



Flywheel for Smart Building Applications

Chicago Microgrid Stakeholder Working Group,
22nd September 2016

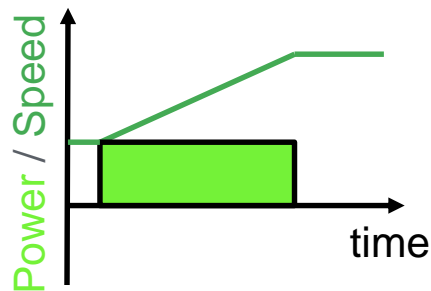
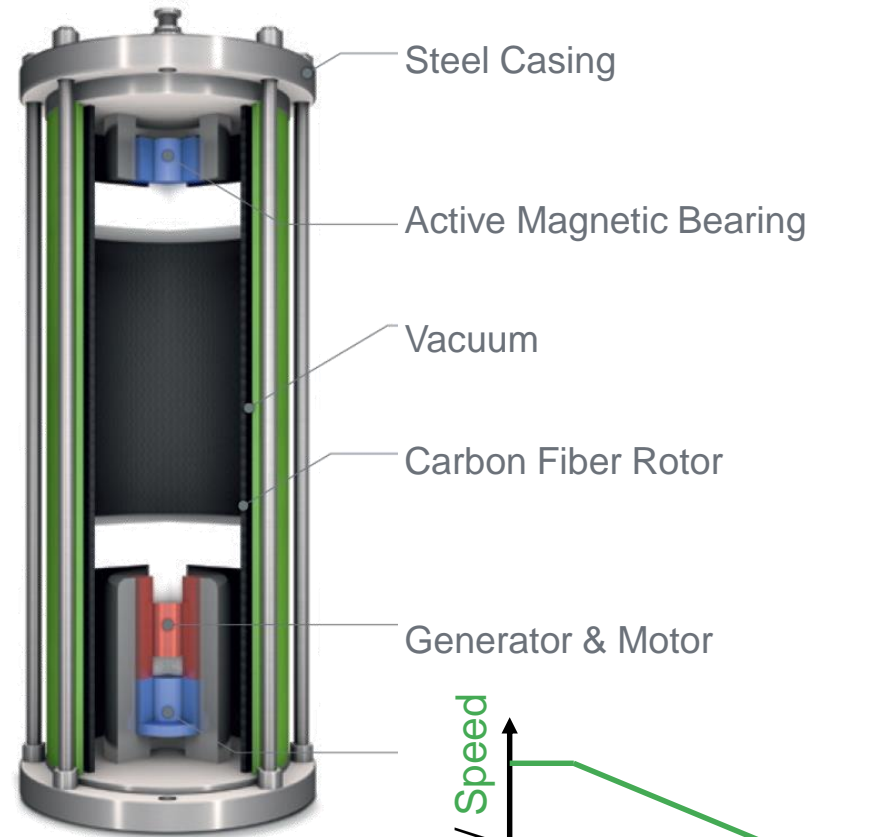
How it works

Physics

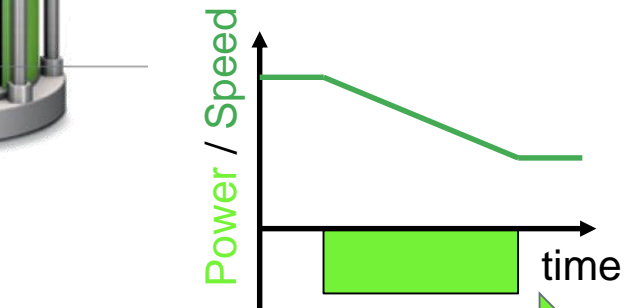
- ⊕ Energy = Power * time
- ⊕ Energy = $\frac{1}{2}$ * Inertia * speed²

Features

- ⊕ For continuous duty cycles
- ⊕ Full power & capacity over entire lifetime
- ⊕ Operating in wide temperature range
- ⊕ Meets all standards and is proven safe
- ⊕ Emission free (no CO₂, almost no noise)
- ⊕ No hazardous material, fully recyclable



