Recreational Boating and COP21 "Paris Agreement"

- Recreational boats consume 140,000 barrels/day oil equivalent @ .475 tons CO_2/barrel or **665,000 tons of CO_2/ day, 1% of US transportation fuel, more than busses.** (See Appendix)
- Current EPA regulation of boats fall far short of CAFÉ automobile standards and extend the useful (or rather, counterproductive) life of old, inefficient, polluting boats indefinitely.
- Cars and trucks already get 10x better fuel mileage than recreational boats, new or used.
- This problem is inescapable, as boats will be the very last vehicles to be electric, due to the prohibitive weight and cost of the required battery capacity at 5-10x the requirements for cars.

Effect of current regulation on NEW boat sales:

1. EPA's current standards encourage fuel-inefficiency.

The Premier 310 Dodici below is fully compliant with current EPA grams/kwh regulations and is in one of the fastest growing new boat market segments. It can go 57 mph using **72.3 gallons per hour,** and **the best it can do at any cruising speed is 1.6 mpg.**

http://www.boattest.com/review/premier/3516_310-dodici

As shown above, while marine engines have been getting more efficient, they are being used less efficiently in new boats. Boat buyers are far more interested in performance than in fuel economy, and the EPA's current g/kwh efficiency standard enables this (COP21 dysfunctional) behavior.

2. Used Boat Sales Now Dwarf New Boat Sales.

Today, more than 9 out of 10 boat buyers buy used boats. In sterndrive boats, still the most popular family boat type, over 9.5 out of 10 buy used boats. In 2015, only 12,000 new sterndrive boats were sold into a US registered base of 1.6 million. 150,000 of these boats were sold new in 1989, tapering down to 70,000 in 2007, just before the great recession and the 2010 imposition of catalytic converters.

Why used sterndrive boats dominate sales:

1. New outboard boats, like the one shown above, are more competitive on a performance/cost basis. This is partly because they do not carry the reported $2500 additional cost of **emission control technology** required in new sterndrive boats, and partly due to the improved technology in outboard motors and the related innovations in outboard boats.

2. EPA regulations require new sterndrive and inboard boats sold in 2010 and later years to have **catalytic converters** and closed fuel systems. These systems must be maintained, which buyers see as an additional cost to the already high maintenance costs of a boat.

3. 2009 and earlier boats may have their engines rebuilt or replaced **forever** (either with old carbureted engines or with new high-performance engines) without ever requiring the costs associated with catalyst and closed fuel systems.

4. Buyers see no performance innovation in new sterndrive boats to justify their higher cost.

Just how bad is it? And how bad is it going to get?
→ *Here is the latest industry news:*

The Age of Vessels is Increasing.

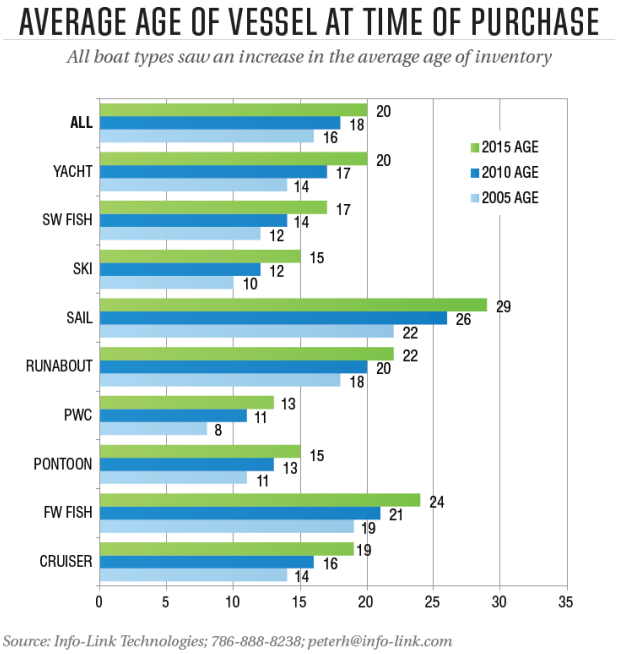
". . Peter Houseworth, director of client services at Info-Link, says this aging inventory goes back to boats built in the 1960s and 1970s; those boats were built in such a way that

they could effectively be used "forever" if maintained properly.

"They don't expire, given that you can repower them."

In current years, the boating industry is adding roughly 235,000 units to a fleet of 11 million. ". . .so we're adding about 2 percent to the fleet every year. Basically, the size of the fleet is flat to declining slightly, but it's hard to influence if you're only adding 2 percent every year,"

From Boating Industry's Market Data Book 2016
www.BoatingIndustry.com.



Since this sea of used vessels can be legally repowered forever with inefficient systems,
→ ***how can their 665,000 tons of CO2/ day effect on the environment ever be reduced?***

Regulations Required to Meet COP21 Paris Agreement

There is technology available that addresses all the issues raised above in one package. Its acceptance requires EPA regulation of boat carbon emissions similarly to the Agency's regulation of automotive carbon emissions with the current Corporate Average Fuel Economy (CAFE) standards for automobiles.

Prospective New Boat Regulation:

For new boats the EPA could establish a series of classes of boats based on size and function, establish a mpg requirement for each class, and use a CAFÉ scheme like the one for automobiles. Such a CAFÉ scheme would also result both in more efficient boat hulls and in more efficient propulsion.

