Correlations between external parameters and electricity prices, demand in Estonia

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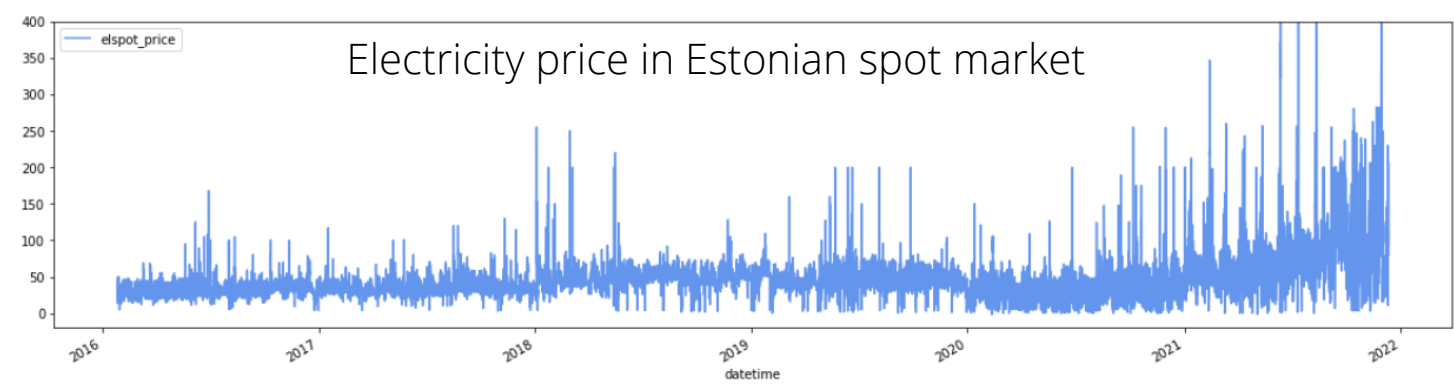
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Overview

Goals of the project
- **Goal 1**: Analyze **Covid-19 impact** on **electricity prices** and **consumption**
- **Goal 2**: Find **correlation between** different external **parameters** and **electricity prices**
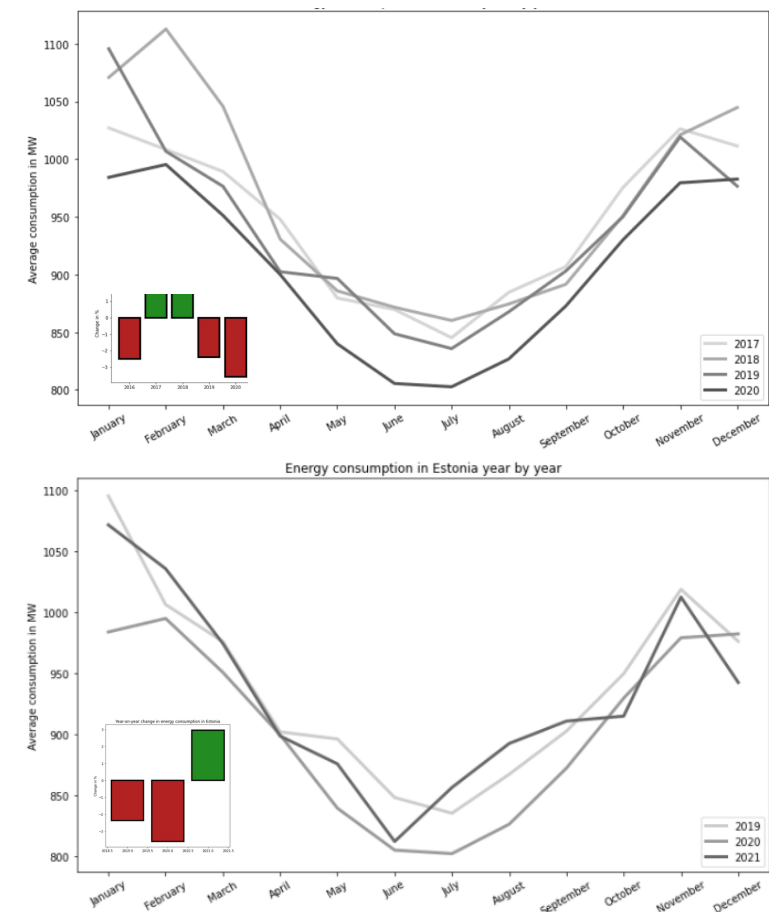- **Goal 3**: How much **money** could be **saved** by applying **smart consumption theory**

Datasets
- **ILMATEENISTUS: -** Estonian weather data
  https://www.ilmateenistus.ee/
- **NORDPOOL: -** Elspot prices, consumption
  https://www.nordpoolgroup.com/historical-market-data/
- **YAHOO FINANCE: -** Gas price
  https://finance.yahoo.com/quote/TTF%3DF/history/
- **Personal house energy consumption data**


