Innovation Challenge 3: Dataroom

Future proof power consumption prediction

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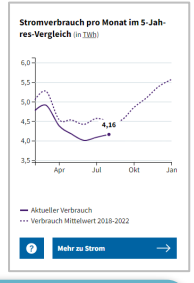
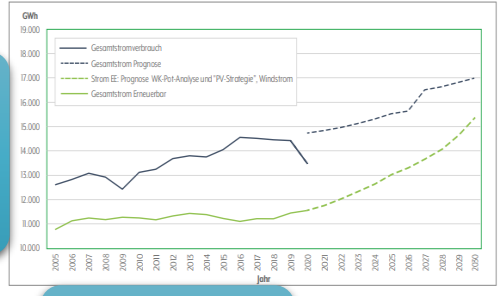


Current Forecasting Methods

Upcoming Regulations



Megatrends

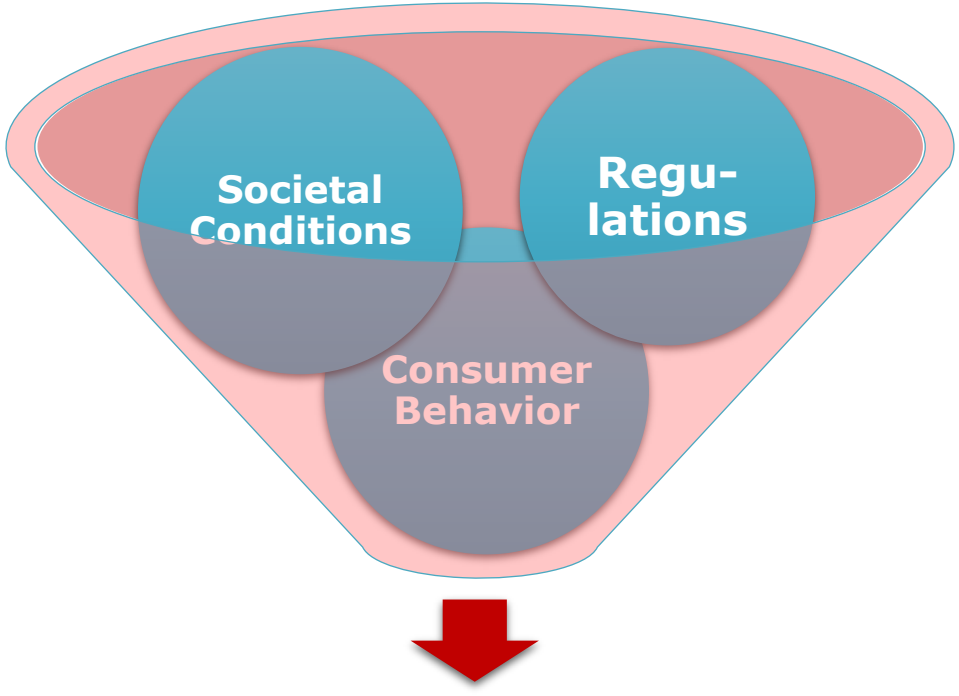
Global Risks

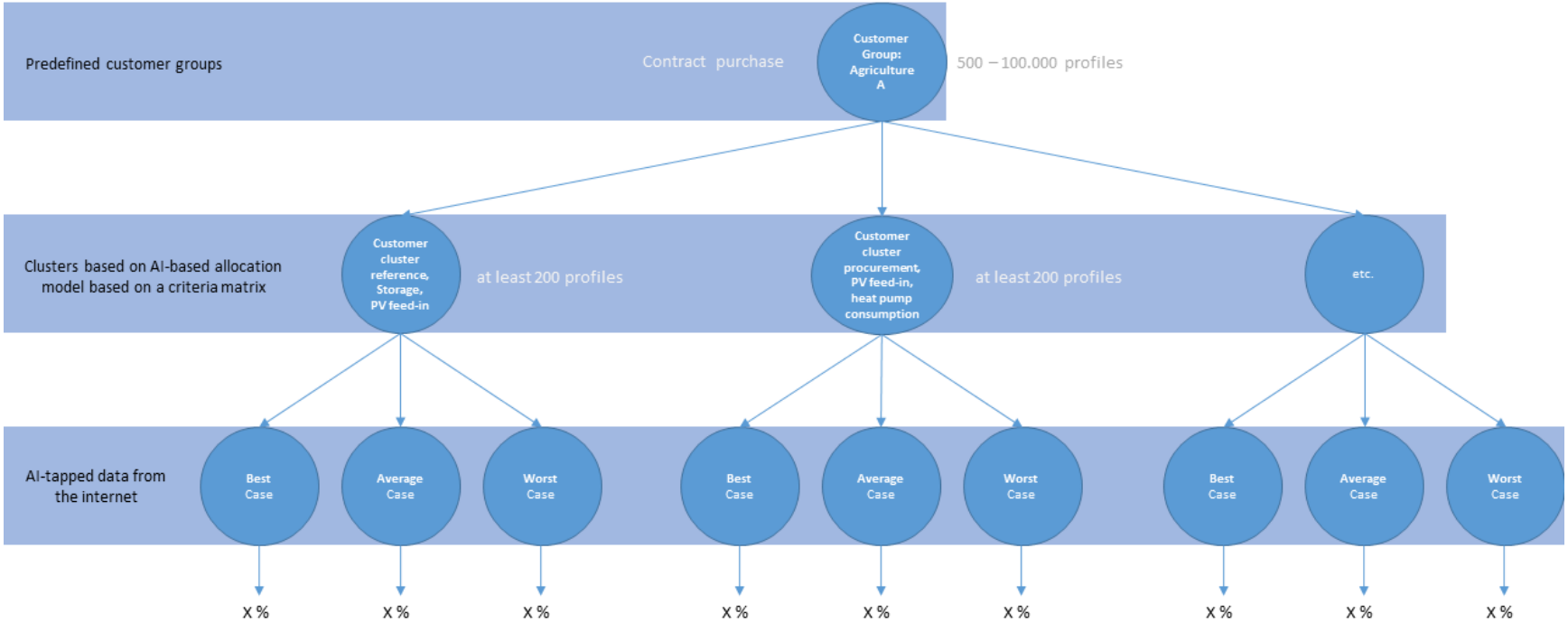
Your Prediction Model

Initial situation

In order to better assess the historical data of our customers, we need additional information that is currently difficult to extract from the meter data. How can we allocate our **customer groups** (household customers, small business customers, agriculture, energy community, etc.) in the electricity commodity to **different customer clusters** (e.g. customers with heat pumps and PV, customers with electric home charging stations and PV, etc.) using an **AI-based allocation model**?

With this AI-based model, we want to look behind the counter and cluster customers with a certain probability so that we can then forecast and **plan them better**.


Societal Conditions
Regu-lations
Consumer Behavior
Challenges for Forecasting


Predefined customer groups
Contract purchase
Customer Group: Agriculture A
500 – 100.000 profiles
Clusters based on AI-based allocation model based on a criteria matrix
Customer cluster reference, Storage, PV feed-in
at least 200 profiles
Customer cluster procurement, PV feed-in, heat pump consumption
