



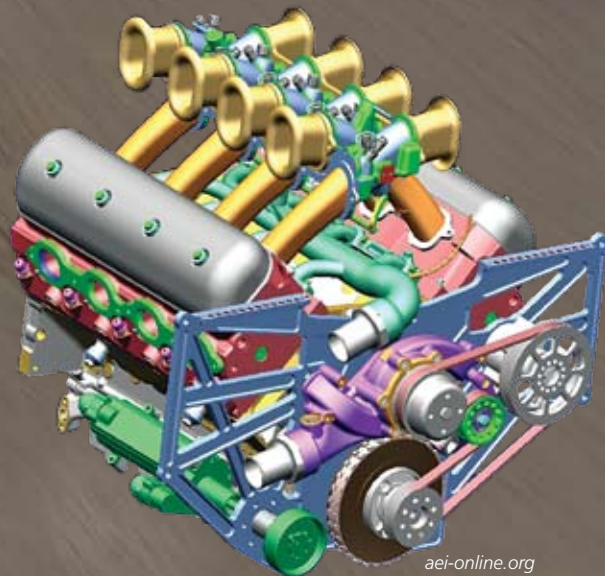
Green victory?

The motorsports community contemplates winning races while leaving behind the smallest environmental footprint.

by Steven Ashley

Above: A Chevrolet Corvette C6.R driven by Johnny O'Connell. Jan Magnussen and Ron Fellows in the GT1 class won the inaugural ALMS Green Challenge competition at this year's Petit Le Mans race in Georgia.

Bottom left and right: Cellulosic-based E85 ethanol fuels the L57.R small block V8 racing engines that power the Corvette Racing team's two C6.R cars in the American Le Mans Series.



Not long after cars were invented, drivers began to race them. Winning races meant that builders competed to develop faster, more reliable cars that featured the best-available propulsion systems as well as innovative handling technology and related equipment.

Automakers in time realized that race victories boosted sales, engendering the adage: "Race on Sunday; sell on Monday." The rest is history. Honed to a keen edge on the ultimate proving ground, the car has since undergone the most intensive long-term engineering effort ever seen, leading in large part to the incredibly sophisticated vehicles on roads today.

But car racing has seen changes of late. No longer do technical advances on the track necessarily translate directly onto the asphalt. Much race technology is nowadays just too arcane and

stressed Scott Atherton, President and CEO of ALMS. "We believe that there's real substance to this 'race within a race,' especially since it has been validated by the EPA and DOE. We hope that the manufacturers and consumers agree." The inaugural Green Challenge took place on October 4th at this year's Petit Le Mans event in Braselton, GA.

"We need to pursue fresh ideas like green racing," asserted Herb Fishel, former Executive Director of **General Motors** Racing and SAE advisor on the topic. "The concept," he explained, "is to connect to racing the billions of dollars that manufacturers spend on R&D, so as to leverage the motorsport community's proven ability to innovate technology rapidly."

The society has provided a neutral platform by which to convene all the interested parties to look into opportunities of-



The initial Green Challenge trophy for the ALMS LMP2 (prototype) class at the 2008 Petit Le Mans race went to a E10 gasoline direct-injected, 503-hp (375-kW) Porsche RS Spyder prepared by the Penske Racing team.

costly for mass commercialization. And the glut of corporate marketing money has switched much of the fan focus from the winning car to the personalities of the drivers.

In the meantime, the auto industry faces its biggest challenge—the threefold impact of growing foreign oil imports, the threat of petroleum shortages, and looming climate change. For the last several years, farsighted motorsport enthusiasts have envisioned turning the remarkable ability of the auto-racing community to innovate quickly toward solving these problems. Their chosen vehicle? "Green racing," that is, winning in the most environmentally sound way possible.

Contradiction in terms?

Old-timers might consider the concept of green racing to be an oxymoron, given that the main goal in racing is to finish first. But others can legitimately disagree. Recently, under the auspices of **SAE International**, unprecedented cooperation by an unlikely group of car makers, racing-series sanctioning bodies, as well as the **U.S. Department of Energy** (DOE) and the **U.S. Environmental Protection Agency** (EPA) has led to the formulation of the initial standard protocols to govern the means by which racing can go green.

Indeed, the **American Le Mans Series** (ALMS) has just instituted its Green Challenge, whereby its race teams will be ranked according to their entries' fuel efficiency, greenhouse gas emissions, and amount of petroleum use. "It's not just PR spin,"

fered by green racing, Fishel continued. "For this initiative to go anywhere, it had to involve the interests of the entire industry, because the complexities of these issues go well beyond the normal capabilities of individual racing teams."

