Modelling regional discrepancies on the Swedish energy market

Energy prices in recent years have been at an all-time high. However, the effect on your wallet may vary drastically depending on where you live.

Sweden's energy market consists of four bidding areas with different prices for electricity. Bidding areas SE1 and SE2 are in the northern part of Sweden and areas SE3 and SE4 are in the south. In general, the two northern bidding areas produce more energy than they consume while it is the opposite way in the two southern regions. Combined with other factors this has lead to extreme discrepancies. The energy price in southern Sweden is sometimes ten times as high as in the north. In order to alleviate this problem our understanding of how the four bidding areas differ and what they have in common needs to be improved. To investigate what some of these factors are a Sparse Jump Model was used.

With a given large data set of features for each region such as temperature and energy production from different sources like solar, wind and thermal, the model determines which features are the most important ones through the use of several algorithms. In contrast to many other models the Sparse Jump Model takes the time aspect of the data into consideration by grouping different time periods together to represent different states, in this case states of the energy market. This feature selection process is evaluated using an Information Criterion measuring how well the model fits the data set and how complex the model is. The more accurately the model fits the data set and the less complex it is the better.

Results showed both similarities and differences between the regions. When selecting for the six most important features all four bidding areas had three features in common; the temperature, the Danish electricity load and an energy delivery proxy. In all four bidding areas one and only one within-region energy source was selected, but they both looked and were picked for different reasons. In general, the features selected for the two northern bidding areas more aptly captures the seasonal trends over the year while in the south the model opted for features that coincided with market extremes.

One of the more interesting results from the model was how important Danish features were in all four subregions, even up in the north of Sweden. It was surprisingly preferred over the within-region energy consumption even though they effectively measure the same thing; how much energy an area needs. A possible explanation is that a large Danish load leads to an increase in energy exports from Sweden. This would affect all four bidding areas due to the general deficit in the southern parts forcing the northern areas to also export more.