

Green Yachts Suggestions for the Fiscal Year 2022-23 Funding Plan for Clean Transportation Incentives Accompanied by Proposed Carl Moyer Program Changes

Green Yachts is dedicated to the sale, propulsion installation and servicing of electric boats and strongly supports California efforts to reduce emissions, particularly GHG emissions that cause climate change.

Our hope in submitting these comments is to make suggestions that aid CARB in leading a transition to a zero-emissions future. We believe that the suggestions below will all reduce GHG and NOx emissions and facilitate a faster transition to zero-emission technology adoption in the marine sector.

Recommendation #1: Regarding CORE and any future CARB funding program, treat zero-emission platforms differently than ICE platforms. A zero-emission platform on a vessel that is augmented by an ICE generator is still the platform for a decarbonized future that is easily modified as technology develops. This is consistent with state policy in the state of Washington and could begin to create a national standard that advances zero-emission platforms.

As background, here is a breakdown of the four propulsion strategies available on marine vessels:

ICE only – an ICE coupled to the shaft. This is what powers 99.9% of commercial vessels today, an ICE coupled to the shaft

Parallel Hybrid – an ICE and a zero-emission system (usually an electric motor) both coupled to the shaft

Serial Hybrid – zero-emission system only coupled to the shaft, an ICE (usually a diesel generator) generates electricity into the battery bank, but is not in any way part of the drive system.

Zero-emission – zero-emission system only coupled to the shaft, no ICE provides energy generation to the battery bank

Five of the 15 short-run ferries in California could operate 100% zero-emission and no other inspected commercial vessel could be 100% zero-emission with today's technology. CORE guidelines prohibit funding for any zero-emission equipment on a vessel that has any ICE generator on it. That means that only five of the thousands of commercial vessels in California could be eligible for CORE funding. Five. This guarantees underutilization of the CORE program in the marine sector. The VW fund has had one vessel be contracted for funding. One. This is because the guidelines don't recognize the reality of land vs water transportation. The Tesla semi-truck requires less than 2 kWh to go one mile. A medium passenger ferry requires 34 kWh to go one mile. And unlike federal highways where charging stations can be located where needed, charging stations cannot be located in the ocean. Green Yachts hopes that CARB can both recognize the value of the zero-emission platform in facilitating a decarbonized future and the reality of today that the 1,700% increased energy required to go one mile for a medium-sized ferry vs a semi-truck creates cannot be ignored unless CARB wants its zero-emission marine programs like the CORE vouchers and the VW fund to be underutilized.

No other vessel use case that we know of would work with a zero-emission platform with today's technology or any technology we foresee in the next 3-5 years. Serial hybrid systems would work for the rest of the short-run ferries and we believe for all ferries that have less than 20 miles to travel between terminals. Also, excursion vessels, sportsfishing vessels, pilot boats, work boats, dredge boats, and tug boats could all utilize serial hybrid technology successfully. The only vessels that today could not successfully use serial hybrid are long-distance ferries (greater than 20 miles between terminals),

commercial fishing vessels and cargo vessels. Essentially, any vessel that travels more than 20 miles or more for 75% of its operation or any vessel that travels 50 miles or more for 50% of its time of operation would be better off with an ICE or parallel hybrid, but the number of vessels that fit these higher use cases is not the majority of commercial vessels.

Serial Hybrid and Zero-emission both are 100% zero-emission propulsion systems. The difference is the serial hybrid has an additional module added to the system that uses an ICE. Today, California treats parallel and serial hybrid equally. That does not help transition California to a zero-emission future and it is incongruent with Washington policy for example. Here is an email from the Washington Department of Revenue:

On Wed, Feb 26, 2020 at 1:52 PM Johnson, Chase (DOR) <ChaseJ@dor.wa.gov> wrote:

Hello Graham,

I received some clarification on the law. The way the batteries are charged does not matter. You can have a generator (of any type) on board the vessel to recharge the batteries. The vessel qualifies for the exemption as long as it is electrically powered.

The email I received from Erin mentioned a diesel generator on board. Vessels with a diesel generator qualify for the exemption as long as the diesel engine is only powering the generator.

