Delta Data Analysis

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Introduction

Delta hosts multiple sensors that collect information about environment and devices. In total 182 different parameters are measured on daily basis. Our goal was to pick a few of them and bring out their correlation.

The Data

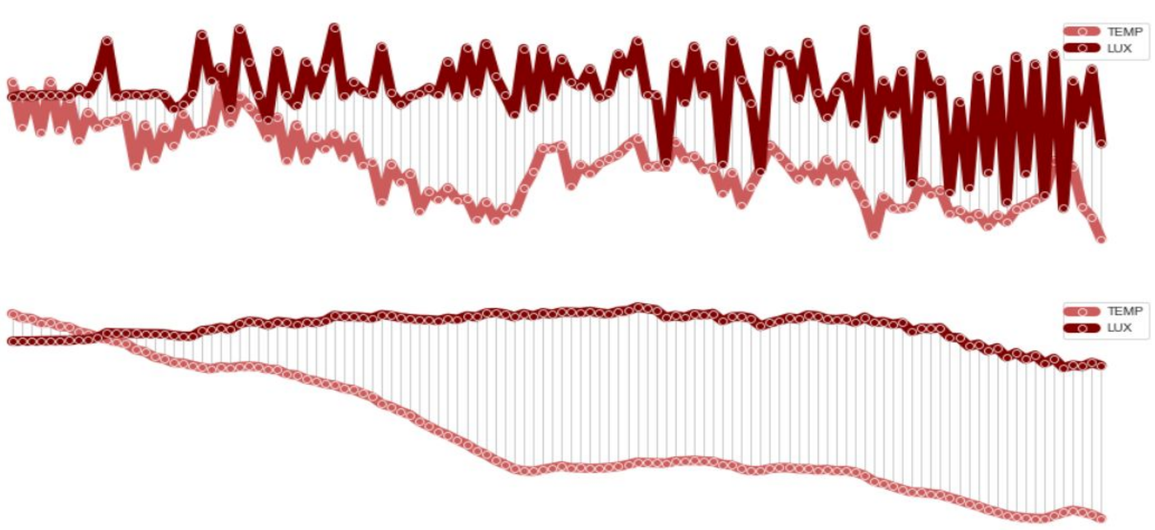
From 33 files that contained data collected by 41 different devices, we chose to focus on 3 major datasets: *heating*, *consumed energy*, *produced energy*.
To create more understandable comparisons, we added the data of *light level* and *temperature*, that were also collected by the sensors.

The preprocessing of the data included putting records together from several files, filling in missing data, manually fixing other flaws, normalizing and smoothing the data with smoothing factor 0.05. To get a uniform data, we divided the final values into periods of 12 hours (from 7:00-19:00 and 19:00-7:00). The time period for the final data ranges from September 24, 2020 to November 20, 2020.

Temperature and Light

To give a better overview of the help datasets, we have a comparison of the temperature and light level on Figure 1.

Figure 1. Temperature and Light (LUX). Normalized data (up) and smoothed data (bottom).

