The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

U.S. Air Force Report to Congress Bashes Navy's Biofuels Program

Posted by Robert Rapier on February 27, 2013 - 9:08am

The following article by Robert Rapier originally appeared on his R-Squared Energy column at Energy Trends Insider, where he serves as Managing Editor and Director of Analysis.

Sailors assigned to Riverine Group 1 conduct maneuvers aboard Riverine Command Boat (Experimental) (RCB-X) at Naval Station Norfolk. The RCB-X is powered by an alternative fuel blend of 50 percent algae-based and 50 percent NATO F-76 fuels to support the secretary of the Navy's efforts to reduce total energy consumption on naval ships. (U.S. Navy photo by Mass Communication Specialist 2nd Class Gregory N. Juday).

In 2010 I conducted an interview with Tom Hicks, who is the Deputy Assistant Secretary to the Navy (Energy). During the interview, Tom described the Navy's efforts in pushing for widespread availability of biofuels for Naval operations. He stated that sourcing alternative energy is a top priority for the Navy, and would enhance its war-fighting capabilities. He said the Navy sees itself in a leadership role in driving a transition to "homegrown, secure, independent sources of fuel."

The goal, as described by Tom, is for biofuels to make a major contribution toward the fuel needs of the Navy by 2020. The Navy has embarked upon an initiative called the "Great Green Fleet" in which they would deploy a strike group on all alternative fuels by 2016. By 2020, the goal is for 50% of all of the Navy's energy consumption to come from alternative sources. In pursuit of this initiative, the Navy is doing research, and testing and certifying all of their engines on renewable fuels.

The Critics

The program has had its critics. A 2011 congressionally-mandated study by the Rand Corporation suggested that renewable isn't necessarily better for the military. The study concluded "There is

no direct benefit to the Department of Defense or the services from using alternative fuels rather than petroleum-derived fuels." Secretary of the Navy, Ray Mabus, stated that he disagreed "vehemently" with the report. One of the reasons for this conclusion is that the military is near the front of the line if fuel scarcity became a problem, and thus they do not need to push biofuels.

Other critics have suggested that the Navy is wasting taxpayer dollars on a program that should fall under the domain of the Department of Energy. In a July 27, 2012 letter to Secretary Mabus, U.S. Sen. John McCain (R-Ariz.) stated that the navy should stick to building and operating ships. McCain wrote "You are the Secretary of the Navy, not the Secretary of Energy."

Air Force vs. Navy

On March 1st, 2013, the US Air Force journal — Strategic Studies Quarterly — will publish an article highly critical of the Navy's efforts. This periodical is sent in hard copy to Congress and top military leaders. The article is entitled *Energy Insecurity: The False Promise of Liquid Biofuels* and will become available online about 25 Feb at http://www.au.af.mil/au/ssq/.

A longer version of this paper is available at the end of this article.

The article is incredibly in-depth, and raises a number of points that I have not seen raised elsewhere. For instance, one of the selling points that has been used to justify the Navy's efforts is that if fuel could be produced locally, it would cut down on casualties. In Part 3 of my interview with Tom Hicks, he stated:

> And just to give you a sense – and this is based on Army study – but for every 24 fuel convoys that we bring into the theater, we have one casualty. So that's one soldier, one marine, killed or wounded who is not otherwise fighting the fight or engaged with the local population to build a nation. That's a big part of what is driving this as well, that there is a human cost to this; a big price to pay and we are very concerned about that.

CAPT T. A. "Ike" Kiefer, who is with Department of Strategy at the USAF Air War College — and is the author of this new report — disputes that. In the report, he notes that in the case of lower-energy density biofuels:

> Moving a given quantity of energy around a battlefield as biodiesel instead of petroleum diesel would require 8% more tanker trucks, ethanol or bio-oil 65% more, liquid hydrogen 280% more. Substituting biobutanol, biogas, ammonia, fuel cells, capacitors, or batteries in place of hydrocarbons on the battlefield would require even longer convoys that expose more Soldiers and Marines to enemy attack, not fewer.

Energy Return on Investment

Kiefer argues that certain deficiencies preclude biofuels from replacing petroleum as a national-scale transportation fuel. In his report, biofuels are evaluated with respect to energy return on investment (EROI), energy density, water footprint, food competition, environmental footprint, and lifecycle greenhouse gas (GHG) emissions. The author argues that biofuels will harm national and global security more than they will help.

One of the more interesting arguments in the paper concerns the EROI needed by modern society. The author gives some historical examples from ancient Rome, and then argues that when the EROI of society is below 6/1, "industrial civilization is locked into a death spiral where an ever increasing fraction of its economic output (GDP) is spent on energy at the cost of an eroding standard of living." When the EROI drops below 3/1, he states that we can either find sources with higher energy returns, or "decay into a pre-industrial civilization with lower energy needs."

This argument is significant because almost all biofuels are produced at an EROI of less than 3/1. Certainly — as I have noted many times — as the EROI declines, society will have to devote more time, effort, and energy (literally) into producing usable energy for society. The lower the EROI, the greater the input from society in order to produce the same amount of energy.

