Energy Tidbits

Helima Croft "*closely watching whether Ukraine moves at some stage to target actual [Russian] export facilities*"

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Table 1. Summary of natural gas supply and disposition in the United States, 2019-2024

billion cubic feet

Year and month	Gross withdrawals	Marketed production	NGPL production[a]	Dry gas production[b]	Supplemental gaseous fuels[c]	Net imports	Net storage withdrawals[d]	Balancing item[e]	Consumption[f]
2019 total	**40,780**	**36,447**	**2,548**	**33,899**	**61**	**-1,916**	**-503**	**-408**	**31,132**
2020 total	**40,730**	**36,521**	**2,710**	**33,811**	**63**	**-2,734**	**-180**	**-357**	**30,603**
2021 total	**41,677**	**37,338**	**2,809**	**34,529**	**66**	**-3,845**	**83**	**-188**	**30,646**
2022									
January	3,628	3,235	252	2,983	6	-315	1,013	-95	3,593
February	3,266	2,914	227	2,687	5	-288	673	-17	3,059
March	3,663	3,282	256	3,026	6	-380	171	-43	2,781
April	3,568	3,199	250	2,950	6	-342	-220	-33	2,360
May	3,695	3,332	260	3,072	6	-386	-412	-39	2,241
June	3,565	3,232	252	2,980	6	-325	-332	-13	2,317
July	3,736	3,375	263	3,112	6	-303	-187	-46	2,583
August	3,730	3,392	265	3,128	6	-322	-213	-39	2,559
September	3,669	3,330	260	3,071	6	-293	-446	-50	2,288
October	3,814	3,438	268	3,170	6	-315	-432	-66	2,364
November	3,712	3,327	259	3,067	6	-308	78	-77	2,767
December	3,755	3,370	263	3,107	6	-304	588	-21	3,376
Total	**43,802**	**39,428**	**3,075**	**36,353**	**73**	**-3,880**	**281**	**-539**	**32,288**
2023									
January	E3,820	E3,429	270	E3,159	7	-333	456	17	3,305
February	E3,456	E3,103	247	E2,856	6	-331	399	18	2,947
March	E3,858	E3,475	286	E3,189	6	-401	224	-6	3,012
April	E3,729	E3,362	283	E3,079	5	-400	-269	5	2,421
May	E3,869	E3,500	289	E3,210	6	-422	-452	-27	2,315
June	E3,720	E3,375	278	E3,098	4	-376	-344	-22	2,360
July	E3,827	E3,495	290	E3,205	6	-378	-134	-34	2,666
August	E3,850	E3,534	294	E3,240	5	-388	-133	-50	2,674
September	E3,761	E3,426	291	E3,135	3	-396	-323	-46	2,373
October	E3,909	E3,537	302	E3,235	3	-421	-321	-58	2,438
November	E3,841	E3,469	292	E3,177	5	-403	65	R-20	2,823
December	RE3,998	RE3,597	292	RE3,305	6	-432	284	R7	3,169
Total	**RE45,637**	**RE41,300**	**3,413**	**RE37,887**	**63**	**-4,682**	**-548**	**R-217**	**32,504**
2024									
January	E3,862	E3,471	269	E3,202	6	-350	844	-5	3,696

[a] We derive monthly natural gas plant liquid (NGPL) production, gaseous equivalent, from sample data reported by gas processing plants on Form EIA-816, *Monthly Natural Gas Liquids Report*, and Form EIA-64A, *Annual Report of the Origin of Natural Gas Liquids Production*.

[b] Equal to marketed production minus NGPL production.

[c] We only collect supplemental gaseous fuels data on an annual basis except for the Dakota Gasification Co. coal gasification facility, which provides data each month. We calculate the ratio of annual supplemental fuels (excluding Dakota Gasification Co.) to the sum of dry gas production, net imports, and net withdrawals from storage. We apply this ratio to the monthly sum of these three elements. We add the Dakota Gasification Co. monthly value to the result to produce the monthly supplemental fuels estimate.

[d] Monthly and annual data for 2019 through 2022 include underground storage and liquefied natural gas storage. Data for January 2023 forward include underground storage only. Appendix A, Explanatory Note 5, contains a discussion of computation procedures.

[e] Represents quantities lost and imbalances in data due to differences among data sources. Net imports and balancing item excludes net intransit deliveries. These net intransit deliveries were (in billion cubic feet): 91 for 2022; 184 for 2021; 207 for 2020; and -8 for 2019. Appendix A, Explanatory Note 7, contains a full discussion of balancing item calculations.

[f] Consists of pipeline fuel use, lease and plant fuel use, vehicle fuel, and deliveries to consuming sectors as shown in Table 2.

[R] Revised data.

[RE] Revised estimated data.

[E] Estimated data.

Source: 2019-2022: U.S. Energy Information Administration (EIA), *Natural Gas Annual 2022*. January 2023 through current month: Form EIA-914, *Monthly Crude Oil and Lease Condensate, and Natural Gas Production Report*; Form EIA-857, *Monthly Report of Natural Gas Purchases and Deliveries to Consumers*; Form EIA-191, *Monthly Underground Gas Storage Report*; EIA computations and estimates; and Office of Fossil Energy and Carbon Management, *Natural Gas Imports and Exports*. Table 7 includes detailed source notes for Marketed Production. Appendix A, Notes 3 and 4, includes discussion of computation and estimation procedures and revision policies.

Note: Data for 2019 through 2022 are final. All other data are preliminary unless otherwise indicated. Geographic coverage is the 50 states and the District of Columbia. Totals may not equal sum of components because of independent rounding.

Table 5. U.S. natural gas exports, 2022-2024

volumes in million cubic feet; prices in dollars per thousand cubic feet

	2024					2023
	January	Total	December	November	October	September
Exports						
Volume (million cubic feet)						
Pipeline						
Canada	92,532	1,026,097	111,869	89,446	66,936	76,619
Mexico	185,076	2,241,553	174,602	179,002	200,466	202,402
Total pipeline exports	**277,608**	**3,267,651**	**286,471**	**268,448**	**267,402**	**279,021**
LNG						
Exports						
By vessel						
Antigua and Barbuda	2	47	6	4	7	7
Argentina	0	76,921	0	0	0	0
Bahamas	42	499	32	34	34	51
Bangladesh	0	24,147	3,257	3,240	0	0
Barbados	22	11	11	0	0	0
Belgium	14,255	97,017	14,272	10,288	20,775	13,697
Brazil	8,292	38,595	3,708	3,563	3,720	6,561
Chile	3,696	31,217	0	0	0	0
China	7,944	173,247	13,949	25,601	18,013	10,222
Colombia	6,465	32,014	7,162	1,844	6,689	10,322
Croatia	9,464	55,439	3,050	9,995	0	10,542
Dominican Republic	7,489	73,761	3,177	8,647	8,826	6,734
El Salvador	0	1	0	0	0	0
Finland	0	38,858	2,762	3,335	0	7,057
France	28,049	492,696	40,692	58,907	53,559	32,016
Germany	17,371	204,605	19,439	14,382	17,901	17,228
Greece	7,153	39,426	8,287	0	0	1,968
Haiti	16	113	13	8	8	10
India	10,685	164,325	17,062	7,441	13,698	24,452
Indonesia	0	3,157	0	0	0	489
Israel	0	0	0	0	0	0
Italy	24,767	197,513	21,283	23,786	6,850	22,094
Jamaica	6,576	9,048	480	122	1,831	4,038
Japan	19,340	310,190	27,461	24,896	24,357	33,375
Jordan	0	3,282	0	0	0	0
Kuwait	0	35,185	0	0	0	6,636
Lithuania	1,083	55,332	3,409	0	6,476	10,666
Malta	0	2,592	0	0	0	0
Mexico	0	13,661	3,660	0	1,776	0
Netherlands	41,873	588,557	48,658	36,150	49,701	39,745
Nicaragua	0	0	0	0	0	0
Pakistan	0	3,141	3,141	0	0	0
Panama	3,677	19,565	328	3,530	0	3,196
Philippines	0	6,823	0	3,445	3,378	0
Poland	5,746	139,635	10,862	14,500	14,213	14,121
Portugal	9,503	73,158	2,945	3,204	7,125	6,437
Singapore	3,194	23,320	0	0	3,279	6,649
South Korea	20,640	275,779	35,187	26,140	28,224	24,112
Spain	38,812	269,202	15,629	17,280	49,792	9,933
Taiwan	6,555	104,075	6,655	3,104	6,686	13,201
Thailand	7,904	59,477	3,818	7,581	7,538	0
Turkiye	42,693	156,403	42,304	27,560	4,507	3,531
United Kingdom	42,928	450,694	60,209	47,642	25,414	7,464
By truck						
Canada	0	85	7	7	0	16
Mexico	21	604	20	26	27	35
Total LNG exports	**396,260**	**4,343,415**	**422,935**	**386,262**	**384,403**	**346,604**
CNG						
Canada	0	1	0	0	0	0
Total CNG exports	**0**	**1**	**0**	**0**	**0**	**0**
Total exports	**673,868**	**7,611,067**	**709,406**	**654,710**	**651,805**	**625,625**

See footnotes at end of table.

Table 5. U.S. natural gas exports, 2022-2024

volumes in million cubic feet; prices in dollars per thousand cubic feet – continued

	2023					
	August	July	June	May	April	March
Exports						
Volume (million cubic feet)						
Pipeline						
Canada	68,390	76,567	75,320	77,984	75,674	106,178
Mexico	213,050	208,625	204,115	193,623	169,179	177,653
Total pipeline exports	**281,440**	**285,193**	**279,435**	**271,608**	**244,853**	**283,832**
LNG						
Exports						
By vessel						
Antigua and Barbuda	5	4	3	3	3	2
Argentina	0	11,162	22,663	26,930	11,536	2,343
Bahamas	47	47	45	45	43	53
Bangladesh	7,095	0	3,624	3,561	0	0
Barbados	0	0	0	0	0	0
Belgium	3,363	0	6,953	3,809	4,844	8,053
Brazil	3,287	0	8,628	4,196	3,598	1,334
Chile	3,065	7,144	4,011	6,419	0	7,271
China	14,252	35,337	20,261	6,593	3,426	5,132
Colombia	3,149	0	0	2,847	0	0
Croatia	3,023	10,121	0	2,932	3,163	3,694
Dominican Republic	10,055	6,076	7,443	7,871	6,901	876
El Salvador	0	1	0	0	0	0
Finland	6,630	3,666	1,622	6,935	0	6,850
France	34,332	20,589	45,569	51,658	53,211	28,581
Germany	20,709	17,245	15,769	16,002	18,546	24,841
Greece	4,700	0	2,924	4,498	3,905	3,156
Haiti	9	8	6	12	11	8
India	13,713	20,494	14,488	7,140	14,585	10,230
Indonesia	766	1,097	0	0	0	0
Israel	0	0	0	0	0	0
Italy	21,519	13,923	13,959	18,542	17,378	13,699
Jamaica	3	1,443	3	289	31	540
Japan	31,302	44,016	28,031	31,208	13,687	20,102
Jordan	0	3,282	0	0	0	0
Kuwait	3,289	7,081	10,670	3,802	3,707	0
Lithuania	7,005	3,375	3,629	7,048	3,412	3,599
Malta	0	0	0	0	0	0
Mexico	0	1,954	0	0	0	3,051
Netherlands	53,596	53,296	45,866	64,538	60,234	61,017
Nicaragua	0	0	0	0	0	0
Pakistan	0	0	0	0	0	0
Panama	0	3,295	0	3,289	0	3,209
Philippines	0	0	0	0	0	0
Poland	10,550	3,635	18,046	17,422	7,165	7,236
Portugal	6,660	9,845	3,194	10,424	4,237	6,133
Singapore	3,384	0	10,009	0	0	0
South Korea	34,932	16,462	17,044	10,958	24,734	10,807
Spain	20,023	34,106	12,274	12,266	13,680	38,096
Taiwan	14,117	13,090	6,848	10,262	9,774	10,311
Thailand	14,793	7,463	4,242	0	4,225	4,249
Turkiye	0	0	0	0	13,908	11,866
United Kingdom	3,655	0	0	25,242	75,836	70,499
By truck						
Canada	8	8	17	7	7	7
Mexico	19	25	34	26	58	96
Total LNG exports	**353,059**	**349,292**	**327,872**	**366,774**	**375,843**	**366,941**
CNG						
Canada	0	0	0	0	0	*
Total CNG exports	**0**	**0**	**0**	**0**	**0**	*
Total exports	**634,499**	**634,485**	**607,307**	**638,382**	**620,697**	**650,773**

See footnotes at end of table.

Table 5. U.S. natural gas exports, 2022-2024

volumes in million cubic feet; prices in dollars per thousand cubic feet – continued

	2023			2022		
	February	January	Total	December	November	October
Exports						
Volume (million cubic feet)						
Pipeline						
Canada	95,691	105,422	959,630	98,718	90,179	72,738
Mexico	152,807	166,028	2,078,627	158,638	160,986	171,766
Total pipeline exports	**248,498**	**271,450**	**3,038,257**	**257,355**	**251,165**	**244,505**
LNG						
Exports						
By vessel						
Antigua and Barbuda	2	4	22	1	2	2
Argentina	2,287	0	66,939	0	0	0
Bahamas	27	42	489	42	35	40
Bangladesh	0	3,369	12,663	0	0	0
Barbados	0	0	93	0	1	0
Belgium	7,322	3,640	80,245	3,274	0	7,190
Brazil	0	0	71,998	0	0	3,439
Chile	0	3,307	30,131	0	0	0
China	2,565	17,896	96,659	6,992	17,308	22,598
Colombia	0	0	5,703	0	0	3,699
Croatia	6,006	2,913	77,286	6,204	5,122	2,922
Dominican Republic	3,514	3,643	50,824	6,644	0	3,469
El Salvador	0	0	0	0	0	0
Finland	0	0	329	329	0	0
France	39,457	34,124	571,399	38,311	50,655	41,959
Germany	8,229	14,314	7,113	7,112	1	0
Greece	6,781	3,207	69,031	2,869	421	4,424
Haiti	11	8	115	9	0	0
India	14,064	6,956	122,518	14,139	10,138	7,005
Indonesia	0	805	6,579	3,256	505	625
Israel	0	0	0	0	0	0
Italy	17,555	6,925	116,034	6,992	3,205	0
Jamaica	161	107	1,516	147	137	144
Japan	14,058	17,696	209,220	20,535	24,396	10,684
Jordan	0	0	0	0	0	0
Kuwait	0	0	57,018	0	0	3,299
Lithuania	0	6,713	77,212	3,281	3,708	7,072
Malta	0	2,592	5,273	0	2,928	0
Mexico	0	3,219	3,832	539	0	0
Netherlands	39,301	36,453	378,329	39,893	20,645	39,703
Nicaragua	0	0	0	0	0	0
Pakistan	0	0	3,074	0	0	0
Panama	0	2,718	13,759	249	3,833	0
Philippines	0	0	0	0	0	0
Poland	10,347	11,538	127,404	13,885	3,453	7,095
Portugal	6,138	6,816	69,583	10,025	3,732	7,005
Singapore	0	0	22,980	0	0	6,628
South Korea	22,672	24,507	292,732	24,700	14,069	38,844
Spain	32,138	13,987	426,657	33,847	26,445	26,369
Taiwan	6,557	3,471	106,738	9,203	3,592	9,041
Thailand	1,829	3,738	25,988	0	0	0
Turkiye	13,444	39,283	192,067	17,979	31,430	10,333
United Kingdom	71,702	63,032	464,462	69,332	76,693	46,040
By truck						
Canada	0	0	76	8	0	19
Mexico	106	133	1,552	160	153	175
Total LNG exports	**326,275**	**337,155**	**3,865,643**	**339,960**	**302,608**	**309,823**
CNG						
Canada	*	*	2	0	*	1
Total CNG exports	*****	*****	**2**	**0**	*****	**1**
Total exports	**574,773**	**608,605**	**6,903,902**	**597,316**	**553,774**	**554,328**

See footnotes at end of table.

Table 5. U.S. natural gas exports, 2022-2024

volumes in million cubic feet; prices in dollars per thousand cubic feet – continued

	2022					
	September	August	July	June	May	April
Exports						
Volume (million cubic feet)						
Pipeline						
Canada	61,926	75,220	69,774	70,105	79,214	80,475
Mexico	169,159	182,596	189,652	182,995	186,003	176,447
Total pipeline exports	**231,086**	**257,816**	**259,426**	**253,100**	**265,217**	**256,922**
LNG						
Exports						
By vessel						
Antigua and Barbuda	3	2	2	3	2	3
Argentina	0	2,202	9,448	25,246	20,111	9,933
Bahamas	43	53	45	47	42	34
Bangladesh	0	0	0	0	3,346	0
Barbados	0	0	0	0	0	0
Belgium	9,165	3,589	0	7,023	3,441	7,341
Brazil	0	10,542	5,192	3,857	15,303	3,448
Chile	3,365	0	6,917	0	9,943	3,530
China	10,275	10,272	784	7,329	0	10,217
Colombia	0	606	0	912	0	0
Croatia	9,073	7,824	4,600	7,925	8,543	6,763
Dominican Republic	3,196	3,357	6,532	5,838	4,964	3,645
El Salvador	0	0	0	0	0	0
Finland	0	0	0	0	0	0
France	57,943	33,885	53,443	37,564	47,150	56,343
Germany	0	0	0	0	0	0
Greece	0	10,763	12,922	9,633	12,650	1,336
Haiti	8	11	8	13	9	11
India	10,528	10,265	13,902	10,653	7,152	14,223
Indonesia	509	967	0	0	0	0
Israel	0	0	0	0	0	0
Italy	8,355	15,462	9,914	7,137	21,696	15,519
Jamaica	240	110	121	48	144	135
Japan	7,005	20,156	18,189	21,561	24,024	13,231
Jordan	0	0	0	0	0	0
Kuwait	7,038	6,415	5,382	8,105	14,204	7,298
Lithuania	3,541	7,579	7,947	6,729	11,237	13,770
Malta	0	0	0	0	0	0
Mexico	0	0	0	3,292	0	0
Netherlands	30,924	50,020	32,637	34,420	28,902	28,395
Nicaragua	0	0	0	0	0	0
Pakistan	0	0	0	0	0	3,074
Panama	0	0	0	623	1,192	1,536
Philippines	0	0	0	0	0	0
Poland	16,917	6,885	17,780	14,282	18,224	13,882
Portugal	5,806	3,202	6,412	5,582	3,888	6,632
Singapore	0	0	6,275	3,352	0	0
South Korea	19,736	36,033	34,342	25,054	17,538	13,813
Spain	21,263	26,140	34,396	29,639	40,337	40,259
Taiwan	9,753	8,901	9,353	6,892	15,975	9,541
Thailand	3,673	3,607	0	6,920	3,419	0
Turkiye	5,458	0	0	7,542	7,281	6,637
United Kingdom	51,467	21,263	3,797	3,326	10,608	39,775
By truck						
Canada	0	0	0	8	8	15
Mexico	94	103	76	105	115	122
Total LNG exports	**295,379**	**300,215**	**300,415**	**300,659**	**351,448**	**330,463**
CNG						
Canada	*	*	1	*	0	0
Total CNG exports	*****	*****	**1**	*****	**0**	**0**
Total exports	**526,465**	**558,031**	**559,842**	**553,760**	**616,665**	**587,385**

See footnotes at end of table.

Table 5. U.S. natural gas exports, 2022-2024

volumes in million cubic feet; prices in dollars per thousand cubic feet – continued

	2022		
	March	February	January
Exports			
Volume (million cubic feet)			
Pipeline			
Canada	105,074	74,630	81,577
Mexico	169,885	155,032	175,467
Total pipeline exports	**274,958**	**229,662**	**257,045**
LNG			
Exports			
By vessel			
Antigua and Barbuda	2	0	2
Argentina	0	0	0
Bahamas	43	31	34
Bangladesh	3,421	5,896	0
Barbados	34	31	28
Belgium	17,743	7,691	13,786
Brazil	2,236	10,660	17,322
Chile	3,214	0	3,162
China	7,527	3,357	0
Colombia	0	0	486
Croatia	3,358	5,870	9,084
Dominican Republic	6,530	0	6,647
El Salvador	0	0	0
Finland	0	0	0
France	64,415	39,646	50,084
Germany	0	0	0
Greece	4,116	8,094	1,802
Haiti	10	16	20
India	10,438	7,210	6,866
Indonesia	0	717	0
Israel	0	0	0
Italy	7,088	13,629	7,037
Jamaica	92	111	86
Japan	17,697	10,214	21,527
Jordan	0	0	0
Kuwait	0	5,277	0
Lithuania	5,700	3,131	3,518
Malta	0	2,345	0
Mexico	0	0	0
Netherlands	24,922	31,591	16,279
Nicaragua	0	0	0
Pakistan	0	0	0
Panama	0	3,069	3,255
Philippines	0	0	0
Poland	3,831	7,475	3,695
Portugal	10,728	3,703	2,868
Singapore	6,725	0	0
South Korea	19,289	27,489	21,824
Spain	59,224	39,359	49,379
Taiwan	12,161	6,115	6,211
Thailand	0	4,880	3,490
Turkiye	16,629	43,697	45,081
United Kingdom	56,799	25,301	60,060
By truck			
Canada	0	4	13
Mexico	144	157	148
Total LNG exports	**364,116**	**316,766**	**353,791**
CNG			
Canada	*	0	0
Total CNG exports	*****	**0**	**0**
Total exports	**639,074**	**546,428**	**610,836**

See footnotes at end of table.

Table 7. Marketed production of natural gas in selected states and the Federal Gulf of Mexico, 2019-2024

million cubic feet

Year and month	Alaska	Arkansas	California	Colorado	Kansas	Louisiana	Montana	New Mexico	North Dakota	Ohio
2019 total	**329,361**	**524,757**	**196,823**	**1,986,916**	**183,087**	**3,212,318**	**43,534**	**1,769,086**	**850,826**	**2,651,631**
2020 total	**339,337**	**481,205**	**155,979**	**1,996,740**	**163,362**	**3,205,574**	**38,191**	**1,965,533**	**887,445**	**2,389,629**
2021 total	**354,660**	**448,283**	**136,034**	**1,890,260**	**152,986**	**3,443,767**	**38,719**	**2,237,165**	**999,094**	**2,278,731**
2022										
January	32,865	36,087	11,347	155,786	12,478	318,772	3,119	199,405	81,490	190,930
February	30,014	32,336	9,814	141,557	11,122	290,031	2,977	184,452	75,867	172,453
March	32,473	36,319	11,603	159,101	12,465	319,562	3,370	218,272	88,106	190,930
April	30,910	35,043	11,384	153,816	12,347	324,537	3,175	216,047	68,665	181,993
May	31,677	35,781	11,593	154,313	12,826	348,337	3,170	222,902	81,340	188,060
June	28,644	34,299	11,296	149,081	12,302	336,152	3,208	215,334	86,437	181,993
July	29,654	35,096	11,734	153,856	12,659	348,334	3,367	228,003	90,288	193,328
August	29,380	35,394	12,177	155,140	12,814	351,777	3,544	229,728	89,688	193,328
September	29,288	34,211	11,260	151,515	11,854	348,817	3,491	231,482	90,550	187,092
October	31,122	35,112	11,520	156,992	13,008	365,742	3,560	250,312	93,103	190,335
November	30,934	33,568	11,095	151,304	12,206	357,021	3,266	239,821	85,482	184,195
December	36,181	32,951	11,396	150,558	11,764	355,708	2,461	251,472	76,605	190,335
Total	**373,141**	**416,196**	**136,220**	**1,833,019**	**147,846**	**4,064,791**	**38,709**	**2,687,231**	**1,007,621**	**2,244,971**
2023										
January	33,391	E34,788	E11,055	E151,849	E11,783	E363,863	E3,538	E254,905	E83,384	E198,189
February	30,726	E31,085	E10,042	E135,238	E10,528	E352,464	E3,233	E233,411	E80,766	E174,917
March	32,676	E34,429	E10,900	E150,138	E11,441	E370,158	E3,565	E268,590	E88,736	E199,571
April	31,313	E32,911	E10,652	E146,856	E11,228	E363,538	E3,475	E259,515	E88,066	E187,566
May	31,288	E33,689	E11,243	E152,690	E11,555	E379,548	E3,577	E263,626	E92,326	E191,104
June	28,991	E32,280	E10,795	E149,138	E10,817	E345,747	E3,469	E252,650	E92,129	E179,766
July	28,478	E33,094	E11,217	E155,584	E10,985	E363,583	E3,551	E264,909	E96,906	E189,040
August	26,756	E32,973	E11,217	E157,964	E11,293	E365,347	E3,654	E270,933	E97,655	E195,216
September	28,784	E31,874	E10,827	E152,177	E10,902	E351,720	E3,535	E265,057	E98,252	E188,594
October	31,535	E32,602	E10,908	E157,416	E11,305	E360,678	E3,579	E271,482	E100,209	E186,975
November	30,734	RE31,377	RE10,272	RE154,244	RE10,869	RE343,826	RE3,376	RE270,985	RE98,324	RE185,717
December	33,356	RE32,090	RE10,638	RE161,037	RE11,145	RE345,781	RE3,637	RE289,066	RE103,491	RE186,789
Total	**368,027**	**RE393,190**	**RE129,766**	**RE1,824,332**	**RE133,850**	**RE4,306,253**	**RE42,191**	**RE3,165,128**	**RE1,120,244**	**RE2,263,443**
2024										
January	34,077	E29,149	E10,476	E155,553	E10,302	E340,552	E3,475	E273,490	E89,660	E180,597

See footnotes at end of table.

Table 7. Marketed production of natural gas in selected states and the Federal Gulf of Mexico, 2019-2024

million cubic feet – continued

Year and month	Oklahoma	Pennsylvania	Texas	Utah	West Virginia	Wyoming	Other states	Federal Gulf of Mexico	U.S. total
2019 total	**3,036,052**	**6,896,792**	**9,378,489**	**271,808**	**2,155,214**	**1,488,854**	**456,024**	**1,015,343**	**36,446,918**
2020 total	**2,673,207**	**7,168,902**	**9,813,035**	**241,965**	**2,567,990**	**1,206,122**	**435,117**	**791,491**	**36,520,826**
2021 total	**2,555,430**	**7,647,068**	**9,949,156**	**239,422**	**2,675,145**	**1,109,416**	**401,892**	**780,632**	**37,337,860**
2022									
January	216,347	657,613	878,743	20,719	234,795	89,680	30,986	64,105	3,235,266
February	196,621	577,251	795,295	18,516	209,707	78,589	31,234	56,642	2,914,480
March	225,203	634,328	903,364	21,502	239,344	87,991	34,249	64,273	3,282,454
April	226,464	614,569	880,176	21,243	235,580	86,485	31,383	65,402	3,199,218
May	235,497	638,527	918,979	22,306	247,179	85,606	32,053	61,895	3,332,041
June	231,202	616,619	881,753	21,786	240,568	85,970	31,592	64,090	3,232,326
July	239,209	644,039	920,414	22,646	251,625	89,886	34,763	66,176	3,375,077
August	238,619	635,404	937,041	23,549	255,603	87,801	33,420	67,976	3,392,383
September	238,112	618,364	925,985	21,849	245,734	83,339	32,595	64,875	3,330,414
October	245,755	637,050	941,968	22,103	251,647	88,939	33,226	66,250	3,437,743
November	234,562	613,000	910,587	21,297	255,298	85,621	32,901	64,414	3,326,572
December	236,429	624,415	934,211	22,675	253,533	82,730	32,644	64,307	3,370,376
Total	**2,764,019**	**7,511,179**	**10,828,515**	**260,192**	**2,920,613**	**1,032,634**	**391,046**	**770,406**	**39,428,350**
2023									
January	E241,437	E646,645	E935,962	E22,310	E256,931	E79,538	E31,536	E67,666	E3,428,769
February	E217,813	E572,742	E842,907	E18,969	E231,585	E69,492	E27,372	E59,490	E3,102,781
March	E240,498	E642,354	E961,177	E22,752	E266,638	E78,520	E27,921	E64,871	E3,474,934
April	E232,276	E619,656	E932,661	E22,593	E256,029	E75,109	E30,110	E58,454	E3,362,007
May	E237,558	E648,124	E982,394	E24,031	E268,279	E81,880	E30,706	E56,290	E3,499,909
June	E233,220	E627,912	E949,437	E24,338	E266,083	E80,375	E31,225	E57,076	E3,375,450
July	E238,429	E643,265	E985,195	E24,165	E279,996	E70,816	E32,548	E63,043	E3,494,802
August	E236,507	E648,577	E996,400	E25,154	E282,678	E79,142	E32,273	E59,986	E3,533,722
September	E234,235	E616,784	E966,776	E24,587	E268,946	E78,776	E31,376	E62,802	E3,426,002
October	E239,892	E640,992	E999,974	E25,742	E284,310	E85,128	E32,256	E61,707	E3,536,693
November	RE229,910	RE643,405	RE974,811	RE25,583	E282,583	RE84,830	E30,876	RE57,038	RE3,468,760
December	RE235,541	RE669,131	RE1,015,129	RE26,419	E295,123	RE87,443	RE31,385	RE59,317	RE3,596,519
Total	**RE2,817,316**	**RE7,619,589**	**RE11,542,821**	**RE286,643**	**E3,239,180**	**RE951,049**	**RE369,584**	**RE727,741**	**RE41,300,347**
2024									
January	E226,254	E659,207	E968,204	E26,325	E288,010	E85,206	E30,986	E59,056	E3,470,579

RE Revised estimated data.

E Estimated data.

Source: 2019-2022: U.S. Energy Information Administration (EIA), *Natural Gas Annual 2022*, Bureau of Safety and Environmental Enforcement (BSEE), IHS Markit, and Enverus. January 2023 through current month: Form EIA-914, *Monthly Crude Oil and Lease Condensate, and Natural Gas Production Report*; and EIA computations.

Note: For 2023 forward, we estimate state monthly marketed production from gross withdrawals using historical relationships between the two. We collect data for Arkansas, California, Colorado, Kansas, Louisiana, Montana, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Texas, Utah, West Virginia, Wyoming, and federal offshore Gulf of Mexico individually on the EIA-914 report. The "other states" category comprises states/areas not individually collected on the EIA-914 report (Alabama, Arizona, Federal Offshore Pacific, Florida, Idaho, Illinois, Indiana, Kentucky, Maryland, Michigan, Mississippi, Missouri, Nebraska, Nevada, New York, Oregon, South Dakota, Tennessee, and Virginia). Before 2023, Federal Offshore Pacific is included in California. We obtain all data for Alaska directly from the state. Monthly preliminary state-level data for all states not collected individually on the EIA-914 report are available after the final annual reports for these series are collected and processed. Final annual data are generally available in the third quarter of the following year. The sum of individual states may not equal total U.S. volumes because of independent rounding.

Executive Summary

January 2024

Summary

In January 2024, the United States exported 673.9 Bcf and imported 331.3 Bcf of natural gas, which resulted in 342.6 Bcf of net exports.

U.S. LNG Exports

The United States exported 396.2 Bcf (58.8% of total U.S. natural gas exports) of natural gas in the form of liquefied natural gas (LNG) to 30 countries.

- Europe (283.7 Bcf, 71.6%), Asia (76.3 Bcf, 19.2%), Latin America/ Caribbean (36.3 Bcf, 9.2%)
- 6.3% decrease from December 2023
- 17.6% increase from January 2023
- 88.6% of total LNG exports went to non-Free Trade Agreement countries (nFTA), while the remaining 11.4% went to Free Trade Agreement countries (FTA).

U.S. LNG exports to the top five countries of destination accounted for 49.1% of total U.S. LNG exports.

- United Kingdom (42.9 Bcf, 10.8%), Turkiye (42.7 Bcf, 10.8%), Netherlands (41.9 Bcf, 10.6%), Spain (38.8 Bcf, 9.8%), and France (28.0 Bcf, 7.1%).

U.S. Imports and Exports by Pipeline and Truck with Mexico

The United States exported 185.1 Bcf of natural gas to Mexico and imported less than 0.1 Bcf of natural gas from Mexico, which resulted in 185.1 Bcf of net exports.

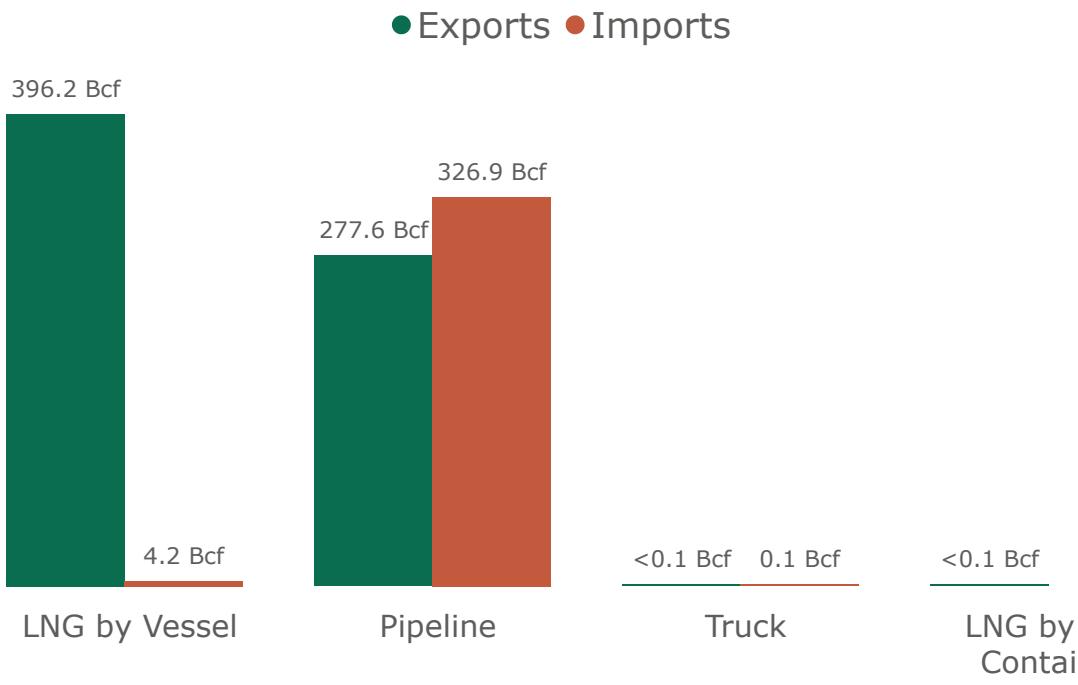
- 6.0% increase from December 2023
- 11.5% increase from January 2023

U.S. Imports and Exports by Pipeline and Truck with Canada

The United States exported 92.5 Bcf of natural gas to Canada and imported 327.0 Bcf of natural gas from Canada, which resulted in 234.5 Bcf of net imports.

- 36.7% increase from December 2023
- 33.4% increase from January 2023

U.S. Natural Gas Imports & Exports by Mode of Transport (January 2024)



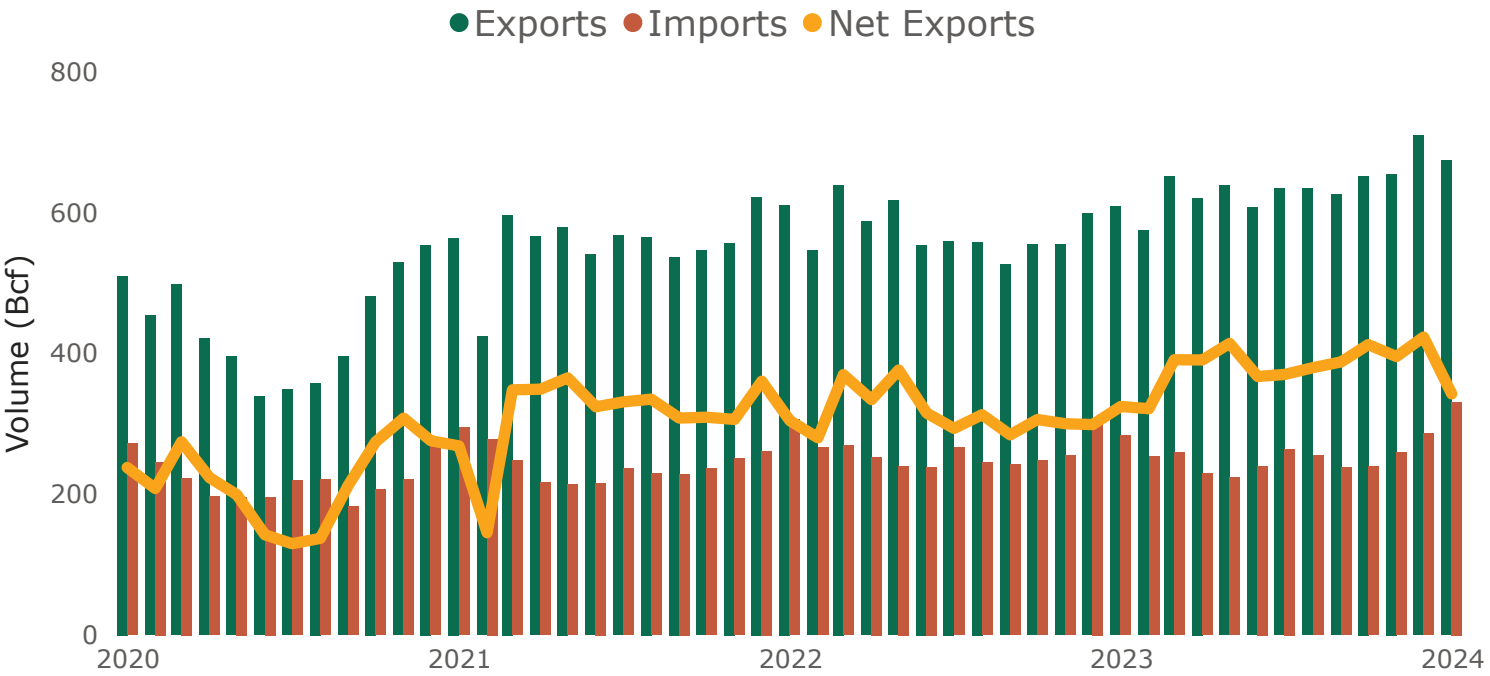
1a. Monthly Summary: U.S. Natural Gas Imports & Exports by Mode of Transport

Volume (Bcf)	Monthly			Percentage Change	
Mode of Transport	Jan 2024	Dec 2023	Jan 2023	Jan 2024 vs. Dec 2023	Jan 2024 vs. Jan 2023
Exports					
LNG by Vessel	396.2	422.8	336.9	-6%	18%
Pipeline	277.6	286.5	271.4	-3%	2%
Truck	<0.1	<0.1	0.1	-24%	-84%
LNG by ISO Container	<0.1	<0.1	0.2	29%	-48%
Total	**673.9**	**709.4**	**608.6**	**-5%**	**11%**
Imports					
LNG by Vessel	4.2	2.7	2.6	59%	63%
Pipeline	326.9	283.4	281.2	15%	16%
Truck	0.1	0.1	0.1	13%	29%
LNG by ISO Container	0	0	0	–	–
Total	**331.3**	**286.1**	**283.9**	**16%**	**17%**
Net Exports	**342.6**	**423.3**	**324.7**	**-19%**	**6%**

Notes

- Natural gas imports & exports by truck included compressed natural gas (CNG) and liquefied natural gas (LNG).
- Does not include LNG Re-Exports or Puerto Rico LNG Imports or Exports. See Table 6 for LNG Re-Exports and Table 8 for Puerto Rico LNG Imports and Exports.
- Totals may not equal sum of components because of independent rounding.
- not applicable(-).

U.S. Natural Gas Imports & Exports



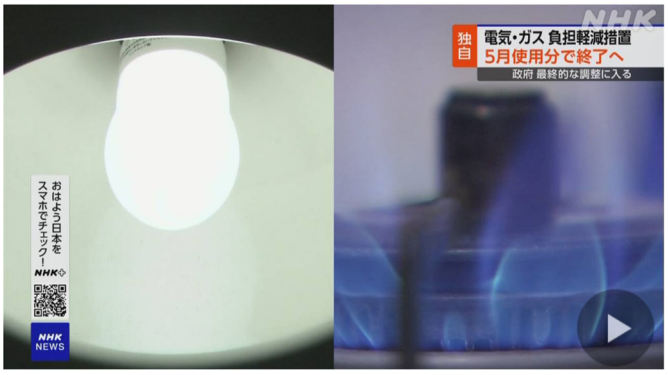
1b. Year-to-Date and Annual Summary: U.S. Natural Gas Imports & Exports by Mode of Transport

Volume (Bcf)	Year-to-Date (Jan)			Annual		
Mode of Transport	**YTD 2024**	**YTD 2023**	**% Change**	**2023**	**2022**	**% Change**
Exports						
LNG by Vessel	396.2	336.9	18%	4,341.6	3,861.9	12%
Pipeline	277.6	271.4	2%	3,267.7	3,040.8	7%
Truck	<0.1	0.1	-84%	0.7	1.6	-58%
LNG by ISO Container	<0.1	0.2	-48%	1.1	2.1	-48%
Total	**673.9**	**608.6**	**11%**	**7,611.1**	**6,906.4**	**10%**
Imports						
LNG by Vessel	4.2	2.6	63%	13.2	23.5	-44%
Pipeline	326.9	281.2	16%	3,016.8	3,104.0	-3%
Truck	0.1	0.1	29%	2.4	2.1	14%
LNG by ISO Container	0	0	–	0	0	–
Total	**331.3**	**283.9**	**17%**	**3,032.4**	**3,129.6**	**-3%**
Net Exports	**342.6**	**324.7**	**6%**	**4,578.7**	**3,776.8**	**21%**

Notes

- Does not include LNG Re-Exports or Puerto Rico LNG Imports or Exports. See Table 6 for LNG Re-Exports and Table 8 for Puerto Rico LNG Imports and Exports.
- Totals may not equal sum of components because of independent rounding.
- not applicable(-).

https://www3.nhk.or.jp/news/html/20240328/k10014404771000.html



Measures to reduce the burden of electricity and gas charges to be temporarily terminated for use in May Government

28th March 2024, 0:38 am Soaring prices

It is understood that the government has entered into final adjustments to the measures to reduce the burden of electricity and gas charges, which have been carried out as a measure against soaring prices, with the aim of ending them by the end of May usage. On the other hand, the government plans to extend subsidies to control gasoline prices for the time being.

In order to reduce the burden on households and businesses, the government subsidizes electricity bills by 3.5 yen per kilowatt-hour for households and 1.8 yen for businesses, and for city gas, 15 yen per cubic meter for households and companies with low annual contracts.

With regard to this burden reduction measure, the government has been considering whether to continue the subsidy after June, stating that "the same amount of subsidy will be continued until April and the subsidy will be reduced for May use."

In this regard, the government has recently reduced the subsidy for May usage to about half of the previous amount, and has entered into final adjustments to end the burden reduction measures by this May.

However, depending on future trends in electricity and gas charges, there is a possibility that measures to reduce the burden will be implemented again.

On the other hand, it has not been decided whether to continue the subsidy to control gasoline prices beyond May, but it will be extended for the time being, as it is necessary to assess the impact on local areas and developments in crude oil prices.

Ukraine Says Russia Barrage Aimed at Underground Gas Storage (1)

2024-03-24 17:20:59.423 GMT

By Aliaksandr Kudrytski

(Bloomberg) -- Russia struck an underground gas storage facility in western Ukraine during Sunday missile and drone attack, underlining threats to the country's energy system posed by war.

The barrage damaged equipment on the ground, Oleksiy Chernyshov, chief executive officer of state-run Naftogaz Ukrainy, said on Facebook. The underground storage itself wasn't damaged as it's significantly below the earth's surface, he said.

Kremlin forces aimed missiles and drones at Ukraine's electric power and gas facilities, the Russian defense ministry said in an operational update posted on Telegram. It was the second such targeted attack against Ukraine's energy systems in three days after a massive barrage on Friday.

Russian attacks have caused as much as $100 million in damage to Ukraine's power grid over the past three days, national operator Ukrenergo CEO Volodymyr Kudrytskyi said on Facebook.

The strikes on Sunday didn't disrupt gas supplies to domestic clients, and Ukraine continues to meet all obligations and fulfill storage capacity bookings by foreign clients, Chernyshov said.

Ukraine has been actively advertising itself as a storage haven for European foreign traders awash with gas.

Almost 80% of Ukraine's underground storage capacity is located in the west, hundreds of kilometers from the front line and in areas that have endured relatively limited airstrikes during Russia's invasion, now into its third year.

Ukraine has lured clients with options to store and trade gas for three years without paying taxes and customs duties. Foreign traders injected 2.5 billion cubic meters of gas in Ukrainian storage sites last year.

Ukraine has increasingly targeted Russian energy facilities, some far from the nations' border. Its forces have attacked more than a dozen refineries inside Russia with explosive-laden drones this month, prompting the country's daily oil refining rate to fall to the lowest weekly level in ten months.

Senior Ukrainian officials on Friday defended Kyiv's attacks on oil infrastructure following a report that US officials had warned against the operation because of rising oil prices and the prospect of Kremlin retaliation.

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https://gasprices.aaa.com/dont-get-april-fooled-by-wobbling-gas-prices/

DON’T GET APRIL FOOLED BY WOBBLING GAS PRICES

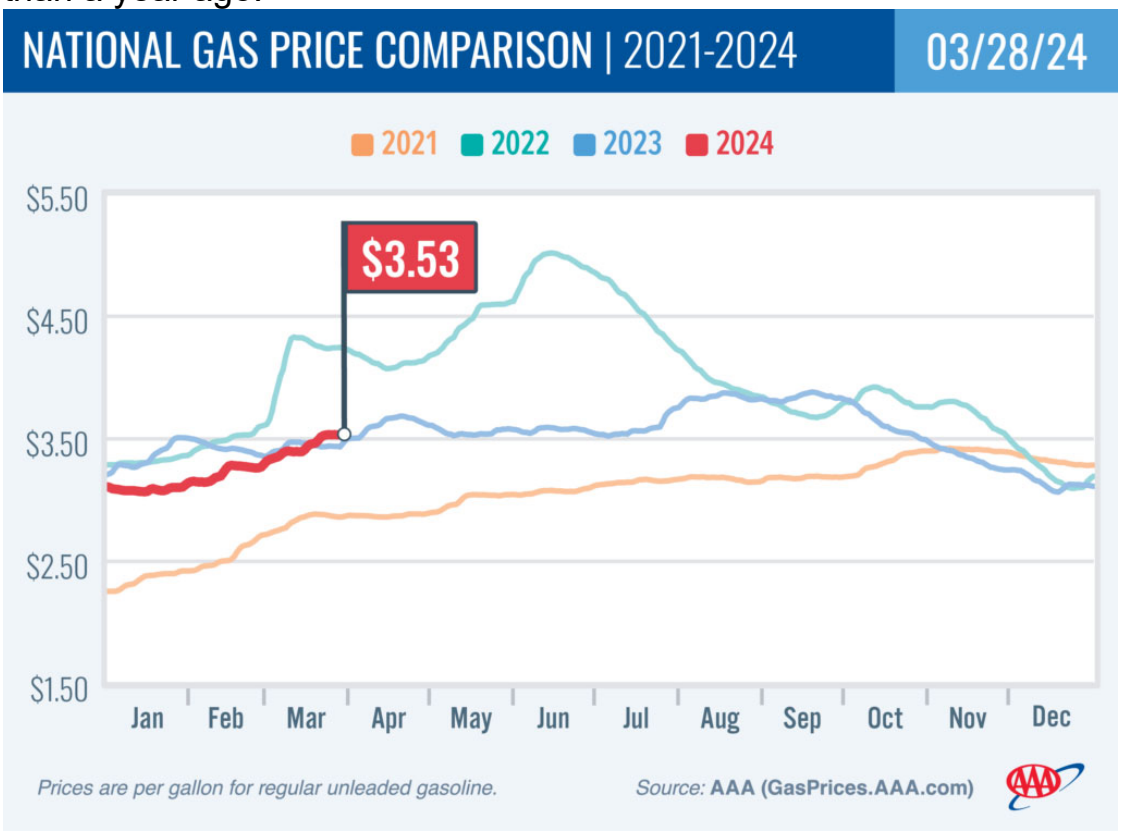
March 28,2024

WASHINGTON, D.C. — After an early spring surge, the national average for a gallon of gas spent the past week drifting up and down by a fraction of a cent before settling a penny higher at $3.53. But the break may be temporary, as gas pump prices will likely resume a spring increase.

“Uncertainty of the impact of Ukraine’s targeting of Russia’s oil infrastructure likely spiked oil prices recently,” said Andrew Gross, AAA spokesperson. “But those concerns have abated somewhat for now, and gas prices are settling into a pattern similar to last year when the usual seasonal increase was slow and steady.”

According to new data from the Energy Information Administration (EIA), gas demand dipped slightly from 8.81 to 8.72 million b/d last week. Meanwhile, total domestic gasoline stocks increased by 1.3 million bbl to 232.1 million bbl. Lower demand would typically contribute to pushing pump prices lower or slowing increases, but rising oil prices have kept them elevated instead.

Today’s national average of $3.53 is 24 cents more than a month ago and 10 cents more than a year ago.



Quick Stats

- Since last Thursday, these **10 states have seen the largest increases** in their averages: Utah (+26 cents), Idaho (+17 cents), Alaska (+15 cents), Nevada (+12 cents), Washington (+12 cents), Oregon (+11 cents), Wyoming (+7 cents), California (+7 cents), North Dakota (+6 cents) and Washington, DC (+6 cents).
- The nation's **top 10 most expensive markets**: California ($5.02), Hawaii ($4.69), Washington ($4.49), Nevada ($4.38), Oregon ($4.25), Alaska ($4.07), Illinois ($3.90), Arizona ($3.78), Utah ($3.76) and Washington, DC ($3.69).

Oil Market Dynamics

At the close of Wednesday's formal trading session, WTI decreased by 27 cents to settle at $81.35. Oil prices fell after the EIA reported that total domestic commercial crude stocks increased by 3.2 million bbl to 448.2 million bbl last week. Although stocks increased when compared to a year ago, the current stock level is 25.5 million bbl lower than at the end of March 2023.

Drivers can find current gas prices along their route using the AAA TripTik Travel planner.

https://www.convenience.org/Topics/Fuels/Changing-Seasons-Changing-Gas-Prices

Seasonal Gas Prices Explained

From refinery maintenance to consumer demand, seasonal fuel production affects gasolines prices at the dispenser.

February 28, 2024 3 min read

Traditionally, gasoline prices are at their lowest during the first week of February and then begin to climb, often peaking right before Memorial Day. Seasonal increases in demand plus a transition to unique fuel blends put pressure on gas prices each spring.

Since 2000, gasoline prices have increased about 50 cents from the seasonal low at the beginning of February to the seasonal high in mid-May. Here's a timeline of events that can affect gas prices during the first half of the year.

February: Refinery Maintenance

U.S. demand for gasoline is generally at its lowest during the first two months of the year, so refinery maintenance, known as a "turnaround," is often scheduled during the first quarter. A turnaround is a planned, periodic shut down (total or partial) of a refinery process unit or plant to perform maintenance, overhaul and repair operations and to inspect, test and replace materials and equipment.

Refineries undergo turnarounds roughly once every four year so about 25% of refineries undergo a turnaround each spring. Another reason for scheduling turnarounds is that they allow refineries to retool for summer-blend fuels.

March-April: Refineries Switch to Summer-Blend Production

The U.S. Environmental Protection Agency (EPA) defines April to June as the "transition season" for fuel production. Refineries lead this transition and switch over to summer-blend production in March and April.

Gasoline blends used in the summer months are different than the blends used in the winter. In the winter, fuels have a higher Reid vapor pressure, meaning they evaporate more easily and allow cars to start in colder weather. In the warm summer months, these evaporative attributes would lead to increased emissions and the formation of smog.

There are also more fuels to produce during the transition season. In the winter months, only a few fuels are used across the United States. However, because of various state or regional requirements, 14 different fuel specifications are required for the summer months. Refineries must produce enough fuel for each area to ensure there are no supply shortages, and that can complicate the production and distribution of fuels.

Summer-blend fuel is also more expensive to make than winter-blend fuel. First, the production process takes longer and, second, the overall yield of gasoline per barrel of oil is lower. These complexities add as much as 15 cents per gallon to the cost to produce these higher-grade fuels.

May-June: Deadlines for Terminals and Retailers

The May 1 compliance deadline for terminals to fully purge their systems of winter-blend fuels is considered one of the biggest factors in seasonal price increases. This regulatory requirement can lead to lower inventories at the terminal, which also puts upward pressure on gas prices. It can also take fuels refined in the Gulf Coast several weeks to reach storage terminals throughout the country, which is why it's important to have summer-blend fuel at terminals and storage facilities by May 1. This date is the most important reason that seasonal gas prices tend to peak in May.

In most areas of the country that require summer-blend fuels, retailers have until June 1 to switch to summer-grade gas.

February-August: Summer Drive Season and Increased Demand

Demand can play a role in elevating seasonal gas prices. Gas demand increases a few percentage points each month beginning in February and peaks in August. Total fuel demand is 10% to 15% greater in August than in February, and any stress to the system—such as a refinery or pipeline outage—can cause a supply/demand imbalance and affect prices.

September: A Welcome Change

As gasoline demand decreases and temperatures cool, retailers are able to switch to selling winter-blend fuel beginning September 15. While these winter-blend fuels are cheaper to produce, the complications of the switchover can result in a temporary bump in price. Weather conditions, such as hurricanes, can also affect gas prices in the late summer to fall months.

Unlike in the spring, the change to winter-blend fuel is not required. However, because winter-blend fuel costs less, retailers often sell the fuel blend to remain price competitive. Not all retailers begin selling this fuel on September 15; many make the switch when their inventories are low.

By the end of September, gas prices generally decrease as the switchover processes and demand continues to fall. And despite conspiracy theories, lower gas prices do not correlate to pre-election politics.

In California, the season for summer-blend fuels is longer than the rest of the country. Both Northern and Southern California's summer-blend requirements run through the end of October. This exacerbated supply issues within the state in early October 2012, when fires at two large refineries limited state-specific production and caused wholesale and retail gas prices to spike to record levels.

Meanwhile, demand for distillate fuel (diesel fuel and home heating oil) begins to increase in September because of both greater diesel fuel demand related to the harvest and greater home heating oil demand because of the colder weather.

Exceptions to the Rule

Summer-blend fuel requirements may be relaxed in times of emergencies or when potential shortages are possible.

In 2005, NACS worked with Congress to give the EPA the authority to waive certain regulations affecting the motor fuels system in times of emergency. The EPA's immediate use of these waivers is critical to bringing the entire fuel supply chain into operation as quickly and safely as possible. For example, this flexibility allowed winter blends of gasoline to enter into the market in 2017 before the traditional transition date of September 15 in response to Hurricanes Harvey, Irma and Maria.

Trudeau's Mega Oil Pipeline Startup Hangs on Final 1.6-Mile Leg

2024-03-20 18:25:14.279 GMT

By Lucia Kassai and Devika Krishna Kumar

(Bloomberg) -- The startup date for Canada's mega oil pipeline should be known within weeks as Trans Mountain drills through hard rock in British Columbia's rugged Fraser Valley for the final stretch of the 715-mile conduit.

"The next few weeks will be very important in terms of being able to enter service in the second quarter," Trans Mountain's Chief Financial and Strategy Officer Mark Maki said in a interview during the CERAWeek by S&P Global conference on Wednesday. "We are feeling better and better every day about the startup."

The last 1.6-mile (2.5-kilometer) segment is being enlarged to make space for pipe with a diameter of about 2 1/2 feet. After construction and testing, the entire line will be flooded with crude oil for the first time, a crucial step in commencing service.

Partial filling has been taking place at each of the segments since last summer and roughly 2.1 million barrels will be pumped into the line once construction is complete.

Maki didn't have a firm date on when in the second quarter the line would commence service, despite news reports citing Alberta Premier Danielle Smith saying it would happen in May.

The expansion of Trans Mountain, first devised 12 ago, is a pet project of Prime Minister Justin Trudeau, whose government bought the project from Kinder Morgan Inc. in 2018. Delays have been so chronic that Trans Mountain has been providing nearly daily updates to crude shippers planning to use the conduit.

Costs have surged six-fold to almost C$34 billion ($25 billion). Maki warned the final pricetag may vary from that estimate depending on how construction of the final stretch goes. He expects the line to be at full capacity in 2025.

Read More: China's Sinochem Buys First Oil Cargo From Canadian Pipeline

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https://corporate.exxonmobil.com/locations/united-states/joliet-operations-overview#Aboutus
Sept. 27, 2018

Joliet operations

The Joliet Refinery is located 40 miles southwest of Chicago, Ill. Built in 1972, the Joliet facility is one of the newest refineries in the United States and is ideally located to receive and process Canadian crude oil delivered by pipeline.

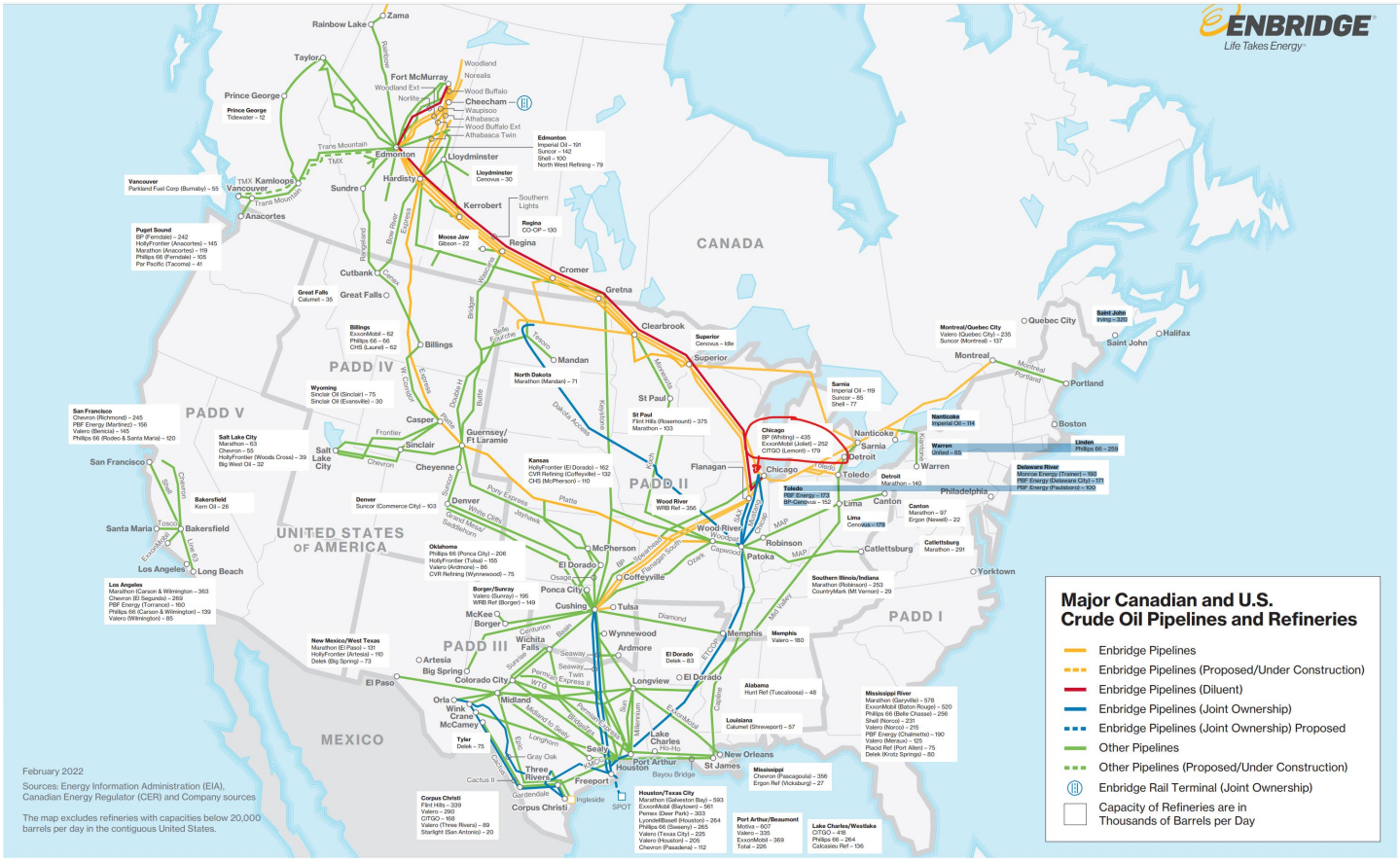
About us

The Joliet Refinery is located 40 miles southwest of Chicago, Ill. Built in 1972, the Joliet facility is one of the newest refineries in the United States and is ideally located to receive and process Canadian crude oil delivered by pipeline.

The characteristics of Canadian crude require specialized refinery equipment and processes and the Joliet Refinery was designed with this purpose in mind.

Today the refinery is equipped to handle 250,000 barrels of crude per day, producing about 9 million gallons of gasoline and diesel fuel every day. That daily production is enough to drive an average car around the world more than 7,000 times. These fuels and other refinery products are transported from the refinery to consumers primarily across the Midwest. The refinery uses state-of-the-art technology to process crude safely, reliably and efficiently.

https://www.enbridge.com/-/media/Enb/Documents/maps/2022-LPCH/2022_RB_Enbridge_Crude_Oil_Map_Feb22_3_FINAL.pdf?rev=62a46e4c48d545ed8c0acaecff41da50&hash=4B613E8B9999BB5498D462816EF5C3B3



https://www.wsj.com/world/americas/biden-is-unlikely-to-reimpose-oil-sanctions-on-venezuela-9fc8ac7c

1. EXCLUSIVE
2. AMERICAS

Biden Is Unlikely to Reimpose Oil Sanctions on Venezuela

Nicolás Maduro of Venezuela has barred presidential candidates, but U.S. officials worry that new penalties would raise gas prices in a U.S. election year

By Kejal Vyas Follow , Patricia Garip and Juan Forero Follow

March 29, 2024 4:09 pm ET

The Biden administration is leaning away from reimposing sanctions on Venezuela's oil industry despite President Nicolás Maduro's moves to bar leading opposition candidates from the country's July elections, said people familiar with the matter.

U.S. officials are concerned that reverting to Trump-era sanctions that accelerated the decline of Venezuela's oil production would raise the price of gas at U.S. pumps and prompt more migration from Venezuela as President Biden campaigns for re-election in November. Restricting Western oil companies would tighten global energy supplies and open the way for Chinese investment in Venezuela, they say.

Biden administration officials have said they didn't think that the oil sanctions—leveled against Venezuela in early 2019 in former President Donald Trump's effort to force Maduro from power—was constructive.

Top officials including national security adviser Jake Sullivan; Amos Hochstein, senior White House energy adviser; and Deputy national security adviser Jon Finer are encouraging a different approach that emphasizes broader strategic interests such as energy supply over political change in Caracas.

"We are committed to maintain sanctions relief if Maduro and his representatives uphold the commitments outlined" in a deal they signed in October for an electoral road map, a senior U.S. administration official said Friday. "We urge Maduro to do so."

Maintaining the current policy "spells a greater opportunity of keeping Venezuela as part of the Western marketplace, less inclined to spin back in the direction of China and Iran," said an oil industry adviser familiar with the deliberations.

In October 2023, after secret talks between U.S. and Venezuelan officials in Qatar, the Biden administration issued a six-month general license, which expires April 18, allowing oil companies to work in Venezuela. The license expanded an easing of sanctions that since late 2022 had been mostly limited to Chevron, the largest private company with assets in Venezuela. In exchange, Maduro's regime pledged to work toward free and fair elections this year and agreed to receive Venezuelan deportees as the U.S. grapples with record migration.

Instead, the government halted the short-lived deportation deal, arrested a range of political opponents and banned from office Maria Corina Machado, an opposition politician who had been chosen in a primary to challenge him.

When Machado and opposition political parties last week named an 80-year-old grandmother and academic as a replacement candidate, the government banned her, too. A poll by the American company ClearPath Strategies showed Machado or any candidate she backed would easily defeat Maduro in a vote.

“I said at the time, you lift the sanctions now, you take away your own leverage,” said Eric Farnsworth, a former high-ranking State Department diplomat who is vice president of the Council of the Americas policy group in Washington. “That is exactly what happened.”

The Biden administration is likely to extend the current policy until July 28, when Venezuela will hold elections, people familiar with the administration’s thinking say, allowing oil companies and traders to engage with national oil company Petróleos de Venezuela for now. U.S. oil executives are negotiating deals in Caracas in the hopes of a more enduring commercial opening.

Those familiar with the administration’s thinking don’t rule out some punitive measures, such as restricting payment for Venezuelan oil to local currency rather than U.S. dollars.

“Fundamentally, the maximum pressure strategy was something that did not lead to the outcome it intended to promote regime change through crushing sanctions,” Juan Gonzalez, who until recently was the White House’s top Latin American adviser, told reporters in February.

The Biden administration has quietly retained Gonzalez as a go-between with Venezuela in ongoing talks, the people familiar with the matter said. A face-to-face meeting is scheduled for early April, possibly in Doha or Mexico City.

Among the U.S.’s top concerns regarding Venezuela has been the exodus of migrants, hundreds of thousands of whom have sought asylum after crossing the American southwestern border. Sanctions relief helped Venezuela raise daily oil production by nearly 200,000 barrels in three years, to about 800,000.

For some analysts who track U.S. policy in Latin America, the Biden administration’s opening to Maduro failed.

“After all that’s been done, without snapping back sanctions, we lose credibility,” said Ryan Berg, who tracks Venezuela at the Center for Strategic and International Studies in Washington. “If we don’t have accountability, I think Maduro would be laughing at us.”

Geoff Ramsey, Venezuela director at the Atlantic Council in Washington, said a policy that gives priority to Western energy interests would require “significant concessions” from Maduro.

“I don’t see the administration completely scrapping a democracy and human rights agenda,” he said. “The White House has walked a fine line between pursuing U.S. energy and geopolitical interests while also trying to encourage a gradual democratic opening in Caracas.”

In Latin America, Maduro’s measures sparked criticism.

Argentine President Javier Milei’s government issued a statement calling on Maduro to “ensure the safety and welfare of the Venezuelan people as well as convening transparent elections.” In

Brazil, President Luiz Inácio Lula da Silva and French President Emmanuel Macron called the exclusion of the Venezuelan candidate, Corina Yoris, "serious."

"I just want the elections carried out the way they are in Brazil, whoever wants to take part, takes part," said da Silva.

In Caracas, foreign energy executives say they have taken comfort in the U.S.'s unwillingness to sever business ties with Venezuela, despite the rocky political climate.

Chevron, which was given a special license by the U.S. Treasury in 2022 to operate in Venezuela, plans to drill dozens of wells this year in a bid to raise its output to 200,000 barrels a day, roughly a quarter of the country's total production. Italy's Eni and Spain's Repsol have also been operating under special exemptions that the U.S. made to its sanctions policy. Other oil companies are in talks with the U.S. over securing terms similar to Chevron's.

Write to Kejal Vyas at kejal.vyas@wsj.com and Juan Forero at juan.forero@wsj.com

GLOBAL COMMODITY STRATEGY AND MENA | RESEARCH

Geopolitical Update: Temperatures Rising

Analysis and Updates on Conflicts in Ukraine and the Middle East

March 27, 2024

RBC Capital Markets, LLC
Helima Croft (Head of Global Commodity Strategy and MENA Research) (212) 618-7798; helima.croft@rbccm.com

President Biden faces the prospect of a cruel summer if the Russia-Ukraine and Middle East conflicts continue to pose risks to global energy supplies.

- **This week brought more attacks by Ukraine on Russian refineries with drones circling back to two previously targeted refineries, Novokuibyshevsky and Kuibyshevsky, in the Samara region, resulting in significant damage to the latter's primary crude distillation unit.** As a result, we now count 5 refineries facing significant throughput disruptions, with our estimates for downed refining capacity rising to 13% of Russia's total. These attacks seem to be serving the twin purposes of partially denying the Russian frontlines diesel as well as reducing Russia's essential energy revenue to fund the war. Preliminary estimates already show aggregate Russian refinery runs in March down 650 kb/d y/y. While it is still too early to see how these disruptions will ultimately affect seaborne refined product export flows, the largest impacts would be seen on global gasoil and fuel oil markets. Turkey, Africa, and Brazil have been the top destinations for Russian gasoil since exports were barred from Europe.
- **There have been reports that the White House has tried to dissuade Kyiv from this strategy, fearing the energy price impact – we find this entirely credible based on our conversations.** As we have repeatedly noted, the White House has sought to avert a Russian supply disruption and has shaped policy towards this end; including price caps designed as a release valve to ensure Russian barrels locked out of Europe would flow to Asia, or directly telling Ukraine to not target Black Sea oil tankers. However, with US assistance being held up in Congress, and Russia making battlefield gains, Ukraine and key regional allies appear to be questioning the utility of this energy bargain with Washington.
- **A key dynamic worth watching is whether Congress moves to approve the $60bln supplementary military, budgetary, and humanitarian aid package being held up in the House after already passing in the Senate.** House Speaker Mike Johnson (R-LA) has signaled a willingness to hold a vote on Ukraine support after Congress's Easter recess, however at the time of writing, there are no clear indications of imminent passage. Moreover, with a complete cutoff of funding potentially in the offing if President Trump wins in November, the window for Ukraine to make battlefield advances in the two-year conflict may be closing.

- **Hence, we will be closely watching whether Ukraine moves at some stage to target actual export facilities to strike a deeper blow on the Russian balance sheet.** We continue to contend that Ukraine seemingly has the capability to target the majority of export facilities in western Russia, which would put ~60% of Russia's crude exports at risk. While Washington would certainly not be happy with such a move because of the serious price implications, Kyiv could decide that such asymmetrical measures may be necessary. Resilient energy revenue has been essential for Russia's continued military strength – the 2024 budget contains record defense spending, with the Russian Federation for the time poised to spend over 6% of GDP on military and defense spending. At the same time, Moscow is forecasting a shrinking deficit based on an anticipated rise in revenue this year. According to the Carnegie Endowment, the 2024 budget is based on the assumption that revenue will climb by over a third to over ₽35tln ($378bln), of which ₽11.5tln ($124bln) is expected to come from the oil and gas sector.
- **While OPEC is sitting on over 2 mb/d of spare capacity, we do not think the producer group would rush in to cool the rally and ramp up output given what transpired in the months immediately following the Russian invasion of Ukraine.** Washington made unprecedented interventions in the market by releasing 180 mb from the SPR after the IEA and other market participants warned of a multimillion b/d Russian disruption that never materialized. Certainly, we do not see any indications that the recent run up in prices due to the heightened Russian infrastructure risk will prompt any policy reversal at next week's Joint Ministerial Monitoring Committee Meeting. Any serious shift will likely have to wait until the June 1 Ministerial Meeting, and even then, we believe the group will be very judicious when it comes to unwinding any cuts.
- **Complicating the challenge for the White House is the lack of progress in resolving the six-month Middle East war.** The Houthis continue to attack ships in the Red Sea, claiming six attacks on Tuesday, while Houthi officials this week have renewed threats against Saudi Arabia over providing support and airspace access to US jets conducting strikes in Yemen. In addition, the continuing exchange of fire between Hezbollah and Israel – with Hezbollah launching "dozens" of rockets in response to deadly Israeli strikes in southern Lebanon yesterday – still represents a serious contagion risk.
- **Hence, it is our view that Washington may once again have to resort to policy tools such as the SPR if these twin conflicts continue to imperil global energy supplies. Certainly, this raises a campaign risk for President Biden, as his opponents will likely accuse him of endangering energy security by tapping further into the strategic reserve. However, if President Biden cannot find a way to ameliorate the risk from these conflicts, the White House may decide that SPR releases are more politically palatable than retail gasoline prices north of $4/gallon for the summer driving season.**

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https://www.reuters.com/markets/commodities/russia-orders-companies-cut-oil-output-meet-opec-target-2024-03-25/

Exclusive: Russia orders companies to cut oil output to meet OPEC+ target

Reuters
March 25, 20248:57 AM MDTUpdated 7 hours ago

MOSCOW, March 25 (Reuters) - Russia's government has ordered companies to reduce oil output in the second quarter to ensure they meet a production target of 9 million barrels per day (bpd) by the end of June in line with its pledges to OPEC+, three industry sources said on Monday.

Earlier this month, Russian Deputy Prime Minister Alexander Novak said that Russia would cut its oil output and exports by an additional 471,000 barrels per day (bpd) in the second quarter, in coordination with some members of the Organization of the Petroleum Countries and allied producers (OPEC+).

Russia plans to gradually ease the export cuts and focus on only reducing output. Novak has not provided the targeted level for output, but production would drop to almost 9 million bpd in June if the reduction is implemented as planned.

The sources, who declined to be named because they were not authorised to speak publicly, said the government had given specific targets to each company, indicating its intention to meet its OPEC+ pledge to cut output to support international oil prices.

Russia's Energy ministry declined to comment. Alexander Novak's press office did not reply to Reuters' request for comment.

Reuters sources said the production cuts would facilitate a seasonal peak in maintenance at refineries, many of which had already reduced fuel production as a result of outages and Ukrainian drone attacks.

Novak late last month said Russian oil output was 9.5 million bpd.

Russian oil and gas condensate production have declined from an annual peak of 11.7 million bpd in 2019 to around 10.8 million in recent months as a result of coordinated actions with OPEC.

Russia decided not to disclose statistics on crude oil production as it treated large amounts of data as classified following the start of what it calls a special military operation in Ukraine in February 2022.

Russian oil production in April, May and June is set to fall by around 3.6%, 4.1% and 4.9% respectively from March, in line with Russia's promises to voluntary reduce production, the data provided by sources and Reuters calculations showed.

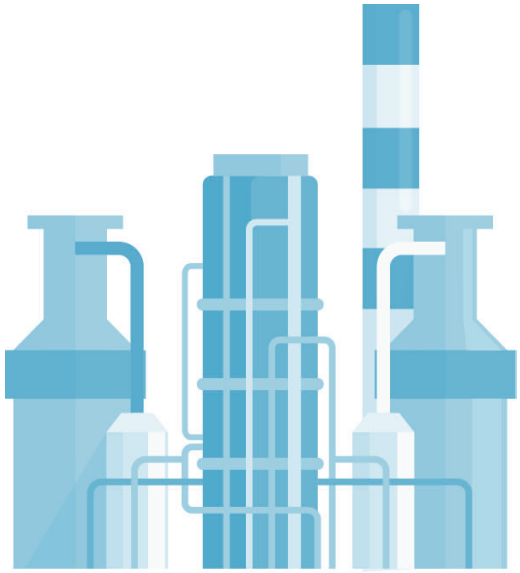
Novak has said Russia will reduce output by an extra 350,000 bpd in April, with exports will be cut from March levels by 121,000 bpd. In May, output will be cut by 400,000 bpd and exports by another 71,000 bpd. In June, all the additional cuts will be from oil output.

That does not include production of gas condensate, a type of very light oil, which in 2023 was around 1.3 million bpd.

Reporting by Reuters; editing by Barbara Lewis

Crude Oil Characteristics

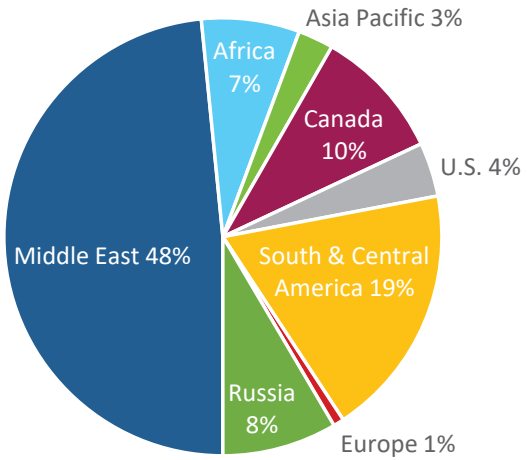
- Crude oils are blends of hydrocarbon molecules
  - Classified and priced by density, sulfur content and acidity
- **Density** is commonly measured in API gravity (relative density of crude oil to water)
  - API > 10: lighter, floats on water
  - API < 10: heavier, sinks in water
- **Sulfur** content is measured in weight percent
  - Less than 0.7% sulfur content = sweet
  - Greater than 0.7% sulfur content = sour
- **Acidity** is measured by Total Acid Number (TAN)
  - High acid crudes are those with TAN greater than 0.7
  - Acidic crudes are corrosive to refinery equipment and require greater investment to process significant volumes

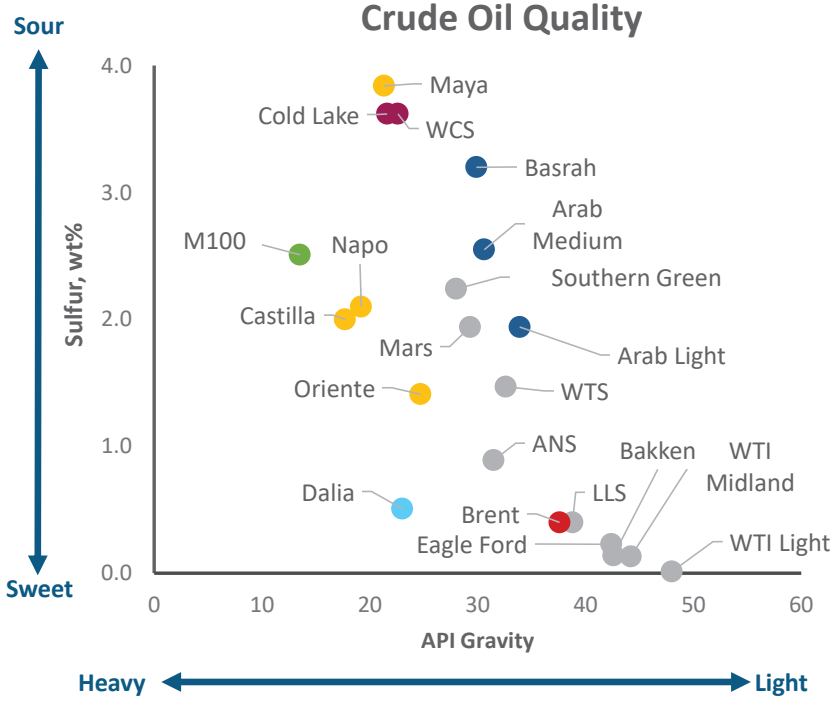


Heavy, sour, high acid crude oils are more difficult to process, but **trade at a discount** relative to **light, sweet, low acid crudes oils**

Crude Oil Reserves and Quality

1.73 Trillion Barrels of Oil Reserves (2020)





Majority of global reserves are **sour crude oils**

WTI and **Brent** are the primary light sweet crude oil **pricing benchmarks**

Source: Valero and industry reports.

What is in a Barrel of Crude Oil?

