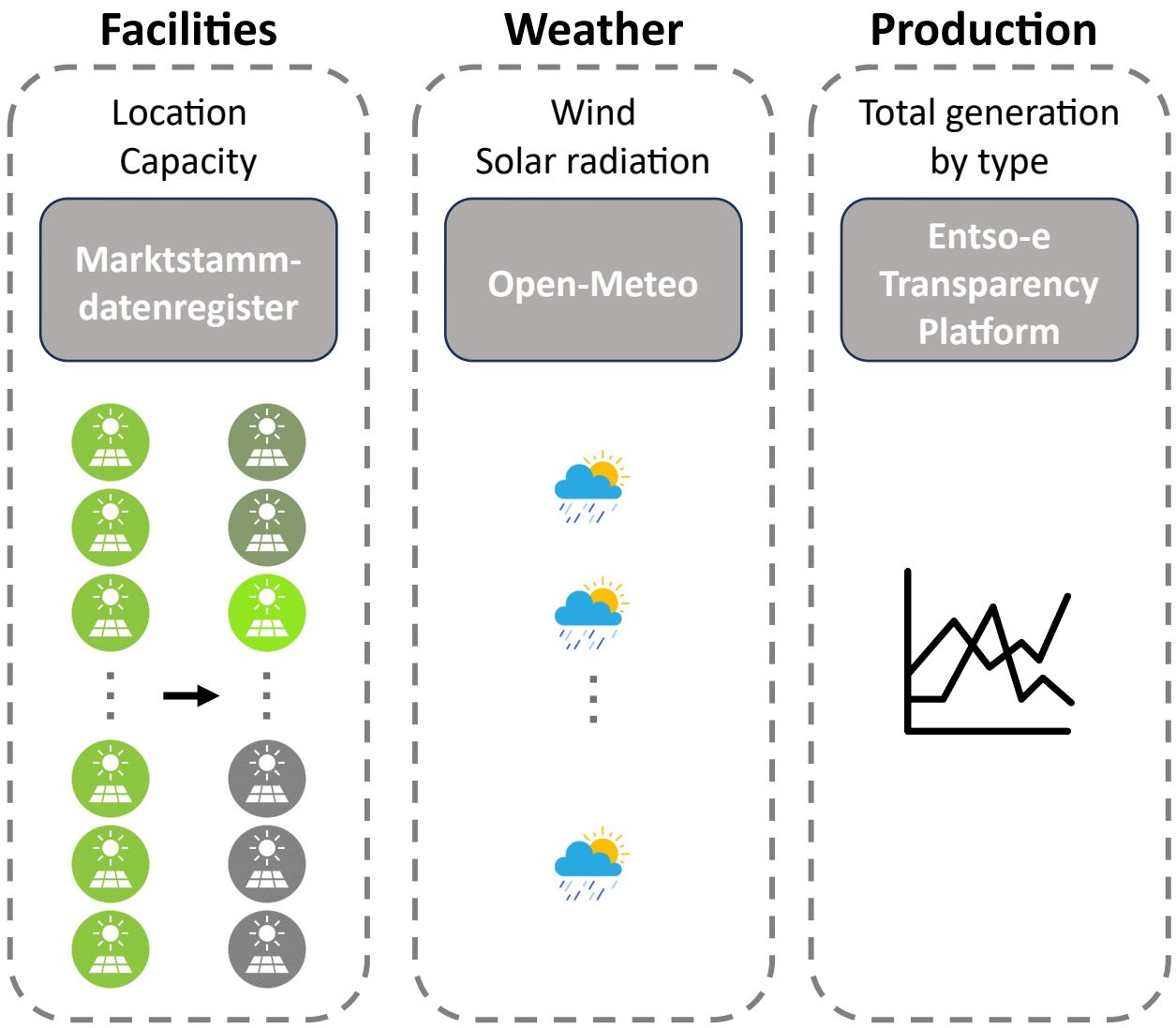
Wind onshore
>10k units



Wind offshore
255 units



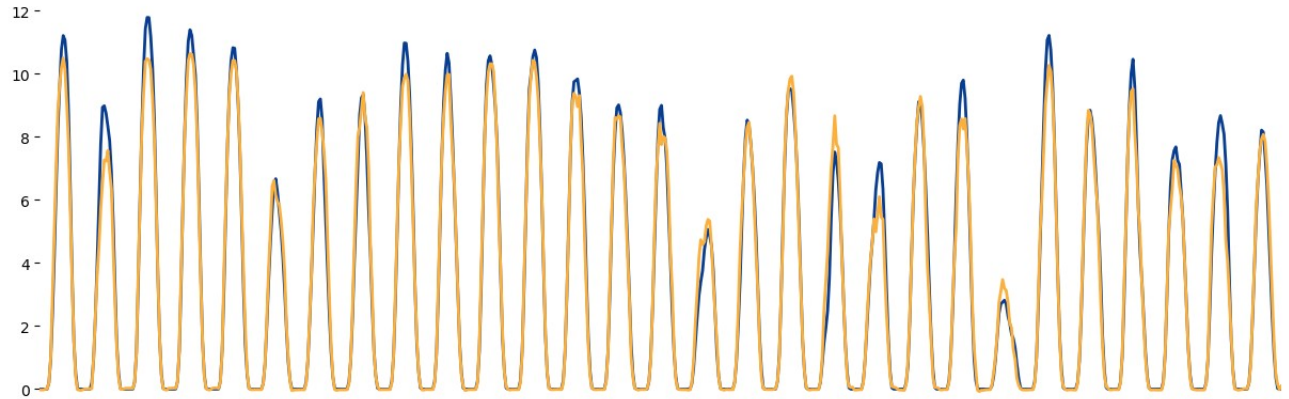
Data Engineering



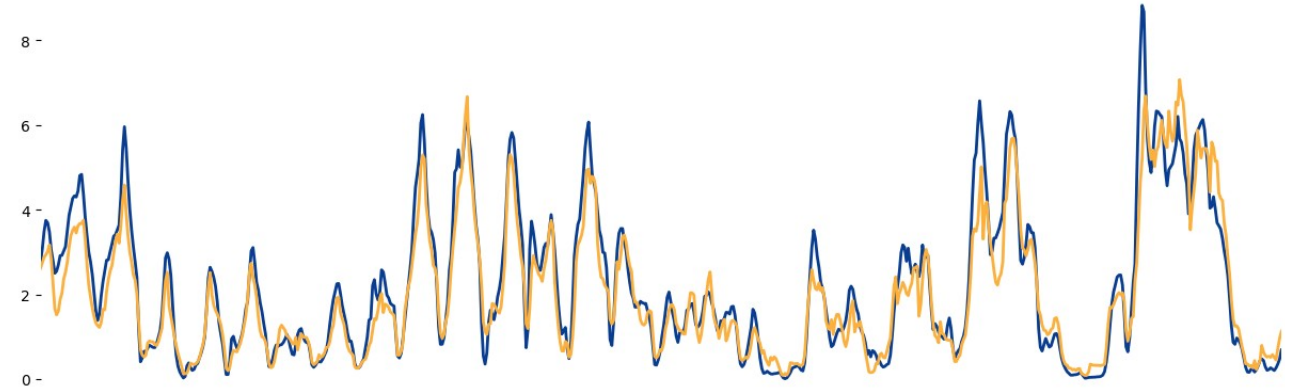
