



Version 1.3 3/22/09

Typical weekend outing comparing the new EnergyTech Marine “Power Core™” Hybrid system to a standard twin diesel installation

This scenario describes a common mission performed by private yachts in San Diego California and other coastal cities all over the world. It is a weekend trip to Catalina Island and back. The distance each way is 70 nautical miles (80 statute miles). Although our EnergyTech Marine 83 HD-X is a sailing yacht and offers hydroelectric turbine regeneration, neither of those benefits is used to produce energy or thrust. This scenario is *motoring only*, so as to be compared to a motor yacht.

This 83’ yacht is offered with the new Pulse buffering Power Core hybrid energy system. It is the only superyacht sized full electric vessel offered at this time. The Power Core is a proprietary closed system, which converts various energy sources to stored charged ions in its internal super capacitors or lithium-ion energy storage system. It replaces the standard diesel propulsion engines, diesel generators, and lead acid battery banks of a normal installation. The Power Core converts a vessel to all-electric, for propulsion and hotel AC loads. To learn how it works see the “Pulse Buffering Power Core” paper at EnergyTechMarine.com

With the Power Core you have the option to charge its Lithium-ion energy storage system at the dock from the public utility grid. This would allow you to complete the voyage without ever starting its encapsulated diesels if you were willing to run the mission at slower trawler speeds. However, for this example we are going to calculate travel at traditional diesel motoring speeds and use lots of energy for water maker, air conditioners, washer, dishwasher, 240VAC clothes dryer and such. So the dockside charge will only provide a small part of the mission and the Power Core’s high-power diesel driven industrial alternators will be called on to recharge the super capacitors and the lithium-ion energy bank to supply the rest of the power needed underway.

The EnergyTech vessel with the Power Core is always propelled by electric motors and the impellers have no direct mechanical link to an internal combustion engine. With the Power Core you can charge the enormous lithium-ion storage system by plugging it in at the dock or by running the 400 kW of industrial alternators at sea. The system can be completely recharged at sea in 40 minutes and can supply extreme hotel loads at anchor for many days on a single charge.

The vessel does not have normal diesel AC generators to produce 120VAC or 240VAC household electrical appliance loads. Those loads are simply inverted from the huge Power Core energy storage system. These loads are hardly noticed. This also saves a lot of space, noise and pollution. Also, new generator silencing laws popping up all over the world prohibit running generators in many anchorages at night.

The vessel has six cabins including two separate crew quarters. For this outing there are eight guests and two crew, for a total of ten people for whom we will cook, provide showers and air conditioning, and wash and dry clothes.

The voyage departs the dock in San Diego at 7PM Friday evening after everyone gets off work and returns to the dock by 5AM Monday morning in time for everyone to leisurely have breakfast aboard and get ready for work.

On Friday night the group parties and dines then sleeps underway to the island at eight knots, which is the nighttime cruising speed. It arrives at the island and gets anchored by about 4AM Saturday morning, set for two days of sun and snorkeling. The outing usually includes motoring around the island about 20 miles at 10 knots sightseeing over the two days of Saturday and Sunday. The vessel then sets out for the return to San Diego at 8PM Sunday evening, at night-cruising speeds of eight knots, to be docked by 5AM. A refreshing outing, which leaves you feeling like you have just enjoyed a much longer vacation.

We compare this mission by starting with a normal diesel installation. It includes twin diesel engine propulsion and a (constantly running) 30kW generator. The fuel costs are reflected below @ the current price of \$3.00/gallon.

Normal diesel installation	Gallons consumed	Cost for energy
140 NM @ 8 knots	69.3	\$207.9
20 NM @ 10 knots	16.7	\$ 50.1
30kW genset runs continuously	94.5	\$283.50
Total gallons & cost	180.5	\$541.50

The same identical mission operating with the Power Core system would cost much less. This is based on a blend of a utility grid price of \$0.13/kWh for plug in electricity, and the increased efficiency of the hybrid electric energy system. See below.

Power Core installation	Kilowatts consumed	Cost for energy
KWh consumed at 10 knots	294.4 kWh	
KWh consumed at 8 knots	986.1 kWh	
KWh for hotel AC loads	101.5 kWh	
Total kWh consumption	1,382.0 kWh	
Cost of energy from plug-in	320.0 kWh	\$ 41.60
Cost for energy generated at sea	1,062.0 kWh	\$201.78
Total cost		\$243.38
Cost efficiency comparison		223%

The identical amount of energy would be either absorbed by the jet drives or consumed by the electric appliances in both missions. Even after the inherent losses of 15% for the

Power Core system, it is still so much more efficient that it doesn't consume as much energy to perform the same work. Also, some of the mission can be run with energy purchased from the electric company at less than the cost of the fuel dock diesel equivalent. The Pulse Buffering Power Core installation uses much less energy and uses a lot of energy that costs less.

The cost for the identical outing aboard the Power Core vessel would be \$243.38 compared to \$541.50, a cost efficiency of 223%. The savings for one weekend are \$298.12 at the current \$3.00 US/gallon diesel price. The savings in emissions are even more dramatic. The normal diesel installation with generator runs engines for a combined 97 hours. The Pulse Buffered Power Core total diesel engine runtime is five hours and eighteen minutes for the same outing. This means the Power Core system runs diesels only 5.4% as much. Add to this fact that the diesels in the Power Core run at 100% loading at all times, greatly increasing engine life.

Most significant is that hotel loads with standard diesel generators require an engine to run for 58 continuous hours to provide the same amount of power, on demand, that the hybrid installation can provide by running a single diesel for 30.45 minutes for the entire outing.