Crude Oil Types	Characteristics	Inherent Yields
Light Sweet (WTI, LLS, Brent)	• > 34 API Gravity • < 0.7 % Sulfur • Most Expensive	3% 32% 30% 35%
Medium Sour (Mars, Arab Medium)	• 24 to 34 API Gravity • > 0.7 % Sulfur • Less Expensive	2% 24% 26% 48%
Heavy Sour (Maya, WCS)	• < 24 API Gravity • > 0.7 % Sulfur • Least Expensive	1% 15% 21% 63%

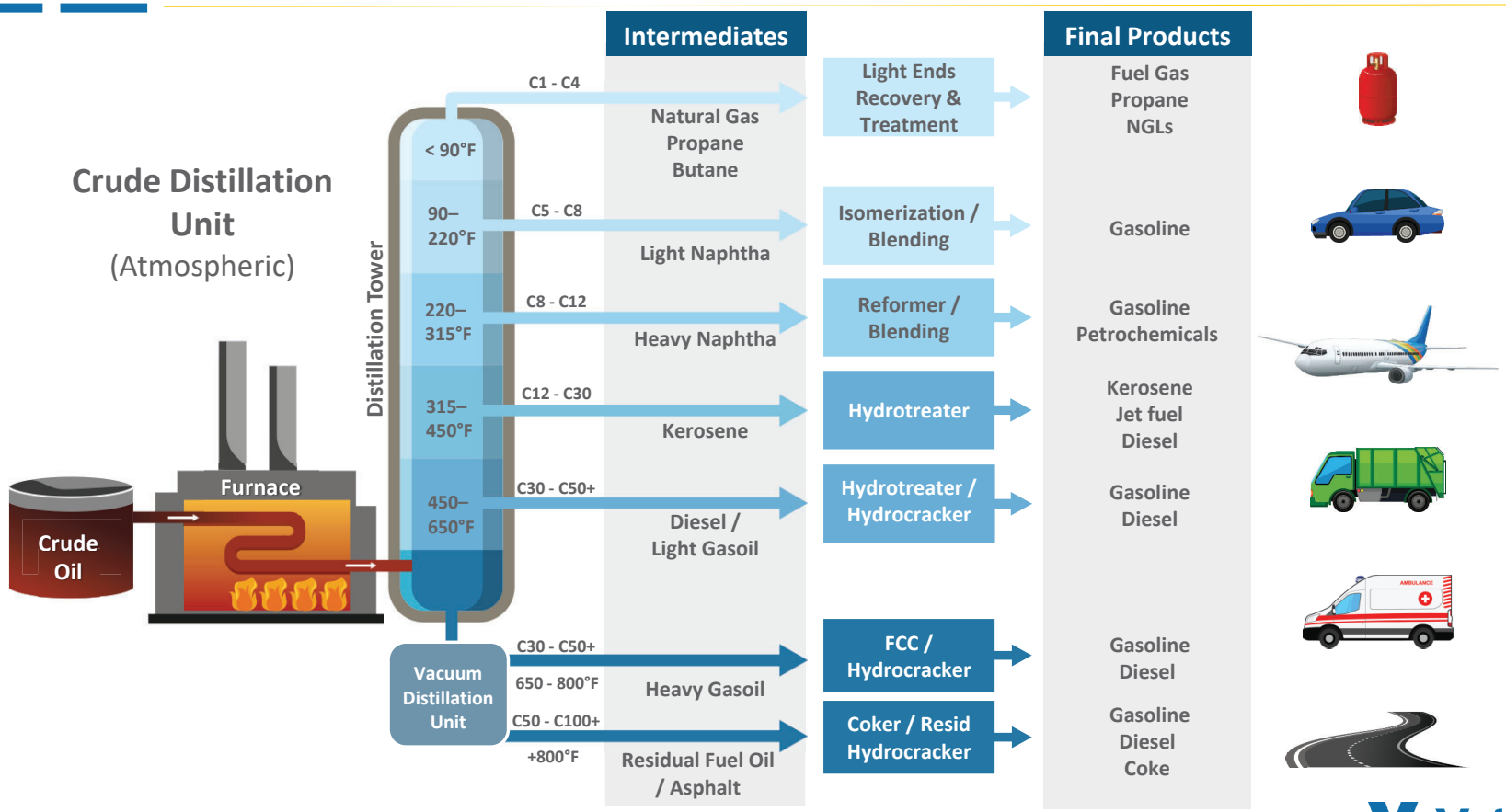
2021 U.S. Refinery Production

10%	Refinery Gases
45%	**Gasoline** RBOB CBOB Conventional CARB Premium
36%	**Distillate** Jet Fuel Diesel Heating Oil
8%	Fuel Oil & Other

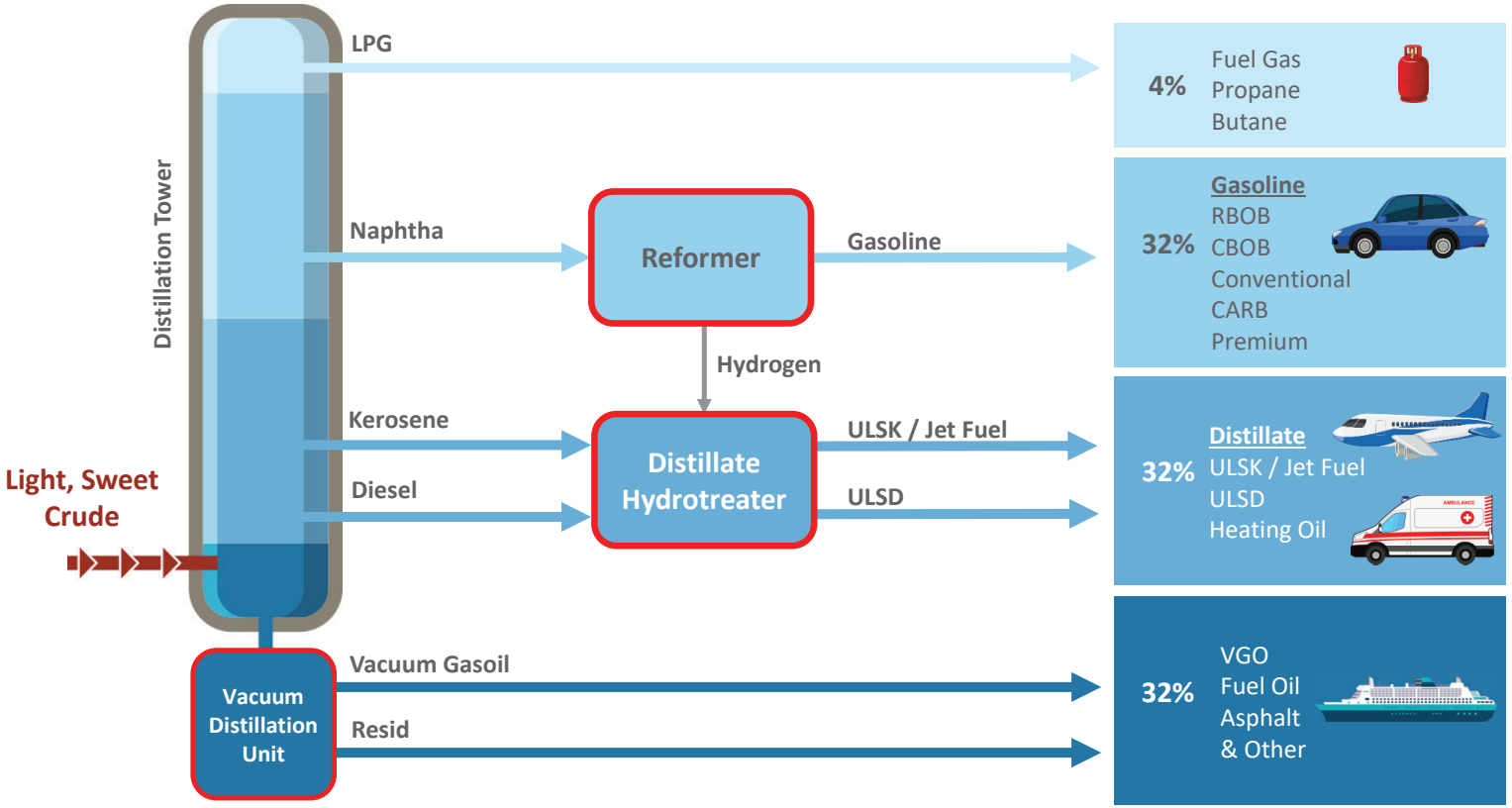
Refineries **upgrade** crude oil into **higher value gasoline** and **distillates**

Source: Energy Information Administration.

Basic Refining Concept

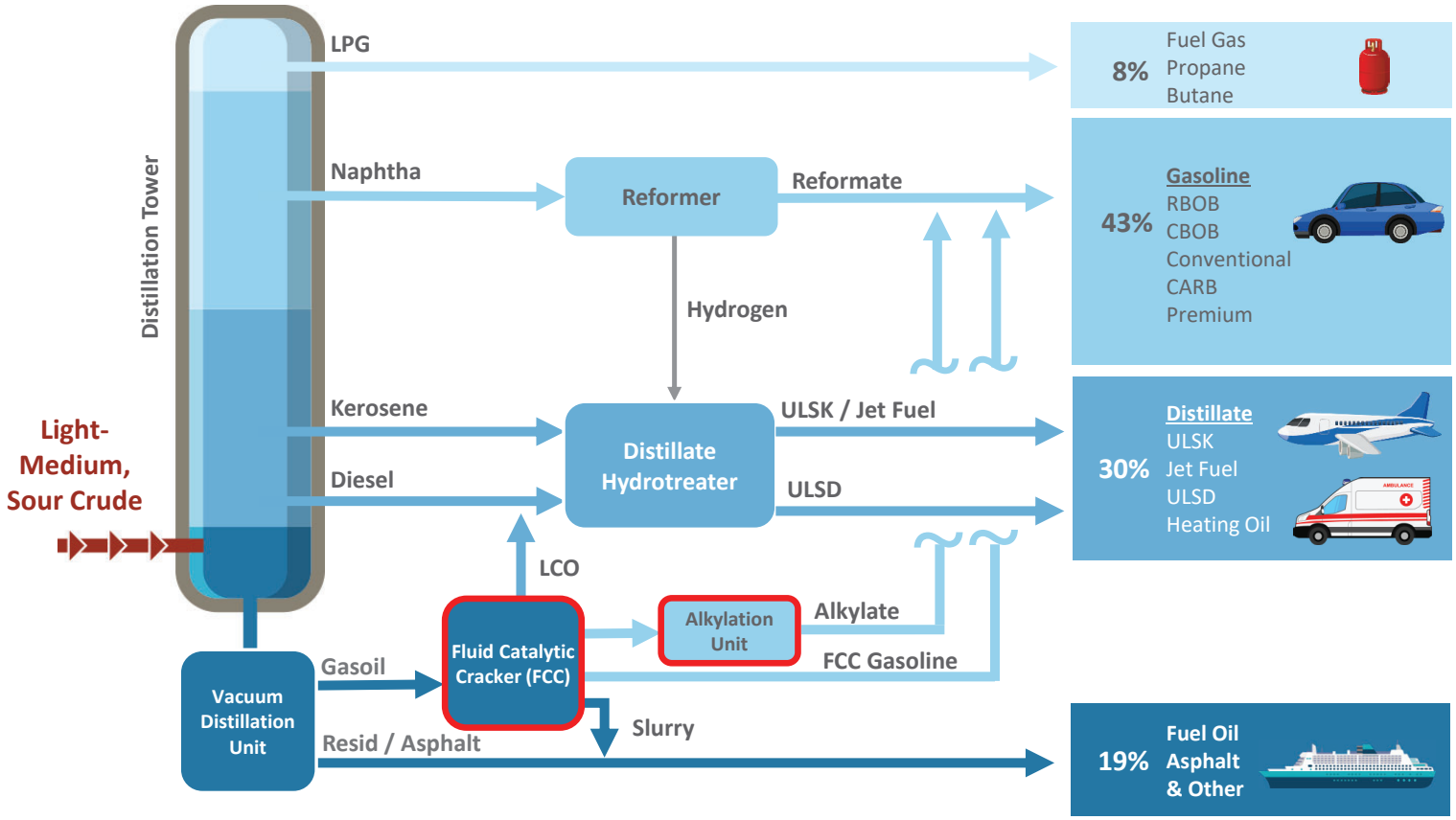


Low Conversion: Hydroskimming (Topping)



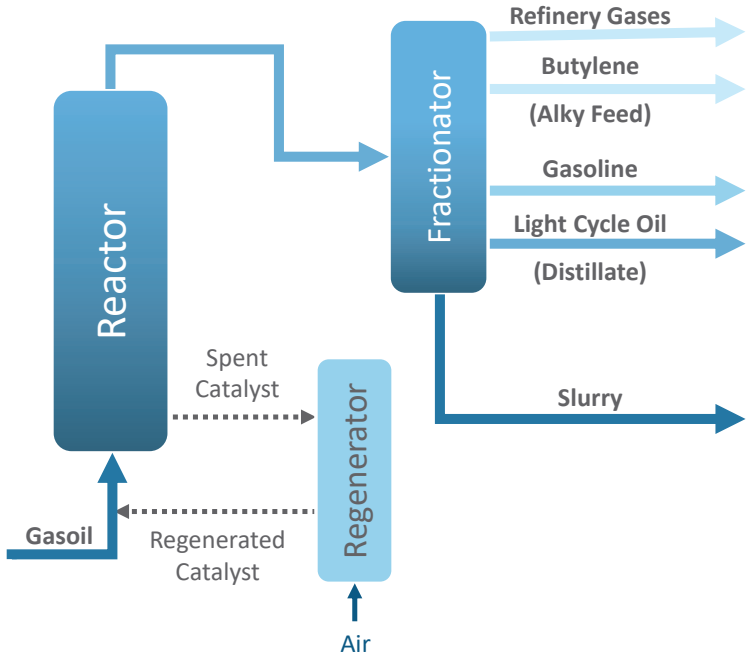
Low complexity refineries process **sweet crude oils**

Medium Conversion: Catalytic Cracking



Moderate complexity refineries tend to run more **sour crudes**, yield more **high value products** and achieve **higher volume gain**

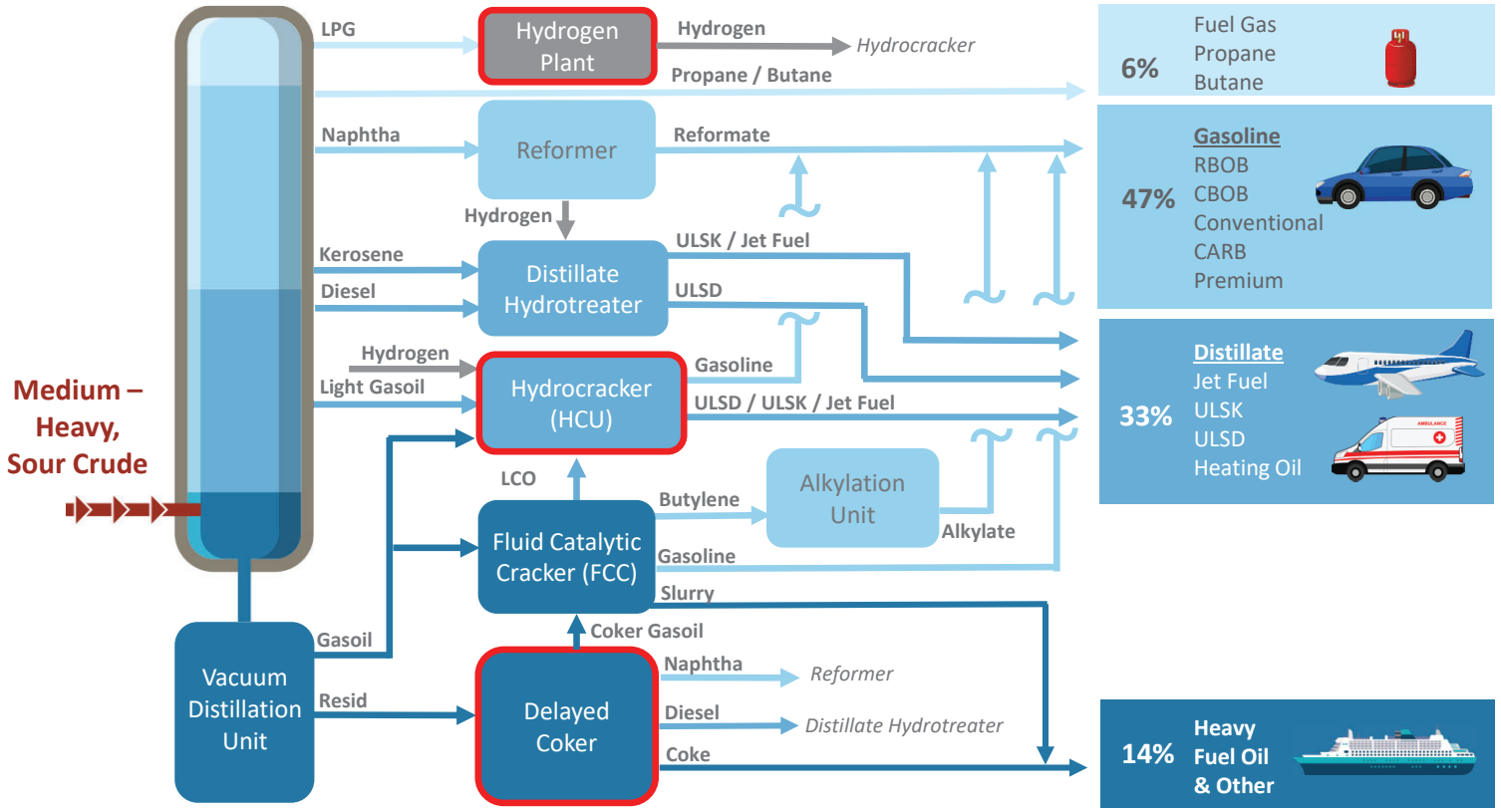
Fluid Catalytic Cracker (FCC)



Total FCC liquid volume yield is approximately 110% of throughput

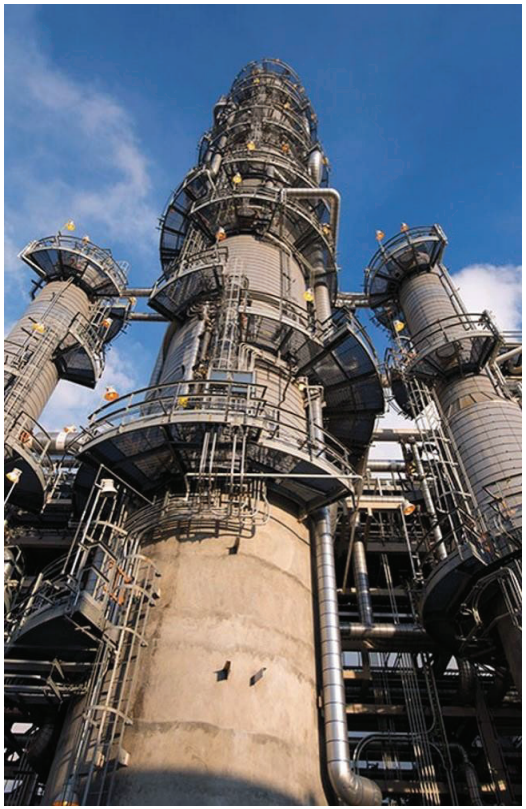
FCC converts **low-value gasoils** into **higher value light products**

High Complexity: Coking / Resid Destruction

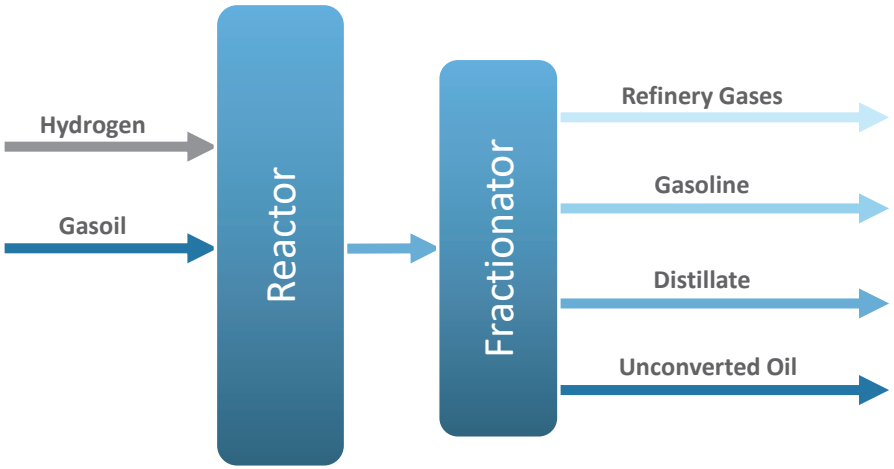


High complexity refineries can run **heavier**, more **sour** crudes oils while achieving the **highest light product yields** and **volume gain**

Hydrocracker Unit (HCU)



Port Arthur Hydrocracker Unit

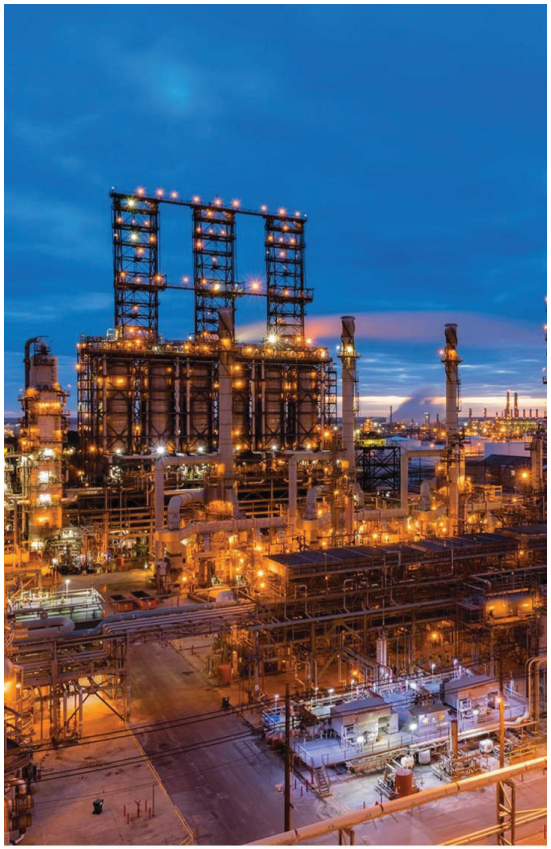


Total Hydrocracker liquid volume yield is approximately 110% to 115% of throughput

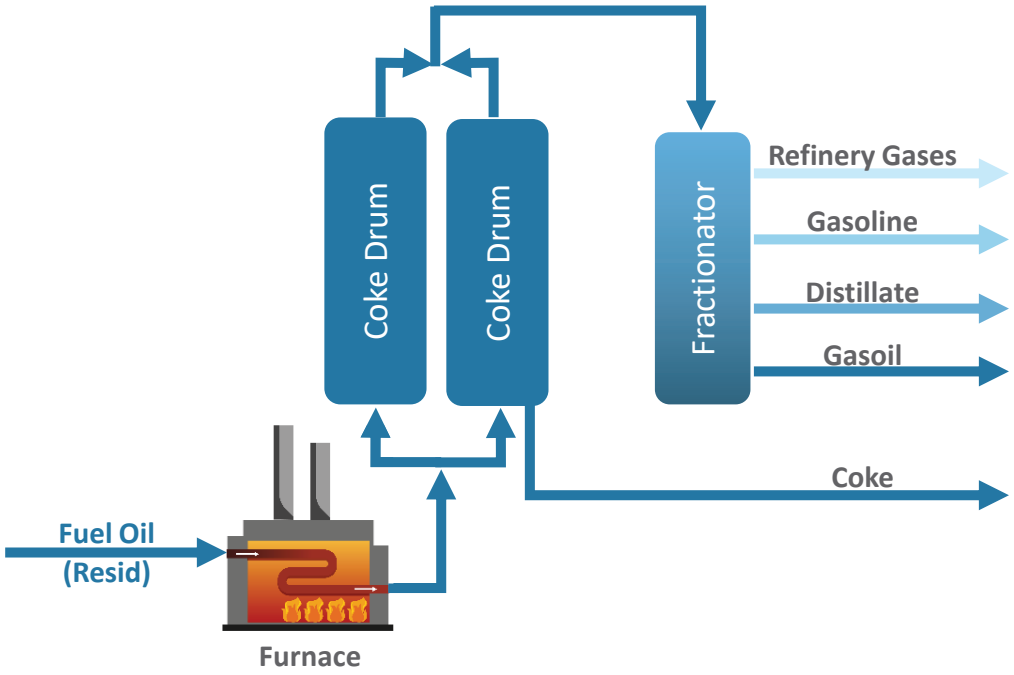
Upgrades high sulfur gasoil into **low sulfur gasoline, jet and diesel**

Increases volumetric yield of products through hydrogen saturation

Delayed Coker



Port Arthur Delayed Coker Unit



Total Coker unit liquid volume yield is approximately 80% of throughput

Upgrades **low value residual fuel oil** into **higher value light products**

03/26/2024 06:10:39 [BN] Bloomberg News

Russia's Crude Shipments Rebound Even as Sanctions Snare Tankers

Tanker bans are complicating some flows without yet hitting overall export levels

By Julian Lee

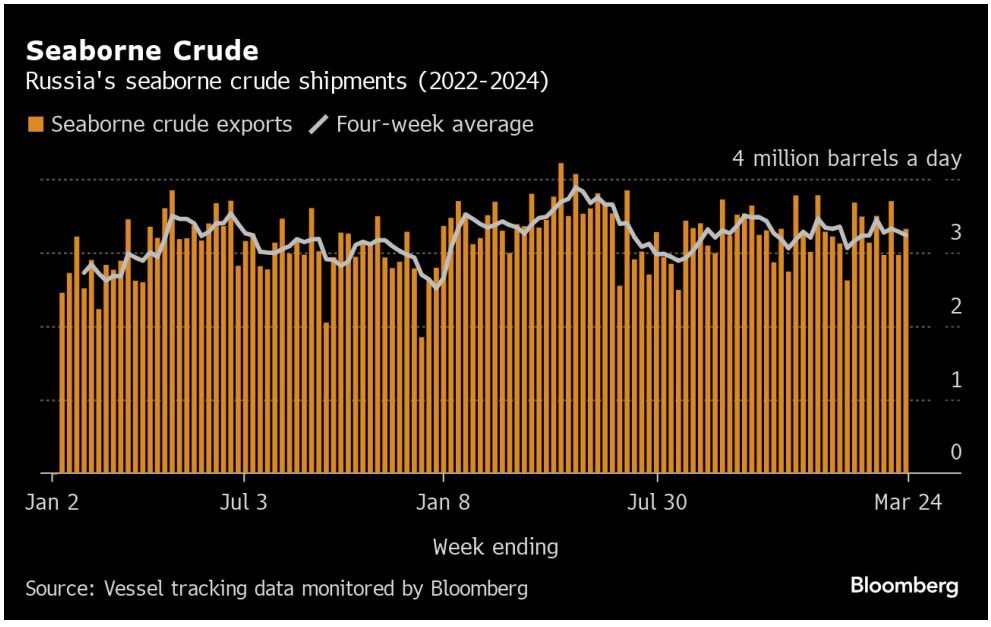
(Bloomberg) -- Russia's seaborne crude exports clawed back about half of the previous week's losses even though there's growing evidence that sanctions are finally starting to stymie Moscow's oil supply chain.

The rebound came after maintenance work ended at Russia's most important Baltic export terminal and storms that had repeatedly hit its main Pacific port in recent weeks began to abate. Those earlier disruptions left four-week average flows slightly below Russia's first-quarter export target, tanker-tracking data compiled by Bloomberg show.

Indian oil refiners — Moscow's second-biggest customers after China since the 2022 invasion of Ukraine — will no longer accept tankers owned by state-run Sovcomflot PJSC because of the risks posed by recently intensified sanctions. That appears to have led to several vessels hauling Russian crude getting held up off the Asian nation's coast, with others diverting to China.

None of the ships designated by the US Treasury as carrying oil in breach of a Group of Seven price cap has loaded a cargo since it was added to a list of sanctioned vessels. Many have diverted to the Black Sea, where they have disappeared from tracking screens. Others are anchored near ports on Russia's Baltic and Pacific coasts.

Still, for now, overall crude flows have not been reduced on any significant scale, with shipments in the week to March 24 rising by about 360,000 barrels a day. With a shadow fleet of tankers willing to haul Russian oil numbering at least 600 vessels, there are still plenty of ships to keep the oil flowing.



The rebound in shipments has helped boost Moscow's oil earnings. The gross value of crude exports recouped about half of the previous week's drop, rising to $1.68 billion in the seven days to March 24 from $1.48 billion in the period to March 17. Four-week average income was also up, rising by about $15 million to $1.62 billion a week.

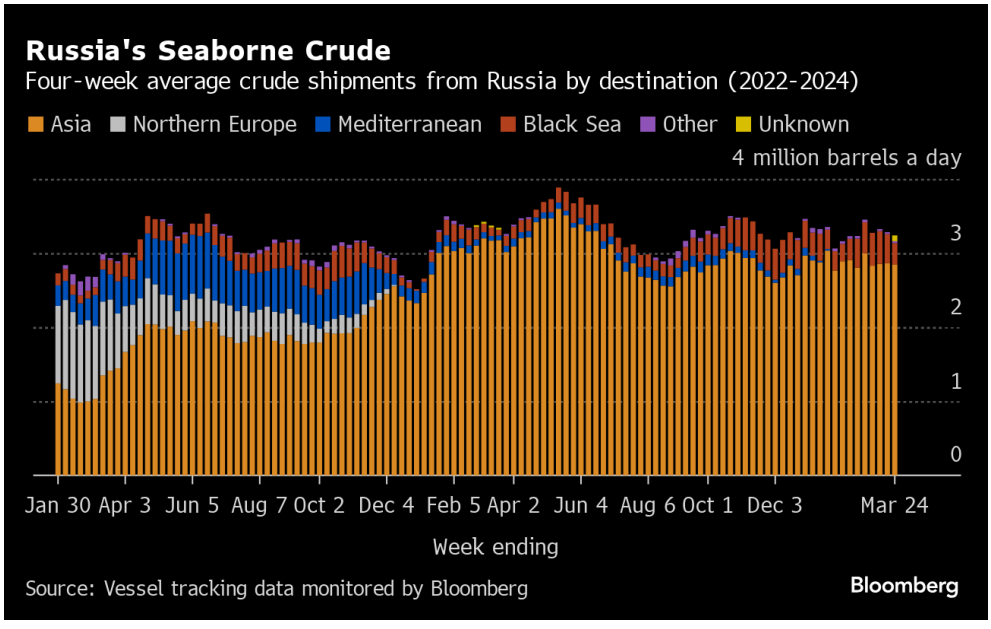
Most of the backlog of Russia's Sokol crude that built up after being turned away by Indian refiners has now been discharged. About 8.4 million barrels have been delivered to plants in China, with some 3.5 million barrels eventually finding their way back to India. One cargo was delivered to Pakistan.

That leaves about 5.5 million barrels yet to discharge, about half of which is also heading back toward India. All of the Sokol cargoes loaded so far this month have headed directly to China.

Flows by Destination

Russia's seaborne crude flows in the week to March 24 rose to 3.32 million barrels a day. However, the less volatile four-week average slipped for a second week, dropping by about 40,000 barrels a day to 3.24 million barrels a day.

Weekly shipments were about 260,000 barrels a day below the average seen in May and June, or about 40,000 barrels a day above Russia's first quarter target that is part of the OPEC+ alliance's broader effort to curb supplies and support prices. The four-week average was about the same amount below the target.



All figures exclude cargoes identified as Kazakhstan's KEBCO grade. Those are shipments made by KazTransoil JSC that transit Russia for export through the Black Sea port of Novorossiysk and the Baltic's Ust-Luga and are not subject to European Union sanctions or a price cap.

The Kazakh barrels are blended with crude of Russian origin to create a uniform export grade. Since Russia's invasion of Ukraine, Kazakhstan has rebranded its cargoes to distinguish them from those shipped by Russian companies.

- **Asia**

Observed shipments to Russia's Asian customers, including those showing no final destination, edged higher to 2.93 million barrels a day in the four weeks to March 24, up from a revised 2.86 million in the previous four-week period.

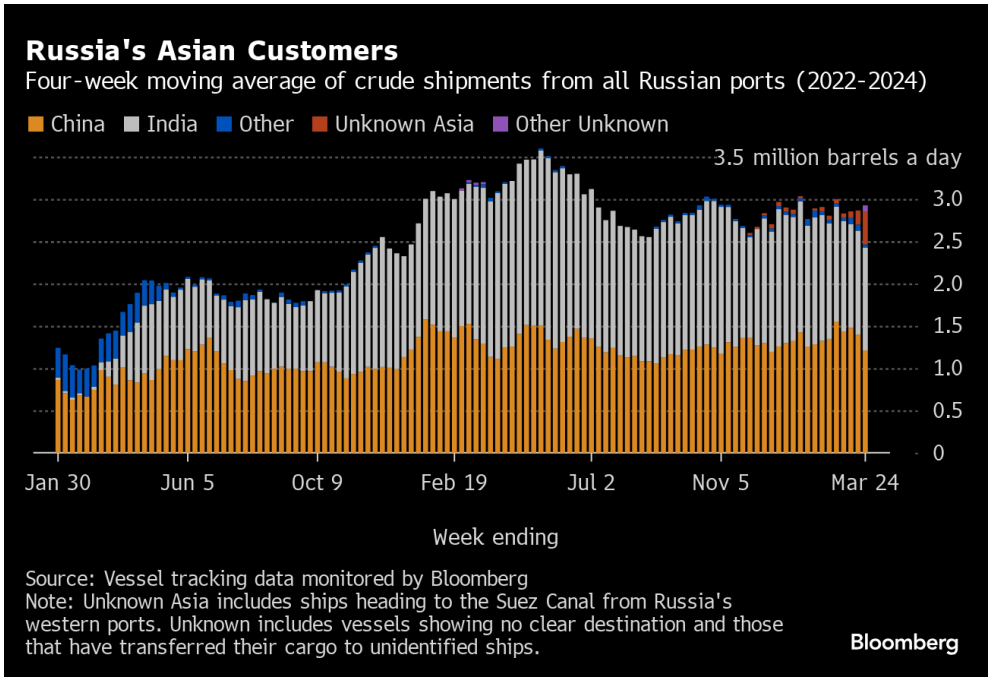
About 1.21 million barrels a day of crude was loaded onto tankers heading to China. The Asian nation's seaborne imports are boosted by about 800,000 barrels a day of crude delivered from Russia by pipeline, either directly, or via Kazakhstan.

Flows on ships signaling destinations in India averaged about 1.22 million barrels a day.

Both the Chinese and Indian figures will rise as the discharge ports become clear for vessels that are not currently showing final destinations.

The equivalent of about 385,000 barrels a day was on vessels signaling Port Said or Suez in Egypt, or are expected to be transferred from one ship to another off the South Korean port of Yeosu. Those voyages typically end at ports in India or China and show up in the chart below as "Unknown Asia" until a final destination becomes apparent. This figure includes stranded Sokol crude cargoes that are still waiting to discharge after failing to find homes in India since mid-December.

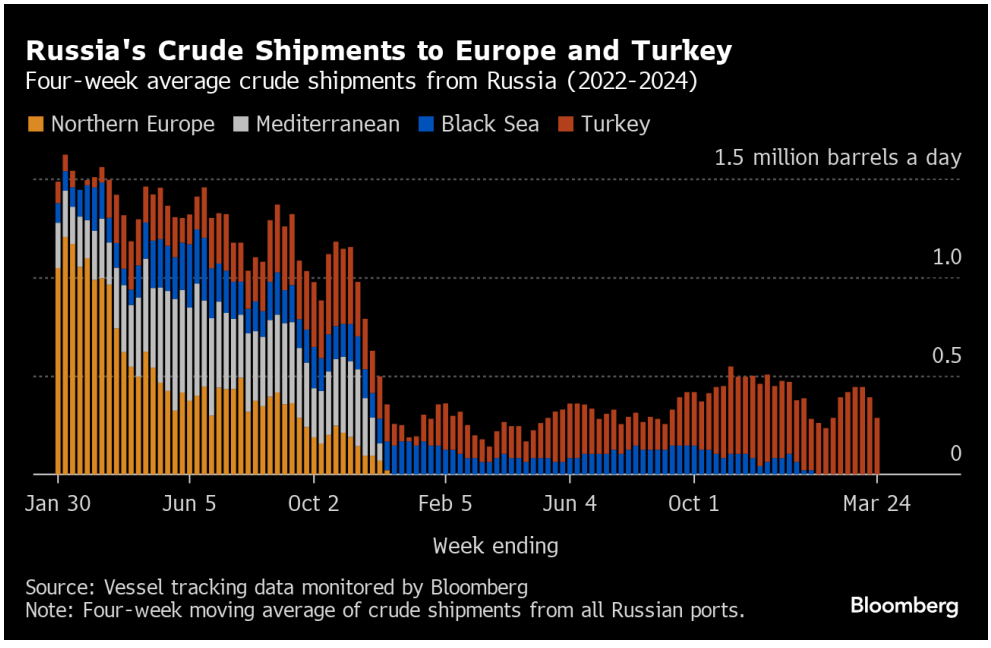
The "Other Unknown" volumes, running at about 80,000 barrels a day in the four weeks to March 24, are those on tankers showing no clear destination. Most of those cargoes originate from Russia's western ports and go on to transit the Suez Canal, but some could end up in Turkey. Others could be moved from one vessel to another, with most such transfers now taking place in the Mediterranean, off the coast of Greece.



Europe and Turkey

Russia's seaborne crude exports to European countries have ceased.

With flows to Bulgaria halted at the end of last year, Turkey is now the only short-haul market for shipments from Russia's western ports.



Exports to Turkey slipped to about 290,000 barrels a day in the four weeks to March 24. That's the lowest in six weeks and down from a revised 390,000 barrels a day in the period to March 17.

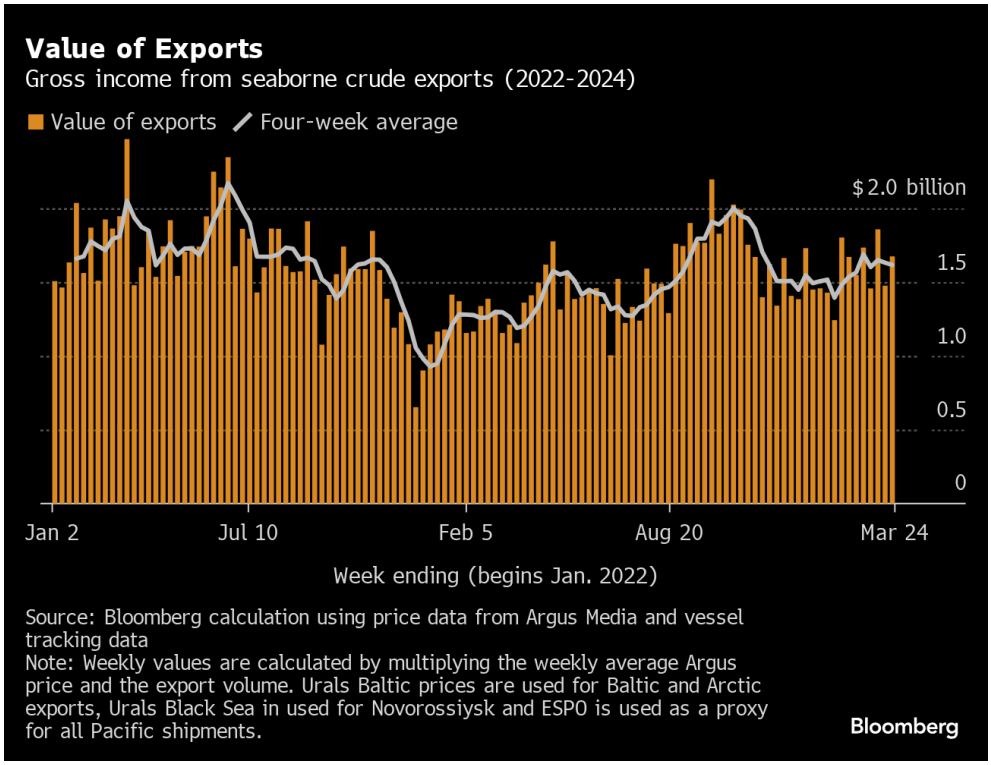
Vessel-tracking data are cross-checked against port agent reports as well as flows and ship movements reported by other information providers including Kpler and Vortexa Ltd.

Export Value

Following the abolition of export duty on Russian crude, we have begun to track the gross value of seaborne crude exports, using Argus Media price data and our own tanker tracking.

The gross value of Russia's crude exports recouped about half of the previous week's drop, rising to $1.68 billion in the seven days to March 24 from $1.48 billion in the period to March 17. Four-week average income was also up, rising by about $15 million to $1.62 billion a week. The four-week average is still well off its peak of $2.17 billion a week, reached in the period to June 19, 2022. The highest it reached last year was $2 billion a week in the period to Oct. 22.

During the first four weeks after the Group of Seven nations' price cap on Russian crude exports came into effect in early December 2022, the value of seaborne flows fell to a low of $930 million a week, but soon recovered.



The chart above shows a gross value of Russia's seaborne oil exports on a weekly and four-week average basis. The value is calculated by multiplying the average weekly crude price from Argus Media Group by the weekly export flow from each port. For shipments from the Baltic and Arctic ports we use the Urals FOB Primorsk dated, London close, midpoint price. For shipments from the Black Sea we use the Urals Med Aframax FOB Novorossiysk dated, London close, midpoint price. For Pacific shipments we use the ESPO blend FOB Kozmino prompt, Singapore close, midpoint price.

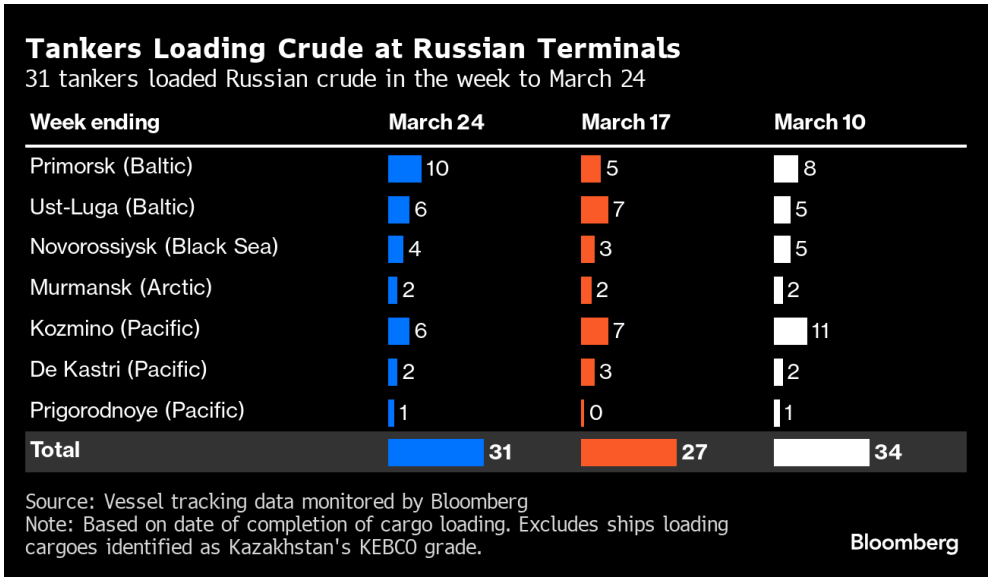
Export duty was abolished at the end of 2023 as part of Russia's long-running tax reform plans.

Ships Leaving Russian Ports

The following table shows the number of ships leaving each export terminal.

A total of 31 tankers loaded 23.2 million barrels of Russian crude in the week to March 24, vessel-tracking data and port agent reports show. That was up by about 2.5 million barrels from the previous week.

High winds at the start of the week may have hampered shipments from Russia's Pacific terminal at Kozmino. Winds were gusting above 30 miles per hour on two of the first three days of the period, according to data from visualcrossing.com.



All figures exclude cargoes identified as Kazakhstan's KEBCO grade. One cargo of KEBCO was loaded at Novorossiysk and one at Ust-Luga during the week.

NOTES

Note: This story forms part of a weekly series tracking shipments of crude from Russian export terminals and the gross value of those flows. Weeks run from Monday to Sunday. The next update will be on Tuesday, April 2.

Note: All figures exclude cargoes owned by Kazakhstan's KazTransOil JSC, which transit Russia and are shipped from Novorossiysk and Ust-Luga as KEBCO grade crude.

If you are reading this story on the Bloomberg terminal, click here for a link to a PDF file of four-week average flows from Russia to key destinations.

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https://www.saba.ye/en/news3316099.htm

Revolution Leader

Revolution leader says Yemen coming in 10th year with advanced military capabilities, secure army, unprecedented popular awareness

Revolution leader says Yemen coming in 10th year with advanced military capabilities, secure army, unprecedented popular awareness

[26/March/2024]

SANA'A March 26. 2024 (Saba) - Revolution leader Sayyed Abdulmalik Badr al-Din al-Houthi has confirmed that the Yemeni people are coming in the tenth year of the American-Saudi-Emirati aggression with advanced military capabilities to protect Yemen, support the oppressed Palestinian people, and confront enemy conspiracies.

In his speech on the eve of the ninth anniversary of the National Day of Steadfastness, al-Houthi indicated that Yemen is coming with a faithful army that combines actual experience, construction, and public mobilization with unprecedented popular awareness and complete cohesion on the internal front.

He said "We are very keen on understanding and peace with all Arab and Islamic countries and on brotherhood and positive relations, and we do not have a hostile orientation towards any Arab country or any Arab or Islamic country."

Al-Houthi added "We are now in a clear and direct confrontation between us and the evil trio of America, Israel, and Britain. Yemen has taken an honorable position alongside the Palestinian people and fully supported them, and our media is directing all its energy and capabilities to support the Palestinian people."

The leader reiterated the continuation of Yemeni military operations and action at various levels, including broad popular movement and activities in all fields.

Al-Houthi said "There is no justification for Saudi Arabia and the UAE to continue their clear procrastination regarding peace entitlements in light of the current stage."

He continued, "The Saudis and the Emirates must move from the stage of reducing escalation to peace entitlements if they really want peace that is in the effective and real interest of everyone, and serious steps are taken in accordance with a clear agreement that includes what we have been emphasizing and what discussions and negotiations have taken place over it throughout all the past stages, an agreement that leads to to a complete end to the siege, aggression and occupation, to the exchange of prisoners and to end the problem for the good and interest of all."

Al-Houthi pointed out that the entitlements for peace, as emphasized in the past, were clear: stopping the aggression, lifting the siege, ending the occupation, exchanging prisoners, and compensating for damages, explaining that these are clear entitlements and legitimate and fair demands of the Yemeni people.

The leader advised the aggression coalition to move from the phase of reducing escalation to a clear agreement in accordance with the direct discussions and negotiations that took place around it and get out of the current situation.

He said that any regime went along with the American polices will face loss and calamity consequence, making clear of Yemen's positions towards he Americans, the Israelis, and the British,

The Revolution leader thanked and appreciated all those who stood with Yemen during the nine years, at the forefront of which is the Islamic Republic of Iran, which clearly and explicitly stood in solidarity with Yemen and Hezbollah in Lebanon, the resistance in Iraq, and all the free people of the world.

Al-Houthi considered the National Steadfastness Day an important occasion for the Yemeni people, noting that after nine years of steadfastness, the victory of God Almighty and His support, care and aid to the Yemeni people became clear to everyone in all these years.

Al-Houthi pointed out that nine years have passed since the beginning of the aggression against the Yemeni people, and steadfastness is the title of Yemen's rightful position.

He indicated that the various Yemeni people moved to confront the aggression with sincerity, dedication, steadfastness and bravery, and behind them were their families who were patient and steadfast during those years.

Al-Houthi explained that thousands of martyrs, wounded and prisoners wrote heroics and epics of sacrifice and redemption that will remain for history and a school for generations.

He stressed that the role of those who took action in the humanitarian, economic, mobilization, educational, political and other fields was an honorable one, pointing out that general cohesion was the most prominent symbol of the state of society in Yemen, especially with the unjust and stifling siege.

He pointed out that the aggression against our country, from its first moment, was treacherous, unjustified, without precedent, brutal and criminal, with dangerous goals, under American supervision, within the framework of an American-Israeli-British plan, and implementation by the coalition.

The revolution leader stated that the aggression against Yemen came within the framework of a comprehensive plan in the region to rearrange its situation under the leadership of the Israeli enemy and liquidate the Palestinian issue.

He explained that one of the goals of the aggression against Yemen is to enable the Zionist enemy to lead the region and arrange its situation as appeared in the normalization program or the so-called "deal of the century.

Al-Houthi stated that the aggression against Yemen has no legitimacy, no legitimate goals, and no legitimate practices, and the headlines raised by the coalition were exposed, as the Arab embrace has no basis, but rather an effort to bring the region into the Hebrew embrace.

He pointed out that the aggression coalition sought from the beginning to destroy and occupy Yemen and confiscate freedom and independence of Yemeni people.

Al-Houthi also confirmed that the raids of the aggression coalition killed people in their homes, whether in cities or villages and even in Bedouin camps, adding the aggressive raids killed people in all their gatherings, including weddings and sorrows halls.

He reported that the aggression coalition was focusing on killing the Yemeni people in markets, hospitals, mosques, schools, and roads, and the aggression coalition targeted the Yemeni people with siege, starvation, and conspiracies against the national currency, transferring the functions of the Central Bank of Yemen, and so on.

Al-Houthi revealed the number of air strikes launched by the aggression coalition against the Yemeni people, while they were counted at 274,302 bomb and missile raids, and this is not a complete count, considering the nature of the aggression as criminal, brutal, and for bad purposes.

He explained that the aggression coalition destroyed 186 university facilities, many of which were completely destroyed, and 1,843 mosques and 427 hospitals and health facilities despite the limited health services in Yemen, and health staff and patients were also killed.

Al-Houthi reviewed that the aggression destroyed educational facilities, amounting to 1,331 schools and educational centers, 146 sports facilities, 269 archaeological sites, 63 media facilities, and more than 12,775 agricultural fields, and targeting 15 airports despite the weak infrastructure in Yemen. However, Sana'a Airport continued to be subjected to air strikes of the American-Saudi-Emirati aggression.

The revolution leader stated that the enemy targeted 354 electrical stations and generators, and also targeted 7940 roads and bridges, killing large numbers of citizens, as well as targeting 647 networks and communication stations and 3332 tanks and water networks, which clearly demonstrates the aggression coalition's aggression and its bad goals.

He pointed out that the aggression targeted 2,155 government facilities, which are built for the benefit of the country, 417 factories, 397 fuel tankers, 12,534 commercial facilities, and 484 poultry and livestock farms.

Al-Houthi said that the aggression hit more than 10,000 means of transportation, more than a thousand food trucks, and 712 markets, and 493 fishing boats, and the fishermen were among those who suffered the most from the aggression coalition, and many of them were martyred at sea.

He reported that the aggression coalition targeted 1,43 food stores in the context of harassing the Yemeni people, starving them, and targeting their economy and food, and 434 gas stations.

Al-Houthi indicated that the targeting affected all landmarks and components of life in Yemen, and such can only be said of unjust aggression.

Al-Houthi confirmed the martyrdom and injury of more than 50,000 civilians, most of them children and women who were not martyrs in the field, as a result of the American-Saudi-Emirati aggression in nine years.

He reiterated that there are brutal crimes known to the world, and news of them has spread in various countries, many of which are devastating to humanity.

Al-Houthi asked "Whoever destroys more than half a million homes, is it a war for the benefit of the Yemeni people or to target a specific group of the Yemeni people? And targeting universities?" Could it express the interest of the Yemeni people, service of the Yemeni people, or for the sake of the Yemeni people?

The siege and starvation were considered a parallel aggression alongside the military aggression, which resulted in great suffering, while there was systematic targeting of the economy, the national process, and the bank, control of oil and gas wealth and ports, and the imposition of a comprehensive siege on the Yemeni people by closing airports and preventing people from traveling, matched by cohesion on both sides, the official, popular, and internal front in an honorable manner contributed to the failure of the aggression coalition to achieve its goals.

He said "Despite the scale of aggression, crimes, and comprehensive destruction, it did not break the will of the people, and this is a great blessing and a great divine blessing, but our people are still suffering very greatly as a result of the aggression and siege."

Al-Houthi also confirmed that the aggression coalition launched major military operations to invade all the provinces and provided them with significant media and political cover. However, it failed to occupy the geographical and strategic depth of Yemen despite its control over a wide area.

The revolution leader stated that the aggression coalition took control of Yemen's sovereign, oil and gas wealth, many ports, and a large area of the coast, and the densely populated provinces remained in confrontation, resistance, jihad, and steadfastness, and this is of very great importance for the whole country.

He pointed out that the inevitable failure of the aggression became clear in achieving its goals of complete occupation and complete control over the Yemeni people and the aggression coalition was counting on the fact that it would initially resolve the battle within two weeks, but its hopes and the hopes of those who planned the aggression were disappointed, and the enemies over many years reached almost despair of reaching, achieve their goals, and suffer huge losses.

Al-Houthi reported that the number of dead and wounded from all formations of the coalition of aggression and mercenaries amounted to 282,879 dead and wounded, in addition to the enemy losses in machinery and equipment, which amounted to 18,397 vehicles and equipment.

He stated that the air defense operations amounted to 4,585 operations during which 165 warplanes and reconnaissance aircraft were shot down, while the operations of the naval forces and coastal defense amounted to 38 operations and were of very great importance in deterring the enemy, among the most prominent naval operations was targeting the Medina frigate and the warship Swift and seizing a "Rawabi Ship."

Al-Houthi stressed that the missile force and the air force had a large presence in confronting aggression on the fronts and operations outside the borders, indicating in this regard that the missile operations amounted to 1,828 operations, including 1,237 operations in military and combat operations, and 589 operations outside the borders.

He touched on the operations of the Air Force, which amounted to 12,090 offensive and reconnaissance operations, indicating that most of the operations of the Air Force were within the framework of defensive and offensive combat missions, including 997 operations outside the borders.

He explained that the number of operations supporting the ground forces amounted to 211,136 sniping, artillery, anti-armor, and engineering targeting operations, stressing the enemy's failure to destroy military capabilities, and the result was completely opposite.

He stressed that the development of military capabilities was a successful upward path despite the blockade and very difficult economic conditions, and the enemy's attempt to put great pressure on the Yemeni people through the economic situation through the blockade and depriving them of the revenues from their oil and gas wealth.

Al-Houthi reiterated the Yemeni people's continued steadfastness and the development of military capabilities, which was and still is an important issue and a basic requirement for achieving victory, defeating the aggression, and restoring what the aggression coalition occupied.

The leader called on the rest of the countries to review their miscalculations and aggressive policies towards Yemen, indicating that the Yemeni people are at the forefront of peoples' concern and concern for Arab national security and the security of the entire Islamic nation.

He called on all Arab countries and the Islamic world to view the Yemeni people as a people who embody true brotherhood and as a support for the entire nation, stressing that the Yemeni people care about their nation to be a dear, strong, fraternal, and cooperative nation, and the enemy of the nation is clear.

Al-Houthi pointed out that the enemy of the Yemeni people is the enemy of the entire nation, and the Israeli enemy poses a real danger to all Muslims, especially the Arabs.

He stressed that the Israeli hostility to the Arabs is known, clear and explicit in their culture, schools, curricula and heritage.

He said "The normalization project came to leap beyond Israeli aggression to spark wars and strife within our nation, and from the tragedy for our nation when countries, governments, and regimes moved to deploy all their energies and capabilities to serve American policy."

He stated that the Takfiris were exposed in the face of the Israeli aggression on Gaza, and they did not have any serious position, even at the level of issuing fatwas.

Al-Houthi confirmed that the aggression against Yemen is done under the American, British and Israeli supervision and planned to target the region in general.

Al-Houthi stressed that the general goal behind targeting the nation is to liquidate the Palestinian issue and for the Israelis to be the ones to lead the region.

He said that normalization with the Israeli enemy is a way to strengthen its control and influence to extend to the entire nation and the Arab world in particular.

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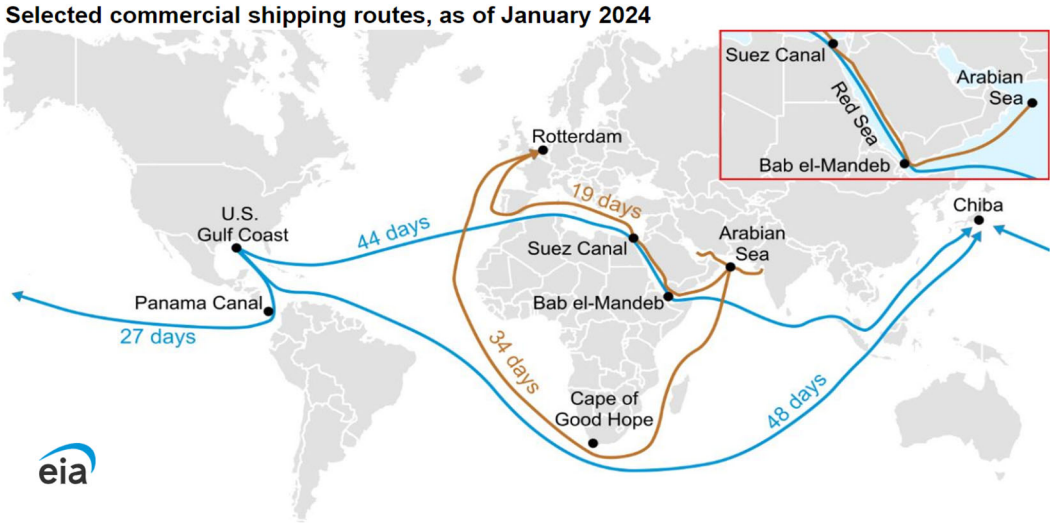
https://www.eia.gov/todayinenergy/detail.php?id=61363

FEBRUARY 1, 2024

Red Sea attacks increase shipping times and freight rates



Data source: U.S. Energy Information Administration using calculations from Vortexa
Note: Voyage time is calculated for laden Suezmax tankers traveling at 14 knots without extended chokepoint delays.

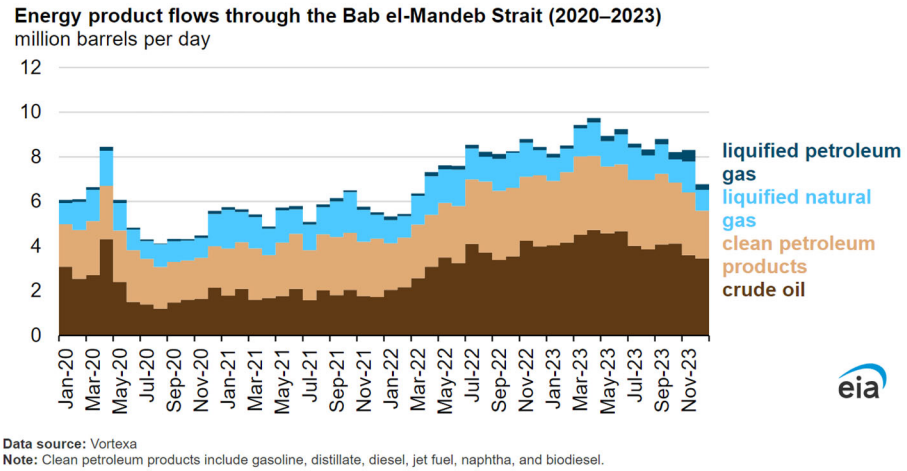
After Yemen-based Houthi militia attacks on commercial ships transiting the Red Sea started in November 2023, some vessels began opting to avoid the Bab el-Mandeb chokepoint—a narrow strait that borders the Yemeni coast and is the southern entrance to the Red Sea. Instead, they're choosing to take longer, more costly routes around the tip of Africa.

Ships transiting between Europe and Asia via the Suez Canal must pass through the Bab el-Mandeb Strait, which connects the Red Sea to the Gulf of Aden. The Bab el-Mandeb Strait is an important oil and natural gas chokepoint, accounting for 12% of seaborne oil trade and 8% of liquefied natural gas (LNG) trade in the first half of 2023. Major oil and natural gas companies that are avoiding the Red Sea include Equinor, which operates mostly natural gas carriers, and bp, which operates both oil and natural gas carriers. As of January 23, 2024, other major energy companies pausing Red Sea transits include Euronav, QatarEnergy, Torm, Shell, and Reliance.

Vessels that do not pass through the Suez Canal via the Bab el-Mandeb Strait and Red Sea can go around southern Africa via the Cape of Good Hope, but that route can add significant time to the voyage, depending on the ship's origin and its destination. A typical voyage from the Persian Gulf to the Amsterdam-Rotterdam-Antwerp petroleum trading hub (ARA) via the Suez Canal takes 19 days. If the ship takes the Cape of Good Hope route, it takes nearly 35 days to reach the ARA. For products leaving the U.S. Gulf Coast and heading toward Asia, vessels typically pass through the Panama Canal, which is nearly a month-long trip. Due to the ongoing drought and restrictions at the Panama Canal, more Very Large Gas Carriers (VLGCs), which primarily carry propane and butane, started going through the Suez Canal. Now some of these VLGCs are going around the Cape of Good Hope. A journey from the U.S. Gulf Coast to Chiba in Japan through the Suez Canal adds about 17 days and one through the Cape of Good Hope adds about 21 days, compared with going through the Panama Canal.

Longer routes put upward pressure on freight rates because of fuel costs and fewer available ships. A VLGC, for example, consumes about $30,000 to $35,000 worth of fuel per day if using high-sulfur bunker fuel at average 2023 prices. In addition to adding to fuel costs, a longer voyage requires more

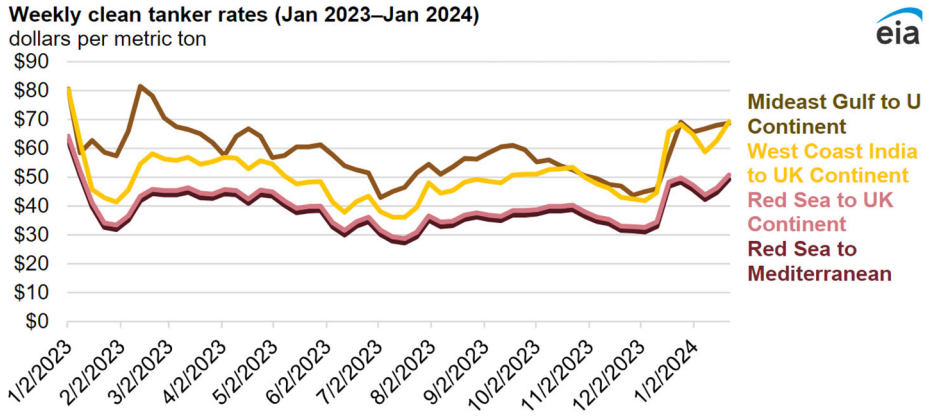
ships to maintain the same delivery schedule, and fewer available ships contribute to higher tanker rates and costs.



Data source: Vortexa
Note: Clean petroleum products include gasoline, distillate, diesel, jet fuel, naphtha, and biodiesel.

After the attacks began in November, flows of oil, refined products, and natural gas passing through the Bab el-Mandeb Strait slowed. About 18% less crude oil flowed through the Bab el-Mandeb in December than on average from January to November 2023. Most crude oil trade that goes through the Bab el-Mandeb Strait leaves Russia and Iraq en route to Asia and the Mediterranean, respectively. Clean petroleum product flows through the Bab el-Mandeb Strait were 30% lower in December than the rest of 2023. The majority of petroleum product trade leaves Saudi Arabia and India bound for Europe and leaves Russia bound for Asia.

In December, 24% less LNG and 1% more liquefied petroleum gas (LPG) were traded globally compared with the rest of 2023. Vessel restrictions at the Panama Canal due to a drought are causing more VLGCs leaving from the United States to head east toward either the Suez Canal or the Cape of Good Hope. LPG flows through the Bab el-Mandeb increased by 59% in 2023 compared with 2022 because water conservation efforts at the Panama Canal began in January 2023, causing delays and higher costs for VLGCs. The Combined Maritime Forces, a partnership representing 39 nations, warned ships to avoid the Bab el-Mandeb Strait on January 12, which will likely reduce passages through January 2024.



Data source: Argus Freight
Note: Rates are for long-range 1 tankers, except the Mideast Gulf to UK Continent rates, which are for medium-range tankers.

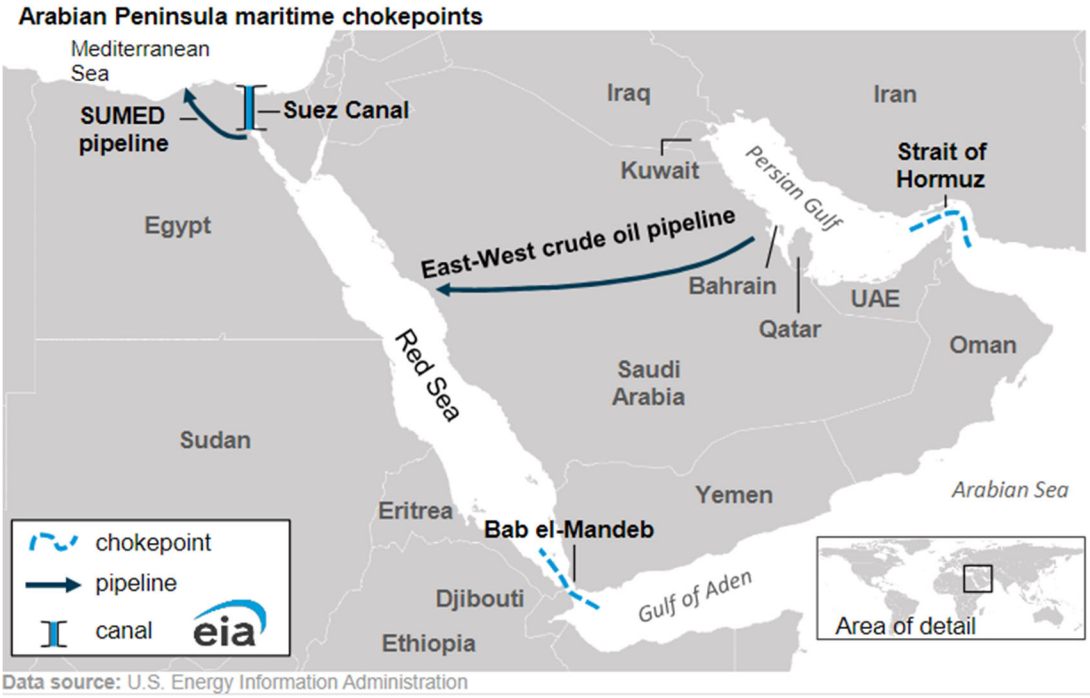
Clean petroleum product tanker rates for routes that cross the Bab el-Mandeb Strait and Suez Canal increased in December 2023 because of the ongoing conflict in the Red Sea. Because routes going through the Red Sea have elevated risk insurance premiums, these costs are passed on to tanker rates. For the four tanker rates that pass through the Red Sea, the average increase was 20% in December compared with November, according to Argus Freight. Long-range 1 tankers traveling from the western coast of India to the UK Continent increased the most (23%), and tankers traveling from the Mideast Gulf to the UK Continent increased the least (16%). Rates for dirty tankers, which mostly transport crude oil, have been relatively unchanged from the elevated prices in November.
Brent crude oil spot prices for the week ending November 17, 2023, the week before attacks on ships in the Red Sea began, were $82 per barrel (b). Since then, prices have traded in range, and they closed at $79/b as of January 18, 2024.

Principal contributor: Josh Eiermann

https://www.eia.gov/todayinenergy/detail.php?id=61025

DECEMBER 4, 2023

Red Sea chokepoints are critical for international oil and natural gas flows



Data source: U.S. Energy Information Administration

The Suez Canal, the SUMED pipeline, and the Bab el-Mandeb Strait are strategic routes for Persian Gulf oil and natural gas shipments to Europe and North America. Total oil shipments via these routes accounted for about 12% of total seaborne-traded oil in the first half of 2023, and liquefied natural gas (LNG) shipments accounted for about 8% of worldwide LNG trade.

The Suez Canal and SUMED pipeline are located in Egypt and connect the Red Sea with the Mediterranean Sea. The SUMED pipeline transports crude oil north through Egypt and has a capacity of 2.5 million barrels per day. The Bab el-Mandeb Strait is between the Horn of Africa and the Middle East, connecting the Red Sea to the Gulf of Aden and Arabian Sea. Most exports of petroleum and natural gas from the Persian Gulf to Europe and North America pass through multiple chokepoints, including the Suez Canal or the SUMED pipeline and both the Bab el-Mandeb and the Strait of Hormuz.

Volume of crude oil, condensate, and petroleum products transported through the Suez Canal, SUMED pipeline, and Bab el-Mandeb Strait (2018–1H23)
million barrels per day

	2018	2019	2020	2021	2022	1H23
Total oil flows through Suez Canal and SUMED pipeline	**6.4**	**6.2**	**5.3**	**5.1**	**7.2**	**9.2**
crude oil and condensate	3.4	3.1	2.6	2.2	3.6	4.9
petroleum products	3.0	3.1	2.6	2.9	3.6	4.3
LNG flows through Suez Canal (billion cubic feet per day)	**3.3**	**4.1**	**3.7**	**4.5**	**4.5**	**4.1**
Total oil flows through Bab el-Mandeb Strait	**6.1**	**5.9**	**5.0**	**4.9**	**7.1**	**8.8**
crude oil and condensate	**3.0**	**2.7**	**2.2**	**1.9**	**3.3**	**4.5**
petroleum products	**3.1**	**3.2**	**2.8**	**3.1**	**3.8**	**4.4**
LNG flows through Bab el-Mandeb Strait (billion cubic feet per day)	**3.1**	**3.9**	**3.7**	**4.5**	**4.5**	**4.1**

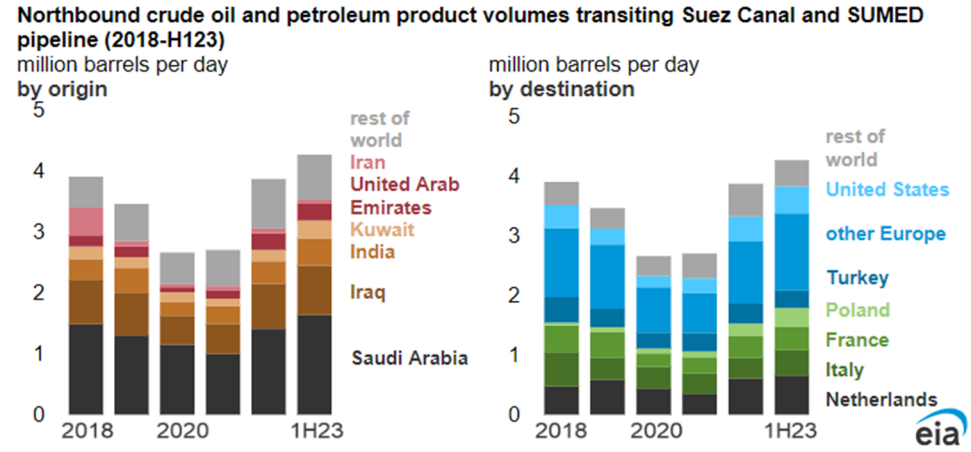
Data source: U.S. Energy Information Administration analysis based on Vortexa tanker tracking
Note: LNG=liquefied natural gas, 1H23=first half of 2023

Oil shipments

Northbound oil flows toward Europe via the Suez Canal and SUMED pipeline fell between 2018 and 2020. Renewed U.S. sanctions on

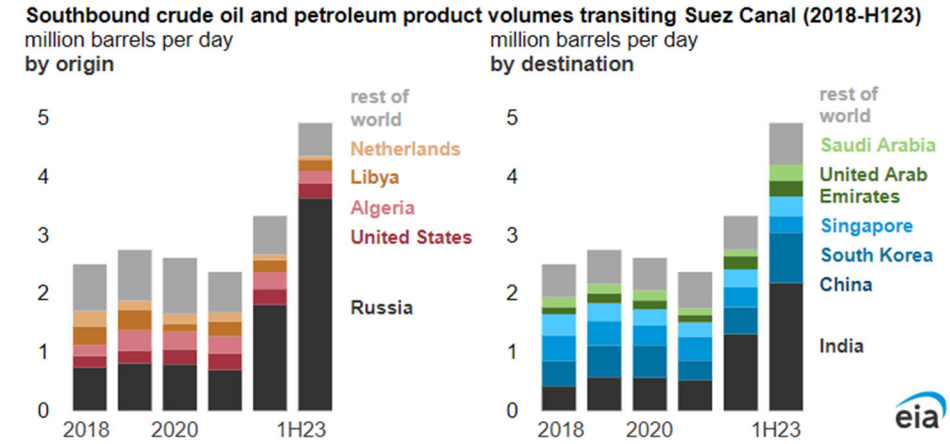
Iran reduced all exports from Iran, including those through the Suez Canal. In addition, less crude oil and oil products from Middle East producers moved through the Suez Canal because Europe imported less oil from the Middle East and more from the United States. The COVID-19 pandemic further reduced flows through the Suez Canal because of slowing global oil demand.

In the first half of 2023, northbound crude oil flowing through the Suez Canal and SUMED pipeline had increased by more than 60% from 2020, as demand in Europe and the United States rose from pandemic-induced lows. Also, Western sanctions on Russia's oil beginning in early 2022 shifted global trade patterns, leading Europe to import more oil from the Middle East via the Suez Canal and SUMED pipeline and less from Russia.



Data source: U.S. Energy Information Administration analysis based on Vortexa tanker tracking
Note: 1H23=first half of 2023.

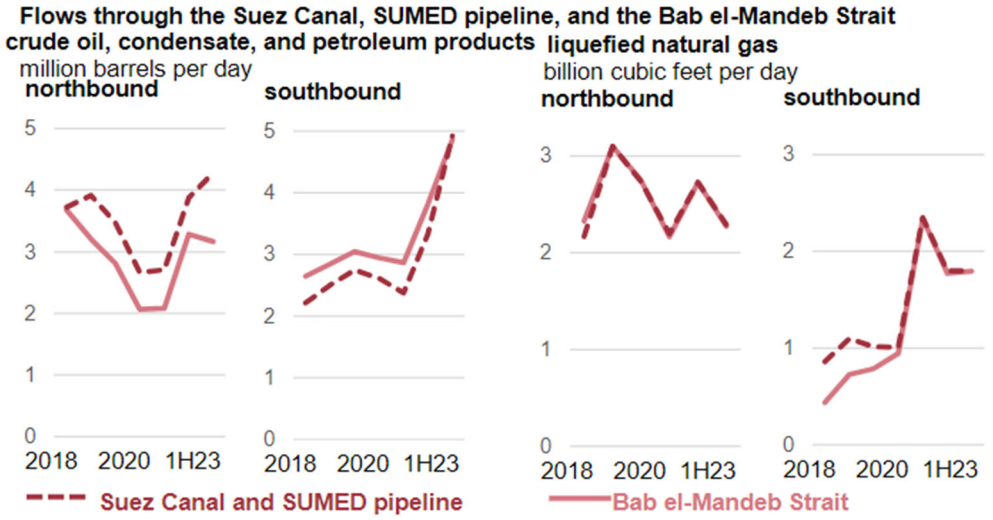
Southbound shipments through the Suez Canal rose significantly between 2021 and 2023, largely because of Western sanctions on Russia's oil exports. Oil exports from Russia accounted for 74% of Suez southbound oil traffic in the first half of 2023, up from 30% in 2021. Most of those export volumes were destined for India and China, which imported mostly crude oil from Russia. The Middle East, primarily Saudi Arabia and the United Arab Emirates, increased imports of refined oil products from Russia in 2022 and the first half of 2023 in order to generate electric power or to store or re-export.



Data source: U.S. Energy Information Administration analysis based on Vortexa tanker tracking

LNG shipments

LNG flows through the Suez Canal in both directions rose to a combined peak in 2021 and 2022 of 4.5 billion cubic feet per day (Bcf/d) before total flows declined in the first half of 2023 to 4.1 Bcf/d. Southbound LNG flows more than doubled from 2020 to 2021, mainly driven by growing exports from the United States and Egypt heading to Asia. In 2022 and the first half of 2023, southbound LNG volumes via the Suez Canal declined as U.S. and Egyptian LNG exports both favored European destinations over Asian markets, supplanting some of the natural gas exports that Russia historically sent to Europe. Most of the variation in northbound volumes reflects changes in Qatar's exports to Europe (via the Suez Canal) compared with Asia. Qatar also sent more LNG to Europe in 2022 to replace some volumes from Russia, increasing northbound flows.



Data source: U.S. Energy Information

Although oil flow trends through the Bab al-Mandeb Strait are similar to those of the Suez Canal, more oil exits the Red Sea (northbound via the Suez Canal and southbound via the Bab el-Mandeb Strait) than enters the Red Sea through these chokepoints. Saudi Arabia transports some crude oil from the Persian Gulf via pipeline to the Red Sea for export mostly to Europe. LNG flows through the Bab el-Mandeb Strait have matched those in the Suez Canal over the last few years because the few LNG import terminals in the Red Sea have been used less.

Principal contributors: Candace Dunn, Justine Barden

https://libyaobserver.ly/news/pm-urges-transparency-vigilance-over-oil-production-increase-plan

PM urges transparency, vigilance over oil production increase plan

BY SAFAALHARATHY TUE, 19/03/2024 - 13:16

Prime Minister Abdul Hamid Dbeibah has emphasized the importance of monitoring the plan to increase oil production to achieve the target of two million barrels within the established timelines.

Dbeibah's remarks came during a meeting he chaired on Monday, grouping several officials, including the heads of the National Oil Corporation, the Audi Bureau, and the Administrative Control Authority.

To ensure transparency and efficiency, the PM stressed the importance of disclosing all expenses and projects being implemented, and monitoring the companies affiliated with the institution.

For his part, the Chairman of the National Oil Corporation, Farhat Bengdara, confirmed that the production will exceed 1.5 million barrels by the end of 2025 and reach two million within three years. However, he highlighted that ongoing projects require continuous financial flows to achieve the necessary productivity.

Meanwhile, the President of the Audit Bureau, Khalid Shakshak, called for adopting a three-year or five-year budget, considering that sector projects are executed over the years. He also noted that adopting an annual budget would not be practical in terms of monitoring or achievement.

During the session, the head of the Administrative Control Authority, Abdullah Qaderboh, highlighted the need for collaboration between executive and oversight bodies and the Central Bank of Libya to support the NOC in increasing oil and gas production.

According to the "Hakomitna" platform, the meeting also discussed the development of oil discoveries by the Waha Company with foreign partners and reviewed the technical report of the committee tasked with studying the agreement to develop oil and gas discoveries in the Ghadames Basin.

TAGS:

03/27/2024 04:58:33 [BN] Bloomberg News

OIL DEMAND MONITOR: Gasoline Signals Strength; Robust Aviation

- Motor fuel usage shows widespread year–on–year gains in Europe
- Flight numbers comfortably above previous year, pre–Covid era

By John Deane

(Bloomberg) –– Gasoline consumption is showing signs of strength, even in the moribund economies of Europe. Strong air travel is also helping to bolster demand for oil.

France's road fuel sales rose 3.1% year–on–year in February, powered by a 12% increase for gasoline. In Italy, sales of the motor fuel jumped 8.6%, exceeding pre–pandemic levels and reaching a multiyear seasonal high. Jet fuel sales surged 24%.

Spain's gasoline deliveries in February gained 12% on an annual basis, according to data from Exolum, which provides fuel strorage and transport logistics services. Gasoline sales in the UK were 2.2% higher year–on–year early this month, government figures show. While overall oil product sales in Germany decreased by 2.6% in December, those for gasoline were 8.6% higher.

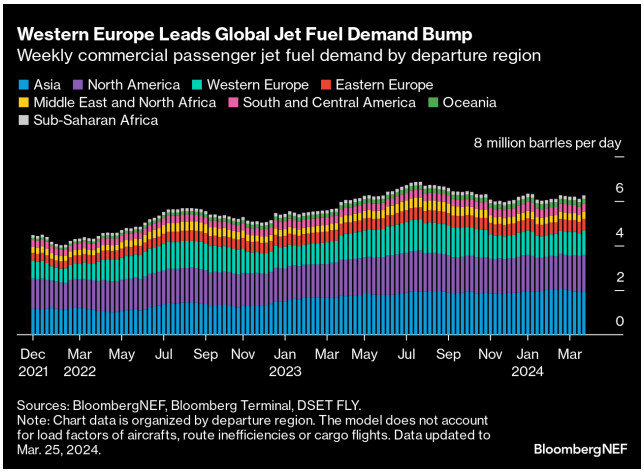
US gasoline inventories fell for a seventh straight week in the period to March 15, to the lowest since December. The Nymex gasoline crack, a measure of the profitability of refining the motor fuel from crude oil, is trading near the highest since August. Money managers boosted net–long positions in the fuel to the highest since the same month. Meanwhile, US pump prices could hit the highest since the summer of 2022, according to the AAA automobile club, potentially making them an issue in November's presidential election.

Read More: Oil Demand Outpaces Expectations, Testing Calculus on Peak Crude

In India, the world's third–biggest oil user, gasoline sales were 3.5% higher in the first 15 days of March than a year earlier, building on recent whole–month year–on–year gains. China – the biggest oil importer – processed a record amount of crude at the start of the year as refiners ramped up operations to meet holiday travel demand. Trips in private vehicles soared, with expressway passenger volumes 54% higher than 2019 levels, while airlines saw 19% more people than the pre–pandemic peak, according to BloombergNEF.

In the skies, commercial flights were about a tenth higher year–on–year in the latest week, and comfortably above 2019 levels, according to Flightradar24 data. Seat capacity data from OAG Aviation painted a similar picture. Flight schedules for the week of March 26 to April 1 imply a 2.5% weekly gain in global passenger jet fuel demand, which will see levels rise to 6.25 million barrels per day, according to BNEF calculations.

Read More: Aviation Indicators Weekly: Spring Season Lift Off



Global oil markets face a supply deficit throughout 2024, instead of the surplus previously expected, assuming that OPEC+ continues output cuts in the second half of the year, according to the International Energy Agency. Saudi Arabia and its partners agreed earlier this month to prolong roughly 2 million barrels day of production curbs to the middle of the year. The IEA assumes the measures will continue until the end of 2024, it said in its most recent monthly report.

