# Batteries charging into the future?

## Popular science summary

The move towards more sustainable electricity production is important to fight climate change. With the transition, however, new challenges arise. As a larger share of intermittent energy is introduced into the grids, the need for flexibility is increasing. One of the ways in which flexibility is needed is through what is called frequency regulation. In Sweden, hydro power has traditionally been providing this service. However, through lower production costs, Battery Energy Storage Systems (BESS) are now potentially suitable for the same frequency regulation.

This thesis investigates if it is economically and technically feasible to use these batteries for frequency regulation. It does so by providing analysis of both quantitative and qualitative data. The quantitative data analysis is conducted by creating a Python program to model revenues and costs. Modelling was based on data from 2022 and the feasibility of the battery is then projected based on the results from 2022. In the model, grid frequency and frequency regulation prices are the inputs. To compliment the quantitative data, an interview study was conducted. The aim of this study was to give another perspective to the analysis. An interview study can give insight about the future that the quantitative data is unable to display. The two data types were analysed in what is called a Convergent Parallel Design. This means that their respective results were presented individually, and only in the discussion and conclusion of the thesis were the two data types combined.

The result of the thesis is that it currently highly profitable with BESS investments for frequency regulation in Sweden. FFR and FCR-D are the services that both the quantitative and qualitative data point to as being most suitable for BESS. Furthermore, it is expected that profitability will go down in the coming years due to more parties entering the market.

In the final part of the thesis, it was concluded it is hard to predict when and how quickly the profitability of investments in BESS will decrease. Furthermore, it was concluded that new opportunities will arise for BESS performing frequency regulation in Sweden, for example through regulatory changes.