at least 200 profiles
etc.
AI-tapped data from the internet
Best Case
Average Case
Worst Case
Best Case
Average Case
Worst Case
Best Case
Average Case
Worst Case
X %
X %
X %
X %
X %
X %
X %
X %
X %

Current forecast models (longterm)

Current forecasting methods

- Historical data
- Considering weekdays, weekends, public holidays
- Weather regarding summer/winter
- Customer changes
- Economic data

Customer segmentation

Planning is based on household, commercial and agricultural customer segments up to 100,000 kWh.

General conditions

Clustering

- Group: min. 500 profiles to max. 100,000.
- The number of clusters formed is unlimited. At least 200 profiles should be assigned to each cluster.
  - Profiles on a daily basis - 365 values per year
  - The cluster assignment follows the structure (PV feed-in, storage, etc.) before the order of magnitude.
  - Historical load profiles should be subjected to a model-based analysis & analysed using a predefined criteria matrix & assigned to a cluster with a certain probability
- **IMPORTANT**: Austrian legal data protection (DSGVO, ElWOG, ...) must be observed in the process

General conditions

Clustering - Example

Customer group: Agriculture A - Contract purchase

(several contracts & properties such as energy communities can also be defined here)Possible criteria for customer clusters: PV feed-in, heat pump consumption, storage, consumption structure (household or commercial), e-mobility, etc.