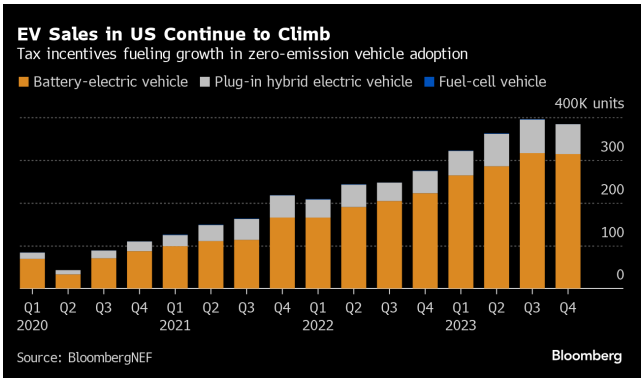
Global Estimates (m b/d)	2024	2024	2025	2025
Agency	Output/Supply	Demand	Output/Supply	Demand
EIA (March STEO)	102.17	102.43	104.17	103.81
See related story				
OPEC (March market report)	n/a	104.46	n/a	106.3
See related story				

IEA (March market report)	102.9	103.18	n/a	n/a

See related story

Still, the market may struggle to make sharp gains in the coming weeks, with refineries in Europe heading into peak maintenance season, subduing demand for crude supplies in the region.

In the longer term, the Biden administration moved last week to throttle pollution from the nation's cars and light trucks, imposing tailpipe emission limits so stringent they will compel automakers to rapidly boost sales of battery-electric and plug-in hybrid models.



The Bloomberg oil demand monitor uses a range of high-frequency data to help identify emerging trends. Following are the latest indicators. The first table shows fuel demand, the second shows air travel globally and the third refinery activity.

Demand Measure	Location	%vs 2023	%vs 2022	% vs 2021	% vs 2020	% vs 2019	% m/m	Freq	Latest Date	Latest Value	Source
Gasoline product supplied	US	-1.7	+2	+4.3	-9.1	-6.4	+7.4	w	March 15	8.81m b/d	EIA
Distillates product supplied	US	-4.7	-16	-6	-5.7	-20	-3.9	w	March 15	3.79m b/d	EIA
Jet fuel product supplied	US	-2.2	-9.7	+55	-9.6	-13	+10	w	March 15	1.57m b/d	EIA
Total oil products supplied	US	-1.4	-6.5	+4.3	-8	-8	+4.4	w	March 15	19.74m b/d	EIA
Gasoline (petrol) avg sales per filling station	UK	+2.2	-3.3	+45	-6.9	-0.8	+3.6	w	Week to March 3	7,131 liters/day	BEIS
Diesel avg sales per station	UK	-2.9	-13	+7.3	-19	-15	+2.8	w	Week to March 3	8,807	BEIS
Total road fuels sales per station	UK	-0.7	-9.1	+21	-14	-9.4	+3.1	w	Week to March 3	15,938	BEIS
Car use	UK	+2.2	+3.3	+34	-6.9	-6	+1.1	m	March 11	94	DfT
Heavy goods vehicle use	UK	+1.9	-1.9	unch.	+1	+5	+1.9	m	March 11	105	DfT
All motor vehicle use index	UK	+2.1	+4.2	+29	-3.9	-1	+1	m	March 11	99	DfT
Diesel sales	India	+0.8					-0.5	m	March 1-15	3.218m tons	Bberg
Gasoline sales	India	+3.5					-0.4	m	March 1-15	1.269m tons	Bberg
Jet fuel sales	India	+4.7					+0.1	m	March 1-15	330k tons	Bberg
LPG sales	India	+15					-5.2	m	March 1-15	1.364m tons	Bberg
Diesel sales	India	+6.2					+0.1	m	February	7.44m tons	PPAC
Gasoline sales	India	+8.9					-2.5	m	February	3.02m tons	PPAC

Jet fuel sales	India	+12				−1.7	m	February	704k tons	PPAC
LPG sales	India	+8.5				−3.9	m	February	2.59m tons	PPAC
Total oil products	India	+5.7				−1.6	m	February	19.72m tons	PPAC
Gasoline deliveries	Spain	+12				−0.8	m	February	508k m3	Exolum
Diesel (and heating oil) deliveries	Spain	−5.7				−5	m	February	2,171k m3	Exolum
Jet fuel deliveries	Spain	+14				−3.7	m	February	466k m3	Exolum
Total oil products deliveries	Spain	−0.5				−4.3	m	February	3,145k m3	Exolum
Naphtha	Germany	−4.4			−23	+19	m	December	887k tons	BAFA
Gasoline	Germany	+8.6			−1.7	+3.7	m	December	1.46m tons	BAFA
Diesel	Germany	−5.6			−6.9	−9.4	m	December	2.73m tons	BAFA
Heating oil	Germany	−2.8			+7.1	+11	m	December	1.17m tons	BAFA
LPG	Germany	−11			−21	+25	m	December	235k tons	BAFA
Jet fuel	Germany	−10			−5	−4.3	m	December	733k tons	BAFA
Total oil product sales	Germany	−2.6			−10	−1.9	m	December	7.38m tons	BAFA
Road fuel sales	France	+3.1		−3.8		−3.5	m	February	3.671 m3	UFIP
Gasoline sales	France	+12					m	February	n/a	UFIP
Road diesel sales	France	unch.					m	February	n/a	UFIP
Jet fuel sales	France	+5.6		−5.5		−4.3	m	February	561k m3	UFIP
All petroleum products sales	France	−0.6				−7	m	February	4.092m tons	UFIP
All vehicles traffic	Italy	+1				+3	m	February	n/a	Anas
Heavy vehicle traffic	Italy	+4				+10	m	February	n/a	Anas
Gasoline sales	Italy	+8.6			+19	−2.7	m	February	617k tons	Energy Ministry
Transport diesel sales	Italy	+0.6			+0.7	−2.2	m	February	1.825m tons	Energy Ministry
Diesel/gasoil sales	Italy	−1.1			−2.7	−1.7	m	February	1.976m tons	Energy Ministry
LPG sales	Italy	+0.7			−4.2	−9.9	m	February	300k tons	Energy Ministry
Jet fuel sales	Italy	+24			unch.	−4.5	m	February	300k tons	Energy Ministry
Total oil product sales	Italy	+2.4			−1.7	−1	m	February	3.917m tons	Energy Ministry
Gasoline consumption	Portugal	+8.2	+20	+82	+9.9	+15	−7	m	February	86,879 tons	ENSE
Diesel consumption	Portugal	−3.9	+0.6	+27	−2.1	−1.8	−6.9	m	February	371,735 tons	ENSE
Jet fuel consumption	Portugal	+7.3	+55	+542	+12	+28	−4	m	February	116,790 tons	ENSE
% change in toll roads kms traveled	France	−0.3						m	February	n/a	Mundys
% change in toll roads kms traveled	Italy	+5.2						m	February	n/a	Mundys

% change in toll roads kms traveled	Spain	+9	m	February	n/a	Mundys
% change in toll roads kms traveled	Brazil	+7.6	m	February	n/a	Mundys
% change in toll roads kms traveled	Chile	−5.2	m	February	n/a	Mundys
% change in toll roads kms traveled	Mexico	+6.3	m	February	n/a	Mundys

Notes: Click here for a PDF with more information on sources, methods. The frequency column shows w for data updated weekly, 2/m for twice a month and m for monthly.

Congestion:

- READ: Road Traffic Indicators: China's Congestion Climbs Again
- READ: Oil Price Indicators Weekly: Agencies Slash Supply Outlook
- Due to ongoing issues with data feeds, this issue omits the table showing BNEF calculations of road congestion changes based on TomTom data. We are looking into potential alternative approaches.

Air Travel:

Measure	Location	vs 2023	vs 2022	vs 2021	vs 2020	vs 2019	m/m	w/w	Freq.	Latest Date	Latest Value	Source
					changes shown as %							
All flights	Worldwide	+7.4	+9.9	+27	+90	+14	−0.8	−4.2	d	March 25	208,363	Flightradar24
Commercial flights	Worldwide	+10	+34	+61	+102	+12	+0.2	−0.7	d	March 25	122,574	Flightradar24
Seat capacity per month	Worldwide	+8.1	+34	+80	+56	+2.1		+1.2	w	March 25 week	107.9m	OAG
Air traffic (flights)	Europe					−6.5	+3.9	+0.3	d	March 25	26,804	Eurocontrol
Airline passenger throughput (7−day avg)	US	+9	+18	+88	+392	+6	+7	+1	w	March 24	2.54m	TSA
Air passenger traffic per month	China	+44	+94	+90	+13	+7.3	+13		m	January	57.3m	CAAC
Heathrow airport passengers	UK	+12	+102	+1,157	+6.5	+5.7	−3.3		m	February	5.8m	Heathrow. See related story
Rome % change in passengers carried	Italy	+31				+4.7			m	February	n/a	Mundys

Note: Comparisons versus 2019 are a better measure of a return to normal for most nations, rather than y/y comparisons.

Note: FlightRadar24 data shown above, and comparisons thereof, all use 7−day moving averages, except for w/w which uses single day data.

Refineries:

Measure	Location	vs 2023	vs 2022	vs 2021	vs 2019	m/m chg	Latest as of Date	Latest Value	Source
				Changes are in ppt unless noted					

								15.79m	
Crude intake	US	+2.7	−0.6	+17.5	−2.5	+8.3	March 15	b/d	EIA
Utilization	US	−0.8	−3.3	+11.7	−1.1	+7.2	March 15	87.8%	EIA
Utilization	US Gulf	−2.6	−5.6	+18	−1.3	+8.9	March 15	88.7%	EIA
Utilization	US East	+12.5	−0.1	+4.2	+3.1	+0.8	March 15	80.5%	EIA
Utilization	US Midwest	+3	+3	+6	+4.2	+6.7	March 15	91.7%	EIA
Utilization (indep. refs)	Shandong, China	−9.4	+1.3	−20.2	−10.8	−1.6	March 22	53.2%	Oilchem

Note: US refinery data is weekly. Changes are shown in percentages for the row on crude intake, while refinery utilization changes are shown in percentage points.

Previous versions/related stories:

Click here for prior versions of the OIL DEMAND MONITOR or run NI OILDEMON

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- Europe Oil Weakens Again as Peak Outage Season Shifts to Region
- Europe's Oil Refiners to Take 1.2m B/D Offline in April: Kpler
- US Republican Leaders Slam Energy Watchdog's Demand Forecast
- US Gasoline Demand Is Making a Spring Comeback: BNEF Chart
- Currie Says Oil Will Break Above Consensus View on Fed Cuts
- Gunvor Sees Oil Prices at $85–$90 in Q3 Even Without OPEC+ Cuts
- China's Jan.–Feb. Apparent Oil Demand Rises 6.07% Y/y
- Morgan Stanley Raises Brent Crude Price Forecast to $90 by 3Q
- Commodities Are Entering Fresh Cyclical Upswing, Macquarie Says
- Red Sea Disruption Causes Spike in Ship Fuel Demand, IEA Says

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--With assistance from Bill Lehane, Prejula Prem, Julian Lee, Joao Lima, Rakesh Sharma, Alex Longley and Grant Smith.

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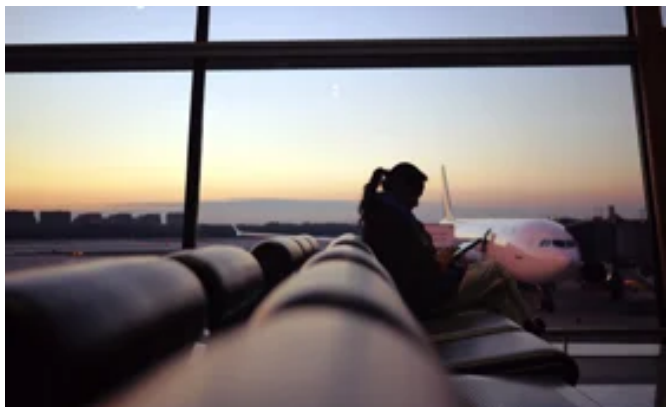
Press Release No: 10

Date: 6 March 2024

Passenger Demand Up 16.6% in January



Geneva - The International Air Transport Association (IATA) released data for January 2024 global passenger demand indicating a strong start for the year.

Total demand, measured in revenue passenger kilometers (RPKs), was up 16.6%; total capacity, measured in available seat kilometers (ASK), was up 14.1%; and the load factor was 79.9% (+1.7pt)

International demand rose 20.8%; capacity was up 20.9% and the load factor remained at 79.7% (+0.0pt)

Domestic demand rose 10.4%; capacity was up 4.6% and the load factor was 80.2% (+4.2pt)

“2024 is off to a strong start despite economic and geopolitical uncertainties. As governments look to build prosperity in their economies in the busiest election-year ever, it is critical that they see aviation as a catalyst for growth. Increased taxes and onerous regulation are a counterweight to prosperity. We will be looking to governments for policies that help aviation to reduce costs, improve efficiency and make progress towards net zero CO2 emissions by 2050,” said Willie Walsh, IATA’s Director General.

Air Passenger Market in Detail

JANUARY 2024 (% YEAR-ON-YEAR)	Total Market
WORLD SHARE1	100%
RPK	16.6%
ASK	14.1%
PLF(%-PT)2	1.7%
PLF(LEVEL)3	79.9%

JANUARY 2024 (% YEAR-ON-YEAR)	Africa
WORLD SHARE1	2.1%
RPK	18.1%
ASK	19.9%
PLF(%-PT)2	-1.1%
PLF(LEVEL)3	73.1%

JANUARY 2024 (% YEAR-ON-YEAR)	Asia Pacific
WORLD SHARE1	31.7%
RPK	31.8%
ASK	26.6%
PLF(%-PT)2	3.2%
PLF(LEVEL)3	80.8%
JANUARY 2024 (% YEAR-ON-YEAR)	**Europe**
WORLD SHARE1	27.1%
RPK	10.0%
ASK	9.6%
PLF(%-PT)2	0.3%
PLF(LEVEL)3	78.2%
JANUARY 2024 (% YEAR-ON-YEAR)	**Latin America**
WORLD SHARE1	5.5%
RPK	9.9%
ASK	5.5%
PLF(%-PT)2	3.4%
PLF(LEVEL)3	85.0%
JANUARY 2024 (% YEAR-ON-YEAR)	**Middle East**
WORLD SHARE1	9.4%
RPK	16.2%
ASK	15.3%
PLF(%-PT)2	0.6%
PLF(LEVEL)3	79.9%
JANUARY 2024 (% YEAR-ON-YEAR)	**North America**
WORLD SHARE1	24.2%
RPK	6.0%
ASK	4.1%
PLF(%-PT)2	1.5%
PLF(LEVEL)3	79.9%

1) % of industry RPKs in 2023 2) Year-on-year change in load factor 3) Load Factor Level

International Passenger Markets

Asia-Pacific airlines saw an 45.4% increase in January 2024 traffic compared to January 2023, continuing the region's rapid recovery after the lifting of pandemic

Middle Eastern airlines posted a 16.2% rise in January 2024 traffic compared to a year ago. Capacity rose 15.7% and load factor climbed 0.4 percentage points to 79.9%.

North American carriers had a 12.3% traffic rise in January 2024 versus the 2023 period. Capacity also increased 13.7%, and load factor fell 1.0 percentage point to 79.4%.

Latin American airlines' traffic rose 17.9% compared to the same month in 2023. January capacity climbed 13.2%, pushing the load factor up 3.4 percentage points to 86%, the highest among the regions.

African airlines' saw a 18.5% traffic increase in January 2024 versus a year ago. January capacity was up 19.2% causing load factor to decline 0.4 percentage points to 73.3%, the lowest among the regions.

Domestic Passenger Markets

Domestic demand growth continues to be led by China, which saw strong demand for Lunar New Year travel. This is likely to have boosted traffic in February also. Chinese carriers have responded by increasing capacity, particularly by deploying wide-body jets.

JANUARY 2024 (% YEAR-ON-YEAR)	Domestic
WORLD SHARE1	**39.9%**
RPK	**10.4%**
ASK	**4.6%**
PLF(%-PT)2	**4.2%**
PLF(LEVEL)3	**80.2%**
JANUARY 2024 (% YEAR-ON-YEAR)	Domestic Australia
WORLD SHARE1	0.8%
RPK	5.3%
ASK	6.3%
PLF(%-PT)2	-0.7%
PLF(LEVEL)3	72.4%
JANUARY 2024 (% YEAR-ON-YEAR)	Domestic Brazil
WORLD SHARE1	1.2%
RPK	0.2%
ASK	-1.0%
PLF(%-PT)2	1.0%
PLF(LEVEL)3	83.2%
JANUARY 2024 (% YEAR-ON-YEAR)	Domestic China P.R.
WORLD SHARE1	11.2%
RPK	33.2%
ASK	19.2%
PLF(%-PT)2	8.4%
PLF(LEVEL)3	80.2%

JANUARY 2024 (% YEAR-ON-YEAR)	Domestic India
WORLD SHARE1	1.8%
RPK	3.9%
ASK	-1.0%
PLF(%-PT)2	4.2%
PLF(LEVEL)3	88.9%

JANUARY 2024 (% YEAR-ON-YEAR)	Domestic Japan
WORLD SHARE1	1.1%
RPK	2.9%
ASK	-2.9%
PLF(%-PT)2	3.8%
PLF(LEVEL)3	68.7%

JANUARY 2024 (% YEAR-ON-YEAR)	Domestic US
WORLD SHARE1	15.4%
RPK	3.1%
ASK	-0.5%
PLF(%-PT)2	2.8%
PLF(LEVEL)3	79.8%

1) % of industry RPKs in 2023 2) year-on-year change in load factor 3) Load Factor Level

Air Passenger Market Overview - January 2024

JANUARY 2024 (% CH VS SAME MONTH IN 2019)	**Total Market**
WORLD SHARE1	**100.0%**
RPK	**-0.4%**
ASK	**-0.5%**
PLF (%-PT)2	**0.1%**
PLF (LEVEL)3	**79.9%**

JANUARY 2024 (% CH VS SAME MONTH IN 2019)	International
WORLD SHARE1	60.1%
RPK	-4.3%
ASK	-4.1%
PLF (%-PT)2	-0.2%
PLF (LEVEL)3	79.7%

JANUARY 2024 (% CH VS SAME MONTH IN 2019)	Domestic
WORLD SHARE1	39.9%
RPK	6.7%
ASK	5.8%
PLF (%-PT)2	0.7%
PLF (LEVEL)3	80.2%

1) % of industry RPKs in 2023 2) year-on-year change in load factor 3) Load Factor Level

> View the January Air Passenger Market Analysis (pdf)

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Notes for Editors:

- IATA (International Air Transport Association) represents some 320 airlines comprising 83% of global air traffic.
- You can follow us at twitter.com/iata for announcements, policy positions, and other useful industry information.
- Fly Net Zero
- Statistics compiled by IATA Economics using direct airline reporting complemented by estimates, including the use of FlightRadar24 data provided under license.
- All figures are provisional and represent total reporting at time of publication plus estimates for missing data. Historic figures are subject to revision.
- Domestic RPKs accounted for about 41.9% of the total market in 2022. The six domestic markets in this report account for 31.3% of global RPKs.
- Explanation of measurement terms:

- RPK: Revenue Passenger Kilometers measures actual passenger traffic

- ASK: Available Seat Kilometers measures available passenger capacity

- PLF: Passenger Load Factor is % of ASKs used.

- IATA statistics cover international and domestic scheduled air traffic for IATA member and non-member airlines.
- Total passenger traffic market shares by region of carriers for 2023 in terms of RPK are: Asia-Pacific 31.7%, Europe 27.1%, North America 24.2%, Middle East 9.4%, Latin America 5.5%, and Africa 2.1%.

Press Release No: 9

Date: 5 March 2024

Air Cargo Demand up 18.4% in January

Translation: 国际航协：1月全球航空货运需求增长18.4% (pdf)

Geneva - The International Air Transport Association (IATA) released data for January 2024 global air cargo markets indicating a strong start to 2024.

Total demand, measured in cargo tonne-kilometers (CTKs*), increased by 18.4% compared to January 2023 levels (19.8% for international operations). This significant upturn marks the highest annual growth in cargo tonne-kilometers (CTKs) since the summer season of 2021.

Capacity, measured in available cargo tonne-kilometres (ACTKs), was up 14.6% compared to January 2023 (18.2% for international operations). This was largely related to the growth in belly capacity. International belly capacity rose 25.8% year-on-year (YoY) on the strength of passenger markets.

"Air cargo demand was up 18.4% year-on-year in January. This is a strong start to the year. In particular, the booming e-commerce sector is continuing to help air cargo demand to trend above growth in both trade and production since the last quarter of 2023. The counterweight to this good news is uncertainty over how China's economic slowdown will unfold. This will be on the minds of air cargo executives meeting in Hong Kong next week for the IATA World Cargo Symposium with an agenda focused on digitalization, efficiency and sustainability," said Willie Walsh, IATA's Director General.

Air cargo growth outpaced trade and production. Several factors in the operating environment should be noted:

- Global cross-border trade increased by 1.0% in December compared to the previous month (-0.2% YoY).
- In January, the manufacturing output Purchasing Managers' Index (PMI) improved to 50.3, surpassing the 50 mark for the first time in eight months, indicating expansion. The new export orders PMI also saw an increase to 48.8, but remains below the critical 50 threshold, suggesting a continuing yet decelerating decline in global exports.
- Inflation in major economies continued to ease from its peak in terms of Consumer Price Index (CPI) in January, reaching 3.1% in both the US and in the EU, and 2.1% in Japan. China's CPI, however, indicated deflation for the fourth consecutive month, raising concerns of an economic slowdown. China's negative inflation rate of -0.8% was the lowest since the Global Financial Crisis in 2009.

Air Cargo Market in Detail

JANUARY 2024 (%YEAR-ON-YEAR)	Total Market
WORLD SHARE *1	100%
CTK	18.4%
ACTK	14.6%
CLF (%-PT) *2	1.4%
CLF (LEVEL) *3	45.7%

JANUARY 2024 (%YEAR-ON-YEAR)	Africa
WORLD SHARE *1	2.0%
CTK	17.0%
ACTK	19.4%
CLF (%-PT) *2	-0.9%
CLF (LEVEL) *3	43.1%
JANUARY 2024 (%YEAR-ON-YEAR)	Asia Pacific
WORLD SHARE *1	33.3%
CTK	24.6%
ACTK	25.0%
CLF (%-PT) *2	-0.2%
CLF (LEVEL) *3	44.6%
JANUARY 2024 (%YEAR-ON-YEAR)	Europe
WORLD SHARE *1	21.4%
CTK	16.4%
ACTK	12.5%
CLF (%-PT) *2	1.9%
CLF (LEVEL) *3	55.5%
JANUARY 2024 (%YEAR-ON-YEAR)	Latin America
WORLD SHARE *1	2.8%
CTK	13.4%
ACTK	6.6%
CLF (%-PT) *2	2.1%
CLF (LEVEL) *3	34.4%
JANUARY 2024 (%YEAR-ON-YEAR)	Middle East
WORLD SHARE *1	13.5%
CTK	25.9%
ACTK	17.1%
CLF (%-PT) *2	3.1%
CLF (LEVEL) *3	43.9%
JANUARY 2024 (%YEAR-ON-YEAR)	North America
WORLD SHARE *1	26.9%
CTK	9.3%

(*1) % of industry CTKs in 2023 (*2) Year-on-year change in load factor (*3) Load factor level

January Regional Performance

Asia-Pacific airlines saw their air cargo volumes increase by 24.6% in January 2024 compared to the same month in 2023. This performance was above the previous month (+18.5%). Carriers in the region benefited from ongoing growth in international CTKs on three major trade lanes: Africa-Asia (+52.5%), Middle East-Asia (+29.5%) and Europe-Asia (+27.5%). Available capacity for the region's airlines increased by 25.0% compared to January 2023 as more belly capacity came online from the passenger side of the business.

North American carriers had the weakest performance of all regions in January with a 9.3% increase (YoY) in cargo volumes. This was an improvement in performance compared to December (2.0%). Carriers in the region benefitted from growth on the North America-Asia trade lane (+17.1%) and North America-Europe trade lane (+3.5%). Capacity increased by 3.8% compared to January 2023.

European carriers saw their air cargo volumes increase by 16.4% in January compared to the same month in 2023. This was a stronger performance than in December (+8.6%). Carriers in the region benefitted from the strong growth in international CTKs in the within Europe market (+18.4%) and the Europe – Asia route (+27.5%). Gains made from the significant expansion in the Middle East-Europe trade lane (+46.1%) also benefited carriers in the region. Capacity increased 12.5% in January 2024 compared to the same month in 2023.

Middle Eastern carriers had the strongest performance in January 2024, with a 25.9% year-on-year increase in cargo volumes. This was a significant improvement from the previous month's performance (+18.3%). Carriers in the region benefited from growth in the Middle East–Asia (+29.5%) and Middle East–Europe markets (+46.1%). Capacity increased 17.1% compared to January 2023.

Latin American carriers experienced a 13.4% increase in cargo volumes compared to January 2023, a notable increase compared to the previous month's gain (+6.4%). Capacity in January was up 6.6% compared to the same month in 2023.

African airlines saw their air cargo volumes increase by 17.0% in January 2024, much improved compared to December's performance (-1.2%). Carriers in the region benefitted from strong growth on the Africa-Asia trade lane. Capacity in January was 19.4% above January 2023 levels.

> **View January 2024 Air Cargo Market Analysis** (pdf)

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Notes for Editors:

- IATA (International Air Transport Association) represents some 320 airlines comprising 83% of global air traffic.
- You can follow us at twitter.com/iata for announcements, policy positions, and other useful industry information.
- Explanation of measurement terms:
  - CTK: cargo tonne-kilometers measures actual cargo traffic
  - ACTK: available cargo tonne-kilometers measures available total cargo capacity
  - CLF: cargo load factor is % of ACTKs used
- IATA statistics cover international and domestic scheduled air cargo for IATA member and non-member airlines.
- Total cargo traffic market share by region of carriers in terms of CTK is: Asia-Pacific 33.3%, Europe 21.4%, North America 26.9%, Middle East 13.5%, Latin America 2.8%, and Africa 2.0%.

https://www.dallasfed.org/research/surveys/des/2024/2401?utm_source=MarketingCloud&utm_medium=email&utm_campaign=24.03.27+Energy+Survey%2c+LK+working+paper&utm_content=https%3a%2f%2fwww.dallasfed.org%2fresearch%2fsurveys%2fdes%2f2024%2f2401#tab-report

First Quarter | March 27, 2024

Outlook improves even as oil and gas activity little changed; Breakeven prices increase

What's New This Quarter

Special questions this quarter include an annual update on breakeven prices by basin, anticipated employee head count changes in 2024, expectations regarding the net firm-level impact of the methane charge and the expected impacts of the recent LNG export facility permitting pause. Among more salient responses, respondents reported higher breakeven prices.

This quarter's survey also includes for the first time a set of questions regarding price expectations for oil and natural gas over six-month, one-year, two-year and five-year horizons.

Activity in the oil and gas sector was relatively unchanged in the first quarter of 2024, according to oil and gas executives responding to the Dallas Fed Energy Survey. The business activity index, the survey's broadest measure of conditions energy firms in the Eleventh District face, was 2.0 in the first quarter, suggesting little to no growth during the quarter. The index was essentially unchanged from last quarter.

Oil and gas production decreased in the first quarter, according to executives at exploration and production (E&P) firms. The oil production index moved down from 5.3 in the fourth quarter to -4.1 in the first quarter, suggesting a small decline in production. Meanwhile, the natural gas production index turned negative, falling sharply from 17.9 to -17.0.

Costs increased at a slightly faster pace for both oilfield services and E&P firms. Among oilfield services firms, the input cost index increased from 21.3 to 31.2. Among E&P firms, the finding and development costs index was relatively unchanged at 24.2. Meanwhile, the lease operating expenses index increased from 22.6 to 33.7.

Oilfield services firms reported modest deterioration in nearly all indicators. The equipment utilization index remained negative but increased from -8.4 in the fourth quarter to -4.2 in the first. The operating margin index moved down from -32.0 to -35.4, suggesting declining margins. The index of prices received for services was unchanged at -6.2.

The aggregate employment index was relatively unchanged at 3.4 in the first quarter. While this is the 13th consecutive positive reading for the index, the low-single-digit reading suggests slow net hiring. The aggregate employee hours index increased from 2.8 in the fourth quarter to 6.9 in the first quarter. Additionally, the aggregate wages and benefits index increased from 21.2 to 32.8.

The company outlook index rebounded in the first quarter, jumping 24 points to 12.0. While the company outlook index increased, it is still below the series average. The overall outlook uncertainty index fell 22 points to 24.1, suggesting that while uncertainty continued to increase on net, fewer firms noted a rise in the recent quarter. The uncertainty index this quarter was slightly above the series average.

On average, respondents expect a West Texas Intermediate (WTI) oil price of $80 per barrel at year-end 2024; responses ranged from $70 to $120 per barrel. When asked about longer-term expectations, respondents on average expect a WTI oil price of $83 per barrel two years from now and $90 per barrel five years from now. Survey participants expect a Henry Hub natural gas price of $2.59 per million British thermal units (MMBtu) at year-end. When asked about longer-term expectations, respondents on average

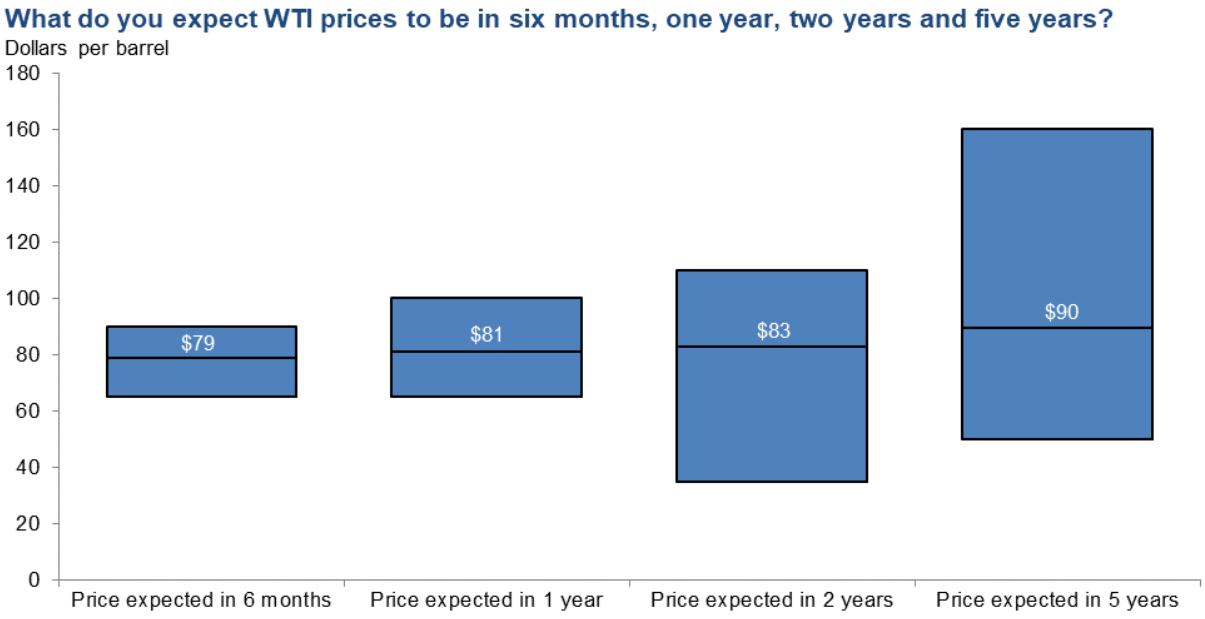
expect a Henry Hub gas price of $3.18 per MMBtu two years from now and $3.94 per MMBtu five years from now. For reference, WTI spot prices averaged $82.52 per barrel during the survey collection period, and Henry Hub spot prices averaged $1.44 per MMBtu.

Next release: June 26, 2024

Data were collected March 13–21, and 147 energy firms responded. Of the respondents, 97 were exploration and production firms and 50 were oilfield services firms.

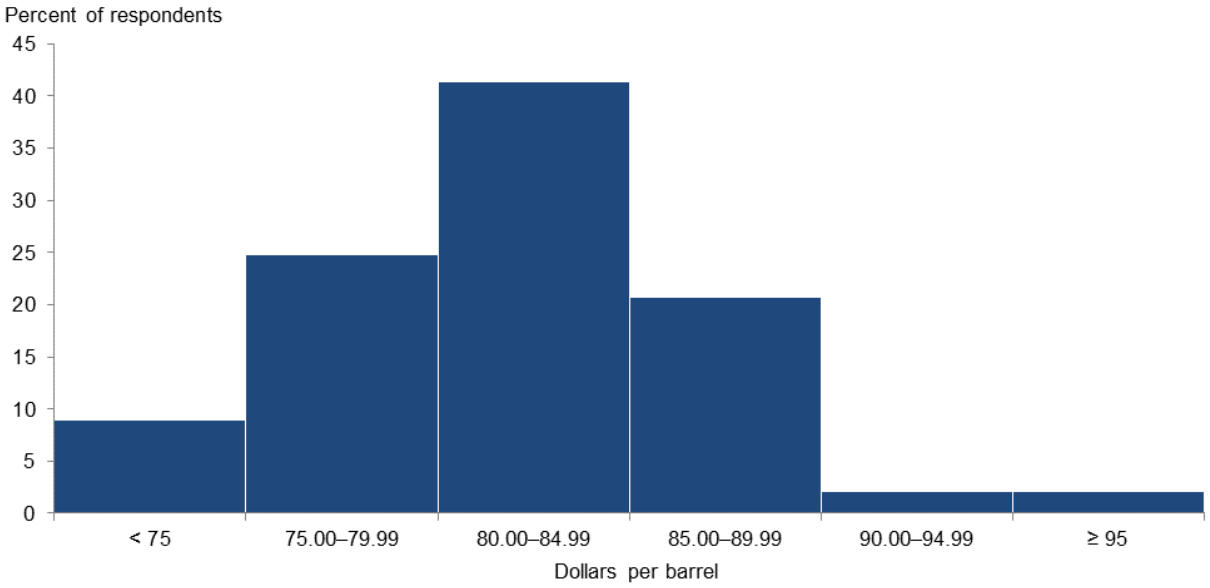
The Dallas Fed conducts the Dallas Fed Energy Survey quarterly to obtain a timely assessment of energy activity among oil and gas firms located or headquartered in the Eleventh District. Firms are asked whether business activity, employment, capital expenditures and other indicators increased, decreased or remained unchanged compared with the prior quarter and with the same quarter a year ago. Survey responses are used to calculate an index for each indicator. Each index is calculated by subtracting the percentage of respondents reporting a decrease from the percentage reporting an increase. When the share of firms reporting an increase exceeds the share reporting a decrease, the index will be greater than zero, suggesting the indicator has increased over the previous quarter. If the share of firms reporting a decrease exceeds the share reporting an increase, the index will be below zero, suggesting the indicator has decreased over the previous quarter.

Price Forecasts



NOTE: Executives from 135 oil and gas firms answered this question during the survey collection period, March 13–21, 2024. For reference, WTI (West Texas Intermediate) spot prices averaged $82.52 per barrel during the period. The middle line denotes the mean, and the bottom and top of the boxes denote the minimum and maximum responses.
SOURCE: Federal Reserve Bank of Dallas.

What do you expect the WTI crude oil price to be at the end of 2024?

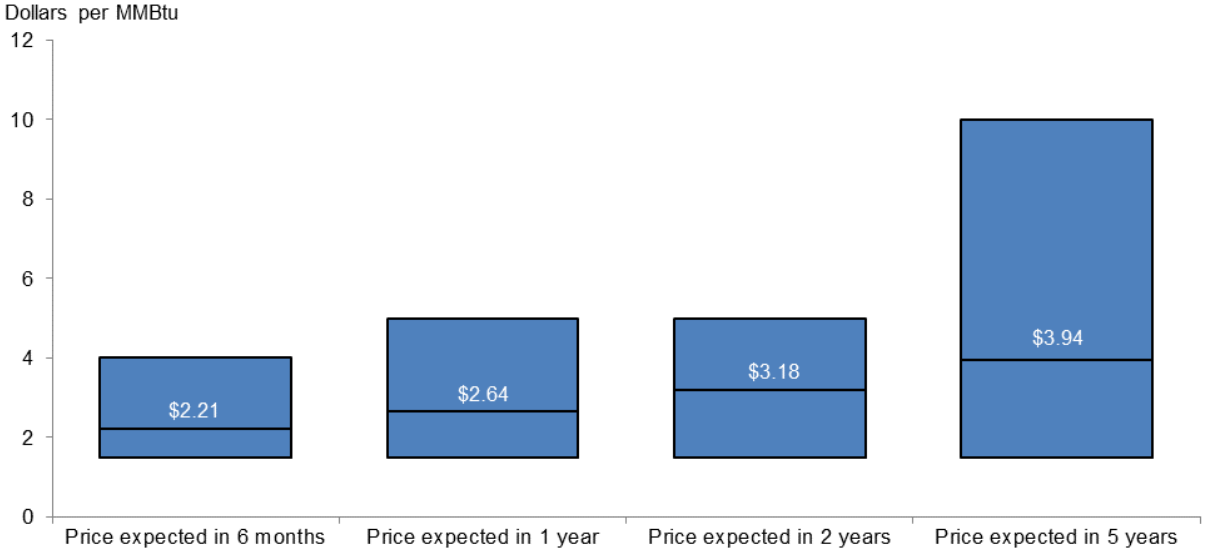


NOTES: Executives from 145 oil and gas firms answered this question during the survey collection period, March 13–21, 2024. The average response was $80 per barrel. For reference, WTI (West Texas Intermediate) spot prices averaged $82.52 per barrel during the period.
SOURCES: Federal Reserve Bank of Dallas; Energy Information Administration (reference price).

West Texas Intermediate crude oil price (dollars per barrel), year-end 2024				
Indicator	Survey Average	Low Forecast	High Forecast	Price During Survey
Current quarter	$80.11	$70.00	$120.00	$82.52
Prior quarter	$77.68	$51.00	$110.00	$69.77

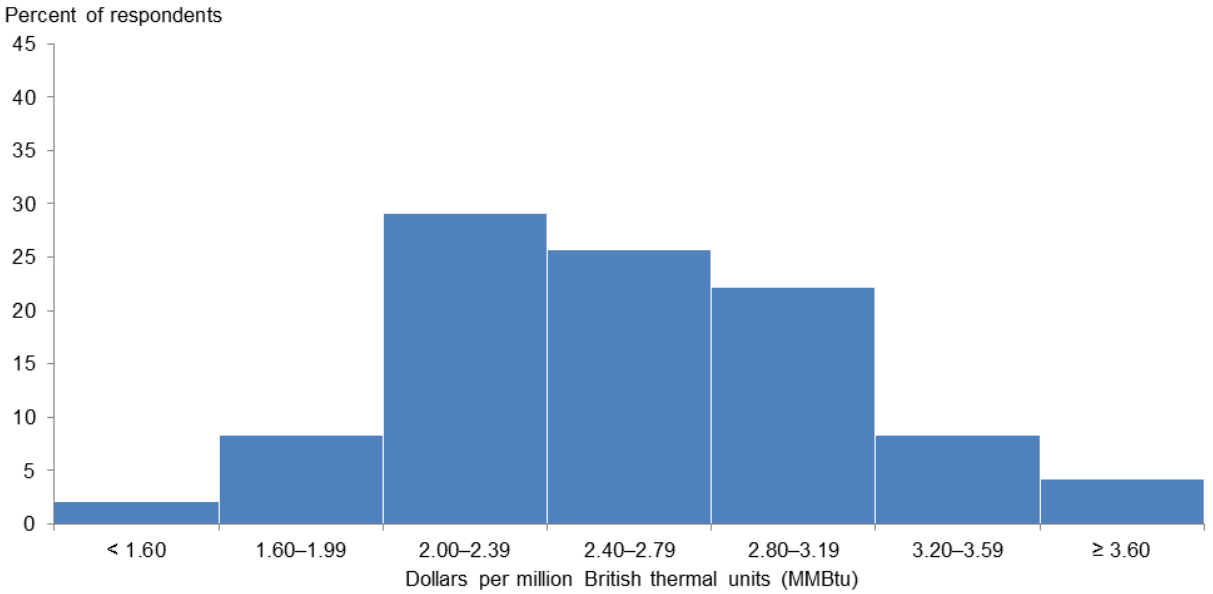
NOTE: Price during survey is an average of daily spot prices during the survey collection period.
SOURCES: Federal Reserve Bank of Dallas; Energy Information Administration.

What do you expect Henry Hub natural gas prices to be in six months, one year, two years and five years?



NOTE: Executives from 128 oil and gas firms answered this question during the survey collection period, March 13–21, 2024. For reference, Henry Hub spot prices averaged $1.44 per MMBtu during the period. The middle line denotes the mean, and the bottom and top of the boxes denote the minimum and maximum responses.
SOURCE: Federal Reserve Bank of Dallas.

What do you expect the Henry Hub natural gas price to be at the end of 2024?



NOTES: Executives from 144 oil and gas firms answered this question during the survey collection period, March 13–21, 2024. The average response was $2.59 per MMBtu. For reference, Henry Hub spot prices averaged $1.44 per MMBtu during the period.
SOURCES: Federal Reserve Bank of Dallas; Energy Information Administration (reference price).

Henry Hub natural gas price (dollars per MMBtu), year-end 2024

Indicator	Survey Average	Low Forecast	High Forecast	Price During Survey
Current quarter	$2.59	$1.50	$7.00	$1.44
Prior quarter	$3.09	$1.50	$5.30	$2.48

NOTE: Price during survey is an average of daily spot prices during the survey collection period.
SOURCES: Federal Reserve Bank of Dallas; Energy Information Administration.

Special Questions

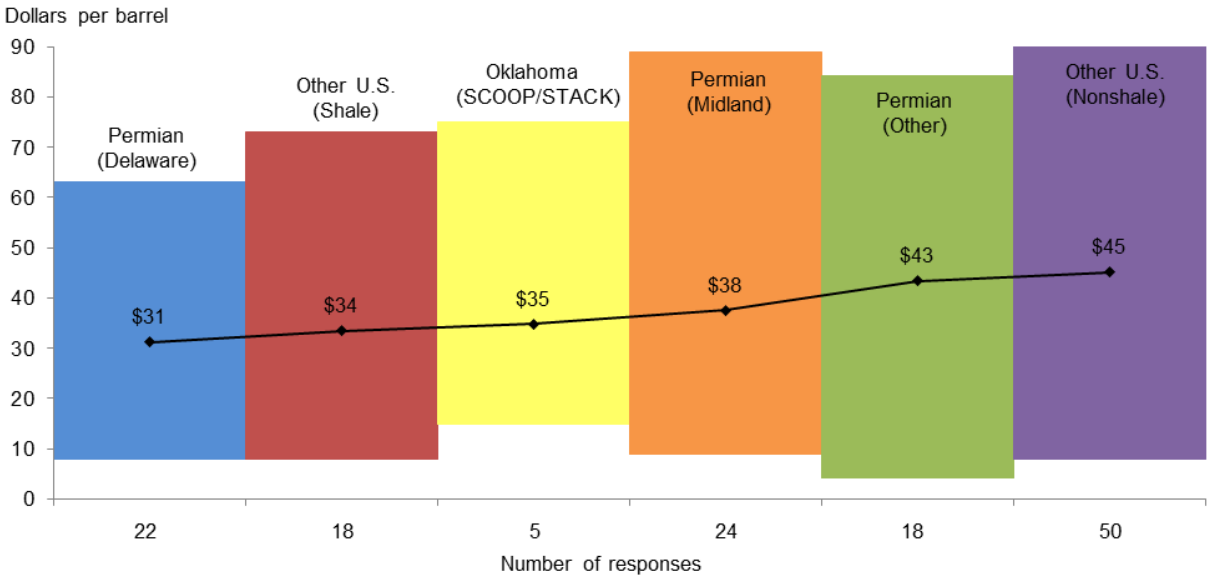
Data were collected March 13–21; 144 oil and gas firms responded to the special questions survey.

Exploration and production (E&P) firms

In the top two areas in which your firm is active: What West Texas Intermediate (WTI) oil price does your firm need to cover operating expenses for existing wells?

The average price across the entire sample is approximately $39 per barrel, up from $37 last year. Across regions, the average price necessary to cover operating expenses ranges from $31 to $45 per barrel. Almost all respondents can cover operating expenses for existing wells at current prices.

Large firms (with crude oil production of 10,000 barrels per day or more as of the fourth quarter of 2023) require prices of $26 per barrel to cover operating expenses for existing wells, based on the average of company responses. That compares with $44 for small firms (fewer than 10,000 barrels per day).

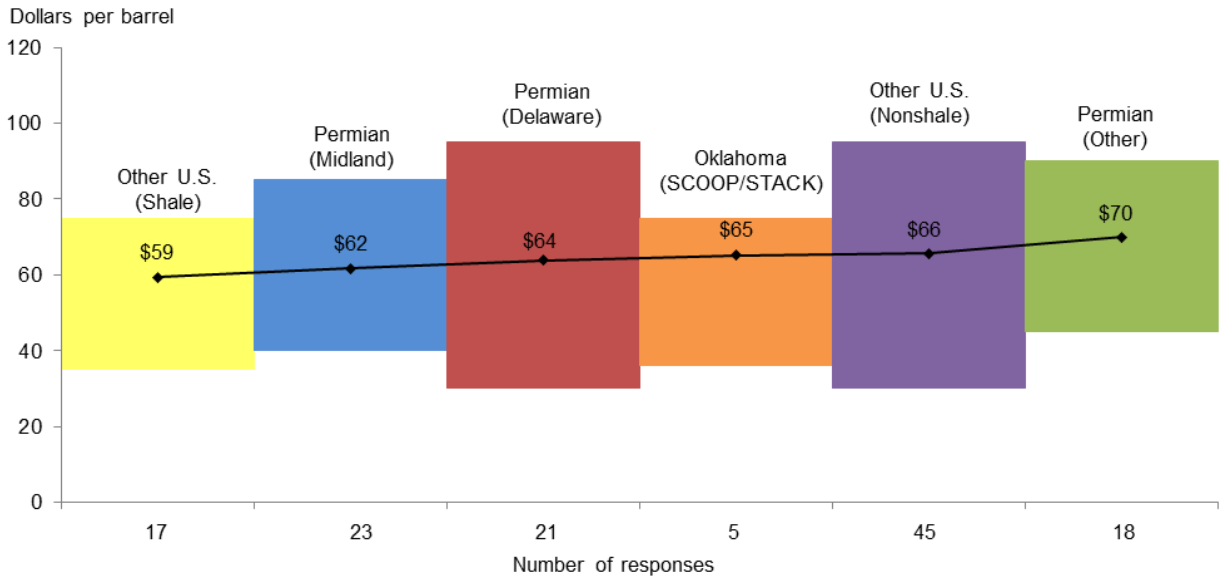


NOTES: Lines show the mean, and bars show the range of responses. Executives from 91 exploration and production firms answered this question during the survey collection period, March 13–21, 2024.
SOURCE: Federal Reserve Bank of Dallas.

In the top two areas in which your firm is active: What WTI oil price does your firm need to profitably drill a new well?

For the entire sample, firms need $64 per barrel on average to profitably drill, higher than the $62-per-barrel price when this question was asked last year. Across regions, average breakeven prices to profitably drill range from $59 to $70 per barrel. Breakeven prices in the Permian Basin average $65 per barrel, $4 higher than last year. Almost all firms in the survey can profitably drill a new well at current prices. (The WTI spot price was $83 per barrel during the survey period.)

Large firms (with crude oil production of 10,000 barrels per day or more as of the fourth quarter of 2023) require a $58-per-barrel price to profitably drill, based on the average of company responses. That compared with $67 for small firms (fewer than 10,000 barrels per day).

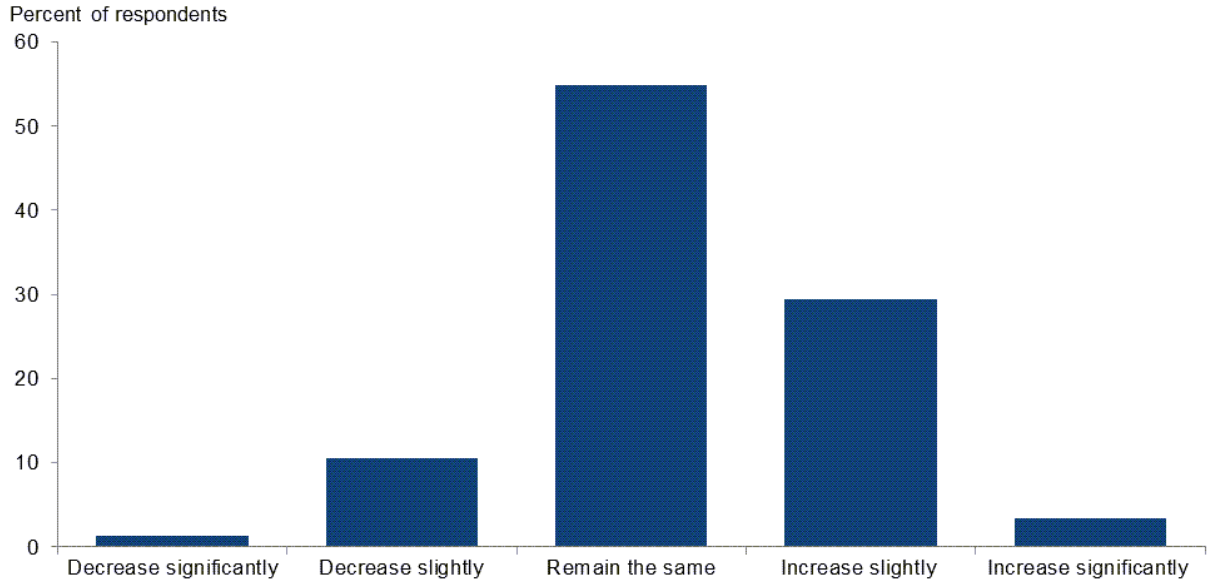


NOTES: Lines show the mean, and bars show the range of responses. Executives from 87 exploration and production firms answered this question during the survey collection period, March 13–21, 2024.
SOURCE: Federal Reserve Bank of Dallas.

All firms

How do you expect the number of employees at your company to change from December 2023 to December 2024?

While the the most-selected response among E&P firms was for employment to "remain the same" in 2024, the most-selected response of support service firms was for employment to "increase slightly." Only a small percentage of executives expect the number of employees at their firms to decrease. (See table for more detail.)



NOTE: Executives from 142 oil and gas firms answered this question during the survey collection period, March 13–21, 2024.
SOURCE: Federal Reserve Bank of Dallas.

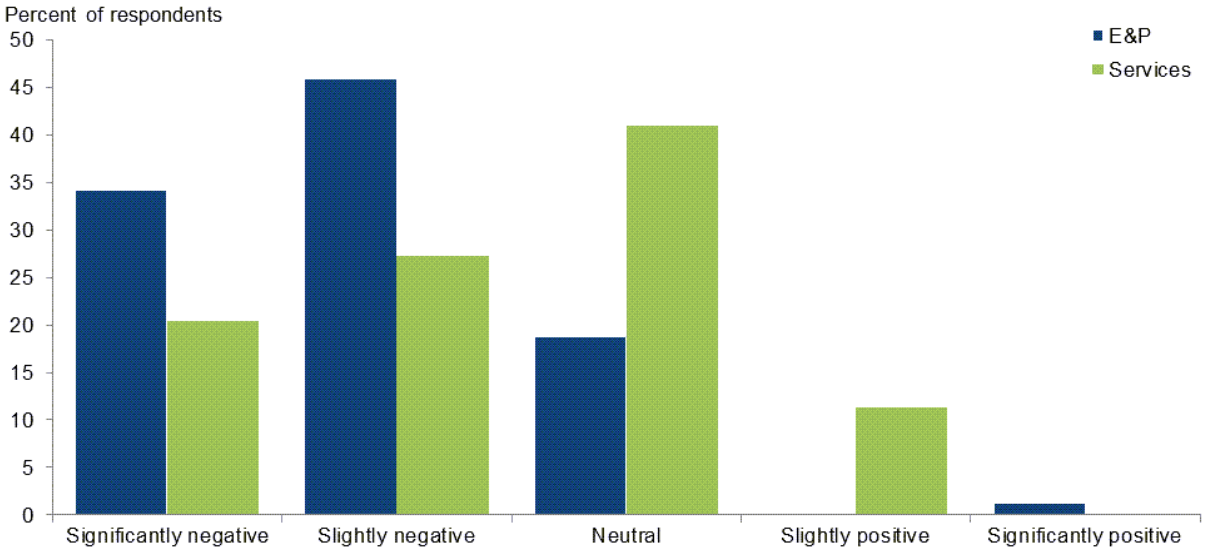
Response	Percent of respondents		
	All firms	E&P	Services
Increase significantly	4	4	2
Increase slightly	30	19	49
Remain the same	55	67	33
Decrease slightly	11	9	14
Decrease significantly	1	1	2

NOTES: Executives from 93 exploration and production firms and 49 oil and gas support services firms answered this question during the survey collection period, March 13–21, 2024. The "All" column reports the percentage of the total 142 responses. Percentages may not sum to 100 due to rounding.
SOURCE: Federal Reserve Bank of Dallas.

The U.S. Environmental Protection Agency released guidance earlier this year regarding the methane charge from the Inflation Reduction Act. What net impact will the methane charge have on your firm?

The most-selected response among E&P firms was "slightly negative," chosen by 46 percent of respondents. Another 34 percent selected "significantly negative," while 19 percent selected "neutral," and 1 percent expect a positive impact. Meanwhile, the most-selected response among support services firms was "neutral," chosen by 41 percent of respondents. The next most-popular response was "slightly negative," selected by 27 percent of support service firms, followed by "significantly negative," 20 percent. A small group, 11 percent, expect a "slight positive" impact.

When considering small and large E&P firms, executives at small E&P firms were more likely to report a significantly negative impact, 38 percent for small versus 20 for large. (See table for more detail.)



NOTE: Executives from 85 exploration and production (E&P) firms and 44 oil and gas support services firms answered this question during the survey collection period, March 13–21, 2024.
SOURCE: Federal Reserve Bank of Dallas.

Response	Percent of respondents				
	All firms	Services	E&P	Large E&P	Small E&P
Significantly negative	29	20	34	20	38
Slightly negative	40	27	46	60	42
Neutral	26	41	19	20	18
Slightly positive	4	11	0	0	0
Significantly positive	1	0	1	0	2

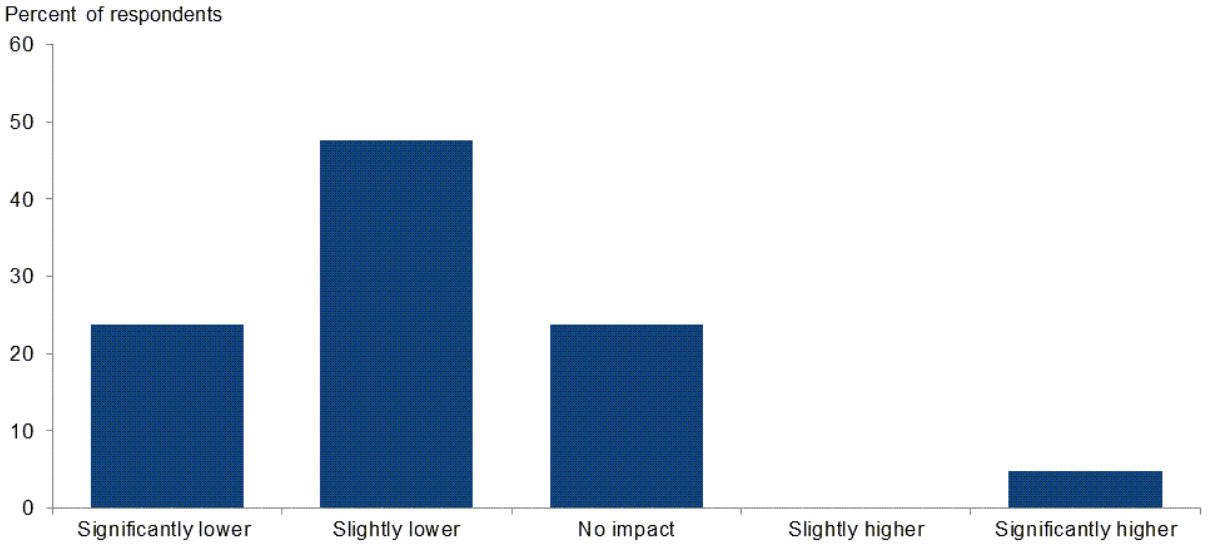
NOTES: Executives from 85 exploration and production firms and 44 oil and gas support services firms answered this question during the survey collection period, March 13–21, 2024. Small E&P firms produced fewer than 10,000 barrels per day (b/d) in the fourth quarter of 2023, while large E&P firms produced 10,000 b/d or more. Responses came from 65 small firms and 20 large firms. Percentages may not sum to 100 due to rounding.
SOURCE: Federal Reserve Bank of Dallas.

Exploration and production (E&P) firms

How does the recent pause in approval of LNG export facilities impact your expectations for your firm's natural gas production five years from now compared with before the pause?

Among executives who indicated their firms are primarily focused on the production of natural gas, slightly under half—48 percent—expect their firms' natural gas production five years from now to be slightly lower than their expectations before the pause. Twenty-four percent said significantly lower, while an additional 24 percent expect no impact. Only 5 percent of executives indicated an increase in expectations due to the recent pause.

Executives from firms not primarily focused on the production of natural gas also expect some impacts from the LNG pause. (See table for more detail.)



NOTE: Results shown are for executives which noted that their firms are primarily focused on the production of natural gas. Executives from 21 exploration and production firms answered this question during the survey collection period, March 13–21, 2024.
SOURCE: Federal Reserve Bank of Dallas.

Response	Percent of respondents	
	Primarily focused on natural gas	Not focused on natural gas
Significantly lower	24	22
Slightly lower	48	19
No impact	24	58
Slightly higher	0	0
Significantly higher	5	1

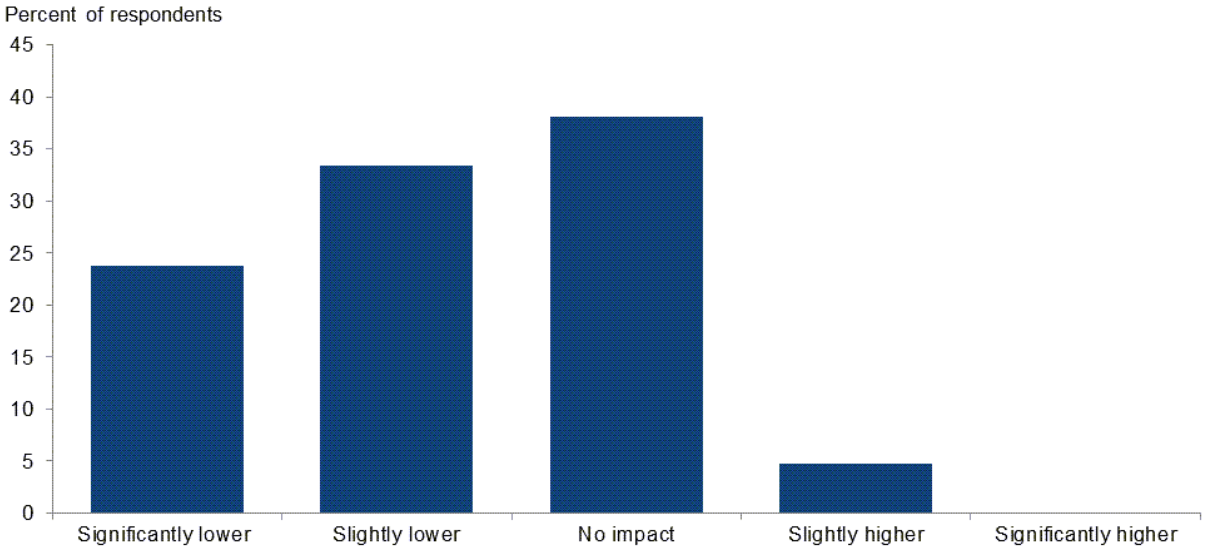
NOTES: Executives from 90 exploration and production firms answered this question during the survey collection period, March 13–21, 2024. Executives were asked whether their firms are primarily focused on the production of natural gas. Responses for 21 executives which noted "yes" can be found in the "primarily focused on natural gas" column, and responses for 69 executives which noted "no" can be found in the "not focused on natural gas" column.
SOURCE: Federal Reserve Bank of Dallas.

Oil and gas support services firms

How does the recent pause in approval of LNG export facilities impact your expectations for your firm's demand for your services five years from now compared with before the pause?

Among executives who indicated their firms have a sizeable number of customers primarily focused on natural gas production, a majority—57 percent—expect demand for their firms' services five years from now to be lower than before the pause, with 33 percent indicating demand will be "slightly lower" and 24 percent selecting "significantly lower." Thirty-eight percent stated no impact, and 5 percent of executives expect customer demand for their firms' services to be slightly higher than before the pause.

Executives from firms without a sizeable number of customers primarily focused on natural gas production also expect some impacts from the LNG pause. (See table for more detail.)



NOTES: Results shown are for executives who noted their firms have a sizeable number of customers primarily focused on the production of natural gas. Executives from 21 oil and gas support services firms answered this question during the survey collection period, March 13–21, 2024.
SOURCE: Federal Reserve Bank of Dallas.

Response	Percent of respondents	
	Firms with customers focused on natural gas	Firms without customers focused on natural gas
Significantly lower	24	8
Slightly lower	33	46
No impact	38	46
Slightly higher	5	0
Significantly higher	0	0

NOTES: Executives from 45 oil and gas support services firms answered this question during the survey collection period, March 13–21, 2024. Executives were asked whether their firms have a sizeable number of customers primarily focused on the production of natural gas. Responses for 21 executives which noted "yes" can be found in the "firms with customers focused on natural gas" column, and responses for 24 executives which noted "no" can be found in the "firms without customers focused on natural gas."
SOURCE: Federal Reserve Bank of Dallas.

Special Questions Comments

Exploration and Production (E&P) Firms

- Our no-impact answer to the LNG pause question assumes that the pause is lifted within the next year. With a longer pause or a future ban, we would expect a negative impact to U.S. natural gas pricing.
- The LNG export pause effect is difficult to forecast several years into the future as both demand, supply and commodity pricing can all change.
- The administration needs to reverse course and show support for American energy while working on common sense solutions that continue the efforts to make production and use of these vital resources as clean as practically possible. Our modern society simply cannot function without the use of fossil fuels. The decision to invest the immense amount of capital needed to provide these vital resources cannot be made if the current level of uncertainty isn't changed.
- The LNG export pause is just that, a pause. It is virtue signaling that will have no benefit other than short-term price depreciation and consolidation of impacted firms by majors that operate largely outside the U.S. without the watchful eyes of environmentalists to provide oversight.
- Regarding the methane charge, the impact is overall not too impactful but will likely require marginal wells to be plugged, given the cost to bring them into compliance.
- Continued ignorance and pandering by the administration. Using an influencer to highlight a positive climate impact from stopping LNG exports (sorry, pausing) will call the stability of our supply into question while causing the displacement of cleaner natural gas with less clean coal.
- This administration has limited knowledge of what is required to enable economically successful production of domestic hydrocarbons.
- The administration’s energy policies make no sense.
- LNG, Bureau of Land Management leasing delays, additional permitting costs, time required and many other policies from Washington and certain governors are hampering growth and collectively are comprehensively debasing the industry.
- With the current permits already approved, I expect a very minor impact over the next five years, and if the political environment changes, I expect no impact.
- Natural gas prices need to be in the $4 per MMBtu range to attract our exploration attention. Current wellhead prices barely cover overhead and have deceased free cash flow.

Oil and Gas Support Services Firms

- Our biggest concern is the evolving merger and acquisition activity for U.S. E&P operators. As the operator pool shrinks, the oilfield services will inevitably follow suit. This leads to concerns on additional oilfield services mergers or worse, aggressive pricing from competitors striving to stay alive.

- The signal sent to our international LNG customers was not good. Other suppliers will fill the void, which will permanently increase the U.S. trade deficit and ultimately harm our economy.
- Natural gas is not a large part of our operation; therefore, the impact is not significant for us, but it will be for operators deeply involved in natural gas production.
- The LNG pause decreases the likelihood of breaking into the East Texas market as the depressed natural gas prices there limit the work for service companies.
- The pause in permits for LNG export facilities will not impact near-term exportation efforts already underway but could impact the incremental capacity envisioned in 2027 and beyond. At a minimum, the ploy introduces more uncertainty for exporters. Additionally, we are not the only country adding capacity, and delays in building out additional U.S. export capacity may allow competitor countries to seize market share from U.S. exporters in the future.
- A healthy natural gas price is essential to the energy industry.

Business Indicators: Quarter/Quarter

Business Indicators: All Firms
Current Quarter (versus previous quarter)

Indicator	Current Index	Previous Index	% Reporting Increase	% Reporting No Change	% Reporting Decrease
Level of Business Activity	2.0	3.6	26.0	50.0	24.0
Capital Expenditures	5.6	3.6	32.6	40.4	27.0
Supplier Delivery Time	-5.0	-2.2	7.8	79.4	12.8
Employment	3.4	4.2	17.9	67.6	14.5
Employee Hours	6.9	2.8	20.7	65.5	13.8
Wages and Benefits	32.8	21.2	34.2	64.4	1.4

Indicator	Current Index	Previous Index	% Reporting Improved	% Reporting No Change	% Reporting Worsened
Company Outlook	12.0	-12.4	26.9	58.2	14.9

Indicator	Current Index	Previous Index	% Reporting Increase	% Reporting No Change	% Reporting Decrease
Uncertainty	24.1	46.1	39.3	45.5	15.2

Business Indicators: E&P Firms
Current Quarter (versus previous quarter)

Indicator	Current Index	Previous Index	% Reporting Increase	% Reporting No Change	% Reporting Decrease
Level of Business Activity	4.2	7.5	25.0	54.2	20.8
Oil Production	-4.1	5.3	18.8	58.3	22.9
Natural Gas Wellhead Production	-17.0	17.9	12.8	57.4	29.8
Capital Expenditures	0.0	0.0	29.3	41.3	29.3
Expected Level of Capital Expenditures Next Year	36.5	1.0	46.9	42.7	10.4
Supplier Delivery Time	-7.5	-5.3	4.3	83.9	11.8
Employment	6.2	1.1	15.6	75.0	9.4
Employee Hours	10.4	0.0	16.7	77.1	6.3
Wages and Benefits	34.4	14.8	34.4	65.6	0.0
Finding and Development Costs	24.2	24.4	32.6	58.9	8.4
Lease Operating Expenses	33.7	22.6	42.1	49.5	8.4

Indicator	Current Index	Previous Index	% Reporting Improved	% Reporting No Change	% Reporting Worsened
Company Outlook	15.6	-9.0	28.9	57.8	13.3

Indicator	Current Index	Previous Index	% Reporting Increase	% Reporting No Change	% Reporting Decrease
Uncertainty	21.1	44.0	37.9	45.3	16.8

Business Indicators: O&G Support Services Firms
Current Quarter (versus previous quarter)

Indicator	Current Index	Previous Index	% Reporting Increase	% Reporting No Change	% Reporting Decrease
Level of Business Activity	-2.0	-4.2	28.0	42.0	30.0
Utilization of Equipment	-4.2	-8.4	27.1	41.7	31.3
Capital Expenditures	16.4	10.7	38.8	38.8	22.4
Supplier Delivery Time	0.0	4.1	14.6	70.8	14.6
Lag Time in Delivery of Firm's Services	4.0	0.0	12.2	79.6	8.2
Employment	-2.1	10.5	22.4	53.1	24.5
Employment Hours	0.0	8.3	28.6	42.9	28.6
Wages and Benefits	30.0	34.0	34.0	62.0	4.0
Input Costs	31.2	21.3	35.4	60.4	4.2
Prices Received for Services	-6.2	-6.2	12.2	69.4	18.4
Operating Margin	-35.4	-32.0	10.4	43.8	45.8

Indicator	Current Index	Previous Index	% Reporting Improved	% Reporting No Change	% Reporting Worsened
Company Outlook	4.5	-18.8	22.7	59.1	18.2

Indicator	Current Index	Previous Index	% Reporting Increase	% Reporting No Change	% Reporting Decrease
Uncertainty	30.0	50.0	42.0	46.0	12.0

Business Indicators: Year/Year

Business Indicators: All Firms
Current Quarter (versus same quarter a year ago)

Indicator	Current Index	Previous Index	% Reporting Increase	% Reporting No Change	% Reporting Decrease
Level of Business Activity	1.5	0.7	32.8	35.8	31.3
Capital Expenditures	7.7	8.1	40.3	27.1	32.6
Supplier Delivery Time	-12.8	-11.7	11.4	64.4	24.2
Employment	11.1	7.2	28.1	54.8	17.0
Employee Hours	6.0	0.0	21.8	62.4	15.8
Wages and Benefits	52.2	51.1	55.1	41.9	2.9

Indicator	Current Index	Previous Index	% Reporting Improved	% Reporting No Change	% Reporting Worsened
Company Outlook	10.0	-7.7	36.7	36.7	26.7

Business Indicators: E&P Firms
Current Quarter (versus same quarter a year ago)

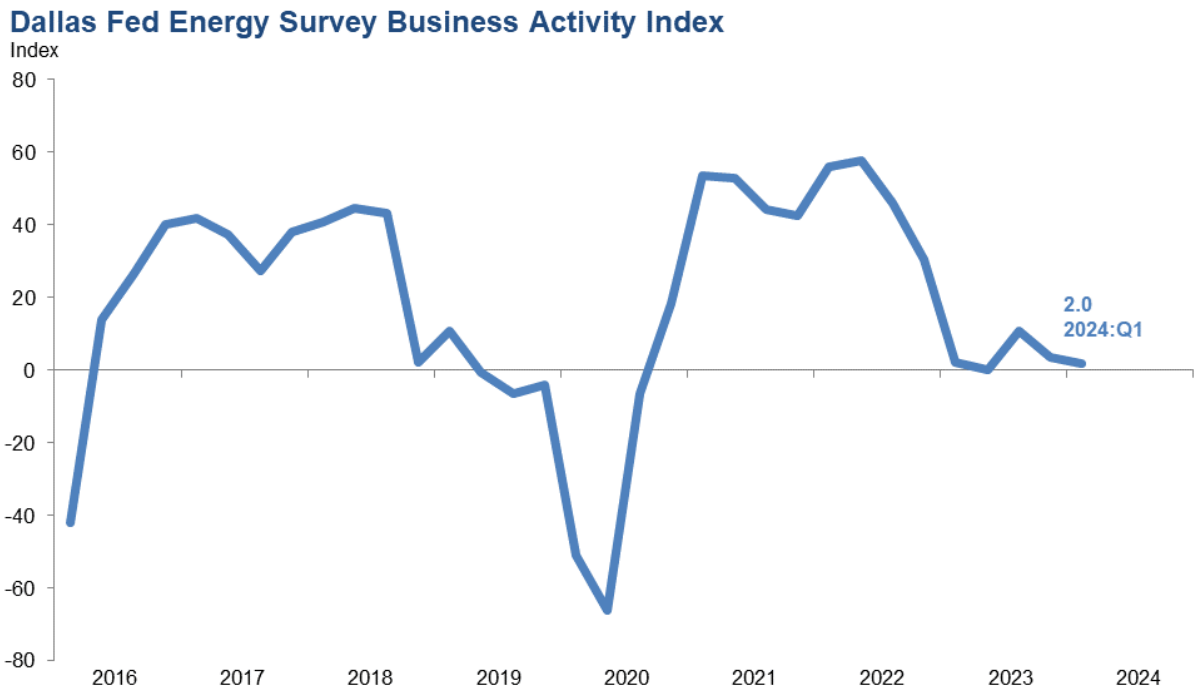
Indicator	Current Index	Previous Index	% Reporting Increase	% Reporting No Change	% Reporting Decrease
Level of Business Activity	7.8	4.4	30.3	47.2	22.5
Oil Production	-1.1	3.3	24.7	49.4	25.8
Natural Gas Wellhead Production	-18.4	9.0	20.7	40.2	39.1
Capital Expenditures	2.3	6.7	36.0	30.2	33.7
Expected Level of Capital Expenditures Next Year	26.1	16.6	46.6	33.0	20.5
Supplier Delivery Time	-18.4	-15.7	5.7	70.1	24.1
Employment	13.5	4.4	23.6	66.3	10.1
Employee Hours	10.2	2.3	17.0	76.1	6.8
Wages and Benefits	52.2	41.7	52.2	47.8	0.0
Finding and Development Costs	28.0	25.3	40.4	47.2	12.4
Lease Operating Expenses	38.6	37.1	50.0	38.6	11.4

Indicator	Current Index	Previous Index	% Reporting Improved	% Reporting No Change	% Reporting Worsened
Company Outlook	14.4	-7.1	35.5	43.4	21.1

Business Indicators: O&G Support Services Firms
Current Quarter (versus same quarter a year ago)

Indicator	Current Index	Previous Index	% Reporting Increase	% Reporting No Change	% Reporting Decrease
Level of Business Activity	-11.1	-6.3	37.8	13.3	48.9
Utilization of Equipment	-11.1	-17.1	37.8	13.3	48.9
Capital Expenditures	18.6	10.9	48.8	20.9	30.2
Supplier Delivery Time	-2.2	-4.3	22.2	53.3	24.4
Lag Time in Delivery of Firm's Services	6.7	0.0	17.8	71.1	11.1
Employment	6.6	12.8	37.0	32.6	30.4
Employment Hours	-2.2	-4.4	31.1	35.6	33.3
Wages and Benefits	52.2	69.5	60.9	30.4	8.7
Input Costs	71.2	65.2	75.6	20.0	4.4
Prices Received for Services	13.3	10.8	42.2	28.9	28.9
Operating Margin	-35.6	-22.2	22.2	20.0	57.8

Indicator	Current Index	Previous Index	% Reporting Improved	% Reporting No Change	% Reporting Worsened
Company Outlook	2.2	-8.7	38.6	25.0	36.4



SOURCE: Federal Reserve Bank of Dallas.

Comments from Survey Respondents

These comments are from respondents' completed surveys and have been edited for publication. Comments from the Special Questions survey can be found below the special questions.

Exploration and Production (E&P) Firms

- Until the next administration is decided, we're in a state of flux when it comes to making certain business decisions.
- Growth in renewable electricity in the West Texas ERCOT region has led to less efficacy in the system due to intermittency. In turn, this had led to a higher heat load base, and as a result, power prices are increasing modestly even as natural gas fuel input pricing is historically low.
- Investor apathy will continue for the energy sector until it's too late. The impending shale supply fiasco (drainage!) will be front-page news within the next two years, and inflation will be very hot again. Shale will likely be unable to help for round two, when oil prices are greater than $120 per barrel. Why do you think there's been $250 billion of merger and acquisition activity in 12 months? Because the majors believe long term is $60 per barrel of oil? OPEC is back in the driver's seat.
- Natural gas prices remain challenged, primarily due to the overhang of storage and lack of winter demand. Crude oil markets have continued to be constructive. We have decreased capital investments in our natural gas portfolio and increased capital investments in our oil portfolio.
- The volatility in geopolitical risk is more concerning than a year ago. Domestic political uncertainty has increased — no confidence in either party to lead.
- I can't recall a more uncertain time with disturbing world conflicts and the choice we have to make in the U.S. presidential election.
- The strength of the market has increased, but the methane detection enforcement procedures for small producers is a looming crisis.
- Continued governmental and regulatory stipulations have an increased bearing on project selection.

- Washington continues to pick business winners and losers, and this practice hampers cooperation and fairness across all sectors. The open denigration and policy blocking of hydrocarbons, a vital part of energy, needs to stop. Soundbites to undermine an entire industry that is critical to our country's standing in the world do no one any good.
- Natural gas is currently pricing at or below costs of production.
- Permits to drill and operate on private land are too difficult to obtain from regulatory authorities in certain states such as Florida, California and Colorado. With respect to Federal leases, which are administered by the Bureau of Land Management, there is too much uncertainty surrounding future changes in regulations and permitting requirements. Such factors limit the ability of small petroleum companies to expand and grow.
- The Great Turnover (wave of retirements backfilled by greenhorns) is continuing to result in elementary mistakes in land work, division orders, and, thus, revenue distributions from oil and gas purchasers. I am seeing increased joint interest billings errors. Collectively, this is causing a diversion of staff time. The greenhorns in the positions making these mistakes are defensive and insisting they are right even when confronted with the facts. Washington’s war against domestic oil and gas is winning. Accounting firms don’t want oil and gas firms as clients, preferring only clients in a so-called reputable industry. Bankers are stiff-arming discussions.
- Natural gas is the primary commodity for our industry in East Texas. This makes our activity depend on pricing for natural gas. The low prices we are experiencing now are causing us to tuck it in and keep our powder dry. The administration's efforts to curb the liquified natural gas (LNG) build-out has hurt our industry. America has lost jobs due to this. This climate change agenda is destroying GDP as well.

Oil and Gas Support Services Firms

- Customer consolidation is an issue affecting our business.
- Access to capital continues to challenge the industry.
- There are many factors negatively impacting the U.S. oilfield services sector. One major issue is that there are too many small, undercapitalized companies. This is leading to an overly competitive and undisciplined market. This creates a short-lived benefit for oil and gas companies, which will quickly begin to see a deterioration in oilfield service quality, safety and stability. The oilfield services industry needs to follow the same consolidation and efficiency path as the oil and gas drillers. Otherwise, we will continue to see a weak oilfield services industry that is not able to match the scale and professionalism of their oil and gas customers.
- The administration’s pause in approving or reviewing LNG export facilities sent a chill through our industry.
- The first quarter of 2024 was surprisingly quiet, especially compared with the first quarter of 2023. We attributed the quiet first quarter 2024 to operators waiting to understand the landscape as heavy merger and acquisition activity continued. It feels like second quarter 2024 is seeing glimmers of increased activity and third quarter 2024 has the potential to be stronger. We are optimistic for the third quarter of 2024.
- Uncertainty of the election outcomes and related policy changes have most oil and gas operators just making minimal investments to maintain production levels. The recent suspension of LNG export permits is also negatively impacting an already oversupplied gas market resulting from associated gas production. We are once again entering an unnecessary period of uncertainty due to inept energy policies.
- Costs of labor and goods are certainly challenging our bottom line and making margins thinner than before. Company men are holding the line on rate increases even though they are enjoying record profits from higher commodity prices. We have to find a way to educate them on what’s affecting our company and get them to buy in to the need for higher rates to keep good companies like ours performing for them.
- Lower natural gas prices combined with E&P consolidation, and their unrelenting focus on capital and operational efficiencies, are causing U.S. lower 48 rig count to remain flatish. The outlook for the first half of 2024 is for U.S. lower 48 rig count to move sideways and for an increased rig count in the second half of 2024 driven primarily by private E&P incremental rig adds in oily

basins. Until gas-directed activity rebounds, however, U.S. lower 48 rig count will remain more muted. There are reasons for optimism later this year and especially for 2025.