A novel concept

The notion of green racing has been percolating in various quarters for some time, according to John Glenn, an environmental specialist at the EPA, who started musing about it around 1993. "I could see that, to win races, developers had focused on boosting engine displacement to increase power-to-weight ratios," he recalled. "It occurred to me that things would have been different if auto racing had emphasized a different metric: power per unit of energy."

Glenn was also aware of the long-standing "Index of Performance," a technology-based handicapping system used by the **European Le Mans Series**. But Glenn did not think much more about the concept until a few years back when the U.K.'s **Motorsport Industry Association** (MIA) started promoting "energy-efficient racing."

Then three years ago, EPA managers including Glenn and Tom Ball, a program manager at the agency's Air Office, heard SAE's Fishel advocating that the auto industry should find ways to make racing more relevant to the needs of current cars. "We all realized that it could be possible to take advantage of the synergies among the racing-series sanctioning bodies and the

OEMs to encourage green technology and practices," Ball said.

The result could be greater relevance for the series, as well as better technology and good publicity for the automakers. "It only made sense to use the innovation and rapid development that racing has always used to improve car performance to produce the green technology we all need," he added.

After all, says former SAE President Greg Henderson, "in Formula One racing, a vehicle can go from concept to museum piece in as little as five weeks." During such short periods, he noted, a race team can design a part, fabricate it, conduct structural and wind-tunnel tests, and then track test it before running it in competition.

In addition to speeding technical development, green racing could help teach people on the street about saving the environment, maintained Bob Larsen, Senior Technology Advisor at the **Center for Transportation Research at the U.S. Argonne National Laboratory (ANL)**. "We want to open the door to educating the fan base, and the public at large, about the full range of these sometimes complex issues—important lessons that everyone needs to learn."

Meeting of the minds

In early 2007, SAE International, in partnership with the DOE, EPA, the major auto manufacturers, the **International Motor Sports Association, ALMS, MIA, the Sports Car Club of America**, and other organizations, established the green-racing activity under the society's Motorsports Council. Its mandate, said Anderson, is to devise the general green-technology protocols that would set the stage for the sanctioning bodies to write their own rules.

The committee soon brought into the mix specialists from ANL, whose researchers years earlier had developed the widely used Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model for estimating, from a "well-to-wheels" perspective, the overall environmental impact of a vehicular fuel. The goal, Larson reported, was "to use the best science to develop an 'apples-to-apples' comparison among car types—a score that could reasonably rate the green performance of all types of vehicles on a level playing field."

The group, he said, eventually decided that the protocol should encompass three elements: fuel efficiency, the number one consideration—everything that goes into the fuel and engine combination; greenhouse gas emissions—not just what is coming out of the tailpipe, but the fuel's entire carbon content from its origin to hauling it to the track to burning it; and petroleum substitutes—how much petroleum an alternate fuel displaces (see sidebar, next page).

Calculating rank

To provide valid weighting for each element, Larson continued, the protocol provides for two adjustments to the fuel-efficiency rating "to make it as if all the vehicles had run the same distance" in timed races or ones that end when the winner passes the finish line. One compensatory factor corrects for the distance traveled by the race winner compared to that run by the other competitors and also determines an average speed for each competitor to normalize fuel consumption.

The second adjustment is aimed at closing a potential loophole that might arise should a team decide to drive slowly to improve fuel mileage. "Basically, it's a force calculation that



Above: The alternative fuel E85 bio-ethanol provides drive energy to the Drayson-Barwell team's Aston Martin Vantage GT2 (grand touring) entry in the American Le Mans Series GT2 class.

Below: Cars in the American Le Mans Series use one of three street-legal alternative fuels: E10 gasoline (or gasohol), a mixture of 10% ethanol and 90% gasoline; E85 cellulosic ethanol containing up to 85% denatured ethanol made from wood waste; and zero-sulfur diesel.



determines the amount of power needed to run at an average speed with a particular fuel," Larsen explained. The formula therefore involves the minimum mass for the vehicle-class times the average velocity. "Then we take the ratio of the winner's number versus each of the other competitors and apply it to the amount of energy each vehicle consumed during the race," he added.

"We think that it's a pretty good rating of the fuel efficiency of each vehicle," Larson said. "Theoretically, the same basic method could be used for any propulsion configuration, including ones that use electricity, such as hybrids, or energy-recovery devices."

The Argonne researcher readily admits that the committee's solution is not ideal because many other variables are not taken into account. "But it's a pretty darn good way to place everyone on the same level," he stated. "With more experience, we may tweak the protocol to improve our approach."