Energy from the Grid →



Energy into the Grid →

1st Commercial DuraStor®



Main features

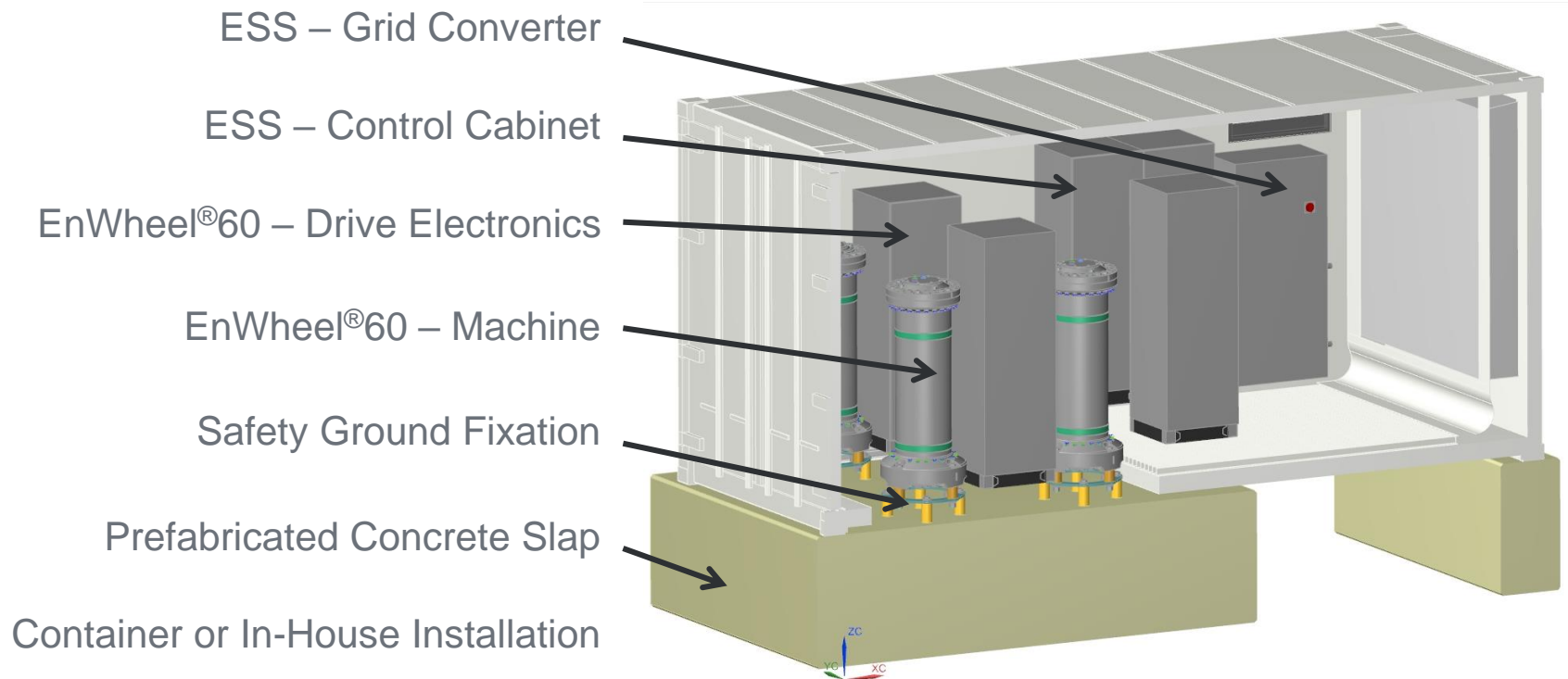
- ⊕ 420kW rated power, 100 kWh
- ⊕ Remote controlled
- ⊕ Includes auxiliaries (plant control, cooling, vacuum, grid inverter)
- ⊕ Self servicing in case of black-out
- ⊕ Factory tested before shipping

Main use cases

- ⊕ Operated by Stadtwerke München
- ⊕ Part of virtual power plant
- ⊕ Energy balancing
- ⊕ Frequency control
- ⊕ Power surging

