

# Comment

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Supplementary information to:

## Decarbonize the military – mandate emissions reporting

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# Decarbonize the military - mandate reporting to manage emissions

It is time for Armed forces to speed up greening and develop consistent reporting mechanisms

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Figures S1-2

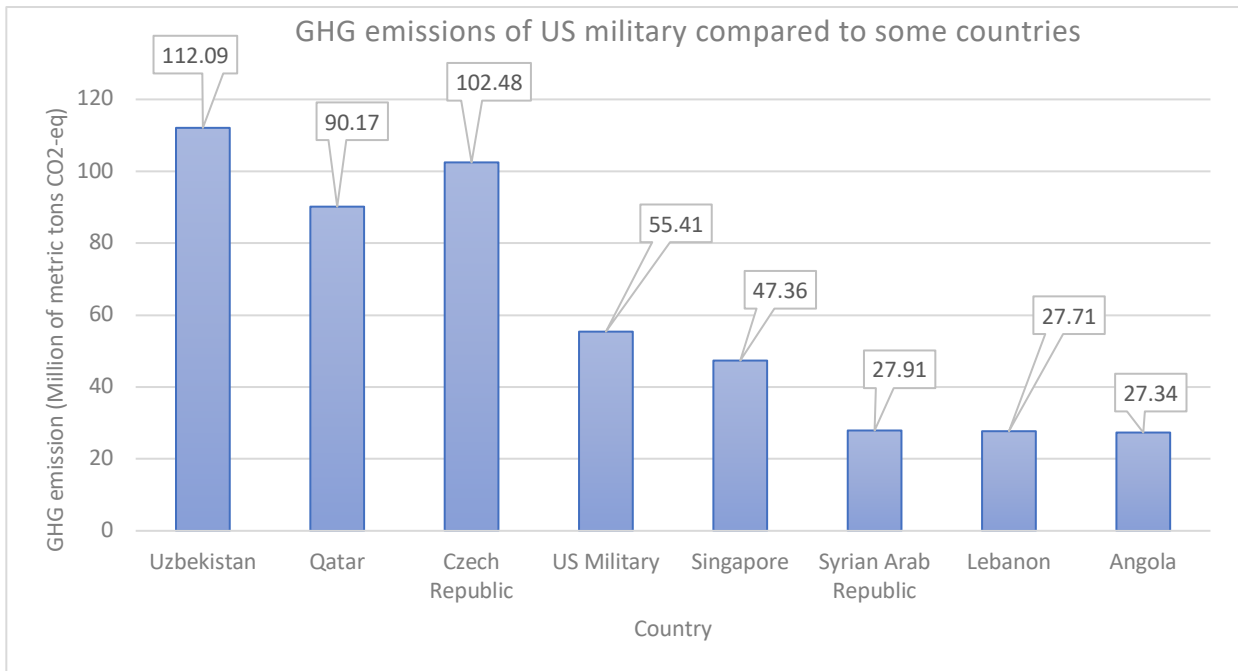
Tables S1

**Table S1.** GHG emissions (in Million Metric Tons CO<sub>2</sub>-eq) of countries and militaries in 2018 (countries GHG emissions from (1); Militaries GHG emissions from (2-4)).