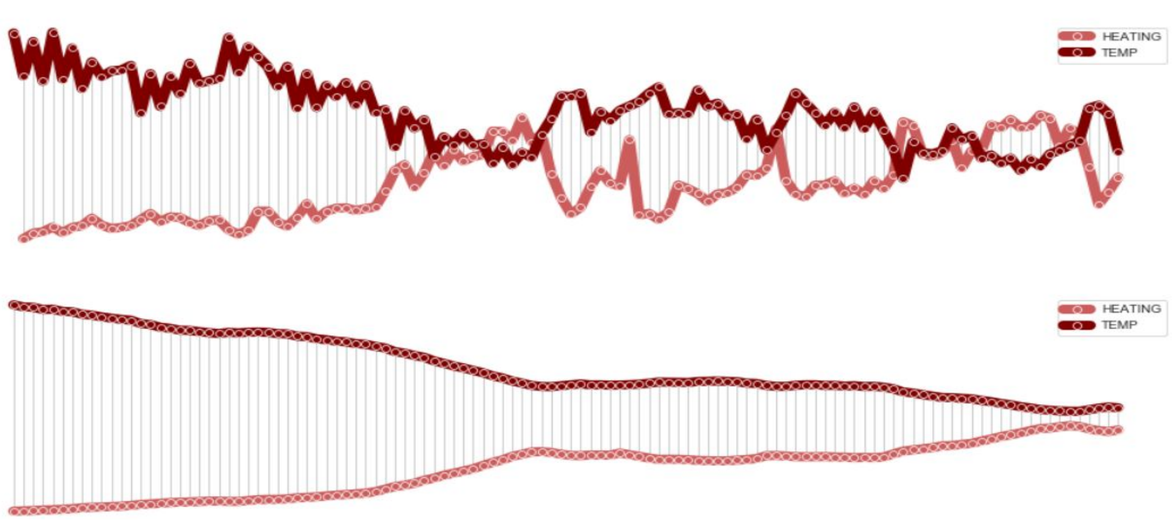


During the survey period, the temperature dropped rapidly. It can be seen best from the smoothed data. The day and night oscillation is more apparent on the top graph. The same kind of descent is not present in the light level data, however, a slight drop in the end of period can be seen. The top graph displays well how the light starts to change over time during day and night as the oscillation gets stronger and denser.
Both temperature and light are similar in terms of periodicity: both values are higher during day and lower during night. That results in a similar oscillation.

Heating

The heating data consists of three sets of measurements: radiators, vents and floor heating. Each set was processed separately and then added together.
Figure 2 shows the normalized data in comparison with temperature changes outside. The top graph displays the normalized data in comparison to outdoors temperature values. The bottom graph displays the same measurements exponentially smoothed.

Figure 2. Temperature and Heating. Normalized data (up) and smoothed data (bottom).



As shown on Figure 2, the heating and temperature are in very clear relation.
We can see that during the time period, the heating level rises continuously. It is again best seen on the smoothed data at the bottom graph on Figure 2.

Source code: https://gitlab.com/mscprojects1/deltadata

Energy Production and Consumption

The energy is mostly produced by the solar panels.
Energy consumption includes all measurement of devices that need electricity.
Figures 3 to 5 show how energy production and consumption are related to each other and temperature.

Figure 3. Produced Energy and Consumed Energy. Normalized data (up) and smoothed data (bottom).

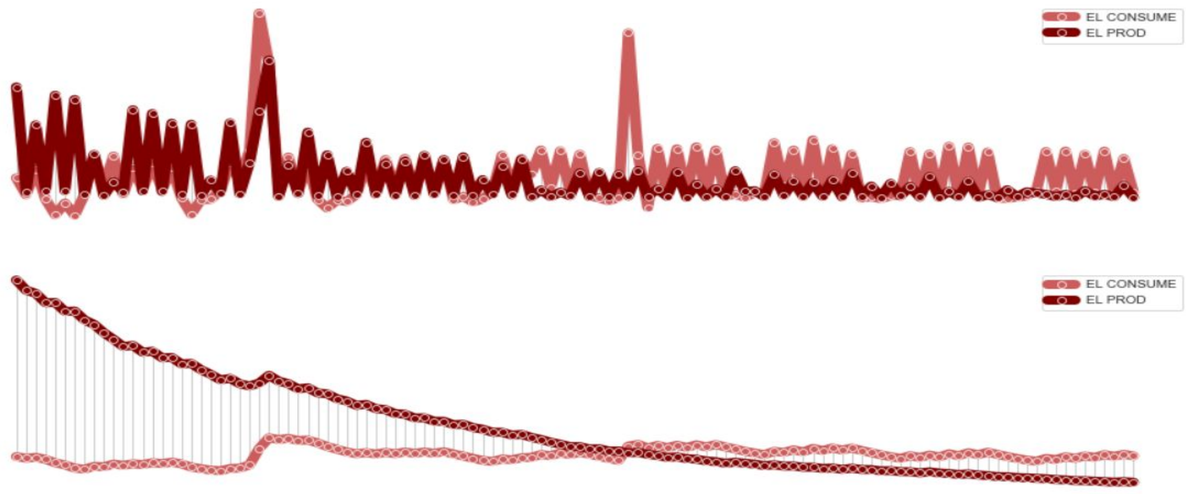


Figure 4. Produced Energy and Temperature. Normalized data (up) and smoothed data (bottom).

