KEMEA: A GAME-CHANGING BATTERY

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ABSTRACT

High speed flywheels can compete with chemical batteries. Flywheel Energy Storage (FES) development involves consideration of mass, both frame and rotor body, speed of rotation, limits of material strength and centrifugal force. The engineering quest undertaken by KEMEA is to design high-speed low friction rotors to increase energy density in a gyro net neutral frame, and make these available to the industry as a very efficient and powerful flywheel battery.

Keywords: high speed flywheels, frame, rotor, energy density, KEMEA

Historical Background Information

Flywheel Energy Storage (FES) is well known as a carry through energy device, popular in engines and stamping machines and as a booster for race cars. Early in the age of fire, flywheels were the first battery using kinetic energy storage to drive a top for making string and thread, and the momentum of a potter's wheel. FES gained notoriety in trains and trams due to its provision of flywheel climbing torque assist on trolleys since 1900, and in steam engines since 1830. Flywheels are now commonly combined with Uninteruptible Power Supply (UPS)/NoBreak motor-generators for backup engine start-up, and fast flywheels are ideal in this age of silica and carbon composites, opening faster flywheel rotors than ever before.

Applications and Innovations

Now, a better battery is needed that can recharge quickly during off-hour low cost periods and can provide power anytime. Obvious applications include the charging of electric or hybrid vehicles (EV or HEV) cheaply and power storage for wind/wave/solar when inactive (no wind, no wave, no sun). Other applications are for homes, hotels, businesses, remote ranches and small towns where a better battery is needed. FES, and in particular this KEMEA device, satisfies this need. A typical application is illustrated in Figure 1.