Five years of historical data for model training (June 2018 – May 2023)

New dataset for model evaluation: June 2023

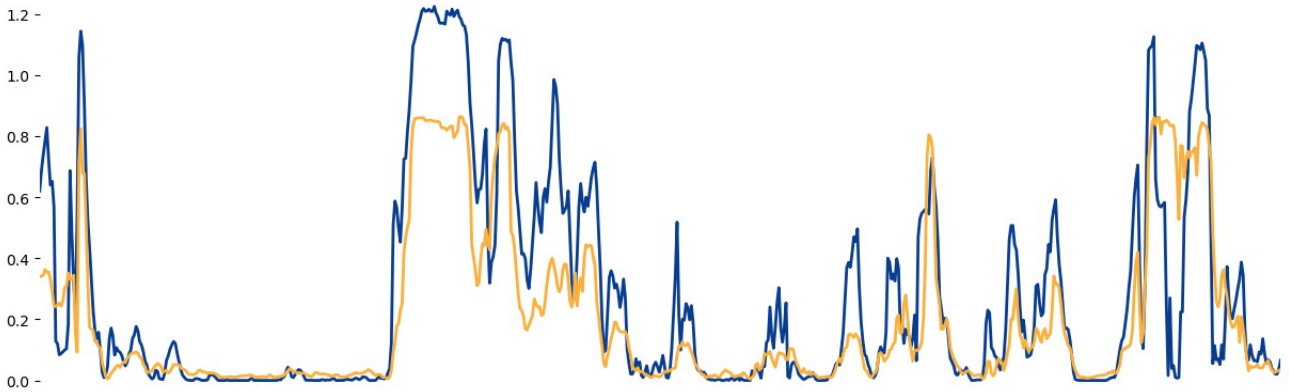
Predictions based on:



Solar



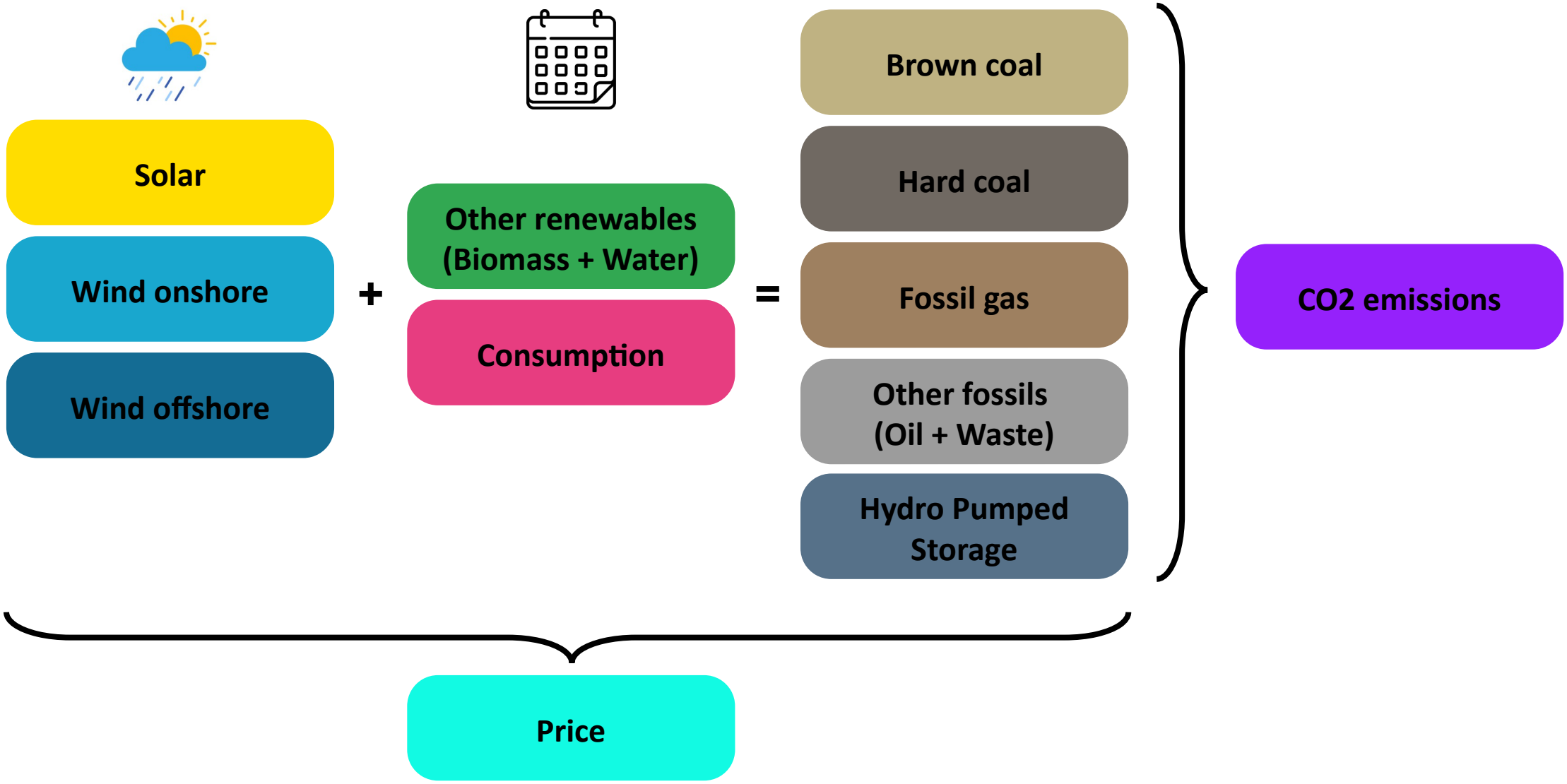
Wind onshore



Wind offshore

- Actual generation
- Prediction

Sequential predictions



Hydro Pumped Storage

Other fossils (Oil + Waste)

Fossil gas

Hard coal

Brown coal

Solar

Wind onshore

Wind offshore

Other renewables (Biomass + Water)

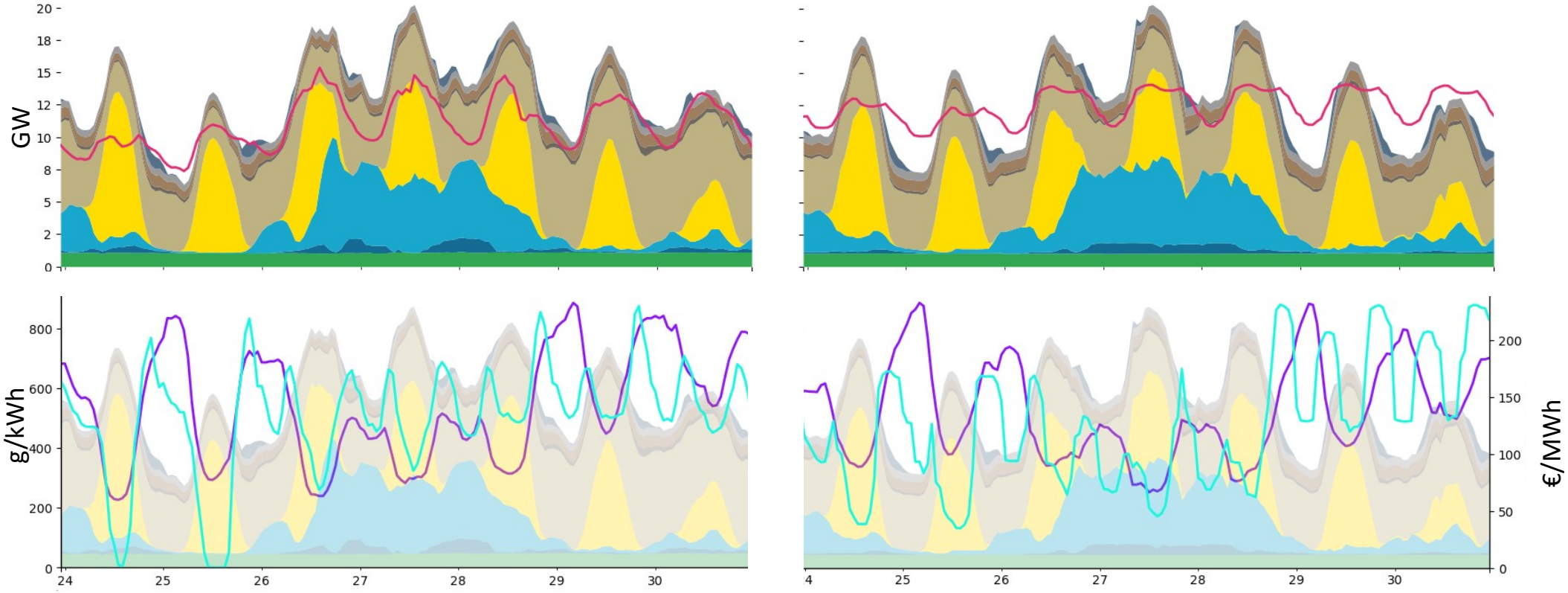
Consumption

CO2 emissions

Price

Actual generation

Prediction



A week in June 2023

Conclusions

- Basic patterns of fluctuating electricity production can be predicted based on seasonal and weather data
- More accurate predictions are hindered by the lack of regional (per-facility) production data
- Price developments and fossil energy generation are harder to predict (likely various influences not captured in the data + the last years were unusual)