If you have any questions, give me a call at 360-705-6066.

Sincerely,

Chase Johnson
Excise Tax Examiner

A serial hybrid platform can have its ICE component easily replaced with new technology as renewable energy technology evolves that provides sufficient energy for a marine vessel to operate. One only has to remove and replace that ICE module without any change to the rest of the system. In contrast, to convert a parallel hybrid system to zero-emission, the entire propulsion system needs to be replaced. Furthermore, parallel hybrid is used as a rationale by ICE manufacturers to stay relevant and maintain sales of their engines. It is not good for our planet for parallel hybrid systems to be treated the same as serial hybrid systems. Serial hybrid systems are part of the transition to zero-emission transportation, parallel hybrid systems are not. Serial hybrid has more emission reduction potential than parallel hybrid systems. And, serial hybrid systems have more efficient zero-emission operation because the machinery of an ICE system does not create inefficiency for the zero-emission system operation.

Additionally, serial hybrid is a significant investment over and above a parallel hybrid system. Because it is a complete change in equipment, a serial hybrid requires a USCG stability test as the net weight taken off and put on the vessel almost always exceeds 2%. And, the shaft, propeller, steering system, charging system, battery compartments, ventilation system, cooling system all need to be changed as part of a

serial hybrid or zero-emission conversion, but not as part of a diesel to diesel repower or a diesel to a parallel hybrid repower because it is essentially still a diesel engine with a bit of electric motor augmentation or even in some cases a large alternator that charges the battery bank. Therefore, a serial hybrid system is more like a zero-emission system in its cost, its USCG timeframe for approval and time for project completion. A parallel hybrid is more like a diesel repower in its cost, USCG time for approval and time for project completion.

Our recommendation is to make the funding formulas the same for ICEs and parallel hybrid systems and treat both as an ICE in terms of funding. The hybrid component will probably result in lower emissions and this can be counted in the formula, but the emissions credit per ton and the eligible cost limit should be whatever it is for an ICE.

Serial and zero-emission systems should both be treated as zero-emission technology in terms of funding. The Zero-emission will have lower emissions and this can be counted in the formula, but the emissions credit per ton and the eligible cost limit should be whatever it is for a zero-emission system.

Doing so will speed the transition to a zero-emission future.

The specific recommendation for CORE is not to fund the ICE power augmentation, but also not to preclude a vessel with an ICE generator from receiving CORE funding.

Recommendation #2: Change surplus emissions funding strategy because it doesn't work for zero-emission requirements and it punishes vessel operators who have upgraded to cleaner engines.

Moyer funding is based off of reducing emissions beyond regulatory requirements or surplus emissions. In requiring short-run ferries to be zero-emission, CARB staff told the CARB board that these conversions "will be eligible for up to 85% project funding". However, there are no surplus emission credits available beyond zero-emissions. As one AQMD staffer said to Green Yachts, "the regulations take all the emissions credit leaving very little or nothing for surplus funding". We agree. When Moyer was created, a world in which we would be getting emissions down so far that the surplus emissions credit was non-existent could not have been envisioned. But that is our reality today. Moyer needs to change its funding strategy because surplus emissions funding is in conflict with increasingly stringent emission targets as there are no emission reductions possible beyond the requirements. Therefore, as the projects to reduce emissions get increasingly expensive, surplus funding beyond the requirements become "very little or nothing."

As an example, by requiring zero-emissions, CARB effectively eliminated Moyer funding for the short-run ferries, which is the first class of vessels required to be zero-emission. Our recommendation is to make Moyer funding for zero-emission platforms (100% zero-emission and serial hybrid), whether it is a regulator requirement or not, be based on total emissions reduced and not based on surplus emissions reduced beyond the regulatory requirement. This will create an advantage for vessel operators to consider zero-emission propulsion systems and create a market incentive to adopt zero-emission technology because more funding would be available if one was funding emission reductions and not surplus emission reductions for zero-emission projects.