Customer clusters: Match with purchase, PV feed-in and heat pump

PV: the AI recognizes PV production here even though there is no contract with Energie AG

Heat pump consumption: the AI recognizes heat pump consumption here even though there is no contract with Energie AG

Customer cluster: Match with consumption and PV feed-in

PV: the AI recognizes PV production here even though there is no contract with Energie AG

Customer group: Agriculture B - contract for purchase and PV feed-in

Customer cluster: agreement with purchase, PV feed-in, heat pump consumption

Heat pump consumption: the AI recognizes heat pump consumption here even though there is no contract with Energie AG

Customer cluster: Match with purchase, PV feed-in, storage system

Storage system: the AI recognizes a storage system here even though there is no contract with Energie AG

Customer group: Agriculture C - Contract for purchase, PV and heat pump

Customer cluster: Match for purchase, PV feed-in, heat pump consumption and storage system

Storage system: the AI recognizes a storage system here even though there is no contract with Energie AG

Customer cluster: Match for consumption, PV feed-in, heat pump consumption, storage and electric home charging station

Storage: the AI recognizes a storage system here even though there is no contract with Energie AG-home

Charging station: the AI recognizes an e-home charging station here even though there is no contract with Energie AG

Etc.

General conditions

Forecast

- AI should use regionally publicly available data (e.g. mobile phone data, road and train traffic, e-mob registrations, media reports, etc.) to recognise changes in the population's activities and continuously predict electricity consumption

- Corresponding correlations between electricity demand and the possible parameters must be established.

Regulatory Conditions

Please note that these are examples of possible input parameters that flow into the forecast

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Government Programme

- 100% electricity from renewable sources by 2030 - approx. 27 TWh expansion by 2030
  - Photovoltaics: 11 TWh,
  - Wind: 10 TWh,
  - hydropower: 5 TWh,
  - biomass: 1 TWh,
- Integration of the energy system
- Ensuring security of supply
- Expanding the information content of the charging point directory for publicly accessible charging points
- Increasing the renewable share in district heating

https://www.land-oberoesterreich.gv.at/files/publikationen/ooe_photovoltaik_strategie_2030.pdf
https://www.parlament.gv.at/gegenstand/XXVII/ME/58

Regulatory Conditions

Please note that these are examples of possible input parameters that flow into the forecast

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Upper Austria's Energy Strategy: "ENERGY LEADING REGION of Upper Austria 2050

"Further increase of the share of renewables in electricity consumption to 80-97% by 2030 while maintaining the current security of supply and subject to the economic utilisation of the renewable potentials in Upper Austria (depending on the scenario of the expansion of renewable energy sources and the reference basis of energetic final consumption of electrical energy and without an extraordinary push of e-mobility and e-heat)"
Source: "Energie-Leitregion OÖ 2050" (2017).

"Increase the share of renewable energy in electricity to over 90% by 2030".
The Upper Austrian government programe 2021-2027 specified the target in the electricity sector.

https://www.land-oberoesterreich.gv.at/files/publikationen/ooe_photovoltaik_strategie_2030.pdf

