Montreal, October 14th, 2016

Air Resources Board
1001 I Street, Sacramento
California 95814

OBJECT: COMMENTS ON PROPOSED REGULATION TO PROVIDE CERTIFICATION FLEXIBILITY FOR INNOVATIVE HEAVY-DUTY ENGINES AND CALIFORNIA CERTIFICATION AND INSTALLATION PROCEDURES FOR MEDIUM- AND HEAVY-DUTY VEHICLE HYBRID CONVERSION SYSTEMS (INNOVATIVE TECHNOLOGY REGULATION)

Dear agency representatives,

Effenco is a Montreal based company focused on the development and commercialization of energy efficiency solutions for medium-, heavy-duty vocational vehicles. Our main offering is the Active Stop-Start™ technology, a system designed to automatically turn off the engine of vocational vehicles when they are stationary and to provide energy to low power vehicle systems such as the body equipment, transmission or HVAC systems when the engine is off. On releasing the brakes, a dedicated electric hybrid starter-generator takes less than half a second to take the engine from a stop to idle speed making the vehicle as responsive as it would have been if the engine had been running. The Active Stop-Start™ technology allows thus eliminating idle both during *stop-and-go* as well as worksite operations. Since vocational vehicles spend a large proportion of their operating time immobile, the Effenco Active Stop-Start™ technology creates value by reducing engine operating hours and corresponding fuel consumption, emissions, maintenance and noise. Our technology is applied to all Medium- Heavy-Duty (Class 6-8) vocational vehicles as defined in EPA's Phase 2 regulations and its benefits combine those frequently associated to idle reduction, automatic engine shutdown, ePTO, APU, and of course, stop-start technologies

Effenco-equipped trucks have been road and lab tested by a number of fleets including: New York City Department of Sanitation, Derichebourg Canada Ltee., Purolator, Veolia UK who have replicated and confirmed 41-54% fewer engine hours and resulting fuel savings ranging between 18 and 34%. While our systems have been installed by secondary manufacturers under delegated assembly agreement up to now, Effenco is presently collaborating with different chassis manufacturers in the U.S. and Europe with the ultimate objective of offering the Active Stop-Start™ system as a vertically integrated standard option.

Like most other smaller, independent manufacturers that make up today's market, Effenco's strategy is to create a "pull" market from OEMs through vehicle conversions with progressive customers. Effenco therefore welcomes the proposed ITR and applauds the ARB staff on recognizing the deterring effect that the agency's existing comprehensive heavy-duty engine and vehicle certification requirements may have had on the introduction of promising new technologies to the Californian market. In fact, Effenco has thus far refrained from deploying its technology in this market for these exact same reasons. However, recent interests from port authorities and the refuse market, along with the probable adoption of the proposed ITR, will most likely change that and Effenco would in fact be glad to be listed a one of the manufacturers that have expressed interest in introducing truck or bus conversion systems into California (ref.

to Initial Statement of Reasons, Section E(1)(b) *Market Overview*). That being said, we would like to share with the agency the following comments and suggestions regarding the proposed ITR.

Our main concern regards the importance of idle in duty cycles and the recognition of idle reduction technologies for CO_2 emission reductions. Indeed, it is now broadly recognized that idle IS A SIGNIFICANT PART of real world duty cycles of many medium- heavy-duty vehicle applications; be it in traffic circulation, at bus stops, at loading-unloading points or at worksites. These conditions are encountered on vocational applications that are generally identified as being the best candidates for hybridization. A myriad of sources now demonstrate that idle (or stationary operations) actually accounts for roughly half of the overall operating time on average for several vocational applications. The National Renewable Energy Laboratory (NREL) undoubtedly conducted the most work on this matter and a few references are listed below[1]. From our own database that sums up more than 110,000 operating days with 468 vehicles over 5 truck applications, we observe that stationary operations account for 30-70% of these vehicles operation time and that associated fuel consumption ranges between 10% to as much as 40% of the overall fuel consumption.

Therefore, neglecting to impose a minimum proportion of idle (or stationary operation) time in the determination of duty cycles for the Hybrid technology emission test procedures will lead to erroneous conclusions. For example, regarding the Test Route Selection for the Portable Emission Measurement System (PEMS) Testing (ref. Appendix E, section 7(c)(2)), the proposed ITR currently only requires manufacturers to identify approximately what percent of time the vehicles are anticipated to operate at zero-speed (i.e., the vehicle idles or is otherwise at rest) (ref. Appendix E, section 7(c)(2)(B)). On the other hand, the procedures impose a range of average driving speed and positive kinetic energy (PKE) for the test route (section 7(c)(2)(A)). It has been clearly demonstrated that PKE, or kinetic intensity (KI): *"… relates well to a hybrid electric vehicle's hybrid advantage for cases where idle fuel usage and vocational loads are small compared with the fuel usage to satisfy roadload*."[2] Given the importance of stationary operations and related fuel usage as stated above, average driving speed and PKE cannot be used as sole metrics. Therefore, Effenco urges the agency to impose a definite range of zero-speed operating time, expressed as a percentage of the overall time, for the selection or elaboration of test routes. Similarly, where specific duty cycles are specified (e.g. section 7(d)), extra idle time should be added to these duty cycles (if required) in order to reflect real world proportions. Failing to do so, technologies that are highly sensitive to PKE and driving speed could potentially be certified with overestimated performances through the proposed procedures; resulting in actual under-achieved emission benefits. Moreover, savings resulting from idle reduction technologies (in a broad sense) would be literally overlooked and this brings the second component of our first comment.