Secondly, the surplus emissions credit reduces funding for vessel operators who have upgraded their emissions. This creates a reverse incentive causing vessel operators to hold out as long as possible before upgrading their engine. For example, a vessel with twin 400 HP engines and 2000 annual hours upgrading from Tier III engines to Tier IV would get \$349,281 whereas the same vessel with Tier II engines would get \$566,127. This is the wrong incentive that discourages vessel operators from upgrading.

Recommendation #3: Create a valuation for GHG emission reductions in Moyer funding and all California funding programs.

Currently, the Moyer program only funds emissions reductions based on NO_x (nitric oxide), ROG (reactive organic compounds) and PM (particulate matter). What about CO₂ or CH₄? CARB is creating programs to address GHG emissions, but to date has placed no value nor created any formula based on reducing GHG. There are emission values for a ton of NO_x in these funding guidelines. But not for CO₂ or CH₄. We recommend adding GHG emissions to the valuation of emission reductions. This will further create an incentive for adopting zero-emission technology.

Recommendation #4: Update Moyer funding guidelines for zero-emission (labeled as hybrid in the Moyer guidelines) projects so that total cost of a zero-emission project is eligible.

The Moyer program has decades of experience and has developed the guidelines based on this experience to clearly define what is able to be funded and what is not. These restrictions are appropriate for a diesel to diesel repower and prevent CARB funds from being used for unnecessary vessel modifications that are not required elements of the repower.

Recommendation 4.1 – change the terminology from hybrid to zero-emission platform.

Recommendation 4.2 eliminate the requirement that hybrid (zero-emission) platforms be EPA verified. The EPA has told Green Yachts that they have no current plans to certify zero-emission systems and thus every zero-emission platform would require an exemption to this requirement.

Recommendation 4.3 – eliminate the requirement that the vessel must meet EPA verification parameters for the proposed hybrid system. No such EPA verification parameters exist and thus every zero-emission platform would require an exemption to meet this requirement.

Recommendation 4.4 – Require EPA Tier III or higher auxiliary engines. While our goal is to reduce emissions, we do not believe requiring Tier IV auxiliary engines for zero-emission systems for two reasons. First, it is prudent because the goal is to replace this ICE auxiliary generator with renewable technology as soon as possible. Increasing the cost of the equipment intended to be removed could unduly delay the removal of the auxiliary engine. 2. Often the auxiliary engine serves as an emergency generator and is not used in daily use. It would not be the most effective reduction of emissions to invest in the most expensive auxiliary engine equipment that is rarely used. If the requirement is that the emissions from the platform, including those from the auxiliary engine, have to be 15% less than a Tier IV engine, then the emission reduction can be better achieved by extending the range of zero-emission operation rather than requiring a higher tier auxiliary engine. Make the emphasis be on

spending more of the repower budget on the zero-emission platform and less on the auxiliary engine but still require 15% greater emissions reduction than a diesel repower. In this way, the requirements don't emphasize emission reductions in the auxiliary engine and allow more of the investment to be made in zero-emission battery storage and/or other components of the zero-emission platform. Tier IV engines are very difficult to maintain. For example, one ferry operator pulls out its Tier IV engines very 10,000 hours and replaces them with another Tier IV engine so that they can take apart and rebuild the Tier IV engine removed. If a zero-emission platform is only required to have a Tier III engine, it greatly reduces the maintenance cost of the system and allows the focus to be on achieving the emissions reduction with the zero-emission platform.

Recommendation 4.5 – Do not require a manufacturer warranty for the duration of the project life for zero-emission systems. This is prejudicial compared to the requirements for a diesel repower. Diesel manufacturers, on average, warranty an engine for 12 months. If a project life is ten years, Moyer guidelines effectively require a zero-emission platform to have a warranty ten times longer than that of a diesel engine manufacturer. It is appropriate and fair for a zero-emission platform manufacturer to provide and publish the details of its warranty. It is not fair to place warranty requirements on a zero-emission platform while not placing warranty requirements on an ICE.