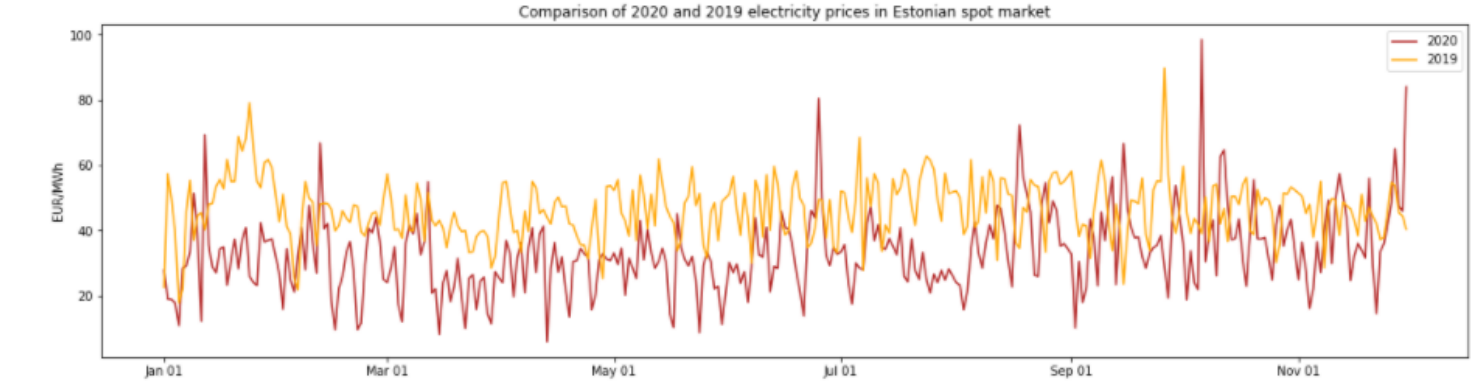Electricity price in Estonian spot market

Goal 1:

Key findings:

- First wave of Covid-19 had negative impact (global trade suffering, lockdowns etc) on Estonian energy **consumption** in **2020**, which **declined** by **3.6%** compared to 2019

- Estonian energy demand since Covid-19 outbreak corresponds with overall worldwide energy demand situation.

Energy consumption in Estonia year by year

- Second outbreak of **Covid-19** in 2021 influenced Estonian energy demand in the same manner as first outbreak did. This implies **low energy consumption** in **first half** of **2021** compared to pre-Covid-19 times. After **situation** with second outbreak **stabilized demand started to increase rapidly**, surpassing 2019 levels for 3 months.
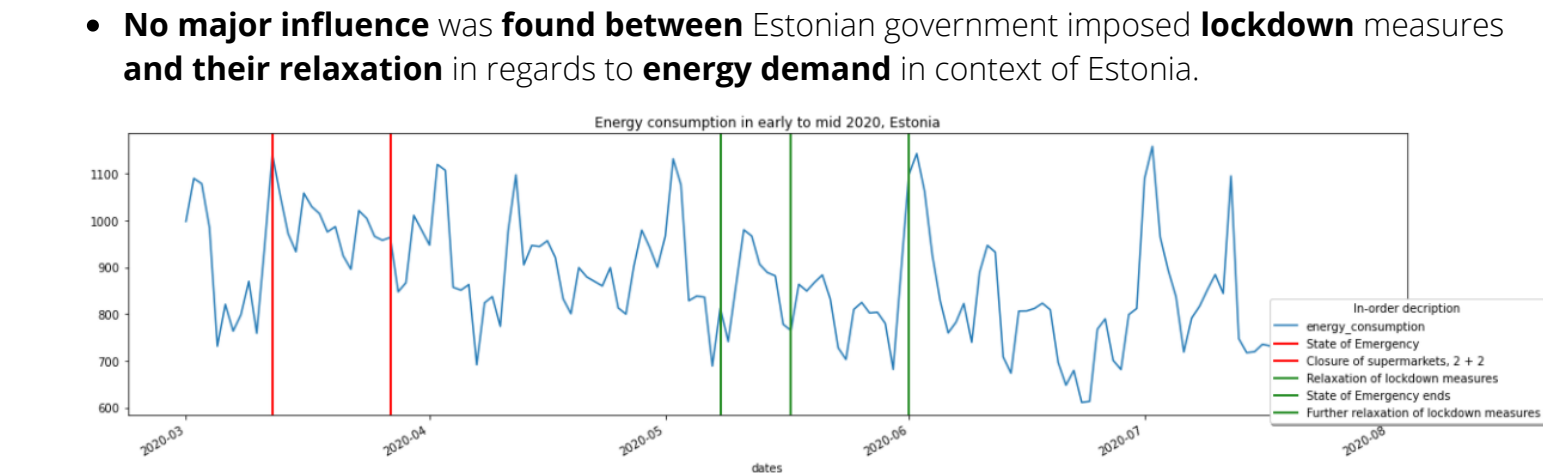
- **No major influence** was **found between** Estonian government imposed **lockdown** measures **and their relaxation** in regards to **energy demand** in context of Estonia.

