

International Conference 5th July 2023 . European Parliament – Nuclear Disarmament

Conversione Nucleare: Scelta Obbligata per la Sostenibilità e la Sicurezza della Vita Umana sulla Terra

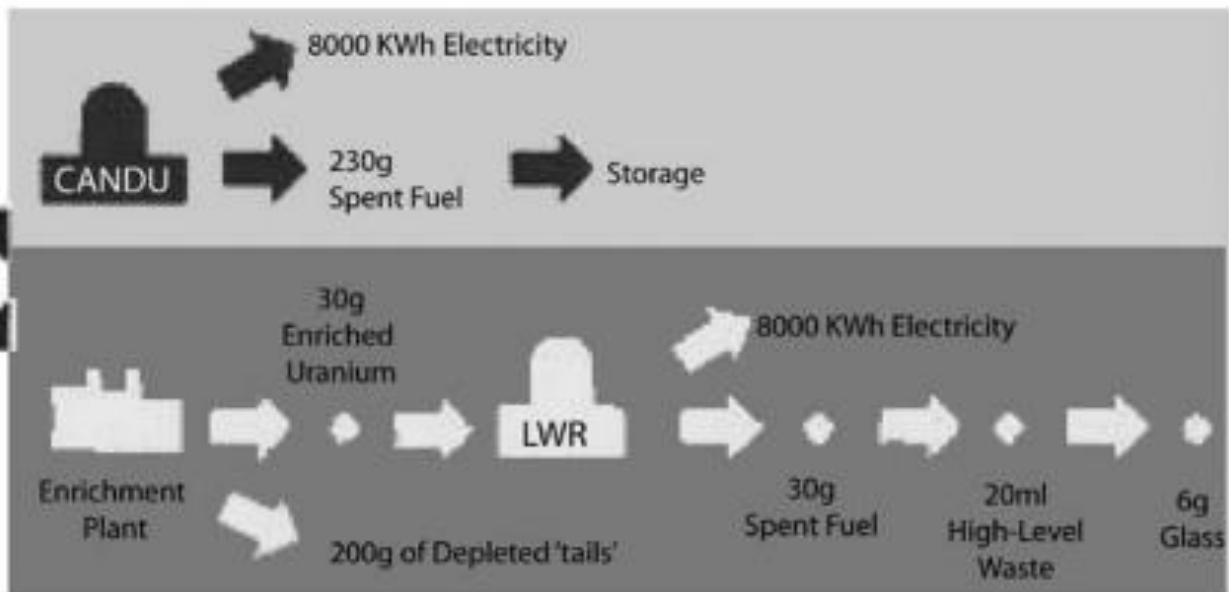
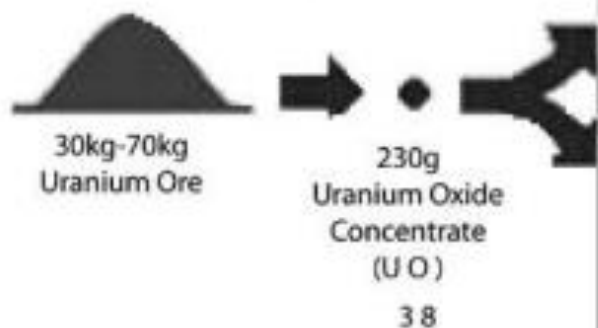
*Diapositive illustrative
(Più ampia Relazione in Atti)*

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Direttivo Associazione Nuclear For Peace, Membro Commissione Scientifica AICE/ICEC,
Comitato Scientifico Associazione Ambiente e Società*