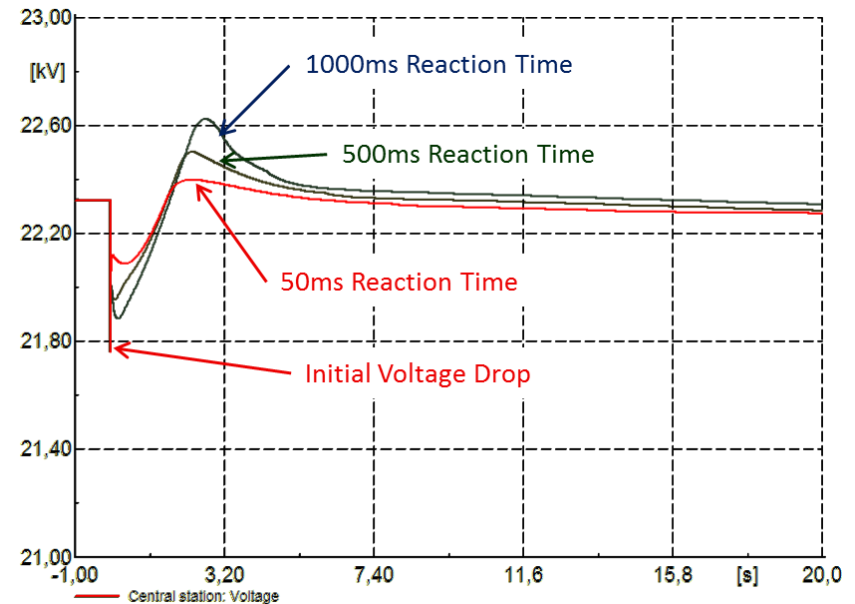
DuraStor[®] – Microgrid System Layout

Nominal rated power	(kW)	120	240
Peak – loading / unloading	(kW)	160	320
Capacity	(kWh)	7	14
Functionalities	Frequency & voltage drooping, seamless transition from grid forming to following		



Characteristics of DuraStor[®] Technology

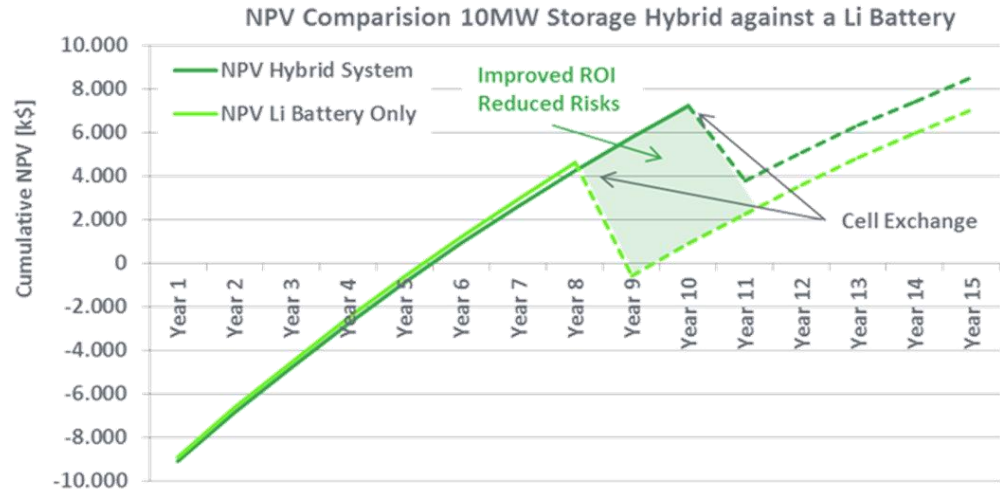
- ☺ Grid voltage and frequency control
 - ☺ ideal voltage source. Voltage is independent of current
 - ☺ Grid forming and grid following
 - ☺ Real and reactive power source
 - ☺ High responsiveness
 - ☺ Voltage independent of SoC
 - ☺ Load cycle resistant
- ☺ High power to capacity ratios possible
 - ☺ High C-Rates (> 15) are standard
 - ☺ Cost effective solution to keep micro grids stable
 - ☺ Fuel savings possible because 100% renewable energy gets possible



