

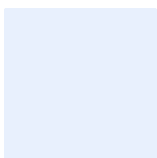


# Flywheel Energy Storage

A report for the Swedish Electric & Hybrid Vehicle  
Centre

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## T2.20 Roterande lager i fordon – ett ”white paper”

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### Summary

The state of the flywheel energy storage industry and research were investigated, specifically for hybrid and electric vehicles within the SHC area. The overall aim was to do a literature study to increase the understanding on the flywheel niches.

The research at Uppsala University was also described and put in context with international research, leading manufacturers and relevant patents.

Flywheels were found to be used in large scale settings in a variety of systems already (both within the SHC area and outside), some of which are:

- A manufacturer will supply 500 power buffers in London buses. Early results indicate a 45% fuel saving for a 17 ton bus.
- Another manufacturer reports 35 % fuel savings for SUVs in the US FTP drive cycle, and 18 % fuel savings
- Another manufacturer holds 30 % of the frequency regulation market in north-eastern USA with only 10 % of the power. The dominance is mostly due to a great ability to follow the control signals and cycle.

The project was conducted during spring 2015 within the flywheel energy storage group at Uppsala University, the authors being: Magnus Hedlund, Johan Lundin, Juan de Santiago, Johan Abrahamsson and Hans Bernhoff.

## General project description and background

At the Institution for Science and Technology in Uppsala new types of rotating energy storage are being developed. The idea is to make kinetic energy storage with electrical interfaces which can handle both high power and still have a given energy density. These flywheels differ from traditional flywheels since they aim for comparably high energy densities.

There is a need to understand why the flywheel energy storage research is needed, and if there is any international interest and within the research and technical community for the technology. Another important aspect is the potential for future developments. We have seen a need to make a comparison between different types of high-power energy storage in different contexts (end applications), to help decision makers understand the niche for flywheels.

## Achieved results

A literature study in flywheel was written, and it has the following results:

- Accurate description of state-of-the-art in flywheels,
- Discussed commercial potential, and future research potential
- Explained flywheel in the context of other energy storage
- Summarized relevant research in the field (26 research groups)
- Summarized manufacturers in the field (27 companies)

All of this is important to increase the understanding of the need for flywheel energy storage, and the niches they excel in.

## Timing and finance

The project has been running during the period 2015-04-01 to 2015-06-12. The total project budget is SEK 150 000, all of which was funded by SHC.

## Executors and collaboration

Magnus Hedlund coordinated the work within the group and contributed with most of the work for the report. Johan Lundin, Juan de Santiago and Johan Abrahamsson (in that particular order) made very significant contributions. Hans Bernhoff served as project manager and had an advisory role.

## Dissemination of Results

The main results will be compiled into a literature review and sent to a peer-review journal. The results will also be presented at seminars for the vehicle industries.

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