

US Military's Carbon Footprint: Piloted Aircraft & Drones

Charley Bowman
Sierra Atlantic Chapter Meeting
Lunch Time Lecture
Binghamton NY
June 23, 2018



Sources

1. DoD's Addiction to Oil: Is there a Cure?, Dr. Fred C. Beach, Journal of Energy Security, March 2011. <https://fredbeach.files.wordpress.com/2015/09/iags-beachv4.pdf>
 2. Oil and the New Economic Order, Gal Luft, Journal of Energy Security, February 2008. http://www.iags.org/new_economic_order0208.pdf
 3. Personal communication from Nick Mottern, former newspaper reporter turned drone expert: www.KnowDrones.org
 4. The Bureau of Investigative Reporting: <https://www.thebureauinvestigates.com>
 5. United States cost of military force projection in the Persian Gulf, 1976–2007, Roger Stern, Energy Policy 38 (2010) 2816–2825
 6. <https://theintercept.com/drone-papers/the-assassination-complex/>
- ...others as noted.



2018

World Annual Oil Consumption: 36.2 Billion bbls/year

US Consumption: 7.3 billion bbls/year (20% of world)

US Imports: 3.7 billion bbls/year

Tight Oil: 2.1 billion bbls/year (28% of US oil)

Pentagon: 0.10 billion bbls/year (1.3% of US)

CO₂: US Consumption: 3,130 million metric tons (MMT)/year

Tight Oil: 900 MMT/year

Pentagon: 43 MMT/year

Sources: EIA, Union of Concerned Scientists



Burning Fossil Fuels

Approximate Rule for Oil, Gasoline, Methane, or Coal:

1 pound of fossil fuel emits 3 pounds of CO₂

1 gram of fossil fuel emits 3 grams of CO₂

1 gallon of gasoline weighs 6.3 lbs 19 lbs of CO₂

Source: <https://dothemath.ucsd.edu/2011/08/recipe-for-climate-change/>



Driving 100 Miles in Your Car

Prius: 53 MPG	35 lbs CO ₂
Dodge Intrepid: 28 MPG	67 lbs CO ₂
Chevy Bolt: 4 Miles/kWh	25 kWh ??

How can we estimate CO₂ emitted for EVs?



NYISO Zone Map



Zone kWh/lb CO₂

A	5.1* Buffalo
B	6.2 Rochester
C	3.1 Syr/Ithaca
D	31.4 Watertown/Utica
E	31.4 Plattsburgh
F	1.2 Albany
G	1.0 Newburgh
H	7.0 Peekskill
J	0.92 New York City
K	1.1 Long Island
NYCA:	1.9 NYS Overall

* See appendix I



Driving 100 Miles in Your Car

NY State

Mileage	CO ₂ Emitted
Prius: 53 MPG	35 lbs CO ₂ ¹
Dodge Intrepid: 28 MPG	67 lbs CO ₂
Chevy Bolt: 4 Miles/kWh ²	25 kWh
Buffalo Chevy Bolt:	4.9 lbs CO ₂ [*]
NY City Chevy Bolt:	27 lbs CO ₂ [*]
Utica Chevy Bolt:	0.80 lbs CO ₂ [*]

*While charging vehicle

1. Prius: overall MPG
2. Approx. summertime efficiency. Winter driving efficiency is much less.



Department of Defense Fuel Use 2008

120 million bbls of oil.....cost: \$16 billion (\$133/bbl)

Air Force Used: 113 million bbls oil.....cost: \$13 billion

51% used for transporting personel, fuel, munitions

28% used for attack missions

7% used for bombing missions

Source: Fred Beach



Aircraft Carrier: Persian Gulf

1 carrier on station 24/7/365 in the Persian Gulf since 1990

Carrier Deployment Cycle: 18 months

6 month stateside + 6 months overseas + 6 month stateside

Each pilot: 27 hours/month flight time

Each carrier: 60 pilots + 4 Hornet squadrons

Fuel Consumption/Hornet: 1,000 gallons per hour

Source: Fred Beach



Aircraft Carrier

Total fuel consumption during 18 month cycle: 26-28 million gallons

Cost of Fuel: \$62 - \$67 million over deployment cycle (2008)

CO₂ Released: 272,000 MT CO₂ over deployment cycle

Number of bombs released: 160 bombs/deployment (median 5 years)

160 bombs released = 160 targets destroyed (assumed)