Recommendation 4.6 – The project life for a diesel engine has a maximum of 16 years. The project life for a zero-emission repower has a maximum project life of 5 years. That is prejudicial treatment of a zero-emission platform because it makes the emissions credits/funding for a zero-emission platform less than for a diesel engine. We recommend making the maximum project life equal between a diesel and a zero-emission platform repower.

Recommendation 4.7 – The ineligible costs guidelines need significant modification.

- USCG Design Documentation – the average cost in time/labor of preparing documentation for a diesel repower is \$2,500. For a zero-emission repower, it is \$400,000. The documentation for a zero-emission repower alone can cost more than a complete diesel repower. Though not specifically defined in Moyer guidelines, CARB and AQMD staff have said that funding for the documentation required for a zero-emission repower is ineligible. Moyer guidelines should clearly state that funding the documentation required for a zero-emission platform is eligible. Furthermore, because these initial costs for considering a zero-emission platform are so high, there is inequitable access to zero-emission options for micro-businesses, businesses in disadvantaged communities and minority/women owned businesses. We recommend that, through Moyer or another program, CARB provide a way for micro-businesses, businesses in disadvantaged communities and minority/women owned businesses to receive upfront funding for USCG design review documentation in order to provide equitable access to zero-emission options.
- Propellers and Shafts - When converting from diesel to a zero-emission platform, the RPMs (rotations per minute) on the shaft often change significantly. This necessitates a change in propeller or at a minimum a repatching of the existing propeller. The propeller cost is part of a zero-emission repower and should be funded. An electric motor is 50-100 cm in length whereas a diesel engine and transmission are 200-400 cm in length. Thus, it often requires a longer shaft to install an electric motor. The shaft cost is part of a zero-emission repower and should be

funded. Rudders in no way are affected by a zero-emission repower, regardless of what is done to the propeller or shaft, and should not be funded as is the case in current guidelines.

- Steering system – many marine vessels have the steering system coupled to and driven by one of the propulsion engines. When a zero-emission platform repower is performed, any system coupled to the engine will have to be upgraded to current standards by the USCG. This steering system upgrade would not be required except for the fact that the vessel is being repowered to a zero-emission platform. In general, a funding questionnaire for Moyer funding for a zero-emission platform should ask what systems are attached in any way to the engine and to provide a picture. Anything attached to the diesel engine should be eligible for funding as it will have to be changed and/or brought to USCG current requirements due to the zero-emission platform repower
- Sea trials – The definition of sea trials is unclear as it could refer to multiple things. What should be included in a zero-emission repower are the following:
 - Load testing – the way to test a zero-emission platform is to run it under load. Load testing can only be done in the water with resistance upon the propeller from the water. Therefore, operating in the boat in the water, both at the dock in the form of a bollard pull test as well as untethered is a critical important component of quality control during the installation process of a zero-emission platform
 - Crew training – the crew does not need training after a diesel repower because the operation is the same. After a zero-emission conversion (from a diesel, not from a zero-emission to zero-emission repower), the crew needs to be trained on how to operate the system because it is completely different. This is a one-time cost for the first vessel repower to a zero-emission platform and not a requirement in any subsequent zero-emission repowers
 - Safety procedures – the safety procedures are very different on a zero-emission platform. Instead of knowing how to respond to an engine failure, the crew need to learn how to respond to new types of safety responses for things like voltage communication errors, battery internal temperature errors, ground or balance fault error, MCU (master control unit) communication with BMS (battery management system) error, SOC (state of charge) error, etc. It will increase safety and success of zero-emission platforms on marine vessels in California if this is not just acceptable for funding, but encouraged. This is an essential part of making the transition to zero-emission platforms safe and needs to be an approved expense as part of a diesel to a zero-emission repower.
 - USCG sea trials – the USCG requires satisfactory demonstration of all operational procedures and safety responses as part of its COI (Certificate of Inspection) for a zero-emission platform, but does not require this for a diesel repower. This is a required element of a zero-emission conversion.
- USCG stability test – a light-ship stability test is not required in most cases on a diesel to diesel repower. It is required in most cases for a zero-emission platform conversion because the net weight of equipment changed is so significant when one factors the propellers, the transmissions, the charging system, the ventilation system and all the components that have to be changed as part of a conversion from diesel to zero-emission platform. Thus, a light-ship stability test should be funded by the Moyer program in a one-time conversion from diesel to

zero-emission because the conversion to diesel to a zero-emission platform requires a light-ship stability test and is part of the cost of converting to zero-emission platforms.

