

## Master Thesis – Impact of V2G Services on EV Battery Life

### Let us describe the challenge we offer

The increased global average temperature and extreme weather events raise the need for immediate actions to combat climate change. Polestar is committed to driving change towards a climate-neutral future with sustainable electric mobility. However, renewable energy, such as wind and solar power generation create new challenges to the electricity grid with unpredictable and varying supply. Additionally, mass electric vehicle adoption also causes large power demand fluctuations. A notable method to alleviate these problems is by utilizing electric vehicle-to-grid (V2G) infrastructure to balance the demand and supply of clean energy, therefore flattening the demand-supply curve of clean energy.

The V2G operation requires battery to cycle between charge and discharge, which may lead to premature battery degradation. As battery cost accounts for a significant portion of the total vehicle cost, it is important to consider battery degradation during V2G operation.

The goals of this project are to understand factors that lead to battery degradation, analyze the impact of V2G on battery life, and to account for battery degradation during V2G operation.

### What you'll do

- Construct battery degradation models with various levels of complexity.
- Optimize V2G operation by considering battery degradation on a single vehicle. Analyze the robustness of optimal solutions under various charging/driving patterns.
- Analyze battery degradation and load balancing effects from the fleet and grid perspectives.

### Who you are

- M.Sc. in Applied mathematics, Computer Science, Engineering physics/electrical/mechatronics, or similar
- Good knowledge in MATLAB/Simulink or Python
- Completed courses and with good knowledge in mathematical optimization
- Analytical and independent

### Duration

- 20 weeks / 30 ECTS
- Starting date: January 2022
- Estimated end date: Summer 2022
- Number of students: 2 students
- This position is based at our HQ in Gothenburg, Sweden.

### Supervisors

Polestar: Dr. Chih Feng Lee

Chalmers: Dr. Yang Li (supervisor), Dr. Changfu Zou (co-supervisor and examiner)

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