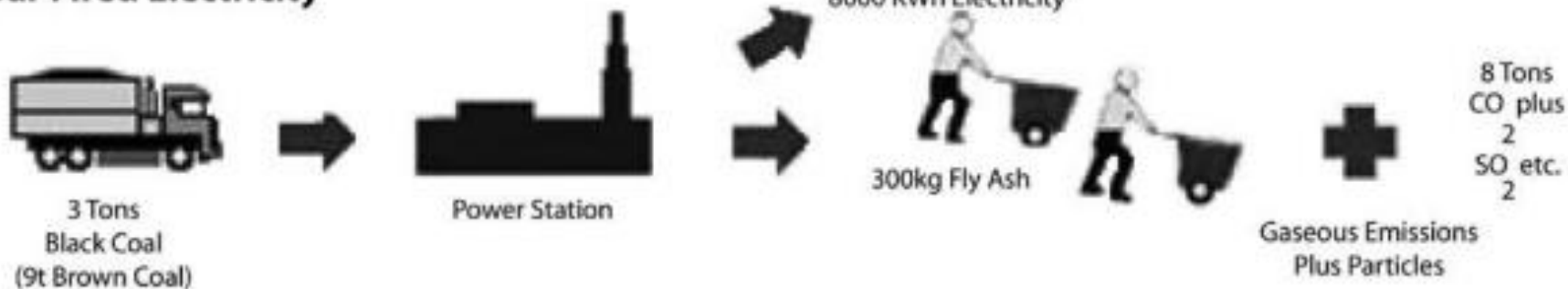
Nuclear and Coal Balances

Fuel and Waste Comparison for Uranium and Coal

Nuclear Electricity



Coal-Fired Electricity



Source:
<https://www.nrc.gov/docs/ML1204/ML12045A003.pdf>

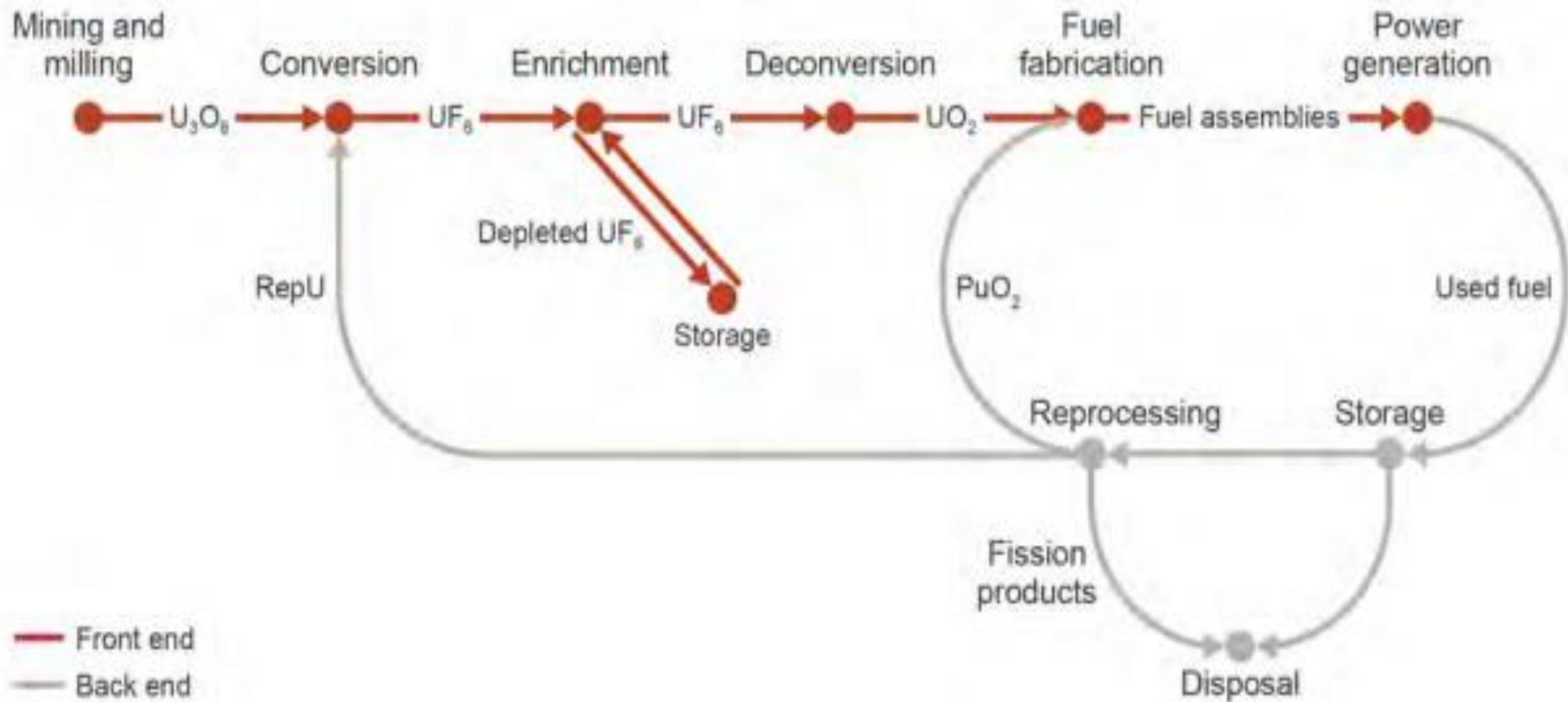
PWR material input requirements per kW⁵⁴

Material	kg / kW
Concrete	180 – 560
Carbon steel	10 – 65
Wood	4.7 – 5.6
Stainless steel	1.56 – 2.10
Galvanized iron	1.26
PVC	0.80 – 1.27
Insulation	0.70 – 0.92
Copper	0.69 – 2.00
Uranium	0.40 – 0.62
Manganese	0.33 – 0.70
Zirconium	0.20 – 0.40
Chromium	0.15 – 0.55
Nickel	0.10 – 0.50
Inconel	0.10 – 0.12
Brass / bronze	0.04
Lead	0.03 – 0.05
Aluminum	0.02 – 0.24
Silver	0.01
Cadmium	0.01
Boron	0.01
Indium	0.01
Total	195 - 635

Source:

<https://www.energy.gov/sites/default/files/2022-02/Nuclear%20Energy%20Supply%20Chain%20Report%20-%20Final.pdf>