As mentioned earlier, high proportion of idle time (or stationary operations) is not an exception but rather the norm; at least for vocational applications and most importantly, for many vehicle applications to which the proposed ITR will be useful. However, the proposed ITR stipulates that: "*Emission testing pursuant to these procedures would exclude the benefits of an engine*

[1] Fleet DNA : http://www.nrel.gov/transportation/fleettest_fleet_dna.html
Adam Duran et al., "The Development of Vocational Vehicle Drive Cycles and Segmentation", NREL, 2016
Matthew Thornton et al., Data Collection, "Testing, and Analysis of Hybrid Electric Trucks and Buses Operating in California Fleets – Final Report", NREL, 2015
A.Duran and K.Walkowicz, "A Statistical Characterization of School Bus Drive Cycles Collected via Onboard Logging Systems", SAE 2013 Commercial Vehicle Engineering Congress, SAE Paper 2013-01-240

[2] Michael P. O'Keefe, Andrew Simpson, Kenneth J. Kelly and Daniel S. Pedersen, "Duty Cycle Characterization and Evaluation Towards Heavy Hybrid Vehicle Applications", 2007 SAE World Congress, SAE Paper 2007-01-0302.

automatic stop-start system…" and that "…*the proposed ITR test procedures are intended to evaluate the emission benefits of vehicle hybridization, not engine stop-start systems.*" In fact, stop-start operation (or idle reduction) IS AN IMPORTANT AND INTEGRAL PART of hybridization strategy, as are regenerative braking and advanced engine management, for example, and that it should be recognized as such. Not only the associated fuel savings are significant but the hardware and software required to realize them is somewhat similar to what is used for propulsion hybrid architectures. For instance, the Active Stop-Start system includes an AC 3 phases 18kW peak power electric hybrid starter-generator and a 144 volts ultracapactior pack as energy storage (visit www.effenco.com for more technical details). We believe that the current proposed ITR determines the "how" to achieve the CO_2 emission reductions in that it favors some hybridization strategies (i.e. regenerative braking) to others, such as an *active* engine stop-start strategy as we labeled it for instance.

Another comment regards the sales volume of hybrid conversion systems allowed for Tier 1 certification. First, we believe that, globally, the proposed pathway of certifying to progressively more stringent Tier 1, Tier 2, and Tier 3 requirements is somewhat reasonable. However, the proposed ITR mentions that "*This structure is intended to encourage early development and market launch of a diversity of hybrid conversion systems, particularly from the smaller, independent manufacturers that make up today's market, by minimizing initial engineering challenges and certification compliance costs and scaling up certification requirements as the market develops"*. We agree with this statement and believe the proposed ITR achieve this objective except that the limit of 10 units (or 25 units for systems that achieve at least 35 miles AER) is too low for a small manufacturer to justify the investment and gain the necessary engineering expertise. Furthermore, and more importantly, the proposed ITR stipulates: "*Finally, hybrid conversion systems provide the opportunity to demonstrate fleet demand that may be needed for original vehicle manufacturers to be incentivized to enter the market with new, vertically-integrated commercial hybrid trucks and buses.*" It is our experience that fleet demand cannot be demonstrated to OEMs with volumes as low as 10 (or 25) units. A note here, we do not expect that OEMs will necessarily enter the market early and concurrently to activities under the Tier 1 certification. However, demonstrating fleet demand helps smaller, independent manufacturer obtaining minimal technical support from OEMs which could help meeting Tier 2 and 3 certification requirements. Thus, we urge the agency to bring the sales limit for Tier 1 certification to 100 units (or 250 units for systems that achieve at least 35 miles AER).

These comments were written with the highest respect for the agency, its staff and the great work that was done to put the proposed ITR together. We also took a great deal of precaution to produce pragmatic, fair and factual comments despite our obvious commercial interest. We hope that these comments will be considered and prove to be helpful.

I will be pleased to answer any questions and further collaborate to this commendable initiative.

Sincerely,

Benoit Lacroix, Eng., Ph.D.
Co-Founder, VP Sales & Marketing

benoitlacroix@effenco.com
Office: +1-514-397-4020 #202
Cell.: +1-514-975-3045