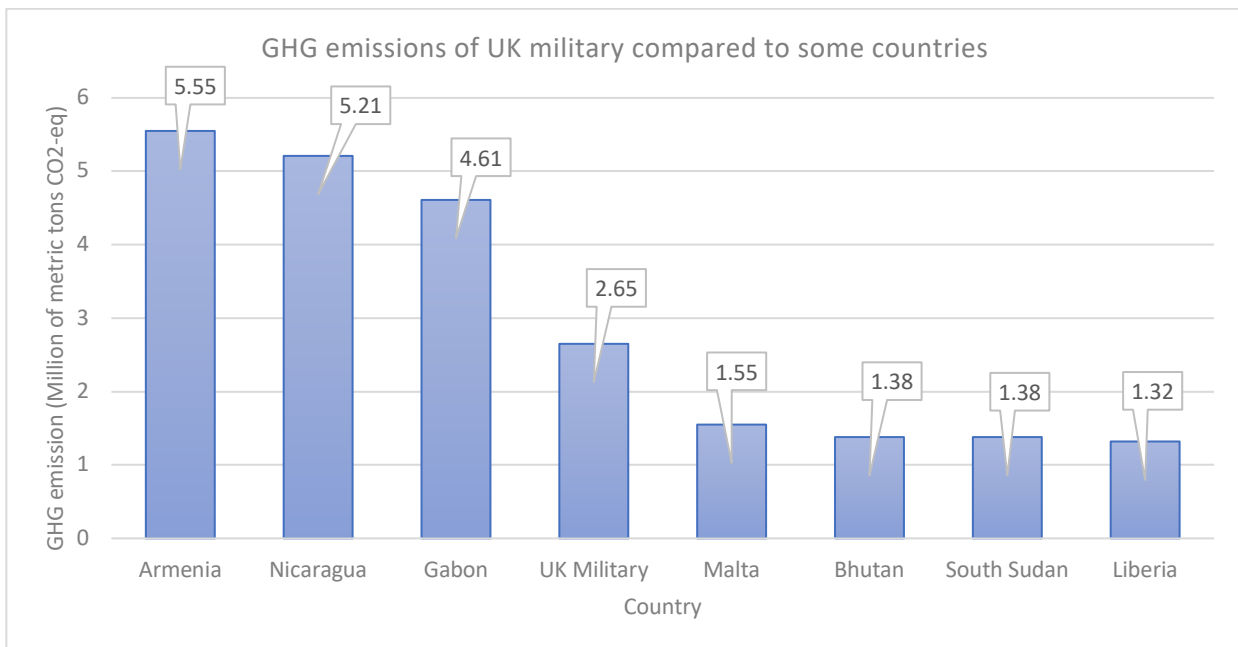
Rank	Country	CO <sub>2</sub> -eq (MT)	Rank	Country	CO <sub>2</sub> -eq (MT)	Rank	Country	CO <sub>2</sub> -eq (MT)	Rank	Country	CO <sub>2</sub> -eq (MT)	Country	CO <sub>2</sub> -eq (MT)	CO <sub>2</sub> -eq (MT)	Rank	Country	CO <sub>2</sub> -eq (MT)
1	China	10313.46	34	Philippines	142.24	67	Denmark	33.38	100	Cote d'Ivoire	9.91	133	Namibia	4.25	166	Belize	0.68
2	United States	4981.3	35	Venezuela, RB	138.16	68	Slovak Republic	33.00	101	Senegal	9.86	134	Mauritius	4.13	167	Timor-Leste	0.64
3	India	2434.52	36	Nigeria	130.67	69	Myanmar	32.52	102	Honduras	9.77	135	Mauritania	4	168	Cabo Verde	0.62
4	Russian Federation	1607.55	37	Uzbekistan	112.09	70	New Zealand	32.21	103	Georgia	9.46	136	Madagascar	3.37	169	Seychelles	0.62
5	Japan	1106.15	38	Czech Republic	102.48	71	Azerbaijan	32.02	104	Luxembourg	9.32	137	Haiti	3.33	170	Burundi	0.59
6	Germany	709.54	39	Belgium	93.47	72	Bahrain	30.75	105	Yemen, Rep.	9.31	138	Congo, Rep.	3.22	171	Gambia, The	0.57
7	Korea, Rep.	630.87	40	Qatar	90.17	73	Syrian Arab Republic	27.91	106	Cameroon	8.62	139	Guinea	3.12	172	Antigua and Barbuda	0.53
8	Iran, Islamic Rep.	629.29	41	Kuwait	89.46	74	Lebanon	27.71	107	Moldova	8.59	140	<b>UK Military</b>	<b>2.65</b>	173	Djibouti	0.49
9	Indonesia	583.11	42	Chile	86.62	75	Angola	27.34	108	Jamaica	8.51	141	Lesotho	2.57	174	Andorra	0.46
10	Canada	574.4	43	Bangladesh	82.76	76	Dominican Republic	25.12	109	Paraguay	8.42	142	Montenegro	2.52	175	<b>Netherlands Military</b>	<b>0.4</b>
11	Saudi Arabia	514.6	44	Colombia	79.49	77	Cuba	24.97	110	Costa Rica	8.26	143	Guyana	2.44	176	St. Lucia	0.39
12	Mexico	472.14	45	Romania	74.88	78	Jordan	24.7	111	Botswana	8.21	144	Niger	2.29	177	Solomon Islands	0.37
13	South Africa	433.25	46	Oman	73.37	79	Bolivia	22.71	112	<b>Militaries of the EU (27 nations)</b>	<b>7.95</b>	145	Bahamas, The	2.26	178	Central African Republic	0.33
14	Brazil	427.71	47	Turkmenistan	71.73	80	Bosnia and Herzegovina	22.54	113	Benin	7.91	146	Togo	2.26	179	Samoa	0.32
15	Turkey	412.97	48	Morocco	66.68	81	Sri Lanka	21.63	114	Zambia	7.74	147	<b>France military</b>	<b>2.23</b>	180	Guinea-Bissau	0.31
16	Australia	386.62	49	Greece	65.29	82	Mongolia	21.32	115	Latvia	7.63	148	Congo, Dem. Rep.	2.2	181	Grenada	0.3
17	United Kingdom	358.8	50	Austria	63.18	83	Sudan	20.2	116	Papua New Guinea	7.46	149	Iceland	2.2	182	Palau	0.29
18	Italy	324.85	51	Israel	61.97	84	Lao PDR	18.79	117	Afghanistan	7.44	150	Suriname	2.08	183	St. Vincent and the Grenadines	0.28