The nuclear fuel cycle

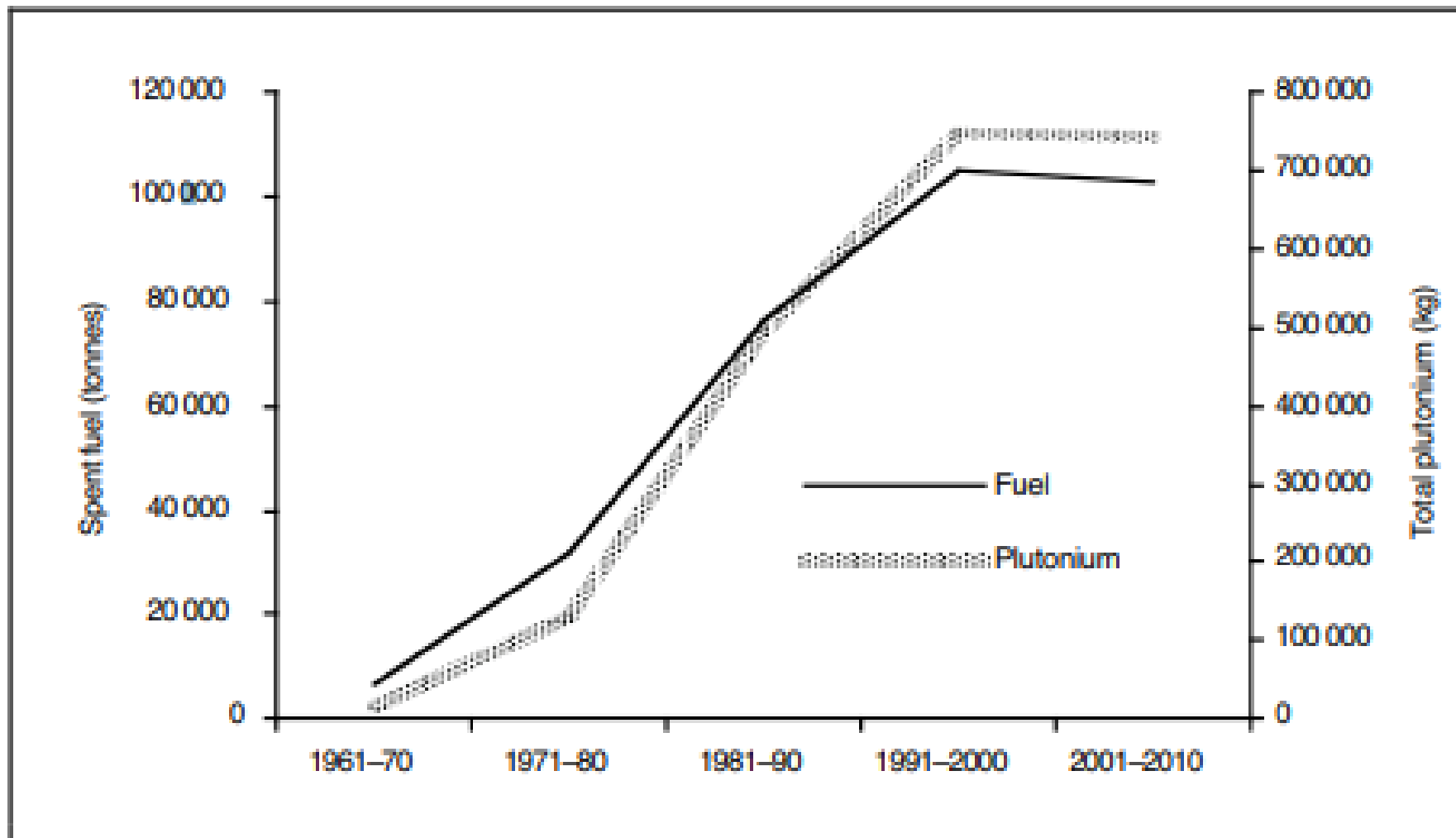


<https://world-nuclear.org/getmedia/9a2f9405-1135-407a-85c8-480e2365bee7/nuclear-fuel-report-2021-expanded-summary.pdf.aspx>



Global distribution of uranium resources⁶³

Source:
<https://www.energy.gov/sites/default/files/2022-02/Nuclear%20Energy%20Supply%20Chain%20Report%20-%20Final.pdf>



World spent-fuel and plutonium discharges from power reactors by decade, 1961-2010

Source:

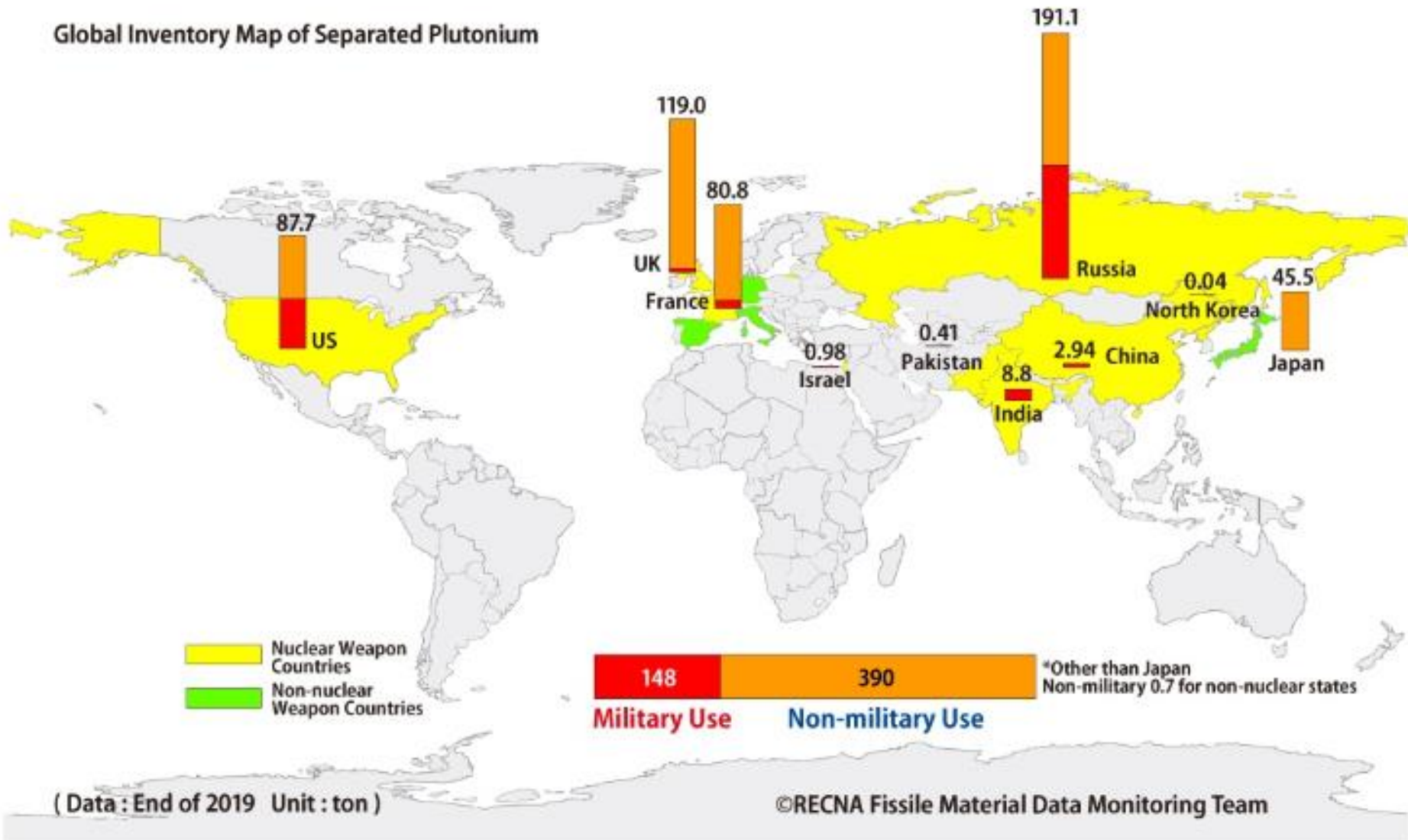
<https://www.sipri.org/sites/default/files/files/books/SIPRI97AlBeWa/SIPRI97AlBeWa.pdf>

