

2016 SPECIFICATIONS
ENERGY EFFICIENT VEHICLES

RACV



ENERGY BREAKTHROUGH

17-20 NOVEMBER 2016 | MARYBOROUGH, VICTORIA

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THE PREMIER SCIENCE, TECHNOLOGY, ENGINEERING AND MATHS, ACTIVE LEARNING PROGRAM

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Energy Efficient Vehicles (EEVs) Supplement

This supplement should be read in conjunction with the Energy Breakthrough Vehicle Specifications.

All specifications listed in the Energy Breakthrough Vehicle Specifications apply to Energy Efficient Vehicles with the following additional specifications.

Single power source Energy Efficient Vehicles operating on petrol will not be eligible to participate in the Energy Breakthrough from 2017. 2016 will be the last year for this type of vehicle.

Electric-only vehicles will be eligible to compete beyond this year.

All enquiries regarding Rules and Specifications should be to:

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1. Occupant Protection Bars

Occupant protection for Energy Efficient Vehicles is the same as for Human Powered vehicles except that the metal protection bars are of greater diameter as per section 4.1.1 of the specifications.

Note: A Human Powered Vehicle that has been converted to an Energy Efficient Vehicle will satisfy the occupant protection specifications by duplicating the minimum specified bar dimensions for a HPV. (ie. another bar can be welded alongside the existing bar.)

2. Fire Extinguisher

A fire extinguisher must be fitted to all Energy Efficient Vehicles. An Australian Standard, dry powder minimum 5BE fire extinguisher of minimum capacity 0.9 kg shall be securely affixed to all hybrid vehicles in such manner and position that it can be readily reached and removed for use by either the rider from the normal riding position or external assistant in an emergency.

The location of the fire extinguisher must be clearly indicated on the exterior of the vehicle.

3. Engine Immobiliser

All Energy Efficient vehicles are required to fit a cut out switch that shuts down all propulsion sources and is accessible from outside the vehicle.

The cut out switch must be clearly visible, marked by a blue triangle and mounted on the left hand side of the vehicle and within 300 mm of the rider's left shoulder.

4. Power Sources

4.1 Number of Power Sources

There are three types of vehicle allowed in the Energy Efficient Vehicle category:

- **Hybrid 1: Pedal power, plus one other power source.**
- **Hybrid 2 (Open): Two power sources, excluding pedal.**
- **Single Power Source: Petrol-only or electric-only vehicles**

4.2 Principle of Power Generation

The fuel allocation is only available to vehicles fitted with internal combustion engines as one of their driving sources and will only be commercially available pump fuel as supplied from normal retail outlets.

All fuel used for the trial will only be available from the RACV Scrutineers.

4.3 Minimum Duration of Power Generation

- The machine must be capable of sustained operation when powered separately by each propulsion system.
- Pedal assist type vehicles will be eligible to compete in the Hybrid 1
- While satisfying this requirement a power source may be used intermittently during the event to overcome particular loads, such as starting from rest or hill climbing.
- The spirit of this clause is that a sacrificial form of propulsion is not acceptable.
- The test for whether a power source is compliant will be whether the vehicle is able to sustain it's speed while driving on either power source on flat road.

5. Electrically Powered Vehicles

5.1 Motor Type

Choice of motor type and gearing is free.

5.2 Total capacity and type of propulsion batteries

Propulsion batteries shall be commercially available.

[Batteries and chargers must be labelled with the school name.](#)

Batteries will be marked by RACV Scrutineers as per Trial Regulation 9.4.

5.3 Battery Casing

[Batteries with deformed or damaged cases are not acceptable for use](#)

[Lithium batteries with thin plastic wrapping must be placed in a hard case to prevent puncture or damage in an accident.](#)

[Wet cell batteries must be housed in a sealed box \(e.g. plastic\) that will prevent spillage if the battery is inverted or damaged.](#)

5.4 Total combined mass of propulsion batteries

The maximum total combined mass of propulsion batteries per vehicle is:

Battery type	Kg
Lead Acid	100
Ni Cd	65
Ni Zn	60
Li Ion	30
Ni MH	45

Note: Where Lithium Ion batteries are used a Battery Management System **must be** carried on board that is designed to provide adequate protection during charging and discharging.

5.5 Mass of propulsion batteries on vehicle

Vehicles are required to carry at least one battery pack at all times so that the electrical circuit is complete.

Batteries must be securely mounted in vehicles.

A battery pack is regarded as the normal quantity of batteries required for the electric motor to propel the vehicle.

5.6 Power Limitation

Electrical systems are restricted to a maximum of 48 volts.

A fuse or circuit breaker (up to 30 amps) must be fitted within 200mm of the battery pack.

6. Vehicles powered by Internal Combustion Engines

6.1 Engine Type

Choice of engine type or gearing is free.

6.2 Fuel types

Fuels for internal combustion engines will be commercially available pump fuels supplied by the organisers.

Any team using a fuel other than premium unleaded petrol must notify RACV prior to the end of October.

Notes: Fuels that must be stored under pressure such as LPG, CNG and hydrogen are not permitted.

6.3 Fuel tanks

Fuel tanks must be of sufficient capacity to contain the entire fuel allocation for the vehicle as indicated in Section 9.2 of the Trial Regulations. The fuel tank must be securely mounted using a fixed retaining bracket on a structural component of the vehicle.

The fuel tank must be shielded from the rider by the firewall (see section 2.5 Firewall, below).

The fuel tank refilling cap and any other tank closure shall be capable of having a mechanical seal (wire cable-tie) applied to prevent unauthorised opening.

Any plastic fuel tanks must be designated for petrol use and be compliant with AS/NZS 2906 Fuel Containers – Portable – Plastics and metal.

All fuel line connections must be secure and of an automotive standard.

6.4 Pressurised Fuel Systems

Pressurised fuel systems can be used, that is, diesel or petrol fuel injection, providing they comply with the following:

- all fuel lines are of a standard automotive type
- all fuel lines have crimped, or union type fittings at all ends
- all fuel lines must be securely mounted on the vehicle
- all fuel lines must be protected from heated sources and contact with any moving components
- any pressurised fuel tanks must have a relief valve that prevents pressure exceeding 10 psi and must be fitted with a metal, automotive tyre valve for testing.

6.5 Firewall

6.5.1 Description

Vehicle occupants must be separated and fully shielded (ie. no gaps) from any potential fire by a metal firewall.

This firewall must shield the rider from any direct flame occurring from:

- Engine and other high temperature heat sources.
- Fuel tank and lines
- Exhaust system

6.5.2 Firewall must extend:

- **In height** - above fuel tank, fuel lines, exhaust system, engine and other heat sources or potential heat sources – as well as above the shoulders of the tallest vehicle occupant in the normal driving or riding position.
- **Downward** - to the floor line
- **In width** – As wide as the rider's shoulders, in any case sufficiently to shield occupants from hot surfaces and potential fire sources.
- Body panels must be kept clear of hot surfaces and fuel lines.

6.6 Exhaust

Exhaust fumes, hot gases and vapours shall be routed to discharge clear of occupants and outside the bodywork, at the rear of the vehicle at a minimum angle to the horizontal of 45°, downward.

An effective silencer shall be fitted to reduce noise, and the pipe must not protrude beyond the frame of the vehicle.

[The exhaust noise level must not exceed 90dB as measured behind the vehicle.](#)