Regulatory Conditions

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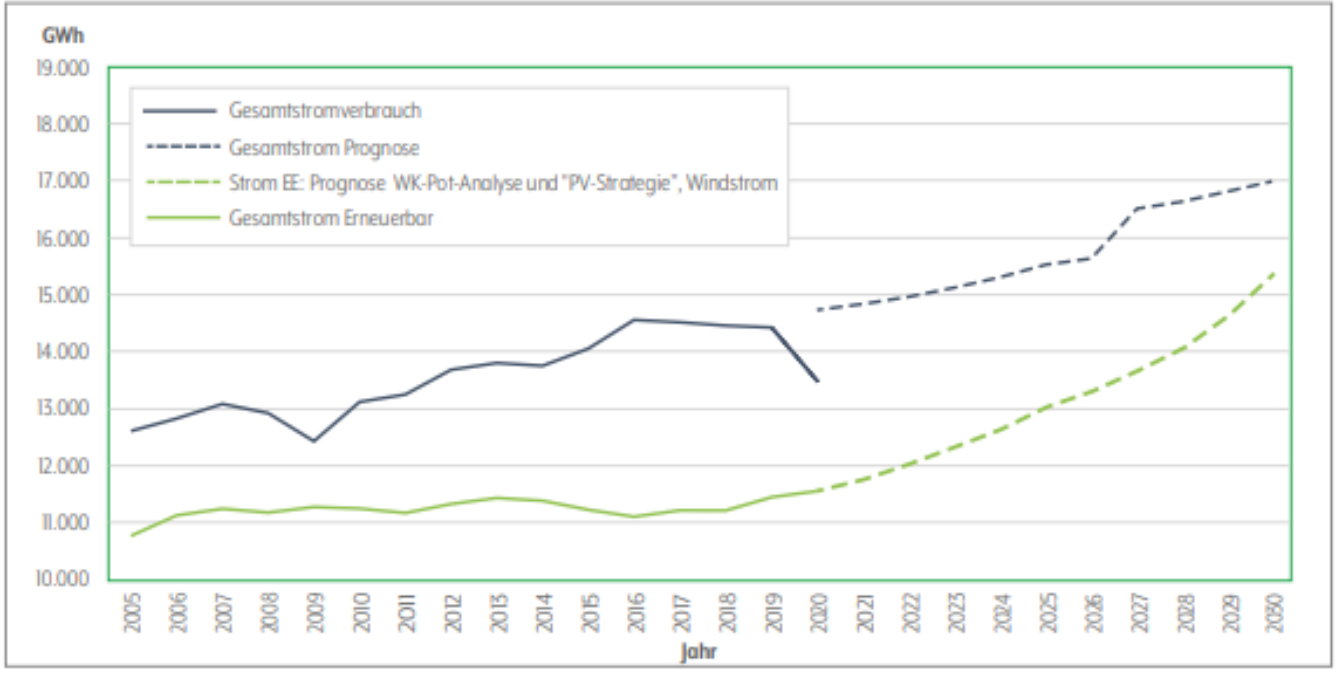

https://www.land-oberoesterreich.gv.at/files/publikationen/ooe_photovoltaik_strategie_2030.pdf

Volatile energy prices

Please note that these are examples of possible input parameters that flow into the forecast

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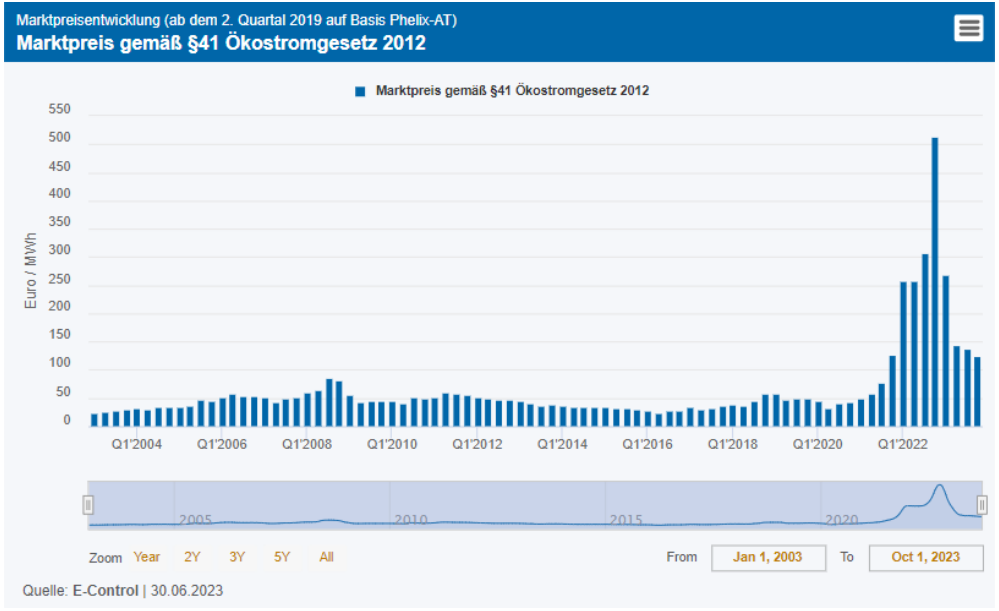
- Remuneration OeMAG: Price increase as of Q4 2021
  - Price currently falling again, but not at the same level as before the crisis.
  - The OeMAG price serves as a rough guide → if the OeMAG price is high, many customers switch to OeMAG and if the price is low, many switch to Energie AG.