Distribution per Country of Total Separated Pu (Tons)

Country	2015		2016		2017		2018		2019		2020		2021	
	Military	Non Military	Military	Non Military	Military	Non Military	Military	Non Military	Military	Non Military	Military	Non Military	Military	Non Military
Russia	94	84	94	86.8	94	89.4	94	91.5	94	93	88	101.3	88	103.1
US	44.9	43.4	38.3	49.3	38.3	49.3	38.4	49.4	38.4	49.4	38.4	49.3	38.4	49.3
France	6	60.2	6	61.9	6	63.4	6	65.4	6	65.4	6	67.7	6	74.8
China	1.8	0.01	1.8	0.03	1.8	0.03	2.9	0.04	2.9	0.04	2.9	0	2.9	0.04
UK	7.3	99.9	3.2	103.3	3.2	106.2	3.2	110.3	3.2	113	3.2	115.8	3.2	115.8
Israel	0.84		0.86		0.88		0.9		0.92		0.92		0.98	
Pakistan	0.15		0.19		0.22		0.28		0.31		0.37		0.41	
India	5.12	0.2	5.69	0.4	6.19	0.4	6.58	0.4	7.07	0.4	7.1		8.4	0.4
North Korea	0.03		0.03		0.03		0.04		0.4		0.4		0.04	
Japan		47.1		47.8		47.9		47		47.3		45.7		45.5
Germany				2.1		1.8		0.5						
Other Countries		5		2.9		2.4		1.8		1.6		1.9		0.7
Sub-Total ~	160.3	340.1	150.1	354.5	150.6	360.8	152.3	366.3	152.8	370.1	150	380	148	390
Year	2015		2016		2017		2018		2019		2020		2021	
Total~	500.4		504.6		511.4		518.6		522.9		530		538	
Source:	https://www.recna.nagasaki-u.ac.jp/recna/en-fmdata/pu_2021								RECNA Fissile Material Data Monitoring T					

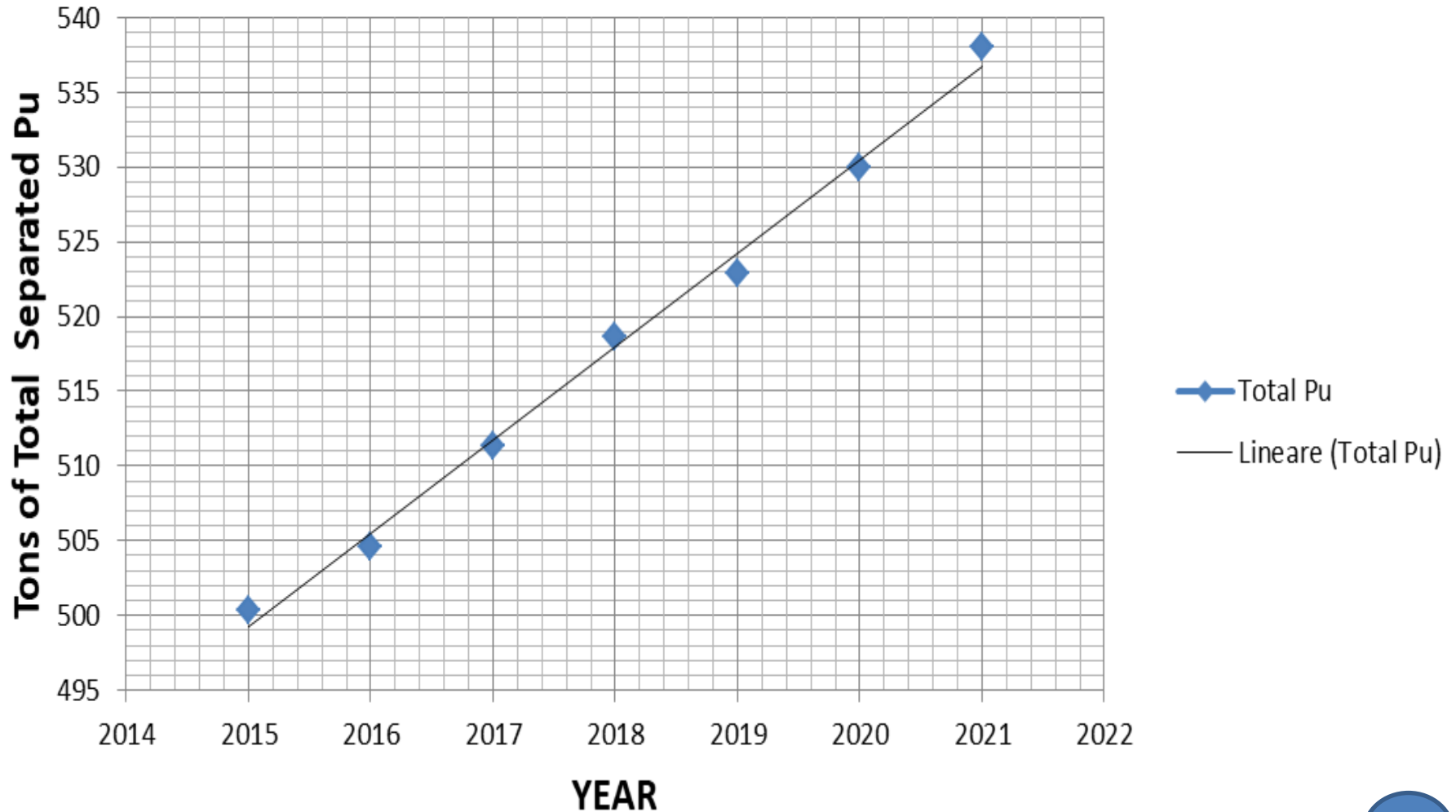
Our elaboration on RECNA data

Global Inventory Map of Separated Plutonium



Source: https://www.recna.nagasaki-u.ac.jp/recna/en-fmdata/pu_2021

Recent Average Trend of Total Separated Pu (5.4 Ton/Year)