Energy consumption in early to mid 2020, Estonia

- Covid-19 had negative impact on Estonian spot market as well, **dropping average electricity price in 2020 by 28.6%** compared to 2019.

Comparison of 2020 and 2019 electricity prices in Estonian spot market

Goal 2:

- Mild **positive correlation** between **consumption** and **electricity prices** - 0.293 - this is mostly due to **CO2 taxes**
- Strong **positive correlation** between **gas prices** and **electricity prices** - 0.653.
- **Optimal temperature range** for electricity prices is **0-15 degrees Celsius**
- Correlations between **weather parameters** and **electricity prices** proved to close to **nonexistant** - every coefficient was **under 0.1.**

Goal 3:

- Average **electricity price** in Estonian spot market had a **major rebound in 2021**, **increasing by 142.6%** compared to the previous year.

Comparison of 2021 and 2020 electricity prices in Estonian spot market
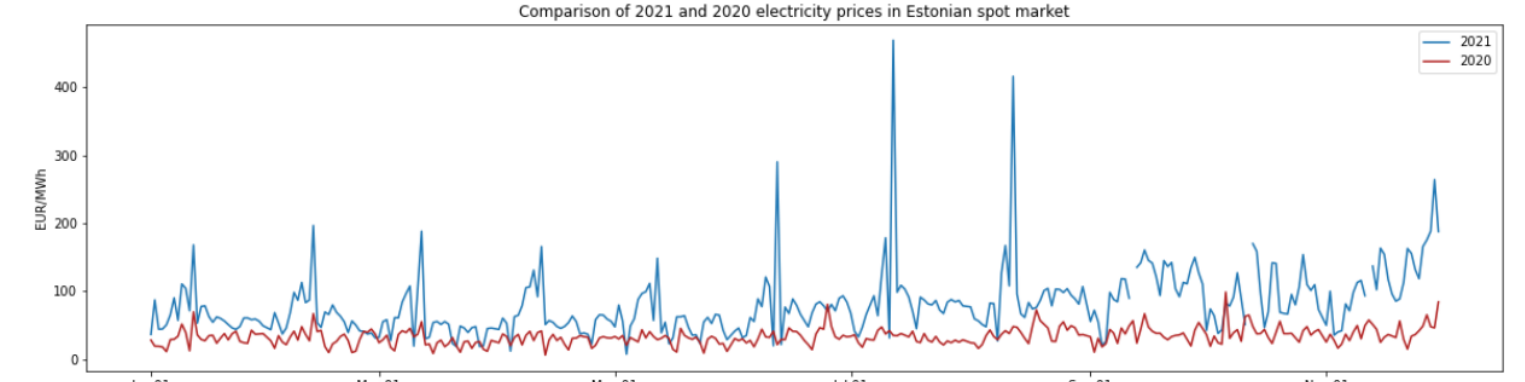
- **DAY** (a.k.a HIGH CONSUMPTION PERIOD) is defined in the contract and by analysis done in this project to be **FROM 06:00 TO 22:00** (UTC+1) on all weekdays.
- **NIGHT** (a.k.a LOW CONSUMPTION PERIOD) is defined in the contract and by analysis done in this project to be **FROM 22:00 TO 06:00** (UTC+1) on all weekdays.
- Final energy price is dependent of contract and client details, therefore Richard Kuklane shared his personal contract data for example calculations.
- The prices in the table below are based on assumptions that the future prices are similar to those in **November 2021.** (It has also been taken to account that from November the government is supporting people by paying 50% of electricity transfer prices)
- The prices in the table below are **without VAT** (20% in Estonia)

Total yearly consumption 3000 KWh	Price €/kWh	4/5 on DAY, 1/5 on NIGHT	2/3 on DAY, 1/3 on NIGHT	Equal Consumption	1/3 on DAY, 2/3 Night	1/5 on DAY, 4/5 on NIGHT
Average price DAY	0.14190	340.56	283.8	212.850	141.90	85.14
Average price NIGHT	0.08010	48.06	80.1	120.150	160.20	192.24
Electricity transfer DAY	0.02115	50.76	42.3	31.725	21.15	12.69
Electricity transfer NIGHT	0.01230	7.38	12.3	18.450	24.60	29.52
Renewable electricity tax	0.01130	33.90	33.9	33.900	33.90	33.90
Electricity tax	0.00100	3.00	3.0	3.000	3.00	3.00
YEARLY COST (€)	NaN	483.66	455.4	420.075	384.75	356.49

- From the table above we can see that **maximal possible energy saving household** would be 483.66€ - 356.49€ = **127.17€**
- And if we add the VAT (20%) it becomes 127.17€ * 1.2 = **152.60€**
- This would save approximately **12.72€ each month**
- The biggest influencer of energy price is electricity price fluctuations, which account for **111.24€** in the 127.17€ maximal possible energy saving. This is around **87%** of the estimated yearly savings.

Average hourly electricity price movement

Introduction to Data Science(LTAT.02.002) 2021