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Flywheel Energy Storage for EV Fast Charging and Grid Integration





Transition to Electric Mobility



Source: International Energy Agency (IEA), Global EV Outlook 2017

We all know the challenges...

1. Peak Loads



- 2. Charging Network
- 3. Volatility

Group Company easelink





"Publicly available EVSE outlets need to grow by a factor that ranges between 7 and 25 by 2025, amounting to between 4 million and 14 million outlets globally in 2030."

(International Energy Agency, "Global EV Outlook 2017")



5. Grid Stability







rives









The main goals of *FlyGrid*:

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- 1. Providing high charge power while avoiding costly electric grid expansion
- 2. Increased EV market-penetration through reduction of charging times
- 3. Higher customer satisfaction through improved charging network
- 4. Improved integration of volatile (local) renewable sources for EV propulsion

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- 5. Improved grid stability and power quality
- 6. Portable fast-charging solution for zero-emission construction equipment

The FlyGrid Vision

TU Graz

Flywheel Energy Storage for Sustainable Mobility

"Peak shaving" for fast charging applications:

- \rightarrow Avoid costly modification of existing electricity grid
- \rightarrow Make use of local renewable sources such as wind / solar
- \rightarrow Increase grid stability and power quality









WHEEL







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Public

Private

Enterprise



Flywheel Energy Storage Systems (FESS)



Physical Advantages

- ✓ High power density
- ✓ High cycle life
- ✓ Uncritical deep discharge
- ✓ Precise SoC determination

Further Advantages

- High potential energy density
- Potential for low cost design
- ✓ Good recyclability
- ✓ Manufacturing in AUT/ EU

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Current Challenges

- Self-discharge
- Energy density
- Manufacturing cost















The FlyGrid System

How will FlyGrid solve the problem of increased electricity demand and volatility?



 \rightarrow A holistic approach that goes well beyond energy storage alone.

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HITZINGER C











FlyGrid Core Technology



Research Topics:

- \rightarrow Low-cost / low-loss bearing system
- \rightarrow Low-cost / high strength rotor

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Content in Wh

Specific Energy

Charging power over time curves for Tesla Model S (left) and Nissan Leaf (right).

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Improvement Beyond the State of Art

FlyGrid - Unique Overall Key Innovations

- **1** Worldwide first practical combination of FESS and fast charging station
- 2 Consideration of a mobile "FlyGrid container" for fast charging of construction machinery
- **3** First time combination of fully automated MATRIX CHARGING[®] with fast charging technology
- 4 Integration of Secar E-Port for local renewable energy supply
- **5** Double use of FESS: Load mitigation and grid stability at once (bi-directional)

Degree of Innovation

THIENeDrives

FlyGrid – Consortium and Competences

GHG Reduction Potential in Austria

Savings up to 13200 tons of CO_2 equivalent per year.

→Amy advancements in the field of FESS technology contributes to the energy revolution!

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Thank you for your attention!