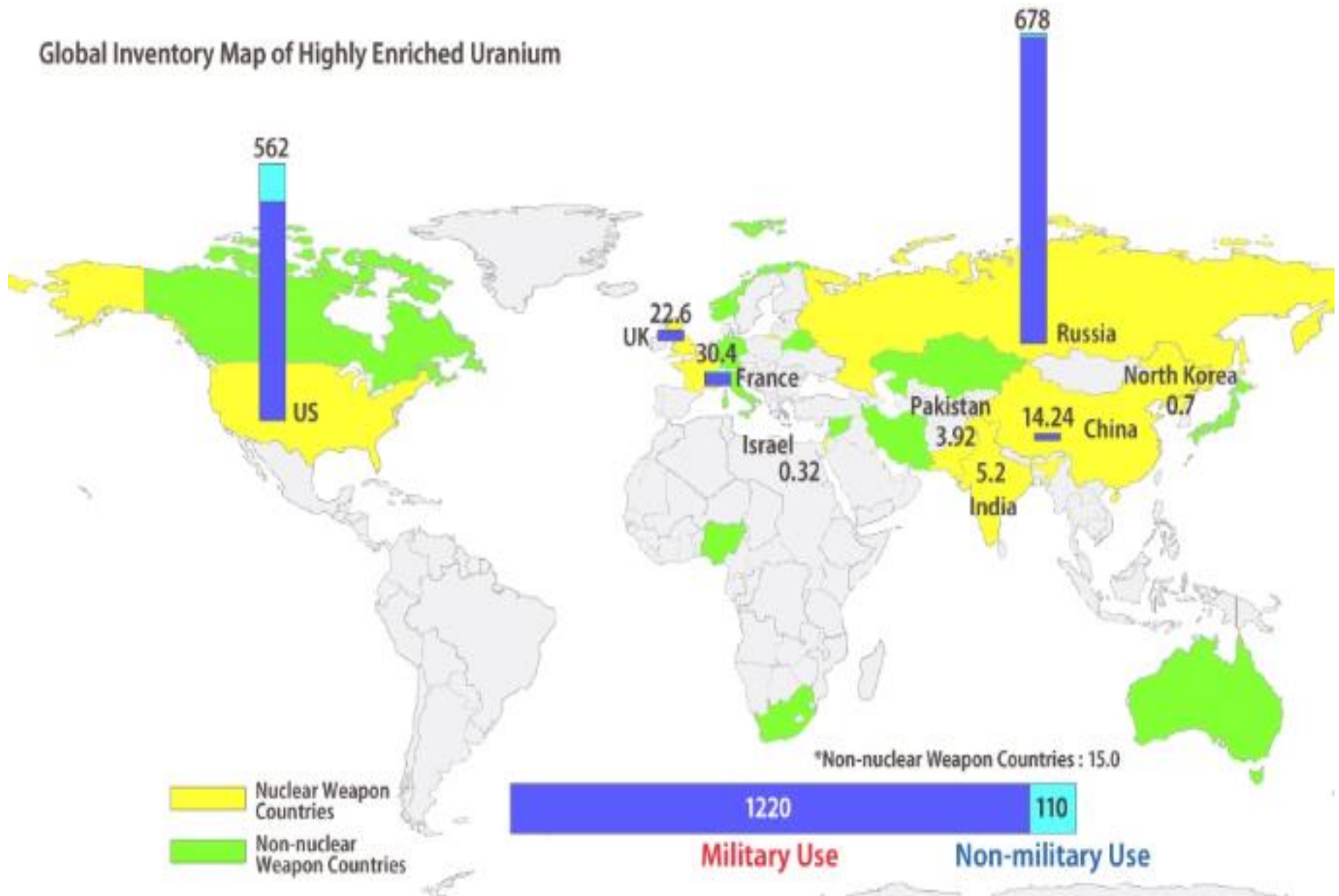


Distribution per Country of Total HEU (Tons)

Country	Military	Non Military	Military	Non Military	Military	Non Military	Military	Non Military	Military	Non Military	Military	Non Military	Military	Non Military
Russia	646	20	670	9	670	9	670	9	670	9	670	9	672	6
US	512	83	517	82	468.6	98.6	479.4	95.1	478.9	92.1	480	85.1	480	82
France	26	4.6	26	4.7	26	4.7	26	4.806	26	5.19	25	5.1	25	5.4
China	16		18	0.24	18	0.24	14	0.24	14	0.24	14	0.2	14	0.24
UK	19.8	1.4	19.8	1.398	19.8	1.398	19.8	1.37	19.8	1.24	21.9	0.7	21.9	0.7
Israel	0.3		0.3	0.002	0.3	0.002	0.3	0.002	0.3	0.022	0.3		0.3	
Pakistan	3		3.1	0.017	3.3	0.017	3.4	0.017	3.6	0.017	3.7		3.9	
India	2.4		3.2	0.005	3.6	0.005	4	0.005	4.4	0.005	4.4		5.2	
North Korea			0.042		0.042		0.042		0.045		0.5		0.7	
Non-nuclear Weapon Countries		15		15		15		15		15		15		15
Sub-Total	1226	124	1257	122.3	1210	128.9	1217	125.6	1217.5	122.8	1220	115	1220	110
Year	2015		2016		2017		2018		2019		2020		2021	
Total	1349.5		1379.7		1338.5		1342.5		1340.3		1335		1330	