2024 STATE OF ENERGY REPORT

TEXAS INDEPENDENT PRODUCERS AND ROYALTY OWNERS ASSOCIATION

TIPRO

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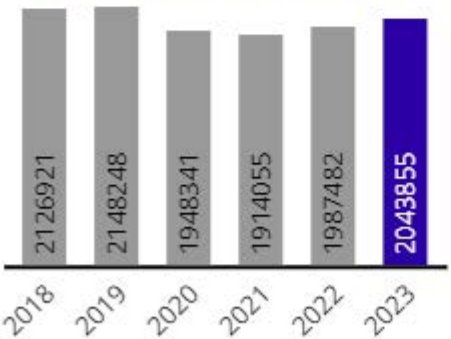
2023 U.S. INDUSTRY FAST FACTS

- 221,456 people worked in oil and gas support services earning an average annual wage of $107,833
- 115,039 people worked in oil and natural gas extraction earning an average annual wage of $205,386
- Direct and indirect jobs totaled 24,146,285
- U.S. crude oil production averaged a record 12.9 million b/d in 2023
- U.S. natural gas production averaged a record 104 Bcf/d in 2023
- Oil and gas purchased U.S. goods and services in the amount of $882 billion

The U.S. oil and gas industry directly employed 2,043,855 workers in 2023

OIL & GAS EMPLOYMENT



TOTAL ECONOMIC BENEFITS

2,043,855
Total oil and gas jobs

385,662
Total upstream jobs

163,588
Total number of businesses

$79,417
Average annual wage

$162 Billion
Total oil and gas payroll

$1 Trillion
Direct oil and gas Gross Regional Product

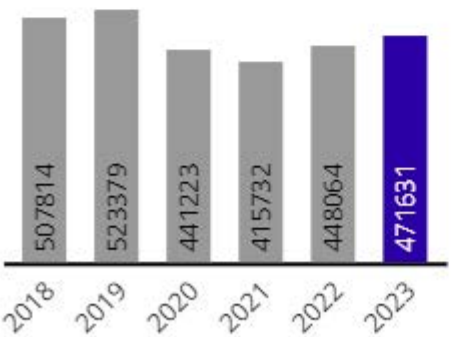
Source: See Report Methodology

2023 TEXAS INDUSTRY FAST FACTS

- 23 percent of all U.S. oil and gas jobs were located in Texas
- Total direct and indirect oil and gas jobs totaled 2,869,411
- 74 percent higher average wages in the oil and gas industry compared to all average private sector wages in Texas
- A record 1.99 billion barrels of oil produced
- A record 12.24 Tcf of natural gas produced
- 1st ranked state by oil and gas employment, businesses and payroll
- Purchased $288 billion in U.S. goods and services, 83 percent from Texas businesses

Texas is the nation's leading oil and gas employer and producer

OIL & GAS EMPLOYMENT



STATE ECONOMIC BENEFITS

471,631
Total oil and gas jobs

199,397
Total upstream jobs

23,315
Total number of businesses

$124,453
Average annual wage

$59 Billion
Total oil and gas payroll

$364 Billion
Direct oil and gas Gross Regional Product

Source: See Report Methodology

Country Analysis Brief: Sudan and South Sudan

Last Updated: March 20, 2024
Next Update: March 2026

Independent Statistics and Analysis
U.S. Energy Information Administration

www.eia.gov
U.S. Department of Energy
Washington, DC 20585

The U.S. Energy Information Administration (EIA), the statistical and analytical agency within the U.S. Department of Energy (DOE), prepared this report. By law, our data, analyses, and forecasts are independent of approval by any other officer or employee of the U.S. Government. The views in this report do not represent those of DOE or any other federal agencies.

Overview

Table 1. Sudan's energy overview, 2021

	Crude oil and other petroleum liquids	Natural gas	Coal	Nuclear	Hydro	Renewables and other	Total
Primary energy consumption (quad)	0.27	0.00	0.00	0.00		0.09	0.36
Primary energy consumption (%)	75%	0%	0%	0%		25%	100%
Primary energy production (quad)	0.12	0.00	0.00	0.00		0.09	0.21
Primary energy production (%)	58%	0%	0%	0%		42%	0%
Electricity generation (TWh)	6.46		0.00	0.00	10.00	0.14	16.60
Electricity generation (%)	39%		0%	0%	60%	1%	100%

Data source: U.S. Energy Information Administration, International Energy Statistics database
Note: EIA aggregates hydroelectricity and renewables as *renewables and other* for primary energy production and consumption, and it aggregates crude oil and other petroleum liquids and natural gas as *fossil fuels* for electricity generation. Quad=quadrillion British thermal units, TWh=terawatthours

Table 2. South Sudan's energy overview, 2021

	Crude oil and other petroleum liquids	Natural gas	Coal	Nuclear	Hydro	Renewables and other	Total
Primary energy consumption (quad)	0.03	0.00	0.00	0.00		0.00	0.03
Primary energy consumption (%)	100%	0%	0%	0%		0%	100%
Primary energy production (quad)	0.29	0.00	0.00	0.00		0.00	0.29
Primary energy production (%)	100%	0%	0%	0%		0%	100%
Electricity generation (TWh)	0.56		0.00	0.00	0.00	0.01	0.57
Electricity generation (%)	98%		0%	0%	0%	2%	100%

Data source: U.S. Energy Information Administration, International Energy Statistics database
Note: EIA aggregates hydroelectricity and renewables as *renewables and other* for primary energy production and consumption, and it aggregates crude oil and other petroleum liquids and natural gas as *fossil fuels* for electricity generation. Quad=quadrillion British thermal units, TWh=terawatthours

- Sudan has had two civil wars since it gained independence in 1956. The second civil war ended in 2005 and led to the Comprehensive Peace Agreement (CPA) between the Sudanese government and the rebel factions in the southern region. The CPA established guidelines for oil revenue sharing and a timeframe to hold a referendum for independence of the South. The southern region overwhelmingly voted for secession, and in July 2011, South Sudan became an independent nation, separate from Sudan. The secession of South Sudan significantly affected Sudan's economy because Sudan lost 75% of its oil reserves to South Sudan. Sudan and South Sudan's oil sectors play a vital role in both economies and are closely linked to each other; most of the oil-producing assets are near or extend across their shared border. Since the split, oil production growth in Sudan and South Sudan has stagnated because of insufficient upstream investment and continued domestic political instability in both countries.[1]

- Disruptions in oil production, disputes over oil revenue sharing, and lower oil prices have negatively affected both economies. Armed conflict in both countries has persisted in the post-referendum period because unresolved issues on domestic and interstate relations still linger. Both countries still contest some areas around the demarcated border established by the CPA. Disputes over the Abyei area and the Heglig oil field between the South Kordofan State in Sudan and the Unity State in South Sudan have been particularly contentious because these areas have strategic importance for the oil sector and have agricultural resources that both countries heavily use, adding another layer of complexity to the disputes.[2]
- In April 2023, armed conflict broke out in Khartoum, the Sudanese capital city, between the Sudanese Armed Forces (SAF), under the leadership of General Abdel Fattah al-Burhan (who is also the current leader of the military-led government), and the paramilitary Rapid Support Forces (RSF), under the leadership of Mohamed Hamdan Dagalo (also known as Hemedti). Both al-Burhan and Hemedti rose to power after the April 2019 military coup that removed the former Sudanese head of state Omar al-Bashir from power, but relations between the two deteriorated after al-Burhan dissolved the civilian transitional governing body in October 2021, extending his rule under a military-led government. As of January 2024, fighting between the two factions is still ongoing and has spread to other parts of the country, increasing the risk of shut-ins or damage to oil infrastructure that could reduce both Sudan's and South Sudan's crude oil production.[3]

Figure 1. Map of Sudan

Data source: U.S. Central Intelligence Agency, *CIA World Factbook*–Sudan

Figure 2. Map of South Sudan

Data source: U.S. Central Intelligence Agency, *CIA World Factbook*–South Sudan

Petroleum and Other Liquids

- Sudan and South Sudan collectively held an estimated 5 billion barrels of proved crude oil reserves at the beginning of 2024, which was unchanged from the previous year.[4]
- Most of the crude oil in Sudan and South Sudan is produced in the Muglad Basin and Melut Basin. Sudan and South Sudan produce three different crude oil blends: Dar, Nile, and Fula. The Dar and Nile blends are the two main crude oil grades used for export and domestic consumption. The Dar blend is a heavy crude oil with a low sulfur content. It also has a high total acid number (TAN) and has corrosive qualities that can make it difficult for refiners to process. The Dar blend is produced at Blocks 3 and 7 in the Melut Basin, which is controlled by South Sudan. The Nile blend is a medium, waxy crude oil produced in the Muglad Basin at Blocks 1, 2A, 2B, 4, and 5A; its crude oil characteristics make it a relatively more attractive blend to refiners because of its high fuel and gasoil yields. The Fula blend is a highly acidic crude oil produced in the Muglad Basin at Block 6 and is processed for domestic use (Table 3).[5]

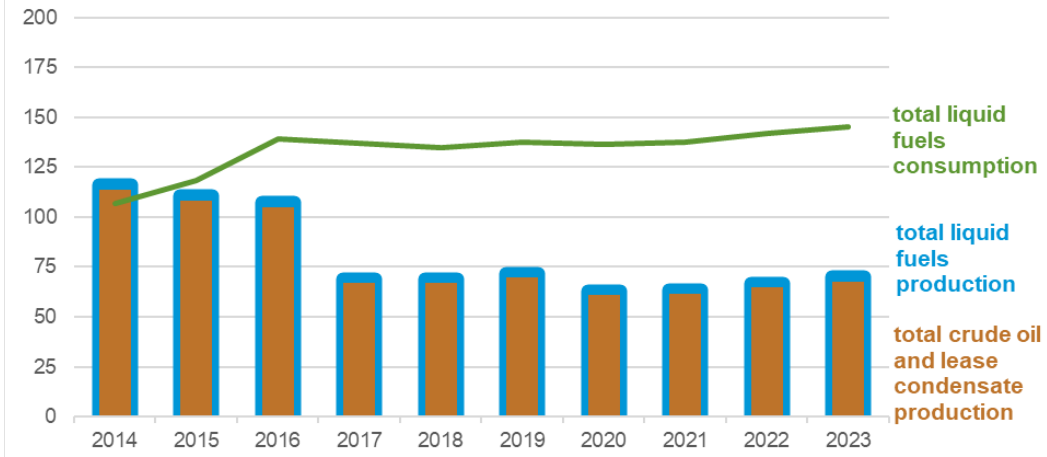
Table 3. Selected crude oil grades produced in Sudan and South Sudan

Crude oil grade	API gravity number (degrees)	Sulfur content (percentage)
Dar	26.4	0.12%
Fula	21.0	0.14%
Nile	32.8	0.05%

Data source: *McKinsey & Company Energy Insights*, Sudan government ministry

- Sudan produced an average of about 70,000 barrels per day (b/d) of total liquid fuels in 2023, and South Sudan produced an average of about 149,000 b/d. Sudan's total liquid fuels production has steadily and significantly declined over the past decade because upstream exploration and development has been lacking in the country. Growth in South Sudan's total liquid fuels production has been relatively flat, averaging about 153,000 b/d over the past decade. Both Sudan and South Sudan are seeking to attract investor interest through ongoing or upcoming upstream licensing rounds, but whether the rounds will attract sufficient upstream investment to boost total liquid fuels production remains unclear (Figures 3 and 4).[6]

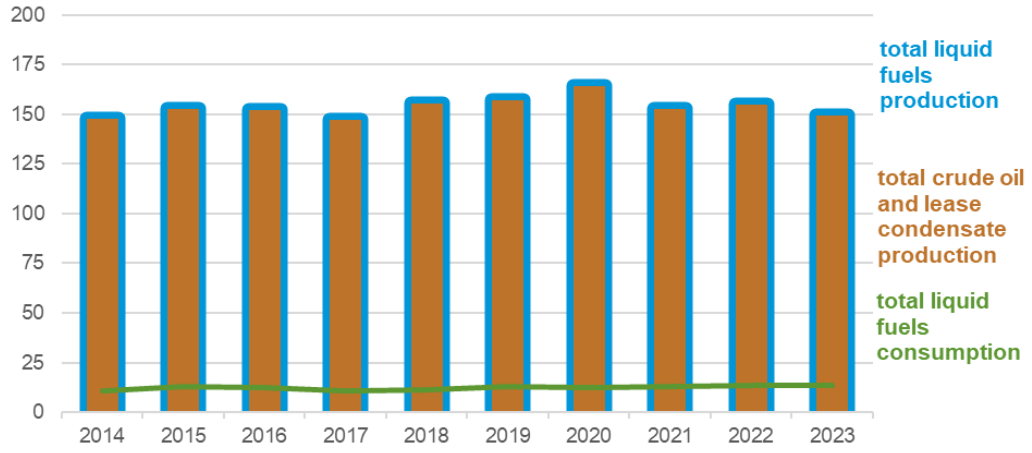
Figure 3. Total annual liquid fuels production and consumption in Sudan, 2014–2023



Data source: U.S. Energy Information Administration, International Energy Statistics database and *Short-term Energy Outlook*

Figure 4. Total annual liquid fuels production and consumption in South Sudan, 2014–2023

thousand barrels per day



Data source: U.S. Energy Information Administration, International Energy Statistics database and *Short-term Energy Outlook*

- In December 2022, Petronas announced that it had entered a share repurchase agreement with Savannah Energy, enabling Petronas to divest its entire South Sudan oil and natural gas asset portfolio to Savannah Energy once the transaction is completed. Petronas will reportedly relinquish its working interests in three joint operating companies (Greater Pioneer Operating Company, Dar Petroleum Operating Company, and Sudd Petroleum Operating Company) for up to $1.25 billion.[7]
- Sudan has three oil refineries and three topping plants (smaller, less complex refineries). However, most of these facilities have either been shut in or decommissioned; only the al-Jaili refinery, which is the country's largest refinery and is approximately 45 miles north of Khartoum, and the El-Obeid topping plant are currently operating. Furthermore, the operational status of the al-Jaili refinery is unclear because violent clashes between the ruling government-aligned SAF and the paramilitary RSF over control of the refinery broke out in 2023, and damage to facilities at the refinery have been reported.[8]
- In South Sudan, the refinery at Bentiu finished construction and began commercial operations in 2021. The refinery at Bentiu can produce diesel, gasoline, and heavy fuel oil from domestic crude oil, enabling the country to meet some of its consumption needs and raising the possibility of exporting petroleum products regionally. South Sudan plans to construct other refineries to increase the country's refining capacity and reduce the need for imported petroleum products, but the timeline for the construction of these refineries is unclear (Table 4).[9]

Table 4. Oil refineries in Sudan and South Sudan

Country	Refinery	Operator	Nameplate capacity (thousand barrels per day)
Sudan	Khartoum (al-Jaili)	CNPC/Sudapet	100
	Port Sudan	Sudapet	22
	El Obeid	Sudapet	10
	Shajirah	Concorp	10
	Abu Gabra	Sudapet	2
South Sudan	Unity State (Bentiu)	Safinat (Russia)/Nilepet	10

Data source: Fitch Solutions Country Risk & Industry Research, African Development Bank

Natural Gas

- Sudan and South Sudan collectively held an estimated 3 trillion cubic feet of proved natural gas reserves at the beginning of 2024, which was unchanged from the previous year.[10]
- Neither Sudan nor South Sudan produces or consumes any natural gas.

Coal

- Neither Sudan nor South Sudan produces or consumes any coal.

Electricity

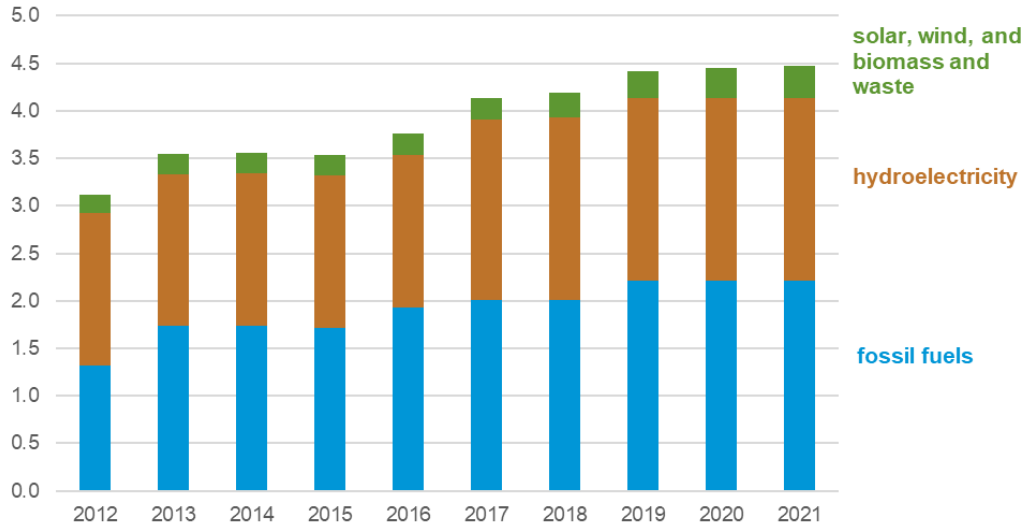
Sudan

- Total installed generation capacity in Sudan was 4.5 gigawatts (GW) in 2021. About half of the capacity was from fossil fuel sources, about 43% from hydroelectricity, and the remainder (57%) from renewable energy sources such as solar and biomass. Total electricity generation in Sudan was 16.6 billion kilowatthours (kWh) in 2020, of which 60% was generated by hydropower (Figures 5 and 6).[11]
- Sudan's transmission and distribution network provides services to the country's major demand centers, such as Khartoum, and is largely concentrated in the more populous eastern part of the country, a relatively small geographic area. Transmission and distribution of electricity is limited, particularly in the rural areas in western Sudan.[12]
- Although power generation has continued to grow in the post-independence era, only about 62% of Sudan's population had access to electricity in 2021, according to the latest estimates from the World Bank. However, urban populations have substantially more access (84%) than rural populations (49%). People who are not connected to a grid use biomass or diesel-fired generators to meet their electricity needs.[13]
- Hydroelectricity in Sudan is generated from a number of large-scale hydropower plants in the south (Roseires and Sennar), the north (Merowe), and the Upper Atbara and Seteit rivers in the

east (Rumela and Burdana). The Rumela and Burdana dams were brought on line in 2018, providing an additional 320 megawatts (MW) of power generation capacity.[14]

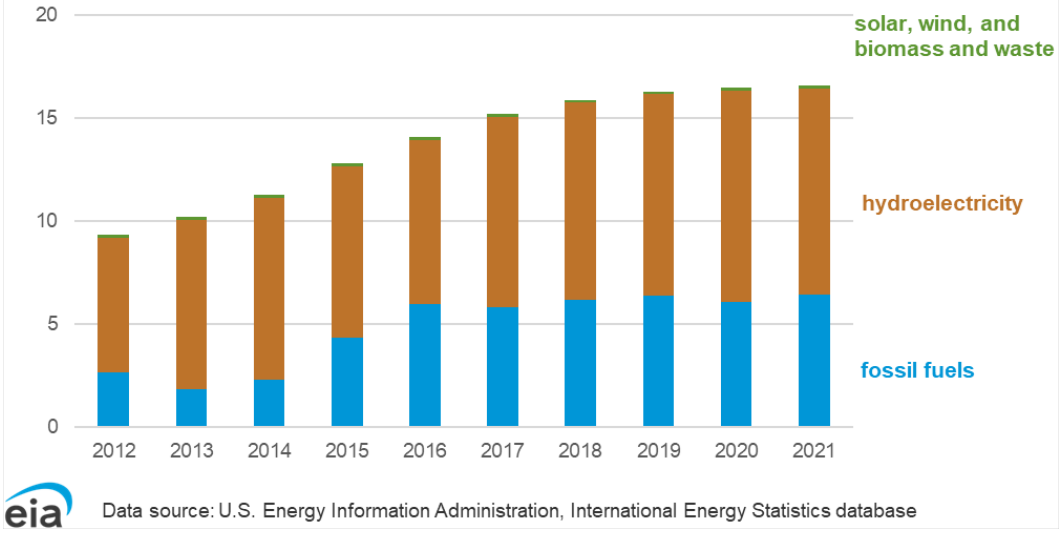
- The government of Sudan has sought to diversify its power portfolio mix and has prioritized thermal power investments in recent years. The government is reportedly planning to build additional thermal power generation units at Garri (El-Jaili) and at Port Sudan that could collectively provide almost 1 GW of generation capacity, but the completion date for construction of the additional power units is unclear.[15]
- Sudan has significant wind and solar energy resources that are largely untapped. According to a World Bank study, Sudan has significant wind power potential along its coast on the Red Sea and in the Northern State. Sudan also has solar power potential, but renewable power tends to be small in scale and used for off-grid solutions.[16]

Figure 5. Sudan's electricity capacity by fuel type, 2012–2021



Data source: U.S. Energy Information Administration, International Energy Statistics database

Figure 6. Sudan's net electricity generation by fuel type, 2012–2021
gigawatthours



South Sudan

- Total installed generation capacity in South Sudan was 0.12 GW in 2021. Nearly all of the capacity was from fossil fuel sources, and a marginal amount was from solar power sources. Total electricity generation in South Sudan was 0.6 billion kWh in 2021, nearly all of which was from fossil fuel sources (Figures 7 and 8).[17]
- South Sudan has one of the lowest electrification rates in the world; only 8% of its population had access to electricity in 2021, according to the latest estimates from the World Bank. Those connected to the power network experience frequent blackouts or forced load shedding, which makes standby generators necessary to meet electricity needs.[18]
- In June 2023, the governments of Uganda and South Sudan signed an agreement to allow South Sudan to import electric power from Uganda, and feasibility studies to construct an interconnector transmission line between the two countries is currently underway. The proposed transmission project would enable Uganda to supply electricity to Kaya and Nimule, two of South Sudan's towns near the Uganda border and would help address the serious lack of access to electricity in the remote and rural areas of South Sudan.[19]

Figure 7. South Sudan's electricity capacity by fuel type, 2012–2021
gigawatts

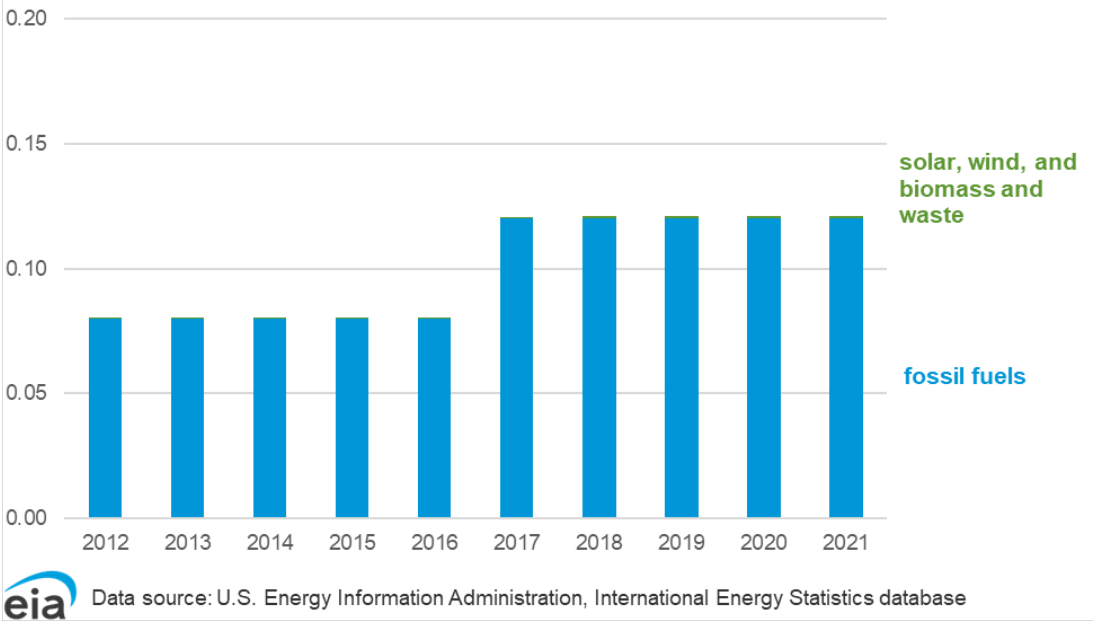
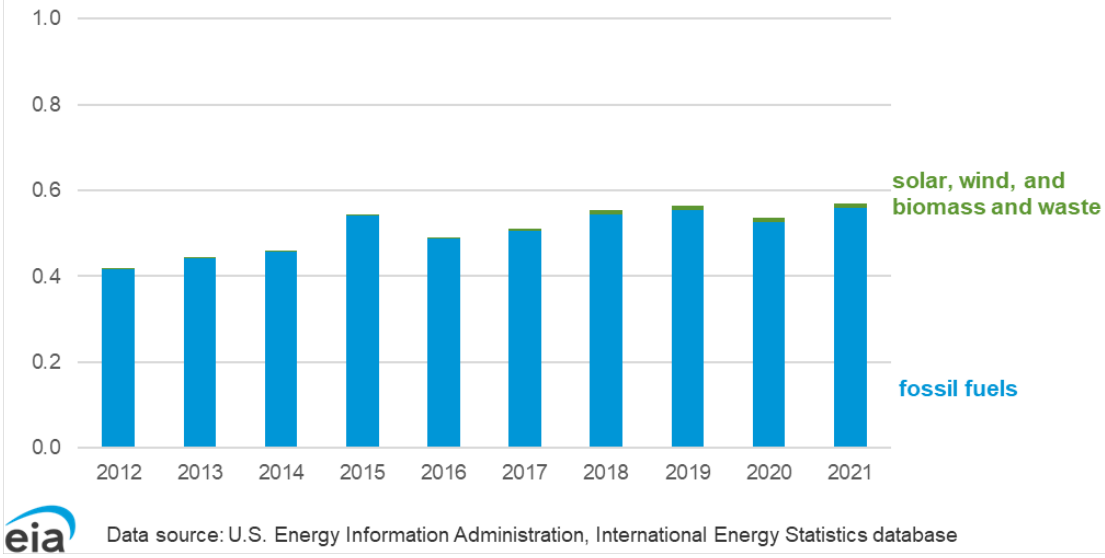


Figure 8. South Sudan's net electricity generation by fuel type, 2012–2021
gigawatthours

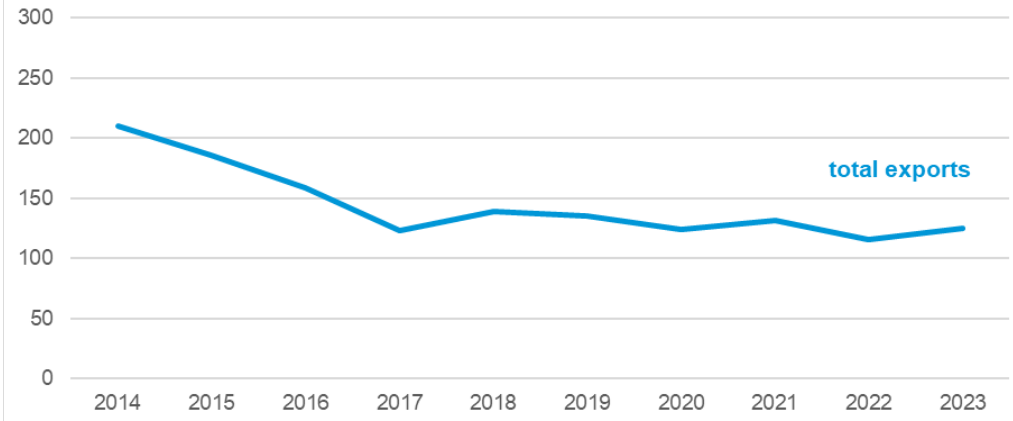


Energy Trade

- Sudan and South Sudan exports are primarily the Nile and Dar blends going to markets in Asia. Crude oil is exported from Port Sudan to Asia via the Bab el-Mandeb Strait. Given the lack of alternative transit routes, Bab el-Mandeb is a strategically important chokepoint where any blockages or closures could lead to significant increases in shipping time and costs.[20]

- Sudan and South Sudan averaged about 145,000 b/d of crude oil exports between 2014 and 2023, according to estimates by Vortexa and EIA. Total crude oil exports from Sudan and South Sudan have declined over the past decade as a result of lower overall production from both countries. Sudan and South Sudan import virtually no crude oil because current production meets domestic demand (Figure 9).[21]

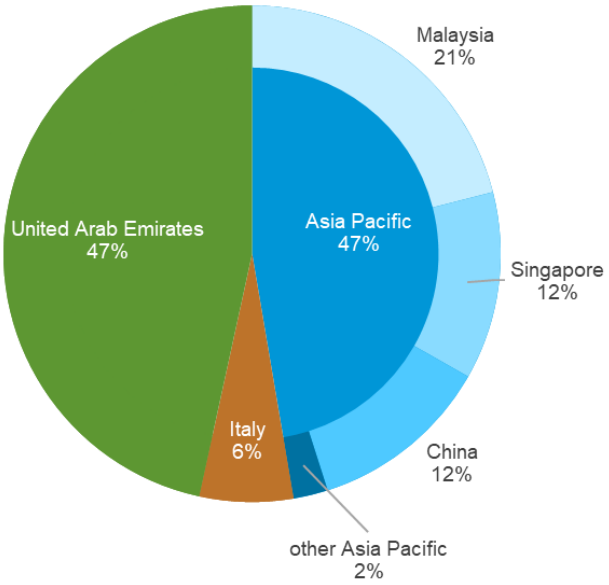
Figure 9. Sudan's and South Sudan's total annual exports of crude oil, 2014–2023



Data source: U.S. Energy Information Administration, International Energy Statistics database and Vortexa
Note: EIA estimates are for 2014–2018; subsequent years are Vortexa estimates.

- According to Vortexa, Sudan and South Sudan exported about 125,000 b/d of crude oil in 2023. The United Arab Emirates was the top destination country by volume, accounting for nearly half of total exports from the two countries. Malaysia was the second-highest destination by volume, importing about 26,000 b/d of Sudan's and South Sudan's crude oil in 2023. China and Singapore both imported about 15,000 b/d each in the same year. However, the volumes that were exported to Singapore likely ended up elsewhere because Singapore is a significant transshipment area for global crude oil trade (Figure 10).[22]

Figure 10. Sudan's and South Sudan's crude oil and condensate exports by destination, 2023



eia Data source: Vortexa

- Neither Sudan nor South Sudan participate in any natural gas or coal trade and so, have no imports or exports.

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Regional Analysis Brief: South China Sea

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Overview

- The South China Sea is a critical world trade route. In 2023, 10 billion barrels of petroleum and petroleum product and 6.7 trillion cubic feet (Tcf) of liquefied natural gas (LNG) passed through the South China Sea.[1] The sea stretches from Singapore and the Strait of Malacca in the southwest to the Strait of Taiwan in the northeast (Map 1). The sea is rich in resources, holds high potential to be a source for hydrocarbons, and has significant strategic and political importance.

Map 1. South China Sea

Source: World Bank and U.S. Energy Information Administration

Note: Representation of international boundaries is not necessarily authoritative.

- The South China Sea includes several hundred geographic features, such as small islands, rocks, and reefs, and the majority are located in the Paracel and Spratly Island chains. These island chains spread over vast areas, and many islands are partially submerged land masses unsuitable for habitation. For example, the Spratly Islands area spreads across 158,000 square miles; however, the total habitable land area encompasses less than 3 square miles.[2]
- Several of the countries bordering the South China Sea declare sovereignty of some portion of the islands as a way to claim the surrounding sea and its resources. This has led to all features in the Spratly and Paracel Island chains being contested. The Gulf of Thailand borders the South China Sea, and although technically not part of the sea, the complex coastal geography of the Gulf of Thailand has created disputes among surrounding countries (Thailand, Malaysia, Cambodia, and Vietnam) over who owns the islands in the Gulf and the Gulf's resources.[3]
- The South China Sea offers the potential for significant natural gas discoveries, creating an incentive to secure larger parts of the area for domestic production.[4] Asia's economic growth increases demand for energy in the region. Total liquid fuels consumption in the Asia-Pacific region rose 1.1% in 2022 and accounted for 36% of total world consumption. We project this growth to increase 1.3% annually and to account for 43% of total world consumption in 2050. Similarly, the Asia-Pacific region's projected natural gas consumption grows by 1.6% annually. Its share of world natural gas consumption increases from 23% in 2022 to 28% in 2050.[5]

Reserves and Resources

- The South China Sea is underexplored because of territorial disputes. Most discovered oil and natural gas fields are in uncontested areas, close to the shorelines. Approximately 3.6 billion barrels (b) of petroleum and other liquids and 40.3 trillion

cubic feet (Tcf) of natural gas in proved and probable reserves are in the South China Sea, according to Rystad.

Table 1. South China Sea reserves by country, 2023

Country	Liquids proved and probable reserves (million barrels)	Natural gas proved and probable reserves (trillion cubic feet)
Indonesia	44	1.1
Philippines	17	0.4
Malaysia	1,284	28.9
Brunei	299	1.9
China	1,423	5.7
Vietnam	530	2.3
Total	**3,596**	**40.3**

Data source: Rystad Energy, *CubeBrowser*

Map 2. South China Sea oil and natural gas basins

Source: U.S. Geological Survey, World Bank, ESRI, and U.S. Energy Information Administration
Note: Representation of international boundaries is not necessarily authoritative.

- In addition to proved and probable reserves, the South China Sea may have additional hydrocarbons in underexplored areas. In 2023, the U.S. Geological Survey (USGS) analyzed the potential for undiscovered conventional oil and natural gas fields within several geologic provinces of Southeast Asia as part of its World Petroleum Resources Assessment Project.
- The USGS project included 13 basins, the South China Sea platform, and the Palawan Shelf within the South China Sea (Map 2). Collectively, the USGS estimates these areas may contain anywhere between 2.4 billion barrels and 9.2 billion barrels of petroleum

and other liquids and between 62 Tcf and 216 Tcf of natural gas in undiscovered resources (including several basins with portions that run outside of the South China Sea, on land, or both). Because the USGS did not examine the entire area, undiscovered resources could be greater. These additional resources are not considered commercial reserves at this time because the economic feasibility to extract them is unclear.[6]

Territorial Claims

Uncontested areas

- Most current reserves exist in shallow water basins on the boundaries of the sea. A significant portion of water basins that hold larger amounts of proven oil reserves are uncontested because they fall within clearly defined waters, such as those found north of Malaysia and Brunei and south of Vietnam.[7]
- Vietnam, Malaysia, and Brunei have a long history of development in the South China Sea. Without significant onshore potential, they have invested in offshore technology, pipeline networks, and drilling.

Contested areas

Paracel Islands

- The Paracel Island territory sits just outside of the Qiongdongnan Basin and does not have any proved or probable reserves. Geologic evidence suggests the area lacks significant potential in terms of conventional hydrocarbons. China, Taiwan, and Vietnam all claim the Paracel Islands.[8]
- China occupies Woody Island, the largest of the Paracel Islands. The island has an estimated population of over a 1,000 people and a military installation. It also has a military airport and port facilities.[9]

Spratly Islands

- The Spratly Island chain is made up of over 100 small islands and reefs.[10] The largest feature is the 90-acre Itu Aba Island.[11] The Spratly Island territory may have significant deposits of undiscovered hydrocarbons. The Spratly Islands are in the South China platform, which the USGS estimates to have between 0.9 billion barrels and 3.0 billion barrels (mean 2.1 billion barrels) of petroleum and other liquids and between 0.0 Tcf

and 16.2 Tcf (mean 8.0 Tcf) of natural gas in undiscovered resources.[12] China, Taiwan, and Vietnam each claim all of the Spratly Islands. Meanwhile, Brunei, Malaysia, and the Philippines only claim some of the islands.[13]

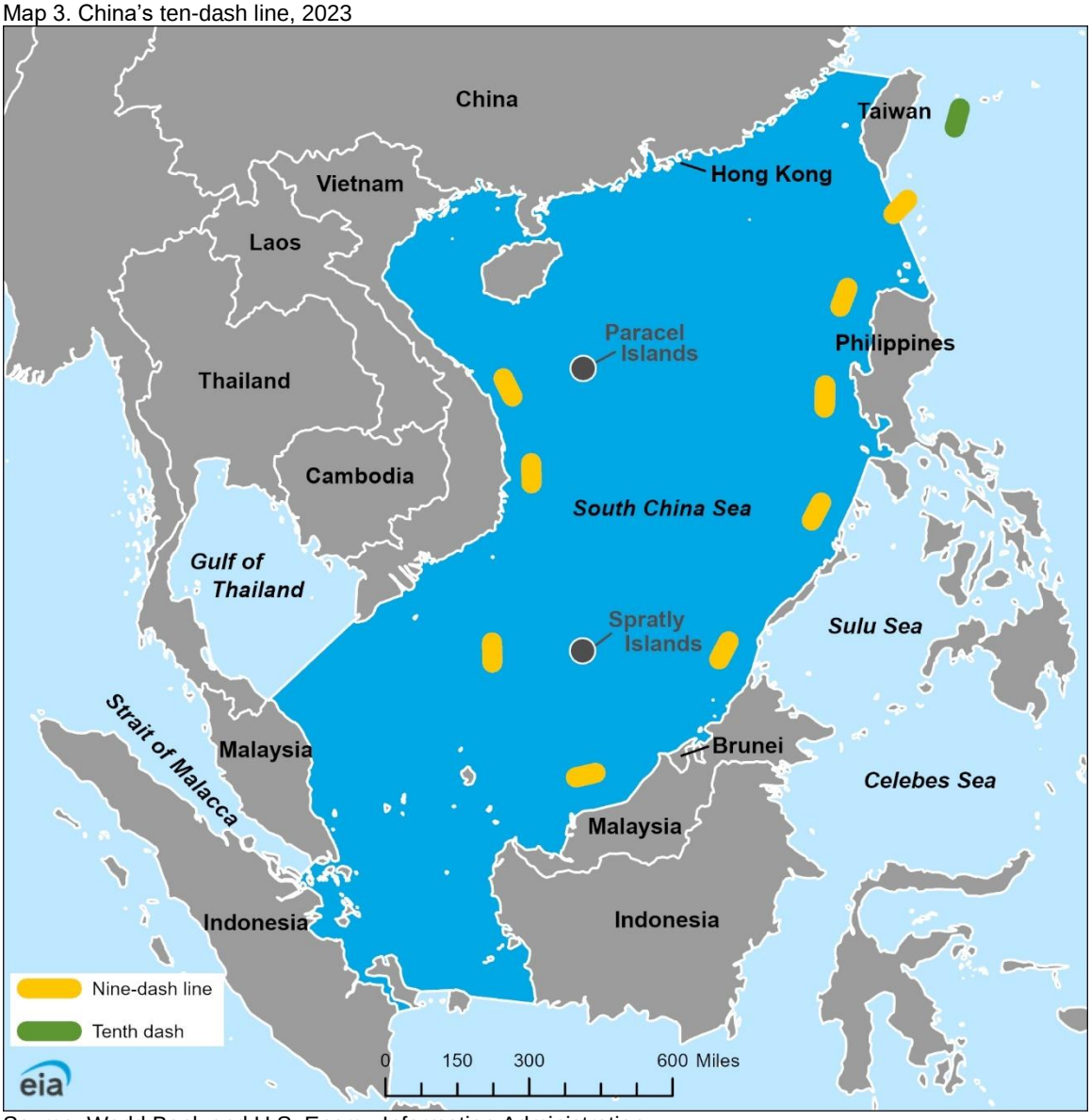
Brunei

- Brunei claims a 200-nautical mile exclusive economic zone (EEZ). The EEZ overlaps with China's 10-dash line (see section on China for more details) and claims the uninhabited Louisa Reef, which is part of the Spratly Islands. Brunei and Malaysia have agreed on the delimitation of maritime boundaries, territorial seas, the continental shelf, and EEZs, and have come to a commercial arrangement agreement for oil and natural gas.[14]

China

- China claims the largest area of the South China Sea. In 1947, China issued an official map with an 11-dash line that outlined the extent of its territories but reduced it to the 9-dash line in 1952. However, China has neither given specifics on all that the 9-dash line claims nor included coordinates. The 9-dash line is generally interpreted as the simplified border for China's territory. However, China uses the 9-dash line to identify: islands and features in the South China Sea it claims sovereignty over, maritime zones the United Nations Convention on the Law of Sea governs, and waters over which China claims it has some rights.[15]
- In August 2023, China's Ministry of Natural Resources released its new map, which added a dash to the 9-dash line off the eastern coast of Taiwan to form a 10-dash line (Map 3). The new line claims almost the entirety of the South China Sea. Similar to the 9-dash line, the 10-dash line was denounced by several countries.[16]
- China has seven outposts in the Spratly Islands. Three of the outposts, located on Fiery Cross, Mischief, and Subi Reefs, contain air bases with other military infrastructure. The infrastructure includes facilities such as barracks, surveillance radars, and naval ports. China's other four outposts are on the Cuarteron, Gavin, Hughes, and Johnson Reefs.

Map 3. China's ten-dash line, 2023



Source: World Bank and U.S. Energy Information Administration
Note: Based on 2023 edition of China's standard map from China's Ministry of Natural Resources. The 10-dash line is a representation and not meant to be authoritative.

Indonesia

- Indonesia claimed its EEZ and agreed with Vietnam over maritime boundaries in the South China Sea at the end of 2022. Details of the agreement are classified and have not been released.[17] Indonesia has not stated a claim in the South China Sea disputes; however, China's 10-dash line overlaps with Indonesia's EEZ.[18]

Malaysia

- Malaysia claims 10 maritime features in the Spratly Islands, some of which are based on its claim to a continental shelf, as defined by a 1966 law and a 2009 joint submission with Vietnam to the Commission on the Limits of the Continental Shelf. Malaysia controls 7 of the 10 features. However, Vietnam and China also claim all of the features, and the Philippines claims a few of them. Malaysia also has two submerged systems, the James Shoal and Luconia Shoals, that are within the boundaries of the continental shelf region that China has claimed.[19]
- Malaysia has previously claimed the Louisa Reef, but after an agreement with Brunei was reached in 2009, its claim may have been dropped. However, few details about the agreement have been released.[20]
- Malaysia has five outposts in the southern part of the Spratly Islands. The outpost on Shallow Reef has an airstrip, and the outposts on Ardasier Reef, Eric Reef, Mariveles Reef, and Investigator Shoals have helipads.

Philippines

- The Philippines claims a large northeast portion of the Spratly Islands, calling it the Kalayaan (Freedom) Island Group, and occupies several of the islands. It also claims the Scarborough Shoal, which China and Taiwan also claim and which is patrolled by Chinese law enforcement vessels. The Philippines EEZ and continental shelf overlap with China's 10-dash line.[21]
- The Philippines has nine outposts in the Spratly Islands. The Pag-asa Island outpost is the largest and includes a runway and military garrison. The others are Rizal Reef, Lawak Island, Panata Island, Loaita Island, Northeast Cay, West York Island, Flat Island, and Second Thomas Shoal.[22]

Taiwan

- Taiwan, like China, asserts *historic* sovereignty over all features drawn within the 10-dash line—including the Spratly Islands, Paracel Islands, Pratas Island, and Scarborough Reef. Taiwan occupies Itu Aba Island and administers Pratas Island.[23] A coast guard outpost and airstrip may be maintained on the island.[24]

Thailand

- Thailand has no claims in the South China Sea.

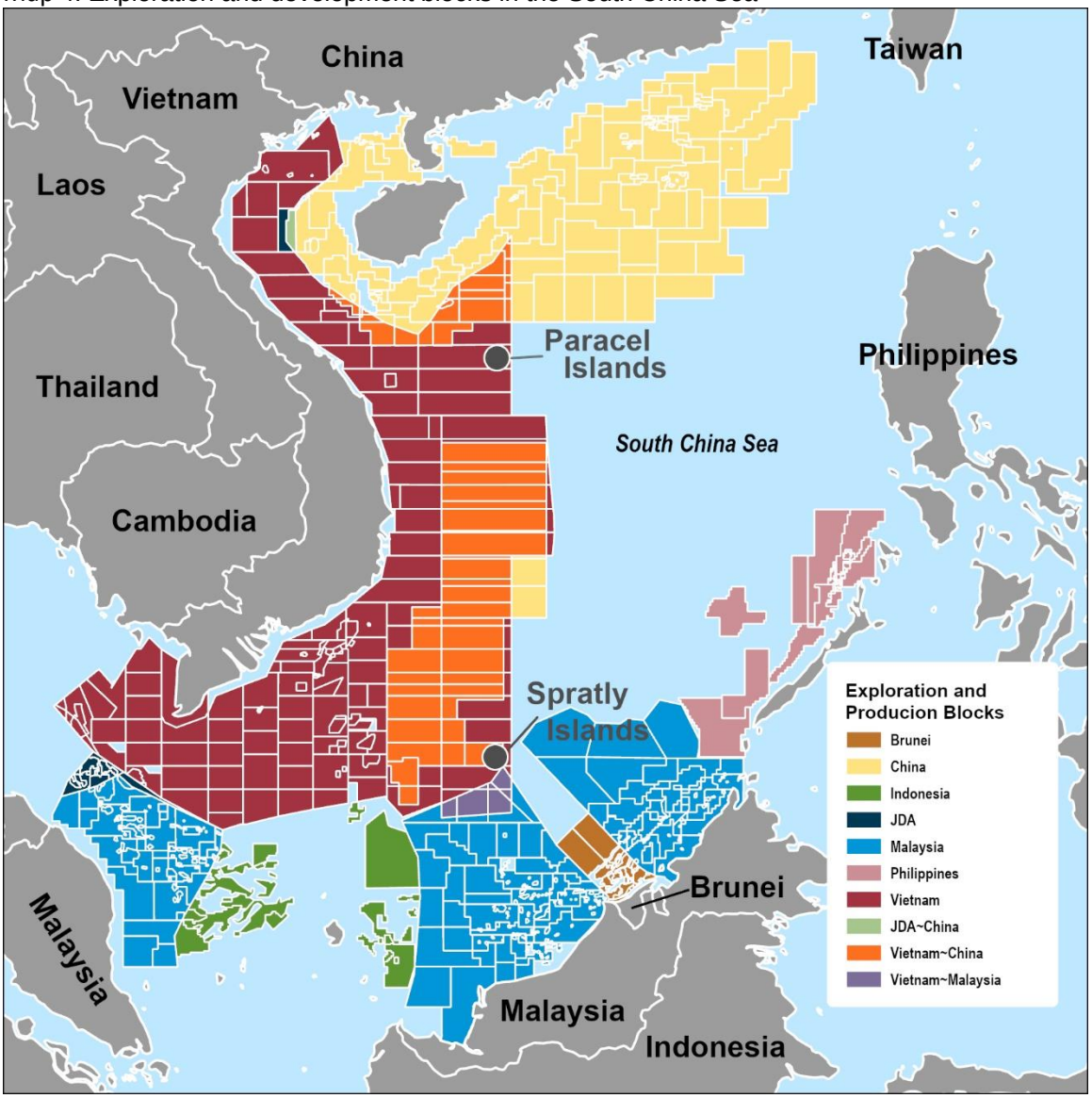
Vietnam

- Vietnam claims both the Spratly and Paracel Islands. Vietnam occupies the most land features in the Spratly Islands.[25] Through landfilling, Vietnam has created approximately 420 acres of new land in 2022, expanding its occupied area on the Spratly Islands to 540 acres. Vietnam's four major expansions are on the Pearson Reef, Tennent Reef, Sand Cay, and Namyit Island. Vietnam has also started expanding on the Barque Canada Reef, Alison Reef, Cornwallis South Reef, Discovery Great Reef, and Ladd Reef.[26]

Exploration and Production

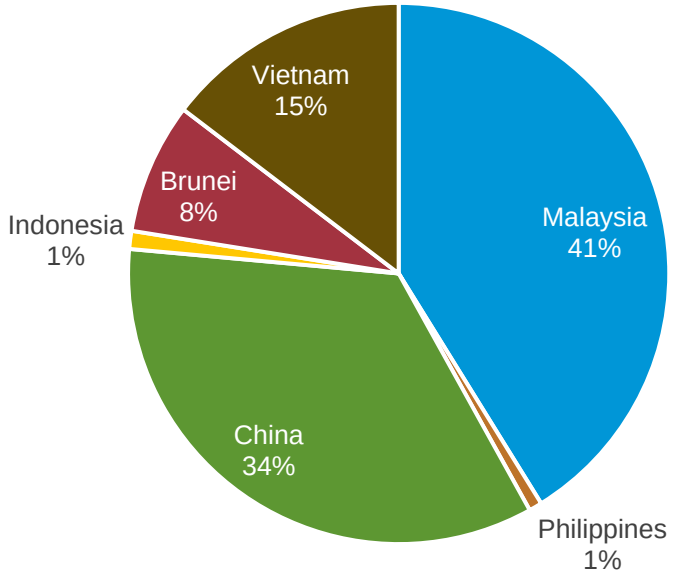
The South China Sea has extensive geological, technological, and political challenges to developing its resources. Countries have been successful in oil and natural gas production near the shorelines of the South China Sea. However, most of the area presents various challenges to development that can become more complex as they get further from the coastline.

Map 4. Exploration and development blocks in the South China Sea



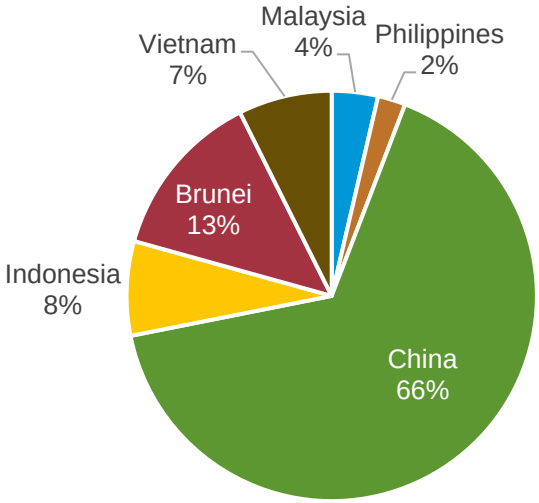
Source: World Bank, CSIS Asia Maritime Transparency Initiative and the U.S. Energy Information Administration
Note: JDA=Joint Development Agreement

Figure 1. South China Sea petroleum and other liquids production by country, 2023



Data source: Rystad Energy, *Cube Browser*

Figure 2. South China Sea natural gas production by country, 2023



Data source: Rystad Energy, *Cube Browser*

Brunei

- The Brunei National Petroleum Company (PetroleumBRUNEI) manages Brunei's offshore activities. Brunei-Shell Petroleum (BSP), a joint venture between Shell and the

government, is the largest crude oil producer in the country and is responsible for about 90% of Brunei oil and natural gas revenue.[27]

- Champion, Brunei's largest offshore oil and natural gas field, began production in 1972. In 2022, it produced more than 60% of Brunei's oil production and holds over 40% of its proven reserves.[28] The Southwest Ampa natural gas field accounts for more than half of the country's natural gas reserves and production. It supplies Brunei's natural gas liquefaction plant in Lumut.[29]
- Production in the maturing Champion field has been declining and new discoveries will need to be made to help offset the decline. BSP is currently leading the efforts for deepwater exploration, and brownfield redevelopment projects are also set to take place, including in the Champion field.[30] In 2023, Brunei produced an average of 93,000 b/d of petroleum and other liquids and 134 billion cubic feet (Bcf) of natural gas from the South China Sea, according to Rystad.[31]

China

- China's natural gas and oil production have grown since 2018 as they have continued to advance into deepwater areas in the South China Sea.[32] The three major national oil companies (NOC), China National Offshore Oil Corporation (CNOOC), China Petroleum & Chemical Corporation (Sinopec), and China National Petroleum Corporation (CNPC), are responsible for developing South China Sea's resources. In 2023, China produced 410,000 b/d of petroleum liquids and 489 Bcf of natural gas from the South China Sea, according to Rystad.[33]
- CNOOC has the most experience with offshore oil production and has invested the most into offshore development. According to its 2022 annual report, CNOOC produced an average of 394,000 b/d of crude oil and 1.1 Bcf/d of natural gas in the South China Sea that year. Activities in the South China Sea accounted for 43% of CNOOC's crude oil production and almost 60% of natural gas production.
- In December 2022, CNOOC started operations of Enping 15-1, 10-2, 15-2, and 20-4 oil fields in the eastern South China Sea. Peak production (35,500 b/d) is expected to be achieved by 2024, according to CNOOC.[34] Enping 18-6 oil field will start production in 2023 and have a peak production of 9,300 b/d, which they are expected to reach by

2024.[35] In September 2023, production started in their Lufeng 12-3 project. The project is expected to reach peak production of 29,000 b/d in 2024, according to CNOOC.[36]

- CNOOC also has plans to build a natural gas production hub in the Pearl River Mouth. As part of this plan, it has applied to the country's Ministry of Natural Resources for an environmental impact assessment to begin developing Ledong 10-1 in the Yinggehai Basin in the South China Sea.[37]
- CNOOC had four new discoveries in the South China Sea in 2022. In the western part of the South China Sea are Wenchang 19-3, Weizhou 12-8E, and Yacheng 13-10, and in the eastern part is Liuhua 28-2W.[38]
- CNPC and Sinopec are less active in the area. CNPC largely focuses on offshore drilling activities in the Bohai Bay, which is not in the South China Sea, although it provides offshore drilling equipment to other companies.
- CNOOC has the exclusive right to offer product-sharing contracts (PSCs) with foreign companies to partner in exploring, developing, and producing oil and natural gas in offshore China.[39]
- In 2021, the United States blacklisted CNOOC, accusing the NOC of helping China intimidate neighboring countries in the South China Sea. The economic blacklist prevents U.S. firms from exporting or transferring technologies with CNOOC without gaining a special license from the U.S. Department of Commerce.[40]

Indonesia

- Indonesia's oldest oil fields, including Duri and Minas, are mostly located offshore east and south of Sumatra outside the South China Sea. Duri and Minas, once the largest producing fields, produced approximately 159,000 b/d in 2022. Indonesia's NOC, Pertamina, took over operations of the Duri field from Chevron in August 2021. The company plans to raise production to 180,000 b/d, which includes new wells added in 2022 and upgrading existing facilities.[41]
- Similarly, most natural gas reserves are located near the Arun field in Aceh or in the Bada field in East Kalimantan, which are located outside the South China Sea. The fields' locations limit the participation Indonesia has in developing resources in the South China Sea. In 2023, Indonesia produced only 13,000 b/d of petroleum and other liquids from the South China Sea and 134 Bcf (0.37 bcf/d) of natural gas, according to Rystad.[42]

- Pertamina has begun to focus more on developing fields in South China Sea fields, such as the offshore Tuna natural gas field near the Natuna Islands. In early 2023, the Indonesian government approved development of the Tuna natural gas field, which is expected to produce 115 million cubic feet (MMcf) per day starting in 2027, according to SKK Migas, the country's oil and natural gas regulator. The $3 billion project will sell natural gas to Vietnam via pipeline to the Nam Con Son project. Although the field is within Indonesia's 200 nautical mile EEZ, its location hasn't prevented China from opposing the development based on its 10-dash line claim.[43]

Malaysia

- The state's NOC, PETRONAS, holds most of the country's oil and natural gas assets and is Malaysia's biggest domestic oil and natural gas producer. The company's Peninsular Gas Utilization (PGU) system, made up of six processing plants and 1,600 miles of pipeline, forms a key link to offshore natural gas development in the South China Sea.[44]
- Malaysia has several deepwater projects underway in the Sabah and Sarawak Basins. The Kasawari natural gas field has started development and has an estimated 3.2 Tcf of natural gas resources. Production from the field is estimated to reach 900 MMcf/d of natural gas, according to trade press.[45] In 2022, Malaysia signed production-sharing contracts (PSC) for five exploration blocks in the Sabah and Sarawak Basins (Table 3). Three discoveries were also made in Sarawak at the end of 2022: SK320 (September), SK306 (December), and SK410B (December).[46] In 2023, Malaysia produced 490,000 b/d of petroleum and other liquids from the South China Sea and 2.4 Tcf of natural gas.[47]

Table 2. Malaysia offshore exploration blocks with signed production sharing contracts, 2022

Project	Location	Companies
Block SB412	Sabah Basin	PTTEP; SapuraOMV
Block 2W	Sabah Basin	Petronas Carigali; Shell
Block X	Sabah Basin	Petronas Carigali; Shell
Block SK439	Sarawak Basin	Sarawak Shell; Petroleum Sarawak E & P
Block Sk440	Sarawak Basin	Sarawak Shell; Petroleum Sarawak E& P

Data source: Cavcic, Melisa. "Petronas Inks Deals for Five Offshore Blocks to Ramp up Exploration in Malaysia." Offshore Energy, March 12, 2023.

- Malaysia and Thailand agreed to develop a section of the Gulf of Thailand jointly without either party ceding legal rights to it. This Joint Development Area (JDA) consists of Block A-18, Block B-17, Block C-19, and Block B-17-01.[48]

Philippines

- The Philippines' production from the South China Sea is mostly natural gas. It produced 9,000 b/d of petroleum and other liquids compared with 80 Bcf in 2023, according to Rystad.[49]
- The Malampaya natural gas platform located in the northern Palawan Basin is operated by the Malampayan Consortium (Prime Infrastructure Capital 45%, UC38 LLC 45%, and Philippine National Oil Company-Exploration Corp. 10%).[50] Drilling began in October 2001 with a reserve base of 2.7 Tcf and 85 million barrels of condensate. Production has been declining for several years. According to the Philippines' Department of Energy, the field can produce an additional 210 Bcf, which is a little more than two years of consumption, based on 2021 numbers.[51] President Ferdinand Marcos, Jr., extended the service contract, initially set to expire in February 2024, by 15 years.[52] Under the commitment made to receive the extension, the consortium will invest $600 million into drilling new wells in the field.[53]
- The Philippines began exploring the Reed Bank area of the Spratly Islands in the 1970s and successfully tested a natural gas well in 1976. Before commercial drilling began, Chinese protests forced the operation to shut down. Since then, rights to the area have been highly contested. In 2013, the Philippines decided to submit the dispute to the

Permanent Court of Arbitration (PCA) in the Hague. In 2016, the PCA rejected the premise that China had historical claims to the Spratly Islands.[54] China refuses to recognize the decision, and a natural gas project in the area operated by PXP Energy Corporation, a Philippine firm, has been stalled.[55]

Singapore

- Singapore is a major transit point and a refining center in the region. Singapore had a crude oil refining capacity of 1.3 million b/d in 2023.[56] NOC Singapore Petroleum Company is a partner in projects in the South China Sea with Indonesia, Vietnam, and China. Singapore Petroleum have a 15% share of Kakap PSC (Indonesia), which is in the Nantuna Sea, the southern part of the South China Sea. For Blocks 102 and 106 (Vietnam), which are located in the Song Hong Basin, they have a 23% share**.** Finally, in Blocks 04/36 (China), Singapore Petroleum Company has a 9% share and Unitized Area China has an 11% share. Both projects are located in Bohai Bay.[57]

Thailand

- More than 60% of Thailand's crude oil production came from offshore fields in the Gulf of Thailand in 2022.[58] Chevron is the largest oil producer in Thailand, accounting for nearly 70% of the country's crude oil and condensate production in 2011. The largest oilfield is Chevron's Benjamas field located in the north Pattani Basin.[59] The field's production peaked in 2006 and declined to 13,000 b/d of crude oil and 45 MMscf per day of natural gas in 2023.[60] Independent companies such as Salamander Energy and Coastal Energy have made smaller discoveries over the years, such as the Bualuang, Songkhla, and Bua Ban fields.
- Almost all natural gas and condensate production comes from offshore fields in the Gulf of Thailand.[61] PTT Total and BG Group have stakes in Thailand's largest producing field in the basin, named Bongkot. The field produced about 200 Bcf of natural gas and 6 million barrels of condensate in 2021.[62]
- The Malaysia-Thailand Joint Development Area (JDA), located in the lower part of the Gulf of Thailand and northern part of the Malay Basin, provides some natural gas supplies to Thailand. However, production from the JDA has been declining.

Vietnam

- Vietnam hopes to expand offshore production in the South China Sea as a way of meeting domestic demand. In 2023, Vietnam produced 174,000 b/d of petroleum and other liquids and 271 Bcf of natural gas in the South China Sea, according to Rystad.[63] The government revised its Law on Petroleum (2008) in November 2022 to quicken the process for upstream activities and provide incentives for foreign investment.[64]
- Vietnam's NOC PetroVietnam is responsible for all oil and natural gas activities. In a joint development, as Vietsovpetro, it operates Vietnam's largest oil field, Bach Ho. Because the field is in decline, exploring the South China Sea for resources is a possible solution to offset production losses at Bach Ho.[65]
- Vietnam's attempts to develop resources in the South China Sea have been met with opposition. In 2017, Repsol canceled its project on the Vanguard Bank because of China's opposition. The following year, China opposed Vietnam's attempts to attract foreign investment into developing the South China Sea.[66] Despite China's opposition over the years, Vietnam plans to accept oil from the Tuna field via pipeline to its Nam Con Son Basin project. Nam Con Son is in the Vanguard Bank within China's 10-dash line.[67]
- Other projects in the Nam Con Son Basin are the Sao Vang Dai Nguyet natural gas and condensate project, which is in Block 05-1B and Block 05-1C. The Japanese company Idemitsu Kosan operates the project. Harbour Energy started work to extend the production life of its projects in the Chim Sao and Dua fields in 2022. Production in 2022 was 4,000 boe/d, which is a decline from previous years, driven by field maturity and rig delivery delays.[68]
- The Ca Voi Xanh, or *Blue Whale*, natural gas field is scheduled to be developed by PetroVietnam, ExxonMobil, and American Oil. The field has natural gas reserves of 5.3 Tcf, which would make it Vietnam's largest natural gas project. The field would consist of an offshore platform, natural gas treatment plant, and pipelines that would bring natural gas to shore and to four power plants. The project has been delayed for years, but in early 2023, Vietnam's Minister of Industry and Trade instructed government officials and PetroVietnam to agree on a natural gas supply contract to expedite the project.[69]

- The Block B project is located off Vietnam's southwestern coast and has a natural gas reserve of 3.8 Tcf. The project's partners are PetroVietnam, Vietnam Electricity, Mitsui Oil Exploration, and PTT Exploration and Production. Similar to Ca Voi Xanh, Vietnam's Minister has stepped in to accelerate the project.[70]

Regional Conflicts and Mediation Efforts—Timeline

- January 2013—The Philippines began an international arbitration process under the United Nations Convention on the Law of the Sea (UNCLOS) against China for its sovereignty claims on the Spratly Islands and Scarborough Shoal. China refused to participate.[71]
- May 2013—Japan committed to providing patrol boats to the Philippines to aid its ability to counter China's increasing presence in the South China Sea.[72]
- November 2013—China creates the East China Sea Air Defense Identification Zone, which requires non-commercial aircraft to submit flight plans before entering the area that encompasses most of the East China Sea and the Senkaku (Diaoyu) Islands.[73] The Senkaku Islands are administered by the United States and are considered part of Japanese territory.[74]
- April 2014—The Philippines signed a 10-year military pact with the United States to increase U.S. troop presence and joint military training.[75]
- May 2014—Vietnamese and Chinese vessels collided in an altercation to prevent China from establishing an oil rig in contested waters. Each country claims the other rammed into its ships.[76]
- November 2014—China and Japan reached a four-point agreement to improve diplomatic relations. Part of the agreement established a crisis management mechanism to prevent conflict and conflict escalation in the East China Sea.[77]
- February 2016—China placed surface-to-air missiles on Woody Island in the Paracel Islands.[78]
- July 2016—The Hague ruled in favor of the Philippines and found China's "9-dash line" has no legal basis for its claims to historical rights on resources in the South China Sea.[79]
- November 2016—The Philipines declared a no-fishing zone in the disputed Scarborough Shoal. Philippine President Duterte worked to strengthen economic ties with China and reopen dialogue on disputed territories.[80]

- December 2016—China seized a U.S. Navy underwater drone in the South China Sea. China agreed to return the drone a few days later.[81]
- January 2018—A tanker carrying one million barrels of condensate collided with a ship carrying grain 160 nautical miles from Shanghai. The tanker exploded, killing all 32 crew members and creating the largest condensate spill on record.[82]
- June 2018—China and Japan created a hotline to prevent accidents in the sea and air and agreed to hold regular meetings to maintain communications.[83]
- September 2018—A U.S. Navy ship conducting a routine freedom of navigation operation near the Spratly Islands had a near collision with a Chinese destroyer. China claimed that its ship was defending Chinese sovereignty in the Spratly Islands.[84]
- April 2019—After approximately 275 Chinese ships were reported to be seen near Pag-asa Island from January thru March, Philippine President Duterte threatened to send troops on a "suicide mission" if Chinese actions persisted.[85]
- July 2019—A Chinese survey ship with escort spent several months in Vietnam's EEZ in an area China had previously attempted to prevent Vietnam from drilling in by using aggressive maritime maneuvers.[86]
- February 2020—A Chinese military ship aimed its weapons system at a Philippine military ship in the Spratly Islands.[87]
- March 2020—China started operations at research stations that include defense silos and military runways on Fiery Cross and Subi Reefs.[88]
- April 2020—Vietnam lodged an official protest with China after a Chinese vessel rammed and sunk a Vietnamese fishing ship near the Paracel Islands.[89] China unilaterally established two administrative districts in the South China Sea: Xisha District, which covers the Paracel Islands and Macclesfield Bank, and Nansha District, which covers the Spratly Islands.[90]
- March 2021—The Philippines protested 200 Chinese ships located at Whitsun Reef, which falls within its EEZ. China claimed they were fishing vessels; however, the Philippines claimed they were operated by military personnel.[91]
- November 2022—China forcibly seized debris from a suspected Chinese rocket that landed within Philippine waters as the Philippine Navy towed it away.[92]
- December 2022—Indonesia and Vietnam agreed on their EEZ boundaries after 12 years of negotiations.[93]

- February 2023—The Philippines agreed to allow the U.S. military to expand its presence in the country despite China's objections. The expansion will add four military bases in the northern region of the country and expand the U.S. presence in the South China Sea.[94]
- August 2023—The United States, Japan, and South Korea held a summit and made a public statement reaffirming their standing on the Hague's 2016 ruling on China's 9-dash line and denounced China's aggressive behavior in the region.
- August 2023—China released a new version of its territory map that expands the 9-dash line to a 10-dash line. The new line includes Taiwan and most of the Spratly Islands. The map was rejected by India, Indonesia, Japan, Malaysia, the Philippines, Taiwan, and Vietnam.[95]

Global Trade

- In 2023, 76 million barrels per day (b/d) of petroleum and petroleum product was shipped globally via maritime transport. Approximately 28 million b/d (37%) of those shipments traversed the South China Sea. Most of the maritime trade through the South China Sea passes through the Straits of Malacca, Sunda, and Lombok.[96]
- The South China Sea is a critical world trade route, with 21% of global trade ($3.4 trillion dollars) in 2016, the most recent year these data are available. China was the largest exporter, accounting for more than one-third of that trade, followed by Japan at 8%.[97]

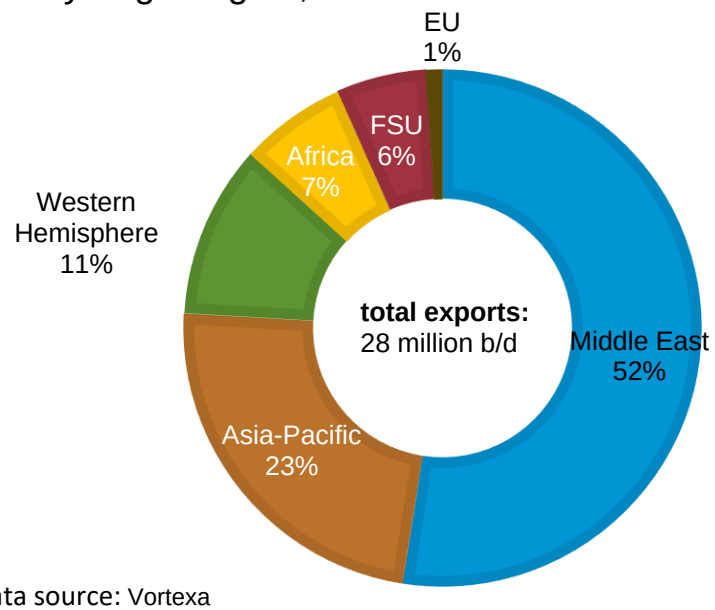
Table 3. Trade value through the South China Sea by country, 2016

Country	South China Sea trade value (USD billions)	South China Sea trade as percentage of all goods
China	$1,470	39.5%
Japan	$240	19.1%
Germany	$215	9.0%
United States	$208	5.7%
India	$189	30.6%
United Kingdom	$124	11.8%
France	$84	7.8%
Brazil	$77	23.4%
Italy	$71	8.1%
Canada	$22	2.7%
Total	**$2,700**	

Data source: CSIS, China Power

- Slightly more than half of the petroleum and petroleum product shipments that go through the South China Sea originate from the Middle East (Figure 1). The top three sources of shipments are Saudi Arabia (4.9 million b/d), United Arab Emirates (3.4 million b/d), and Iraq (1.6 million b/d). The United States (1.5 million b/d) and Kuwait (1.5 million b/d) round out the top five (Figure 2).

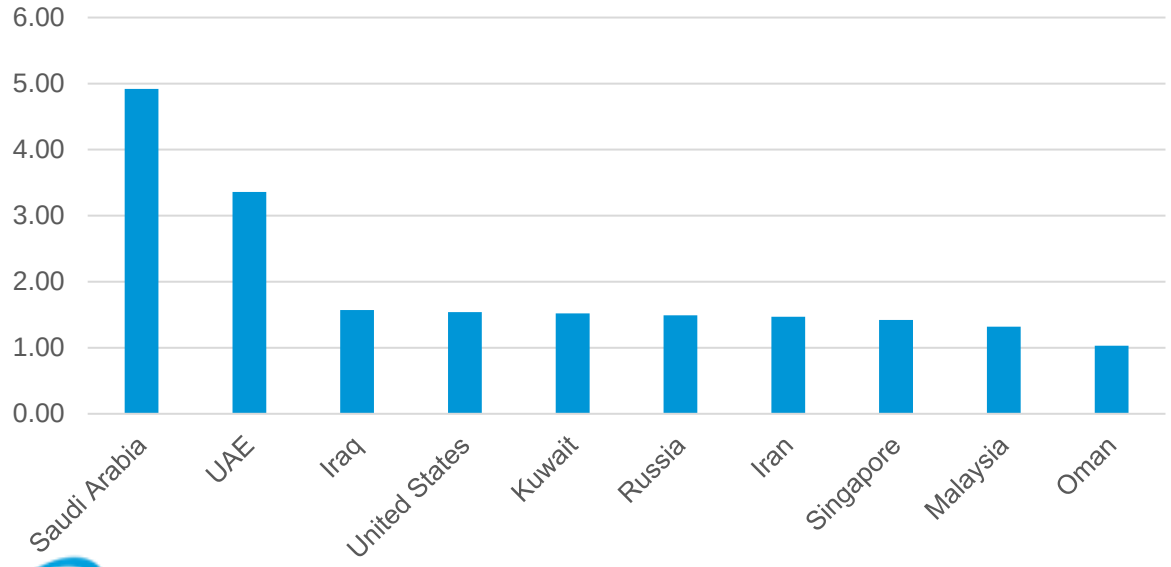
Figure 3. Flows of petroleum and petroleum product in the South China Sea by origin region, 2023



Data source: Vortexa
Note: Includes crudes/condensates, petroleum products, and LNG

Figure 4. Top 10 origins of petroleum and petroleum product flows in the South China Sea, 2023

million barrels per day

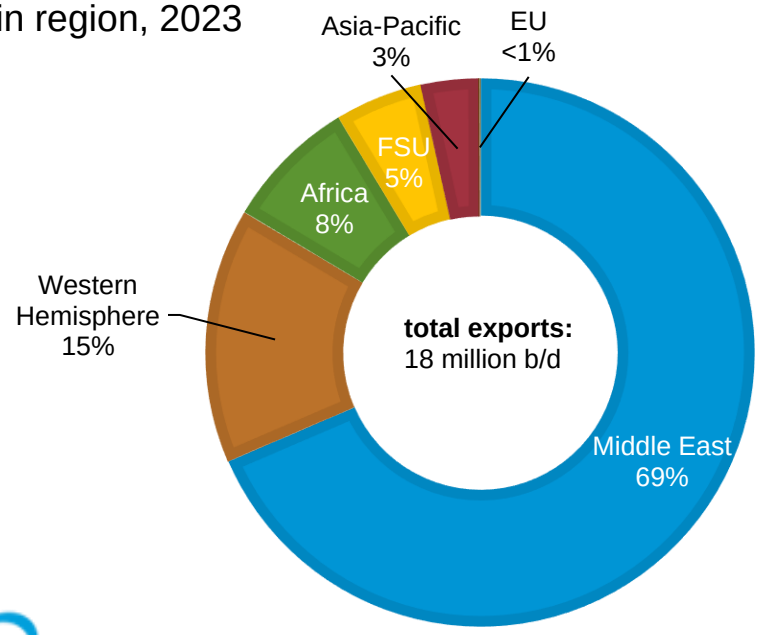


Data source: Vortexa
Note: Includes crudes/condensates, petroleum products, and LNG

Petroleum trade

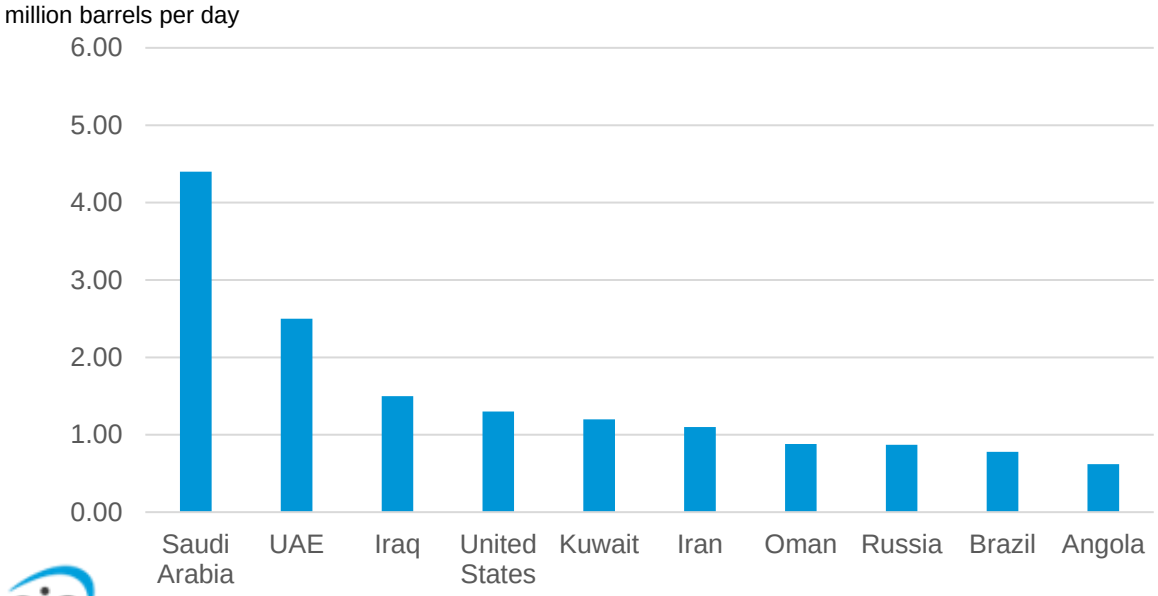
- Approximately 18 million barrels per day (b/d) of crude oil and condensate passed through the South China Sea and Gulf of Thailand in 2023, which was 43% of global oil maritime shipments (Map 5). Most of these shipments go to China (50%), followed by South Korea (14%) and Japan (12%).[98]
- Most of the crude oil and condensate shipments that passed through the South China Sea in 2023 originated in the Middle East (69%) (Figure 3). Saudi Arabia (4.4 million b/d) was the top source of crude oil and condensate exports, followed by the United Arab Emirates, Iraq, the United States, and Kuwait (Figure 4).

Figure 5. Flows of crude and condensate in the South China Sea by origin region, 2023



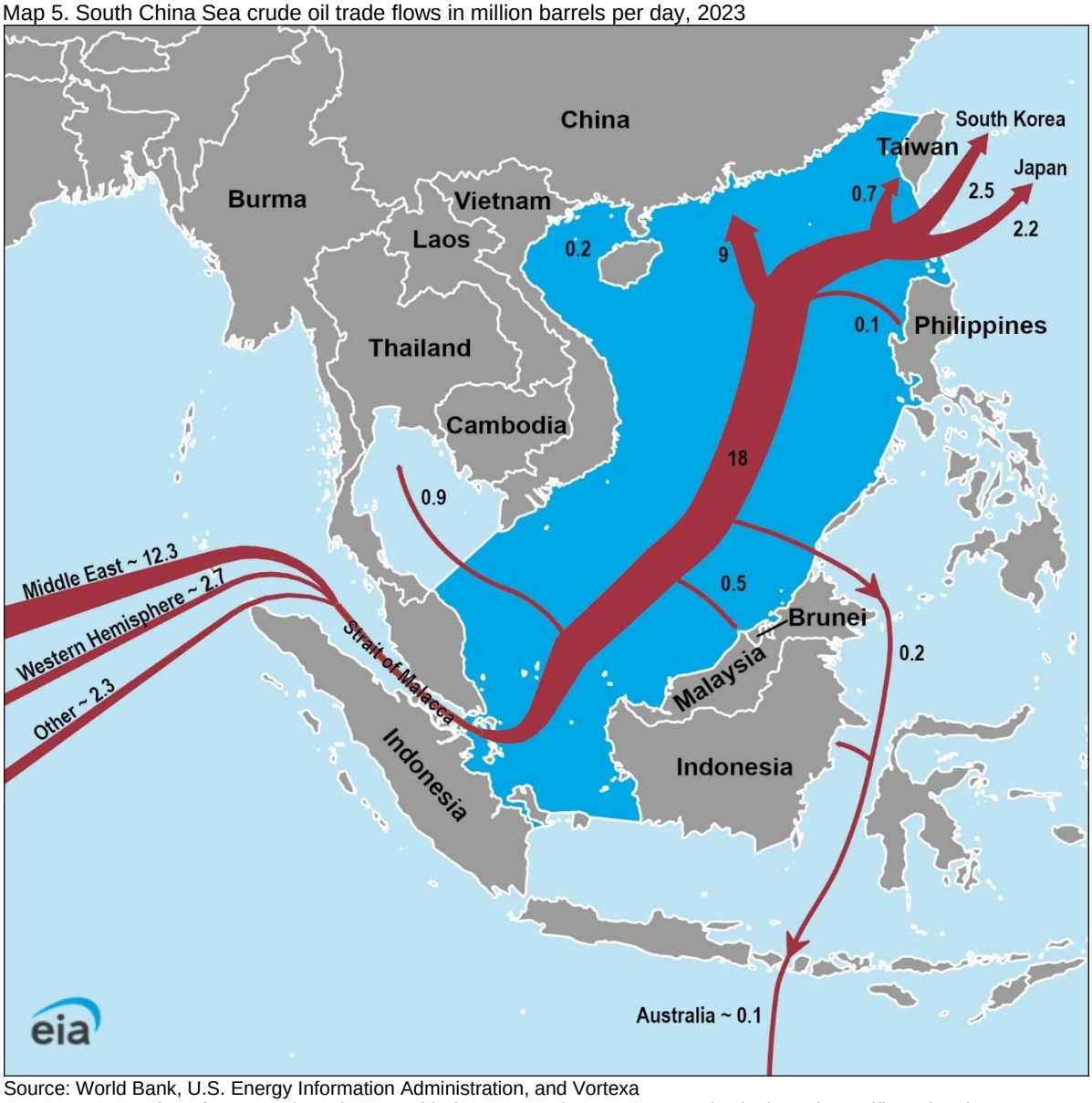
Data source: Vortexa

Figure 6. Top 10 origin countries of crude oil and condensate flows in the South China Sea, 2023



Data source: Vortexa

Map 5. South China Sea crude oil trade flows in million barrels per day, 2023



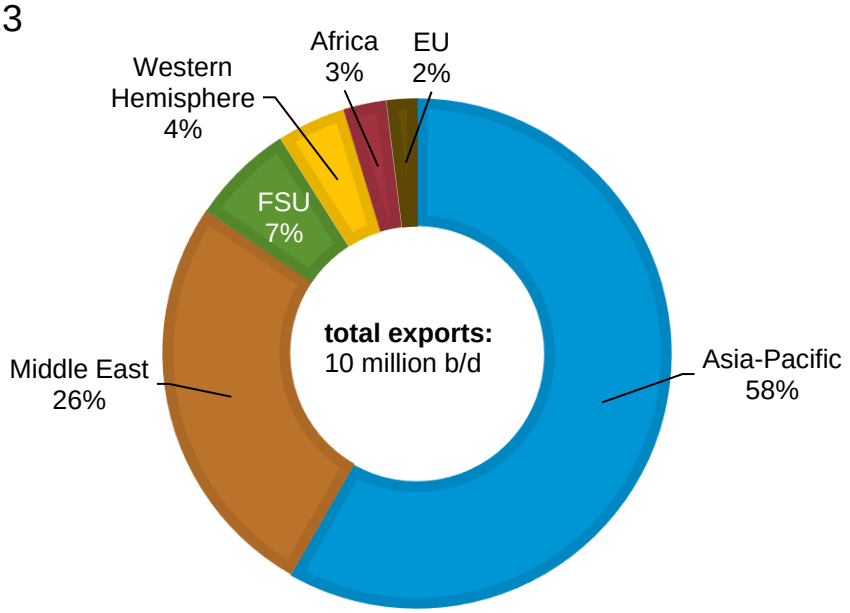
Source: World Bank, U.S. Energy Information Administration, and Vortexa
Note: Routes are for reference only and not a guide for exact trade routes. Countries in the Asia-Pacific region that export small amounts of crude oil and condensates were not included in the map for clarity.