The Costs

Table 1 of the report will undoubtedly raise some eyebrows:

Table 1: Department of Defense Fuel Purchases

DoD Biofuels Purchases						
Date	**Contract**	**Vendor**	**Fuel**	**Gallons**	**$ Total**	**Per Gallon**
Aug 2009	SP0600-09-D-0519	Sustainable Oils	Camelina JP-5	40,000	2,664,000	**$66.60**
Aug 2009	SP4701-09-C-0040	Solazyme	Algae F-76	20,055	8,574,022	**$427.53**
Sep 2009	SP0600-09-D-0518	Solazyme	Algae JP-5	1,500	223,500	**$149.00**
Sep 2009	SP0600-09-R-0704	UOP (Cargill)	Tallow JP-8	100,000	6,400,000	**$64.00**
Sep 2009	SP0600-09-D-0520	Sustainable Oils	Camelina JP-8	100,526	6,715,137	**$66.80**
Jun 2010	SP0600-09-D-0519	Sustainable Oils	Camelina JP-5	150,000	5,167,500	**$34.45**
July 2010	SP0600-10-D-0489	Sustainable Oils	Camelina JP-8	34,950	1,349,070	**$38.60**
Aug 2010	SP0600-10-D-0490	Sustainable Oils	Camelina JP-8	19,672	759,339	**$38.60**
Aug 2010	SP0600-09-D-0520	Sustainable Oils	Camelina JP-8	100,000	3,490,000	**$34.90**
Aug 2010	SP0600-09-D-0517	UOP (Cargill)	Tallow JP-8	100,000	3,240,000	**$32.40**
Sep 2010	SP4701-10-C-0008	Solazyme	Algae F-76	75,000	5,640,000	**$75.20**
Aug 2011	SP4701-10-C-0008	Solazyme	Algae F-76	75,000	4,600,000	**$61.33**
Sep 2011	SP0600-11-D-0526	Gevo	Alcohol to JP-8	11,000	649,000	**$59.00**
Sep 2011	SP0600-11-D-0530	UOP	Bio JP-8	4,500	148,500	**$33.00**
Nov 2011	SP0600-11-R-0705	Dynamic Fuels (Tyson, Syntroleum, Solazyme)	Tallow & Algae JP-5 Tallow & Algae F-76	100,000 350,000	12,037,500	**$26.75**
Feb 2012	N68936-12-P-0209	Albemarle	Cobalt n-Butanol to Jet Fuel	55	245,000	**$4,454.55**
Sep 2012	SP0600-13-D-0452	Amyris	Sugar F-76	18,000	463,140	**$25.73**
Sep 2012	SP0600-12-D-0561	Gevo	Alcohol JP-8	45,000	2,655,000	**$59.00**
DoD Synthetic Fuels Purchases						
Jun 2007	SP0600-07-D-0486	Equilon	Natural Gas to Aviation Kerosene	315,000	1,075,694	**$3.41**
Jun 2008	SP0600-08-D-0496	SASOL	Coal to Aviation Kerosene	60,000	225,000	**$3.75**
Jul 2008	SP0600-08-D-0497	SASOL	Coal to Aviation Kerosene	335,000	1,306,500	**$3.90**
Sep 2009	SP0600-09-D-0523	PM Group	Natural Gas to Diesel	20,000	140,000	**$7.00**
DoD Bulk Contract Conventional Fuel Purchases						
FY 2010	Various		JP-8 Jet Fuel	2,296M	5,201M	**$2.26**
			JP-4 / Jet A-1	1,249M	2,884M	**$2.31**
			JP-5 Jet Fuel	541.8M	1,175M	**$2.17**
			F-76 / Diesel	805.7M	1,816M	**$2.25**
			Motor Gasoline	70.7M	174.1M	**$2.46**
FY 2011	Various		JP-8 Jet Fuel	2,079M	6,478M	**$3.12**
			JP-4 / Jet A-1	1,246M	4,032M	**$3.24**
			JP-5 Jet Fuel	529.3M	1,572M	**$2.97**
			F-76 / Diesel	875.9M	2,590M	**$2.96**
			Motor Gasoline	59.0M	186.6M	**$3.16**

When it was first announced that the Navy had spent $8.5 million for 20,000 gallons of algae-derived fuel from Solazyme, I reported on this story in U.S. Navy Pays Big Bucks for Biofuels. Following the article, Solazyme CEO Jonathan Wolfson contacted me to clarify that part of that contract was for research and development. Wolfson wrote:

> I wanted to clarify that the $8.5 million contract is actually an R&D contract that also includes a fuel delivery. Since that funding is directed to R&D and includes a delivery of fuel, it is inaccurate to divide the contract price by the number of gallons delivered to get to a dollar per gallon figure. We also announced a new contract with DoD and the Navy in September following on the heels of the successful delivery of the 20k gallon contract, which is also an R&D contract and includes a delivery of 150,000 gallons of fuel to the Navy. That contract is valued at a little over $10 million, but like the previous contract is not dividable into a per gallon price because of the R&D focus. Even though these contracts include R&D, you should also assume that the actual fuel production cost

(which we do not publish), is currently above commercial costs.

However, as I noted at the time the fact that the Navy is spending millions funding this research is strong evidence that algal fuel can't yet be produced at a competitive price — contrary to the claims of many hypesters.

Conclusion

The report is definitely worth a read. Even if you disagree with the premise, it is full of interesting historical tidbits. I don't agree with everything in the article, but the author makes many strong points. In any event, the report will undoubtedly be used as additional ammunition against the Navy's efforts to create a Great Green Fleet.

You can view the report "21st Century Snake Oil" here.