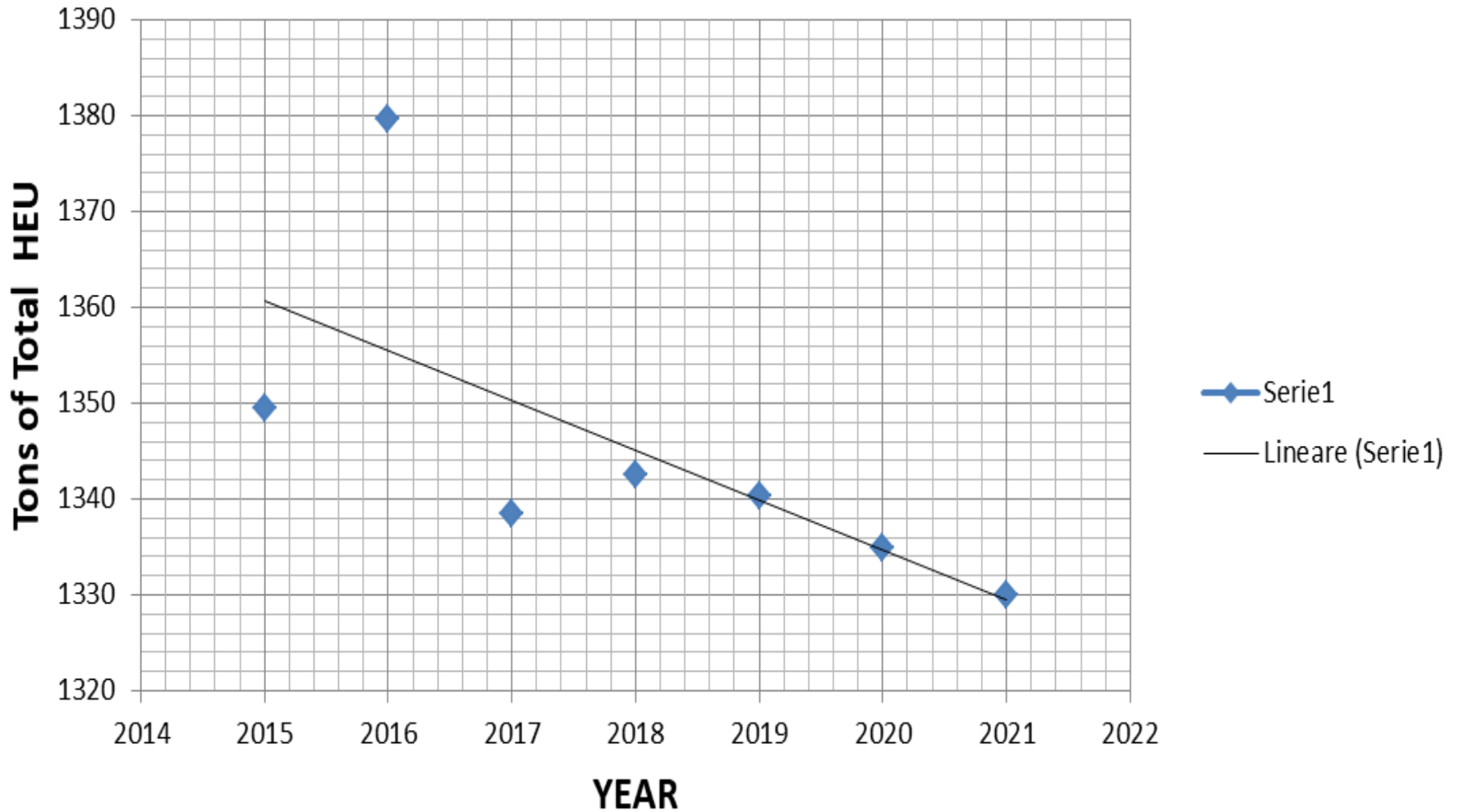
Source: our elaboration on data from https://www.recna.nagasaki-u.ac.jp/recna/en-fmdata/heu_2022