Petroleum product trade

- In 2023, over 10 million b/d of petroleum products, one-third of global petroleum products trade, went through the South China Sea and Gulf of Thailand. China (20%), Singapore (16%), Malaysia (8%), and South Korea (8%) are the top importers of petroleum product flows that went through the South China Sea.[99]
- The Asia-Pacific region was responsible for 58% of petroleum product maritime shipments in the South China Sea in 2023 (Figure 5). Singapore and Malaysia were two

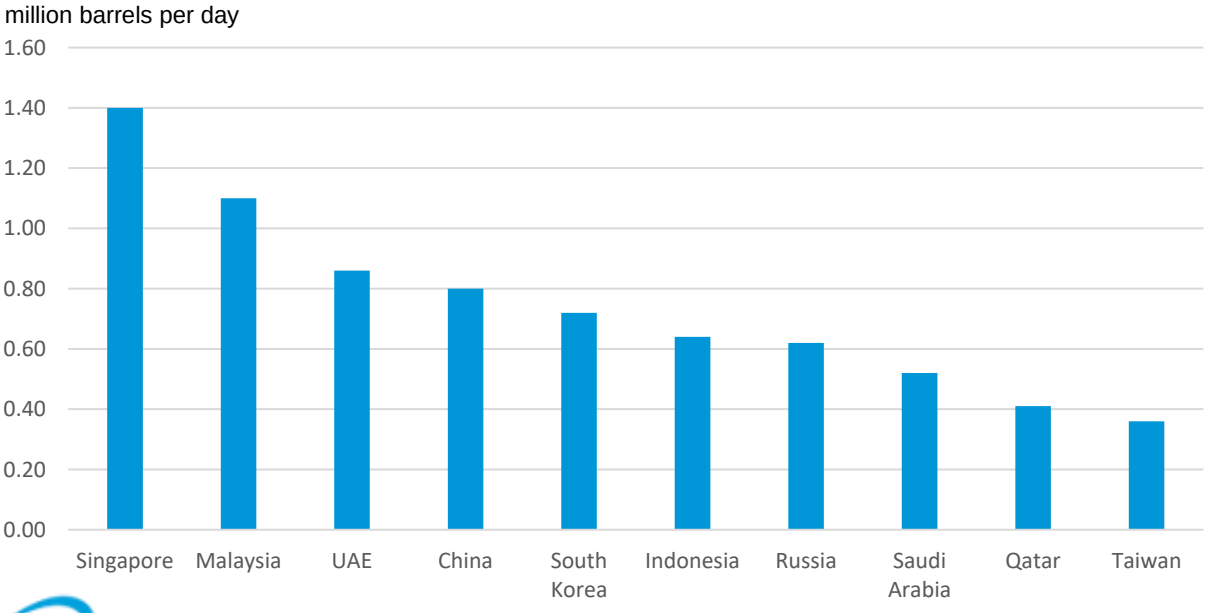
of the top importers of petroleum products and the two top sources, followed by the United Arab Emirates (Figure 6).

Figure 7. Flows of petroleum product in the South China Sea by origin region, 2023



Data source: Vortexa
Note: EU=European Union, FSU=Former Soviet Union

Figure 8. Top 10 origin countries of petroleum product flows in the South China Sea, 2023

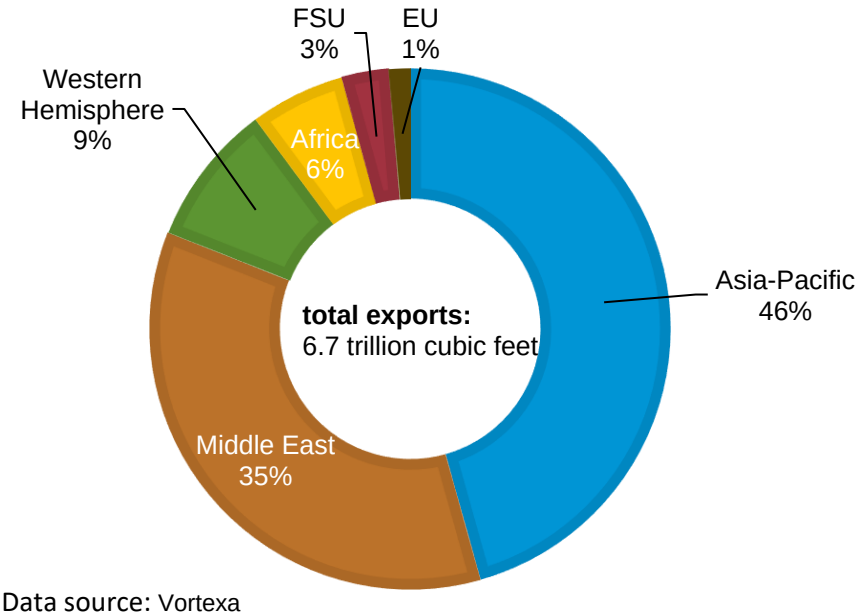


Data source: Vortexa

Liquefied natural gas trade

- In 2023, 6.7 Tcf of LNG passed through the South China Sea, which was 34% of global LNG trade. Most of the LNG that went through the South China Sea were LNG imports to China, which was approximately the same amount of LNG as the second- and third-highest importers combined, South Korea and Japan.[100]
- The Asia-Pacific region and Middle East were responsible for 81% of LNG exports that went through the South China Sea in 2023 (Figure 6). Qatar, Malaysia, and Australia were the sources for 64% of LNG that entered the South China Sea (Figure 7).

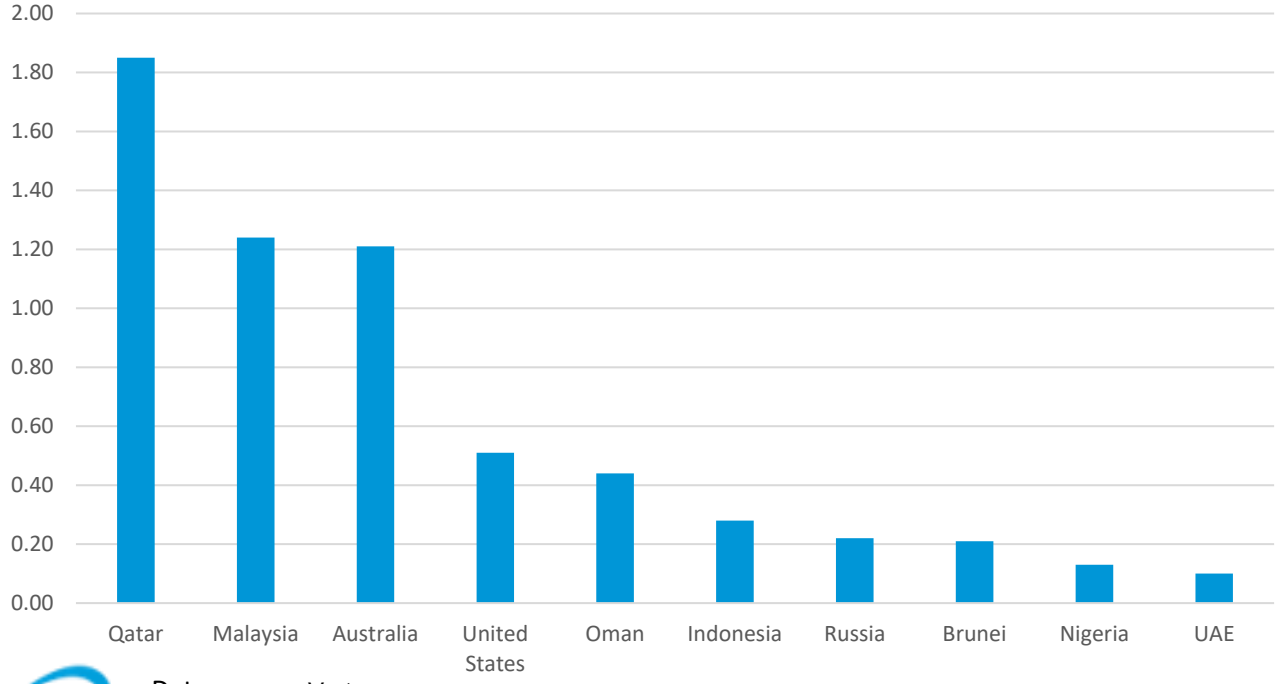
Figure 9. Flows of LNG in the South China Sea by origin region, 2023



Data source: Vortexa
Note: LNG=liquefied natural gas, FSU=Former Soviet Unon, EU=European Union

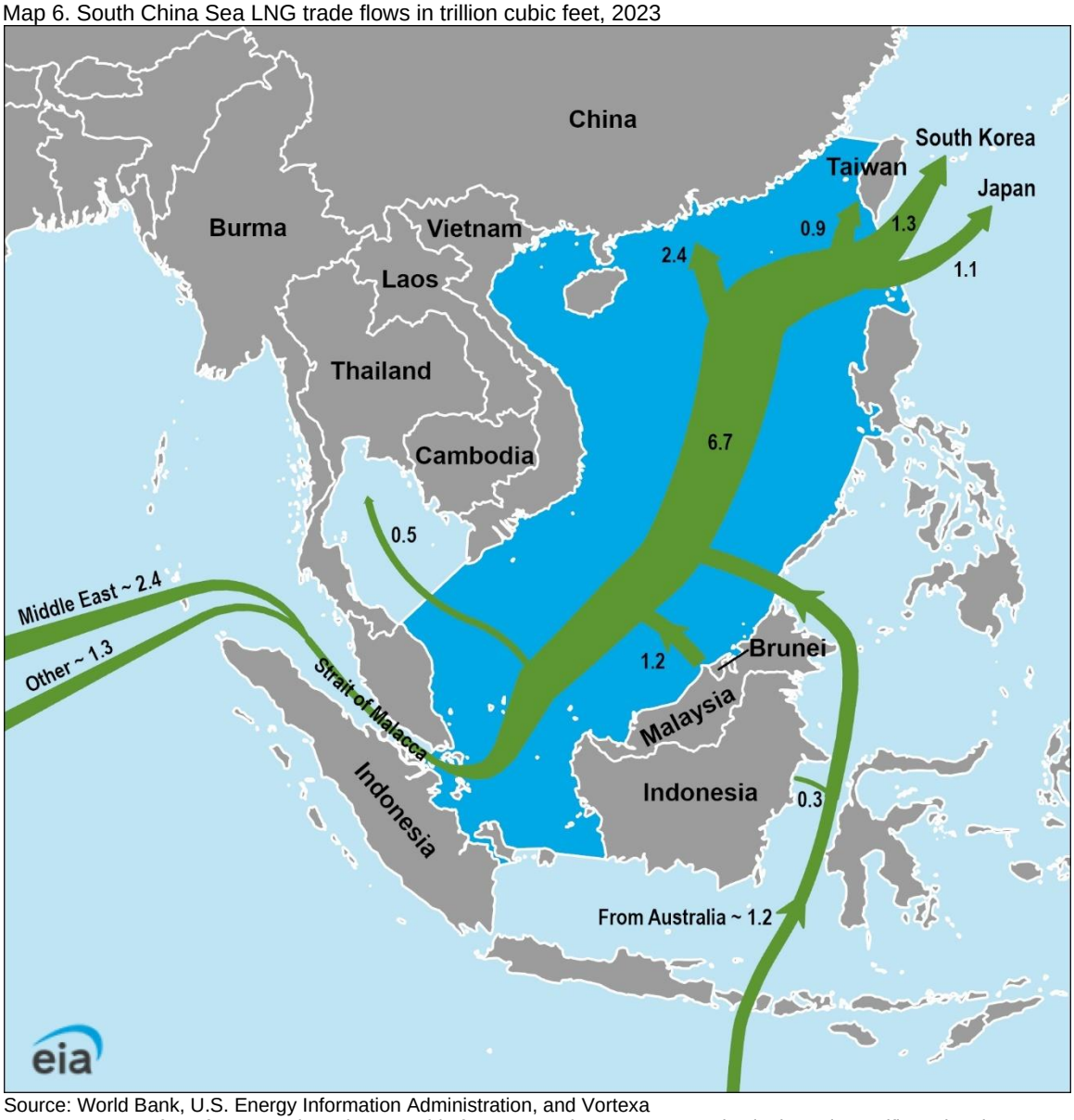
Figure 10. Top 10 origin countries of LNG flows in the South China Sea, 2023

trillion cubic feet



Data source: Vortexa
Note: LNG=liquefied natural gas

Map 6. South China Sea LNG trade flows in trillion cubic feet, 2023



Source: World Bank, U.S. Energy Information Administration, and Vortexa
Note: Routes are for reference only and not a guide for exact trade routes. Countries in the Asia-Pacific region that export small amounts of LNG were not included in the map for clarity. LNG=liquefied natural gas

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Explosive Atlantic hurricane season predicted for 2024, AccuWeather experts warn

A super-charged hurricane season could spawn a near-record number of storms in the Atlantic this year, and forecasters may even run out of names for storms amid a frenzy of tropical systems.

By Brian Lada, AccuWeather meteorologist and staff writer
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Alex De Silvia explains key points of the forecast to make sure that you're prepared to make the best decisions to protect your family and property for this hurricane season.

The scene is being set for a turbulent year in the tropics, one that could approach a record-setting pace that may exhaust the entire list of names for tropical storms and hurricanes -- and then some.

The Atlantic hurricane season officially gets underway on June 1 and runs through the end of November, and AccuWeather's team of long-range forecasters say now is the time to prepare for a frenzy of tropical systems. There are signs that the first named system could spin up before the season kicks off as the calendar flips to June, a precursor of what's to come.

"The 2024 Atlantic hurricane season is forecast to feature well above the historical average number of tropical storms, hurricanes, major hurricanes and direct U.S. impacts," AccuWeather Lead Hurricane Forecaster Alex DaSilva said. This echoes the early warning AccuWeather issued in late February, ringing the alarm bells about the potential for a surge in tropical activity.

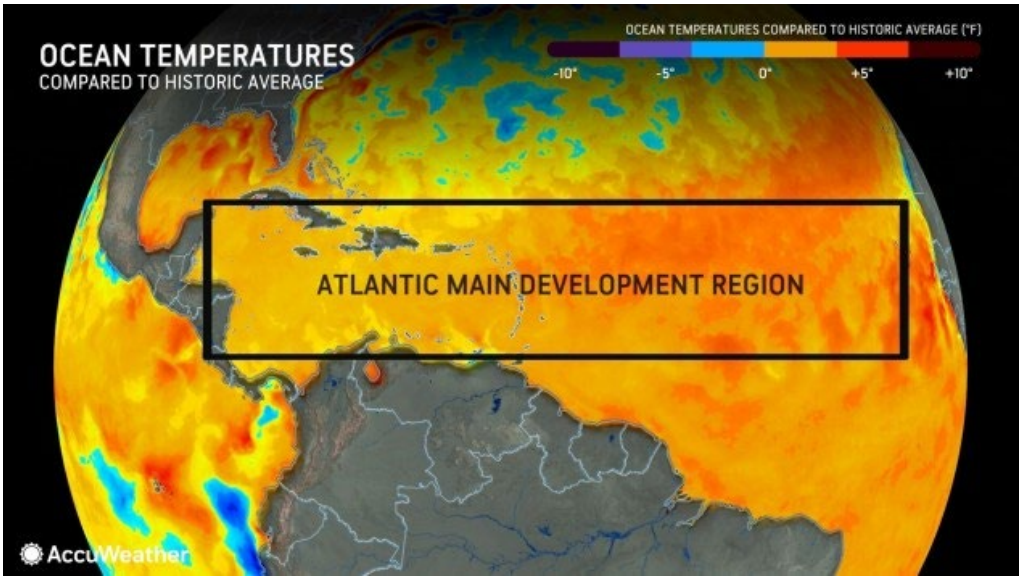
Last hurricane season featured 19 named storms, but there were only four direct U.S. impacts. Hurricane Idalia was the storm of the year, which slammed into Florida as a powerful Category 3 hurricane in late August. Additionally, Tropical Storm Harold drenched southern Texas, and Tropical Storm Ophelia made landfall in North Carolina. Lee also swiped the New England coast as a tropical rainstorm before making landfall in Nova Scotia, Canada.

All signs continue to point toward the upcoming season being worse than the last, with the potential for the 2024 Atlantic hurricane season to rank as one of the most active in history.

Driving factors for a hyperactive hurricane season

Warm water is fuel for tropical systems, and there will be plenty of warm water for fledgling systems to tap into and strengthen.

"Sea-surface temperatures are well above historical average across much of the Atlantic basin, especially across the Gulf of Mexico, Caribbean and the Main Development Region [for hurricanes]," DaSilva explained. The Atlantic water temperatures observed in March were around or even warmer than they were in March ahead of the blockbuster 2005 and 2020 hurricane seasons.



Not only will this promote frequent development, but it will increase the potential for systems to undergo rapid intensification, a phenomenon that has occurred in recent years with historic hurricanes.

In 2020, Hurricane Laura was in the Gulf of Mexico and was making a beeline toward southwestern Louisiana. In just 24 hours, it rapidly intensified from a Category 1 hurricane with winds of 85 mph to a menacing Category 4 storm with winds of 150 mph -- 7 mph shy of Category 5 status.

Unusually warm water could also help to spawn tropical systems in November when the Atlantic hurricane season is winding down.

The other major factor in AccuWeather's Atlantic hurricane forecast is hitched to the Pacific Ocean.

Water near the equator of the eastern Pacific is in the process of quickly flipping from El Niño, when temperatures in this area are higher than historical averages, to La Niña, when temperatures in this zone are lower than long-term normals. This swift transition may have significant implications across the Atlantic Ocean.

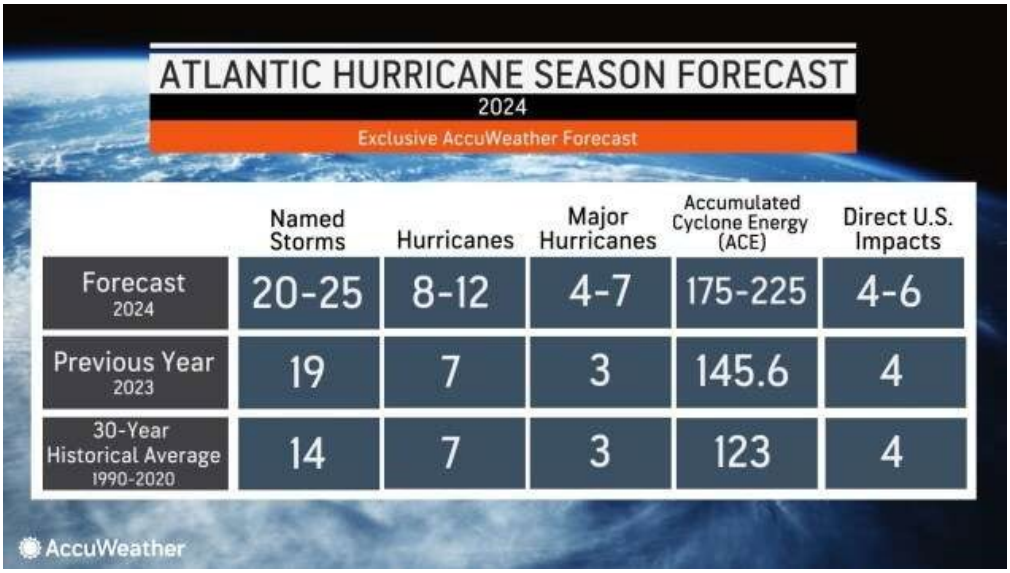
La Niña results in less disruptive winds, known as wind shear, over most of the Atlantic basin. "It can be helpful to visualize a stack of pancakes," DaSilva explained. When there is a high amount of wind shear, the top of a tropical system can be pushed and tilted away from its base, causing it to become lopsided. If a mature hurricane is in place, it may weaken but will not necessarily dissipate. "A tall, neat stack is what a tropical system wants to be, but wind shear can cause some pancakes to be displaced and the stack could fall over," said DaSilva.

The faster the transition to La Niña occurs, the more active the hurricane season is likely to be.

La Niña was present during the 2020, 2021 and 2022 Atlantic hurricane seasons, all of which featured near or well above the historical average of 14 named storms. The 2020 season is tied with the historic 2005 season for the highest number of named storms, with 30.

How many tropical storms and hurricanes are predicted in 2024?

AccuWeather meteorologists are forecasting 20-25 named storms across the Atlantic basin in 2024, including 8-12 hurricanes, four to seven major hurricanes and four to six direct U.S. impacts. This is all above the 30-year historical average of 14 named storms, seven hurricanes, three major hurricanes and four direct U.S. impacts.



	Named Storms	Hurricanes	Major Hurricanes	Accumulated Cyclone Energy (ACE)	Direct U.S. Impacts
Forecast 2024	20-25	8-12	4-7	175-225	4-6
Previous Year 2023	19	7	3	145.6	4
30-Year Historical Average 1990-2020	14	7	3	123	4

With so many factors that could bolster development, there is the potential that there could be even more than 25 named storms in 2024.

"There is a 10-15% chance of 30 or more named storms this year," DaSilva said.

"All indications are pointing toward a very active Atlantic Hurricane season in 2024."

AccuWeather Lead Hurricane Forecaster Alex DaSilva

In addition to the number of storms and hurricanes, AccuWeather is predicting an Accumulated Cyclone Energy (ACE) of 175-225, above the historical average of 123.
ACE measures the intensity and longevity of tropical systems throughout the year, making it a reliable way to quantify the true strength of a hurricane season. A powerful, long-lived hurricane will generate a large amount of ACE, while a short-lived tropical storm will only generate a small amount of ACE.

What areas of the US have the highest hurricane risk in 2024?

"The Texas coast, Florida Panhandle, South Florida and the Carolinas are at a higher-than-average risk of direct impacts this season," DaSilva said.

While these four areas are at an elevated risk for a direct strike from a tropical system, residents near other coastal locations should remain vigilant.

"All residents and interests along the U.S. coast, including Puerto Rico and the Virgin Islands, should have a hurricane plan in place and always be fully prepared for a direct impact.," DaSilva added.

One tool meteorologists use to create long-range forecasts is analyzing analog years, or past years when the weather patterns were similar to current conditions.

An analog year for this season is 2016 -- a year when Hurricane Matthew barreled over Hispaniola and eastern Cuba before taking a swipe at Florida's Atlantic coast. The Category 5 hurricane was the most powerful storm of that season, which took place during La Niña, similar to what is predicted to happen this year.

What happens if there are more than 21 storms and we run out of names?

With AccuWeather experts predicting 20-25 named storms, meteorologists could run out of names to use for tropical storms and hurricanes.

Although the alphabet has 26 letters, Q, U, X, Y and Z are skipped, leaving 21 names. So what happens when we run out?

The Greek alphabet was used in the past to name storms, starting with Alpha, but that rule was changed by the World Meteorological Organization (WMO) in 2021.

"The use of the Greek alphabet was not expected to be frequent enough to warrant any change in the existing naming procedure," the WMO said on its website. "However, after the record-breaking 2020 season, the WMO Regional Association IV Hurricane Committee annual session in 2021 decided to end the use of the Greek alphabet and instead established two lists of supplemental tropical cyclone names, one for the Atlantic, one for the Pacific."
The supplemental list of names is also in alphabetical order, starting with the name Adria.

If there are at least 22 named storms in the Atlantic this season, 2024 will be the first time the supplemental list is used.

https://www.freep.com/story/money/cars/ford/2024/03/27/ford-rouge-electric-vehicle-center-dearborn-cuts/73117641007/

Ford to dramatically cut hourly workforce at F-150 Lightning plant in Dearborn

By Phoebe Wall Howard and Olivia Evans

Detroit Free Press and Louisville Courier Journal

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Ford Motor Co. is dramatically cutting the hourly workforce at the factory that builds the Ford F-150 Lightning starting next week, as the automaker slashes product targets of its all-electric pickup.

Of the 2,100 workers who make up three work crews at the Rouge Electric Vehicle Center in Dearborn, one third will remain on-site after April 1, Ford spokeswoman Jessica Enoch told the Detroit Free Press on Wednesday. A crew of 700 will be transferred to the Michigan Assembly Plant in Wayne to build the Bronco and Ranger while the remaining 700 or so will either take the $50,000 retirement package negotiated during the 2023 contract talks or accept reassignment in southeast Michigan. Ford is adding a third crew at Michigan Assembly.

Staffing reductions at the Lightning plant, first announced in January, will not result in job losses, Enoch said.

She declined to confirm production volume details on Wednesday.

A year ago, Ford announced plans to hire more workers to ramp up Lightning production. Ford had been rotating their shifts since October, with layoffs built into the schedule, as the pace of electric vehicle sales slowed, Enoch noted.

New vehicles have been held for quality review since Feb. 9, with expected shipping to begin in April, Enoch said.

Meanwhile, dealers have Lightning trucks available currently for consumers who want to purchase the pickups now.

Todd Dunn, president of UAW Local 862 in Louisville, Kentucky, told members during his weekly video update released Tuesday that the labor union leaders are closely monitoring all activity involving battery-electric production as the industry continues to manage dynamic and often unpredictable change.

Battery tech affecting production plans

"The battery technology right now is kind of slowing some of the purchasing down. The REV Center, the Rouge Electric Vehicle Center, we call it REV-C, was ramping up their second crew. They're now going to lay off that second crew and not put the third crew on," Dunn said. "Their intentions were to build 180,000-plus units. Right now, we're looking at 55,000 units they're gonna build. There are some things out there that's causing this — distance on (battery) charges, new technology that's being brought about overseas, that technology being implemented over there already in certain design models. It's also showing almost double in mileage, if not a significant increase. So, some of those things are changing."

He added, "We're staying right on top of things, the way we should."

Dunn mentioned in the video that he was offered a position with the UAW world headquarters in Detroit but declined. He is often part of strategy meetings and updates involving plants all around the country and union business overall because the Kentucky Truck Plant is the most profitable in the company.

Dunn, whose members build the Ford Super Duty at the Kentucky Truck Plant as well the Ford Expedition and Lincoln Navigator, also represents members at the Louisville Assembly Plant building the Lincoln Corsair. Dunn led nearly 9,000 workers out on strike in October during contract talks.

Also Tuesday, Ford Chief Financial Officer John Lawler said during a talk at the Bank of America Securities Auto Summit that the Dearborn automaker is constantly making adjustments to purchasing decisions to address market changes. Ford's electric vehicle strategy assumes brutal competition, radical change and rethinking how things have been done in the recent past and even now, Lawler said.

"We definitely need to work to match capacity with demand. Demand is much slower than the industry expected when it comes to EVs," he said. "We are right-sizing our capacity and the investments that we're putting into EVs. but it's not a matter of 'if,' it's a matter of 'when.' I think we're in the transition between the early adopters who were much more willing to deal with some of the ancillary items that come with EVs — charging range and things like that. We're moving into the early majority. And the early majority is much less forgiving, and pricing is an issue."

Changes to battery technology, which allow for longer driving distances, are key to adoption for many potential buyers. And that's something Ford and its competitors are monitoring in this early mass-adoption period.

"The bigger the vehicle, the bigger the battery. And the battery is the most expensive thing in the vehicle. And then the bigger the battery, the more weight. The more battery you need, the less efficient the vehicle is," Lawler said. "So the costs just spiral out of control."

He added, "The EV business, Model e, has to stand on its own. It has to get there."

No one will be forced to drive an electric vehicle

While Ford has said it's developing a small electric vehicle to compete with Chinese automakers and Tesla, Lawler declined to confirm a 2025 launch date. Too many variables are under review, he said.

Ford CEO Jim Farley has said the automaker has no plans to abandon its internal combustion engine vehicles but will diversify its offerings to consumers. Ford currently builds the top-selling trucks across gas, hybrid and electric propulsion systems. Both the F-150 hybrid and Maverick hybrid are strong sellers.

“We are taking advantage of our manufacturing flexibility to offer customers choices while balancing our growth and profitability," Farley said in a news release in January. "We see a bright future for electric vehicles for specific consumers, especially with our upcoming digitally advanced EVs and access to Tesla's charging network."

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A - John T. Lawler {BIO 17882934 <GO>}

Yeah, well, we definitely need to work to match capacity with demand. And demand is much lower than the industry expected when it comes to EVs. And when we look at that, prices came down dramatically. Growth is much less than what we thought. So we are right-sizing our capacity and the investments that we're putting into EVs. But it's not a matter of if, it's a matter of when.

And I think we're in the transition between the early adopters that were much more willing to deal with some of the ancillary items that come with EVs, charging range, and things like that. We're moving into the early majority. And the early majority is much less forgiving, and pricing is an issue. And one of the things we're finding and we realized this, and I think this was a benefit of being a first mover in the market. One of the first movers in the market is that we don't believe the game is going to be really fought in one with larger vehicles. We think it's going to be in the smaller, more affordable vehicles. And that's why we started the group out in California, which is a group of highly successful EV engineers, designing a new platform for us in a much different way. And it'll allow us to have that low-cost affordable EV platform where we can create multiple top hats off of that.

And I think that's where we're really going to start to see the traction because the real competition where we see it is the low-cost EVs from China, as well as Tesla. And so, we're working towards that future. Now, of course, we're going to have some large EVs as well, but they're going to be very limited in the scope and the number of top hats that we have. So we're thinking about it in that way. And one of the things about the segmentation that's different, clearly, is everybody gets to see exactly where we are in EVs.

There's no wondering what's happening with EVs with Ford, I'd say pure business, there are no credits in there for the greenhouse gas or the emissions that they provide for us, right? Every lightning allows us to sell twelve 150s.

And so -- but there's nothing numerical in there. There's nothing financial in there. So you see the pure business and the reason why we did that with the EV business is because eventually it has to stand on its own, right? It can't be there only to provide credits for your Blue and Pro business because eventually, it has to stand on its own. So that's how we're thinking about it, John. We think that the first real inflection point is going to come when some of the lower-priced EVs come online.

Q - John Murphy {BIO 5762430 <GO>}

So, I mean, we used to think -- I mean, and this is our faulty thinking, or maybe not. I don't. We'll Waltz and see how this works out is that if you came in with high-end, high-performance, high-priced EVs, that might work. And it seems like that there's a tiny part of the market. So that's actually maybe true, but it's small. So the small EVs might be a larger market, but I guess the question is, when you talk about a small vehicle, like does that mean Escape size? Does that mean sub-Escape size? What does that mean? Because Americans, whether it be an EV, a diesel, four-cylinder,

whatever it may be, don't like small vehicles, right? And your business is predicated on these unbelievably great large trucks. So now you're talking about a small vehicle.

What does that mean? And does that mean that Ford is coming back into, maybe it's not. We'll see, is it a car and who are they kind of -- who you are going to supplant in that part of, part of the market? Because there's some pretty good competition on the ice side there. So I just curious, like what this really means. And there's some concern that, like this, this might be compliant and that you just answered the question that it could be a compliance vehicle.

That's not what you're saying. You're saying it's the exact opposite of that. But I mean, how does the American market work for a vehicle like this?

A - John T. Lawler {BIO 17882934 <GO>}

Yeah, I think so you have to start to unpack what an EV is and what an EV isn't from a standpoint of, as Doug explains, the physics around the size and the battery. In the conventional internal combustion business, the larger the vehicle, the more margin there was, because the cost to add from the size is much less than the value of the consumer, right?

The marginal utility of the vehicle. The third row, the ability to tow more, the ability to haul more, and so the margin goes up. It's the exact opposite with EVs because the bigger the vehicle, the bigger the battery. And the battery is the most expensive thing in the vehicle. And then the bigger the battery, the more weight, the more battery you need, the less efficient the vehicle is. So the costs just spiral out of control, which is the exact opposite to what internal combustion vehicle does, a gas or a diesel.

So it's about that smaller platform. Now, the great thing about EVs is when you look at the design footprint, the way you can think about it is that the exterior size of an Escape could be the interior size of an Explorer because you don't have the package limitations of the front, right?

And so there's a lot of degrees of freedom when -- especially when you're designing it with a new platform, with individuals that are on their third or fourth platform of EVs that they're designing. And the way they do it is allowing us to create a platform that we believe is going to be able to cover a large segment of the population and give them the needs through different top hats on that platform. So that's how we're thinking about it.

And I know it's a little bit opaque because we haven't introduced the vehicle. And, you know, we need a little bit more time before we do that. But I think there's a lot of opportunity there to take the benefits of an EV and meet the consumers' needs with a smaller platform type that requires less of a battery, which then brings the affordability down.

Q - John Murphy {BIO 5762430 <GO>}

Okay, I'm going to ask you a follow-up to that. And you want to say, hey, listen, we just can't answer because we're not talking about it yet. I think you said the footprint of Escape with the interior of an Explorer.

A - John T. Lawler {BIO 17882934 <GO>}

Yeah.

Q - John Murphy {BIO 5762430 <GO>}

Okay. All right. So that means that changes the game, right? Because the Explorer as you take almost the heart of the US market. If you can give it to somebody in that performance range, they would lap it up all day long.

A - John T. Lawler {BIO 17882934 <GO>}

Yeah. And so you think about it, you could probably do the footprint of an Explorer with the interior of an Expedition. I think it's basically it's not exact, but it's almost one size from the exterior to the interior degree of freedom that you can do with an EV.

Q - John Murphy {BIO 5762430 <GO>}

So this is not recreating the Pinto. This is recreating an Escape size, size exterior with a big interior?

A - John T. Lawler {BIO 17882934 <GO>}

Yeah. It could be an SUV, it could be a truck, it could be a van. It could be a lot of different things.

Q - John Murphy {BIO 5762430 <GO>}

Now, I guess you guys have talked about that vehicle coming out in 2025. I think that's what the statements have been. Is that something where it would be revealed in 2025 or SOP would be 2025 or is that still TBD?

A - John T. Lawler {BIO 17882934 <GO>}

That's still TBD.

Q - John Murphy {BIO 5762430 <GO>}

Okay. And if we think about the gen one product being essentially Mach-E, gen two, and then gen three, which you guys have talked about, is this vehicle is separate from that development process?

A - John T. Lawler {BIO 17882934 <GO>}

Yeah. So hopefully I can clarify this without adding confusion. So check me on it. So gen one, of course, was the lightning, the Mach-E in the transit van, right? The e-van, e-transit van. So gen two, we've been talking about gen two, but I don't think we can

think about it as gen two. I think it's our next EV platforms. And there's one that is the ground up pickup and then the potential to have other vehicles off that platform.

And then there is the small platform that we're developing. And I wouldn't think about them as gen two or gen three. I'd just say it's our next generation platforms, and one's a larger platform and one's a smaller platform.

Q - John Murphy {BIO 5762430 <GO>}

Got it. Okay, so the (Technical Difficulty) the coming of gen two. Okay. Is the same group making the ground-up pickup to the small platform, or is it?

A - John T. Lawler {BIO 17882934 <GO>}

No. The small platform is a group of individuals. We call it our skunkworks in California, led by Alan Clarke, who came from Tesla. And it's a group of individuals that he's recruited into the company to develop this platform in a different way.

And I think that's important to understand because cost is critical on this platform, and it's the next leap forward in the design and how you design, manufacture, and develop an electric vehicle platform.

Q - John Murphy {BIO 5762430 <GO>}

Exciting. So it sounds like there's a greater recognition. It's the full package as opposed to just a hyper-focus just on the battery, right? Than it's (Multiple Speakers). It is the total vehicle integration?

A - John T. Lawler {BIO 17882934 <GO>}

It is the total vehicle integration, complete systems design. Not a waterfall process, an agile process, completely different design process from what traditional OEMs have designed -- have used to design vehicles over the years.

And there's a thought out there about how are the Chinese able to design their electric vehicles so quickly relative to what the traditional OEMs are taking? It's a different approach. It's an agile approach. It's not the traditional waterfall approach that we've had for decades. And Alan and his team are using that type of approach to design this vehicle.

Q - John Murphy {BIO 5762430 <GO>}

So if you think about those products, I mean, is this an acceptance that battery technology might not make breakthroughs? Or, I mean, how do you think about sort of the potential for battery product -- battery technology in the context of this? I mean, we had quantum scape on there, and they sound like they have some really interesting things. Not to say it's going to be solid state, but how do you think about the technological breakthroughs in batteries on costs, efficiency, and it's all kind of intertwined to make the future of EVs work for Ford?

A - John T. Lawler {BIO 17882934 <GO>}

That's going to have to continue. It's got to be a core part of it. The battery technology is going to have to advance, especially when you start to get into advanced duty cycles, right? You can' -- the technologies that exist today are not going to allow you to put a battery in a vehicle that has a high towing duty cycle.

It's just not going to work. The battery will have to be too big. So there's going to have to be advances in the technology, and that'll cascade down and that'll be available to smaller vehicles.

But then that'll help drive down cost in the future because less battery, more efficiency, quicker charge times, et cetera.

Q - John Murphy {BIO 5762430 <GO>}

And when you think about getting to breakeven or potentially the -- I think the ultimate target of mid to high single digit EBIT profit margins on gen two products, I don't know if you can give us sort of an idea of volumes to get there, time frame to get there.

What drives the $5.5 billion losses to something that would be nice? Good, positive profit generation?

A - John T. Lawler {BIO 17882934 <GO>}

Yeah. Hurdling all the time.

Q - John Murphy {BIO 5762430 <GO>}

Yeah. The way we are, hopefully. Yeah.

A - John T. Lawler {BIO 17882934 <GO>}

Yeah.

Q - John Murphy {BIO 5762430 <GO>}

We had Edwin Moses to clear the hurdle, but, I mean, this is going to have to be real.

A - John T. Lawler {BIO 17882934 <GO>}

Yeah. So it has to be real. And some would say we're exposed because you can see exactly where we're at and the progress that we're going to make. But I think, some might say that's a bad thing. I think the transparency is a good thing, especially for our investors. So battery technology is a big part of it and advances in battery technology, but then again, it's the integrated system design, and it's the complete process that we're using from a ground-up standpoint.

And so although the group in California is designing the platform separate from the larger vehicle platform, remember, Doug's in charge of both.

Q - John Murphy {BIO 5762430 <GO>}

Yeah, yeah, yeah.

A - John T. Lawler {BIO 17882934 <GO>}

Right. And so Doug is leading both of those, and he's bringing as much back into our larger platform that the next lightning pickup truck will be on or pickup truck will be on. I don't know that it's going to be called lightning. So now I'm getting out of my comfort zone there. So no one says it's the next lightning, it's the next pickup truck. But, yeah, John, it absolutely has to be breakthroughs from a battery standpoint, from the ground up design, moving into a more efficient design, less complexity.

And then, of course, the electrical architecture is going to play a role in that and providing more advanced interface from that standpoint, the ability to provide services and experiences, improving the manufacturing ability of the vehicle, designing better for manufacturing. So all of those things are coming into play to improve the margins. And as I said earlier, the most important thing is the EV business.

Model E has to stand on its own. It has to get there, and it's going to be through these next generations that will get to those points, or we are not going to move forward and we said that.

Q - John Murphy {BIO 5762430 <GO>}

Is there any potential that you would tag on to that high to mid-single-digit EBIT margin incremental services and post-sale -- sales in profit to get to that adequate margin in return for Model E in a way that you're not currently doing it for Ford Blue? And assuming you have a higher attach with those kinds of consumers in that kind of product?

A - John T. Lawler {BIO 17882934 <GO>}

So there is services, revenue and margin assumes but I wouldn't say that, in that time period that we're assuming it's going to be that much different than what we'd see on the Blue side.

Q - John Murphy {BIO 5762430 <GO>}

Got it. IRA, we didn't even ask about that yet, and we're talking about Model E. What is your -- I mean, what is your take on how good that is for Ford at the moment as far as you're making these EVs more affordable And what do you think the risk is and how would the business shift if consumer incentives were somehow canceled post-November election? Maybe utilization out of it, if these got rolled back for whatever reason they got, they got rolled back, how impactful do you think that would be in the way you think about development Model E here in North America?

A - John T. Lawler {BIO 17882934 <GO>}

Yeah, so, I think first of all, we think that the probability that there could be rolled back quickly is relatively low. But never say never. Clearly, it's going to add to an affordability issue for consumers. And so it's going to put more pressure on the business. But that's why, I think you know the ramp and what we're seeing as far as the rollout is important from the standpoint of the technologies and the efficiencies that we need to bring forward.

So, it's just another reason why it's important that in our next-gen and then the generation after that, we're continuing to drive those new technologies from better standpoint, the efficiencies et cetera. Because eventually, they do roll off, right? And as the business needs to stand on its own. So it's going to come down to affordability and if they were to go away, that's going to be the issue is either the advance is going to come down because the price is going to have to is going to be higher or the OEMs are going to have to find offsets.

Q - John Murphy {BIO 5762430 <GO>}

And the change in the EPA revision in these final rules that we'll see what final in a year or two ratings shift, right? There is nothing final unfortunately from the regulatory front, which I feel for you guys to that makes it very difficult to run and run the business and allocate capital. But based on what you know right now, does that glide path match more what you think is going to -- going on in the market and allow you to operate the business more efficiently and more directed at what's happening in the market as opposed to have to meet some onerous near-term regulations. Tough in the long-term, but I mean, it gives you a little bit of breathing room here in the near-term?

A - John T. Lawler {BIO 17882934 <GO>}

Yeah, they're ambitious in challenging I would say that. That's for sure. But I do think that EPA has been working with us to better construct the ramp for those consistent with how we're seeing EVs come in and what we're seeing in the marketplace. But by no means, they are ambitious and challenging. But one of the things that is important for us is that we continue to have hybrid technologies. We continue to invest in them. We've been building hybrids for 20 years.

And we never pulled back from them. And we see that as an important part of that bridge and that transition over the next, let's say, five years. As we move through the rest of the decade of how you meet that compliance. But we're going to continue to provide HEVs, plug-in hybrids, battery-electric vehicles, exciting products where our customers are going to love that will allow us to meet those requirements.

Q - John Murphy {BIO 5762430 <GO>}

Competitive landscape is shifting quite a bit. Chinese vehicles were net exported 2.6 million units last year, three years prior essentially none. So not only you are facing great competition in the domestic market in China. You starting to face these companies and these vehicles are around the world. How do you keep up with them,

Executive summary

Electric car sales break new records with momentum expected to continue through 2023

Electric car markets are seeing exponential growth as sales exceeded 10 million in 2022. A total of 14% of all new cars sold were electric in 2022, up from around 9% in 2021 and less than 5% in 2020. Three markets dominated global sales. China was the frontrunner once again, accounting for around 60% of global electric car sales. More than half of the electric cars on roads worldwide are now in China and the country has already exceeded its 2025 target for new energy vehicle sales. In Europe, the second largest market, electric car sales increased by over 15% in 2022, meaning that more than one in every five cars sold was electric. Electric car sales in the United States – the third largest market – increased 55% in 2022, reaching a sales share of 8%.

Electric car sales are expected to continue strongly through 2023. Over 2.3 million electric cars were sold in the first quarter, about 25% more than in the same period last year. We currently expect to see 14 million in sales by the end of 2023, representing a 35% year-on-year increase with new purchases accelerating in the second half of this year. As a result, electric cars could account for 18% of total car sales across the full calendar year. National policies and incentives will help bolster sales, while a return to the exceptionally high oil prices seen last year could further motivate prospective buyers.

There are promising signs for emerging electric vehicle (EV) markets, albeit from a small base. Electric car sales are generally low outside the major markets, but 2022 was a growth year in India, Thailand and Indonesia. Collectively, sales of electric cars in these countries more than tripled compared to 2021, reaching 80 000. For Thailand, the share of electric cars in total sales came in at slightly over 3% in 2022, while both India and Indonesia averaged around 1.5% last year. In India, EV and component manufacturing is ramping up, supported by the government's USD 3.2 billion incentive programme that has attracted investments totalling USD 8.3 billion. Thailand and Indonesia are also strengthening their policy support schemes, potentially providing valuable experience for other emerging market economies seeking to foster EV adoption.

Landmark EV policies are driving the outlook for EVs closer to climate ambitions

Market trends and policy efforts in major car markets are supporting a bright outlook for EV sales. Under the IEA Stated Policies Scenario (STEPS), the global outlook for the share of electric car sales based on existing policies and firm objectives has increased to 35% in 2030, up from less than 25% in the previous outlook. In the projections, China retains its position as the largest market for electric cars with 40% of total sales by 2030 in the STEPS. The United States doubles its market share to 20% by the end of the decade as recent policy announcements drive demand, while Europe maintains its current 25% share.

Projected demand for electric cars in major car markets will have profound implications on energy markets and climate goals in the current policy environment. Based on existing policies, oil demand from road transport is projected to peak around 2025 in the STEPS, with the amount of oil displaced by electric vehicles exceeding 5 million barrels per day in 2030. In the STEPS, emissions of around 700 Mt CO_2-equivalents are avoided by the use of electric cars in 2030.

The European Union and the United States have passed legislation to match their electrification ambitions. The European Union adopted new CO_2 standards for cars and vans that are aligned with the 2030 goals set out in the Fit for 55 package. In the United States, the Inflation Reduction Act (IRA), combined with adoption of California's Advanced Clean Cars II rule by a number of states, could deliver a 50% market share for electric cars in 2030, in line with the national target. The implementation of the recently proposed emissions standards from the US Environmental Protection Agency is set to further increase this share.

Battery manufacturing continues to expand, encouraged by the outlook for EVs. As of March 2023, announcements on battery manufacturing capacity delivered by 2030 are more than sufficient to meet the demand implied by government pledges and would even be able to cover the demand for electric vehicles in the Net Zero Emissions by 2050 Scenario. It is therefore well possible that higher shares of sales are achievable for electric cars than those anticipated on the basis of current government policy and national targets.

As spending and competition increase, a growing number of more affordable models come to market

Global spending on electric cars exceeded USD 425 billion in 2022, up 50% relative to 2021. Only 10% of the spending can be attributed to government support, the remainder was from consumers. Investors have also maintained confidence in EVs, with the stocks of EV-related companies consistently

outperforming traditional carmakers since 2019. Venture capital investments in start-up firms developing EV and battery technologies have also boomed, reaching nearly USD 2.1 billion in 2022, up 30% relative to 2021, with investments increasing in batteries and critical minerals.

SUVs and large cars dominate available electric car options in 2022. They account for 60% of available BEV options in China and Europe and an even greater share in the United States, similar to the trend towards SUVs seen in internal combustion engine (ICE) car markets. In 2022, ICE SUVs emitted over 1 Gt CO_2, far greater than the 80 Mt net emissions reductions from the electric vehicle fleet that year. Battery electric SUVs often have batteries that are two- to three-times larger than small cars, requiring more critical minerals. However, last year electric SUVs resulted in the displacement of over 150 000 barrels of oil consumption per day and avoided the associated tailpipe emissions that would have been generated through burning the fuel in combustion engines.

The electric car market is increasingly competitive. A growing number of new entrants, primarily from China but also from other emerging markets, are offering more affordable models. Major incumbent carmakers are increasing ambition as well, especially in Europe, and 2022-2023 saw another series of important EV announcements: fully electric fleets, cheaper cars, greater investment, and vertical integration with battery-making and critical minerals.

Consumers can choose from an increasing number of options for electric cars. The number of available electric car models reached 500 in 2022, more than double the options available in 2018. However, outside of China, there is a need for original equipment manufacturers (OEMs) to offer affordable, competitively priced options in order to enable mass adoption of EVs. Today's level of available electric car models is still significantly lower than the number of ICE options on the market, but the number of ICE models available has been steadily decreasing since its peak in the mid-2010s.

Focus expands to electrification of more vehicle segments as electric cars surge ahead

Electrification of road transport goes beyond cars. Two or three-wheelers are the most electrified market segment today; in emerging markets and developing economies, they outnumber cars. Over half of India's three-wheeler registrations in 2022 were electric, demonstrating their growing popularity due to government incentives and lower lifecycle costs compared with conventional models, especially in the context of higher fuel prices. In many developing economies, two/three-wheelers offer an affordable way to get access to mobility, meaning their electrification is important to support sustainable development.

The commercial vehicle stock is also seeing increasing electrification. Electric light commercial vehicle (LCV) sales worldwide increased by more than 90% in 2022 to more than 310 000 vehicles, even as overall LCV sales declined by nearly 15%. In 2022, nearly 66 000 electric buses and 60 000 medium- and heavy-duty trucks were sold worldwide, representing about 4.5% of all bus sales and 1.2% of truck sales. Where governments have committed to reduce emissions from public transport, such as in dense urban areas, electric bus sales reached even higher shares; in Finland, for example, electric bus sales accounted for over 65% in 2022.

Ambition with respect to electrifying heavy-duty vehicles is growing. In 2022, around 220 electric heavy-duty vehicle models entered the market, bringing the total to over 800 models offered by well over 100 OEMs. A total of 27 governments have pledged to achieve 100% ZEV bus and truck sales by 2040 and both the United States and European Union have also proposed stronger emissions standards for heavy-duty vehicles.

EV supply chains and batteries gain greater prominence in policy-making

The increase in demand for electric vehicles is driving demand for batteries and related critical minerals. Automotive lithium-ion (Li-ion) battery demand increased by about 65% to 550 GWh in 2022, from about 330 GWh in 2021, primarily as a result of growth in electric passenger car sales. In 2022, about 60% of lithium, 30% of cobalt and 10% of nickel demand was for EV batteries. Only five years prior, these shares were around 15%, 10% and 2%, respectively. Reducing the need for critical materials will be important for supply chain sustainability, resilience and security, especially given recent price developments for battery material.

New alternatives to conventional lithium-ion are on the rise. The share of lithium-iron-phosphate (LFP) chemistries reached its highest point ever, driven primarily by China: around 95% of the LFP batteries for electric LDVs went into vehicles produced in China. Supply chains for (lithium-free) sodium-ion batteries are also being established, with over 100 GWh of manufacturing capacity either currently operating or announced, almost all in China.

The EV supply chain is expanding, but manufacturing remains highly concentrated in certain regions, with China being the main player in battery and EV component trade. In 2022, 35% of exported electric cars came from China, compared with 25% in 2021. Europe is China's largest trade partner for both electric cars and their batteries. In 2022, the share of electric cars manufactured in China and sold in the European market increased to 16%, up from about 11% in 2021.

EV supply chains are increasingly at the forefront of EV-related policy-making to build resilience through diversification. The Net Zero Industry Act, proposed by the European Union in March 2023, aims for nearly 90% of the European Union's annual battery demand to be met by EU battery manufacturers, with a manufacturing capacity of at least 550 GWh in 2030. Similarly, India aims to boost domestic manufacturing of electric vehicles and batteries through Production Linked Incentive (PLI) schemes. In the United States, the Inflation Reduction Act emphasises the strengthening of domestic supply chains for EVs, EV batteries and battery minerals, laid out in the criteria to qualify for clean vehicle tax credits. As a result, between August 2022 and March 2023, major EV and battery makers announced cumulative post-IRA investments of at least USD 52 billion in North American EV supply chains – of which 50% is for battery manufacturing, and about 20% each for battery components and EV manufacturing.

Trends and developments in EV markets

Electric light-duty vehicles

Electric car sales continue to increase, led by China

Electric car sales [1] saw another record year in 2022, despite supply chain disruptions, macro-economic and geopolitical uncertainty, and high commodity and energy prices. The growth in electric car sales took place in the context of globally contracting car markets: total car sales in 2022 dipped by 3% relative to 2021. Electric car sales – including battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) – exceeded 10 million last year, up 55% relative to 2021.[2] This figure – 10 million EV sales worldwide – exceeds the total number of cars sold across the entire European Union (about 9.5 million vehicles) and is nearly half of the total number of cars sold in China in 2022. In the course of just five years, from 2017 to 2022, EV sales jumped from around 1 million to more than 10 million. It previously took five years from 2012 to 2017 for EV sales to grow from 100 000 to 1 million, underscoring the exponential nature of EV sales growth. The share of electric cars in total car sales jumped from 9% in 2021 to 14% in 2022, more than 10 times their share in 2017.

Over 26 million electric cars were on the road in 2022, up 60% relative to 2021 and more than 5 times the stock in 2018

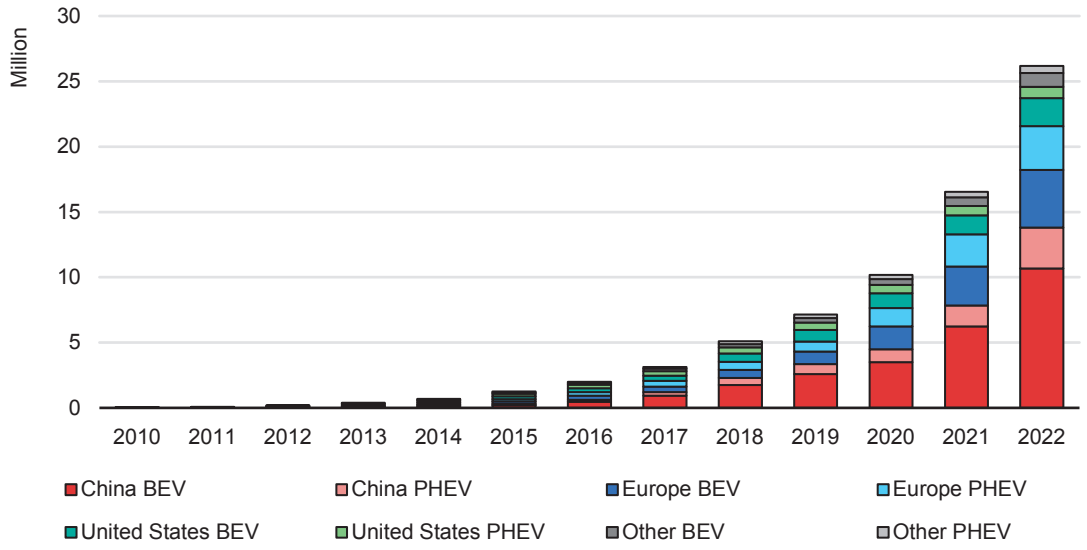
Increasing sales pushed the total number of electric cars on the world's roads to 26 million, up 60% relative to 2021, with BEVs accounting for over 70% of total annual growth, as in previous years. As a result, about 70% of the global stock of electric cars in 2022 were BEVs. The increase in sales from 2021 to 2022 was just as high as from 2020 to 2021 in absolute terms – up 3.5 million – but relative growth was lower (sales doubled from 2020 to 2021). The exceptional boom in 2021 may be explained by EV markets catching up in the wake of the coronavirus

[1] The term sales, as used in this report, represents an estimate of the number of new vehicles hitting the roads. Where possible, data on new vehicle registrations is used. In some cases, however, only data on retail sales (such as sales from a dealership) are available. See Box 1.2 for further details. The term car is used to represent passenger light-duty vehicles and includes cars of different sizes, sports utility-vehicles and light trucks.

[2] Unless otherwise specified, the term electric vehicle is used to refer to both battery electric and plug-in hybrid electric vehicles but does not include fuel cell electric vehicles. For a brief description of the trends related to fuel cell electric vehicles, see Box 1.3.

(Covid-19) pandemic. Seen in comparison to recent years, the annual growth rate for electric car sales in 2022 was similar to the average rate over 2015-2018, and the annual growth rate for the global stock of electric cars in 2022 was similar to that of 2021 and over the 2015-2018 period, showing a robust recovery of EV market expansion to pre-pandemic pace.

Figure 1.1 Global electric car stock in selected regions, 2010-2022



Notes: BEV = battery electric vehicle; PHEV = plug-in hybrid electric vehicle. Electric car stock in this figure refers to passenger light-duty vehicles. In "Europe", European Union countries, Norway, and the United Kingdom account for over 95% of the EV stock in 2022; the total also includes Iceland, Israel, Switzerland and Türkiye. Main markets in "Other" include Australia, Brazil, Canada, Chile, Mexico, India, Indonesia, Japan, Malaysia, New Zealand, South Africa, Korea and Thailand.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Source: IEA analysis based on country submissions, ACEA, EAFO, EV Volumes and Marklines.

Over 26 million electric cars were on the road in 2022, up 60% relative to 2021 and more than five times the stock in 2018.

Half of the world's electric cars are in China

The increase in electric car sales varied across regions and powertrains, but remains dominated by the People's Republic of China (hereafter "China"). In 2022, BEV sales in China increased by 60% relative to 2021 to reach 4.4 million, and PHEV sales nearly tripled to 1.5 million. The faster growth in PHEV sales relative to BEVs warrants further examination in the coming years, as PHEV sales still remain lower overall and could be catching up on the post-Covid-19 boom only now; BEV sales in China tripled from 2020 to 2021 after moderate growth over 2018-2020. Electric car sales increased even while total car sales dipped by 3% in 2022 relative to 2021.

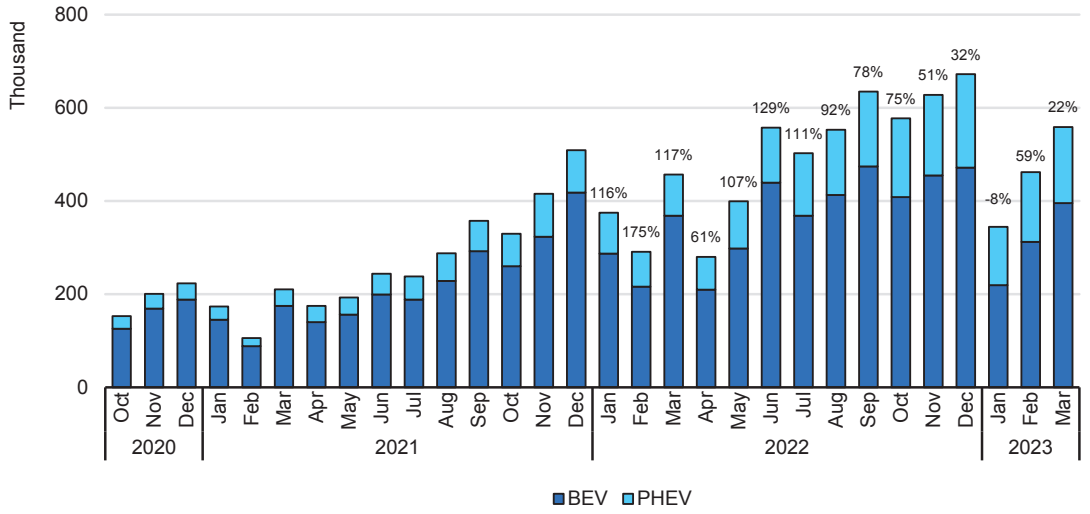
China accounted for nearly 60% of all new electric car registrations globally. For the first time in 2022, China accounted for more than 50% of all the electric cars on the world's roads, a total of 13.8 million. This strong growth results from more than a decade of sustained policy support for early adopters, including an extension of purchase incentives initially planned for phase-out in 2020 to the end of 2022 due to Covid-19, in addition to non-financial support such as rapid roll-out of charging infrastructure and stringent registration policies for non-electric cars.

In 2022, the share of electric cars in total domestic car sales reached 29% in China, up from 16% in 2021 and under 6% between 2018 and 2020. China has therefore achieved its 2025 national target of a 20% sales share for so-called new energy vehicles (NEVs)[3] well in advance. All indicators point to further growth: although the national NEV sales target is yet to be updated by China's Ministry of Industry and Information Technology (MIIT), which is responsible for the automotive industry, the objective of greater road transport electrification is re-affirmed in multiple strategy documents. China aims to reach a 50% sales share by 2030 in so-called "key air pollution control regions", and 40% across the country by 2030 to support the national action plan for carbon peaking. If recent market trends continue, China's 2030 targets may also be reached ahead of time. Provincial governments are also supporting adoption of NEVs, with 18 provinces to date having set NEV targets.

Support at the regional level in China has also helped to advance some of the world's largest EV makers. Shenzhen-based BYD has supplied most of the city's electric buses and taxis, and its leading position is also reflected in Shenzhen's ambition of reaching a 60% NEV sales share by 2025. Guangzhou, which has a 50% NEV sales share by 2025 target, facilitated the expansion of Xpeng Motors to become one of the national EV frontrunners.

[3] NEVs (China) include BEVs, PHEVs and fuel cell electric vehicles.

Figure 1.2 Monthly new electric car registrations in China, 2020-2023



Note: BEV = battery electric vehicle; PHEV = plug-in hybrid electric vehicle. Percentage labels in 2022-2023 refer to year-on-year growth rates relative to the same month in the previous year.
Source: IEA analysis based on EV Volumes.

Electric car sales in China have been steadily increasing since 2020, but future trends will warrant further examination given that purchase incentives ended in 2022.

Whether China's electric car sales share will remain significantly above the 20% target in 2023 remains uncertain, as sales may have been especially high in anticipation of incentives being phased out at the end of 2022. Sales in January 2023 plunged, and while this is in part due to the timing of the Chinese New Year, they were nearly 10% lower than sales in January 2022. However, electric car sales caught up in February and March 2023, standing nearly 60% above sales in February 2022 and more than 25% above sales in March 2022, thereby bringing sales in the first quarter of 2023 more than 20% higher than in the first quarter of 2022.

Growth remained steady in Europe despite disruptions

In Europe,[4] electric car sales increased by more than 15% in 2022 relative to 2021 to reach 2.7 million. Sales grew more quickly in previous years: annual growth stood at more than 65% in 2021 and averaged 40% over 2017-2019. In 2022, BEV sales rose by 30% relative to 2021 (compared to 65% growth in 2021 relative to 2020) while PHEV sales dipped by around 3%. Europe accounted for 10% of global growth in new electric car sales. Despite slower growth in 2022, electric car

[4] Europe includes European Union countries, Iceland, Israel, Norway, Switzerland, Türkiye, and the United Kingdom.

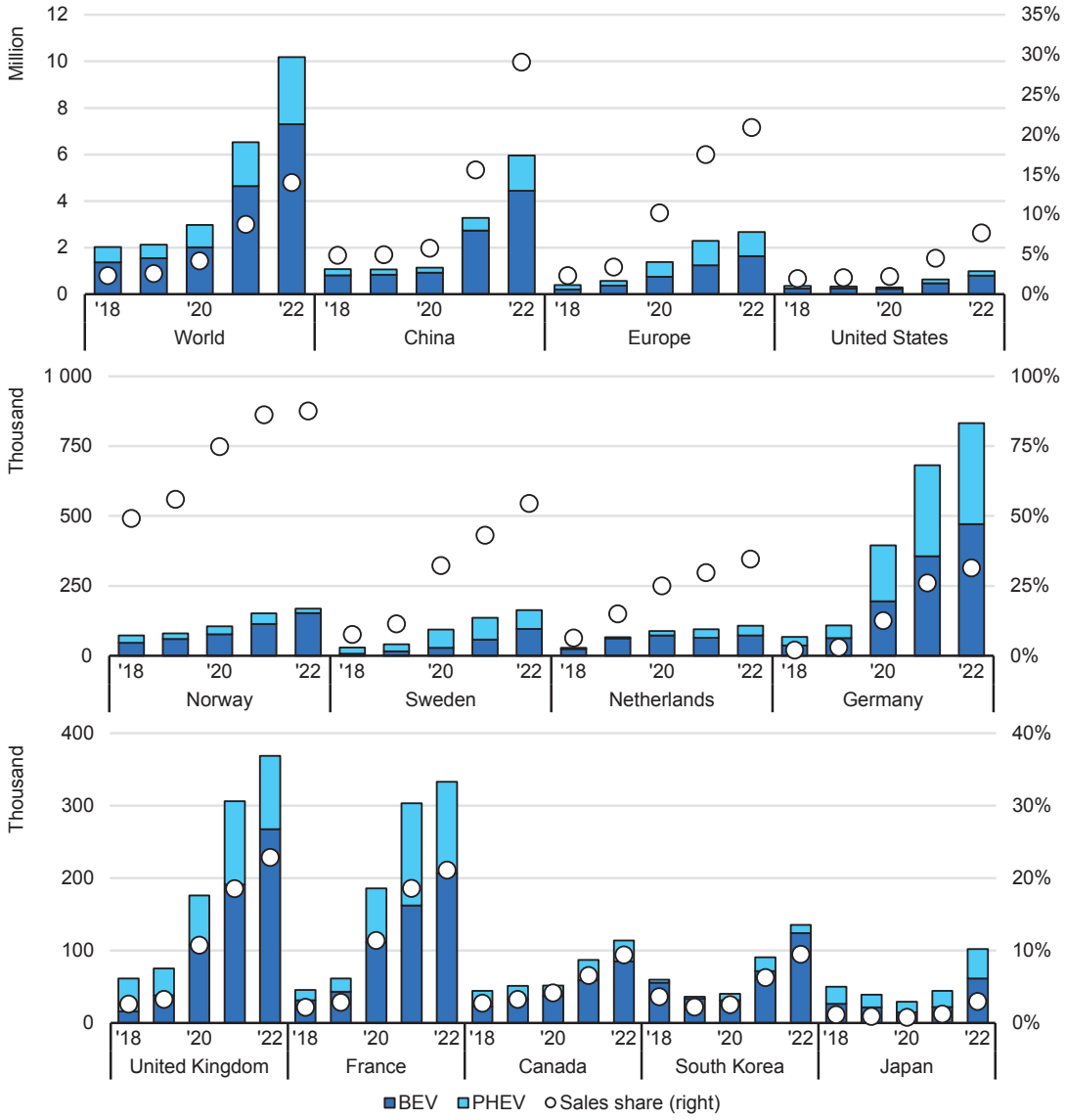
sales are still increasing in Europe in the context of continued contraction in car markets: total car sales in Europe dipped by 3% in 2022 relative to 2021.

The slowdown seen in Europe relative to previous years was, in part, a reflection of the exceptional growth in electric car sales that took place in 2020 and 2021 in the European Union, as manufacturers quickly adjusted corporate strategy to comply with the CO_2 emission standards passed in 2019. These standards covered the 2020-2024 period, with EU-wide emission targets becoming stricter only from 2025 and 2030 onwards.

High energy prices in 2022 had a mixed impact on the competitiveness of EVs relative to internal combustion engine (ICE) cars. Gasoline and diesel prices for ICE cars spiked, but residential electricity tariffs (with relevance for charging) also increased in some cases. Higher electricity and gas prices also increased manufacturing costs for both ICE and EV cars, with some carmakers arguing that high energy prices could restrict future investment for new battery manufacturing capacity.

Europe remained the world's second largest market for electric cars after China in 2022, accounting for 25% of all electric car sales and 30% of the global stock. The sales share of electric cars reached 21%, up from 18% in 2021, 10% in 2020 and under 3% prior to 2019. European countries continued to rank highly for the sales share of electric cars, led by Norway at 88%, Sweden at 54%, the Netherlands at 35%, Germany at 31%, the United Kingdom at 23% and France at 21% in 2022. In volume terms, Germany is the biggest market in Europe with sales of 830 000 in 2022, followed by the United Kingdom with 370 000 and France with 330 000. Sales also exceeded 80 000 in Spain. The share of electric cars in total car sales has increased tenfold in Germany since before the Covid-19 pandemic, which can in part be explained by increasing support post-pandemic, such as purchase incentives through the Umweltbonus, and a frontloading of sales in 2022 in expectation of subsidies being further reduced from 2023 onwards. However, in Italy, electric car sales decreased from 140 000 in 2021 to 115 000 in 2022, and they also decreased or stagnated in Austria, Denmark and Finland.

Figure 1.3 Electric car registrations and sales share in selected countries and regions, 2018-2022



Notes: BEV = battery electric vehicle; PHEV = plug-in hybrid electric vehicle. Passenger light-duty vehicles only. Major markets at the top. Other countries (middle, bottom) ordered by the share of electric car sales in total car sales. Y-axes do not have the same scale to improve readability.

Source: IEA analysis based on country submissions, ACEA, EAFO, EV Volumes and Marklines.

Electric car sales exceeded 10 million in 2022, up 55% relative to 2021. Sales in China increased by 80% and accounted for 60% of global growth. Growth in Europe remained high (up 15%) and accelerated in the United States (up 55%).

Sales are expected to continue increasing in Europe, especially following recent policy developments under the 'Fit for 55' package. New rules set stricter CO_2 emission standards for 2030-2034 and target a 100% reduction in CO_2 emissions for new cars and vans from 2035 relative to 2021 levels. In the nearer term, an

incentive mechanism operating between 2025 and 2029 will reward manufacturers that achieve a 25% car sales share of zero- and low-emission cars (17% for vans). In the first two months of 2023, battery electric car sales were already up by over 30% year-on-year, while overall car sales increased by just over 10% year-on-year.

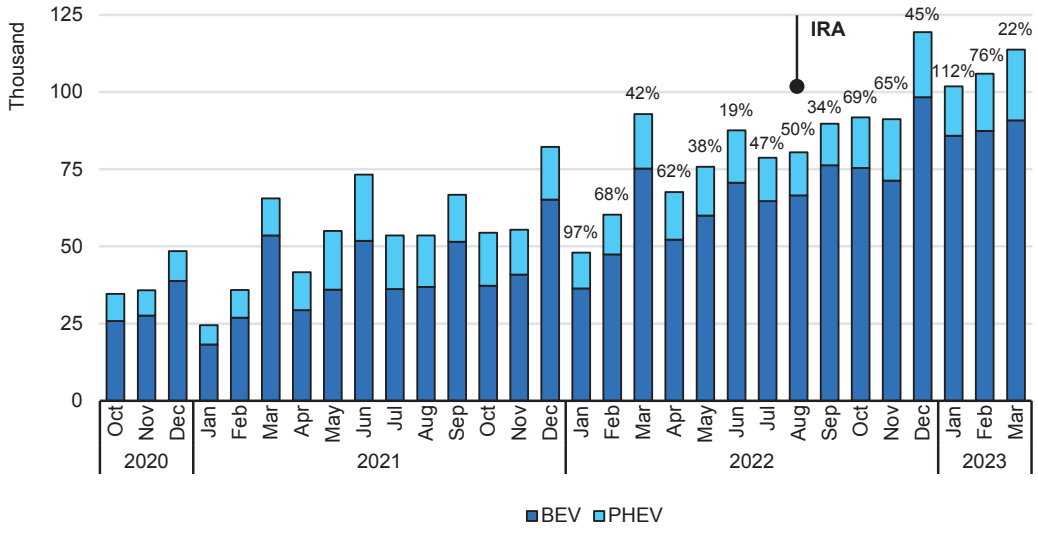
The United States confirms return to growth

In the United States, electric car sales increased 55% in 2022 relative to 2021, led by BEVs. Sales of BEVs increased by 70%, reaching nearly 800 000 and confirming a second consecutive year of strong growth after the 2019-2020 dip. Sales of PHEVs also grew, albeit by only 15%. The increase in electric car sales was particularly high in the United States, considering that total car sales dropped by 8% in 2022 relative to 2021, a much sharper decrease than the global average (minus 3%). Overall, the United States accounted for 10% of the global growth in sales. The total stock of electric cars reached 3 million, up 40% relative to 2021 and accounting for 10% of the global total. The share of electric cars in total car sales reached nearly 8%, up from just above 5% in 2021 and around 2% between 2018 and 2020.

A number of factors are helping to increase sales in the United States. A greater number of available models, beyond those offered by Tesla, the historic leader, helped to close the supply gap. Given that major companies like Tesla and General Motors had already reached their subsidy cap under US support in previous years,[5] new models from other companies being available means that more consumers can benefit from purchase incentives, which can be as high as USD 7 500. Awareness is increasing as government and companies lean towards electrification: in 2022, a quarter of Americans expect that their next car will be electric, according to the American Automobile Association. Although charging infrastructure and driving range have improved over the years, they remain major concerns for US drivers given the typically long travel distances and lower popularity and limited availability of alternatives such as rail. However, in 2021 the Bipartisan Infrastructure Law strengthened support for EV charging, allocating USD 5 billion in total funding over the 2022-2026 period through the National Electric Vehicle Infrastructure Formula Program, as well as USD 2.5 billion in competitive grants over the same period through the Charging and Fueling Infrastructure Discretionary Grant Program.

[5] Manufacturer caps were still in place for sales taking place in 2022, with models by carmakers having sold over 200 000 EVs losing eligibility for the purchase incentive, even if they were manufactured in North America following requirements under the IRA. Caps were removed starting from 2023.

Figure 1.4 Monthly new electric car registrations in the United States, 2020-2023



Notes: BEV = battery electric vehicle; PHEV = plug-in hybrid electric vehicle; "IRA" refers to the Inflation Reduction Act. Percentage labels in 2022-2023 refer to year-on-year growth rates relative to the same month in the previous year.
Source: IEA analysis based on EV Volumes.

Monthly sales of electric cars have been steadily increasing in the United States, with further growth expected in 2023 as a result of strengthened policy support.

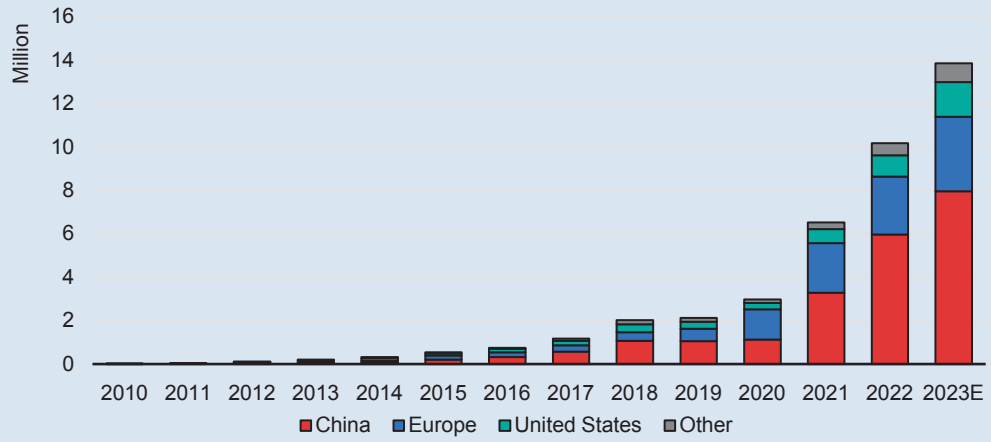
The acceleration in sales growth could continue in 2023 and beyond thanks to recent new policy support (see Prospects for electric vehicle deployment). The Inflation Reduction Act (IRA) has triggered a rush by global electromobility companies to expand US manufacturing operations. Between August 2022 and March 2023, major EV and battery makers announced cumulative post-IRA investments of USD 52 billion in North American EV supply chains, of which 50% is for battery manufacturing, and about 20% each for battery components and EV manufacturing. Overall, company announcements including tentative commitments for US investments for future battery and EV production add up to around USD 75-108 billion. As an example, Tesla plans to relocate its Berlin-based lithium-ion battery gigafactory to Texas, where it will work in partnership with China's CATL, and to manufacture next-generation EVs in Mexico. Ford also announced a deal with CATL for a battery plant in Michigan, and plans to increase electric car manufacturing sixfold by the end of 2023 relative to 2022, at 600 000 vehicles per year, scaling up to 2 million by 2026. BMW is seeking to expand EV manufacturing at its plant in South Carolina following the IRA. Volkswagen chose Canada for its first battery plant outside Europe, which will begin operations in 2027, and is also investing USD 2 billion in its plant in South Carolina. While these investments can be expected to lead to high growth in the years to come, the impact may only fully be seen from 2024 onwards as plants come online.

In the immediate term, the IRA has constrained eligibility requirements for purchase incentives, as vehicles need to be produced in North America in order to qualify for a subsidy. However, electric car sales have remained strong since August 2022 (Figure 1.4), and the first months of 2023 have been no exception: In the first quarter of 2023, electric car sales increased 60% compared to the same period in 2022, potentially boosted by the January 2023 removal of the subsidy caps for manufacturers, which means models by market leaders can now benefit from purchase incentives. In the longer-term, the list of models eligible for subsidies is expected to expand.

Box 1.1 The 2023 outlook for electric cars is bright

Early indications from first quarter sales of 2023 point to an upbeat market, supported by cost declines as well as strengthened policy support in key markets such as the United States. Globally, our current estimate is therefore for nearly 14 million electric cars to be sold in 2023, building on the more than 2.3 million already sold in the first quarter of the year. This represents a 35% increase in electric car sales in 2023 compared to 2022 and would bring the global electric sales share to around 18%, up from 14% in 2022.

Electric car sales, 2010-2023



Note: 2023 sales ("2023E") are estimated based on market trends through the first quarter of 2023.
Source: IEA analysis based on EV Volumes.

Electric car sales in the first three months of 2023 have shown strong signs of growth compared to the same period in 2022. In the United States, more than 320 000 electric cars were sold in the first quarter of 2023, 60% more than over the same period in 2022. Our current expectation is for this growth to be sustained throughout the year, with electric car sales reaching over 1.5 million in 2023, bringing the electric car sales share in the United States up to around 12% in 2023.

In China, electric car sales were off to a rough start in 2023, with January sales being 8% lower than in January 2022. The latest available data suggests a quick recovery: over the entire first quarter of 2023, electric car sales in China were more than 20% higher than in the first quarter of 2022, with more than 1.3 million electric cars being registered. For the remainder of 2023, we expect the generally favourable cost structure of electric cars to outweigh the effects of the phase-out of the NEV subsidy. As a result, our current expectation is for electric car sales in China to be more than 30% higher than in 2022 and reach around 8 million by the end of 2023, reaching a sales share of over 35% (from 29% in 2022).

Based on recent trends and tightening CO_2 targets not going into effect until 2025, the growth of electric car sales in Europe is expected to be the lowest of the three largest markets. In the first quarter of 2023, electric car sales in Europe increased by around 10% compared to the same period in 2022. For the full year, we currently expect electric car sales to increase by over 25%, with one-in-four cars sold in Europe being electric.

Outside of the major EV markets, electric car sales are expected to reach around 900 000 in 2023 – 50% higher than in 2022. Electric car sales in India in the first quarter of 2023 are already double what they were in the same period in 2022. In India and across all regions outside the three major EV markets, electric car sales are expected to represent 2-3% of car sales in 2023, a relatively small yet growing share.

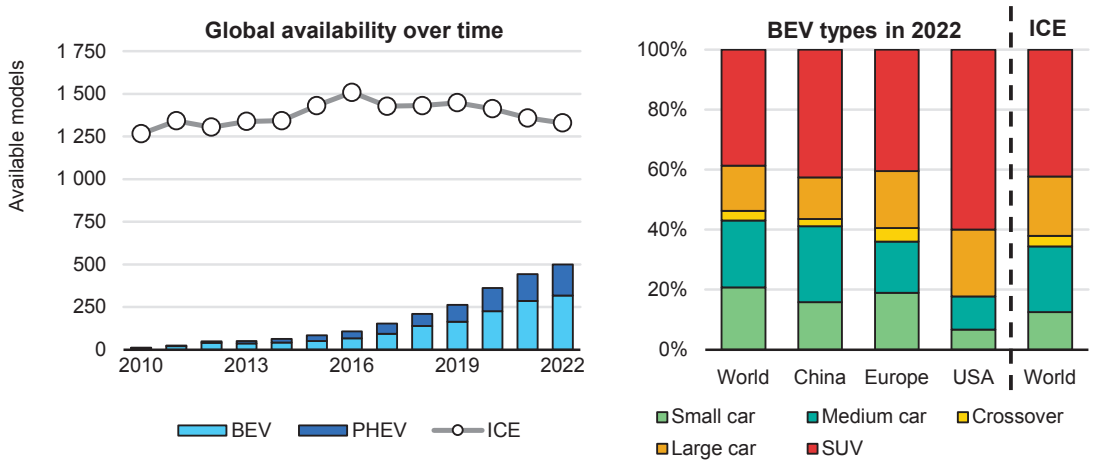
There are, of course, downside risks to the 2023 outlook: a sluggish global economy and the phase-out of subsidies for NEVs in China could reduce 2023 growth in global electric car sales. On the upside, new markets may open up more quickly than anticipated, as persistent high oil prices make the case for EVs stronger in an increasing number of settings. And new policy developments, such as the April 2023 proposal from the US Environmental Protection Agency (EPA) to strengthen GHG emissions standards for cars, may send signals that boost sales even before going into effect.

The number of electric car models rises, especially for large cars and SUVs, at the same time as it decreases for conventional cars

The race to electrification is increasing the number of electric car models available on the market. In 2022, the number of available options reached 500, up from below 450 in 2021 and more than doubling relative to 2018-2019. As in previous years, China has the broadest portfolio with nearly 300 available models, double the number available in 2018-2019, prior to the Covid-19 pandemic. This remains nearly twice as many as in Norway, the Netherlands, Germany, Sweden, France and the United Kingdom, which all have around 150 models available, more than

three times as many as before the pandemic. In the United States, there were fewer than 100 models available in 2022, but twice as many as before the pandemic; and 30 or fewer were available in Canada, Japan and Korea.

Figure 1.5 Car model availability by powertrain, 2010-2022 (left), and breakdown of available cars by powertrain and segment in 2022 (right)



Notes: BEV = battery electric vehicle; PHEV = plug-in hybrid vehicle; ICE = internal combustion engine; SUV = sports utility vehicle; USA = United States. Analysis based on models for which there was at least one new registration in a given year; a model on sale but never sold is not counted, and as such actual model availability may be underestimated. In the chart on the right-hand side, distribution is based on the number of available models, not sales-weighted. Small cars include A and B segments. Medium cars include C and D segments. Crossovers are a type of sports utility vehicle (SUV) built on a passenger car platform. Large cars include E and F segments and multi-purpose vehicles.