Source: Fred Beach



Aircraft Carrier

For each target destroyed in Afganistan – piloted aircraft:

1 million gallons of fuel used

\$10 million cost of Hornet fuel

10,000 metric tons of CO₂ released

Typical Target: “...mud hut, sport utility vehicle”

Source: Fred Beach



Reaper Drones

Reaper Drone for 14 hours: 600 gallons 43 gallons/hour
1,200 drone pilots: 1,000 hours/year = 1.2 million flight hours¹

51 million gallons/year for drone operations
@100 gallons/MT CO₂: 510,000 MT CO₂ released/year

Total Drone Strikes in Afghanistan: 235 (FY 2015)²
Total Killed: 982 – 1434 (up to 16 children)
65,000 gallons/drone strike³
11,000 – 16,000 gallons/person killed
110- 160 MT CO₂ / person killed

1. Nick Mottern, www.KnowDrones.org, personal communication.
2. Drone Strikes in Afghanistan 2015: <https://www.thebureauinvestigates.com>
3. Assume 30% of the flight hours is devoted to Afghanistan



	<u>Piloted Aircraft</u>	Drone
Gallons Fuel/Strike:	1,000,000	65,000
MT CO ₂ Emitted/Strike:	10,000	110-160
Fuel Cost/Strike:	\$10,000,000	\$650,000

....and the wars continue....



Appendix I

Each NYISO zone produces GWh (1×10^9 Wh) from a mix of generator types (coal, methane, wind, hydro, etc) and produces a certain amount CO₂ doing so. See table below:

Zone	NYCA	A	B	C	D	E	F	G	H	J	K
2017 GWh	130,788.69	17,707.55	5,026.76	29,563.93	9,512.40	4,104.31	15,340.56	1,778.79	15,304.41	23,181.77	9,268.21
MMT CO2 from All Fuels	27.18	0.718	0.33	3.82	0.12	0.06	5.61	0.78	1.01	10.98	3.76
kWh per MT CO2	4,811.62	24,659.62	15,022.13	7,745.62	77,833.13	73,646.96	2,732.19	2,289.85	15,151.52	2,111.84	2,467.79
kWh per lb CO2	2.18	11.19	6.82	3.51	35.31	33.42	1.24	1.04	6.87	0.96	1.12

NYSIO does not publish the CO₂ emitted, but the emissions for each zone can be estimated using CO₂ emission factors published by Benjamin Savacool: Valuing the greenhouse gas emissions from nuclear power: A critical survey. Energy Policy 36 (2008) 2940-2953.



Appendix II

US Citizens Killed by Drone

1. Kemal Darwish*	November 3, 2002	Yemen
2. Unknown	November 7, 2008	Pakistan
3. Unknown	November 7, 2008	Pakistan
4. Anwar al-Awlaki	September 30, 2011	Yemen
5. Samir Kahn	September 30, 2001	Yemen
6. Abdulrahman al-Awlaki	October 14, 2011	Yemen
7. Jude Kenan Mohammed	November 16, 2011	Pakistan
8. Warren Weinstein	January 2015	Pakistan
9. Ahmed Farouq	January 2015	Pakistan
10. Adam Gadahn	January 2015	Pakistan

Source: <https://www.thebureauinvestigates.com/stories/2015-04-23/hostage-deaths-mean-38-westerners-killed-by-us-drone-strikes-bureau-investigation-reveals>

* Darwish was born in Buffalo NY and once lived in Tonawanda NY, a few miles north of Buffalo, and Lackawanna NY.

Appendix III

US Citizens Possibly on Kill-List

“Bilal Abdul Kareem is an American citizen, who has been reporting on the conflict in Syria since it began. In 2016, he narrowly escaped being killed by drone strikes on five separate occasions, including two strikes on cars he was travelling in and a further two strikes on the headquarters of his news agency, On the Ground News, while he was present.”¹

Kareem is challenging in court his presumed inclusion on the kill-list.

“Due process is not merely an old and dusty procedural obligation,” wrote U.S. District Judge, Rosemary Collyer, in her ruling partially denying the Government’s motion to dismiss the case. “Instead, it is a living, breathing concept that protects US persons from over-reaching government action even, perhaps, on an occasion of war.”²

1. <http://reprieve.org/2018/05/01/journalists-challenge-drones-kill-list-federal-court/>
2. <http://reprieve.org/2018/06/14/breaking-news-us-journalist-wins-right-challenge-inclusion-trumps-kill-list/>