https://www.oem-ag.at/de/oemag/oemag/ueber-uns/

Volatile energy prices

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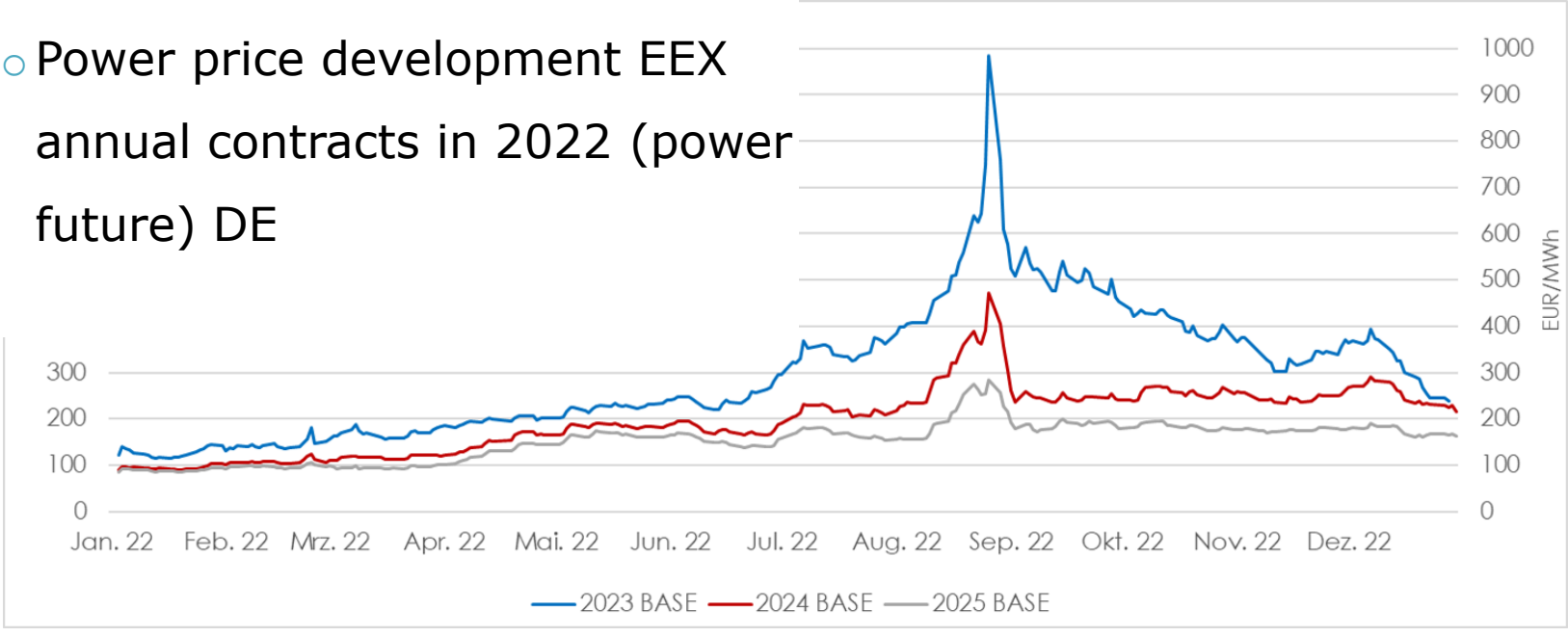
- Power price development EEX annual contracts in 2022 (power future) DE



https://first-energy.net/strompreise/strompreisentwicklung

Market developments PV

Please note that these are examples of possible input parameters that flow into the forecast