19	Poland	312.74	52	Belarus	59.31	85	Kenya	18.4	118	North Macedonia	7.37	151	Maldives	1.91	184	Comoros	0.26
20	France	309.96	53	Libya	58.94	86	Guatemala	18.21	119	Tajikistan	7.33	152	Fiji	1.9	185	St. Kitts and Nevis	0.26
21	Spain	258.34	54	<b>US Military</b>	<b>55.41</b>	87	Korea, Dem. People's Rep.	18.12	120	Cyprus	7.23	153	Malawi	1.57	186	Marshall Islands	0.19
22	Thailand	257.86	55	Peru	54.28	88	Croatia	16.58	121	Brunei Darussalam	7.14	154	Malta	1.55	187	Tonga	0.19
23	Vietnam	257.86	56	Portugal	49.78	89	Ethiopia	16.28	122	El Salvador	6.81	155	<b>German Military</b>	<b>1.45</b>	188	Dominica	0.18
24	Egypt, Arab Rep.	246.26	57	Singapore	47.36	90	Ghana	16.11	123	Equatorial Guinea	6.67	156	Bhutan	1.38	189	Micronesia, Fed. Sts.	0.18
25	Malaysia	239.62	58	Hungary	46.39	91	Estonia	16	124	Mozambique	6.64	157	South Sudan	1.38	190	Vanuatu	0.18
26	Kazakhstan	220.45	59	Serbia	45.54	92	Slovenia	14.05	125	Uruguay	6.52	158	Liberia	1.32	191	Liechtenstein	0.14
27	Pakistan	208.37	60	Finland	44.36	93	Zimbabwe	12.27	126	Uganda	6.13	159	Barbados	1.25	192	Sao Tome and Principe	0.14
28	United Arab Emirates	200.3	61	Bulgaria	41.13	94	Nepal	12.03	127	Mali	5.62	160	Eswatini	1.09	193	Kiribati	0.08
29	Iraq	188.14	62	Ecuador	39.53	95	Lithuania	11.59	128	Albania	5.56	161	Rwanda	1.08	194	Nauru	0.07
30	Ukraine	185.37	63	Switzerland	37.48	96	Tanzania	11.58	129	Armenia	5.55	162	Chad	1.07	195	Tuvalu	0.01
31	Argentina	177.41	64	Norway	37.35	97	Cambodia	11.16	130	Nicaragua	5.21	163	Sierra Leone	1.02			
32	Algeria	151.67	65	Ireland	37.11	98	Kyrgyz Republic	11	131	Gabon	4.61	164	Eritrea	0.8			
33	Netherlands	151.17	66	Sweden	36	99	Panama	10.14	132	Burkina Faso	4.27	165	Somalia	0.69			

**Figure S1.** GHG emissions (in CO<sub>2</sub>-eq) of US military compared to some countries (base year 2018-19).



**Figure S2.** GHG emissions (in CO<sub>2</sub>-eq) of the UK military compared to some countries (base year 2018-19).



## References

1. The World Bank, "CO2 emissions (kt) by All Countries and Economies," (2022).<https://data.worldbank.org/indicator/EN.ATM.CO2E.KT>.
2. S. Parkinson, L. Cottrell, "Under the Radar, The Carbon Footprint of Europe's Military Sectors'," (Scientists for Global Responsibility (SGR),, 2021).[https://ceobs.org/wp-content/uploads/2021/02/Under-the-radar\\_the-carbon-footprint-of-the-EUs-military-sectors.pdf](https://ceobs.org/wp-content/uploads/2021/02/Under-the-radar_the-carbon-footprint-of-the-EUs-military-sectors.pdf).
3. N. C. Crawford, *Pentagon fuel use, climate change, and the costs of war*. (Watson Institute, Brown University, 2019).
4. United Kingdom Ministry of Defence, "Annual Report and Accounts 2018–19," (2018).[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/831728/MOD\\_Annual\\_Report\\_and\\_Accounts\\_2018-19\\_WEB\\_ERRATUM\\_CORRECTED\\_.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/831728/MOD_Annual_Report_and_Accounts_2018-19_WEB_ERRATUM_CORRECTED_.pdf).
5. The World Bank, "Military expenditure (current USD)," (2022).<https://data.worldbank.org/indicator/MS.MIL.XPND.CD>.