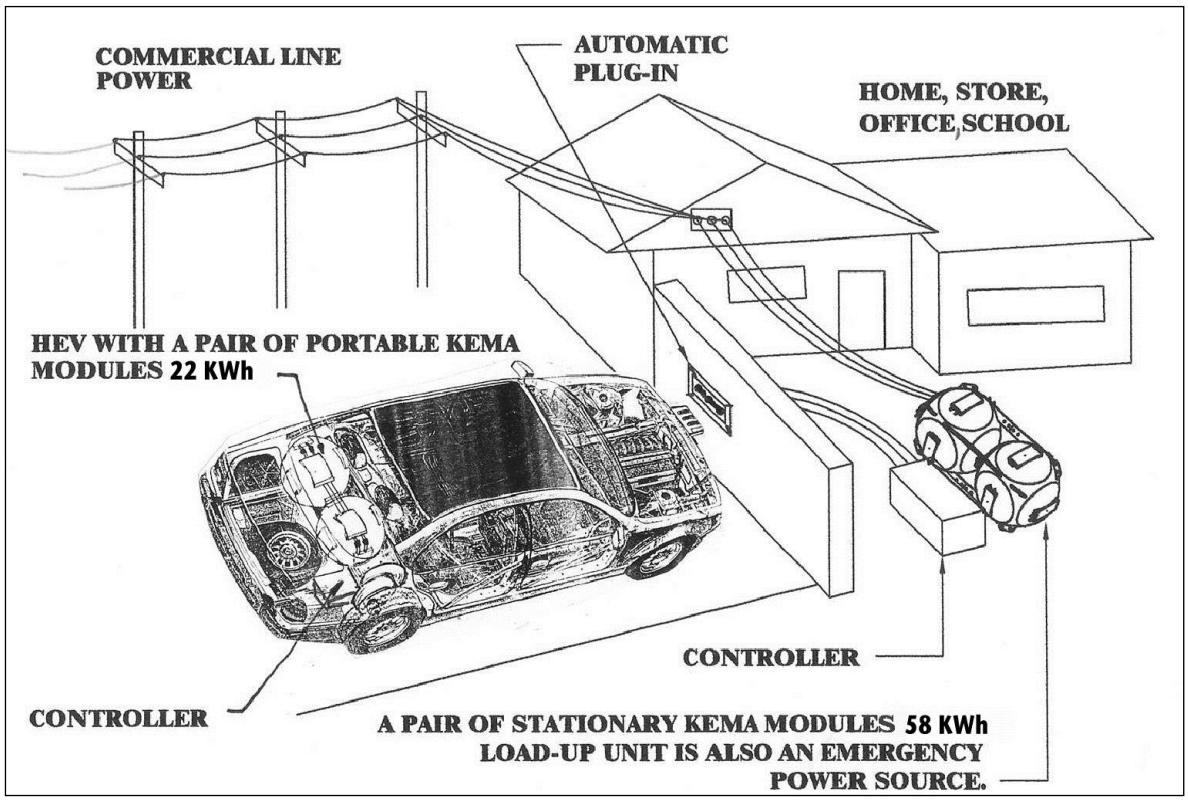

Figure 1: application of the KEMEA battery to buffer commercial power

Other remote applications for solar power are microwave relay stations, radio, signaling, remote early warning radar, earthquakes sensing stations, light houses, fire stations, remote airports, etc.

3D CR KEMEA (3 Dimensional, Counter Rotating, Kinetic Electro-Mechanical Energy Accumulator), integrates well with wind turbines and large solar panel installations where KEMEA charges up during windy moments or sunny hours in order to energize living or working spaces when the source is dormant. Further, emergency power stations can substitute KEMEA banks for conventional generators. UPSs are also obvious applications, and another stationary method sure to become important is to "load up" utility power into a bank of KEMEA to provide reloading power for the family/business EV or HEV.

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As illustrated in Figure 2, KEMEA is a set of six fast and heavy double cone flywheels mounted in a sealed and secure vacuum sphere. It is an innovative, long life, and low maintenance stationary battery bank. The engineering involves multiple double cone shaped rotors that fill the sphere, are precision balanced, and quickly spin-up from 1000 to 100,000 RPM using optimized DC brushless motor-generator drives. KEMEA opens up new levels of regenerative braking recovery and quick charging. It is a better bank of batteries.

KEMEA uses 48 neodynium or samarium magnets per unit. Twelve pairs of doughnut magnets are used to suspend the rotors on shafts, and 24 on DC brushless motor/generators. A total rotor assembly weighs around 24 kg making a Sphere under 200 kg. Energized, the six flywheels buffer around 5.8 kWh at 28,000 RPM.

KEMEA outshines the best chemical battery in useful life, repeated peak power demand, fast charging, and does not diminish with every cycle or die when left uncharged.

Tight turns and bumps are not advised unless the flywheel speed is low, and this means cars on flat roads and wide turns must limit flywheel speed to around 36,000 rpm to mitigate road shock while delivering 11 kWh. On freeways, 42,000 RPM is achievable for 13 kWh, and a pair of KEMEA Spheres provides 26 kWh. Practical mobile operation is likely limited to flat roads and wide turning public buses, trolley cars, trains, and trucks. This mobile version can recover over 55% of the braking energy resulting in recycling 30% of the braking energy for fuel savings.