Global Inventory Map of Highly Enriched Uranium



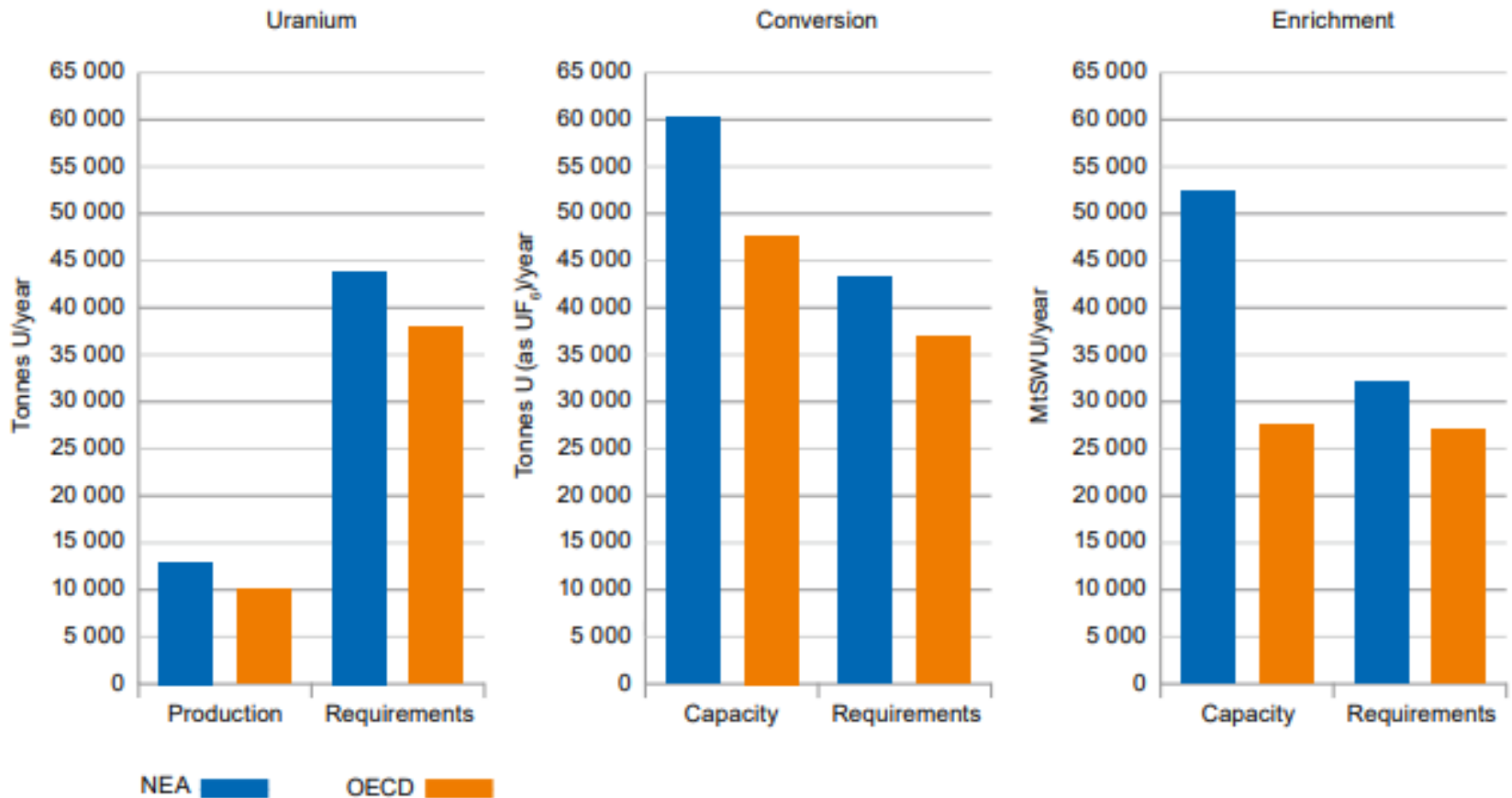
Source: <https://www.recna.nagasaki-u.ac.jp/recna/en-fmdata/map-heu-2021>


Recent Average Trend of Total HEU (- 4.3 Tons/Year)



Source: our elaboration on data from
https://www.recna.nagasaki-u.ac.jp/recna/en-fmdata/heu_2022

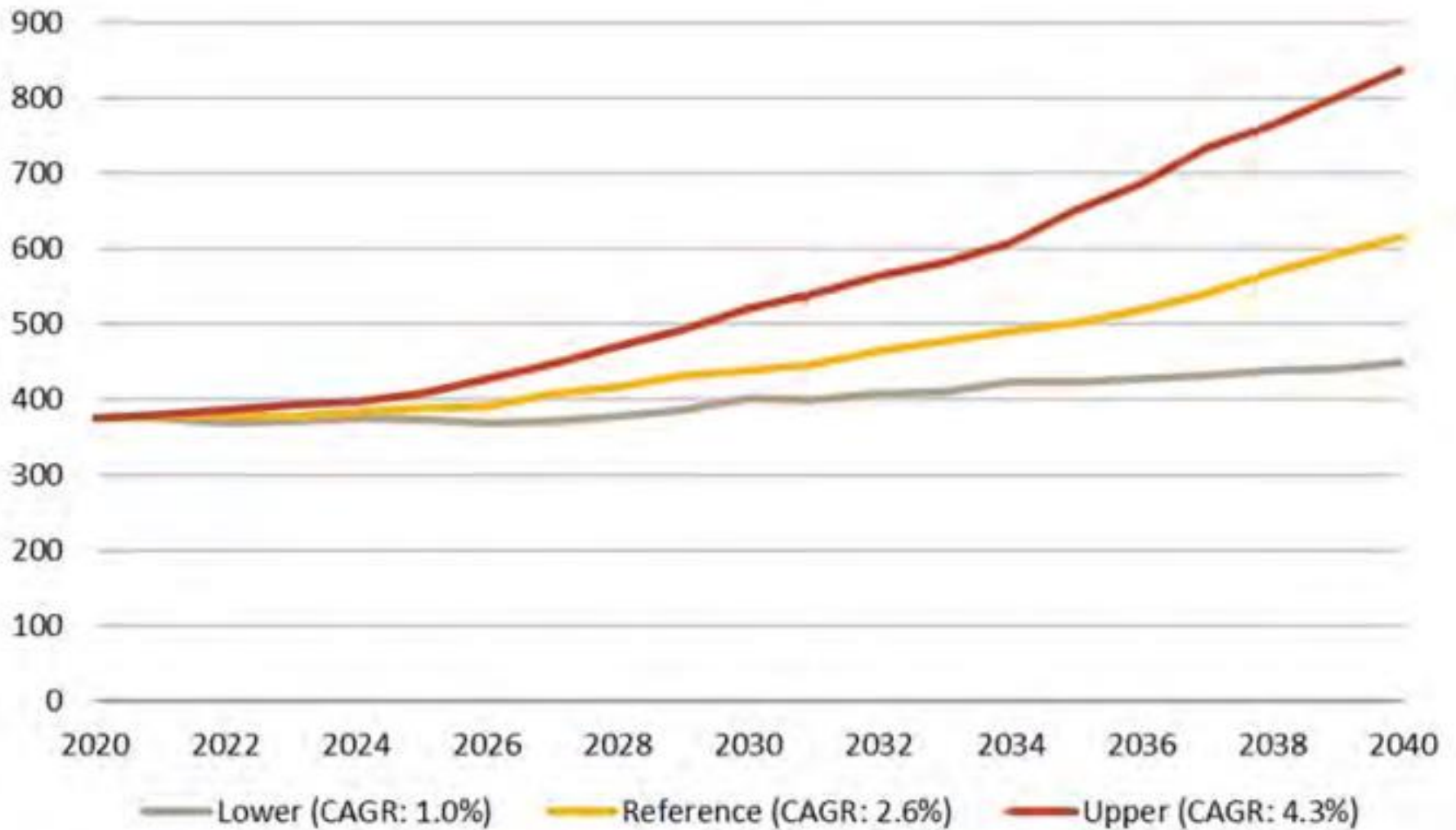
Fuel cycle supply and demand comparisons in OECD countries (as of 1 January 2021)