Recommendation #5: Due to the high cost and long time-frames of a zero-emission repower, distribute funding during the conversion to zero-emission platform at defined project milestones instead of as one lump reimbursement at project completion. Or as a lesser substitute, provide a zero-interest loan until project completion.

Currently, a zero-emission platform repower from a diesel costs 8-12 times as much as a diesel to diesel repower. Instead of taking 3-6 months, they take 4-6 years meaning they are significantly longer. A vessel operator is incapable of funding a \$2M to \$10M project for 4-6 years without taking out a loan with interest costs of \$200,000 to \$1,000,000 over the course of the project. The interest alone is equivalent to the cost of a diesel to diesel repower on most vessels. Providing funding at defined completion points during the project and/or offering a zero-interest loan is essential. Potential completion points for funding are USCG design review approval (indicating both that the design documentation was completed successfully and the equipment being installed is all approved), the on-shore charging system is permitted (indicating that the electrical engineering plan was done as required and the equipment for installation was approved), the on-shore charging system was installed and the local municipality inspection was completed, the vessel conversion is completed and the vessel operates back and forth (the current CARB completion test) and the USCG COI is issued meaning the conversion was done according to the approved design and the crew demonstrated an ability to follow all operational and safety procedures). These defined project milestones allow project funding to be disbursed with confidence before the full project is completed as a way of making the project financially feasible. Another alternative is to offer zero-interest loans. However, we believe that defined milestone funding is more effective and less costly.

Furthermore, this approach would better protect CARB from funding vessels that are not technically viable. Today, CARB and the AQMDs could fund a commercial vessel that is operational, but does not meet the requirements for a US Coast Guard COI (Certificate of Inspection) required for commercial operation. This would mean CARB's funding would go unutilized or have to be repaid by the vessel operator. CARB staff are being asked to evaluate the equipment onboard a vessel during a repower, when this is outside their technical expertise. CARB could rely on more in-depth technical reviews by professionals trained to do such reviews by aligning funding with the US Coast Guard design review and COI as well as local municipality building permit and inspection. The technical experts conducting these approvals provide greater security to CARB that the design and installation of all equipment is done properly.

Recommendation #6: Transfer clean engines to recipient vessels in developing nations or states with no/low emission standards instead of spiking them

While our goal at Green Yachts is to eliminate all ICEs in the world, I think it is important to recognize that as California moves towards zero-emission, there are relatively clean burning engines that current Moyer guidelines require to be spiked when upgraded to Tier IV engines or zero-emission platforms. Wouldn't it make more sense to donate or sell an EPA Tier III engine to a vessel owner who has a Tier 1

or 0 engine and spike that Tier 1 or 0 engine instead of spiking the Tier III engine? What if California had a partnership with Mexico or Costa Rica to transfer EPA Tier III or cleaner engines there? “There is an urgent need to facilitate the transfer of technology to developing countries,” said Ceyla Pazarbasioglu, Vice President for Equitable Growth, Finance and Institutions at the World Bank Group. It hurts the environment to spike an EPA Tier III engine taken out of one vessel and consume the metal and energy to produce a new EPA Tier III engine to put in other boats or for a vessel to run a Tier 0 engine when it could get and install a Tier III engine at low cost if it is donated. California is far ahead of other states and Central and South American nations on marine vessel emission controls. Why are we spiking engines that could play a role in reducing emissions around the world? For every EPA Tier III engine transferred to a developing nation that replaces a Tier 0 engine, an extra 2 tons of NOx is reduced annually. If all the Tier III engines that have been installed over the past 10 years and in the next ten year are transferred instead of spiked when they are upgraded to Tier IV or zero-emission, these Tier III engines could reduce NOx emissions by thousands of tons annually in nearby states or countries if they replace Tier 1 or 0 engines.