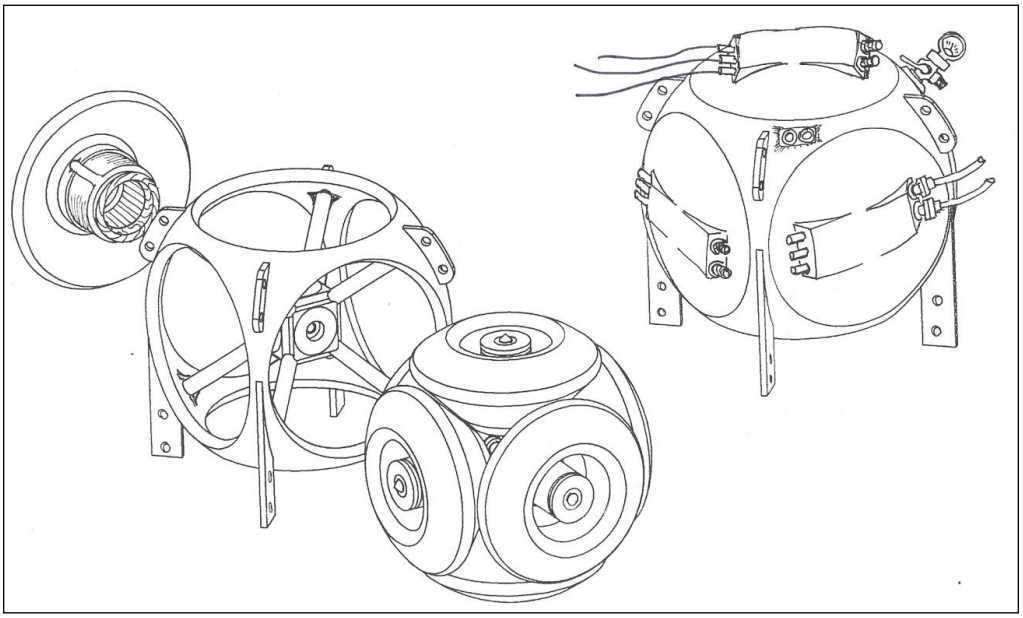

Figure 2: KEMEA Sphere with six rotors

Several stationary KEMEA can eliminate a motor-generator and provide abundant emergency power, and a larger KEMEA bank can buffer wind farm or solar farm excess energy. Each stationary Sphere stores 29 kWh at 62,000 RPM, and a bank of 100 KEMEA Spheres can accumulate 2.8 MWh of emergency power for large users such as airports, smart buildings, hospitals, trains, military, etc.

A recent paper published by DOE Oak Ridge; publication ORNL/TM-2010/280, on the Assessment of Flywheel High Power Energy Storage favorably rates the KEMEA technology.

KEMEA is covered by issued US patent 8,584,55 along with two other pending patents. To date, development institutions has invested over US$ 1.5 million. KEMEA is 95% designed, 60% constructed, and is targeting mass production with safety in mind.

In summary, the uses of a powerful, long life, working energy storage device is bound to become a game changer for many applications.

KEMEA is currently seeking investors and individuals and groups having interest in such a development.

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Biographical Notes

Mario Gottfried

Mario has been involved with energy since joining Grupo Fuerza, S.A. -- a traditional NEMA and SAE motor and generator manufacturer and repair facility in Mexico. A member of the senior management, he has been responsible for line production and design of 15 MW/13KW volt systems and the engineering of other products such as 1.25 MW 60 Hz flywheel UPS, 10 KW to 1 MW wind turbines, special motors, and motor-generator sets.

While serving as the President of several companies and of a local business owner's council, he has provided energy consultation for the Mexican government and for mines and mills. Energy solutions include steam engines and remote power solutions with solar and wind for refrigeration and desalinizing.

Now Mario funds full time research and development of fast flywheel rotors using material technology to form flywheel-based batteries. He combines income from mining properties, real estate, and other investments with grants from the Mexican government to build prototype flywheel rotors operating in excess of 80,000 RPM.

Kitch Wilson, Ph.D.

As a systems/electrical/biomedical engineer, for more than 35 years Kitch has provided consultant services to the aerospace, medical, commercial, automotive, and wind/solar industries. He holds 18 patents in these diverse areas.

Kitch is the founder and President of Applied Theoretic Systems, Inc., of Santa Barbara California.. He focuses on applied mathematics to study the dynamics of systems through the perspective of system science and modern and classical control systems and, as a practicing electrical engineer, he recommends digital/analog/processor hardware and software.

Kitch has supported clients in China, Mexico, USA, and Europe. Further information can be found at www.appliedTheoreticSystems.com and www.linkedin.com/in/kitchwilson.