StatLink  www.oecd-nea.org/statlinks-2021

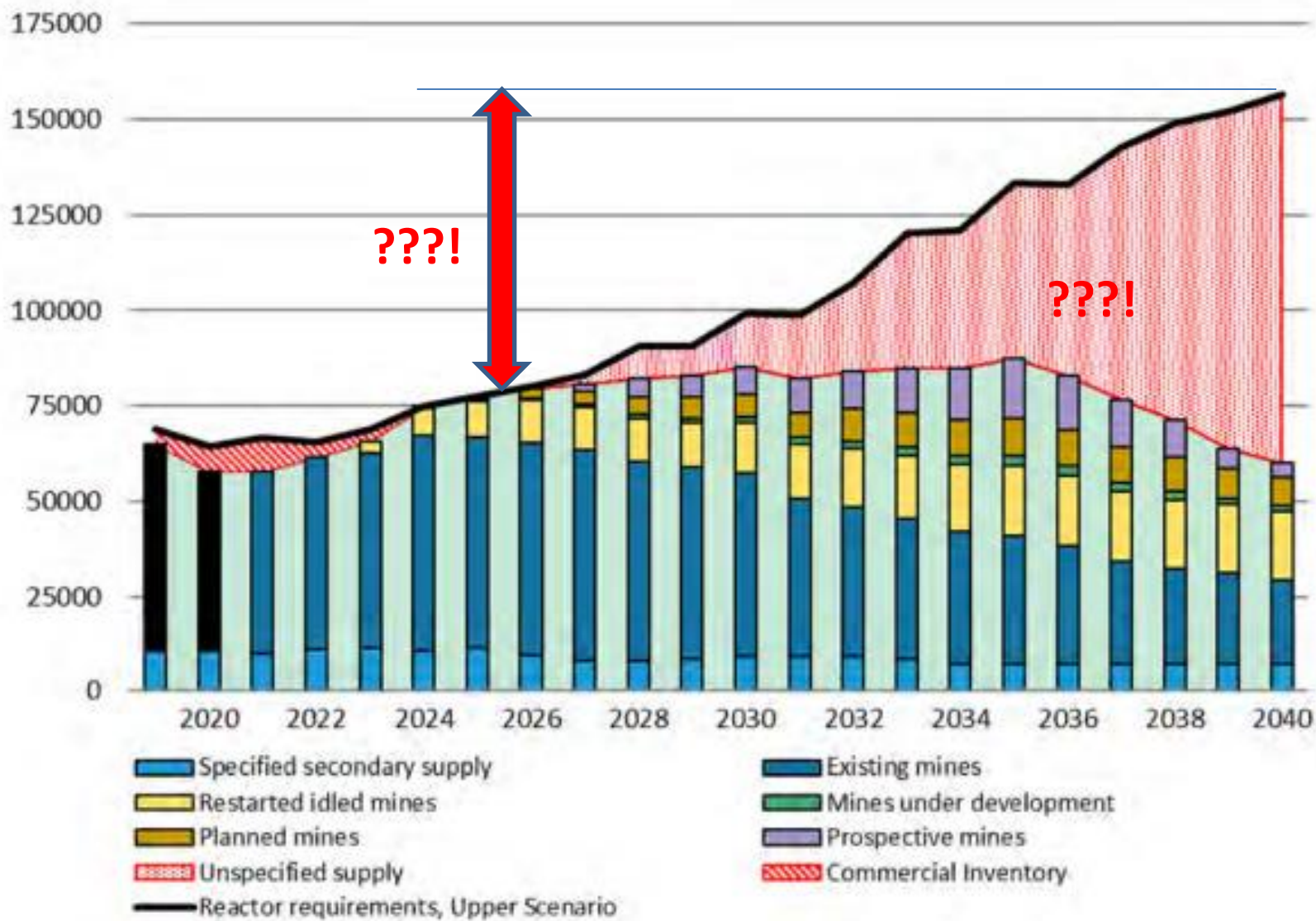
Source : https://www.oecd-nea.org/upload/docs/application/pdf/2022-05/7608_nuclear_energy_data_2021.pdf

Nuclear generating capacity scenarios to 2040, GWe



https://www.oecd-nea.org/upload/docs/application/pdf/2022-05/7608_nuclear_energy_data_2021.pdf

Upper Scenario for uranium supply and demand, tU



No.	Risk	Probability of occurrence	Impact on supply	Duration of impact	Final score
1	Lack of transport hubs open to nuclear shipments	3.20	2.30	2.00	7.36
2	Lack of investments in conversion facilities	3.10	2.20	2.60	6.82
3	Permanent reduction of production and withdrawal from uranium exploration	3.00	2.20	2.70	6.60
4	Lack of harmonisation and multiple regulation in transport authorisation	3.10	2.00	2.10	6.20
5	Temporary suspension of production, or shortage of capacity of conversion	3.00	2.00	1.80	6.00
6	Lack of investment in mines	3.00	1.90	2.70	5.70
7	Temporary suspension of production, or shortages in uranium mines	3.00	1.60	1.50	4.80
8	Security of supply in light of the current political situation, e.g. restrictions on access to nuclear material and related services	2.50	1.90	1.60	4.75
9	Supply disruption resulting from political instability	2.30	2.00	1.80	4.60
10	Overdependence on a single source of supply of fuel fabrication services	2.70	1.70	2.00	4.59

Source:
https://euratom-supply.ec.europa.eu/system/files/2021-06/2020_Security_report_2.pdf