# Bachelor on Science Thesis Proposal on Adaptive Control of Energy Storage (adaptation to a Master on Science Thesis is possible

## Department of Engineering and Physics, Karlstad University, Karlstad Glava Energy Center, Arvika

### Background

The global photovoltaic (PV) market has had a tremendous development the last 10 years. In many countries, there are bidding schemes where the Government open up for international bids for building and long-term operation of larger PV systems. Different kinds of additional conditions together with the lowest bid price normally win the bid. From the technical point of view, monitoring and control of PV systems are also required for systems cost effective operation since the initial investment for the installation and maintenance is high and for reliable functioning and maximum output solar power. Monitoring systems can provide information such as system efficiency, performance and en)artifyloprodecid bederprefuminalrýnvæstameht walstreaimistalikatito tradehstasse essorbsettylingsföreskneogyingtorage system and calculate cost for each business model to optimize parameter setting [7].

In this proposed thesis work, the focus will be given to propose a suitable control strategy in order to integrate the forecasting of the electric energy consumption output to the control parameters of the battery management system from a cooperative house.

a) b)
Figure 1. a) System overview, b) Cross-validation for forecasting of energy consumption based on the historical data over 1 month.

## Objectives:

The objective are:

- Proposed a control strategy to adapt the battery control parameters based on the forecasting output from the LSTM model
- Perform basic tests to determine the effectiveness of the proposed control strategy
- х [Optional] Propose possible improvements for the existent LSTM to better detect the energy consumption peaks and Implement and test the improved LSTM

#### Tasks and tools

The thesis work should comprise the following tasks:

- Literature study on PV systems, Machine Learning and Control
- Propose a methodology to map the forecasting output to the battery control parameters
- Perform tests to verify the performance of the proposed control strategy
- х [Optional] Propose improvements for the existent LSTM model to better detect the energy consumption peaks and implement the proposed improvements of the algorithm in Matlab
- Х Write thesis report describing the work and results

#### Requirements

One or two students in Bachelor of Science in Electrical Engineering or Mechanical Engineering (Otherwise, it is possible to adapt the thesis content for on Master of Science student in Mechanical Engineering or Energy and Environmental Science or Physics Engineering or similar is suited for this job). Candidate should have a basic background in electrical engineering, modelling, control and programming. Good programming skills is desired. It is also important that the applicant have good writing and