



Grid operators require a solution to efficiently integrate renewable energy sources such as solar and wind power

Temporal Power's flywheel energy storage technology helps to effectively manage output variability, resulting in a smooth output of power from wind and solar



Flywheels for Renewable Integration

Adding Predictability to Wind and Solar Power

Temporal Power flywheels balance out the short term intermittencies caused by wind and solar power, which can cause both local and grid-wide power quality challenges. By responding quickly to short-duration power fluctuations from renewable generation Temporal Power's energy storage solution acts like a shock absorber, smoothing power flows to reduce strain on the electricity system. This results in benefits to power producers, utilities and customers which include:

- ▶ Increased renewable penetration
- ▶ Reduced curtailment
- ▶ Improved power quality

Flywheel Energy Storage Capabilities

- ▶ **Voltage and power quality support:** The ability to provide both real and reactive power to balance local power fluctuations caused by industrial loads or renewable energy sources helps to improve power quality and stabilize voltage levels at the local distribution level.
- ▶ **Ramp rate control:** The majority of ramps greater than 10% occur over a very short period of time (<1min). The rapid response and high power of flywheels eliminates these high ramping events, resulting in smoother power output, and a more stable power system.
- ▶ **Frequency control:** A flywheel plant can be dispatched as a flexible grid support asset, providing direct frequency control that responds to balancing commands from the grid operator. The rapid response of flywheels results in more effective energy delivery than conventional generators in providing short-duration grid balancing.



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Temporal Power's flywheel technology lowers costs, is environmentally friendly and boasts utility grade durability

Lowers the cost to operate the grid

- ▶ **Millisecond response** means Temporal Power delivers power exactly when it's needed, making Temporal Power flywheels 3 to 5 times more effective than typical generators
- ▶ **Balancing of the grid** allows for more expensive generators to be turned off, saving money, fuel and emissions
- ▶ **Low lifecycle cost** with minimal maintenance over Temporal Power flywheel's 20 year operating life

An environmentally friendly energy storage solution

- ▶ **Fully recyclable and uses non-exotic materials**, allowing for low cost and high availability of components
- ▶ **No harmful chemicals or emissions are used as** Temporal Power utilizes fully recyclable components, offering significant environmental benefits compared to competing technologies
- ▶ **Use of recycled steel** positions Temporal Power's flywheel as one of the greenest solutions for energy storage worldwide

The grid demands utility grade durability

- ▶ **Highest energy** flywheels in the world, ideal for utility scale use for multi-megawatt energy storage projects
- ▶ **Full depth of discharge capability** with unlimited cycling, making use of the full range of energy capacity, without any loss in performance
- ▶ **Scalable design** offering tremendous flexibility as flywheels are typically arrayed in modules of 10 flywheels, but can be combined to provide almost any system size required

Flywheel Energy Storage at a Glance

<i>Rated output power range</i>	<i>500 kW/1 MW</i>
<i>Energy storage capacity per flywheel</i>	<i>50 kWh</i>
<i>Duration at rated power</i>	<i>6-15 min</i>
<i>Operational life</i>	<i>>20 years</i>

temporal
high-performance energy storage

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