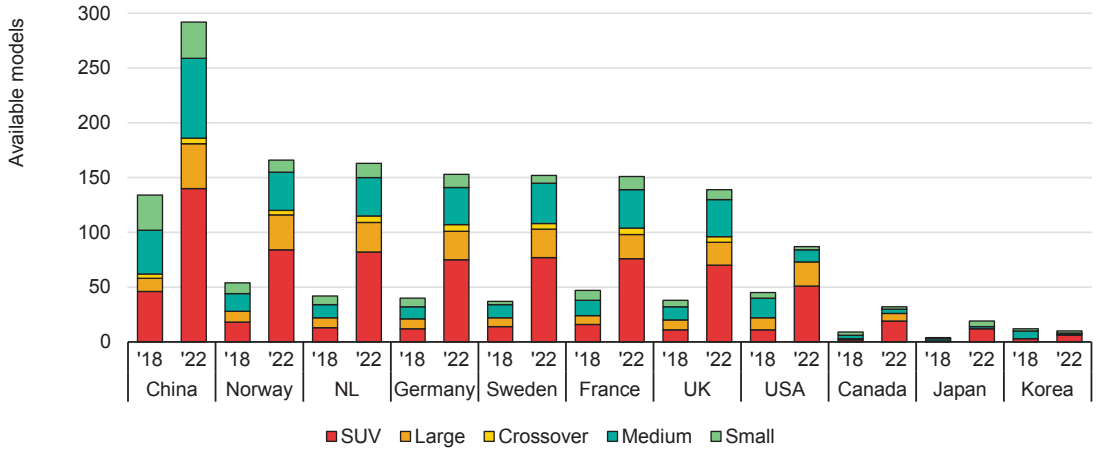
Source: IEA analysis based on Marklines.

The number of available electric car models reached 500 in 2022 but remains far below the number of ICE options. Large cars and SUVs still account for over half of available BEVs.

The 2022 trend reflects the increasing maturity of EV markets and demonstrates that carmakers are responding to increasing consumer demand for electric cars. However, the number of electric car models available remains much lower than that of conventional ICE cars, which has remained above 1 250 since 2010 and peaked at 1 500 in the middle of the past decade. In recent years, the number of ICE models sold has been steadily decreasing, at a compound annual growth rate of minus 2% over the 2016-2022 period, reaching about 1 300 models in 2022. This dip varies across major car markets and is most pronounced in China, where the number of available ICE options was 8% lower in 2022 than in 2016, versus 3-4% lower in the United States and Europe over the same period. This could result from contracting car markets and a progressive shift towards EVs among major carmakers. Looking forward, the total number of ICE models available could remain stable, while the number of new models shrinks, if carmakers focus on electrification and keep selling existing ICE options rather than increasing budgets to develop new models.

In contrast to ICE models, EV model availability has been growing quickly, at a compound annual growth rate of 30% over the 2016-2022 period. Such growth is to be expected in a nascent market with a large number of new entrants bringing innovative products to the market, and as incumbents diversify their portfolios. Growth has been slightly lower in recent years: the annual growth rate stood at around 25% in 2021 and 15% in 2022. In the future, the number of models can be expected to continue to increase quickly, as major carmakers expand their EV portfolios and new entrants strengthen their positions, particularly in emerging markets and developing economies (EMDEs). The historic number of ICE models available on the market suggests that the current number of EV options could double, at least, before stabilising.

Figure 1.6 Electric car model availability in selected countries by size, 2018-2022



Notes: NL = the Netherlands; UK = United Kingdom; USA = United States; SUV = sports utility vehicle. Includes battery electric vehicles and plug-in hybrid electric vehicles. Countries are ordered by the number of available models in 2022. Analysis based on models for which there was at least one new registration in a given year; a model on sale but never sold is not counted, and as such actual model availability may be underestimated.

Source: IEA analysis based on Marklines.

In 2022, 7 countries had around 150 EV models or more available for sale, up from 50 in 2018. The number of large models is increasing more quickly than that of small models.

SUVs and large car models dominate both EV and ICE markets

A major concern for global car markets – both EV and ICE – is the overwhelming dominance of SUVs and large models among available options. Carmakers are able to generate higher revenues from such models, given higher profit margins, which can cover some of the investments made in developing electric options. In certain cases, such as in the United States, larger vehicles can also benefit from less stringent fuel economy standards, hence creating an incentive for carmakers to slightly increase the vehicle size of a car for it to qualify as a light truck.

However, large models are more expensive, which poses significant affordability issues across the board, and all the more so in EMDEs. Large models also have

implications for sustainability and supply chains, being equipped with larger batteries that require more critical minerals. In 2022, the sales-weighted average battery size of small battery electric cars ranged from 25 kWh in China to 35 kWh across France, Germany and the United Kingdom, and about 60 kWh in the United States. In comparison, the average for battery electric SUVs was around 70-75 kWh in these countries, and within the 75-90 kWh range for large car models.

Transitioning from ICE to electric is a priority for achieving net zero emissions targets, regardless of vehicle size, but mitigating the impacts of higher battery sizes will also be important. In France, Germany and the United Kingdom in 2022, the sales-weighted average weight of a battery electric SUV was 1.5 times higher than the average small battery electric car, requiring greater amounts of steel, aluminium and plastic; the battery in the SUV was twice as large, requiring about 75% more critical minerals. The CO_2 emissions associated with materials processing, manufacturing and assembly can be estimated at more than 70% higher as a result.

At the same time, in 2022, electric SUVs resulted in the displacement of over 150 000 barrels per day of oil consumption and avoided the associated tailpipe emissions that would have been generated through burning the fuel in combustion engines. Although electric SUVs represented roughly 35% of all electric passenger light-duty vehicles (PLDVs) in 2022, their share of oil displacement was even higher (about 40%), as SUVs tend to be driven more than smaller cars. Of course, smaller vehicles generally require less energy to operate and less materials to build, but electric SUVs certainly remain favourable to ICE vehicles.

In 2022, ICE SUVs emitted more than 1 Gt CO_2, far greater than the 80 Mt net emissions reductions from the electric vehicle fleet that year. While total car sales decreased by 0.5% in 2022, SUV sales increased by 3% relative to 2021, accounting for about 45% of total car sales, with noticeable growth in the United States, India and Europe. Of the 1 300 available options for ICE cars in 2022, more than 40% were SUVs, compared to fewer than 35% for small and medium cars. The total number of available ICE options went down from 2016 to 2022, but the drop was only for small and medium cars (down 35%) while large cars and SUVs increased (up 10%).

Similar trends are observed in EV markets. Around 16% of all SUVs sold were electric in 2022, which is above the overall market share of EVs and demonstrates consumer preferences for SUVs regardless of whether they are an ICE vehicle or EV. Nearly 40% of all BEV models available in 2022 were SUVs, which is equivalent to the shares of small and medium car options combined. Other large models accounted for more than 15%. Just 3 years before, in 2019, small and medium models accounted for 60% of all available models, and SUVs just 30%.

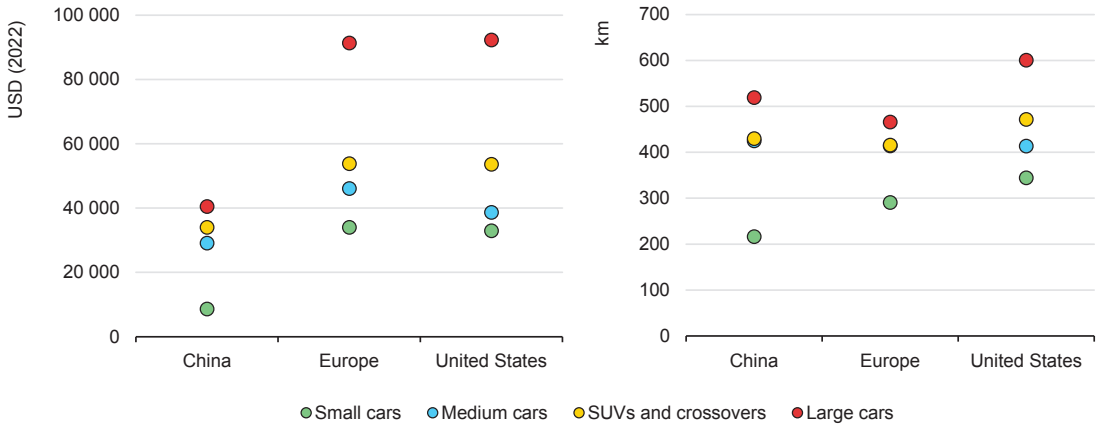
In China and Europe, SUVs and large models accounted for 60% of available BEV options in 2022, on par with the world average. As a comparison, ICE SUVs and large models accounted for about 70% of available ICE options in these regions,

suggesting that electric cars currently remain somewhat smaller than their ICE equivalents. Announcements by some major European carmakers indicate that there could be a greater focus on smaller, more popular models in the years to come. For example, Volkswagen has announced the launch of a compact model for the European market under EUR 25 000 by 2025 and under EUR 20 000 by 2026-2027, as a means to appeal to a broader consumer base. In the United States, over 80% of available BEV options in 2022 were SUVs or large car models, which is greater than the share of ICE SUVs or large models at 70%. Looking ahead, more electric SUVs are to be expected in the United States, should recent policy announcements on expansion of IRA incentives to more SUVs be implemented. Following the IRA, the US Treasury has been revising vehicle classifications, and in 2023 changed the eligibility criteria for clean vehicle credits relevant to smaller SUVs, which are now eligible if priced under USD 80 000, up from the previous limit of USD 55 000.

Electric cars remain much cheaper in China

The growth in electric car sales in China has been underpinned by sustained policy support, but also cheaper retail prices. In 2022, the sales-weighted average price of a small BEV in China was below USD 10 000. This is significantly less than the prices of small BEVs found in Europe and the United States, where the sales-weighted average price exceeded USD 30 000 in the same year.

Figure 1.7 Sales-weighted average retail price (left) and driving range (right) of BEV passenger cars in selected countries, by size, in 2022



Notes: BEV = battery electric vehicle; SUV = sports utility vehicle. 'Europe' is based on data only from France, Germany and the United Kingdom. Retail prices collected in 2022-2023, before subsidy.

Source: IEA analysis based on EV Volumes.

In 2022, BEV passenger cars remained much cheaper in China, which explains in part higher adoption rates there.

In China, the best-selling electric cars in 2022 were the Wuling Mini BEV, a small model priced at under USD 6 500, and BYD's Dolphin, another small model, below USD 16 000. Together, these two models accounted for nearly 15% of Chinese BEV passenger car sales, illustrating the appetite for smaller models. To compare, the best-selling small BEVs across France, Germany and the United Kingdom – Fiat's 500, Peugeot's e-208 and Renault's Zoe – were all priced above USD 35 000. Few small BEVs were sold in the United States, limited mainly to Chevrolet's Bolt and the Mini Cooper BEV, which are priced around USD 30 000. Tesla's Y Model was the best-selling BEV passenger car in both the selected European countries (priced at more than USD 65 000) and the United States (more than USD 50 000).[6]

Chinese carmakers have focused on developing smaller and more affordable models in advance of their international peers, cutting down costs following years of tough competition domestically. Hundreds of small EV manufacturers have entered the market since the 2000s, benefitting from a variety of public support schemes, including subsidies and incentives for both consumers and manufacturers. The majority of these firms went bankrupt due to competition as subsidies were gradually phased out, and the market has since consolidated around a dozen frontrunners, which have succeeded in developing small and cheap electric cars for the Chinese market. Vertical integration of battery and EV supply chains from mineral processing to battery and EV manufacturing, as well as cheaper labour, manufacturing and access to finance across the board, have also contributed to developing cheaper models.

Meanwhile, carmakers in Europe and the United States – both early developers such as Tesla and incumbent major manufacturers – have mostly focused on larger or more luxurious models to date, hence offering few options affordable for mass-market consumers. However, the small options available in these countries typically offer greater performance than those in China, such as longer driving range. In 2022, the sales-weighted average range of small BEVs sold in the United States was nearly 350 km, while in France, Germany and the United Kingdom it was just under 300 km, compared to under 220 km in China. For other segments, the differences are less significant. The broader availability of public charging points in China may, in part, explain why consumers there have been more willing to opt for lower driving ranges than their European or American counterparts.

In 2022, Tesla heavily reduced the price of its models on two occasions as competition increased, and many carmakers have also announced cheaper options in the coming years. While these announcements warrant further examination, this trend could indicate that the price gap between small electric cars and incumbent ICE options could progressively close during this decade.

[6] However, Tesla has decreased car prices several times since the publication of the IRA in the United States, in part to boost sales as competition gets tougher (see section on corporate strategy and finance).

Actual vehicle range depends on the loaded vehicle weight, duty cycle, aerodynamics and drivetrain efficiency, as well as environmental factors such as temperature. In addition, as no harmonised test procedure currently exists to measure electric range for medium- and heavy-duty vehicles in any of the major markets where deployment of electric trucks has begun, manufacturers can determine their own methods to declare the electric range of the commercially available and announced models. However, any standardised test procedure would need to consider complicated issues of non-motive energy consumption (e.g. heating ventilation and air conditioning in buses, cooling in refrigerated trucks), as well as the potential for buses and trucks to be used in vehicle-to-grid applications (as has been demonstrated, for instance, with electric school buses in the United States). In light of such considerations, a first regulatory step could be to mandate that electric medium- and heavy-duty vehicle makers measure and disclose the usable battery energy according to a yet-to-be-developed standardised measurement procedure.

Charging infrastructure

Public charging points are increasingly necessary to enable wider EV uptake

While most of the charging demand is currently met by home charging, publicly accessible chargers are increasingly needed in order to provide the same level of convenience and accessibility as for refuelling conventional vehicles. In dense urban areas, in particular, where access to home charging is more limited, public charging infrastructure is a key enabler for EV adoption. At the end of 2022, there were 2.7 million public charging points worldwide, more than 900 000 of which were installed in 2022, about a 55% increase on 2021 stock, and comparable to the pre-pandemic growth rate of 50% between 2015 and 2019.

Slow chargers

Globally, more than 600 000 public slow charging points[11] were installed in 2022, 360 000 of which were in China, bringing the stock of slow chargers in the country to more than 1 million. At the end of 2022, China was home to more than half of the global stock of public slow chargers.

Europe ranks second, with 460 000 total slow chargers in 2022, a 50% increase from the previous year. The Netherlands leads in Europe with 117 000, followed by around 74 000 in France and 64 000 in Germany. The stock of slow chargers

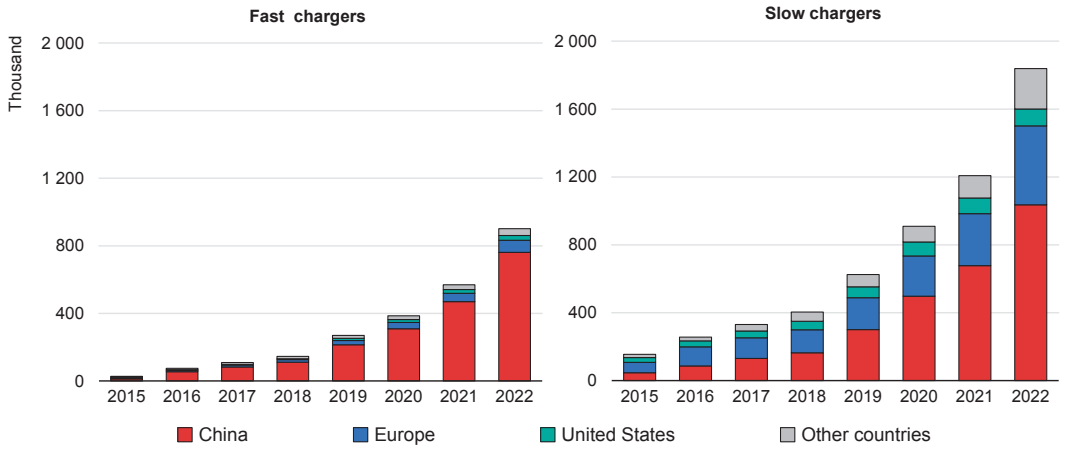
[11] Slow chargers have power ratings less than or equal to 22 kW. Fast chargers are those with a power rating of more than 22 kW and up to 350 kW. “Charging points” and “chargers” are used interchangeably and refer to the individual charging sockets, reflecting the number of EVs that can charge at the same time. ‘‘Charging stations” may have multiple charging points.

in the United States increased by 9% in 2022, the lowest growth rate among major markets. In Korea, slow charging stock has doubled year-on-year, reaching 184 000 charging points.

Fast chargers

Publicly accessible fast chargers, especially those located along motorways, enable longer journeys and can address range anxiety, a barrier to EV adoption. Like slow chargers, public fast chargers also provide charging solutions to consumers who do not have reliable access to private charging, thereby encouraging EV adoption across wider swaths of the population. The number of fast chargers increased by 330 000 globally in 2022, though again the majority (almost 90%) of the growth came from China. The deployment of fast charging compensates for the lack of access to home chargers in densely populated cities and supports China's goals for rapid EV deployment. China accounts for total of 760 000 fast chargers, but more than 70% of the total public fast charging pile stock is situated in just ten provinces.

Figure 1.13 Installed publicly accessible light-duty vehicle charging points by power rating and region, 2015-2022



Note: Values shown represent number of charging points.
Source: IEA analysis based on country submissions.

Installed publicly accessible charging points have increased by around 55%, with accelerated deployment led by China and Europe.

In Europe the overall fast charger stock numbered over 70 000 by the end of 2022, an increase of around 55% compared to 2021. The countries with the largest fast charger stock are Germany (over 12 000), France (9 700) and Norway (9 000). There is a clear ambition across the European Union to further develop the public charging infrastructure, as indicated by provisional agreement on the proposed

Alternative Fuels Infrastructure Regulation (AFIR), which will set electric charging coverage requirements across the trans-European network-transport (TEN-T).[12] An agreement between the European Investment Bank and the European Commission will make over EUR 1.5 billion available by the end of 2023 for alternative fuels infrastructure, including electric fast charging.

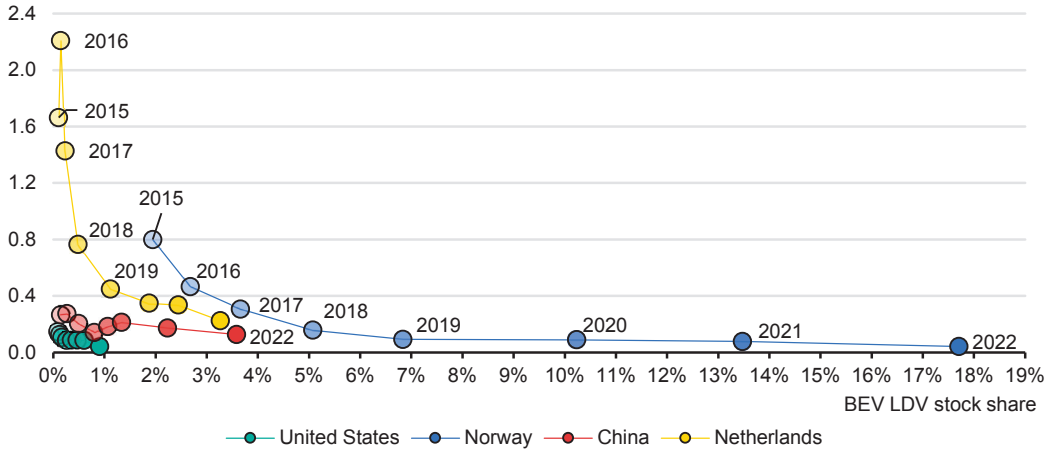
The United States installed 6 300 fast chargers in 2022, about three-quarters of which were Tesla Superchargers. The total stock of fast chargers reached 28 000 at the end of 2022. Deployment is expected to accelerate in the coming years following government approval of the National Electric Vehicle Infrastructure Formula Program (NEVI). All US states, Washington DC, and Puerto Rico are participating in the programme, and have already been allocated USD 885 million in funding for 2023 to support the build-out of chargers across 122 000 km of highway (see Policy support for EV charging infrastructure). The US Federal Highway Administration has announced new national standards for federally funded EV chargers to ensure consistency, reliability, accessibility and compatibility. As a result of the new standards, Tesla has announced it will open a portion of its US Supercharger (where Superchargers represent 60% of the total stock of fast chargers in the United States) and Destination Charger network to non-Tesla EVs.

Ratio of electric LDVs per public charger

Deployment of public charging infrastructure in anticipation of growth in EV sales is critical for widespread EV adoption. In Norway, for example, there were around 1.3 battery electric LDVs per public charging point in 2011, which supported further adoption. At the end of 2022, with over 17% of LDVs being BEVs, there were 25 BEVs per public charging point in Norway. In general, as the stock share of battery electric LDVs increases, the charging point per BEV ratio decreases. Growth in EV sales can only be sustained if charging demand is met by accessible and affordable infrastructure, either through private charging in homes or at work, or publicly accessible charging stations.

[12] Previously a directive, the proposed AFIR, once formally approved, would become a binding legislative act, stipulating, among other things, a maximum distance between chargers installed along the TEN-T, the primary and secondary roads within the European Union.

Figure 1.14 Public charging points per battery electric light-duty vehicle ratio in selected countries against battery electric light-duty vehicle stock share, 2015-2022



Notes: BEV = battery electric vehicle; LDV = light-duty vehicle. Charging points include only publicly available chargers, both fast and slow. Shading grows darker each year.

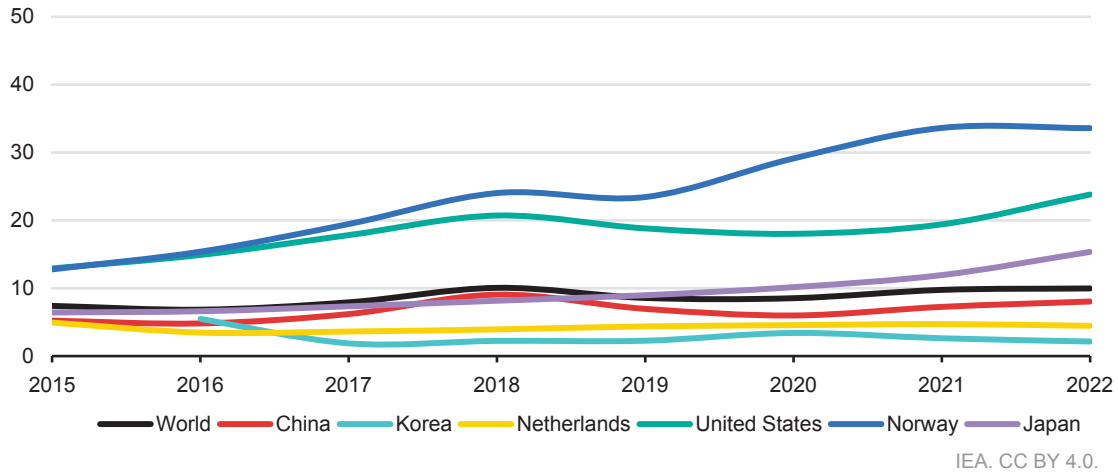
Source: IEA analysis based on country submissions.

In many advanced markets, as the stock share of battery electric LDVs increased, the charging point per BEV ratio has decreased.

While PHEVs are less reliant on public charging infrastructure than BEVs, policy-making relating to the sufficient availability of charging points should incorporate (and encourage) public PHEV charging. If the total number of electric LDVs per charging point is considered, the global average in 2022 was about ten EVs per charger. Countries such as China, Korea and the Netherlands have maintained fewer than ten EVs per charger throughout past years. In countries that rely heavily on public charging, the number of publicly accessible chargers has been expanding at a speed that largely matches EV deployment.

However, in some markets characterised by widespread availability of home charging (due to a high share of single-family homes with the opportunity to install a charger) the number of EVs per public charging point can be even higher. For example, in the United States, the ratio of EVs per charger is 24, and in Norway is more than 30. As the market penetration of EVs increases, public charging becomes increasingly important, even in these countries, to support EV adoption among drivers who do not have access to private home or workplace charging options. However, the optimal ratio of EVs per charger will differ based on local conditions and driver needs.

Figure 1.15 Electric light-duty vehicle per public charging point, 2010-2022



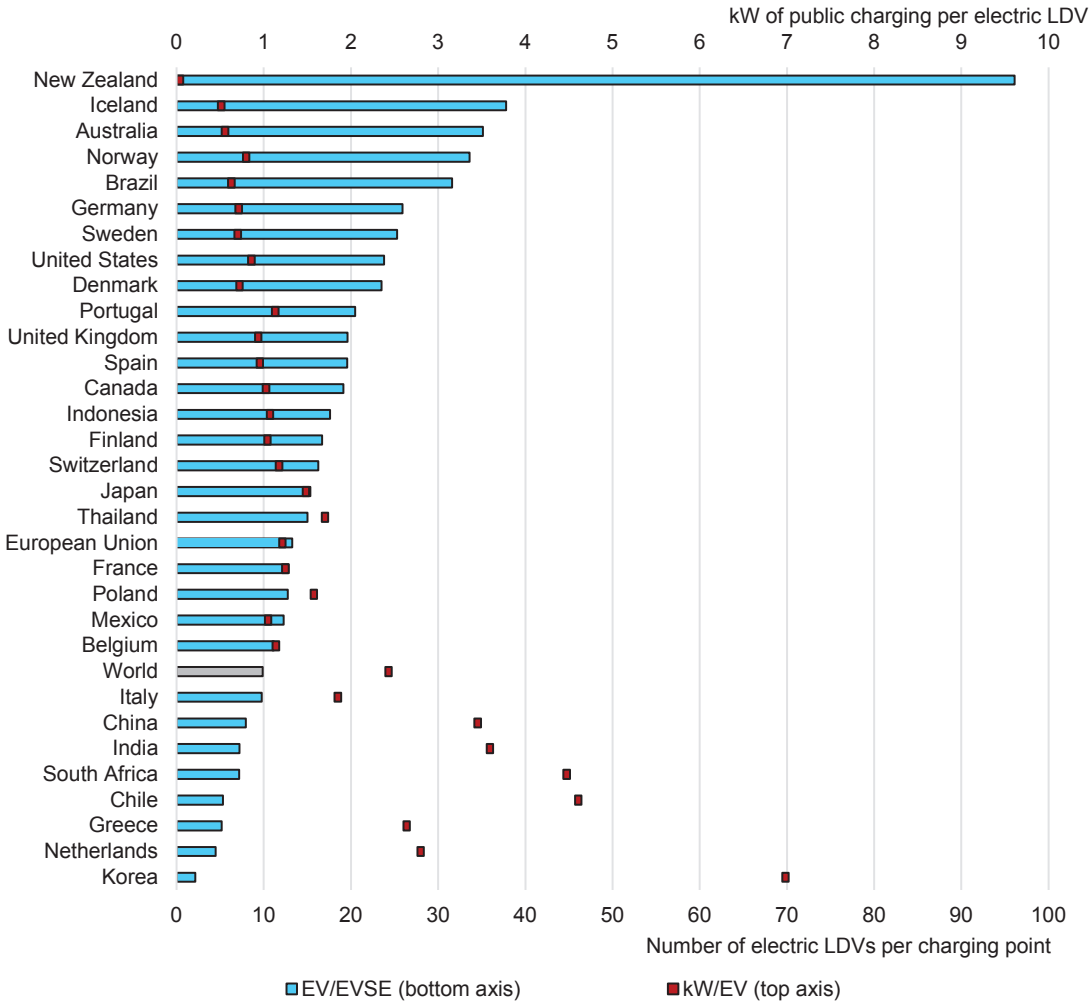
Note: Charging points include only publicly available chargers, both fast and slow.
Source: IEA analysis based on country submissions.

Countries show different speeds in public charging deployment as the number of EVs on the road increases.

Perhaps more important than the number of public chargers available is the total public charging power capacity per EV, given that fast chargers can serve more EVs than slow chargers. During the early stages of EV adoption, it makes sense for available charging power per EV to be high, assuming that charger utilisation will be relatively low until the market matures and the utilisation of infrastructure becomes more efficient. In line with this, the European Union's provisional agreement on the AFIR includes requirements for the total power capacity to be provided based on the size of the registered fleet.

Globally, the average public charging power capacity per electric LDV is around 2.4 kW per EV. In the European Union, the ratio is lower, with an average around 1.2 kW per EV. Korea has the highest ratio at 7 kW per EV, even with most public chargers (90%) being slow chargers.

Figure 1.16 Number of electric light-duty vehicles per public charging point and kW per electric light-duty vehicle, 2022



Notes: EV = electric vehicle; EVSE = electric vehicle supply equipment; LDV = light-duty vehicle. Kilowatts per EV are estimated assuming 11 kW for slow and 50 kW for fast chargers. Official national metrics might differ from these values as they can rely on more granular data.

Source: IEA analysis based on country submissions.

The number of electric light-duty vehicles per public EV charging point varies dramatically between countries, ranging from about 2 vehicles per charging point in Korea to almost 100 in New Zealand.

Charging needs for heavy-duty vehicles

In the regions where electric trucks are becoming commercially available, battery electric trucks can compete on a TCO basis with conventional diesel trucks for a growing range of operations, not only urban and regional, but also in the heavy-duty tractor-trailer regional and long-haul segments. Three parameters that determine the time at which TCO parity is reached are tolls; fuel and operations

costs (e.g. the difference between diesel and electricity prices faced by truck operators, and reduced maintenance costs); and CAPEX subsidies to reduce the gap in the upfront vehicle purchase price. Since electric trucks can provide the same operations with lower lifetime costs (including if a discounted rate is applied), the time horizon in which vehicle owners expect to recuperate upfront costs is a key factor in determining whether to purchase an electric or conventional truck.

The economics for electric trucks in long-distance applications can be substantially improved if charging costs can be reduced by maximising "off-shift" (e.g. night-time or other longer periods of downtime) slow charging, securing bulk purchase contracts with grid operators for "mid-shift" (e.g. during breaks), fast (up to 350 kW), or ultra-fast (>350 kW) charging, and exploring smart charging and vehicle-to-grid opportunities for extra income.

Electric trucks and buses will rely on off-shift charging for the majority of their energy. This will be largely achieved at private or semi-private charging depots or at public stations on highways, and often overnight. Depots to service growing demand for heavy-duty electrification will need to be developed, and in many cases may require distribution and transmission grid upgrades. Depending on vehicle range requirements, depot charging will be sufficient to cover most operations in urban bus as well as urban and regional truck operations.

The major constraint to rapid commercial adoption of electric trucks in regional and long-haul operations is the availability of "mid-shift" fast charging. Although the majority of energy requirements for these operations could come from "off-shift" charging, fast and ultra-fast charging will be needed to extend range such that operations currently covered by diesel can be performed by battery electric trucks with little to no additional dwell time (i.e. waiting). Regulations that mandate rest periods can also provide a time window for mid-shift charging if fast or ultra-fast charging options are available en route: the European Union requires 45 minutes of break after every 4.5 hours of driving; the United States mandates 30 minutes after 8 hours.

Most commercially available direct current (DC) fast charging stations currently enable power levels ranging from 250-350 kW. The European Union's Alternative Fuels Infrastructure Regulation (AFIR) aims to enable mid-shift charging across the EU's core TEN-T network, which covers 88% of total long-haul freight activity, and along other key freight corridors. The provisional agreement reached by the European Council and Parliament includes a gradual process of infrastructure deployment for electric heavy-duty vehicles starting in 2025. Recent studies of power requirements for regional and long-haul truck operations in the United States and Europe find that charging power higher than 350 kW, and as high as 1 MW, may be required to fully recharge electric trucks during a 30- to 45-minute break.

Recognising the need to scale up fast or ultra-fast charging as a prerequisite for making both regional and, in particular, long-haul operations technically and economically viable, in 2022 Traton, Volvo, and Daimler established an independent joint venture, Milence. With EUR 500 million in collective investments from the three heavy-duty manufacturing groups, the initiative aims to deploy more than 1 700 fast (300 to 350 kW) and ultra-fast (1 MW) charging points across Europe.

Multiple charging standards are currently in use, and technical specifications for ultra-fast charging are under development. Ensuring maximum possible convergence of charging standards and interoperability for heavy-duty EVs will be needed to avoid the cost, inefficiency, and challenges for vehicle importers and international operators that would be created by manufacturers following divergent paths.

In China, co-developers China Electricity Council and CHAdeMO's "ultra ChaoJi" are developing a charging standard for heavy-duty electric vehicles for up to several megawatts. In Europe and the United States, specifications for the CharIN Megawatt Charging System (MCS), with a potential maximum power of 4.5 MW, are under development by the International Organization for Standardization (ISO) and other organisations. The final MCS specifications, which will be needed for commercial roll-out, are expected for 2024. After the first megawatt charging site offered by Daimler Trucks and Portland General Electric (PGE) in 2021, at least twelve high-power charging projects are planned or underway in the United States and Europe, including charging of an electric Scania truck in Oslo, Norway, at a speed of over 1 MW, Germany's HoLa project, and the Netherlands Living Lab Heavy-Duty and Green Transport Delta Charging Stations, as well as investments and projects in Austria, Sweden, Spain and the United Kingdom.

Commercialisation of chargers with rated power of 1 MW will require significant investment, as stations with such high-power needs will incur significant costs in both installation and grid upgrades. Revising public electric utility business models and power sector regulations, co-ordinating planning across stakeholders and smart charging can all help to manage grid impacts. Direct support through pilot projects and financial incentives can also accelerate demonstration and adoption in the early stages. A recent study outlines some key design considerations for developing MCS rated charging stations:

- Planning charging stations at highway depot locations near transmission lines and substations can be an optimal solution for minimising costs and increasing charger utilisation.
- "Right-sizing" connections with direct connections to transmission lines at an early stage, thereby anticipating the energy needs of a system in which high shares of freight activity have been electrified, rather than upgrading distribution grids on an

ad-hoc and short-term basis, will be critical to reduce costs. This will require structured and co-ordinated planning between grid operators and charging infrastructure developers across sectors.

- Since transmission system interconnections and grid upgrades can take 4-8 years, siting and construction of high-priority charging stations will need to begin as soon as possible.

Alternative solutions include installing stationary storage and integrating local renewable capacity, combined with smart charging, which can help reduce both infrastructure costs related to grid connection and electricity procurement costs (e.g. by enabling truck operators to minimise cost by arbitraging price variability throughout the day, taking advantage of vehicle-to-grid opportunities, etc.).

Other options to provide power to electric heavy-duty vehicles (HDVs) are battery swapping and electric road systems. Electric road systems can transfer power to a truck either via inductive coils[13] in a road, or through conductive connections between the vehicle and road, or via catenary (overhead) lines. Catenary and other dynamic charging options may hold promise for reducing the uncertainty of system-level costs in the transition to zero-emission regional and long-haul trucks, competing favourably in terms of total capital and operating costs. They can also help to reduce battery capacity needs. Battery demand can be further reduced, and utilisation further improved, if electric road systems are designed to be compatible not only with trucks but also electric cars. However, such approaches would require inductive or in-road designs that come with greater hurdles in terms of technology development and design, and are more capital intensive. At the same time, electric road systems pose significant challenges resembling those of the rail sector, including a greater need for standardisation of paths and vehicles (as illustrated with trams and trolley buses), compatibility across borders for long-haul trips, and appropriate infrastructure ownership models. They provide less flexibility for truck owners in terms of routes and vehicle types, and have high development costs overall, all affecting their competitiveness relative to regular charging stations. Given these challenges, such systems would most effectively be deployed first on heavily used freight corridors, which would entail close co-ordination across various public and private stakeholders. Demonstrations on public roads to date in Germany and Sweden have relied on champions from both private and public entities. Calls for electric road system pilots are also being considered in the China, India, the United Kingdom and the United States.

[13] Inductive solutions are further from commercialisation and face challenges to deliver sufficient power at highway speeds.

in 2022, and the company has set a target of 4 000 battery swap stations globally by 2025. The company claims their swap stations can perform over 300 swaps per day, charging up to 13 batteries concurrently at a power of 20-80 kW.

NIO also announced plans to build battery swap stations in Europe as their battery swapping-enabled car models became available in European markets towards the end of 2022. The first NIO battery swap station in Sweden was opened in November 2022, and by the end of 2022, ten NIO battery swap stations had been opened across Norway, Germany, Sweden and the Netherlands. In contrast to NIO, whose swapping stations service NIO cars, the Chinese battery swapping station operator Aulton's stations support 30 models from 16 different vehicle companies.

Battery swapping could also be a particularly attractive option for LDV taxi fleets, whose operations are more sensitive to recharging times than personal cars. US start-up Ample currently operates 12 battery swapping stations in the San Francisco Bay area, mainly serving Uber rideshare vehicles.

Batteries

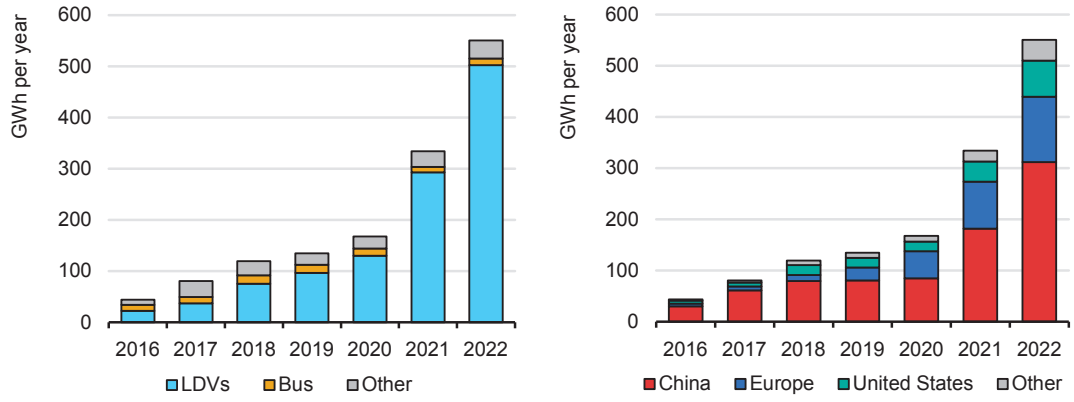
Battery demand for EVs continues to rise

Automotive lithium-ion (Li-ion) battery demand increased by about 65% to 550 GWh in 2022, from about 330 GWh in 2021, primarily as a result of growth in electric passenger car sales, with new registrations increasing by 55% in 2022 relative to 2021.

In China, battery demand for vehicles grew over 70%, while electric car sales increased by 80% in 2022 relative to 2021, with growth in battery demand slightly tempered by an increasing share of PHEVs. Battery demand for vehicles in the United States grew by around 80%, despite electric car sales only increasing by around 55% in 2022. While the average battery size for battery electric cars in the United States only grew by about 7% in 2022, the average battery electric car battery size remains about 40% higher than the global average, due in part to the higher share of SUVs in US electric car sales relative to other major markets,[14] as well as manufacturers' strategies to offer longer all-electric driving ranges. Global sales of BEV and PHEV cars are outpacing sales of hybrid electric vehicles (HEVs), and as BEV and PHEV battery sizes are larger, battery demand further increases as a result.

[14] For more information on the climate impact of SUVs, refer to the IEA's 27 February 2023 commentary on the subject.

Figure 1.17 Battery demand by mode and region, 2016-2022



Notes: LDVs = light-duty vehicles, including cars and vans; In the left chart, "Other" includes medium- and heavy-duty trucks and two/three-wheelers. Battery demand refers to automotive lithium-ion batteries. This analysis does not include conventional hybrid vehicles.

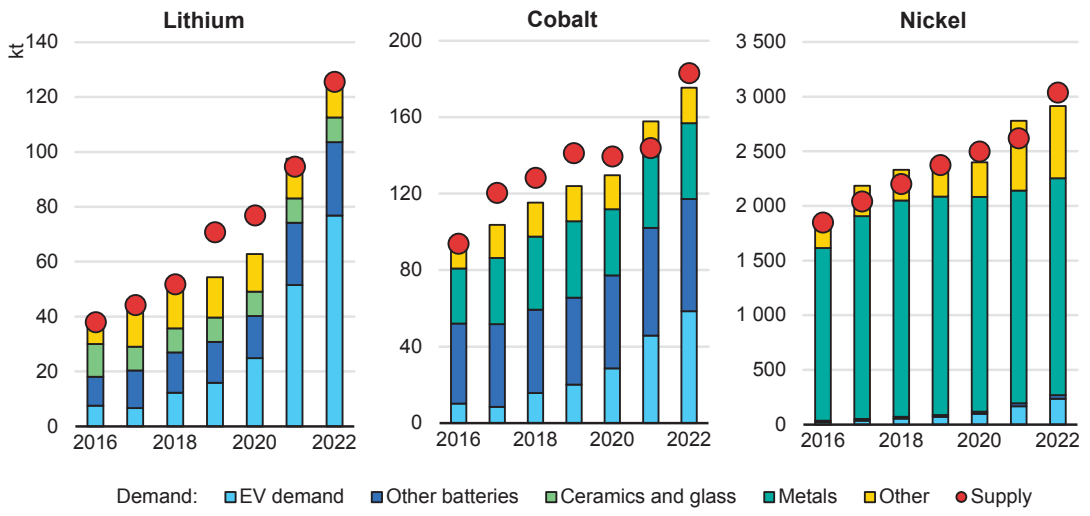
Source: IEA analysis based on EV Volumes.

Global battery demand increased by 65% in 2022, mainly as a result of electric car sales in China.

The increase in battery demand drives the demand for critical materials. In 2022, lithium demand exceeded supply (as in 2021) despite the 180% increase in production since 2017. In 2022, about 60% of lithium, 30% of cobalt and 10% of nickel demand was for EV batteries. Just five years earlier, in 2017, these shares were around 15%, 10% and 2%, respectively. As has already been seen for lithium, mining and processing of these critical minerals will need to increase rapidly to support the energy transition, not only for EVs but more broadly to keep up with the pace of demand for clean energy technologies.[15] Reducing the need for critical materials will also be important for supply chain sustainability, resilience and security. Accelerating innovation can help, such as through advanced battery technologies requiring smaller quantities of critical minerals, as well as measures to support uptake of vehicle models with optimised battery size and the development of battery recycling.

[15] For more information on the future of supply and demand of critical minerals, refer to the Energy Technology Perspective 2023 report.

Figure 1.18 Overall supply and demand of battery metals by sector, 2016-2022



Note: EV = electric vehicle. The metals category includes alloying applications. Supply refers to refinery output and not mining output.

Source: IEA analysis based on Mineral Commodity Summary 2022 by USGS, lithium and cobalt global supply-demand balance (January 2023) and nickel global supply-demand balance (January 2023) from S&P Global and World Metal Statistics Yearbook by the World Bureau of Metal Statistics.

In 2022, supply of nickel and cobalt exceeded demand, while lithium demand outpaced supply by a small margin.

Battery chemistries are diversifying

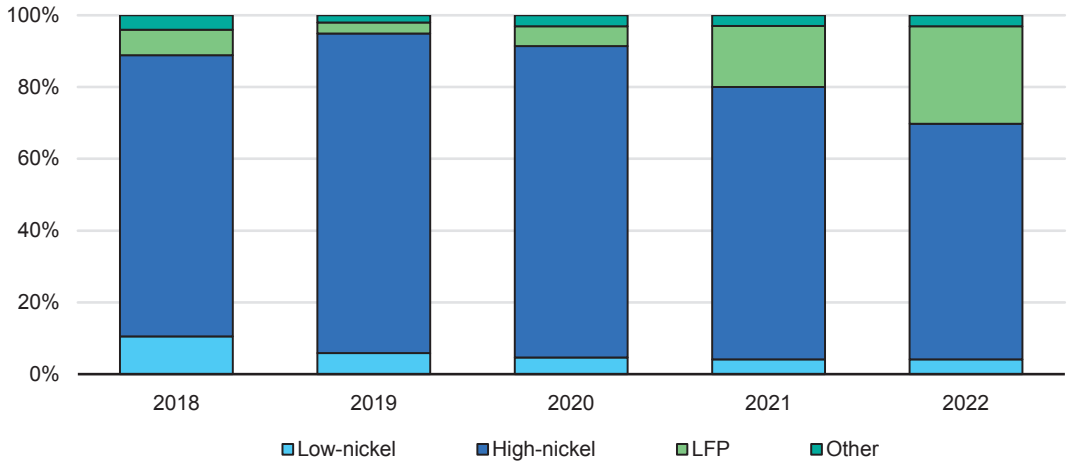
New alternatives to conventional lithium-ion are on the rise

In 2022, lithium nickel manganese cobalt oxide (NMC) remained the dominant battery chemistry with a market share of 60%, followed by lithium iron phosphate (LFP) with a share of just under 30%, and nickel cobalt aluminium oxide (NCA) with a share of about 8%.

Lithium iron phosphate (LFP) cathode chemistries have reached their highest share in the past decade (Figure 1.19). This trend is driven mainly by the preferences of Chinese OEMs. Around 95% of the LFP batteries for electric LDVs went into vehicles produced in China, and BYD alone represents 50% of demand. Tesla accounted for 15%, and the share of LFP batteries used by Tesla increased from 20% in 2021 to 30% in 2022. Around 85% of the cars with LFP batteries manufactured by Tesla were manufactured in China, with the remainder being manufactured in the United States with cells imported from China. In total, only around 3% of electric cars with LFP batteries were manufactured in the United States in 2022.

LFP batteries contrast with other chemistries in their use of iron and phosphorus rather than the nickel, manganese and cobalt found in NCA and NMC batteries. The downside of LFP is that the energy density tends to be lower than that of NMC. LFP batteries also contain phosphorus, which is used in food production. If all batteries today were LFP, they would account for nearly 1% of current agricultural phosphorus use by mass, suggesting that conflicting demands for phosphorus may arise in the future as battery demand increases.

Figure 1.19 Electric light-duty vehicle battery capacity by chemistry, 2018-2022

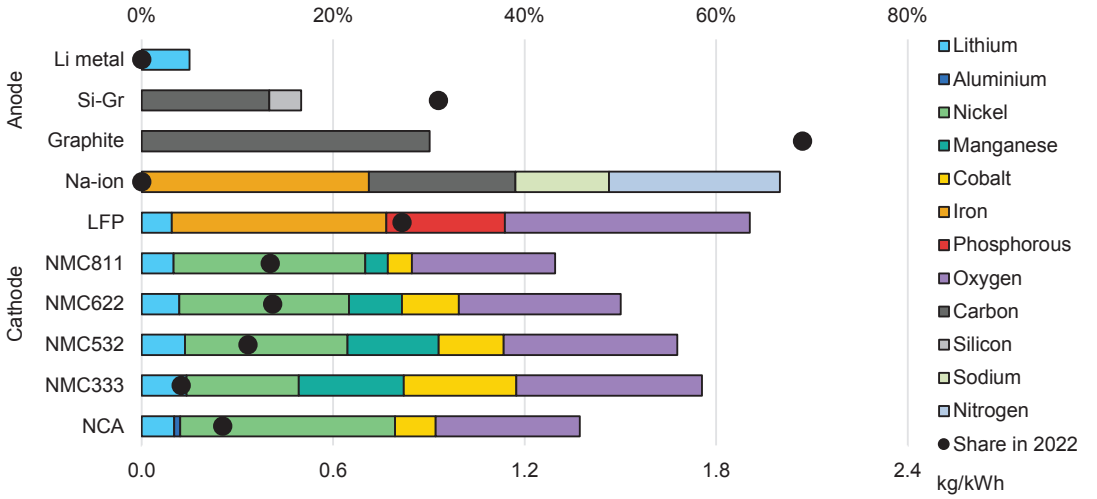


Notes: LFP = Lithium iron phosphate. Low-nickel includes: NMC333. High-nickel includes: NMC532, NMC622, NMC721, NMC811, NCA and NMCA. Cathode sales share is based on battery capacity.
Source: IEA analysis based on EV Volumes.

The share of lithium iron phosphate reached its highest ever point, accounting for almost 30% of new electric LDV battery capacity in 2022.

With regards to anodes, a number of chemistry changes have the potential to improve energy density (watt-hour per kilogram, or Wh/kg). For example, silicon can be used to replace all or some of the graphite in the anode in order to make it lighter and thus increase the energy density. Silicon-doped graphite already entered the market a few years ago, and now around 30% of anodes contain silicon. Another option is innovative lithium metal anodes, which could yield even greater energy density when they become commercially available (Figure 1.20).

Figure 1.20 Material content in different anode and cathodes



Notes: Li metal = Lithium metal anode; Si-Gr = Silicon-graphite anode; Graphite = Pure graphite anode; Na-ion = Sodium-ion; LFP = Lithium iron phosphate; NMC = Lithium nickel manganese cobalt oxide; NCA = Lithium nickel cobalt aluminium oxide. Materials composing the battery casing and the electrolyte are excluded. Chemistry shares are based on demand. The share of NCA battery includes every NCA type and Si-Gr includes every degree of silicon-graphite mix. Carbon covers the graphite composing anodes. The Na-ion cathode shown is the Prussian white.

Source: IEA analysis based on Lithium-Ion Batteries: State of the Industry 2022 by BNEF, BatPaC v4 by Argonne Laboratory and Sodium-ion batteries: disrupt and conquer? by Wood Mackenzie.

Lithium iron phosphate cathodes do not rely on nickel, manganese or cobalt, which has contributed to their increased market share.

In recent years, alternatives to Li-ion batteries have been emerging, notably sodium-ion (Na-ion). This battery chemistry has the dual advantage of relying on lower cost materials than Li-ion, leading to cheaper batteries, and of completely avoiding the need for critical minerals. It is currently the only viable chemistry that does not contain lithium. The Na-ion battery developed by China's CATL is estimated to cost 30% less than an LFP battery. Conversely, Na-ion batteries do not have the same energy density as their Li-ion counterpart (respectively 75 to 160 Wh/kg compared to 120 to 260 Wh/kg). This could make Na-ion relevant for urban vehicles with lower range, or for stationary storage, but could be more challenging to deploy in locations where consumers prioritise maximum range autonomy, or where charging is less accessible. There are nearly 30 Na-ion battery manufacturing plants currently operating, planned or under construction, for a combined capacity of over 100 GWh, almost all in China. For comparison, the current manufacturing capacity of Li-ion batteries is around 1 500 GWh.

Multiple carmakers have already announced Na-ion electric cars, such as the Seagull by BYD, which has an announced range of 300 km and is sold for USD 11 600 (with possible discounts bringing the price down to USD 9 500), and the Sehol EX10, produced by the VW-JAC joint venture, with a 250 km range.

While these first models are likely to be slightly more expensive than the cheapest small BEV models in China – such as the Wuling Mini BEV, sold for as little as USD 5 000 to 6 500 – they are still cheaper than equivalent options with similar driving range. To compare, the Wuling Mini BEV's range stands at 170 km, but BYD's Dolphin BEV, the second best-selling small BEV in China in 2022, with a similar range to the announced Na-ion cars, can cost more than USD 15 000. BYD plans to progressively integrate Na-ion batteries into all its models below USD 29 000 as battery production ramps up. These announcements suggest that electric vehicles powered by Na-ion will be available for sale and driven for the first time in 2023-2024, hence bringing the technology to a readiness level (TRL[16]) of 8-9, between first-of-a-kind commercial and commercial operation in the relevant environment. In 2022, it was assessed at TRL 6 (full prototype at scale) in the IEA Clean Technology Guide, compared to only TRL 3-4 (small prototypes) in the assessment from 2021, highlighting quick technological progress.

Critical mineral prices can have an impact on chemistry choice

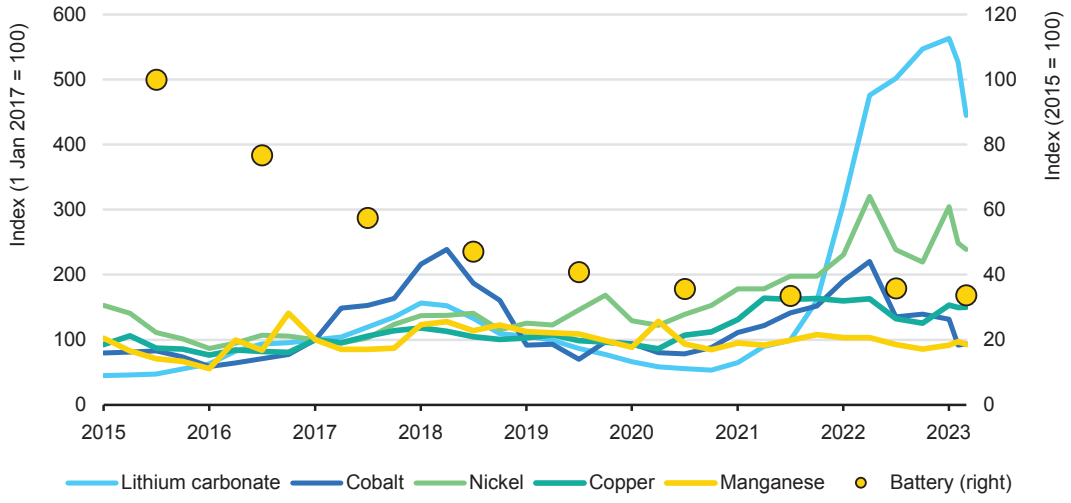
The variability in price and availability of critical minerals can also explain some of the developments in battery chemistry from the last few years (Figure 1.21). NMC chemistries using an equal ratio of nickel, manganese, and cobalt (NMC333 or NMC111) were popular until 2015. Since then, cobalt price increases and concerns affecting public acceptance of cobalt mining have contributed to a shift towards lower-cobalt ratios, such as NMC622, and then NMC811, which are nevertheless more difficult to manufacture. In 2022, the price of nickel increased, reaching a peak twice as high as the 2015-2020 average. This created incentives to use chemistries that are less reliant on nickel, such as LFP, despite their lower energy density.

Lithium carbonate prices have also been steadily increasing over the past two years. In 2021, prices multiplied four- to five-fold, and continued to rise throughout 2022, nearly doubling between 1 January 2022 and 1 January 2023. At the beginning of 2023, lithium prices stood six times above their average over the 2015-2020 period. In contrast to nickel and lithium, manganese prices have been relatively stable. One reason for the increase in prices for lithium, nickel and cobalt was the insufficient supply compared to demand in 2021 (Figure 1.18). Although nickel and cobalt supply surpassed demand in 2022, this was not the case for lithium, causing its price to rise more strongly over the year. Between January and March 2023, lithium prices dropped 20%, returning to their late 2022 level. The combination of an expected 40% increase in supply and slower growth in demand, especially for EVs in China, has contributed to this trend. This drop – if sustained – could translate into lower battery prices.

[16] Technology Readiness Level (TRL) provides a snapshot of the maturity of a given technology. It has 11 steps ranging from initial idea at step 1 to proof of stability reached at step 11. For more information, refer to the IEA Clean Technology Guide.

Beyond those materials, global commodity prices have surged in the last few years, as a result of supply disruptions in the wake of the Covid-19 pandemic, rising demand as the global economy started to recover, and Russia's invasion of Ukraine in February 2022, among other factors.

Figure 1.21 Price of selected battery materials and lithium-ion batteries, 2015-2023



Notes: Data until March 2023. Lithium-ion battery prices (including the pack and cell) represent the global volume-weighted average across all sectors. Nickel prices are based on the London Metal Exchange, used here as a proxy for global pricing, although most nickel trade takes place through direct contracts between producers and consumers. The 2023 battery price value is based on cost estimates for NMC 622.

Source: IEA analysis based on material price data by S&P, 2022 Lithium-Ion Battery Price Survey by BNEF and Battery Costs Drop as Lithium Prices in China Fall by BNEF.

From 2021 to the end of 2022, the price of critical materials such as lithium, cobalt and nickel increased dramatically, putting pressure on historical Li-ion battery price decreases.

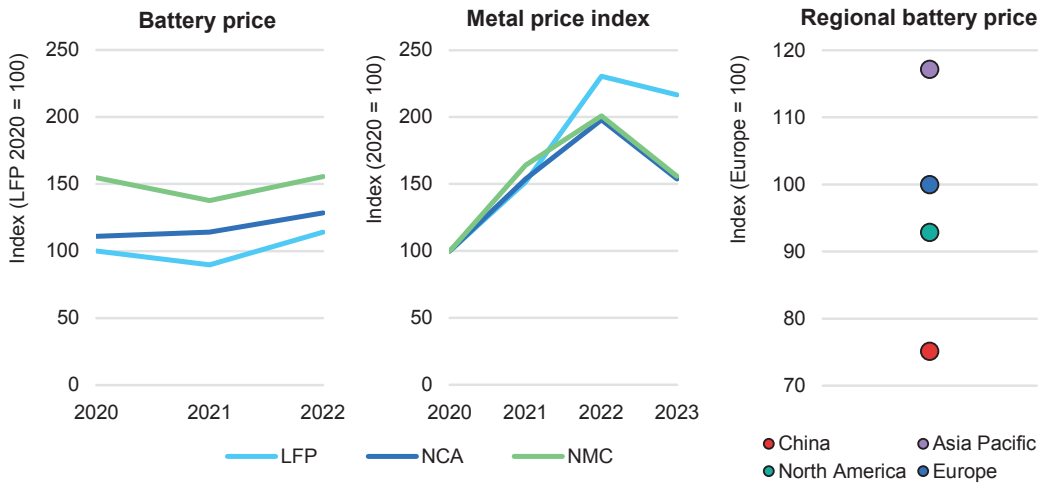
In 2022, the estimated average battery price stood at about USD 150 per kWh, with the cost of pack manufacturing accounting for about 20% of total battery cost, compared to more than 30% a decade earlier. Pack production costs have continued to decrease over time, down 5% in 2022 compared to the previous year. In contrast, cell production costs increased in 2022 relative to 2021, returning to 2019 levels. This can be explained in part by the increasing prices of materials, which account for a significant portion of cell price, and of electricity, which affects manufacturing costs, whereas efficiency gains in pack manufacturing help decrease costs. Bloomberg New Energy Finance (BNEF) sees pack manufacturing costs dropping further, by about 20% by 2025, whereas cell production costs decrease by only 10% relative to their historic low in 2021. This warrants further analysis based on future trends in material prices.

The effect of increased battery material prices differed across various battery chemistries in 2022, with the strongest increase being observed for LFP batteries

(over 25%), while NMC batteries experienced an increase of less than 15% (Figure 1.21). Since LFP batteries contain neither nickel nor cobalt, which are relatively expensive compared to iron and phosphorus, the price of lithium plays a relatively larger role in determining the final cost. Given that the price of lithium increased at a higher rate than the price of nickel and cobalt, the price of LFP batteries increased more than the price of NMC batteries. Nonetheless, LFP batteries remain less expensive than NCA and NMC per unit of energy capacity.

The price of batteries also varies across different regions, with China having the lowest prices on average, and the rest of the Asia Pacific region having the highest (Figure 1.21). This price discrepancy is influenced by the fact that around 65% of battery cells and almost 80% of cathodes are manufactured in China.

Figure 1.22 Price index for selected battery chemistries, regions and metal price, 2020-2023



Note: LFP = Lithium iron phosphate; NMC = Lithium nickel manganese cobalt oxide; NCA = Lithium nickel cobalt aluminium oxide. The metal price index is based on the price evolution of four commodities (lithium carbonate, cobalt, nickel and copper) weighted by their use in each battery chemistry. For this metal price index, NMC uses the NMC622 chemistry. The 2023 value of the metal price index covers only the first 3 months of the year. Asia Pacific excludes China. Regional battery (pack) price refers to 2022.

Source: IEA analysis based on material price data by S&P, 2022 Lithium-Ion Battery Price Survey by BNEF, BatPaC v4 by Argonne Laboratory and Lithium-Ion Batteries: State of the Industry 2022 by BNEF.

Despite a higher relative increase in price compared to other battery chemistries, LFP batteries remain the lowest price per kWh.

Prospects for electric vehicle deployment

Several pathways to electrify road transport in the period to 2030 are explored in this section. First, deployment of electric vehicles (EVs) is projected by region and road segment for the Stated Policies and Announced Pledges scenarios, and globally by segment for the Net Zero Emissions by 2050 Scenario. These projections are then compared to announcements by original equipment manufacturers (OEMs). Then the corresponding battery demand is projected, followed by roll-out requirements for charging infrastructure. Finally, the impacts of EV deployment are assessed, including increased electricity demand, oil displacement, implications for tax revenues, and net well-to-wheels GHG emissions.

Outlook for electric mobility

Scenarios

A scenario-based approach is used to explore road transport electrification and its impact, based on the latest market data, policy drivers and technology perspectives. Two IEA scenarios – the Stated Policies and Announced Pledges scenarios – inform the outlooks, which are examined in relation to the Net Zero Emissions by 2050 Scenario at the global level.[1] These scenarios are based on announced policies, ambitions and market trends through the first quarter of 2023.

The purpose of the scenarios is to assess plausible futures for global EV markets and the implications they could have. The scenarios do not make predictions about the future. Rather, they aim to provide insights to inform decision-making by governments, companies and stakeholders about the future of EVs.

These scenario projections incorporate GDP and population assumptions from the International Monetary Fund (2022) and United Nations (2022), respectively.

Stated Policies Scenario

The Stated Policies Scenario (STEPS) reflects existing policies and measures, as well as firm policy ambitions and objectives that have been legislated by

[1] The projections in the Stated Policies and Announced Pledges scenarios are based on historical trends through the end of 2022 as well as stated policies and ambitions as of the end of March 2023. The Net Zero Emissions by 2050 Scenario is consistent with the World Energy Outlook 2022 publication.

governments around the world. It includes current EV-related policies, regulations and investments, as well as market trends based on the expected impacts of technology developments, announced deployments and plans from industry stakeholders. The STEPS aims to hold up a mirror to the plans of policy makers and illustrate their consequences.

Announced Pledges Scenario

The Announced Pledges Scenario (APS) assumes that all announced ambitions and targets made by governments around the world are met in full and on time. With regards to electromobility, it includes all recent major announcements of electrification targets and longer-term net zero emissions and other pledges, regardless of whether these have been anchored in legislation or in updated Nationally Determined Contributions (NDCs). For example, the APS assumes that countries that have signed on to the Conference of the Parties (COP 26) declaration on accelerating the transition to 100% zero emissions cars and vans will achieve this goal, even if there are not yet policies or regulations in place to support it. In countries that have not yet made a net zero emissions pledge or set electrification targets, the APS considers the same policy framework as the STEPS. Non-policy assumptions for the APS, including population and economic growth, are the same as in the STEPS.

The difference between the APS and the STEPS represents the “implementation gap” that exists between the policy frameworks and measures required to achieve country ambitions and targets, and the policies and measures that have been legislated.

Net Zero Emissions by 2050 Scenario

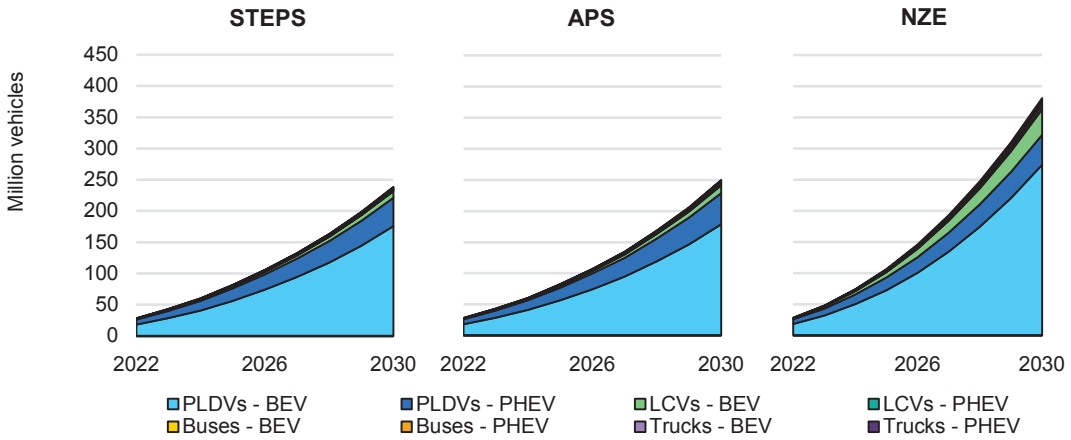
The Net Zero Emissions by 2050 Scenario (NZE Scenario) is a normative scenario that sets out a narrow but achievable pathway for the global energy sector to achieve net zero CO_2 emissions by 2050. The scenario is compatible with limiting the global temperature rise to 1.5°C with no or limited temperature overshoot, in line with reductions assessed by the Intergovernmental Panel on Climate Change in its Special Report on Global Warming of 1.5°C. There are many possible paths to achieve net zero CO_2 emissions globally by 2050 and many uncertainties that could affect them. The NZE Scenario is therefore *a* path and not *the* path to net zero emissions.

The difference between the NZE Scenario and the APS highlights the “ambition gap” that needs to be closed to achieve the goals under the 2015 Paris Agreement.

Electric vehicle fleet to grow by a factor of eight or more by 2030

The total fleet of EVs (excluding two/three-wheelers) grows from almost 30 million in 2022 to about 240 million in 2030 in the Stated Policies Scenario (STEPS), achieving an average annual growth rate of about 30%. In this scenario, EVs account for over 10% of the road vehicle fleet by 2030. Total EV sales reach over 20 million in 2025 and over 40 million in 2030, representing over 20% and 30% of all vehicle sales, respectively.

Figure 3.1. Electric vehicle stock by mode and scenario, 2022-2030

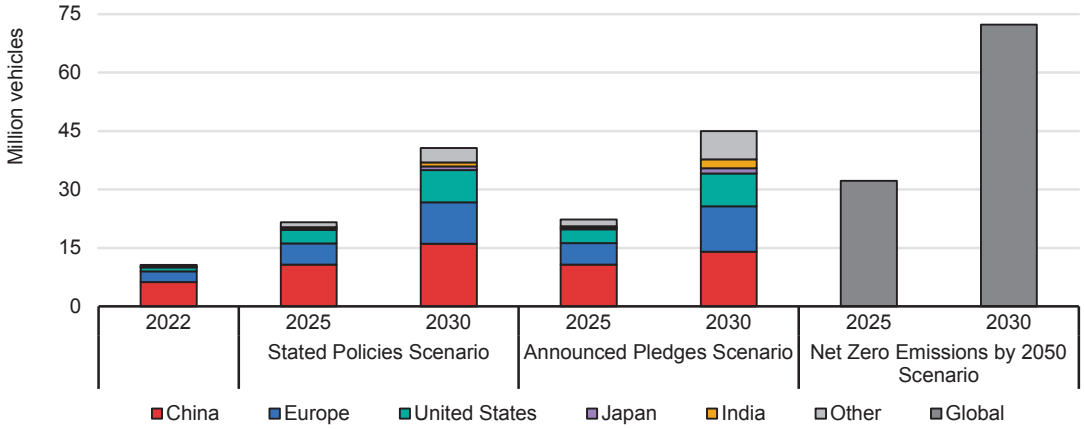


Notes: STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario; NZE = Net Zero Emissions by 2050 Scenario; BEV = battery electric vehicle; PHEV = plug-in hybrid electric; PLDV = passenger light-duty vehicle; LCV = light commercial vehicle.

EV deployment commensurate with government pledges is only 5% above what stated policies would imply by 2030.

In the Announced Pledged Scenario (APS), based on announced government targets and pledges that go beyond existing policies, the global EV fleet reaches almost 250 million in 2030, around 5% higher than in the STEPS. The average annual growth rate in the APS is nearly 35%, with the result that one in seven vehicles on the road is an EV in 2030. Total EV sales reach 45 million in 2030, representing over 35% of all vehicle sales.

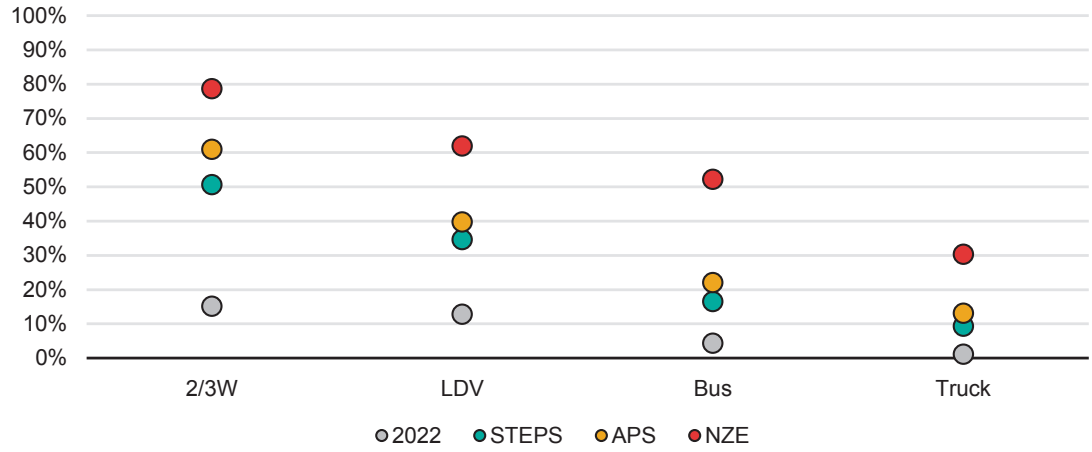
Figure 3.2. Electric vehicle sales by region, 2022-2030



Global EV sales increase around fourfold from 2022 to 2030 under both stated policies and announced ambitions.

The global EV sales share in 2030 in the STEPS is about half that in the NZE Scenario, in which the fleet of EVs grows more rapidly, at an average annual rate of around 40%, reaching 380 million EVs on the road in 2030. Electric vehicle sales reach over 30 million in 2025 and over 70 million in 2030, a total of approximately 30% and 60% of all vehicle sales, respectively.

Figure 3.3. Electric vehicle sales shares by mode and scenario, 2030



Notes: 2/3W = two/three-wheeler; LDV = light-duty vehicle; STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario; NZE = Net Zero Emissions by 2050 Scenario.

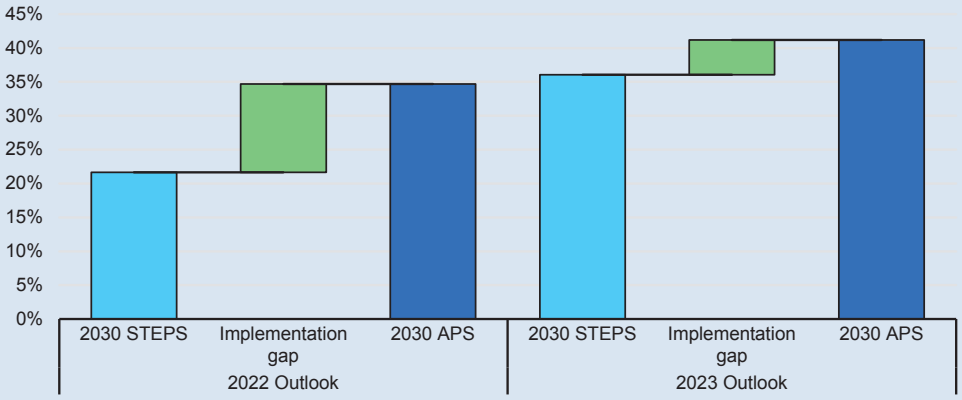
Existing policies are projected to yield market shares almost in line with country pledges across all modes of transport.

Box 3.1 Closing the implementation gap: how EV policy is catching up with targets

Targets and ambitions for clean energy technology deployment are generally more easily formulated than they are achieved, but in the case of EVs, the momentum is clearly on the side of achievement. Strong market uptake in 2022, combined with major policy announcements over the past year, have led to a significant upward revision of EV deployment to 2030 in the STEPS presented in this edition of the Global EV Outlook compared to the 2022 edition. The projected sales shares of EVs based on stated policies and market trends are now coming close to country stated ambitions for EVs, meaning that the policy implementation gap – the difference between country deployment ambitions and the policies currently in place – in the 2023 Outlook is much smaller than in the 2022 edition.

This is most notable for light-duty vehicles, where recent policies such as the US Inflation Reduction Act (IRA) and new EU CO_2 standards for cars and vans have resulted in a significantly higher EV sales share in 2030 in the STEPS. In this year's Outlook, under announced ambitions, the electric car sales share exceeds 40% in 2030 compared to 35% under stated policies: this gap has more than halved in the past year. For trucks and buses, the EV sales share in 2030 in the STEPS also increased faster than ambition. As a result, the gap between ambition and legislated policies for HDVs is half of what it was in the 2022 Outlook.

Electric car sales share implementation gap, 2030



Realising the potential of EVs to support government climate (as well as energy security) ambitions is thus almost in reach under current policy frameworks. In particular, the gap between policy and ambition has closed in three of the largest EV markets: the European Union, the United States and China. At the global level, oil displacement by EVs reaches 1.8 million barrels per day in 2025 (over 5 mb/d in 2030) under stated policies. As a result, global demand for oil-based road transport fuels will peak by 2025.

The momentum seen over the past year in terms of increasing EV sales and new supportive policies being introduced, along with funding designated for the necessary infrastructure (for example, the USD 5 billion allocated in the US IIJA to support EV charger installation), have also led industry players to invest more in EV supply chains. Notably, planned EV battery manufacturing expansions are set to increase capacity more than fourfold, reaching 6.8 TWh/year of production capacity in 2030, 65% higher than is needed to enable the level of EV deployment in the APS. Taken together, this suggests that even higher EV deployment than is implied by the APS is achievable by 2030 if policy efforts are sustained and critical potential bottlenecks (such as around recharging infrastructure and mining) are addressed early on.

Light-duty vehicles

Light-duty vehicles (LDVs), including passenger light-duty vehicles (PLDVs) and light commercial vehicles (LCVs), continue to make up the majority of electric vehicles (excluding two/three-wheelers). This is a result of strong policy support, including light-duty vehicle fuel economy or CO_2 standards, the availability of EV models, and the size of the LDV market. In the STEPS, electric LDV sales are projected to reach over 20 million in 2025, doubling the number of sales in 2022, and to quadruple to 40 million in 2030. The sales share of electric LDVs thus increases from 13% in 2022 to over 20% in 2025 and around 35% in 2030. The stock of electric LDVs reaches about 230 million in 2030, meaning that about one in every seven LDVs on the road is electric.

In the APS, the fleet of electric LDVs reaches over 240 million in 2030, a 15% stock share. Of these, 230 million are electric PLDVs, with only 6% being LCVs. Sales of electric LDVs reach almost 45 million in 2030 in the APS, representing a sales share of 40%. These results reflect government electrification ambitions and net zero pledges, including the 2021 COP 26 declaration target to achieve 100% zero-emission LDV sales by 2040, and by 2035 in leading markets, which 40 national governments have committed to.

In the NZE Scenario, the sales share of electric LDVs reaches 30% in 2025, four years earlier than in the STEPS. In 2030, the sales share is over 60%, about 80% higher than in the STEPS and 55% higher than in the APS.

Buses

Governments have made significant progress in electrifying public bus fleets. In 2022, there were more than 800 000 electric buses on the road, representing over 3% of all buses. As such, buses are the most electrified road segment, excluding two/three-wheelers. In the STEPS, the electric bus fleet reaches 1.4 million in 2025 and 2.7 million in 2030, at which point around one in ten buses will be electric. In the near term, electrification is expected to progress most rapidly within the publicly owned urban bus fleet, which is covered by government procurement

regulations and, in some cases, government funding. For example, Canada is aiming to put 5 000 electric public and school buses on the road by the end of 2025 via the CAD 2.75 billion Zero Emission Transit Fund.

In the APS, the electric bus fleet exceeds 3 million in 2030, reaching a stock share of over 10%. In 2030, about a quarter of buses sold are electric, which is about 35% higher than the sales share in the STEPS. In part, this increase is due to the proposed EU heavy-duty vehicle CO_2 standards, which would require 100% zero-emission city bus sales from 2030. In the NZE Scenario, the electrification of buses is even more rapid, with one in two buses sold in 2030 being electric.

Medium- and heavy-duty trucks

Medium- and heavy-duty trucks are more difficult to electrify than other road segments, due in part to the size, weight and cost of the batteries needed to fully electrify this segment. However, progress is being made: around 320 000 electric trucks were on the road in 2022. By 2030, the fleet of electric trucks reaches almost 3.5 million in the STEPS, over 3% of the total truck fleet.

In the APS, the stock of electric trucks exceeds 4 million in 2030, a stock share of 4%. Electric truck sales increase from a negligible share today to over 9% in the STEPS in 2030 and 13% in the APS. The increased sales in the APS are driven in particular by the Global Memorandum of Understanding (MoU) on Zero-Emission Medium- and Heavy-Duty Vehicles, through which 27 countries have now pledged to reach 30% zero-emission medium- and heavy-duty vehicle[2] sales by 2030 and 100% by 2040. In addition, the European Union has proposed HDV CO_2 standards that would require a 45% reduction in emissions in 2030 compared to 2019 levels.

In the NZE Scenario, electric trucks reach 30% of sales in 2030, which is aligned with the Global MoU on Zero-Emission Medium- and Heavy-Duty vehicles. However, this sales share is still two-and-a-half times that in the APS, and over three times that in the STEPS.

Two/three-wheelers

Two/three-wheelers are currently the most electrified road transport segment. Given the vehicles' light weight and limited daily driving distance, battery electrification is relatively easy and makes economic sense on a total cost of ownership basis in many regions. In 2022, the electric two/three-wheeler fleet totalled over 50 million, reaching a stock share of around 7%.

In the STEPS, the fleet of electric two/three-wheelers reaches 220 million in 2030, or a quarter of the total two/three-wheeler fleet. In the APS, the stock grows to 280 million, and almost 30% of all two/three-wheelers are electric. The electric sales share in 2030 reaches 50% in the STEPS and 60% in the APS. In the NZE Scenario, the electric two/three-wheeler sales share reaches almost 80% in 2030.

[2]Includes buses.

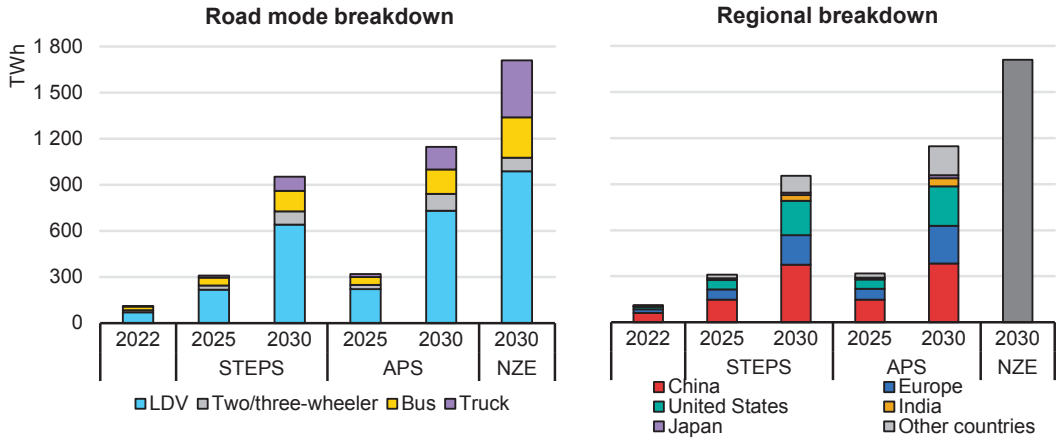
To power the growing stock of electric trucks, the number of depot chargers increases from around 300 000 today to 3.5 million in 2030 in the STEPS and 4.2 million in the APS. The installed capacity of truck depot chargers is about 310 GW in the STEPS and 380 GW in the APS in 2030. As with buses, the number of depot chargers needed in 2030 is far greater than the number of opportunity chargers. In the STEPS, the number of opportunity truck chargers is about 13 500 (6.5 GW installed capacity), increasing to 25 000 (13 GW installed capacity) in the APS in 2030.

Impact on energy demand and emissions

Electricity demand

The global EV fleet consumed about 110 TWh of electricity in 2022, which equates roughly to the current total electricity demand in the Netherlands. Almost a quarter of the total EV electricity consumption was for electric cars in China, and a fifth for electric buses in the same country. Electricity demand for EVs accounts for less than half a percent of current total final electricity consumption worldwide, and still less than one percent of China's final electricity consumption.

Figure 3.12. Electricity demand by mode and region, 2022-2030



Notes: STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario; NZE = Net Zero Emissions by 2050 Scenario; LDV = light-duty vehicle; RoW = rest of the world. The analysis is carried out for each region in the transport model within the IEA's Global Energy and Climate Model (GEC-Model) separately and then aggregated for global results. For the Net Zero Emissions by 2050 Scenario, only global values are reported. Regional data can be interactively explored via the Global EV Data Explorer.

Electricity demand for EVs accounts for only a minor share of global electricity consumption in 2030 in the Announced Pledges Scenario.