Characteristics of DuraStor[®] Technology

😊 EnWheel in hybrid solutions

- 😊 Easy to couple with generators or chemical Storage systems
- 😊 Cost effective combining low cost power with low costs capacity
- 😊 Simplified load cases for batteries
 - 😊 Energy focussed battery design
 - 😊 Longer battery life
 - 😊 Improved warranties



Hybrid Storage Solutions for Building

Building needs

- ☺ Stability and reliability
- ☺ Energy efficiency

Power characteristics

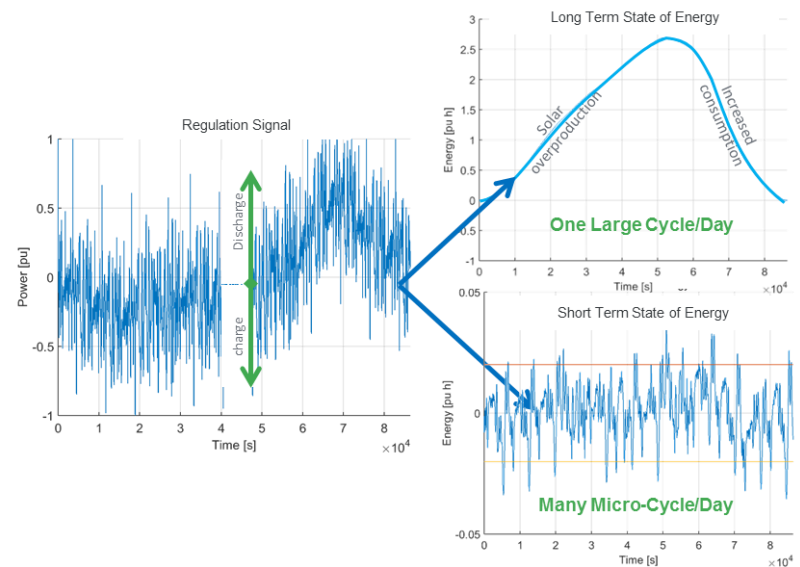
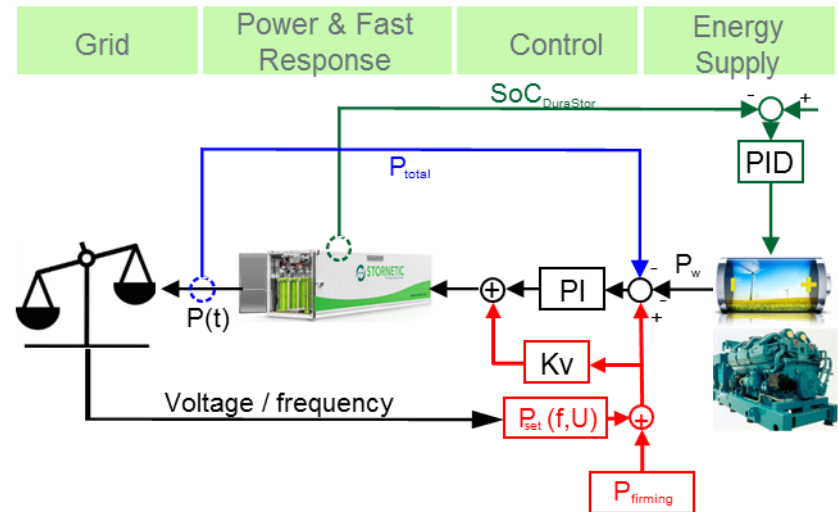
- ☺ Predictable energy demand, but
- ☺ High short term volatility

Hybrid Solution

- ☺ DuraStor takes the volatility and power peaks
- ☺ Battery or CHP deals with mid and long term energy demand

Benefits

- ☺ Improved fuel consumption
- ☺ Recuperation possible
- ☺ Long system life



**THANKS FOR YOUR
ATTENTION**