The fuel-efficiency number keys into the "downstream side" (in-race) calculations of greenhouse gas and petroleum use in



Corsa Motorsports will field a new hybrid Zytek-built race car featuring an ethanol-fueled V8 engine together with a lithium-ion powered electric motor in the LMP1 (prototype) class of the 2009 American Le Mans Series.

the various fuels, be they corn or cellulosic ethanol or whatever other alternative fuel comes onto the scene. The GREET model is meanwhile employed to figure in the “upstream side” of the fuels’ oil and carbon-dioxide-equivalent content.

Sixty percent of the final green value is accounted for by the fuel-efficiency rating, with the remainder coming from the ratings of greenhouse gas and petroleum content. “We believe that we’ve structured the calculation so that everyone has a reasonable chance of being competitive,” Larson concluded.

Build it and they may come

The ALMS Green Challenge is based on the committee’s protocol as stated in the recently released SAE J2880 document. Nearly all involved seem to agree that it makes sense that ALMS should be the first to adopt the new approach because all the fuels the series uses have some non-petroleum content and because ALMS races both prototype- and production-based cars.

But ALMS’ Atherton remains unsure whether the industry will fully accept it: “We’ll have to see whether the manufacturers salute or ignore it,” he said.

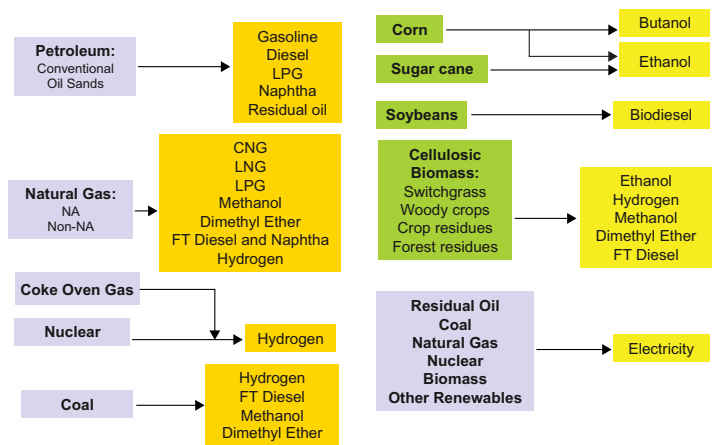
One of those manufacturers, **Honda**, is mulling over the opportunities. Erik Berkman, President of Honda Performance Development, says that his group is now trying to figure out how it might respond to the Green Challenge rules: “Do you try to win the race, win the challenge, or both?”

Berkman, for one, does not consider the concept of green racing to be that far out. “Racing is often about fuel economy,” he said. “For instance, one of our leading cars in a recent race ran out of gas. Better fuel efficiency could have avoided that outcome.” Green racing might even call for new strategies, he added. “Say you fall out of contention because of technical problems. You might run the rest of the race to win the Challenge.”

The Honda racing chief says that the Green Challenge and the like could also be significant for OEM sales. “People used to say that ‘safety doesn’t sell,’ but today safety is very important to car sales. The same thing is happening with environmental responsibility, and certainly with sky-rocketing gas prices, fuel efficiency.”

The selection of fuel is the crucial choice for the challenge, Berkman pointed out. “If you choose an E85-ethanol blend, for example, you can trade off some ultimate performance.” Also important is a team’s approach to fuel combustion. “Typically for peak power, you run with a rich mixture, which is usually not the cleanest or most efficient way to burn fuel,” he added. “So it comes down to: Do you run clean and give up perfor-

Fuel Production Pathways from Various Energy Feedstocks (Well-to-Pump) in GREET



The GREET (Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation) model developed at Argonne National Laboratory estimates the overall environmental impact of the manufacture and use of many hydrocarbon fuels, enabling an “apples-to-apples comparison” to be made among them.

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For Honda, in particular, these considerations lie well in the future as “our next car has already left the dock, so we’ll have to look at the Green Challenge over the long term to determine how we can work with it.”

For other contestants in the ALMS, though, the new rules will soon be put to good use. **Corsa Motorsport** just announced that it will field an electric-hybrid **Zytek** vehicle in the American Le Mans Prototype-class starting with this season’s Petit Le Mans race. And, according to Atherton, “two major manufacturers not in ALMS now are actively working on new propulsion technology for prototype entries. One could introduce such a car as early as the end of 2009.”

It just may be that novel race formats like the Green Challenge have arrived precisely in time. Several other racing organizations including Formula One and the original Le Mans are reportedly working on similar programs. Who knows, if this groundbreaking environmental competition succeeds, automakers’ new marketing mantra just might be: “Race green on Sunday; sell on Monday.” **aei**