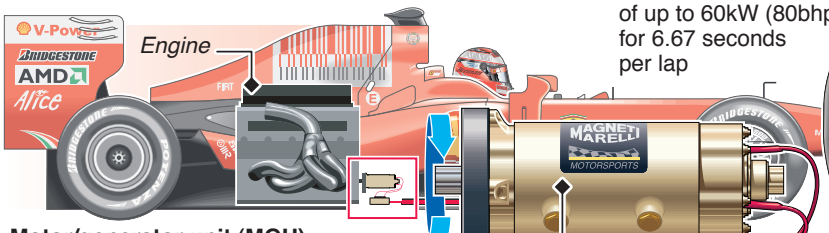
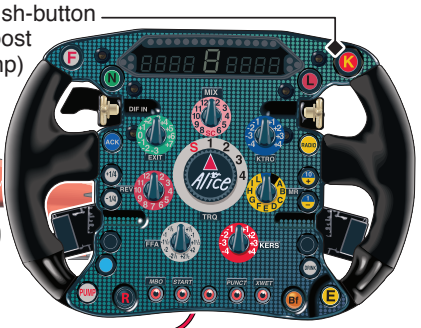
Comparing Kinetic Energy Recovery Systems

With an expected gain of up to half a second per lap, F1 teams are developing rival KERS technologies to harness the energy normally lost during deceleration to provide an acceleration boost at strategic points in the race. But only time – and competitive action on the track – will tell which system is the most effective, reliable, and safe

ELECTRICAL Energy stored in battery or capacitors and released via electric motor – like current hybrid road cars



Steering wheel: Push-button control for power-boost of up to 60kW (80bhp) for 6.67 seconds per lap



Motor/generator unit (MGU): Generates electricity during deceleration, powers driveline during acceleration boost

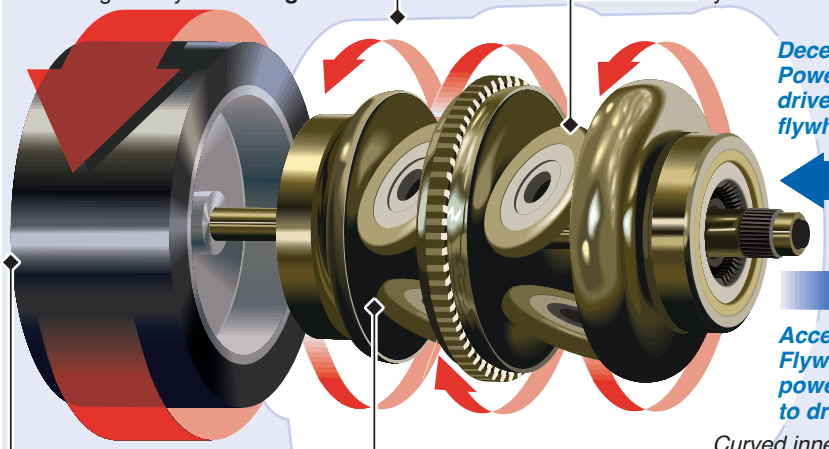
Control Unit: Directs power from generator to batteries, or from batteries to drive motor

Batteries: Store up to 400 kilojoules of energy

MECHANICAL Energy stored in high-inertia flywheel and returned to driveline via ***Continuous Variable Transmission (CVT)***
Total weight of system: **24kg**

CVT: Delivers power to and from flywheel – can go from zero to full power in 50 milliseconds

Adjustable rollers Angle determines speed delivered to flywheel, or torque from flywheel to driveline



Deceleration: ***Power from driveline spins flywheel***

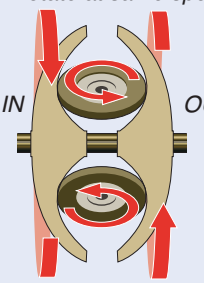
Acceleration: ***Flywheel gives power boost to driveline***

Flywheel: Vacuum sealed, composite cylinder rotates at more than 60,000rpm

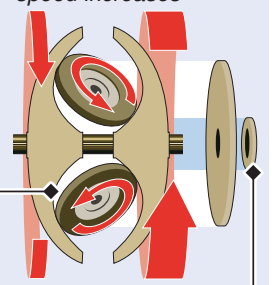
Highly viscous traction fluid enables maximum power transfer between discs

Curved inner surface of discs allows continuously variable ratio change – up to 6:1 within one revolution

1 ***Rollers straight:*** *Discs rotate at same speed*

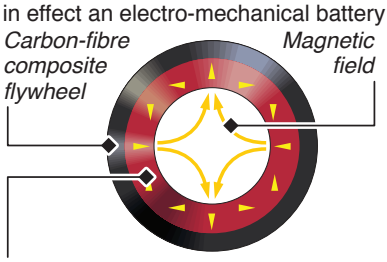


2 ***Rollers angled:*** *Output speed increases*

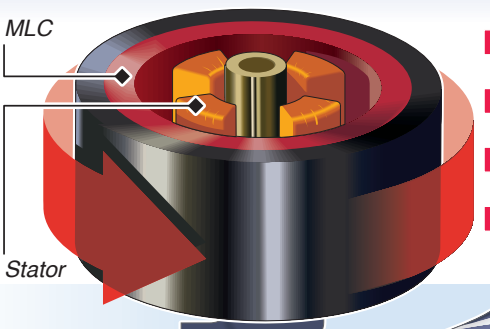


Equivalent gear ratio

HYBRID Energy stored in rotation of flywheel containing magnetic particles. This forms part of an electric motor – in effect an electro-mechanical battery



Magnetic Loaded Composite (MLC): Particles magnetised in ***Halbach array*** to confine magnetic field within cylinder and eliminate eddy currents for higher torque and efficiency up to 99%

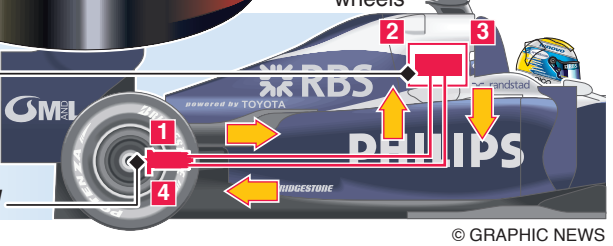


1 **Braking:** Electricity generated in rear MGU

2 Electricity powers second motor to spin flywheel

3 **Acceleration:** Electricity generated by flywheel

4 Electricity to rear MGU to boost acceleration in wheels



Flywheel motor/generator unit

Rear wheel MGU

Sources: Williams Hybrid Power, Magneti Marelli, Flybrid, Torotrak