Overview of the Green Challenge Championship for the American Le Mans Series

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The U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and SAE International have worked closely with the American Le Mans Series (ALMS) to establish the Green Challenge Award. This award will be presented to winners from both the Prototype and Grand Touring classes for the first time at the Petit Le Mans on October 4, 2008. This Le Mans-qualifying race was selected for the debut of this major new award as a way to announce and promote a season-long Green Challenge Championship during the 2009 ALMS season. The Green Challenge Award will be presented by DOE, EPA, and SAE International to the vehicle manufacturer that demonstrates technology that enables their racing vehicle to go the furthest, the fastest, with the smallest environmental footprint for the energy used. The ALMS will make Green Challenge awards to the winners of the Prototype and Grand Touring classes in each ALMS race during the 2009 season and recognize the winning Green Challenge Championship team at the end of next season.

The procedure for selecting the Green Challenge winners is through a three-part scoring scheme. For each race, a Green Challenge score is calculated for each vehicle that completes at least 70% of the winner's laps. That score is made up of three elements that can be expressed as:

Energy Efficiency + Petroleum Consumption+ Greenhouse Gas Emissions = Green Challenge Score

The Energy Efficiency factor is based on the actual amount of energy (both liquid fuel and electricity, when appropriate) that each vehicle consumes during the race. A combination of measurements of fuel dispensed and projections of fuel used will allow winners to be determined immediately after the race is complete. Because cars go different distances during the race, the fuel use of all the vehicles is adjusted to the distance traveled by the winner of each class. This adjustment is necessary to allow "a level playing field" comparison for all the competing vehicles. Another adjustment to energy use required for fairness is a speed-based correction factor. This adjustment takes into account the mass and average speed of competing vehicles compared to that of the winner. It is obvious that competitors that complete the race at a much slower speed than the winner will use less energy. Because the sponsors of the Green Challenge award want to promote competitive and exciting racing, correcting for differences in speed is essential to eliminate the incentive to go slower just to win this award. Finally, if a competing vehicle uses regenerative braking technology (e.g. a hybrid-electric vehicle), any net energy used or captured will be included with the energy from the liquid fuel consumed. Thus, the Energy Efficient factor is a comprehensive and comparable accounting of how much energy each vehicle used in the race.

The Petroleum Consumption factor is a measure of how much energy derived from oil was consumed by the racers. Reducing our nation's growing dependence on imported oil is a major policy imperative with significant economic and political benefits to our country. One of the driving factors in DOE's and EPA's sponsorship of this award is to show that renewable sources of transportation energy are capable of outstanding performance and low environmental impact. The Petroleum Consumption factor is comprised of two parts: one coming directly as a result of the amount of energy used by the vehicles (the downstream component) and one that reflects the amount of petroleum used in the production, refining, and distribution of the energy used (the upstream component). To accurately account for the petroleum used in racing, both elements of petroleum use must be included into this

factor. The downstream component comes from the percentage of petroleum in the fuel used by the vehicle. For example, a vehicle using E10 fuel in an ALMS race has its energy use multiplied by 91% reflecting the amount of gasoline in the E10 fuel. The upstream component of this factor comes from an accounting of the petroleum used in production of various fuels as expressed in the Greenhouse gas, Regulated Emissions, and Energy use in Transportation (GREET) model[1]. The amount of energy used for each car expressed in the Energy Efficiency factor is used to calculate the upstream petroleum in the fuel production and distribution cycle. Using the E10 example above, the upstream petroleum needed to produce the 91% of gasoline used by the car is added to the petroleum needed to produce the 9% corn ethanol in E10 to get the total upstream petroleum used. The upstream total is then added to the amount of petroleum in the fuel on the track (the downstream component) to get a comprehensive measure of the total amount of petroleum consumed by each racing vehicle in each race.

The Greenhouse Gas Emissions (GHG) factor reflects the amount of carbon put into the atmosphere from each ALMS racing vehicle over the course of each race. Rising levels of GHG emissions are of concern as contributors to Climate Change. The GHG factor is calculated much in the same way as the Petroleum Consumption factor using an upstream (embodied) element and a downstream (tailpipe) element. The upstream factor again comes from applying the Energy Efficiency factor to the results of the GREET model to determine the amount of GHGs produced during the production and distribution of the fuel that each ALMS car consumed. To figure out the amount of downstream GHG's produced, the amount of energy used from the Energy Efficiency factor is multiplied by the results of a chemical analysis of the amount of carbon in each of the ALMS fuels to obtain this element of the score. Then the upstream and downstream GHGs are added together and multiplied by a scaling factor to form the final factor in the Green Challenge Award score.

The Green Challenge score differs from other scores in racing in that the smallest number wins. That is, the Prototype and Grand Touring vehicles that use the least energy, the least petroleum, and emit the fewest GHGs on a distance- and speed-equalized basis will be the winners. Those teams will be awarded the same number of points towards the season-long Green Challenge Championship as those earned by the race winners towards the overall ALMS Championship. All teams qualifying for the Green Challenge will receive points based on their Green Challenge scores for each race based on the race's ALMS Championship point structure. The twist for winning the Green Challenge Championship is that each ALMS team starts off the season with the maximum total points available from all the scheduled races. When teams win Green Racing Championship Points they are deducted from this total. Thus, Green Championship points decline for successful teams over the course of the season and the ideal score at the end of the season is zero.

DOE, EPA, SAE International, and ALMS believe that the technology development and demonstration potential inherent in racing is a powerful resource to help address critical national energy and environmental issues. Establishing the Green Challenge Championship returns racing to relevancy and provides incentives to vehicle manufacturers to achieve critical national energy security and environmental improvement goals. In this way, the manufacturers of both the cars of today, as represented by the Grand Touring class, and the cars of tomorrow, represented by the Prototypes, can use racing to leverage the development of technologies and fuels critical to their future and the future of sustainable transportation for our nation.

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[1] The GREET model is the most widely-used and thoroughly peer-reviewed model of its kind in the world. GREET was developed by DOE at Argonne National Laboratory over the past twelve years and is continually undergoing refinement and improvement. It contains the energy use and greenhouse gas emissions for more than one hundred fuel pathways contained in an open spreadsheet model. GREET may be downloaded free at www.transportation.anl.gov/software/GREET .