Electricity demand for EVs is projected to reach over 950 TWh in the STEPS and about 1 150 TWh in the APS in 2030. Notably, electricity demand in the APS is

about 20% higher than in the STEPS, despite the stock of EVs only being about 15% higher. This is in part due to higher rates of electrification in many high-average vehicle mileage markets such as the United States, but also to greater electrification in the truck and bus segments, which contribute incrementally to vehicle stock, but have a high electricity demand per vehicle. In addition, it is assumed that in countries with net zero pledges, a larger share of energy consumption in PHEVs is provided by electricity (as opposed to gasoline or diesel). This is particularly relevant for cars and vans, which account for about two-thirds of demand in both scenarios.

By 2030, electricity demand for EVs accounts for less than 4% of global final electricity consumption in both scenarios. As shown in the World Energy Outlook 2022, in 2030 the share of electricity for EVs is relatively small compared to demand for industrial applications, appliances or cooling and heating.

Table 3.1 Share of electricity consumption from electric vehicles relative to final electricity demand by region and scenario, 2022 and 2030

Country/region	2022	Stated Policies Scenario 2030	Announced Pledges Scenario 2030
China	0.8%	3.8%	4.0%
Europe	0.7%	4.7%	5.7%
United States	0.4%	5.4%	6.3%
Japan	0.1%	1.7%	2.2%
India	0.1%	1.7%	2.5%
Global	0.5%	3.2%	3.8%

Note: Non-road electricity consumption from the World Energy Outlook 2022.

China remains the largest consumer of electricity for EVs in 2030, although its share of global EV electricity demand decreases significantly from about 55% in 2022 to less than 40% in the STEPS, and around 30% in the APS. This reflects wider adoption of electromobility across other countries in the period to 2030.

The size of the EV fleet becomes an important factor for power systems in both scenarios, with implications for peak power demand, transmission and distribution capacity. Careful planning of electricity infrastructure, peak load management, and smart charging will be critical. Reducing dependence on fast charging will allow for optimal planning and resiliency of power systems, mitigating peak power demand. More than 80% of the electricity demand for electric LDVs in 2030 in both scenarios is via slow chargers (private and public).

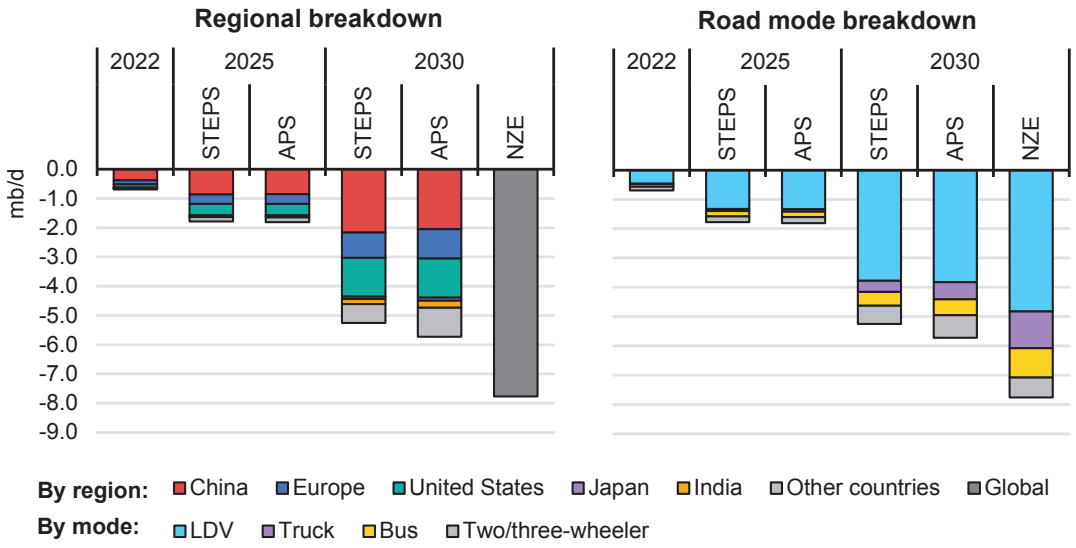
To help policy makers prioritise charging strategies according to the size of their EV fleet and their power system configuration, the IEA has developed a guiding framework and online tool for EV grid integration.

Oil displacement

The growing EV stock will reduce oil use, which today accounts for over 90% of total final consumption in the transport sector. Globally, the projected EV fleet in 2030 displaces more than 5 million barrels per day (mb/d) of diesel and gasoline in the STEPS and almost 6 mb/d in the APS, up from about 0.7 mb/d in 2022. For reference, Australia consumed around 1 mb/d of oil products across all sectors in 2021.

However, recent price volatility for critical minerals that are important inputs to battery manufacturing, and market tension affecting supply chains, are a stark reminder that in the transition to electromobility, energy security considerations evolve and require regular reconsideration.

Figure 3.13. Oil displacement by region and mode, 2022-2030



Notes: STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario; NZE = Net Zero Emissions by 2050 Scenario; LDV = light-duty vehicle. Oil displacement based on internal combustion engine (ICE) vehicle fuel consumption to cover the same mileage as the EV fleet.

Oil displacement increases from 0.7 mb/d in 2022 to nearly 6 mb/d in 2030 if pledges supporting electromobility in road transport around the world are fulfilled.

Box 3.2 How much oil really gets displaced by electric vehicles?

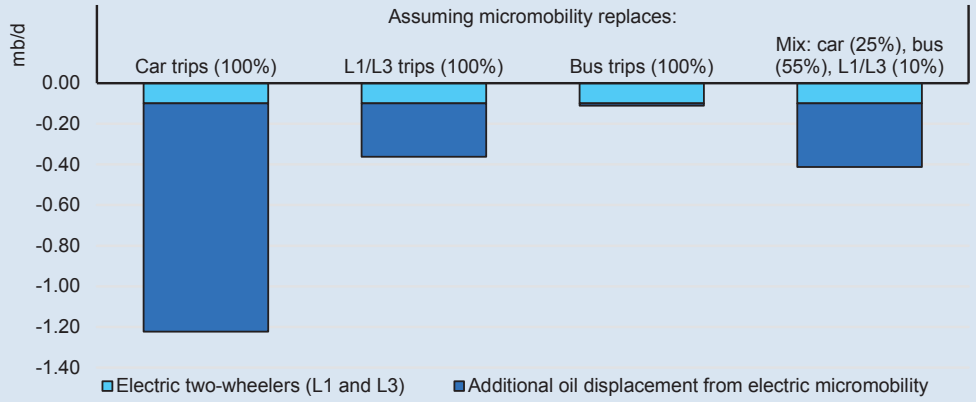
Oil displacement through the use of EVs can be estimated by assuming that the distance (total kilometres) travelled by EVs by segment each year would have otherwise been travelled by ICE vehicles or hybrid electric vehicles (HEVs) (based on the stock shares of each). In the case of PHEVs, only the distance covered by electricity gets included. The stock average fuel consumption of gasoline and diesel vehicles determines the total liquid fuel displacement, where the biofuel portion is taken out of the estimate based on regional blending rates. As a result, it can be estimated that in 2022, the stock of EVs displaced 700 000 barrels of oil per day.

This method of estimation assumes that EVs replace ICE or hybrid vehicles of the same segment, as opposed to some other means of transport, i.e. an electric car replaces an ICE car. The accuracy of this assumption is uncertain, in particular with respect to two-wheelers. In IEA analysis, only two-wheelers that fit the United Nations Economic Commission for Europe (UNECE) classification of L1 or L3 are considered. This definition excludes micromobility options such as electric-assisted bicycles and low-speed electric scooters, leading to a significantly lower stock (around 80% lower) than when including micromobility segments.

Whether or not electric micromobility avoids oil use is uncertain, as it might displace manual bicycles or walking rather than ICE two-wheelers. At the same time, there is evidence that in some cases micromobility displaces personal car or taxi trips. The estimate of the amount of oil use that is avoided by two-wheeled micromobility therefore strongly depends on the assumptions about the mode that is being displaced.

The case of China, which represents over 95% of the global stock of two-wheeled electric micromobility, is a good example. Assuming that all two-wheeled micromobility in China replaces conventional ICE two-wheelers would increase oil displacement by 260 kb/d (or 160%). If instead electric micromobility was assumed to replace only bus trips, then the total oil displacement from two-wheelers in China would increase by just 10 kb/d (10%). However, if it was assumed that they displaced car trips, then oil use avoided by two-wheelers in China would be more than 1 mb/d higher. Including oil displacement from the two-wheeled electric micromobility segment in China alone can therefore increase the estimated 2022 global oil displacement from all electric vehicles anywhere from 1% to 160%. But there is significant uncertainty as to whether any oil is displaced at all.

Additional two-wheeler oil displacement in China when accounting for micromobility segments, 2022



Notes: Electric L1 and L3 two-wheelers (based on UNECE classifications) are assumed to replace ICE two-wheelers. For this analysis, it is assumed micromobility two-wheelers travel on average 10 km/day. The mix shown is based on findings from an investigation of e-bike use in Kunming, China. The other 10% of the mix is assumed to replace active transport, and thus does not contribute to oil displacement.
Sources: IEA analysis based on BNEF and Cherry et al. (2016).

Tax revenues

Taxes on petroleum-based road fuels can be a significant source of income for governments, [7] and are often used to support investments in transport infrastructure, such as roads and bridges. Given the levels of oil displacement discussed above, the transition to EVs will reduce these tax revenues. Additional tax revenue from electricity will not be sufficient to fully compensate for this reduction, both because taxes on electricity tend to be lower on an energy basis and because EVs are more efficient and thus use less energy than ICE vehicles.

In 2022, the transition to electric vehicle stock displaced around USD 11 billion in gasoline and diesel tax revenues globally. At the same time, the use of EVs generated around USD 2 billion in electricity tax revenue, meaning there was a net loss of around USD 9 billion. Although China has the greatest stock of EVs, the greatest impact on tax revenues was seen in Europe, a trend which is expected to continue into the future. This is because Europe has some of the highest taxes on gasoline and diesel; for example, the gasoline tax rate in Germany is almost ten times the rate in China.

As the number of EVs increases globally, government fuel tax revenues are expected to decline, with global net tax losses increasing by around two-and-a-

[7] While the share of total government revenue from fuel taxes may be small, for example it has recently been less than 3% in the United Kingdom, in many cases it represents a large share of the budget allocations for transportation infrastructure.

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Amid all the climate gloom, let's not ignore the good news

Fatih Birol

Executive Director at International Energy Agency (IEA)
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March 24, 2024

Powerful economic and technological factors are driving the shift to clean energy

This article was originally published by the Financial Times.

It's easy to become overwhelmed by the seemingly relentless onslaught of disturbing news about the world's deepening climate crisis. Last year was by far the hottest on record, bringing with it a catalogue of devastating storms, floods, droughts and heat waves. And the worrying trend of unusual heat has continued into this year. Meanwhile, the amount of greenhouse gas emissions humans are releasing into the atmosphere keeps going up, not down.

What's more, elections in major economies around the world are creating heightened uncertainty about energy and climate policies. vs — the areas where real progress is being made that can still enable us to avoid the most severe effects of climate change. Nowhere is this clearer than in clean energy, where technologies like solar, wind and electric cars are increasingly replacing the need for fossil fuels and reining in emissions.

The impetus here is coming not just from government policies but from other powerful economic, industrial, strategic and technological forces.

The first is simple economics. Clean energy technologies are already competitive in many key areas and are getting more so as production scales up. It's now cheaper to build onshore wind and solar power projects than new fossil fuel plants almost everywhere worldwide.

Meanwhile, the price of electric cars continues to come down and their market share keeps rising. In 2020, around one in 25 cars sold worldwide were electric; just a few years later, in 2023, it was one in five. EVs are now at the heart of most automakers' strategies for the future. Together with the rapidly increasing investments going into battery manufacturing, this makes a U-turn away from them improbable and impractical.

Clean energy is also benefitting from a flurry of technological innovation. After concerns that supply bottlenecks for critical minerals such as lithium could hamper the production of EV batteries, the industry responded by quickly bringing to market new battery chemistries that will reduce their dependence on key minerals. And innovation is moving fast in other emerging low-emissions technologies such as electrolysers for producing hydrogen and new processes for making green steel.

Another key force at work is energy security. The global energy crisis that erupted in 2022 has put a lot of pressure on the cost of living and laid bare the frailties of our existing fossil fuel-dominated energy system. It highlighted the energy security benefits of renewables, nuclear power and energy efficient technologies such as electric cars and heat pumps, that reduce consumers' exposure to volatile fossil fuel prices.

These economic and energy security considerations have made it clear that the future of energy — and therefore of our economies and industries — lies in clean technologies. This has prompted a renaissance of industrial policy among governments around the world as they seek to ensure their economies are at the forefront of the new global energy economy that is emerging.

The country leading the growth of clean energy is China, which installed as much solar capacity in 2023 as the entire world did in 2022. China is also comfortably the biggest player in global supply chains for solar panels, wind turbines, electric cars and other major technologies, and is investing in manufacturing capacity in other regions, as well. Regardless of where they stand on climate policy, if countries want to compete with China in the industries of the future, they need to double down on clean energy plans, not dial back on them.

Clean energy is also where the jobs are. Its industries — including renewables, electric cars and heat pumps — already account for more than half of employment in the global energy sector and are continuing to add more jobs all the time.

Last but not least, the worsening impacts of global warming, mainly caused by emissions from fossil fuels, are increasingly apparent to citizens around the world, who will over time demand more, not less, climate action from their governments.

We already have ample evidence that the journey to net zero emissions is likely to be a bumpy one. But the events of recent years — including the turmoil caused by the global energy crisis, the sharp spikes in fossil fuel prices and the impacts of extreme weather — are all reminders of why we need to press ahead.

And while changes in governments may well affect the pace of energy transitions — accelerating them in some cases, slowing them in others — they won't alter the fundamental direction of travel.

https://www.iea.org/commentaries/a-strong-focus-on-oil-security-will-be-critical-throughout-the-clean-energy-transition?utm_content=bufferabb82&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

A strong focus on oil security will be critical throughout the clean energy transition

Ronan Graham, Energy Security Analyst
Ilias Atigui, Energy Security ResearcherCommentary — 11 March 2024
CiteShare

Oil security and emergency preparedness remain key priorities for the IEA half a century after its founding amid the oil shock of the early 1970s

Much has changed in the global energy landscape since the IEA was founded 50 years ago, but the security of oil supply remains a pressing concern for governments across the globe.

An enduring focus on oil security is a consequence of the continued need for oil to fuel cars, trucks, ships and aircraft, as well as to produce the petrochemicals necessary to manufacture countless everyday items.

As nearly 200 countries recognised at the COP28 climate change conference in Dubai in December, the world needs to transition away from fossil fuels if it is to avoid the worst impacts of global warming. However, while the world's dependence on oil is lessening, it remains deep-rooted, so supply disruptions can still cause significant economic harm and have a substantial negative impact on people's lives.

Oil supply risks could increase, even as demand falls

While global oil consumption reached a record high in 2023, oil dependence is set to weaken further in many parts of the world in the coming years. The shift to a clean energy economy is gathering pace, with electric vehicle sales soaring, energy efficiency improving, and other clean energy technologies advancing rapidly. Consequently, a peak in global oil demand is in sight before the end of this decade, based on today's policy settings.

However, the threat posed by oil supply disruptions will not disappear anytime soon. Even once demand starts declining, oil will remain an important part of the global energy mix for some time. There is also good reason to believe that oil supply disruptions are even more likely to occur in the coming decades than they are today. This is due to an elevated risk of supply-demand imbalances, increasing supply concentration for both crude oil and oil products, a highly uncertain geopolitical outlook, and a plethora of additional risks including the growing threat of cyberattacks and the increasing frequency of extreme weather events.

Investment uncertainty raises the risk of a supply-demand imbalance

Given the long-term outlook for oil demand and the risks to the climate from its combustion, the eventual need to scale back production activity is undeniable. However, there is a high degree of uncertainty around how quickly demand will fall, leaving oil companies facing difficult and

commercially risky decisions around upstream investment. The consequences of these decisions will have an impact on the security of oil supply, as well as the bottom lines of oil companies.

If oil demand falls quickly and sharply, companies investing in production could struggle to make a return on their investments. But, if production activity is scaled back at a faster pace than demand falls, the outcomes would be increased market tightness, higher prices and an elevated risk of supply disruptions.

Increased crude oil supply concentration could leave importers more vulnerable

As clean energy transitions progress around the world, there will be a tendency for oil production to become more concentrated in the hands of low-cost producers, particularly those in some OPEC countries. For the moment, this tendency has been kept in check, mainly by increased production in the Americas. However, in all three scenarios outlined in the IEA's *World Energy Outlook 2023*, OPEC's share of global oil production is projected to rise well above the 33% the group of producers held in 2023.

Transitions could be destabilising for producer economies that fail to diversify away from their high dependence on hydrocarbon revenues. Therefore, a higher concentration of global oil supply among a smaller group of countries could lead to heightened concerns about security of supply, with disruptions potentially having even greater impacts than if they were to occur today.

Further declines in refining capacity will leave many countries increasingly exposed to potential disruptions in oil product supplies

Developments further along the oil value chain will also result in increased exposure to oil market risk for many countries.

In the refining sector, a significant amount of capacity has been shut down in advanced economies over the past decade, particularly in Europe where some refiners have struggled to remain competitive following the completion of numerous large-scale, highly complex refineries in the Middle East and Asia.

Faced with increased competition and a highly uncertain demand outlook in their main markets, more refineries in advanced economies are likely to close. This will leave many countries increasingly reliant on imports of oil products, such as diesel and jet fuel, even as demand declines. As a consequence of their increased import dependence, these countries will become more vulnerable to disruptions in oil product markets.

Oil supply security is also threatened by an array of additional factors

The risks to oil security are manifold and wide-ranging, extending far beyond risks emanating from structural changes in global oil markets. Governments should take particular note of the threats posed by the increasingly uncertain geopolitical outlook, climate change and extreme weather events, and cyber-attacks. In recent years, supply disruptions have been caused by events that fall into each of these categories.

In the past two years, oil markets have been roiled by Russia's invasion of Ukraine and by conflicts in the Middle East. Meanwhile, water level changes and severe storms have caused

supply difficulties across many regions, and a ransomware attack resulted in an extended closure of the largest oil product pipeline in the United States in 2021.

The IEA has built strong emergency response capabilities, aimed at minimising the risk posed by oil supply disruptions

Energy security has been at the centre of the IEA's mission since its creation in 1974. At the IEA's 2024 Ministerial Meeting last month, ministers responsible for energy in IEA member countries reaffirmed "the IEA's foundational and central mission to ensure global energy security". In the decades since its creation, the Agency's work on energy security has expanded in scope, moving from an initial focus on oil security to promoting the security of natural gas and electricity supply, and more recently, to addressing the emerging security dimensions of clean energy transitions, such as critical mineral supplies.

However, throughout its existence, the IEA has remained focused on oil security and emergency preparedness. All IEA member countries have made a firm commitment to oil security by pledging to maintain readiness to respond to major oil supply disruptions at all times.

One of the IEA's key tools is an oil stockholding system that requires member countries to hold stocks equivalent to at least 90 days of their net oil imports. IEA members are also obliged to maintain demand restraint programs to rapidly reduce oil consumption during disruptions, while some members can implement measures to increase crude oil production when needed. The effectiveness of oil emergency policies and response measures in IEA member countries is periodically assessed in emergency reviews coordinated by the IEA Secretariat.

Over the past five decades, the IEA's oil emergency response mechanisms have proven to be a lynchpin of global oil markets. Since 1991, the IEA has coordinated five collective responses to major oil supply disruptions, bringing critical additional supplies to oil markets amid turbulence triggered by wars, geopolitical strife and extreme weather events. As recently as 2022, the IEA coordinated the largest collective response in its history, involving the release of just over 180 million barrels of oil stocks in response to the market turmoil that followed Russia's invasion of Ukraine.

The IEA will maintain an unwavering focus on oil security throughout the energy transition

Ultimately, reducing dependence on fossil fuels by promoting the uptake of clean energy solutions is the most effective means for any government to enhance energy security. Shifting to a clean energy economy should be seen as a golden opportunity to build a more sustainable energy system that minimises exposure to oil market volatility and decreases the prospect of supply shocks.

However, the journey to a clean energy economy may not be a smooth one, and oil consumption will not vanish overnight. For many years to come, oil supply disruptions will have the potential to cause significant economic harm and negatively impact people's lives. Maintaining a resolute focus on oil security and emergency preparedness will therefore be critical throughout clean energy transitions worldwide, and the IEA's emergency response capabilities will remain vital.

At the 2024 IEA Ministerial Meeting last month, marking the Agency's 50th Anniversary, ministers reaffirmed the "importance of oil security to the global economy and the key role that the IEA oil stockholding system plays in contributing to global oil security". As always, the IEA stands ready to act in the event of any major disruption to global oil supply.

Timeline of IEA emergency oil stock releases, 1991-2022

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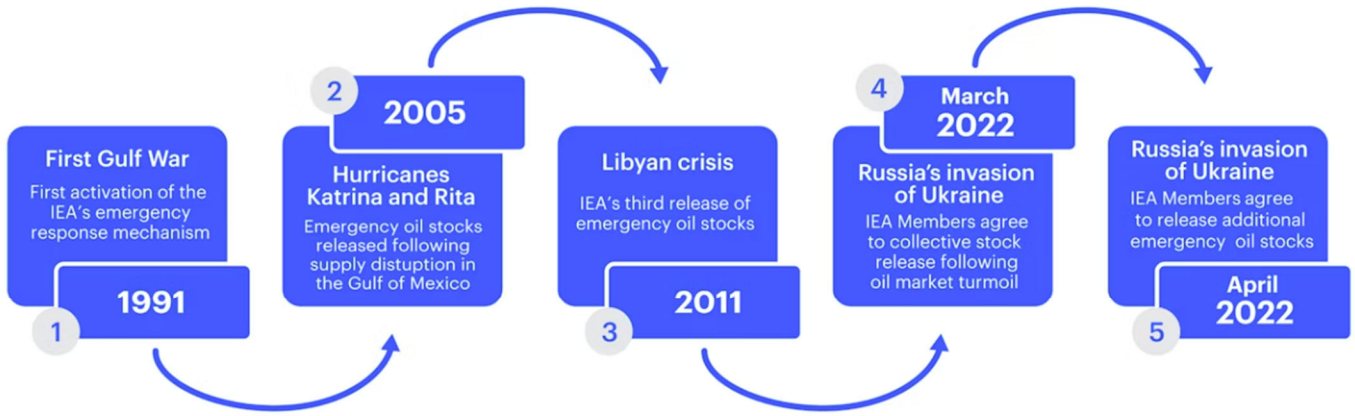


https://www.blackrock.com/corporate/investor-relations/larry-fink-annual-chairmans-letter

Larry Fink's 2024 Annual Chairman's Letter to Investors

Time to rethink retirement

When my mom passed away in 2012, my dad started to decline quickly, and my brother and I had to go through my parents' bills and finances.

Both my mom and dad worked great jobs for 50 years, but they were never in the top tax bracket. My mom taught English at the local state college (Cal Northridge), and my dad owned a shoe store.

I don't know exactly how much they made every year, but in today's dollars, it was probably not more than $150,000 as a couple. So, my brother and I were surprised when we saw the size of our parents' retirement savings. It was an order of magnitude bigger than you'd expect for a couple making their income. And when we finished going over their estate, we learned why: My parents' investments.

My dad had always been an enthusiastic investor. He encouraged me to buy my first stock (the DuPont chemical company) as a teenager. My dad invested because he knew that whatever money he put in the bond or stock markets would likely grow faster than in the bank. And he was right.

I went back and did the math. If my parents had $1,000 to invest in 1960, and they put that money in the S&P 500, then by the time they'd reached retirement age in 1990, the $1,000 would be worth nearly $20,000.[1] That's more than double what they would have earned if they'd just put the money in a bank account. My dad passed away a few months after my mom, in his late 80s. But both my parents could have lived beyond 100 and comfortably afforded it.

Why am I writing about my parents? Because going over their finances showed me something about my own career in finance. I had been working at BlackRock for almost 25 years by the time I lost my mom and dad, but the experience reminded me — in a new and very personal way — why my business partners and I founded BlackRock in the first place.

Obviously, we were ambitious entrepreneurs, and we wanted to build a big, successful company. But we also wanted to help people retire like my parents did. That's why we started an asset manager — a company that helps people invest in the capital markets — because we believed participating in those markets was going to be crucial for people who wanted to retire comfortably and financially secure.

We also believed the capital markets would become a bigger and bigger part of the global economy. If more people could invest in the capital markets, it would create a virtuous economic cycle, fueling growth for companies and countries, which would, in turn, generate wealth for millions more people.

My parents lived their final years with dignity and financial freedom. Most people don't have that chance. But they can. The same kinds of markets that helped my parents in their time can help others in our time. Indeed, I think the growth- and prosperity-generating power of the capital markets will remain a dominant economic trend through the rest of the 21st Century.
This letter attempts to explain why.

I had been working at BlackRock for almost 25 years by the time I lost my mom and dad, but the experience reminded me — in a new and very personal way — why my business partners and I founded BlackRock in the first place.

A brief (and admittedly incomplete) history of U.S. capital markets

In finance, there are two basic ways to get or grow money.
One is the bank, which is what most people historically relied on. They deposited their savings to earn interest or took out loans to buy a home or expand their business. But over time a second avenue for financing arose, particularly in the U.S., with the growth of the capital markets: publicly traded stocks, bonds, and other securities.
I saw this firsthand in the late 1970s and early 1980s when I played a role in the creation of the securitization market for mortgages.
Before the 1970s, most people secured financing for their homes the same way they did in the Christmas classic *It's a Wonderful Life* — through the Building & Loan (B&L). Customers deposited their savings into the B&L, which was essentially a bank. Then that bank would turn around and lend out those savings in the form of mortgages.
In the movie — and in real life — everything works fine until people start lining up at the bank's front door asking for their deposits back. As Jimmy Stewart explained in the film, the bank didn't have their money. It was tied up in somebody else's house.
After the Great Depression, B&Ls morphed into savings & loans (S&Ls), which had their own crisis in the 1980s. Approximately half of the outstanding home mortgages in the U.S. were held by S&Ls in 1980, and poor risk management and loose lending practices led to a raft of failures costing U.S. taxpayers more than $100 billion dollars.[2]
But the S&L crisis didn't cause the American economy lasting damage. Why? Because at the same time the S&Ls were collapsing another method of financing was getting stronger. The capital markets were providing an avenue to channel capital back to challenged real estate markets.
This was mortgage securitization.
Securitization allowed banks not just to make mortgages but to sell them. By selling mortgages, banks could better manage risk on their balance sheets and have capital to lend to home buyers, which is why the S&L crisis didn't severely impact American homeownership.
Eventually, the excesses of mortgage securitization contributed to the crash in 2008, and unlike the S&L crisis, the Great Recession did harm home ownership in the U.S. The country still hasn't fully recovered in that respect. But the broader underlying trend — the expansion of the capital markets — was still very helpful for the American economy.

In fact, it's worth considering: Why did the U.S. rebound from 2008 faster than almost any other developed nation?[3]

A big part of the answer is the country's capital markets.

In Europe, where most assets were kept in banks, economies froze as banks were forced to shrink their balance sheets. Of course, U.S. banks had to tighten capital standards and pull back from lending as well. But because the U.S. had a more robust secondary pool of money – the capital markets — the nation was able to recover much more quickly.

Today public equities and bonds provide over 70% of financing for non-financial corporations in the U.S. – more than any other country in the world. In China, for example, the bank-to-capital market ratio is almost flipped. Chinese companies rely on bank loans for 65% of their financing.[4]

In my opinion, this is the most important lesson in recent economic history: Countries aiming for prosperity don't just need strong banking systems — they also need strong capital markets.

That lesson is now spreading around the world.

Replicating the success of America's capital markets

Last year, I spent a lot of days on the road, logging visits to 17 different countries. I met with clients and employees. I also met with many policymakers and heads of state, and during those meetings, the most frequent conversation I had was about the capital markets.

More and more countries recognize the power of American capital markets and want to build their own.

Of course, many countries do have capital markets already. There are something like 80 stock exchanges around the world, everywhere from Kuala Lumpur to Johannesburg.[5] But most of these are rather small, with little investment. They're not as robust as the markets in the U.S., and that's what other nations are increasingly looking for.

In Saudi Arabia, for example, the government is interested in building a market for mortgage securitization, while Japan and India want to give people new places to put their savings. Today, in Japan, it's mostly the bank. In India, it's often in gold.

When I visited India in November, I met policymakers who lamented their fellow citizens' fondness for gold. The commodity has underperformed the Indian stock market, proving a subpar investment for individual investors. Nor has investing in gold helped the country's economy.

Compare investing in gold with, let's say, investing in a new house. When you buy a home, that creates an economic multiplier effect because you need to furnish and repair the house. Maybe you have a family and fill the house with children. All that generates economic activity. Even when someone puts their money in a bank, there's a multiplier effect because the bank can use that money to fund a mortgage. But gold? It just sits in a safe. It can be a good store of value, but gold doesn't generate economic growth.

This is a small illustration — but a good one — of what countries want to accomplish with robust capital markets. (Or rather, of what they *can't* accomplish without them.)

Despite the anti-capitalist strain in our modern politics, most world leaders still see the obvious: No other force can lift more people from poverty or improve quality of life quite like capitalism. No other

economic model can help us achieve our highest hopes for financial freedom — whether we want it for ourselves or our country.

That's why the capital markets will be key to addressing two of the mid-21st Century's biggest economic challenges.

1. The first is providing people what my parents built over time — a secure, well-earned retirement. This is a much harder proposition than it was 30 years ago. And it'll be a much harder proposition 30 years *from now*. People are living longer lives. They'll need more money. The capital markets can provide it — so long as governments and companies help people invest.

2. A second challenge is infrastructure. How are we going to build the massive amount the world needs? As countries decarbonize and digitize their economies, they're supercharging demand for all sorts of infrastructure, from telecom networks to new ways to generate power. In fact, in my nearly 50 years in finance, I've never seen more demand for energy infrastructure. And that's because many countries have twin aims: They want to transition to lower-carbon sources of power while also achieving energy security. The capital markets can help countries meet their energy goals, including decarbonization, in an affordable way.

[Retirement] is a much harder proposition than it was 30 years ago. And it'll be a much harder proposition 30 years *from now*.

Asking the old age question: How do we afford longer lives?

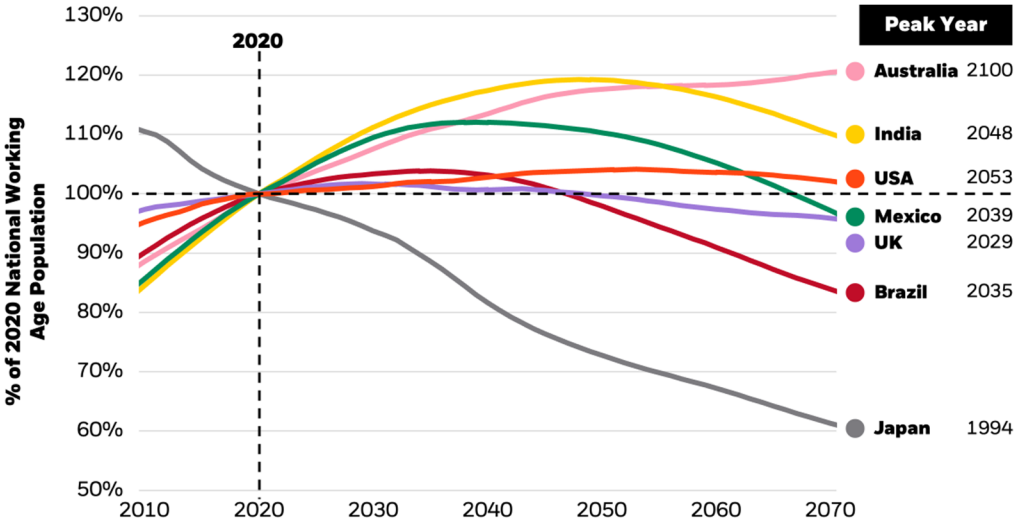
Last year, Japan passed a demographic milestone. The country's population has been aging since the early 1990s, as the pool of working-age people has shrunk and the number of elderly has risen. But 2023 was the first time that 10% of their people exceeded 80 years old,[6] making Japan the "oldest country in the world" according to the United Nations.[7]

This is part of the reason the Japanese government is making a push for retirement investment. Most Japanese keep the bulk of their retirement savings in banks, earning a low interest rate. It wasn't such a bad strategy when Japan was suffering from deflation, but now the country's economy has turned around, with the NIKKEI surging past 40,000 for the first time this month (March 2024).[8] Most aspiring retirees are missing out on the upswing. The country didn't have anything resembling a 401(k) program until 2001, but even then, the amount of income people could contribute was quite low. So a decade ago, the government launched the Nippon Individual Savings Accounts (NISA) to encourage people to invest even more in retirement. Now they're trying to double NISA's enrollment. The goal is 34 million Japanese investors before the end of the decade.[9] It will require the Japanese government to expand their capital markets, which historically had very little retail participation.

Japan isn't alone in helping more of its citizens invest for retirement. BlackRock has a joint venture — Jio BlackRock — with Jio Financial Services, an affiliate of India's Reliance Industries. Over the past

10 years, India has built a huge digital public infrastructure network that connects nearly one billion Indians to everything from healthcare to government payments via their smartphones. Jio BlackRock's goal is to use the same infrastructure to deliver retirement investing (and more).
After all, India is aging, too. The whole world is, albeit at different speeds. Brazil will start seeing more people leave its workforce than enter it by 2035; Mexico will reach peak workforce by 2040; India sometime around 2050.

As populations age, building retirement savings has never been more urgent



Source: Working-age population (ages 15-64): UN "medium trend[10]

By the mid-century mark, one-in-six people globally will be over the age of 65, up from one-in-11 in 2019.[11] To support them, governments are going to have to prioritize building out robust capital markets like the U.S. has.
But this isn't to say the U.S. retirement system is perfect. I'm not sure anybody believes that. The retirement system in America needs modernizing, at the very least.

Rethinking retirement in the United States

This was particularly clear last year as the biotech industry pumped out a rush of new, life-extending drugs. Obesity, for example, can take more than 10 years off someone's life expectancy, which is why some researchers think that new pharmaceuticals like Ozempic and Wegovy can be life-extending drugs, not just weight-loss drugs.12 In fact, a recent study shows that semaglutide, the generic name for Ozempic, can give people with cardiovascular disease an extra two years of life where they don't suffer a major condition like a heart attack.[13]

We focus a tremendous amount of energy on helping people live longer lives. But not even a fraction of that effort is spent helping people afford those extra years.

These drugs are breakthroughs. But they underscore a frustrating irony: As a society, we focus a tremendous amount of energy on helping people live longer lives. But not even a fraction of that effort is spent helping people afford those extra years.

It wasn't always this way. One reason my parents had a financially secure retirement was CalPERS, California's state pension system. As a public university employee, my mom could enroll. But pension enrollment has been declining across the country since the 1980s.[14] Meanwhile the federal government has prioritized maintaining entitlement benefits for people my age (I'm 71) even though it might mean that Social Security will struggle to meet its full obligations when younger workers retire. It's no wonder younger generations, Millennials and Gen Z, are so economically anxious. They believe my generation — the Baby Boomers — have focused on their own financial well-being to the detriment of who comes next. And in the case of retirement, they're right.

Today in America, the retirement message that the government and companies tell their workers is effectively: "You're on your own." And before my generation fully disappears from positions of corporate and political leadership, we have an obligation to change that.

Maybe once a decade, the U.S. faces a problem so big and urgent that government and corporate leaders stop business as usual. They step out of their silos and sit around the same table to find a solution. I participated in something like this after 2008, when the government needed to find a way to unwind the toxic assets from the mortgage crisis. More recently, tech CEOs and the federal government came together to address the fragility of America's semiconductor supply chain. We need to do something similar for the retirement crisis. America needs an organized, high-level effort to ensure that future generations can live out their final years with dignity.

What should that national effort do? I don't have all the answers. But what I do have is some data and the beginnings of a few ideas from BlackRock's work. Because our core business is retirement. More than half the assets BlackRock manages are for retirement.[15] We help about 35 million Americans invest for life after work,[16] which amounts to about a quarter of the country's workers.[17] Many are educators like my mom was. BlackRock helps manage pension assets for roughly half of U.S. public school teachers.[18] And this work — and our similar work around the globe — has given us some insight into how a national initiative to modernize retirement might begin.

We think the conversation starts by looking at the challenge through three different lenses.

- What's the issue from the perspective of a current worker, someone who's still trying to save for retirement?
- What about someone who has already retired? We have to look at the problem from the retiree's point of view — an individual who has already saved enough to stop working but is worried the money will run out.
- But first it's important to look at retirement in America like you'd look at a map of America — a high-level picture of the problem, the kind a national policymaker might look at. What's the issue for the population as a whole? (It's demographics.)

> [Young people] believe my generation — the Baby Boomers — have focused on their own financial well-being to the detriment of who comes next. And in the case of retirement, they're right.

The demographics don't lie

There's a popular saying in economics: "You just can't fight demographics." And yet, when it comes to retirement, the U.S. is trying anyway.

In wealthy countries, most retirement systems have three pillars. One is what people invest personally (my dad putting his money in the stock market). Another is the plans provided by employers (my mom's CalPERS pension). A third component is what we hear politicians mostly talking about – the government safety net. In the U.S., this is Social Security.

You're probably familiar with the economics behind Social Security. During your working years, the government takes a portion of your income, then after you retire, it sends you a check every month.

The idea actually originates from pre-World War I Germany, and these "old-age insurance" programs gradually became popular over the 20th Century largely because the demographics made sense.

Think about someone who was 65 years old in 1952, the year I was born. If he hadn't retired already, that person was probably getting ready to stop working.

But now think about that person's former colleagues, all the people around his age who he'd entered the workforce with back in the 1910s. The data shows that in 1952, most of those people were not preparing for retirement *because they'd already passed away*.

This is how the Social Security program functioned: More than half the people who worked and paid into the system never lived to retire and be paid from the system.[19]

Today, these demographics have completely unraveled, and this unraveling is obviously a wonderful thing. We should want more people to live more years. But we can't overlook the massive impact on the country's retirement system.

It's not just that more people are retiring in America; it's also that their retirements are increasing in length. Today, if you're married and both you and your spouse are over the age of 65, there's a 50/50 chance at least one of you will be receiving a Social Security check until you're 90.[20]

All this is putting the U.S. retirement system under immense strain. The Social Security Administration itself says that by 2034, it won't be able to pay people their full benefits.[21]

What's the solution here? No one should have to work longer than they want to. But I do think it's a bit crazy that our anchor idea for the right retirement age — 65 years old — originates from the time of the Ottoman Empire.

Humanity has changed over the past 120 years. So must our conception of retirement.

One nation that's rethought retirement is the Netherlands. In order to keep their state pension affordable, the Dutch decided more than 10 years ago to gradually raise the retirement age. It will now automatically adjust as the country's life expectancy changes.[22]

Obviously, implementing this policy elsewhere would be a massive political undertaking. But my point is that we should start having the conversation. *When people are regularly living past 90, what should the average retirement age be?*

Or rather than pushing back when people receive retirement benefits, perhaps there's a more politically palatable idea: *How do we encourage more people who wish to work longer, with carrots rather than sticks? What if the government and the private sector treated 60-plus year-olds as late-career workers with much to offer rather than people who should retire?*

One way Japan has managed its aging economy is by doing exactly this. They've found new ways to boost the labor force participation rate, a metric that has been declining in the U.S. since the early 2000s.[23] It's worth asking: *How can America stop (or at least, slow) that trend?*

Again, I'm not pretending to have the answers. Despite BlackRock's success helping millions retire, these questions are going to have to be posed to a broader range of investors, retirees, policymakers, and others. Over the next few months, BlackRock will be announcing a series of partnerships and initiatives to do just that, and I invite you to join us.

For workers, make investing (almost) automatic

When the U.S. Census Bureau released its regular survey of consumer finances in 2022, nearly half of Americans aged 55 to 65 reported not having a single dollar saved in personal retirement accounts.[24] Nothing in a pension. Zero in an IRA or 401(k).

Why? Well, the first barrier to retirement investing is affordability.

Four-in-10 Americans don't have $400 to spare to cover an emergency like a car repair or hospital visit.[25] Who is going to invest money for a retirement 30 years away if they don't have cash for today? No one. That's why BlackRock's foundation has worked with a group of nonprofits to set up an Emergency Savings Initiative. The program has helped mostly low-income Americans put away a total of $2 billion in new liquid savings.[26]

Studies show that when people have emergency savings, they're 70% more likely to invest for retirement.[27] But this is where workers run into another barrier: Investing is complex even if you can afford it.

No one is born a natural investor. It's important to say that because sometimes in the financial services industry we imply the opposite. We make it seem like saving for retirement can be a simple task, something anyone can do with a bit of practice, like driving your car to work. Just grab your keys and hop in the driver's seat. But financing retirement isn't so intuitive. The better analogy is if someone dropped a bunch of engine and auto parts in your driveway and said, "Figure it out."

At BlackRock, we've tried to make the investing process more intuitive by inventing simpler products like target date funds. They only require people to make one decision: What year do they expect to retire? Once people choose their "target date," the fund automatically adjusts their portfolio, shifting from higher-return equities to less risky bonds as retirement approaches.[28]

In 2023, BlackRock expanded the types of target date ETFs we offer so people can more easily buy them even if they don't work for employers offering a retirement plan. There are 57 million people like this in America — farmers, gig workers, restaurant employees, independent contractors — who don't

have access to a defined contribution plan.[29] And while better investment products can help, there are limits to what something like a target date fund can do. Indeed, for most people, the data shows that the hardest part of retirement investing is just getting started.

Other nations make things simpler for their part-time and contract workers. In Australia, employers must contribute a portion of income for every worker between the ages of 18 and 70 into a retirement account, which then belongs to the employee. The Superannuation Guarantee was introduced in 1992 when the country seemed like it was on the path to a retirement crisis. Thirty-two years later, Australians likely have more retirement savings per capita than any other country. The nation has the world's 54th largest population,[30] but the 4th largest retirement system.[31]

Of course, every country is different, so every retirement system should be different. But Australia's experience with Supers could be a good model for American policymakers to study and build on. Some already are. There are about 20 U.S. states — like Colorado and Virginia — that have instituted retirement systems to cover all workers like Australia does, even if they're gig or part-time.[32] It's a good thing that legislators are proposing different bills and states are becoming "laboratories of retirement." More should consider it. The benefits could be enormous for individual retirees. These new programs could also help the U.S. ensure the long-term solvency of Social Security. That's what Australia found — their Superannuation Guarantee relieved the financial tension in their country's public pension program.[33]

But what about workers who *do* have access to an employer retirement plan? They need support too. Even among employees who have access to employer plans, 17% don't enroll in them, and the hypothesis among retirement experts is this is *not* a conscious choice. People are just busy.

It sounds trivial, but even the hour or so it takes someone to look through their work email inbox for the correct link to their company's retirement system, and then select the percentage of their income they want to contribute can be the unclearable hurdle. That's why companies should make a conscious effort to look at what their default option is. *Are people automatically enrolled in a plan or not? And how much are they auto-enrolled to contribute? Is it a minimum percentage of their income? Or the maximum?*

In 2017, the University of Chicago economist Richard Thaler won the Nobel Prize, in part, for his pioneering work around "nudges" — small changes in policy that can have enormous impact in people's financial lives. Auto-enrollment is one of them. Studies show that the simple step of making enrollment automatic increases retirement plan participation by nearly 50%.[34]

As a nation, we should do everything we can to make retirement investing more automatic for workers. And there are already bright spots. Next year, a new federal law will kick in, requiring employers that set up new 401(k) plans to auto-enroll their new workers. Plus, there are hundreds of major companies (including BlackRock) that have already taken this step voluntarily.

But firms can do even more to improve their employee's financial lives, such as providing some level of matching funds for retirement plans and offering more financial education on the tremendous long-term difference between contributing a small percentage of your income to retirement versus the maximum. I also think we should make it easier for workers to transfer their 401(k) savings when they switch jobs. There is a menu of options here, and we need to explore all of them.

For retirees, help them spend what they saved

In 2018, BlackRock commissioned a study of 1,150 American retirees. When we dug into the data, we found something unexpected — even paradoxical.

The survey showed that after nearly two decades of retirement, the average person still had 80% of their pre-retirement money saved. We're talking about people who were probably between the ages of 75 and 95. If they had invested for retirement, they were likely sitting on more than enough money for the rest of their lives. And yet the data also showed that they were anxious about their finances. Only 32% reported feeling comfortable about spending what they saved.[35]

This retirement paradox has a simple explanation: Even people who know how to save for retirement still don't know how to ***spend*** for it.

In the U.S., this problem's roots stretch back more than four decades when employers began switching from defined benefit plans — pensions — to defined contribution plans like 401(k)s.

In a lot of ways, pensions were much simpler than the 401(k). You had a job somewhere for 20 or 30 years. Then when you retired, your pension paid you a set amount — a defined benefit — every month.

When I entered the workforce in the 1970s, 38% of Americans had one of these defined benefit plans, but by 2008 the percentage had been cut almost in half.[36] Meanwhile, the fraction of Americans with defined contribution plans almost quadrupled.[37]

This should have been a good thing. Beginning with the Baby Boomers, fewer and fewer workers spent their entire careers in one place, meaning they needed a retirement option that would follow them from job to job. In theory, 401(k)s did that. But in practice? Not really.

Anyone who's switched jobs knows how unintuitive it is to transfer your retirement savings. In fact, studies show that about 40% of employees cash out their 401(k)s when they switch jobs, putting themselves back at the starting line for retirement savings.[38]

The real drawback of defined contribution was that it removed most of the retirement responsibility from employers and put it squarely on the shoulders of the employees themselves. With pensions, companies had a very clear obligation to their workers. Their retirement money was a financial liability on the corporate balance sheet. Companies knew they'd have to write a check every month to each one of their retirees. But defined contribution plans ended that, forcing retirees to trade a steady stream of income for an impossible math problem.

Because most defined contribution accounts don't come with instructions for how much you can take out every month, individual savers first must build up a nest-egg, then spend down at a rate that will last them the rest of their lives. But who really knows how long that will be?

Put simply, the shift from defined benefit to defined contribution has been, for most people, a shift from financial certainty to financial ***un***certainty.

That's why around the same time we saw the data that retirees were nervous about spending their savings, we started wondering: Was there something we can do about it? Could we develop an investment strategy that provided the flexibility of a 401(k) investment but also the potential for a predictable, paycheck-like income stream, similar to a pension?

It turns out, we could. That strategy is called LifePath Paycheck™, which will go live in April. As I write this, 14 retirement plan sponsors are planning to make LifePath Paycheck™ available to 500,000 employees. I believe it will one day be the most used investment strategy in defined contribution plans.

We're talking about a revolution in retirement. And while it may happen in the U.S. first, eventually other countries will benefit from the innovation as well. At least, that is my hope. Because while retirement is mainly a saving challenge, the data is clear: it's a spending one too.

Fear vs. hope

Before I conclude this section on retirement, I want to share a few words about one of the largest barriers to investing for the future. In my view, it's not just affordability or complexity or the fact that people are too busy to enroll in their employer's plan.

Arguably the biggest barrier to investing for retirement — or for anything — is fear.

In finance, we sometimes think of "fear" as a fuzzy, emotional concept — not as a hard economic data point. But that's what it is. Fear is as important and actionable a metric as GDP. After all, investment (or lack thereof) is just a measure of fear because no one lets their money sit in a stock or a bond for 30 or 40 years if they're afraid the future is going to be worse than the present. That's when they put their money in a bank. Or underneath the mattress.

This is what happens in many countries. In China, where new surveys show consumer confidence has dropped to its lowest level in decades, household savings have reached their highest level on record — nearly $20 trillion — according to the central bank.[39] China has a savings rate of about 30%. Nearly a third of all money earned is socked away in cash in case it's needed for harder times ahead. The U.S., by comparison, has a savings rate in the single digits.[40]

America has rarely been a fearful country. Hope has been the nation's greatest economic asset. People put their money in American markets for the same reason they invest in their homes and businesses — because they believe this country will be better tomorrow than it is today.

This big, hopeful America has been the one I've known my whole life, but over the past few years, especially as I've had more grandchildren, I've started to ask myself: Will they know this version of America, too?

As I was finishing this letter, *The Wall Street Journal* published an article that caught my attention. It was titled "The Rough Years that Turned Gen Z into America's Most Disillusioned Voters," and it included some eye-catching — and really disheartening — data.

The article showed that from the mid-1990s through most of the early 21st Century, most young people — around 60% of high school seniors, to be specific — believed they'd earn a professional degree, would land a good job, and go on to be wealthier than their parents. They were optimistic. But since the pandemic, that optimism has fallen precipitously.

Compared with 20 years ago, the current cohort of young Americans is 50% more likely to question whether life has a purpose. Four-in-10 say it's "hard to have hope for the world."[41]

I've been working in finance for almost 50 years. I've seen a lot of numbers. But no single data point has ever concerned me more than this one.

The lack of hope worries me as a CEO. It worries me as a grandfather. But most of all, it worries me as an American.

If future generations don't feel hopeful about this country and their future in it, then the U.S. doesn't only lose the force that makes people want to invest. America will lose what makes it America.

Without hope, we risk becoming just another place where people look at the incentive structure before them and decide that the safe choice is the only choice. We risk becoming a country where people keep their money under the mattress and their dreams bottled up in their bedroom.

How do we get our hope back?

Whether we're trying to solve retirement or any other problem, that is the first question we have to ask, although I readily admit that I do not have the solution. I look at the state of America — and the world — and I am as answerless as everyone else. There's so much anger and division, and I often struggle to wrap my head around it.

What I do know is that any answer has to start by bringing young people into the fold. The same surveys that show their lack of hope also show their lack of confidence — far less than any previous generation — in every pillar of society: In politics, government, the media, and in corporations. Leaders of these institutions (I am one) should be empathetic to their concerns.

Young people have lost trust in older generations. The burden is on us to get it back. And maybe investing for their long-term goals, including retirement, isn't such a bad place to begin.

Perhaps the best way to start building hope is by telling young people, "You may not feel very hopeful about your future. But we do. And we're going to help you invest in it."

Young people have lost trust in older generations. The burden is on us to get it back. And maybe investing for their long-term goals, including retirement, isn't such a bad place to begin.

The new infrastructure blueprint: steel, concrete, and public-private partnership

I started traveling to London in the 1980s, and back then, if you had a choice between the city's two major international airports — Heathrow or Gatwick — you probably chose Heathrow. Gatwick was farther from the city. It was also in a comparative state of disrepair.

But things changed in 2009 when Gatwick was purchased by Global Infrastructure Partners (GIP). They increased runway capacity and instituted commonsense changes, like oversized luggage trays that cut security screening times by more than half.

"The thing about infrastructure businesses... is a lot of them tend not to focus on customer service," GIP's CEO Bayo Ogunlesi told *The Financial Times*. GIP wanted to make Gatwick different. In the process, they also turned the airport into a prime example of how infrastructure will be built and run in the 21st century — with private capital.[42]

In the U.S., people tend to think of infrastructure as a government endeavor, something built with taxpayer funds. But because of one very big reason that I'll dive into momentarily, that won't be the

primary way infrastructure is built in the mid-21st Century. Rather than only tapping government treasuries to build bridges, power grids, and airports, the world will do what Gatwick did.
The future of infrastructure is public-private partnership.

Debt matters

The $1 trillion infrastructure sector is one of the fastest growing segments of the private markets, and there are some undeniable macroeconomic trends driving this growth. In developing countries, people are getting richer, boosting demand for everything from energy to transportation while in wealthy countries, governments need to both build new infrastructure and repair the old.
Even in the U.S., where the Biden Administration has signed generational infrastructure investments into law, there's still $2 trillion worth of deferred maintenance.[43]
How will we pay for all this infrastructure? The reason I believe it'll have to be some combination of public and private dollars is that funding probably cannot come from the government alone. The debt is just too high.
From Italy to South Africa, many nations are suffering the highest debt burdens in their history. Public debt has tripled since the mid-1970s, reaching 92% of global GDP in 2022.[44] And in America, the situation is more urgent than I can ever remember. Since the start of the pandemic, the U.S. has issued roughly $11.1 trillion of new debt, and the amount is only part of the issue.[45] There's also the interest rate the Treasury needs to pay on it.
Three years ago, the rate on a 10-year Treasury bill was under 1%. But as I write this, it's over 4%, and that 3-percentage-point increase is very dangerous. Should the current rates hold, it amounts to an extra trillion dollars in interest payments over the next decade.[46]
Why is this debt a problem now? Because historically, America has paid for old debt by issuing new debt in the form of Treasury securities. It's a workable strategy so long as people want to buy those securities — but going forward, the U.S. cannot take for granted that investors will want to buy them in such volume or at the premium they currently do.
Today, around 30% of U.S. Treasury securities are held by foreign governments or investors. That percentage will likely go down as more countries build their own capital markets and invest domestically.[47]
More leaders should pay attention to America's snowballing debt. There's a bad scenario where the American economy starts looking like Japan's in the late 1990s and early 2000s, when debt exceeded GDP and led to periods of austerity and stagnation. A high-debt America would also be one where it's much harder to fight inflation since monetary policymakers could not raise rates without dramatically adding to an already unsustainable debt-servicing bill.
But is a debt crisis inevitable? No.
While fiscal discipline can help tame debt on the margins, it will be very difficult (both politically and mathematically) to raise taxes or cut spending at the level America would need to dramatically reduce the debt. But there is another way out beyond taxing or cutting, and that's growth. If U.S. GDP grows at an average of 3% (in real, not nominal terms) over the next five years, that would keep the country's debt-to-GDP ratio at 120% – high, but reasonable.

I should be clear: 3% growth is a very tall order, especially given the country's aging workforce. It will require policymakers to shift their focus. We can't see debt as a problem that can be solved only through taxing and spending cuts anymore. Instead, America's debt efforts have to center around pro-growth policies, which include tapping the capital markets to build one of the best catalysts for growth: Infrastructure. Especially energy infrastructure.

Energy pragmatism

Roads. Bridges. Ports. Airports. Cell towers. The infrastructure sector contains multitudes, but the multitude where BlackRock sees arguably the greatest demand for new investment is energy infrastructure.

Why energy? Two things are happening in the sector at the same time.

The first is the "energy transition." It's a mega force, a major economic trend being driven by nations representing 90% of the world's GDP.[48] With wind and solar power now cheaper in many places than fossil-fuel-generated electricity, these countries are increasingly installing renewables.[49] It's also a major way to address climate change. This shift – or *energy transition* – has created a ripple effect in the markets, creating both risks and opportunities for investors, including BlackRock's clients.

I started writing about the transition in 2020. Since then, the issue has become more contentious in the U.S. But outside the debate, much is still the same. People are still investing heavily in decarbonization. In Europe, for example, net-zero remains a top investment priority for most of BlackRock's clients.[50] But now the demand for clean energy is being amplified by something else: A focus on energy security.

Governments have been pursuing energy security since the oil crisis of the 1970s, (and probably as far back as the early Industrial Revolution), so this is not a new trend. In fact, when I wrote my original 2020 letter about sustainability, I also wrote to our clients that countries would still need to produce oil and gas to meet their energy needs.

To be energy secure, I wrote, most parts of the globe would need "to rely on hydrocarbons for a number of years." [51]

I'm hearing more leaders talk about decarbonization and energy security together under the joint banner of what you might call "energy pragmatism."

Then in 2022, Putin invaded Ukraine. The war lit a fresh spark under the idea of energy security. It disrupted the world's supply of oil and gas causing massive energy inflation, particularly in Europe. The UK, Norway, and the 27 EU countries had to collectively spend 800 billion euros subsidizing energy bills.[52]

This is part of the reason I'm hearing more leaders talk about decarbonization and energy security together under the joint banner of what you might call "energy pragmatism."

Last year, as I mentioned, I visited 17 countries, and I spent a lot of time talking to the people who are responsible for powering homes and businesses, everybody from prime ministers to energy grid operators. The message I heard was completely opposite to what you often hear from activists on the far left and right, who say that countries have to choose between renewables and oil and gas. These

leaders believe that the world still needs both. They were far more pragmatic about energy than dogmatic. Even the most climate conscious among them saw that their long-term path to decarbonization will include hydrocarbons, albeit it less of them, for some time to come.

Germany is a good example of how energy pragmatism is still a path to decarbonization. It's one of the countries most committed to fighting climate change and has made enormous investments in wind and solar power. But sometimes the wind doesn't blow in Berlin, and the sun doesn't shine in Munich. And during those windless, sunless periods, the country still needs to rely on natural gas for "dispatchable power." Germany used to get that gas from Russia, but now it needs to look elsewhere. So, they're building additional gas facilities to import from other producers around the world.[53]

Or look at Texas. They face a similar energy challenge – not because of Russia but because of the economy. The state is one of the fastest growing in the U.S.,[54] and the additional demand for power is stretching ERCOT, Texas' energy grid, to the limit.[55]

Today, Texas runs on 28% renewable energy[56] – 6% more than the U.S. as a whole.[57] But without an additional 10 gigawatts of dispatchable power, which might need to come partially from natural gas, the state could continue to suffer devastating brownouts. In February, BlackRock helped convene a summit of investors and policymakers in Houston to help find a solution.

Texas and Germany are great illustrations of what the energy transition looks like. As I wrote in 2020, the transition will only succeed if it's "fair." Nobody will support decarbonization if it means giving up heating their home in the winter or cooling it in the summer. Or if the cost of doing so is prohibitive.

Since 2020, economists have popularized better language to describe what a fair transition actually means. One important concept is the "green premium." It's the surcharge people pay for "going green": for example, switching from a car that runs on gas to an electric vehicle. The lower the green premium, the fairer decarbonization will be because it'll be more affordable.

This is where the power of the capital markets can be unleashed to great effect. Private investment can help energy companies reduce the cost of their innovations and scale them around the world.

Last year, BlackRock invested in over a dozen of these transition projects on behalf of our clients. We partnered with developers in Southeast Asia aiming to build over a gigawatt of solar capacity (enough to power a city) in both Thailand and the Philippines.[58] We also invested in Lake Turkana Wind Power, Africa's largest windfarm. It's located in Kenya and currently accounts for about 12% of the country's power generation.[59]

There are also earlier-stage technologies, like a giant "hot rock" battery being built by Antora Energy. The company heats up blocks of carbon with wind or solar power during parts of the day when renewable energy is cheap and abundant. These "thermal batteries" reach up to 2,400 degrees Celsius and glow brighter than the sun.[60] Then, that heat is used to power giant industrial facilities around-the-clock, even when the sun isn't shining, or the wind isn't blowing.

BlackRock invested in Antora through Decarbonization Partners, a partnership we have with the investment firm, Temasek. Our funding will help Antora scale up to deliver billions of dollars worth of zero-emission energy to industrial customers.[61] (One day, their thermal batteries might help solve the kind of dispatchable power problem that Texas and Germany are facing – but without carbon emissions.)

The final technology I'll spotlight is carbon capture. Last year, one of BlackRock's infrastructure funds invested $550 million in a project called STRATOS, which will be the world's largest direct air capture facility when construction is completed in 2025.[62] Among the more interesting aspects of the project is who's building the facility: Occidental Petroleum, the big Texas oil company.

The energy market isn't divided the way some people think, with a hard split between oil & gas producers on one side and new clean power and climate tech firms on the other. Many companies, like Occidental, do both, which is a major reason BlackRock has never supported divesting from traditional energy firms. They're pioneers of decarbonization, too.

Today, BlackRock has more than $300 billion invested in traditional energy firms on behalf of our clients. Of that $300 billion, more than half – $170 billion – is in the U.S.[63] We invest in these energy companies for one simple reason: It's our clients' money. If they want to invest in hydrocarbons, we give them every opportunity to do it – the same way we invest roughly $138 billion in energy transition strategies for our clients. That's part of being an asset manager. We follow our clients' mandates.

But when it comes to energy, I also understand why people have different preferences in the first place. Decarbonization and energy security are the two macroeconomic trends driving the demand for more energy infrastructure. Sometimes they're competing trends. Other times, they're complementary, like when the same advanced battery that decarbonizes your grid can also reduce your dependence on foreign power.

The point is: The energy transition is not proceeding in a straight line. As I've written many times before, it's moving in different ways and at different paces in different parts of the world. At BlackRock, our job is to help our clients navigate the big shifts in the energy market no matter where they are.

BlackRock's next transformation

One way we're helping our clients navigate the booming infrastructure market is by transforming our company. I began this section by writing about the owners of Gatwick Airport, GIP. In January, BlackRock announced our plans to acquire them.

Why GIP? BlackRock's own infrastructure business had been growing rapidly over the past several years. But to meet demand, we realized we needed to grow even faster.

It's not just debt-strapped governments that need to find alternate pools of financing for their infrastructure. Private sector firms do too. All over the world, there's a vast infrastructure footprint that's owned and operated entirely by private companies. Cell towers are a good example. So are pipelines that deliver the feedstocks for chemical companies. Increasingly, the owners of these assets prefer to have a financing partner, rather than carrying the full cost for the infrastructure on their balance sheet.

I had been thinking about this trend and called an old colleague, Bayo Ogunlesi.

Both Bayo and I started our careers in finance at the investment bank First Boston. But our paths diverged. I lost $100 million on a series of bad trades at First Boston and…well, nobody needs to hear that story again. But it led me (and my BlackRock partners) to pioneer better risk management

for fixed income markets. Meanwhile, Bayo and his team were pioneering modern infrastructure investing in the private markets.

Now, we plan to join our forces again. I think the result will be better opportunities for our clients to invest in the infrastructure that keeps our lights on, planes flying, trains moving, and our cell service at the maximum number of bars.

More about BlackRock's work in 2023

In this letter, I've shared my view that the capital markets are going to play an even bigger role in the global economy. They'll have to if the world wants to address the challenges around infrastructure, debt, and retirement. These are the major economic issues of the mid-21st Century. We're going to need the power of capitalism to solve them.

The way BlackRock figures into that story is through our work with clients. We want to position them well to navigate these trends, which is why we've tried to stay more connected to our clients than ever.

Over the past five years, thousands of clients on behalf of millions of individuals have entrusted BlackRock with managing over $1.9 trillion in net new assets. Thousands also use our technology to better understand the risks in their portfolios and support the growth and commercial agility of their own businesses. Years of organic growth, alongside the long-term growth of the capital markets, underpin our $10 trillion of client assets, which grew by over $1.4 trillion in 2023.

In good times and bad, whether clients are focused on increasing or decreasing risk, our consistent industry-leading organic growth demonstrates that clients are consolidating more of their portfolios with BlackRock. In 2023, our clients awarded us with $289 billion in net new assets during a period of rapid change and significant portfolio de-risking.

BlackRock's differentiated business model has enabled us to continue to grow with our clients and maintain positive organic base fee growth. We've grown regardless of the market backdrop and even as most of the industry experienced outflows.

I think back to 2016 and 2018 when uncertainty and cautious sentiment impacted investment behavior among institutions and individuals. Many clients de-risked and moved to cash. BlackRock stayed connected with our clients. We stayed rigorous in driving investment performance, innovating new products and technologies, and providing advice on portfolio design. Once clients were ready to step back into the markets more actively, they did it with BlackRock – leading to new records for client flows, and organic base fee growth at or above our target.

Flows and organic base fee growth accelerated into the end of 2023. We saw $96 billion of total net inflows in the fourth quarter and we entered 2024 with great momentum.

In 2024, I plan to do what I did in 2023 – spend a lot of time on the road visiting clients. I've already taken several trips in the U.S. and around the world, and it's clearer than ever that companies and clients want to work with BlackRock.

For companies where we are investing on behalf of our clients, they appreciate that we typically provide long-term, consistent capital. We often invest early, and we stay invested through cycles whether it's debt or equity, pre-IPO or post-IPO. Companies recognize BlackRock's global

relationships, brand, and expertise across markets and industries. This makes us a valuable partner, and in turn supports the sourcing and performance we can provide for clients.

Over the past 18 months, we've sourced and executed on a number of deals for clients. In addition to the STRATOS direct air capture project, our funds partnered with AT&T on the Gigapower JV to build out broadband in communities across the U.S. We also made investments globally, including in Brasol (Brazil), AirFirst (South Korea), Akaysha Energy (Australia), and the Lake Turkana Wind Farm (Kenya).

Our ability to source deals for clients is a primary driver of demand for BlackRock private markets strategies. These strategies saw $14 billion of net inflows in 2023, driven by infrastructure and private credit. We continue to expect these categories to be our primary growth drivers within alternatives in the coming years.

Our active investment insights, expertise and strong investment performance similarly differentiate BlackRock in the market. We saw nearly $60 billion of active net inflows in 2023, compared with industry outflows.

In ETFs, BlackRock generated an industry-leading $186 billion of net inflows in 2023. Our leadership in the ETF industry is another testament to our global platform and connectivity with clients.

What we have seen in market after market is that if we can make investing easier and more affordable, we can quickly attract new clients. We are leveraging digital wealth platforms in local markets to provide more investment access and accelerate organic growth for iShares ETFs.

In EMEA, BlackRock powers ETF savings plans for end investors, partnering with many banks and brokerage platforms, including Trade Republic, Scalable Capital, ING, Lloyds, and Nordnet. These partnerships will help millions of people access investments, invest for the long-term, and achieve financial well-being.

In 2023, we also announced our minority investment in Upvest, which will help drive innovation in how Europeans access markets and make it cheaper and simpler to start investing.

Then there is our work with Britain's leading digital bank, Monzo, to offer its customers our products through its app, with minimum investments as low as £1. Through these relationships, we're evolving our iShares ETF franchise to meaningfully increase access to global markets.

Let me also say a few words about Aladdin. It remains the language of portfolios, uniting all of BlackRock, and providing the technological foundation for how we serve clients across our platform. And Aladdin isn't just the key technology that powers BlackRock; it also powers many of our clients. The need for integrated data and risk analytics as well as whole portfolio views across public and private markets is driving annual contract value (ACV) growth.

In 2023, we generated $1.5 billion in technology services revenue. Clients are looking to grow and expand with Aladdin, reflected in strong harvesting activity, with over 50% of Aladdin sales being multi-product.

As we look ahead, the re-risking of client portfolios will create tremendous prospects for both our public and private markets franchises. And integrated technology will be needed to help clients be nimble while operating at scale.

These are the times where investors are making broad changes to the way they build portfolios. BlackRock is helping investors build the “portfolio of the future” – one that integrates public and private markets and is digitally enabled. We view these changes as big catalysts. With the diversified investment and technology platform we’ve built, we’ve set ourselves up to be a structural grower in the years ahead.

Positioning our organization for the future

Just as we continually innovate and evolve our business to stay ahead of our clients, we also evolve our organization and our leadership team.

Earlier this year we announced changes to reimagine our business and transform our organization to better anticipate what clients need – and shape BlackRock so clients can continue to get the insights, solutions, and outcomes they expect from us.

For years, BlackRock has worked with clients across the whole portfolio, albeit with distinctions between product structures for ETFs, active mutual funds, and separate accounts.

Now, the traditional lines between products are blurring. Clients are building portfolios that seamlessly combine both active and index strategies, including liquid and illiquid assets and spanning public and private markets, across ETF, mutual fund, and separate account structures.

BlackRock has been critical in expanding the market for ETFs by making them accessible to more investors and delivering new asset classes (like bonds) and investment strategies (like active). As a result of that success, the ETF is no longer just an indexing concept – it is becoming an efficient structure for a range of investment solutions.

We always viewed ETFs as a technology, a technology that facilitated investing. And just as our Aladdin technology has become core to asset management, so too have ETFs. That’s why we believe embedding our ETF and Index expertise across the entire firm will accelerate the growth of iShares and every investment strategy at BlackRock.

We’ll be nimbler and more closely aligned with clients through our new architecture with the aim of delivering a better experience, better performance, and better outcomes.

Voting choice

Healthy capital markets depend on a continuous feedback loop between companies and their investors. For more than a decade, BlackRock endeavored to improve that feedback loop for our clients.

We’ve done it by building an industry-leading stewardship program, one that’s focused on engaging investee companies on issues impacting our clients’ long-term economic interests. This requires understanding how companies are positioned to navigate the risks and opportunities they face – for example, how geopolitical fragmentation might rewire their supply chains or how higher borrowing cost might impact their capacity to deliver sustained earnings growth.

To do that, we built one of the largest stewardship teams to engage with companies, often alongside our investment teams, because we never believed in the industry’s reliance on the recommendations of a few proxy advisors. We knew our clients would expect us to make independent proxy voting

decisions, informed by our ongoing dialogue with companies – a philosophy that continues to underpin our stewardship efforts today. For our clients who have entrusted us with this important responsibility, we remain steadfast in promoting sound corporate governance practices and financial resilience at investee companies on their behalf.

And for our clients who wish to take a more direct role in the proxy voting process, we continue to innovate to provide them with more choice. In 2022, BlackRock was the first in our industry to launch Voting Choice, a capability that enabled institutional investors to participate in the proxy voting process. Today, about half of our clients' index equity assets under management can access Voting Choice. And in February, we launched a pilot in our largest core S&P 500 ETF, enabling Voting Choice for individual investors for the first time.

We welcome these additional voices to corporate governance and believe they can further strengthen shareholder democracy. I believe that more asset owners can participate in this important process effectively if they are well-informed. We are encouraged by their engagement and the continued transformation of the proxy voting ecosystem but continue to believe that the industry would benefit from additional proxy advisors.

Strategy for long-term growth

For 36 years, BlackRock has led by listening to our clients and evolving to help them achieve long-term outcomes. That commitment has been behind everything we've done as a firm, whether it's unlocking new markets through iShares, pioneering whole portfolio advisory, launching Aladdin on the desktops of investors and so much more. Clients have been at the foundation of our mindset and our growth strategy, informing the investments we've made across our businesses.

The combination of technology and advisory, alongside ETFs, active and private markets capabilities, enables us to deliver a better client experience – leading to clients consolidating more of their portfolios with BlackRock or engaging us for outsourcing solutions. We believe this in turn will drive continued differentiated organic growth into the future.

As we do each year, our management team and Board spent time assessing our strategy for growth. We challenge ourselves to think: What opportunities will this economic environment create for BlackRock and our clients, what more can we do to meet and anticipate their needs? How can we evolve our organization, operating structure, investment capabilities, and service models and, in doing so, keep leading the industry?

We have strong conviction in our strategy and our ability to execute with scale and expense discipline. Our strategy remains centered on growing Aladdin, ETFs, and private markets, keeping alpha at the heart of BlackRock, leading in sustainable investing, and advising clients on their whole portfolio.

We have continually made internal investments for organic growth and efficiency, investing ahead of client opportunities in private markets, ETFs, technology, and whole portfolio solutions.

In private markets, we are prepared to capitalize on structural growth trends. Whether it's executing on demand for much-needed infrastructure, or the growing role of private credit as banks and public lenders move away from the middle market, private capital will be essential. BlackRock is poised to

capture share through our scale, proprietary origination, and track record. And we believe our planned acquisition of GIP will meaningfully accelerate our ability to offer our private markets capabilities to our clients.

In ETFs, we will continue to lead by expanding investment access globally and through innovation. The ETF is an adaptable piece of financial technology, and over time we've been able to do more with it than just making investing more affordable. We've been able to bring better liquidity and price discovery to more opaque markets. One recent example is offering people exposure to Bitcoin through ETFs.

ETFs have been an incredible growth story in the U.S., with iShares leading the way. We believe global ETF adoption is set to accelerate as catalyst trends that we saw in the U.S. years ago like the growth of fee-based advisory and model portfolios are just beginning to take root. Nearly half of 2023 iShares net inflows were from our ETFs listed internationally in local markets, led by European iShares net inflows of $70 billion.

Active asset allocation, security selection and risk management have consistently been key elements in long-term returns. Our active teams across multi-asset, fixed income and equities are well-positioned to seize on broad opportunities arising out of this new interest rate and potentially more volatile regime. We are particularly excited about the opportunity in fixed income and how artificial intelligence is propelling performance in our systematic investing businesses.

Fixed income is going to be increasingly relevant in the construction of whole portfolios with higher yields and better return potential compared to the low-rate environment of the last 15 years. Now that the rate on 10-year U.S. Treasuries is near long-term averages, clients are reconsidering bond allocations.

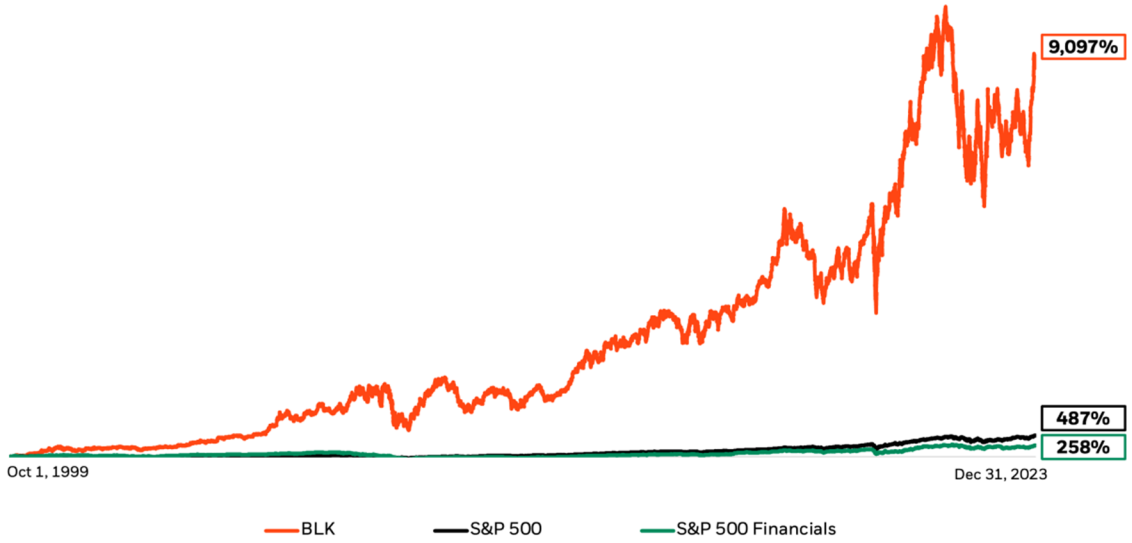
BlackRock is well-positioned with a diversified, fixed income platform. It's not going to be just about index, where we manage nearly $1.7 trillion. Or just about active where we manage over $1 trillion. Some of the most interesting portfolio conversations are with allocators who are blending ETFs with active or using innovations like our active ETFs for professionally managed income solutions.

Across asset classes, the need for integrated data, technology and risk management will continue to drive demand for Aladdin. Through its dynamic ecosystem of over 130,000 users, the Aladdin platform is constantly innovating and being improved. Investments in Aladdin AI copilots, enhancements in openness supporting ecosystem partnerships, and advancing whole portfolio solutions are going to further augment the value of Aladdin.

We are honored that our clients entrusted us with $289 billion of net new assets in 2023. And over the past few months, we've seen a decidedly more positive sentiment and tone in markets and among clients that I'm very optimistic will carry into the rest of 2024.

Our ability to adapt, evolve, and grow has generated a total return of 9,000% for our shareholders since our IPO in 1999. That is well in excess of the S&P 500 return of 490% and representative of a business model serving all our stakeholders.

Total return since BlackRock’s IPO through December 31, 2023



S&P Global. The performance graph is not necessarily indicative of future investment performance.

Our Board of Directors

BlackRock’s Board plays an integral role in our strategy, our growth and our success.

The diverse experiences and backgrounds of our Directors enable us to have rich discussions and debates. At each meeting, our Directors review components of our long-term strategy and foster constructive dialogue with our leadership team on strategic opportunities, priorities and risks facing BlackRock’s business. This dialogue ultimately pushes us to make the sometimes tactical and sometimes transformational moves to build a better BlackRock. This includes the two transformational moves we made in January: The strategic re-architecture of our organization and our agreement to acquire GIP.

These two transformational changes are the largest since our acquisition of Barclays Global Investors nearly 15 years ago.

Following the closing of the GIP transaction, we plan to have Bayo Ogunlesi join our Board of Directors. We will continue to evolve our Board over time to reflect the breadth of our global business and to guide us as we evolve ahead of our clients’ needs.

A final note

Over the past 36 years, BlackRock has grown from a company of eight people in a tiny Manhattan office into the largest asset manager in the world. But our growth is just a small part of a much larger success story.

It’s part of the same story that includes my parents retiring comfortably after 50 years of hard work. The same story where America was able to endure the 1980s S&L crisis and 2008 financial crisis – and rebound quickly and with growing strength.

And it’s the story that, hopefully, will include more people around the world. Nations that can outgrow their debt. Cities that can afford to power more homes and build more roads. Workers who can live out their golden years with dignity.

All of these stories are only possible because of the power of the capital markets and the people who are hopeful enough to invest in them.

Sincerely,

Laurence Fink

Chairman and Chief Executive Officer

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A Fundamental Reshaping of Finance

Dear CEO,

As an asset manager, BlackRock invests on behalf of others, and I am writing to you as an advisor and fiduciary to these clients. The money we manage is not our own. It belongs to people in dozens of countries trying to finance long-term goals like retirement. And we have a deep responsibility to these institutions and individuals – who are shareholders in your company and thousands of others – to promote long-term value.

Climate change has become a defining factor in companies' long-term prospects. Last September, when millions of people took to the streets to demand action on climate change, many of them emphasized the significant and lasting impact that it will have on economic growth and prosperity – a risk that markets to date have been slower to reflect. But awareness is rapidly changing, and I believe we are on the edge of a fundamental reshaping of finance.

The evidence on climate risk is compelling investors to reassess core assumptions about modern finance. Research from a wide range of organizations – including the UN's Intergovernmental Panel on Climate Change, the BlackRock Investment Institute, and many others, including new studies from McKinsey on the socioeconomic implications of physical climate risk – is deepening our understanding of how climate risk will impact both our physical world and the global system that finances economic growth.

Will cities, for example, be able to afford their infrastructure needs as climate risk reshapes the market for municipal bonds? What will happen to the 30-year mortgage – a key building block of finance – if lenders can't estimate the impact of climate risk over such a long timeline, and if there is no viable market for flood or fire insurance in impacted areas? What happens to inflation, and in turn interest rates, if the cost of food climbs from drought and flooding? How can we model economic growth if emerging markets see their productivity decline due to extreme heat and other climate impacts?

Investors are increasingly reckoning with these questions and recognizing that climate risk is investment risk. Indeed, climate change is almost invariably the top issue that clients around the world raise with BlackRock. From Europe to Australia, South America to China, Florida to Oregon, investors are asking how they should modify their portfolios. They are seeking to understand both the

physical risks associated with climate change as well as the ways that climate policy will impact prices, costs, and demand across the entire economy.

These questions are driving a profound reassessment of risk and asset values. And because capital markets pull future risk forward, we will see changes in capital allocation more quickly than we see changes to the climate itself. In the near future – and sooner than most anticipate – there will be a significant reallocation of capital.

Climate Risk Is Investment Risk

As a fiduciary, our responsibility is to help clients navigate this transition. Our investment conviction is that sustainability- and climate-integrated portfolios can provide better risk-adjusted returns to investors. And with the impact of sustainability on investment returns increasing, we believe that sustainable investing is the strongest foundation for client portfolios going forward.

In a letter to our clients today, BlackRock announced a number of initiatives to place sustainability at the center of our investment approach, including: making sustainability integral to portfolio construction and risk management; exiting investments that present a high sustainability-related risk, such as thermal coal producers; launching new investment products that screen fossil fuels; and strengthening our commitment to sustainability and transparency in our investment stewardship activities.

Over the next few years, one of the most important questions we will face is the scale and scope of government action on climate change, which will generally define the speed with which we move to a low-carbon economy. This challenge cannot be solved without a coordinated, international response from governments, aligned with the goals of the Paris Agreement.

Under any scenario, the energy transition will still take decades. Despite recent rapid advances, the technology does not yet exist to cost-effectively replace many of today's essential uses of hydrocarbons. We need to be mindful of the economic, scientific, social and political realities of the energy transition. Governments and the private sector must work together to pursue a transition that is both fair and just – we cannot leave behind parts of society, or entire countries in developing markets, as we pursue the path to a low-carbon world.

While government must lead the way in this transition, companies and investors also have a meaningful role to play. As part of this responsibility, BlackRock was a founding member of the Task

Force on Climate-related Financial Disclosures (TCFD). We are a signatory to the UN's Principles for Responsible Investment, and we signed the Vatican's 2019 statement advocating carbon pricing regimes, which we believe are essential to combating climate change.