Prospective Used Boat Regulation:

Even a phased-in CAFE for new boats will make new boats even less competitive in terms of performance/cost, which will again have the effect of driving down new boat sales and extending the life of pre-2010 boats. The only way to prevent these unintended consequence is to **impose additional regulations on the sea of used boats**.

Such regulations are inescapable if there is to ever be a meaningful reduction in boat carbon emissions.

Used-boat regulations suggested by market and COP21 Paris Agreement realities:

1. Require that all gas marine replacement motors be electronically controlled and **fuel-injected**, which would eventually eliminate the use of carburetors in boats, which would be justified by reductions in $C0_2$, CO, VOC, and NO_x emissions, as well as by the prevention of explosions and fires due to gasoline leaks from the carburetor into the bilge. The vast majority of sterndrive and inboard boat engines now in use are carbureted and used inefficiently.

2. Provide a "Cash-for-Clunkers"-like payment, a tax credit, or other incentive to encourage the **replacement of existing carbureted engines and inefficient propulsion systems with a more efficient boat propulsion system.** This would be justified by reductions in $C0_2$, CO, VOC, and NO_x emissions and by eliminating the exposed propeller to mitigate the "Propeller-related Environmental Issues" detailed below. (Such a system would include/require an electronically controlled, fuel injected engine, such as are universally used/required in new automobile motors and in new inboard and outboard boat motors. It would also include a more efficient means of converting the motor's shaft power into thrust force for propelling the boat. Such systems would be tested/certified by the EPA to qualify for such tax credits.)

In Addition to Emissions, Boats Have Other Propeller-Related Environmental Issues:

1. Human Health and Safety. Open propeller drives on boats are about the only device in common use that maims or kills people around it. If a situation like this were found in a factory, OSHA would not allow it and would require immediate remediation to mitigate the hazard.

2. Protection of Marine Life. Injuries to marine mammals, sea turtles, fish, coral, sea grass, and other marine life also commonly result from open propeller drives.

3. Pollution of navigable water. Propeller drives are known for disturbing the bottom, which releases pollutants into the water and destroys habitat for marine life.

Conclusion:

The proposed regulations will be necessary under the COP21 Paris Agreement for the reduction of boat carbon emissions in any event, and they will also be an opportunity to eliminate propeller injuries to people, wildlife, and water quality.

We are using the values in the projected 2020 column of Appendix below for our statement at the top of this White Paper. Note that Recreational Boats are projected to grow from 1% to 1.2% of transportation fuel between 2020 and 2040. We believe that 1.2% could be cut to 0.7% or less and **2040 recreational boat CO2 emissions from 818,000 tons of CO_2/ day to 480,000 tons of CO_2/ day.**

Appendix: U.S. Energy Information Administration | Annual Energy Outlook 2016, Page A-17

Table A7. Transportation sector key indicators and delivered energy consumption *(continued)*

Key indicators and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Energy use by mode (million barrels per day oil equivalent)								
Light-duty vehicles	8.45	8.60	8.52	7.66	6.98	6.60	6.47	-1.1%
Commercial light trucks[1]	0.42	0.42	0.43	0.41	0.39	0.39	0.40	-0.2%
Bus transportation	0.13	0.13	0.13	0.14	0.14	0.14	0.15	0.6%
Freight trucks	2.59	2.67	2.77	2.87	2.96	3.14	3.36	0.9%
Rail, passenger	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.9%
Rail, freight	0.23	0.23	0.24	0.25	0.24	0.24	0.24	0.2%
Shipping, domestic	0.05	0.05	0.04	0.04	0.04	0.03	0.03	-1.4%
Shipping, international	0.29	0.33	0.29	0.31	0.31	0.33	0.34	0.1%
Recreational boats	0.13	0.13	0.14	0.15	0.16	0.16	0.16	0.8%
Air	1.14	1.15	1.22	1.29	1.36	1.42	1.45	0.9%
Military use	0.31	0.31	0.31	0.31	0.33	0.35	0.38	0.8%
Lubricants	0.06	0.06	0.07	0.06	0.07	0.07	0.07	0.2%
Pipeline fuel	0.41	0.42	0.39	0.42	0.44	0.47	0.51	0.7%
Total	**14.23**	**14.52**	**14.57**	**13.92**	**13.45**	**13.36**	**13.58**	**-0.3%**

[1]Commercial trucks 8,501 to 10,000 pounds gross vehicle weight rating.
[2]CAFE standard based on projected new vehicle sales.
[3]Includes CAFE credits for alternative fueled vehicle sales and credit banking.
[4]Environmental Protection Agency rated miles per gallon.
[5]Tested new vehicle efficiency revised for on-road performance.
[6]Combined"on-the-road" estimate for all cars and light trucks.
CAFE = Corporate average fuel economy.
Btu = British thermal unit.
Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.
Sources: 2014: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016; EIA, Alternatives to Traditional Transportation Fuels 2009 (Part II - User and Fuel Data), April 2011; Federal Highway Administration, *Highway Statistics 2012*; Oak Ridge National Laboratory, *Transportation Energy Data Book: Edition 34*; National Highway Traffic and Safety Administration, *Summary of Fuel Economy Performance* June 2015; U.S. Department of Commerce, Bureau of the Census, "Vehicle Inventory and Use Survey," EC02TV; EIA, U.S. Department of Transportation, Research and Special Programs Administration, *Air Carrier Statistics Monthly, December 2010/2009*; and United States Department of Defense, Defense Fuel Supply Center, Factbook January, 2010. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. **Projections:** EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.