



@EVSymposium29
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Electric Vehicle Symposium & Exhibition

June 19-22, 2016 | du 19 au 22 juin 2016

Montréal, Québec, Canada

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DRIVE ELECTRIC INNOVATION
PROPULSER L'INNOVATION EN MOBILITÉ ÉLECTRIQUE

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Winning Approach:

Selection Criteria for Competitive Battery-Powered Racing Vehicles

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KillaJoule Racing Team, Colorado, USA

Eva Håkansson & Bill Dubé

KillaJoule:

- The world's fastest **electric** motorcycle at 270.224 mph (434 km/h) (official two-way record 240.726 mph).
- The world's fastest **sidecar** motorcycle.
- Eva is the world's fastest **female** motorcycle rider.
- 400 V, 10 kWh A123 Systems battery. 400 HP EVO/GKN motor, and Rinehart Motion Controls controllers.



KillaCycle:

- The world's quickest **electric** vehicle, 0-60 mph (0-97 km/h) in less than 1 second!
- 7.62 s @ 168 mph in the ¼ mile.
- 650 HP A123 Systems battery pack. Advanced DC motors, Zilla controllers.
- (Retired since 2014.)



Strengths

- Very high power drivetrains available.
- Instant torque from zero rpm.
- Reduced driver workload.
- Greatly reduced number of moving parts.
- Low maintenance = small crew requirements.
- Silent drivetrain.
- No gain/loss of HP due to barometric pressure, humidity, or air temperature.
- No fuel starvation due to vehicle acceleration, turns, etc.

Weaknesses

- Limited run time per charge
- Relatively long time required for recharge/battery swap
- Novelty of components and systems. No local spare parts suppliers
- Complex electronics and possible EMI/RFI issues
- Spare battery pack shipping restrictions = logistics can be complicated, slow, and expensive.

The main limitation: run-time per charge

- The current run-time limitation: approximately **10 minutes**
- Example: The Drayson B12/69EV, has been fitted with both E85 engine and fully electric drivetrain



Photo courtesy of Drayson Racing Technologies.