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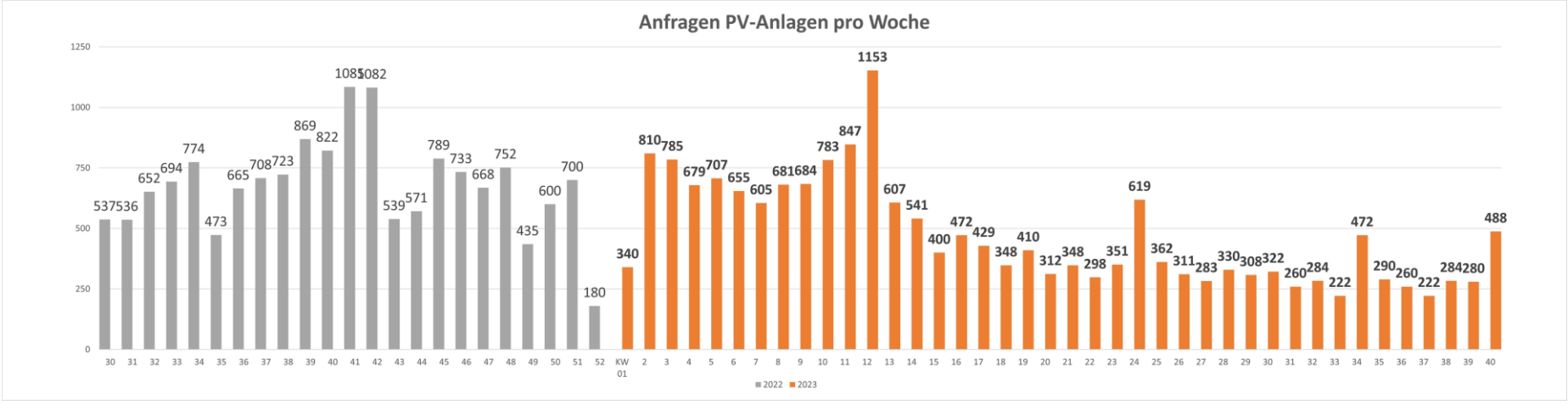
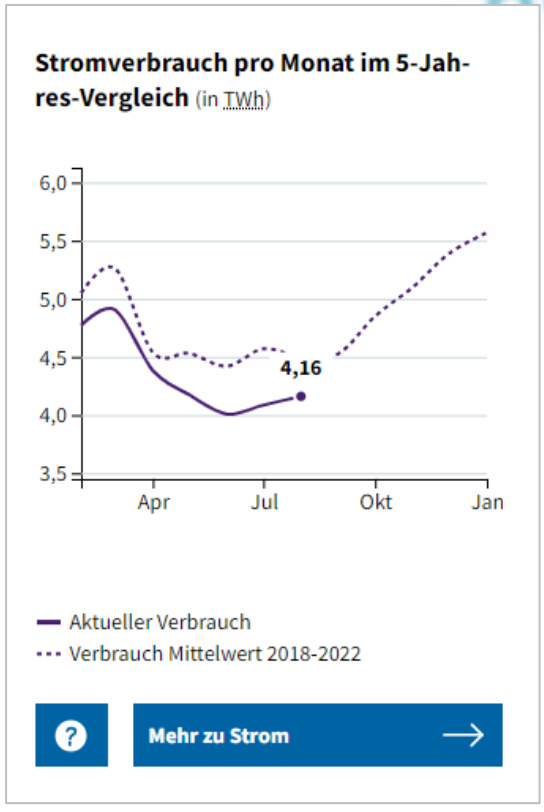
Number of PV requests of the Upper Austrian power grid per week



https://www.netzooe.at/photovoltaik/zahlendatenfakten

Market developments energy



Please note that these are examples of possible input parameters that flow into the forecast

https://energie.gv.at/strom/strom
https://energie.gv.at/

Preferred software and tools

Technical requirements:

- Python
- GitHub Repository
- Jupyter notebook

Desired results

List of the most important data sources that are included in the percentages with the respective weighting to make them easier to comprehend

Cluster	3 scenarios per cluster → best-average-worst case
Scenario	is evaluated with a percentage (growth or decline) for the next 5 years
Granularity	monthly basis
Modelling	Continuous updating of the data retrieved daily from the Internet
Traceability	List of the most important data sources that are included in the percentages