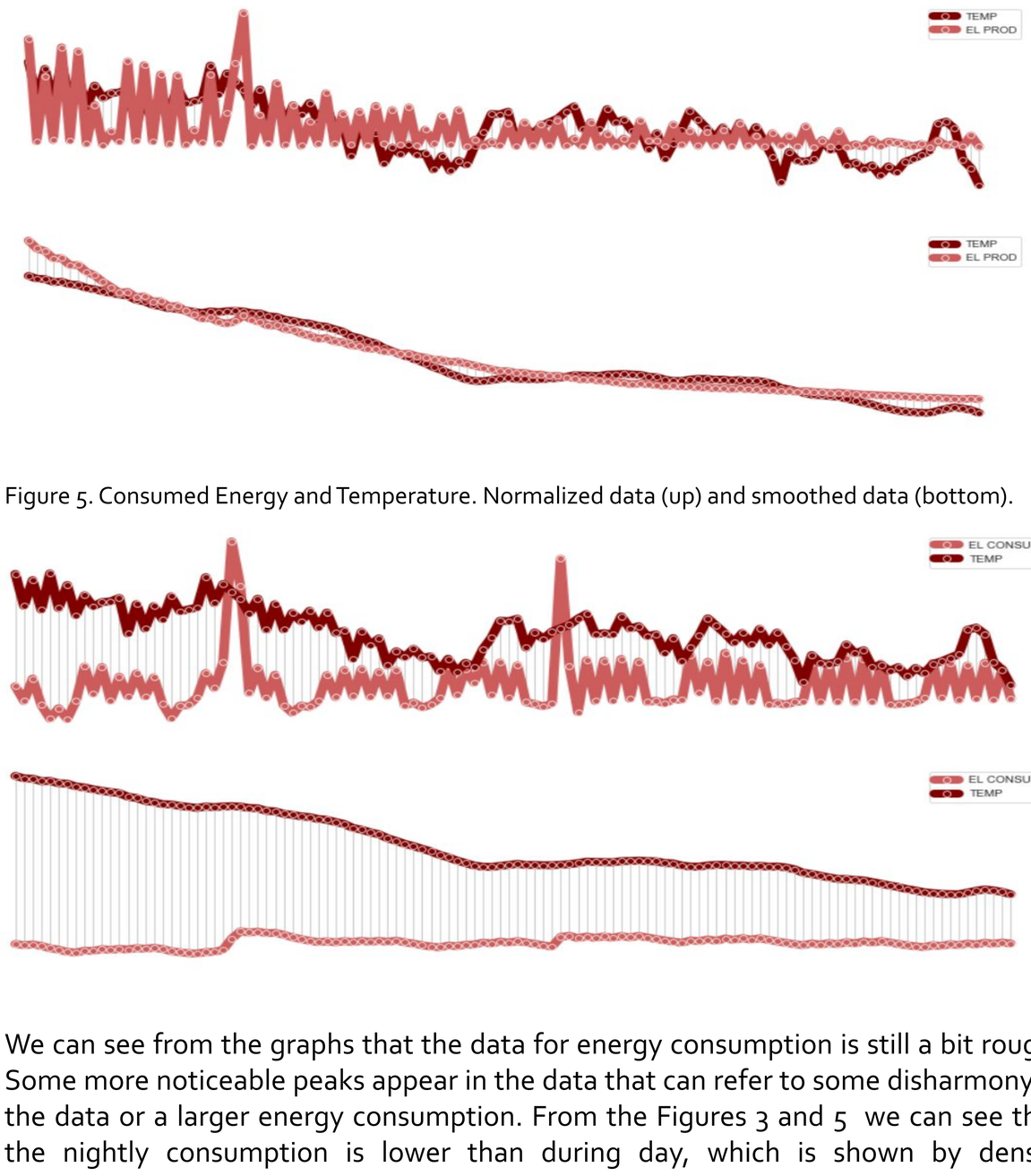


Figure 5. Consumed Energy and Temperature. Normalized data (up) and smoothed data (bottom).

We can see from the graphs that the data for energy consumption is still a bit rough. Some more noticeable peaks appear in the data that can refer to some disharmony in the data or a larger energy consumption. From the Figures 3 and 5 we can see that the nightly consumption is lower than during day, which is shown by denser oscillation. The consumption during weekends is significantly lower, even compared to the nights of workdays. This levels out more towards the end of the survey period.
From the smoothed data, we can see that the energy consumption is relatively stable without any sudden rises or falls over any period. It seems that if all the devices are working then Delta consumes a similar level of energy daily.

From Figures 3 and 4, we can see that the energy production has dropped over the survey period. It is best represented by the smoothed data. From the normalized data, we can get a better view of the day and night cycles. If the data can be trusted the we can assume that some days were more cloudy since some peaks appear to be lower than others. Based on the normalized data, we can say that energy production surpassed the energy consumption at the beginning of the time period. Since we can see a steady fall in the production, we can assume that the decreasing amount of daylight causes that drop. However, from Figure 4, we can see that the energy production drops in a very similar manner to temperature.

Conclusion

We saw that contrary to our expectations, the energy production with solar panels in Estonia is not so much affected by light, but by cold weather. As for heating and temperature, the outcome was similar as to what could be logically assumed.
We also learned that the general trend is better represented by the smoothed data while the normalized data gave a better overview of the 12 hour periods.