The Drayson B12/69EV

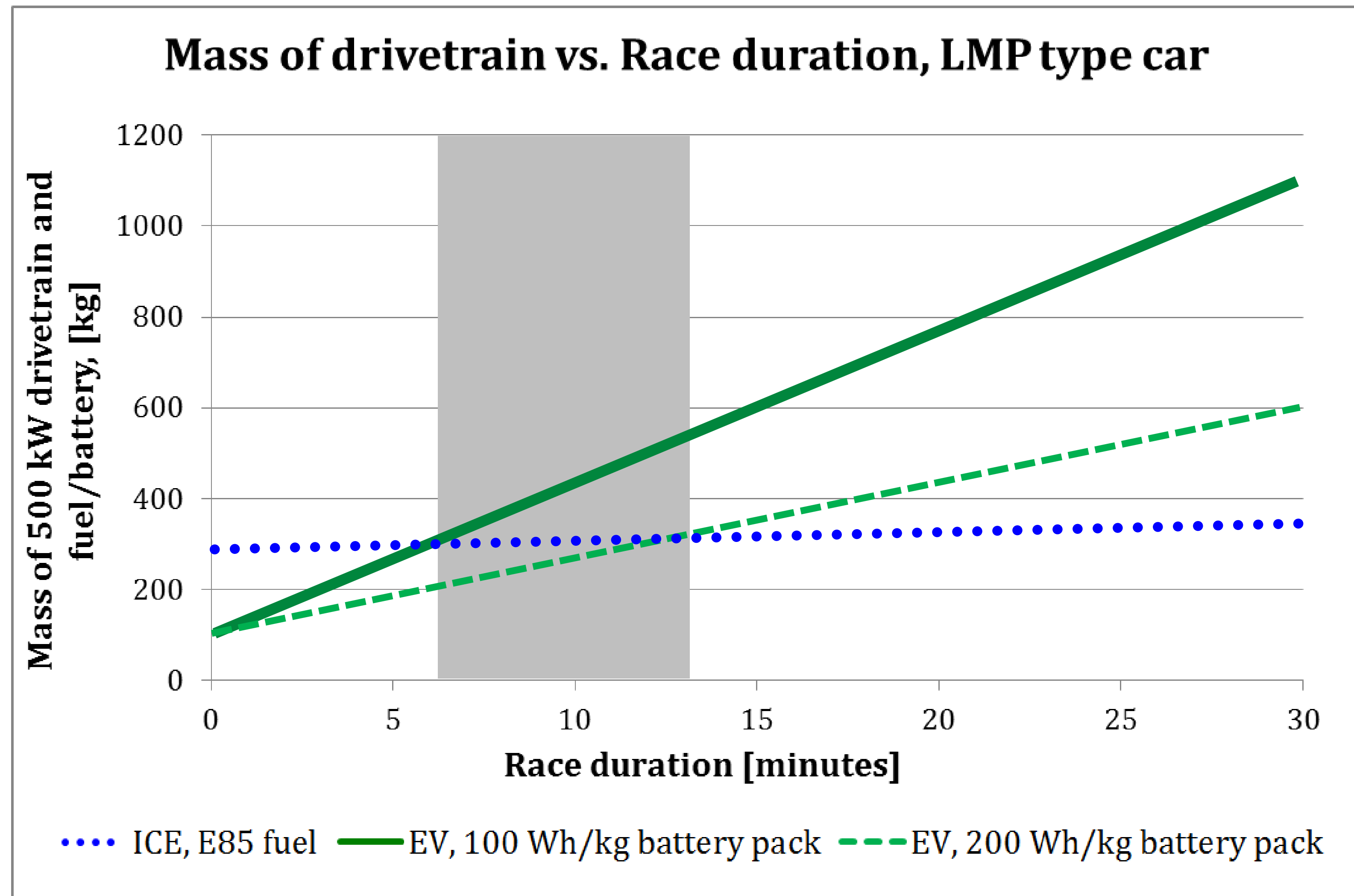
- “Le Mans prototype type 1” (LMP1) car.
- Single-seat, carbon fiber monocoque car, purpose built for racing.
- Originally 700 HP, V8 engine fueled by E85.
- Power increased to 1100 HP with the electric drivetrain
- ICE version: Le Mans 24 h race in 2010.
- EV version: several FIA speed records and hill climb with its owner and driver Lord Paul Drayson.
- Top speed: 219.1 mph (352.3 km/h).



Drayson B12/69EV: ICE vs. EV

Differences between EV and ICE versions:

- Mass of EV drivetrain (excl. battery) lower than ICE (172 kg vs. 302 kg of ICE).
- Power increased (1100 HP vs. 700 HP).
- Energy in battery/fuel: 11 kg/kWh for the battery (system level) vs. 0.12 kg/kWh for E85.
- Efficiency ~4 times higher in EV.



Selection of race discipline and format

- Hill climb
- Drag racing
- Land speed racing
- Track/sprint racing (<10 min)
- Rally cross
- Auto cross
- Monster truck
- Drifting

Specific for motorcycles:

- Trials
- Speedway/Flat track

Other types of vehicles:

- Snow mobile drag racing
- Airplane pylon races (<10 min)



Other important selection criteria:

- Vehicle type: car vs. motorcycle.
- Sanctioning bodies and existing records.
- Make sure your vehicle actually fits in a class!



Resources and “business plan”

- Passion/knowledge/expertise/team (what you already have).
- Overall goal (what you want to accomplish).
 - Showcase a specific component?
 - Personal goal, like beating somebody? Set a record?
 - Be the first to do X?
- Budget and other resources, including existing or potential sponsors. (There is a limit to every budget, no matter how large of a team you have).
- Time frame (for example, certain races only go once a year).

Conclusions

- EVs are already a game changer in certain **short duration** racing disciplines.
- Already beginning to set **overall records**.
- If you that want to enter the world of electric racing, **now is the time to act**.
- The technology is here to be competitive, the battery technology is being continuously improved.
- Sponsors are beginning to become aware of the competitiveness of EVs.
- Set reasonable goals!
- Under-promise and over-deliver.
- Publicity is what attracts sponsorship.
- Don't over-innovate!
- **“To finish first, one must first finish”.**



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Photo by Kevin Smith