BlackRock has joined with France, Germany, and global foundations to establish the Climate Finance Partnership, which is one of several public-private efforts to improve financing mechanisms for infrastructure investment. The need is particularly urgent for cities, because the many components of municipal infrastructure – from roads to sewers to transit – have been built for tolerances and weather conditions that do not align with the new climate reality. In the short term, some of the work to mitigate climate risk could create more economic activity. Yet we are facing the ultimate long-term problem. We don't yet know which predictions about the climate will be most accurate, nor what effects we have failed to consider. But there is no denying the direction we are heading. Every government, company, and shareholder must confront climate change.

Improved Disclosure for Shareholders

We believe that all investors, along with regulators, insurers, and the public, need a clearer picture of how companies are managing sustainability-related questions. This data should extend beyond climate to questions around how each company serves its full set of stakeholders, such as the diversity of its workforce, the sustainability of its supply chain, or how well it protects its customers' data. Each company's prospects for growth are inextricable from its ability to operate sustainably and serve its full set of stakeholders.

The importance of serving stakeholders and embracing purpose is becoming increasingly central to the way that companies understand their role in society. As I have written in past letters, a company cannot achieve long-term profits without embracing purpose and considering the needs of a broad range of stakeholders. A pharmaceutical company that hikes prices ruthlessly, a mining company that shortchanges safety, a bank that fails to respect its clients – these companies may maximize returns in the short term. But, as we have seen again and again, these actions that damage society will catch up with a company and destroy shareholder value. By contrast, a strong sense of purpose and a commitment to stakeholders helps a company connect more deeply to its customers and adjust to the changing demands of society. Ultimately, purpose is the engine of long-term profitability.

Over time, companies and countries that do not respond to stakeholders and address sustainability risks will encounter growing skepticism from the markets, and in turn, a higher cost of capital. Companies and countries that champion transparency and demonstrate their responsiveness to stakeholders, by contrast, will attract investment more effectively, including higher-quality, more patient capital.

Important progress improving disclosure has already been made – and many companies already do an exemplary job of integrating and reporting on sustainability – but we need to achieve more widespread and standardized adoption. While no framework is perfect, BlackRock believes that the Sustainability Accounting Standards Board (SASB) provides a clear set of standards for reporting sustainability information across a wide range of issues, from labor practices to data privacy to business ethics. For evaluating and reporting climate-related risks, as well as the related governance issues that are essential to managing them, the TCFD provides a valuable framework.

We recognize that reporting to these standards requires significant time, analysis, and effort. BlackRock itself is not yet where we want to be, and we are continuously working to improve our own reporting. Our SASB-aligned disclosure is available on our website, and we will be releasing a TCFD-aligned disclosure by the end of 2020.

BlackRock has been engaging with companies for several years on their progress towards TCFD- and SASB-aligned reporting. This year, we are asking the companies that we invest in on behalf of our clients to: (1) publish a disclosure in line with industry-specific SASB guidelines by year-end, if you have not already done so, or disclose a similar set of data in a way that is relevant to your particular business; and (2) disclose climate-related risks in line with the TCFD's recommendations, if you have not already done so. This should include your plan for operating under a scenario where the Paris Agreement's goal of limiting global warming to less than two degrees is fully realized, as expressed by the TCFD guidelines.

We will use these disclosures and our engagements to ascertain whether companies are properly managing and overseeing these risks within their business and adequately planning for the future. In the absence of robust disclosures, investors, including BlackRock, will increasingly conclude that companies are not adequately managing risk.

We believe that when a company is not effectively addressing a material issue, its directors should be held accountable. Last year BlackRock voted against or withheld votes from 4,800 directors at 2,700 different companies. Where we feel companies and boards are not producing effective sustainability disclosures or implementing frameworks for managing these issues, we will hold board members accountable. Given the groundwork we have already laid engaging on disclosure, and the growing investment risks surrounding sustainability, we will be increasingly disposed to vote against management and board directors when companies are not making sufficient progress on sustainability-related disclosures and the business practices and plans underlying them.

Putting sustainability at the center of how we invest

Sustainability-integrated portfolios can provide better risk-adjusted returns to investors. Sustainability will drive the way we manage risk, construct portfolios, design products, and engage with companies.

Read our letter to clients

Accountable and Transparent Capitalism

Over the 40 years of my career in finance, I have witnessed a number of financial crises and challenges – the inflation spikes of the 1970s and early 1980s, the Asian currency crisis in 1997, the dot-com bubble, and the global financial crisis. Even when these episodes lasted for many years, they were all, in the broad scheme of things, short-term in nature. Climate change is different. Even if only a fraction of the projected impacts is realized, this is a much more structural, long-term crisis. Companies, investors, and governments must prepare for a significant reallocation of capital.

In the discussions BlackRock has with clients around the world, more and more of them are looking to reallocate their capital into sustainable strategies. If ten percent of global investors do so – or even five percent – we will witness massive capital shifts. And this dynamic will accelerate as the next generation takes the helm of government and business. Young people have been at the forefront of calling on institutions – including BlackRock – to address the new challenges associated with climate change. They are asking more of companies and of governments, in both transparency and in action. And as trillions of dollars shift to millennials over the next few decades, as they become CEOs and CIOs, as they become the policymakers and heads of state, they will further reshape the world's approach to sustainability.

As we approach a period of significant capital reallocation, companies have a responsibility – and an economic imperative – to give shareholders a clear picture of their preparedness. And in the future, greater transparency on questions of sustainability will be a persistently important component of every company's ability to attract capital. It will help investors assess which companies are serving their stakeholders effectively, reshaping the flow of capital accordingly. But the goal cannot be transparency for transparency's sake. Disclosure should be a means to achieving a more sustainable and inclusive capitalism. Companies must be deliberate and committed to embracing purpose and serving all stakeholders – your shareholders, customers, employees, and the communities where you operate. In doing so, your company will enjoy greater long-term prosperity, as will investors, workers, and society as a whole.

Sincerely,

https://www.blackrock.com/uk/individual/blackrock-client-letter

Sustainability as BlackRock's New Standard for Investing

Dear Client,

Since BlackRock's founding in 1988, we have worked to anticipate our clients' needs to help you manage risk and achieve your investment goals. As those needs have evolved, so too has our approach, but it has always been grounded in our fiduciary commitment to you.

Over the past few years, more and more of our clients have focused on the impact of sustainability on their portfolios. This shift has been driven by an increased understanding of how sustainability-related factors can affect economic growth, asset values, and financial markets as a whole.

The most significant of these factors today relates to climate change, not only in terms of the physical risk associated with rising global temperatures, but also transition risk – namely, how the global transition to a low-carbon economy could affect a company's long-term profitability. As Larry Fink writes in his 2020 letter to CEOs, the investment risks presented by climate change are set to accelerate a significant reallocation of capital, which will in turn have a profound impact on the pricing of risk and assets around the world.

As your fiduciary, BlackRock is committed to helping you navigate this transition and build more resilient portfolios, including striving for more stable and higher long-term returns. Because sustainable investment options have the potential to offer clients better outcomes, we are making sustainability integral to the way BlackRock manages risk, constructs portfolios, designs products, and engages with companies. We believe that sustainability should be our new standard for investing.

Over the past several years, we have been deepening the integration of sustainability into technology, risk management, and product choice across BlackRock. We are now accelerating those efforts in the following ways.

Sustainable, Resilient, and Transparent Portfolios

Resilient and well-constructed portfolios are essential to achieving long-term investment goals. Our investment conviction is that sustainability-integrated portfolios can provide better risk-adjusted returns to investors. And with the impact of sustainability on investment returns increasing, we believe that sustainable investment will be a critical foundation for client portfolios going forward.

- Sustainability as Our Standard Offering in Solutions – BlackRock manages a wide variety of investment solutions that combine different funds to help investors achieve their investment objectives. We intend to make sustainable funds the standard building blocks in these solutions wherever possible, consistent with client preferences and any applicable regulations such as ERISA. All aspects of this approach will be executed over time and in consultation with our clients, and we are committed to offering these sustainable solutions at fees comparable to traditional solutions.
  - This year we will begin to offer sustainable versions of our flagship model portfolios, including our Target Allocation range of models. These models will use environmental, social, and governance (ESG)-optimized index exposures in place of traditional market cap-weighted index exposures. Over time, we expect these sustainability-focused models to become the flagships themselves.
  - We also plan to launch sustainable versions of our asset allocation iShares this year, in order to provide investors with a simple, transparent way to access a sustainable portfolio at good value in a single ETF.
  - Many more steps will follow to make sustainable investments the standard. For example, we are working to develop a sustainable LifePath target date strategy, which would provide investors with an all-in-one, low-fee, sustainable retirement solution, and we are working to expand our sustainable cash offerings as well.

- Strengthening Sustainability Integration into the Active Investment Processes – Currently, every active investment team at BlackRock considers ESG factors in its investment process and has articulated how it integrates ESG in its investment processes. By the end of 2020, all active portfolios and advisory strategies will be fully ESG integrated – meaning that, at the portfolio level, our portfolio managers will be accountable for appropriately managing exposure to ESG risks and documenting how those considerations have affected investment decisions. BlackRock's Risk and Quantitative Analysis Group (RQA), which is responsible for evaluating all investment, counterparty, and operational risk at the firm, will be evaluating ESG risk during its regular monthly reviews with portfolio managers to provide oversight of portfolio managers' consideration of ESG risk in their investment processes. This integration will mean that RQA – and BlackRock as a whole – considers ESG risk with the same rigor that it analyzes traditional measures such as credit and liquidity risk.

- Reducing ESG Risk in Active Strategies – In heightening our scrutiny on ESG issues, we are continuously evaluating the risk-return profile and negative externalities posed by specific sectors as we seek to minimize risk and maximize long-term return for our clients. Today, we have no exposure through our $1.8 trillion in active AUM to public debt or equity in certain sectors with heightened ESG risk, such as controversial weapons systems manufacturers. We continue to evaluate, in both our public and private investment portfolios, high-risk sectors that are exposed to a reallocation of capital, and we will take action to reduce exposures where doing so can enhance the risk-return profile of portfolios.
  - Exiting Thermal Coal Producers - Thermal coal production is one such sector. Thermal coal is significantly carbon intensive, becoming less and less economically viable, and highly exposed to regulation because of its environmental impacts. With the acceleration of the global energy transition, we do not believe that

the long-term economic or investment rationale justifies continued investment in this sector. As a result, we are in the process of removing from our discretionary active investment portfolios the public securities (both debt and equity) of companies that generate more than 25% of their revenues from thermal coal production, which we aim to accomplish by the middle of 2020. As part of our process of evaluating sectors with high ESG risk, we will also closely scrutinize other businesses that are heavily reliant on thermal coal as an input, in order to understand whether they are effectively transitioning away from this reliance. In addition, BlackRock's alternatives business will make no future direct investments in companies that generate more than 25% of their revenues from thermal coal production.

- Putting ESG Analysis at the Heart of Aladdin – We have developed proprietary measurement tools to deepen our understanding of material ESG risks. For example, our Carbon Beta tool allows us to stress-test issuers and portfolios for different carbon pricing scenarios. In 2020 we will continue to build additional tools, including one to analyze physical climate risks and one that produces material investment signals by analyzing the sustainability-related characteristics of companies. We are integrating these measurements into Aladdin, our risk management and investment technology platform.

- Enhancing Transparency of Sustainable Characteristics for All Products – We want investors to be able to clearly see the sustainability risks of their investments. We already provide data on our website for iShares that display an ESG score and the carbon footprint of each fund, among other measurements. By the end of 2020, we intend to provide transparent, publicly available data on sustainability characteristics – including data on controversial holdings and carbon footprint – for BlackRock mutual funds. We will seek to make this information available to all of our clients, including those in separate accounts.

Increasing Access to Sustainable Investing

We want to make sustainable investing more accessible to all investors and lower the hurdles for those who want to act. We have advocated for clear and consistent naming conventions for ESG products across the industry, so that investors can make informed decisions when they invest in a sustainably labeled fund. We have been working to improve access for several years – for example, by building the industry's largest suite of ESG ETFs, which has allowed many more individuals to more easily invest sustainably. And we are committed to doing even more:

- Doubling Our Offerings of ESG ETFs – We intend to double our offerings of ESG ETFs over the next few years (to 150), including sustainable versions of flagship index products, so that clients have more choice for how to invest their money.

- Simplifying and Expanding ESG iShares, Including ETFs with a Fossil Fuel Screen– In addition to more choice, clients have asked for a simpler way to integrate ESG in their existing portfolios. To meet that need, we will have three ESG ETF suites in the US and EMEA: one that enables clients to screen out certain sectors or companies that they do not want to invest in; one that enables clients to improve ESG scores

meaningfully while still optimizing their ability to closely track market-cap weighted indexes; and one that enables clients to invest in companies with the highest ESG ratings and features our most extensive screens including one for fossil fuels. We will be providing additional information on these product lines later this quarter.

- Working with Index Providers to Expand and Improve the Universe of Sustainable Indexes– To provide more sustainable investment options for our clients – and all investors – we are engaging with major index providers to provide sustainable versions of their flagship indexes. We also will continue to work with them to promote greater standardization and transparency of sustainability benchmark methodology. We believe that ESG benchmarks should exclude businesses with high ESG risk such as thermal coal and we are engaging with index providers on this topic.

- Expanding Sustainable Active Investment Strategies – BlackRock will be expanding our range of active strategies focused on sustainability as an investment outcome, including funds focused on the global energy transition, and impact investing funds that seek to promote positive externalities or limit negative ones.
  - Global Energy Transition – BlackRock currently manages $50 billion in solutions that support the transition to a low-carbon economy, including an industry-leading renewable power infrastructure business, which invests in the private markets in wind and solar power; green bond funds; LEAF, the industry's first environmental sustainability-focused cash management strategy; and circular economy active strategies, which invest in businesses focused on minimizing waste and leveraging the full life cycle of materials. We will be expanding dedicated low-carbon transition-readiness strategies, offering investors exposure to the companies that are most effectively managing transition risk.
  - Impact Investing – BlackRock recently brought on board a leading impact investing team that offers clients alpha through a portfolio of companies chosen on their measurable, positive impact to society. We are committing to launching dedicated impact investing solutions, beginning with the launch of our Global Impact Equity fund this quarter. Our impact investing solutions will be aligned with the World Bank's IFC Operating Principles for Impact Management.

Enhancing Engagement, Voting, and Transparency in Stewardship

Investment stewardship is an essential component of our fiduciary responsibility. This is particularly important for our index holdings on behalf of clients, in which we are essentially permanent shareholders. We have a responsibility to engage with companies to understand if they are adequately disclosing and managing sustainability-related risks, and to hold them to account through proxy voting if they are not. We have been engaging with companies for some time on these issues, as reflected in our engagement priorities. As in other areas of our investment functions, our investment stewardship team is intensifying its focus and engagement with companies on sustainability-related risks.

- Joining Climate Action 100+ – BlackRock believes that collaboration between investors, companies, regulators, and others is essential to improving the management of sustainability questions. We are a founding member of the Task Force on Climate-related Financial Disclosures (TCFD), and a signatory to the UN's Principles for Responsible Investment. BlackRock recently joined Climate Action 100+, and prior to joining, BlackRock was a member of the group's five sponsoring organizations. Climate Action 100+ is a group of investors that engages with companies to improve climate disclosure and align business strategy with the goals of the Paris Agreement.

- Engagement Priorities and Voting Guidelines – Each year we refresh our engagement priorities and voting guidelines. This year, we will be mapping our engagement priorities to specific UN Sustainable Development Goals, such as Gender Equality and Affordable and Clean Energy. We will also be incorporating key performance indicators in our engagement policies, providing clarity on our expectations for companies.

- Transparency – We are committed to enhancing the transparency of our stewardship practices, which we believe we owe to our clients and the broader set of stakeholders in these companies.
  - Starting this quarter, we will be moving from annual to quarterly voting disclosure.
  - On key high-profile votes, we will disclose our vote promptly, along with an explanation of our decision.
  - Finally, we will enhance the disclosure of our company engagements by including in our stewardship annual report the topics we discussed during each engagement with a company.

- Voting on Sustainability Proposals – We have engaged with companies on sustainability-related questions for several years, urging management teams to make progress while also deliberately giving companies time to build the foundations for disclosure consistent with the Sustainability Accounting Standards Board (SASB) and TCFD. We are asking companies to publish SASB- and TCFD-aligned disclosures, and as expressed by the TCFD guidelines, this should include the company's plan for operating under a scenario where the Paris Agreement's goal of limiting global warming to less than two degrees is fully realized. Given the groundwork we have already laid and the growing investment risks surrounding sustainability, we will be increasingly disposed to vote against management when companies have not made sufficient progress.

A fundamental reshaping of finance

Climate change is driving a profound reassessment of risk and we anticipate a significant reallocation of capital
Read Larry's letter to CEOs

Our Commitment

Our role as a fiduciary is the foundation of BlackRock's culture. The commitments we are making today reflect our conviction that all investors – and particularly the millions of our clients who are saving for long-term goals like retirement – must seriously consider sustainability in their investments.

We invest on your behalf, not our own, and the investments we make will always represent your preferences, timelines, and objectives. We recognize that many clients will continue to prefer traditional strategies, particularly in market-cap weighted indexes. We will manage this money consistent with your preferences, as we always have. The choice remains with you.

As we move to a low-carbon world, investment exposure to the global economy will mean exposure to hydrocarbons for some time. While the low-carbon transition is well underway, the technological and economic realities mean that the transition will take decades. Global economic development, particularly in emerging markets, will continue to rely on hydrocarbons for a number of years. As a result, the portfolios we manage will continue to hold exposures to the hydrocarbon economy as the transition advances.

A successful low-carbon transition will require a coordinated, international response from governments aligned with the goals of the Paris Agreement, including the adoption of carbon pricing globally, which we continue to endorse. Companies and investors have a meaningful role to play in accelerating the low-carbon transition. BlackRock does not see itself as a passive observer in the low-carbon transition. We believe we have a significant responsibility – as a provider of index funds, as a fiduciary, and as a member of society – to play a constructive role in the transition.

Where we have the greatest discretion – in portfolio construction, our active and alternatives platforms, and our approach to risk management – we will employ sustainability across our investment process. Where we serve index clients, we are improving access to sustainable investment options, and we are enhancing our stewardship to make sure that companies in which our clients are invested are managing these risks effectively. We will also work with a broad range of parties – including asset owners, index providers, and regulatory and multilateral institutions – to advance sustainability in finance.

The steps we are taking today will help strengthen our ability to serve you as a fiduciary. Sustainability is becoming increasingly material to investment outcomes, and as the global leader in investment management, our goal is to be the global leader in sustainable investing. If you have questions about these actions, or if you would like to arrange a portfolio review to understand any potential implications for the assets we manage on your behalf, our relationship managers and product strategists are at your disposal. We are grateful for the trust you place in us.

Sincerely,

BlackRock's Global Executive Committee

- Laurence D. Fink, Chairman and Chief Executive Officer
- Robert S. Kapito, President
- Geraldine Buckingham, Head of Asia Pacific

- Edwin N. Conway, Global Head of BlackRock Alternative Investors
- Frank Cooper III, Chief Marketing Officer
- Robert W. Fairbairn, Vice Chairman
- Robert L. Goldstein, Chief Operating Officer & Global Head of BlackRock Solutions
- Ben Golub, PhD, Chief Risk Officer
- Philipp Hildebrand, Vice Chairman
- J. Richard Kushel, Head of Multi-Asset Strategies and Global Fixed Income
- Rachel Lord, Head of Europe, Middle East and Africa
- Mark S. McCombe, Chief Client Officer
- Christopher J. Meade, Chief Legal Officer
- Manish Mehta, Global Head of Human Resources
- Barbara G. Novick, Vice Chairman
- Salim Ramji, Global Head of iShares and Index Investments
- Gary S. Shedlin, Chief Financial Officer
- Derek N. Stein, Global Head of Technology & Operations
- Mark K. Wiedman, Head of International and of Corporate Strategy

Where we stand

Sustainability as BlackRock's New Standard for Investing

Dear Client,

Since BlackRock's founding in 1988, we have worked to anticipate our clients' needs to help you manage risk and achieve your investment goals. As those needs have evolved, so too has our approach, but it has always been grounded in our fiduciary commitment to you.

Over the past few years, more and more of our clients have focused on the impact of sustainability on their portfolios. This shift has been driven by an increased understanding of how sustainability-related factors can affect economic growth, asset values, and financial markets as a whole.

The most significant of these factors today relates to climate change, not only in terms of the physical risk associated with rising global temperatures, but also transition risk – namely, how the global transition to a low-carbon economy could affect a company's long-term profitability. As Larry Fink writes in his 2020 letter to CEOs, the investment risks presented by climate change are set to accelerate a significant reallocation of capital, which will in turn have a profound impact on the pricing of risk and assets around the world.

As your fiduciary, BlackRock is committed to helping you navigate this transition and build more resilient portfolios, including striving for more stable and higher long-term returns. Because sustainable investment options have the potential to offer clients better outcomes, we are making sustainability integral to the way BlackRock manages risk, constructs portfolios, designs products, and engages with companies. We believe that sustainability should be our new standard for investing.

Over the past several years, we have been deepening the integration of sustainability into technology, risk management, and product choice across BlackRock. We are now accelerating those efforts in the following ways.

Sustainable, Resilient, and Transparent Portfolios

Resilient and well-constructed portfolios are essential to achieving long-term investment goals. Our investment conviction is that sustainability-integrated portfolios can provide better risk-adjusted returns to investors. And with the impact of sustainability on investment returns increasing, we believe that sustainable investment will be a critical foundation for client portfolios going forward.

Sustainability as Our Standard Offering in Solutions – BlackRock manages a wide variety of investment solutions that combine different funds to help investors achieve their investment objectives. We intend to make sustainable funds the standard building blocks in these solutions wherever possible, consistent with client preferences and any applicable regulations such as ERISA. All aspects of this approach will be executed over time and in consultation with our clients, and we are committed to offering these sustainable solutions at fees comparable to traditional solutions.

This year we will begin to offer sustainable versions of our flagship model portfolios, including our Target Allocation range of models. These models will use environmental, social, and governance (ESG)-optimized

index exposures in place of traditional market cap-weighted index exposures. Over time, we expect these sustainability-focused models to become the flagships themselves.

We also plan to launch sustainable versions of our asset allocation iShares this year, in order to provide investors with a simple, transparent way to access a sustainable portfolio at good value in a single ETF.

Many more steps will follow to make sustainable investments the standard. For example, we are working to develop a sustainable LifePath target date strategy, which would provide investors with an all-in-one, low-fee, sustainable retirement solution, and we are working to expand our sustainable cash offerings as well.

Strengthening Sustainability Integration into the Active Investment Processes – Currently, every active investment team at BlackRock considers ESG factors in its investment process and has articulated how it integrates ESG in its investment processes. By the end of 2020, all active portfolios and advisory strategies will be fully ESG integrated – meaning that, at the portfolio level, our portfolio managers will be accountable for appropriately managing exposure to ESG risks and documenting how those considerations have affected investment decisions. BlackRock's Risk and Quantitative Analysis Group (RQA), which is responsible for evaluating all investment, counterparty, and operational risk at the firm, will be evaluating ESG risk during its regular monthly reviews with portfolio managers to provide oversight of portfolio managers' consideration of ESG risk in their investment processes. This integration will mean that RQA – and BlackRock as a whole – considers ESG risk with the same rigor that it analyzes traditional measures such as credit and liquidity risk.

Reducing ESG Risk in Active Strategies – In heightening our scrutiny on ESG issues, we are continuously evaluating the risk-return profile and negative externalities posed by specific sectors as we seek to minimize risk and maximize long-term return for our clients. Today, we have no exposure through our $1.8 trillion in active AUM to public debt or equity in certain sectors with heightened ESG risk, such as controversial weapons systems manufacturers. We continue to evaluate, in both our public and private investment portfolios, high-risk sectors that are exposed to a reallocation of capital, and we will take action to reduce exposures where doing so can enhance the risk-return profile of portfolios.

Exiting Thermal Coal Producers - Thermal coal production is one such sector. Thermal coal is significantly carbon intensive, becoming less and less economically viable, and highly exposed to regulation because of its environmental impacts. With the acceleration of the global energy transition, we do not believe that the long-term economic or investment rationale justifies continued investment in this sector. As a result, we are in the process of removing from our discretionary active investment portfolios the public securities (both debt and equity) of companies that generate more than 25% of their revenues from thermal coal production, which we aim to accomplish by the middle of 2020. As part of our process of evaluating sectors with high ESG risk, we will also closely scrutinize other businesses that are heavily reliant on thermal coal as an input, in order to understand whether they are effectively transitioning away from this reliance. In addition, BlackRock's alternatives business will make no future direct investments in companies that generate more than 25% of their revenues from thermal coal production.

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Simplifying and Expanding ESG iShares, Including ETFs with a Fossil Fuel Screen– In addition to more choice, clients have asked for a simpler way to integrate ESG in their existing portfolios. To meet that need, we will have three ESG ETF suites in the US and EMEA: one that enables clients to screen out certain sectors or companies that they do not want to invest in; one that enables clients to improve ESG scores meaningfully while still optimizing their ability to closely track market-cap weighted indexes; and one that enables clients to invest in companies with the highest ESG ratings and features our most extensive screens including one for fossil fuels. We will be providing additional information on these product lines later this quarter.

Working with Index Providers to Expand and Improve the Universe of Sustainable Indexes– To provide more sustainable investment options for our clients – and all investors – we are engaging with major index providers to provide sustainable versions of their flagship indexes. We also will continue to work with them to promote greater standardization and transparency of sustainability benchmark methodology. We believe that ESG benchmarks should exclude businesses with high ESG risk such as thermal coal and we are engaging with index providers on this topic.

Expanding Sustainable Active Investment Strategies – BlackRock will be expanding our range of active strategies focused on sustainability as an investment outcome, including funds focused on the global energy transition, and impact investing funds that seek to promote positive externalities or limit negative ones.

Global Energy Transition – BlackRock currently manages $50 billion in solutions that support the transition to a low-carbon economy, including an industry-leading renewable power infrastructure business, which invests in the private markets in wind and solar power; green bond funds; LEAF, the industry's first environmental sustainability-focused cash management strategy; and circular economy active strategies, which invest in businesses focused on minimizing waste and leveraging the full life cycle of materials. We will be expanding dedicated low-carbon transition-readiness strategies, offering investors exposure to the companies that are most effectively managing transition risk.

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engaging with companies for some time on these issues, as reflected in our engagement priorities. As in other areas of our investment functions, our investment stewardship team is intensifying its focus and engagement with companies on sustainability-related risks.

Joining Climate Action 100+ – BlackRock believes that collaboration between investors, companies, regulators, and others is essential to improving the management of sustainability questions. We are a founding member of the Task Force on Climate-related Financial Disclosures (TCFD), and a signatory to the UN's Principles for Responsible Investment. BlackRock recently joined Climate Action 100+, and prior to joining, BlackRock was a member of the group's five sponsoring organizations. Climate Action 100+ is a group of investors that engages with companies to improve climate disclosure and align business strategy with the goals of the Paris Agreement.

Engagement Priorities and Voting Guidelines – Each year we refresh our engagement priorities and voting guidelines. This year, we will be mapping our engagement priorities to specific UN Sustainable Development Goals, such as Gender Equality and Affordable and Clean Energy. We will also be incorporating key performance indicators in our engagement policies, providing clarity on our expectations for companies.

Transparency – We are committed to enhancing the transparency of our stewardship practices, which we believe we owe to our clients and the broader set of stakeholders in these companies.

Starting this quarter, we will be moving from annual to quarterly voting disclosure.

On key high-profile votes, we will disclose our vote promptly, along with an explanation of our decision.

Finally, we will enhance the disclosure of our company engagements by including in our stewardship annual report the topics we discussed during each engagement with a company.

Voting on Sustainability Proposals – We have engaged with companies on sustainability-related questions for several years, urging management teams to make progress while also deliberately giving companies time to build the foundations for disclosure consistent with the Sustainability Accounting Standards Board (SASB) and TCFD. We are asking companies to publish SASB- and TCFD-aligned disclosures, and as expressed by the TCFD guidelines, this should include the company's plan for operating under a scenario where the Paris Agreement's goal of limiting global warming to less than two degrees is fully realized. Given the groundwork we have already laid and the growing investment risks surrounding sustainability, we will be increasingly disposed to vote against management when companies have not made sufficient progress.

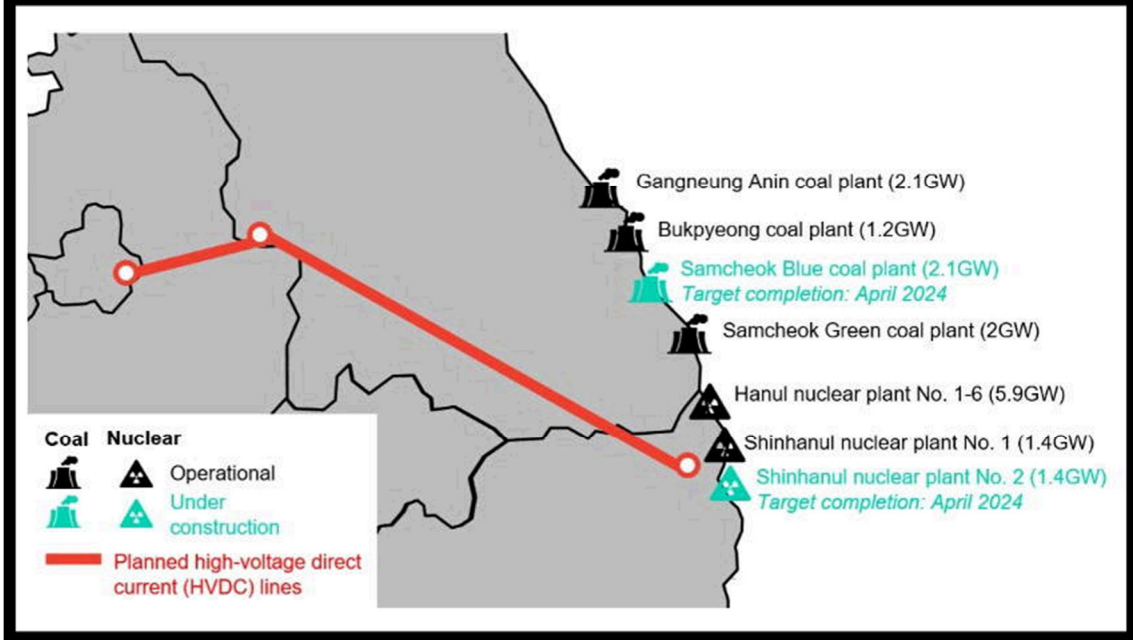
Korea's Newest Coal Plant Can't Send Its Power to Seoul
2024-03-28 08:10:11.702 GMT

By Yumi Kim
(BloombergNEF) -- Years of delays and setbacks to building new transmission lines in South Korea's power grid is hampering efforts to bring more electricity to the capital area. New coal and nuclear power plants in the remote northeast region are losing out on this opportunity to generate more supply. Gas plants located near the capital and surrounding demand centers are poised to pick up the slack.

By the Numbers

30%	15 years	8 gigawatts
Northeast region's share of nuclear capacity in South Korea	Delay in plans to build new transmission lines between South Korea's northeast region and the capital area	Pending transmission capacity to be built in South Korea's northeast region

Transmission lines in South Korea's northern region



(NOTE: Map is illustrative.)

* The government had grand plans to build major thermal power plants on the northeast coast of the Korean peninsula, which would send electricity to power-hungry regions in the northwest – namely the capital Seoul and the surrounding area. Coal and

nuclear plants have stuck to the plan first mooted over 15 years ago, but transmission capacity has not.
* Existing transmission lines are not sufficient to bring excess power supply in the northeast to the capital area. A plan to build two transmission lines to connect the regions is underway but continues to face challenges and local community opposition.
* Since the commissioning of coal and nuclear facilities in 2022, northeastern coal plants have been running at lower capacity factors than previously, and below the national average. This indicates the facilities are not operating at their full potential. Nuclear power has higher priority in the power merit order and has therefore not been materially impacted.
* A new nuclear reactor and the country's last coal plant under construction are scheduled to come online this year. The first new transmission line, however, is not due until 2025 – it should have been ready in 2022. The second line is slated for 2026. Coal generation from the new plants is likely to be curbed until the new transmission lines are built.
* BloombergNEF analysis shows that coal generation from the northeast could be theoretically curtailed by some 44% a month compared with a scenario with no grid constraints. Gas plants located near Seoul are expected to make up for the lack of ability to send new coal power to the northwest. BNEF has therefore raised its LNG demand forecasts.
* Korea Electric Power Corp. is under financial strain to deliver the transmission lines and compensate local communities. The government is looking for ways to alleviate this by tapping into other funds for Kepco to use and spurring local demand opportunities.
View the full report

To contact BloombergNEF about this article click here.
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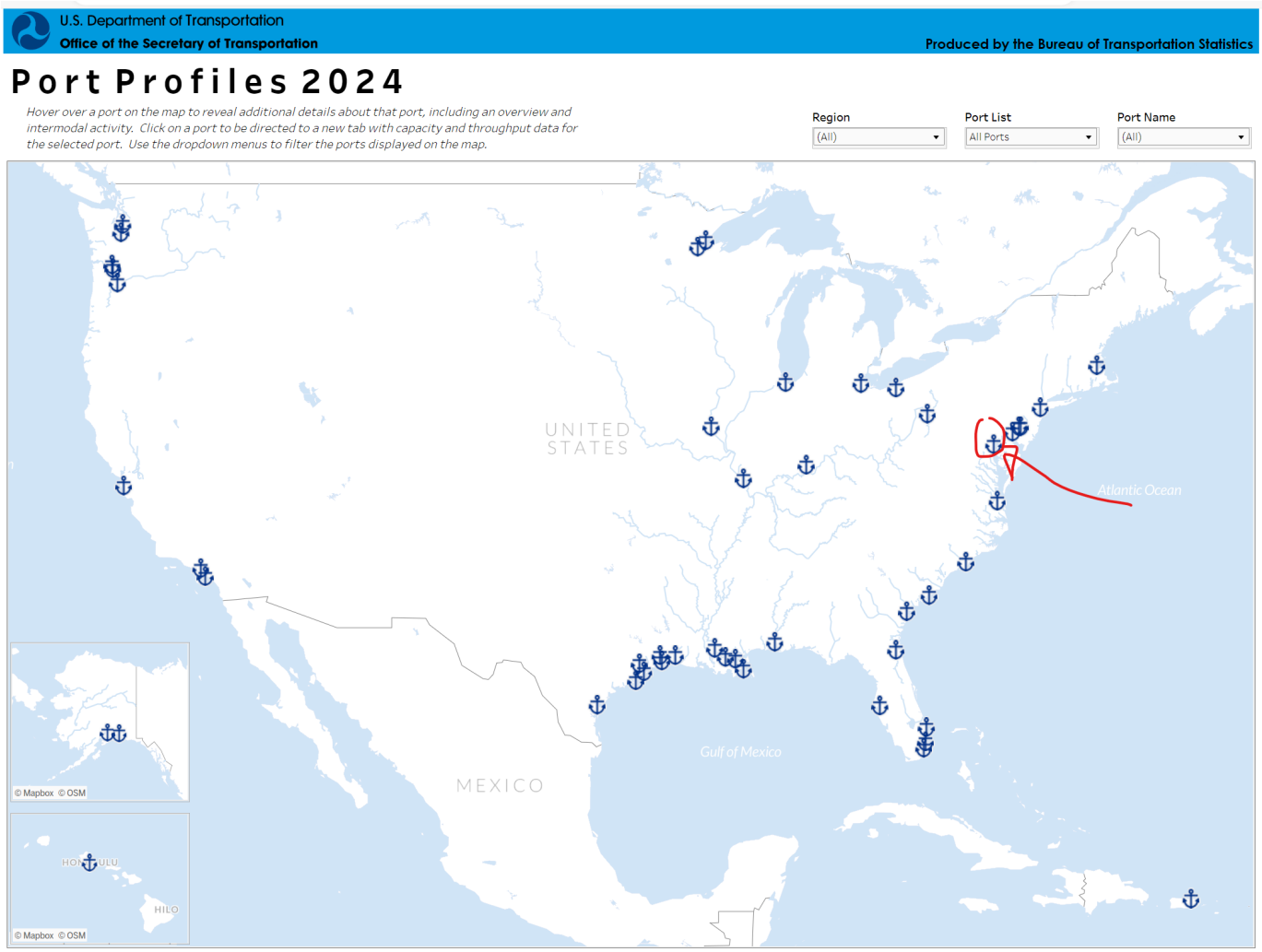
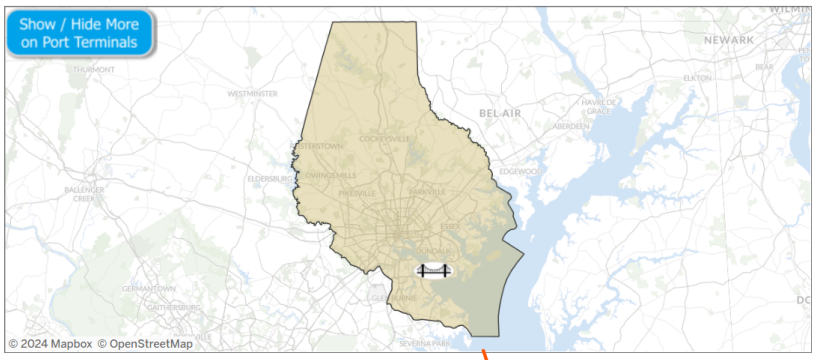
To view this story in Bloomberg click here:
https://blinks.bloomberg.com/news/stories/SB1TCZDWLU6A

https://explore.dot.gov/views/PortProfiles2024/HomeDashboard?%3Aembed=y&%3AisGuestRedirectFromVizportal=y



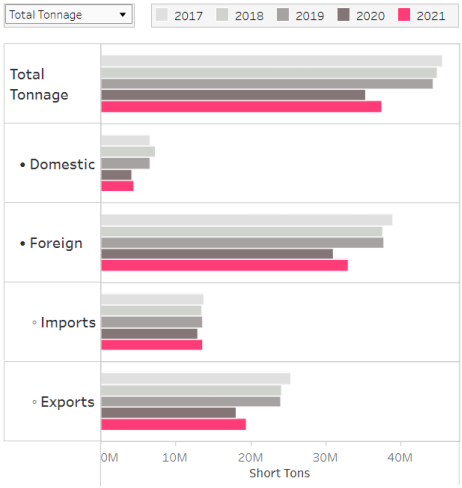
Baltimore, MD



Top Ranked Port for: **Containers** | **Tonnage** | **Dry Bulk**

State	Maryland
Region	Atlantic Coast
Port Authority	Maryland Port Administration
Governance	State
Link	Port of Baltimore Website
Port Updates	Norwegian Cruise Line launched their inaugural voyage from the Port of Baltimore in September 2023 and will have two ships homeporting there.

CARGO THROUGHPUT



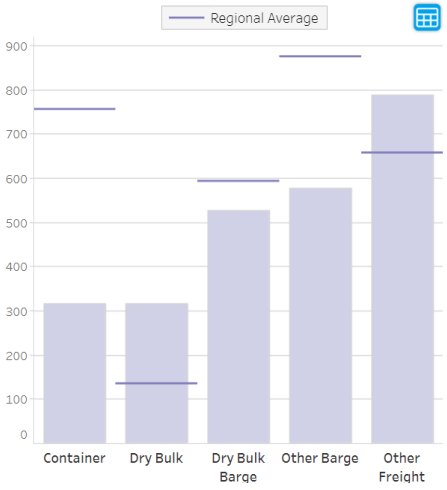
TOP COMMODITIES IN 2021

37,439,579 short tons of Total Tonnage

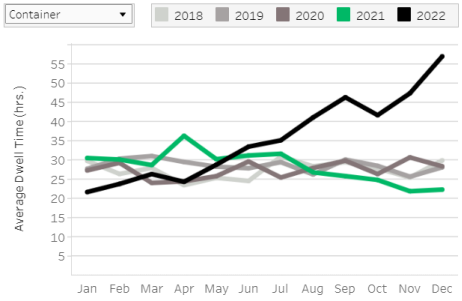
Commodity	Short Tons	2020 - 2021
Coal & Lignite	16,244,916	▲ 6.9%
Vehicles & Parts	1,659,226	▲ 12.7%
Manufac. Prod. NEC	1,398,554	▲ 22.0%
Salt	1,249,803	▲ 40.0%
Pulp & Waste Paper	1,140,533	▲ 6.1%
All Others	15,746,547	▲ 2.2%

*NEC = Not elsewhere classified

VESSEL CALLS IN 2021 & REGIONAL AVERAGE



AVERAGE CONTAINER VESSEL DWELL TIME HOURS



TOP FOOD & FARM PRODUCTS IN 2021

Food Products NEC	309,886	short tons
Soybeans	211,045	short tons
Sugar	193,445	short tons
Animal Feed, Prep.	184,943	short tons
Alcoholic Beverages	174,408	short tons

*NEC = Not elsewhere classified

Produced by the Bureau of Transportation Statistics
Port Performance Freight Statisitics Program
Port Profiles 2023

https://www.ippr.org/media-office/up-to-8-million-uk-jobs-at-risk-from-ai-unless-government-acts-finds-ippr

Up to 8 million UK jobs at risk from AI unless government acts, finds IPPR

27 Mar 2024

Press Story

- ***1111 per cent of tasks are exposed to existing generative AI, rising to 59 per cent if companies integrate AI more deeply***
- ***A range of scenarios demonstrate a 'job apocalypse' is not inevitable: on the contrary, huge wage and GDP gains are also possible***
- ***An alternative future is possible if government, employers and unions act to preserve and help create new automation-safe jobs***

First of its kind analysis of the impact of generative artificial intelligence (AI) on the UK labour market uncovers a distinct sliding doors moment for the UK, with possibilities for huge job disruption in future or significant GDP gains, depending on government policy.

The report identifies two key stages of generative AI adoption: the first wave, which is here and now, and a second wave in which companies will integrate existing AI technologies further and more deeply into their processes.

IPPR analysis of 22,000 tasks in the UK economy, covering every type of job, finds that 11 per cent of tasks done by workers are already exposed to in the first wave. It identifies 'routine cognitive' tasks (such as database management) and 'organisational and strategic' tasks (such as scheduling or inventory management) as most exposed to generative AI, which can both read and create text, software code and data.

However, this could increase to AI doing 59 per cent of tasks in the second wave. This would also impact non-routine cognitive tasks (such as creating and maintaining databases) and would affect increasingly higher earning jobs.

It says that back-office, entry level and part time jobs are at the highest risk of being disrupted during the first wave. These include secretarial, customer service and administrative roles.

Women are more likely to be in such jobs, which means they will be among the most affected, the report says. Young people are also at high risk as firms hire fewer people for entry-level jobs and introduce AI technologies instead. In addition, those on medium and low wages are most exposed to being replaced by AI.

IPPR has modelled three illustrative scenarios for the potential impact of the second wave of AI adoption on the labour market, depending on policy choices:

- Worst case scenario – full displacement: all jobs at risk are replaced by AI, with 7.9 million job losses and no GDP gains
- Central scenario: 4.4 million jobs disappear, but with economic gains of 6.3 per cent of GDP (£144bn per year)
- Best case scenario – full augmentation: all jobs at risk are augmented to adapt to AI, instead of replaced, leading to no job losses and an economic boost of 13 per cent to GDP (£306bn per year)

IPPR has also modelled three scenarios for the potential impact of "here and now" generative AI on the labour market:

- Worst case scenario – full displacement: 1.5 million jobs are lost, with no GDP gains
- Central scenario: 545,000 jobs are lost, with GDP gains of 3.1 per cent (£64bn per year)
- Best case scenario – full augmentation: no jobs are lost, with GDP gains of 4 per cent (£92bn per year)

Additionally, wage gains for workers could be huge – more than 30 per cent in some cases – but they could also be nil.

Deployment of AI could also free up labour to fill gaps related to unaddressed social needs. For instance, workers could be re-allocated to social care and mental health services which are currently under-resourced.

The modelling shows that there is no single predetermined path for how AI implementation will play out in the labour market. It also urges intervention to ensure that the economic gains are widely spread, rather than accruing to only a few.

Without government action and with companies left to their own devices, the worst-case scenario is a real possibility, IPPR says.

IPPR recommends the government develops a job-centric industrial strategy for AI that encourages job transitions and ensures that the fruits of automation are shared widely across the economy. This should include:

1. **Supporting green jobs**, as green jobs are less exposed to automation than non-green jobs
2. **Fiscal policy measures**, such as tax incentives or subsidies to encourage job-augmentation over full displacement
3. **Regulatory change**, to ensure human responsibility of key issues, such as with health

Carsten Jung, senior economist at IPPR, said:

"Already existing generative AI could lead to big labour market disruption or it could hugely boost economic growth, either way it is set to be a game changer for millions of us. Many firms are already investing in it, and it has potential to speed up many more tasks as more businesses adopt it.

"Over the next five years it could transform knowledge work. The question now is less whether AI can be useful, but rather how fast and in what manner employers will use it. History show that technological transition can be a boon if well managed, or can end in disruption if left to unfold without controls. Indeed, some occupations could be hard hit by generative AI, starting with back office jobs.

"But technology isn't destiny and a jobs apocalypse is not inevitable – government, employers and unions have the opportunity to make crucial design decisions now that ensure we manage this new technology well. If they don't act soon, it may be too late."

Bhargav Srinivasa Desikan, senior research fellow at IPPR, said:

"We could see jobs such as copywriters, graphic designers and personal assistants roles being heavily affected by AI. The question is how we can steer technological change in a way that allows for novel job opportunities, increased productivity, and economic benefits for all."

"We are at a sliding doors moment, and policy makers urgently to develop a strategy to make sure our labour market adapts to the 21st century, without leaving millions behind. It is crucial that all workers benefit from these technological advancements, and not just the big tech corporations."

ENDS

Carsten Jung and Bhargav Srinivasa Desikan, the report's authors, are available for interview

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Liam Evans, Senior Digital and Media Officer: 07419 365334 l.evans@ippr.org

NOTES TO EDITORS

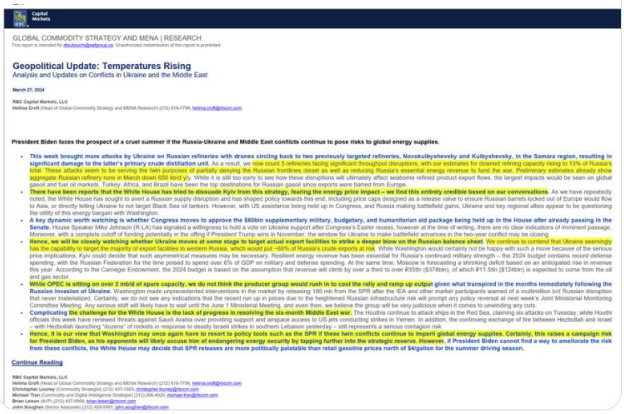
- The IPPR paper, *Transformed by AI: How generative artificial intelligence could affect work in the UK - and how to manage it*, by Carsten Jung and Bhargav Srinivasa Desikan, will be published at 0001 on Wednesday March 27. at www.ippr.org/articles/transformed-by-ai
- Advance copies of the report are available under embargo on request
- Generative AI refers to new computer software that can read and create text, software code and data. Cutting edge models have even shown ability reason and apply abstract concepts in a range of disciplines, often at undergraduate level.
- To see which tasks and jobs will be affected by AI, IPPR produced a metric that indicates how many tasks could be transformed by AI and then scored each task with regards to whether a human could perform it 50% more quickly with the help of AI.
- “Here and now AI” exposure: This is the first wave of AI adoption, where existing generative AI such as GPT4 can already undertake the tasks involved.
- “Integrated AI” exposure: This is the second wave of AI adoption, in which generative AI is connected to other software systems, including databases and has the ability to execute tasks (such as making bookings or orders) that it allows it to execute multiple steps.
- IPPR (the Institute for Public Policy Research) is an independent charity working towards a fairer, greener, and more prosperous society. We are researchers, communicators, and policy experts creating tangible progressive change, and turning bold ideas into common sense realities. Working across the UK, IPPR, IPPR North, and IPPR Scotland are deeply connected to the people of our nations and regions, and the issues our communities face. We have helped shape national conversations and progressive policy change for more than 30 years. From making the early case for the minimum wage and tackling regional inequality, to proposing a windfall tax on energy companies, IPPR’s research and policy work has put forward practical solutions for the crises facing society. www.ippr.org

Dan Tsubouchi @Energy_Tidbits · 2h

This 👇 Must Read from @CroftHelima looks even more relevant with the last 4 days, incl last night, of escalating Russia drone attacks on Ukraine energy/power infra.

Will Ukraine expand its drone attacks to target RUS oil export facilities? has to be at least a risk?

#OOTT

> **Dan Tsubouchi** @Energy_Tidbits · Mar 27
>
> Must read from well plugged-in, not subject to hyperbole @CroftHelima.
>
> Multiple geopolitical risk premium events over the coming weeks/months, NOT years....
> Show more
>
> 
> GLOBAL COMMODITY STRATEGY AND MENA | RESEARCH
>
> **Geopolitical Update: Temperatures Rising**
> Analysis and Updates on Conflicts in Ukraine and the Middle East
>
> March 27, 2024
>
> **President Biden faces the prospect of a cruel summer if the Russia-Ukraine and Middle East conflicts continue to pose risks to global energy supplies.**
>
> - **This week brought more attacks by Ukraine on Russian refineries with drones circling back to two previously targeted refineries, Novokuibyshevsky and Kuibyshevsky, in the Samara region, resulting in significant damage to the latter's primary crude distillation unit.** As a result, we now count 5 refineries facing significant throughput disruptions, with our estimates for downed refining capacity rising to 13% of Russia's total. These attacks seem to be serving the twin purposes of partially denying the Russian frontlines diesel as well as reducing Russia's essential energy revenue to fund the war. Preliminary estimates already show aggregate Russian refinery runs in March down 630 kb/d y/y. While it is still too early to see how these disruptions will ultimately affect seaborne refined product export flows, the largest impacts would be seen on global gasoil and fuel oil markets. Turkey, Africa, and Brazil have been the top destinations for Russian gasoil since exports were barred from Europe.
> - **There have been reports that the White House has tried to dissuade Kyiv from this strategy, fearing the energy price impact – we find this entirely credible based on our conversations.** As we have repeatedly noted, the White House has sought to avert a Russian supply disruption and has shaped policy towards this end, including price caps designed as a release valve to ensure Russian barrels locked out of Europe would flow to Asia, or directly telling Ukraine to not target Black Sea oil tankers. However, with US assistance being held up in Congress, and Russia making battlefield gains, Ukraine and key regional allies appear to be questioning the utility of this energy bargain with Washington.
> - **A key dynamic worth watching is whether Congress moves to approve the $60bln supplementary military, budgetary, and humanitarian aid package being held up in the House after already passing in the Senate.** House Speaker Mike Johnson (R-LA) has signaled a willingness to hold a vote on Ukraine support after Congress's Easter recess, however at the time of writing, there are no clear indications of imminent passage. Moreover, with a complete cutoff of funding potentially in the offing if President Trump wins in November, the window for Ukraine to make battlefield advances in the two-year conflict may be closing.
> - **Hence, we will be closely watching whether Ukraine moves at some stage to target actual export facilities to strike a deeper blow on the Russian balance sheet.** We continue to contend that Ukraine seemingly has the capability to target the majority of export facilities in western Russia, which would put ~60% of Russia's crude exports at risk. While Washington would certainly not be happy with such a move because of the serious price implications, Kyiv could decide that such asymmetrical measures may be necessary. Resilient energy revenue has been essential for Russia's continued military strength – the 2024 budget contains record defense spending, with the Russian Federation for the time poised to spend over 6% of GDP on military and defense spending. At the same time, Moscow is forecasting a shrinking deficit based on an anticipated rise in revenue this year. According to the Carnegie Endowment, the 2024 budget is based on the assumption that revenue will climb by over a third to over ₽35tln ($376bln), of which ₽11.5tn ($124bln) is expected to come from the oil and gas sector.
> - **While OPEC is sitting on over 2 mb/d of spare capacity, we do not think the producer group would rush in to cool the rally and ramp up output given what transpired in the months immediately following the Russian invasion of Ukraine.** Washington made unprecedented interventions in the market by releasing 180 mb from the SPR after the IEA and other market participants warned of a multimillion b/d Russian disruption that never materialized. Certainly, we do not see any indications that the recent run up in prices due to the heightened Russian infrastructure risk will prompt any policy reversal at next week's Joint Ministerial Monitoring Committee Meeting. Any serious shift will likely have to wait until the June 1 Ministerial Meeting, and even then, we believe the group will be very judicious when it comes to unwinding any cuts.
> - **Complicating the challenge for the White House is the lack of progress in resolving the six-month Middle East war.** The Houthis continue to attack ships in the Red Sea, claiming six attacks on Tuesday, while Houthi officials this week have renewed threats against Saudi Arabia over providing support and airspace access to US jets conducting strikes in Yemen. In addition, the continuing exchange of fire between Hezbollah and Israel – with Hezbollah launching "dozens" of rockets in response to deadly Israeli strikes in southern Lebanon yesterday – still represents a serious contagion risk.
> - **Hence, it is our view that Washington may once again have to resort to policy tools such as the SPR if these two conflicts continue to imperil global energy supplies. Certainly, this raises a campaign risk for President Biden, as his opponents will likely accuse him of endangering energy security by tapping further into the strategic reserve. However, if President Biden cannot find a way to ameliorate the risk from these conflicts, the White House may decide that SPR releases are more politically palatable than retail gasoline prices north of $4/gallon for the summer driving season.**
>
> Continue Reading
>
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> John Vaughan (Senior Associate) (212) 428-6491, john.vaughan@rbccm.com

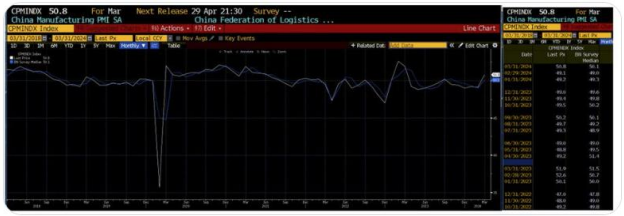
6 14 2.1K

Dan Tsubouchi @Energy_Tidbits · 4h

Positive for #Oil

1st expansion in official China Manufacturing PMI since Sept.

Mar 50.8 (survey 50.1)
Feb 49.1
Jan 49.2
Dec 49.0
Nov 49.4
Oct 49.5...
Show more



> **Dan Tsubouchi** @Energy_Tidbits · Feb 29
>
> 
>
> Continued positive view from China smaller & export oriented firms.
>
> China Caixin Manufacturing PMI Feb 50.9 (est 50.7) vs Jan 50.8, Dec 50.8, Nov 50.7, Oct 49.5. ...

4 19 2.3K

Dan Tsubouchi @Energy_Tidbits · 10h

it's a yr ago, but @BloombergNEF reminds in 👇 04/26/23 tweet why EVs don't displace #Oil as fast as aspirations.

China has big EV adds BUT also has big NET ICE adds.

China ICE retirements are low as its ICE fleet is young.

Only a dent in EU road fuel demand by 2030.
#OOTT

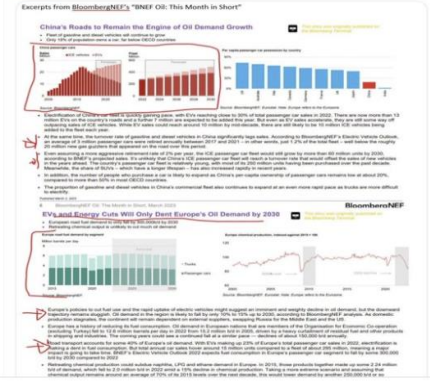
> **Dan Tsubouchi** @Energy_Tidbits · Apr 26, 2023
> Replying to @Energy_Tidbits
> 6/7
>
> A concept everyone has experienced - ICE vehicles are lasting longer.
>
> 03/31. @BloombergNEF. at least in China, ICE vehicles retirements ar...
> Show more

Will take way longer for #EVs sales to hit fuel consumption.

China ICE vehicle retirements are lower. EVs in EU only hit fuel demand by 300,000 b/d to 2030. Thx @BloombergNEF.

Fits 👇 03/25 Equinor, EVs are 2nd or 3rd cars and not primary car.

#OOTT



7 9 3.9K

Dan Tsubouchi @Energy_Tidbits · 12h

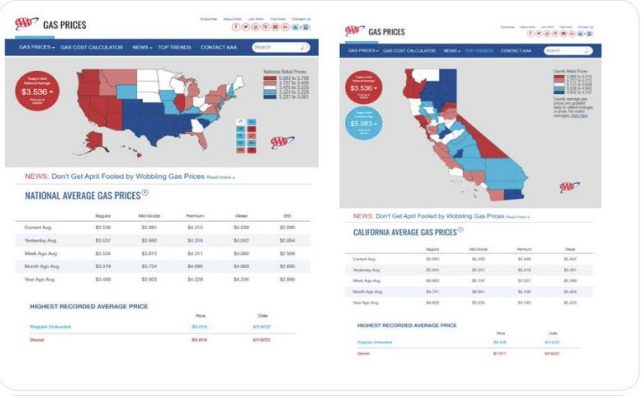
California #Gasoline prices hit $5 this week.

US gasoline prices only +$0.01 this week to $3.54 but are +$0.22 MoM and in normal seasonal period to keep going higher.

Last thing Biden wants is $4 gas in election run up.

Newsom re-election not until 2026

Thx @AAAnews ...
Show more



Unique Solutions @BrianSt77927438 · Mar 24

Replying to @Energy_Tidbits

We can remind them of the billions the mag 7 earns and the hundreds of millions the politicians made investing in them.

2 9 3K

Dan Tsubouchi @Energy_Tidbits · 15h

Gasoline prices is Biden focus for Nov 5 election

"*Biden Is Unlikely to Reimpose Oil Sanctions on Venezuela*" "*US officials are concerned that reverting to Trump-era sanctions that accelerated the decline of Venezuela's #oil production would raise the price of gas at US pumps*"...
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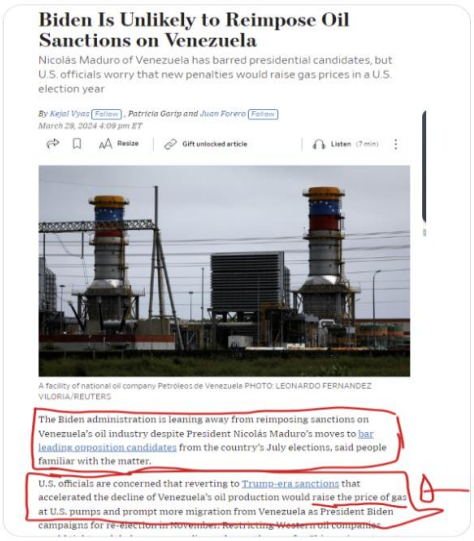

Biden Is Unlikely to Reimpose Oil Sanctions on Venezuela

Nicolás Maduro of Venezuela has barred presidential candidates, but U.S. officials worry that new penalties would raise gas prices in a U.S. election year

By Kejal Vyas, Patricia Garip and Juan Forero
March 29, 2024 4:09 pm ET

Resize | Gift unlocked article | Listen (7 min)

A facility of national oil company Petroleos de Venezuela PHOTO: LEONARDO FERNANDEZ VILORIA/REUTERS

The Biden administration is leaning away from reimposing sanctions on Venezuela's oil industry despite President Nicolás Maduro's moves to bar leading opposition candidates from the country's July elections, said people familiar with the matter.

U.S. officials are concerned that reverting to Trump-era sanctions that accelerated the decline of Venezuela's oil production would raise the price of gas at U.S. pumps and prompt more migration from Venezuela as President Biden campaigns for re-election in November. Restricting Western oil companies'

1 7 9 2K

Dan Tsubouchi @Energy_Tidbits · 15h

#Oil floating storage 65.56 mmb Mar 29

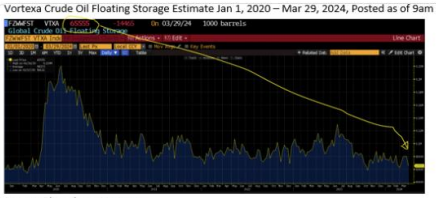
Big revisions up in Mar 15/22 (RUS cargos in limbo?), BUT last 7 wks ave 72.1 mmb ie. floating normalizing at lower levels

Refiners/tankers have worked in longer trips = lower floating storage as OPEC keeps cuts thru Q2

Thx @vortexa...

Show more

Vortexa Crude Oil Floating Storage Estimate Jan 1, 2020 – Mar 29, 2024, Posted as of 9am MT,



Source: Bloomberg, Vortexa

Posted Mar 30, 9am MT

Date	FZWFST VT... Last Px
Fr 03/29/2024	65555
Fr 03/22/2024	80020
Fr 03/15/2024	80224
Fr 03/08/2024	79497
Fr 03/01/2024	76261
Fr 02/23/2024	62552
Fr 02/16/2024	66636
Fr 02/09/2024	81819
Fr 02/02/2024	71738
Fr 01/26/2024	70623
Fr 01/19/2024	80077

Mar 23, 9am MT

Date	FZWFST VT... Last Px
Fr 03/22/2024	66242
Fr 03/15/2024	71169
Fr 03/08/2024	77934
Fr 03/01/2024	73160
Fr 02/23/2024	61646
Fr 02/16/2024	65869
Fr 02/09/2024	81294
Fr 02/02/2024	72191
Fr 01/26/2024	70168
Fr 01/19/2024	80331
Fr 01/12/2024	74127

Mar 16, 9am MT

Date	FZWFST VT... Last Px
Fr 03/15/2024	69277
Fr 03/08/2024	75507
Fr 03/01/2024	75289
Fr 02/23/2024	65448
Fr 02/16/2024	68291
Fr 02/09/2024	83379
Fr 02/02/2024	75792
Fr 01/26/2024	70094
Fr 01/19/2024	80951
Fr 01/12/2024	72848
Fr 01/05/2024	76419

Source: Bloomberg, Vortexa

Vortexa Crude Oil Floating Storage by Region (mmb)				Original Posted	Recent Peak	
Region	Mar 29/24	Mar 22/24	WoW	Mar 22/24	Jun 23/23	Mar 29 vs Jun 23
Asia	31.54	35.99	-4.45	28.67	73.01	-41.47
Europe	9.68	7.54	2.14	6.47	6.21	3.47
Middle East	7.43	10.17	-2.74	10.08	6.76	0.67
West Africa	5.94	6.84	-0.90	7.41	7.62	-1.68
US Gulf Coast	2.48	3.07	-0.59	2.07	1.02	1.46
Other	9.17	7.56	1.61	11.54	35.20	-26.03
Global Total	66.24	71.17	-4.93	66.24	129.80	-63.56
Vortexa crude oil floating storage posted on Bloomberg 9am MT on Mar 30						
Source: Vortexa, Bloomberg						

Prepared by SAF Group: https://safgroup.ca/news-insights/

7 16 2.2K

Dan Tsubouchi @Energy_Tidbits · 18h

321 crack spreads still high.

WTI +$2.54 WoW to close $83.17.

Yes 321 crack spreads were -$2.47 WoW to $29.73, BUT crack spreads near $30 still provide big margins for refineries ie, big incentive to maximize runs & buying crude & support for WTI.

#OOTT Thx @business

> **Dan Tsubouchi** @Energy_Tidbits · Mar 22
>
> 
>
> Blinken's ceasefire comments led to oil down $0.41 Wow to WTI close at $80.63.
>
> BUT continuing positive for WTI over coming weeks.
> ...

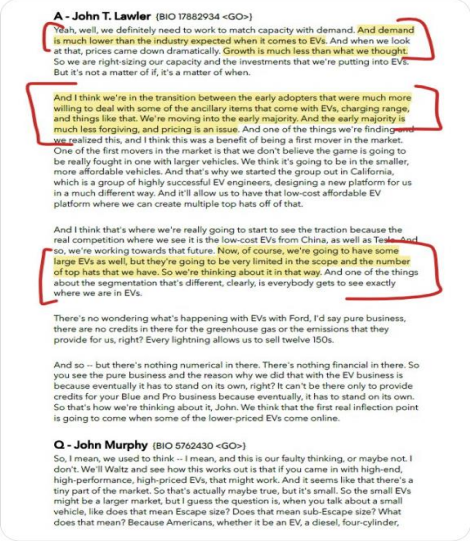
1 · 7 · 39 · 3.7K

Dan Tsubouchi @Energy_Tidbits · Mar 29

Will large EVs fade away before they take off?

No surprise, Ford CFO "*Growth is much less than what we thought*"
"*moving into the early majority. & the early majority is much less forgiving, & pricing is an issue*"

BUT "***we're going to have some large EVs as well, but they're...***
Show more



A - John T. Lawler (BIO 17882934 <GO>)
Yeah, well, we definitely need to work to match capacity with demand. And demand is much lower than the industry expected when it comes to EVs. And when we look at that, prices came down dramatically. Growth is much less than what we thought. So we are right-sizing our capacity and the investments that we're putting into EVs. But it's not a matter of if, it's a matter of when.

And I think we're in the transition between the early adopters that were much more willing to deal with some of the ancillary items that come with EVs, charging range, and things like that. We're moving into the early majority. And the early majority is much less forgiving, and pricing is an issue. And one of the things we're finding and we realized this, and I think this was a benefit of being a first mover in the market. One of the first movers in the market is that we don't believe the game is going to be really fought in one with larger vehicles. We think it's going to be in the smaller, more affordable vehicles. And that's why we started the group out in California, which is a group of highly successful EV engineers, designing a new platform for us in a much different way. And it'll allow us to have that low-cost affordable EV platform where we can create multiple top hats off of that.

And I think that's where we're really going to start to see the traction because the real competition where we see it is the low-cost EVs from China, as well as Tesla. And so, we're working towards that future. Now, of course, we're going to have some large EVs as well, but they're going to be very limited in the scope and the number of top hats that we have. So we're thinking about it in that way. And one of the things about the segmentation that's different, clearly, is everybody gets to see exactly where we are in EVs.

There's no wondering what's happening with EVs with Ford, I'd say pure business, there are no credits in there for the greenhouse gas or the emissions that they provide for us, right? Every lightning allows us to sell twelve 150s.

And so -- but there's nothing numerical in there. There's nothing financial in there. So you see the pure business and the reason why we did that with the EV business is because eventually it has to stand on its own, right? It can't be there only to provide credits for your Blue and Pro business because eventually, it has to stand on its own. So that's how we're thinking about it, John. We think that the first real inflection point is going to come when some of the lower-priced EVs come online.

Q - John Murphy (BIO 5762430 <GO>)
So, I mean, we used to think -- I mean, and this is our faulty thinking, or maybe not. I don't. We'll Waltz and see how this works out is that if you came in with high-end, high-performance, high-priced EVs, that might work. And it seems like that there's a tiny part of the market. So that's actually maybe true, but it's small. So the small EVs might be a larger market, but I guess the question is, when you talk about a small vehicle, like does that mean Escape size? Does that mean sub-Escape size? What does that mean? Because Americans, whether it be an EV, a diesel, four-cylinder,

5 · 14 · 3.6K

Dan Tsubouchi @Energy_Tidbits · Mar 28

OOPS

Here are the graphs i forgot to attach the below tweet on Japan stocks outperforming since Warren Buffett's Apr 12 CNBC interview in Japan . #OOTT

> **Dan Tsubouchi** @Energy_Tidbits · Mar 28
>
> #WarrenBuffett was catalyst to Japanese stocks outperformance.
>
> Extended 👇 @business "*Japan beats Major Indexes in 1Q 2024*" back to show outperformance catalyst was Buffett 04/12/23 interview with @BeckyQuick....

2 2 6 2.8K

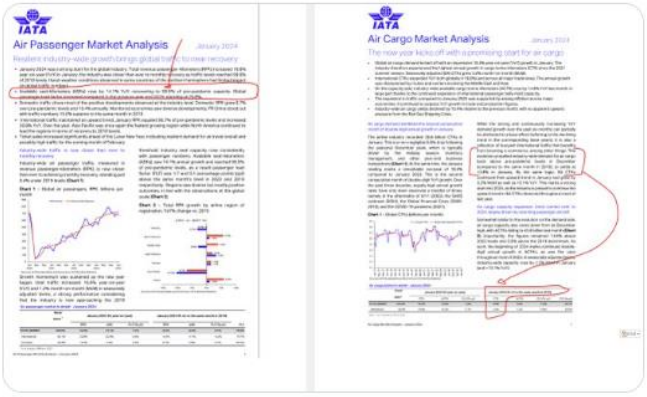
Dan Tsubouchi @Energy_Tidbits · 6h

Here's why #JetFuel can be back to 2019 level per @vitolnews 👇 03/21.

@IATA cargo +2.8% vs 2019.

@IATA passenger "ASKs" only -0.5% vs 2019 despite slow long-haul recovery. So more shorter flights with higher relative fuel consumption ie. takeoffs/landings over shorter distance...

Show more



> **Dan Tsubouchi** @Energy_Tidbits · Mar 21
>
> 
>
> Bullish for near term #Oil.
>
> ***"we're seeing jet fuel now back to averaging around 6.9 million barrels per day over the last 4-weeks, which is back to 2019 levels"*** ...

2 6 1.8K

Dan Tsubouchi @Energy_Tidbits · 10h

Gasoline 101.

See 👇 Mar 9 tweets.

~Mar 1 is when US gas prices start normal seasonal ramp up in driving post winter into the summer.

Plus @NACSonline reminds switch to more summer blend fuels costs as much as $0.15 more to produce.

...

Show more

> **Dan Tsubouchi** @Energy_Tidbits · Mar 9
>
> Summer blend #Gasoline is more expensive as production process takes longer & overall yield of gasoline per barrel of oil is lower.
>
> 02/28/24, 👇 @NACSonline *"these complexities add as much as 15 cents per gallon to the cost to produce these higher-grade fuels....*
>
> Show more

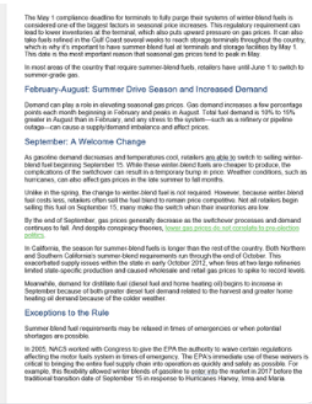
Seasonal Gas Prices Explained

From refinery maintenance to consumer demand, seasonal fuel production affects gasolines prices at the dispenser.

February: Refinery Maintenance

March-April: Refineries Switch to Summer-Blend Production

May-June: Deadlines for Terminals and Retailers



February-August: Summer Drive Season and Increased Demand

September: A Welcome Change

Exceptions to the Rule

2 5 1.7K

Dan Tsubouchi @Energy_Tidbits · 12h

#WarrenBuffett was catalyst to Japanese stocks outperformance.

Extended 👇 @business "*Japan beats Major Indexes in 1Q 2024*" back to show outperformance catalyst was Buffett 04/12/23 interview with @BeckyQuick.

Vs Apr 11/23:
Nikkei +44%
Nasdaq +36%
S&P +28%...
Show more

> **Dan Tsubouchi** @Energy_Tidbits · May 18, 2023
>
> The #WarrenBuffett effect is still working.
>
> @business "foreigners loving Japanese stocks. positive flows into equities for 7th straight week"
> ...
> Show more
>
> 
>

1 · 1.6K

Dan Tsubouchi @Energy_Tidbits · Mar 27

Must read from well plugged-in, not subject to hyperbole @CroftHelima.

Multiple geopolitical risk premium events over the coming weeks/months, NOT years.

#OOTT

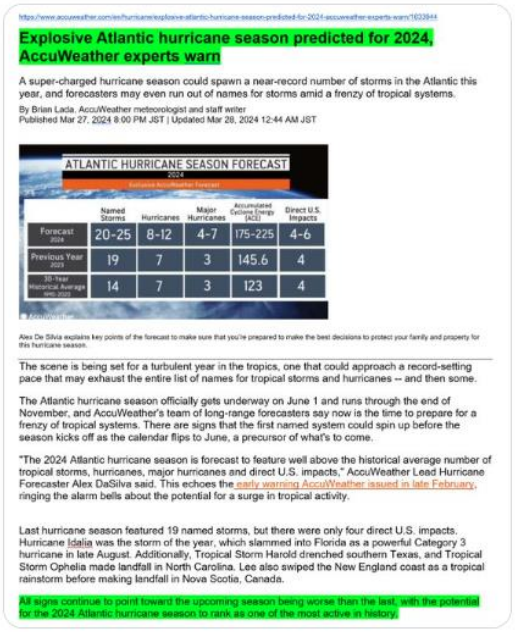
12 · 39 · 6.4K

Dan Tsubouchi @Energy_Tidbits · Mar 27

"*Explosive Atlantic hurricane season predicted for 2024, #AccuWeather experts warn*". @wxlada

"*will increase the potential for systems to undergo rapid intensification*"

"*The faster the transition to La Niña occurs, the more active the hurricane season is likely to be*"
#OOTT



https://www.accuweather.com/en/hurricane/explosive-atlantic-hurricane-season-predicted-for-2024-accuweather-experts-warn/1633944

Explosive Atlantic hurricane season predicted for 2024, AccuWeather experts warn

A super-charged hurricane season could spawn a near-record number of storms in the Atlantic this year, and forecasters may even run out of names for storms amid a frenzy of tropical systems.

By Brian Lada, AccuWeather meteorologist and staff writer
Published Mar 27, 2024 8:00 PM JST | Updated Mar 28, 2024 12:44 AM JST

ATLANTIC HURRICANE SEASON FORECAST
2024

	Named Storms	Hurricanes	Major Hurricanes	Accumulated Cyclone Energy (ACE)	Direct U.S. Impacts
Forecast 2024	20-25	8-12	4-7	175-225	4-6
Previous Year 2023	19	7	3	145.6	4
30-Year Historical Average 1991-2020	14	7	3	123	4

Alex De Silva explains key points of the forecast to make sure that you're prepared to make the best decisions to protect your family and property for this hurricane season.

The scene is being set for a turbulent year in the tropics, one that could approach a record-setting pace that may exhaust the entire list of names for tropical storms and hurricanes -- and then some.

The Atlantic hurricane season officially gets underway on June 1 and runs through the end of November, and AccuWeather's team of long-range forecasters say now is the time to prepare for a frenzy of tropical systems. There are signs that the first named system could spin up before the season kicks off as the calendar flips to June, a precursor of what's to come.

"The 2024 Atlantic hurricane season is forecast to feature well above the historical average number of tropical storms, hurricanes, major hurricanes and direct U.S. impacts," AccuWeather Lead Hurricane Forecaster Alex DaSilva said. This echoes the early warning AccuWeather issued in late February, ringing the alarm bells about the potential for a surge in tropical activity.

Last hurricane season featured 19 named storms, but there were only four direct U.S. impacts. Hurricane Idalia was the storm of the year, which slammed into Florida as a powerful Category 3 hurricane in late August. Additionally, Tropical Storm Harold drenched southern Texas, and Tropical Storm Ophelia made landfall in North Carolina. Lee also swiped the New England coast as a tropical rainstorm before making landfall in Nova Scotia, Canada.

All signs continue to point toward the upcoming season being worse than the last, with the potential for the 2024 Atlantic hurricane season to rank as one of the most active in history.

2 7 11 2.7K

Dan Tsubouchi @Energy_Tidbits · Mar 27

For those like me who are having spotty internet service this morning, @EIAgov released at 8:30am MT its #Oil #Gasoline #Distillates inventory as of Mar 22. Table below compares EIA data vs @businessexpectations and vs @APIenergy yesterday. #OOTT

Oil/Products Inventory Mar 22: EIA, Bloomberg Survey Expectations, API

(million barrels)	EIA	Expectations	API
Oil	3.16	-1.00	9.30
Gasoline	1.29	-1.70	-4.40
Distillates	-1.18	1.00	0.50
	3.27	-1.70	5.40

Note: Oil is commercial. So excludes a +0.7 mmb in SPR for the Mar 22 week
Note: Included in the oil data, Cushing had a 2.10 mm build for Mar 22 week
Source EIA, Bloomberg
Prepared by SAF Group https://safgroup.ca/news-insights/

2 4 1.2K

Dan Tsubouchi @Energy_Tidbits · 1h

Negative to Cdn #Oil

@GasBuddyGuy reports Exxon Joliet refinery beginning ~50 day turnaround.

See 👇 Exxon says Joliet processes 250,000 b/d of Cdn crude.

Plus Enbridge pipeline map shows mainline for Cdn oil then feeds connected pipelines to Joliet.

...

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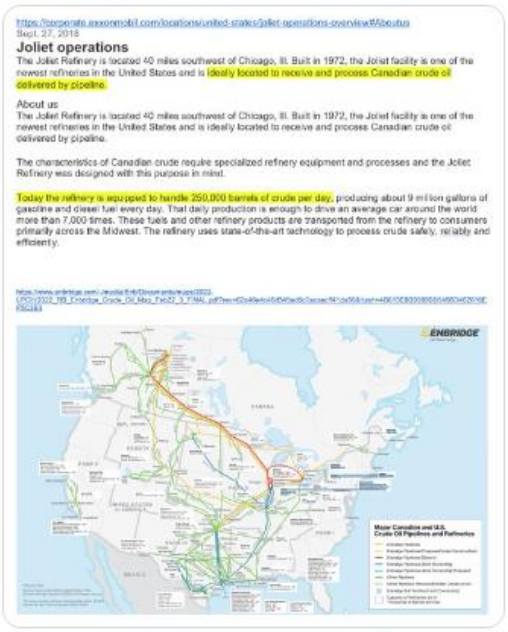


https://corporate.exxonmobil.com/locations/united-states/joliet-operations-overview#Aboutus

Sept. 27, 2018

Joliet operations

The Joliet Refinery is located 40 miles southwest of Chicago, Ill. Built in 1972, the Joliet facility is one of the newest refineries in the United States and is ideally located to receive and process Canadian crude oil delivered by pipeline.

About us

The Joliet Refinery is located 40 miles southwest of Chicago, Ill. Built in 1972, the Joliet facility is one of the newest refineries in the United States and is ideally located to receive and process Canadian crude oil delivered by pipeline.

The characteristics of Canadian crude require specialized refinery equipment and processes and the Joliet Refinery was designed with this purpose in mind.

Today the refinery is equipped to handle 250,000 barrels of crude per day, producing about 9 million gallons of gasoline and diesel fuel every day. That daily production is enough to drive an average car around the world more than 7,000 times. These fuels and other refinery products are transported from the refinery to consumers primarily across the Midwest. The refinery uses state-of-the-art technology to process crude safely, reliably and efficiently.

Patrick De Haan @GasBuddyGuy · 2h

⚠️🚨 A source tells me a full turnaround (shutdown) at ExconMobil's Joliet, IL refinery will begin imminently and is planned to last ~50 days. This refinery can churn out nearly 9 million gallons of gasoline daily, so it'll be a noticeable loss for the Great Lakes.

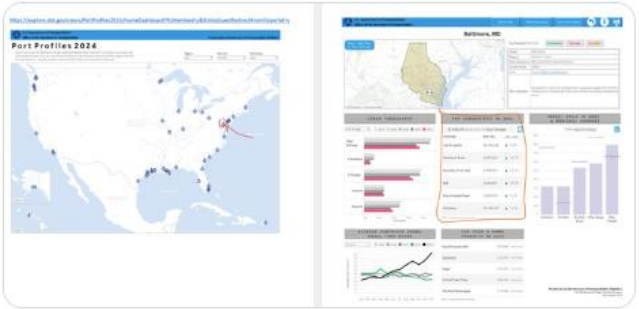
2 6 1.6K

Dan Tsubouchi @Energy_Tidbits · 3h

Baltimore port profile from @USDOT

#Coal and cars are top two commodities.

#OOTT



2 5 1.1K

Dan Tsubouchi @Energy_Tidbits · 12h

Digitization/AI already wiping out back office, non-revenue generator jobs

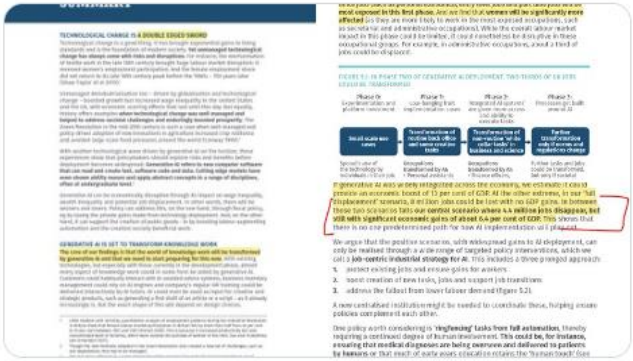
👇03/19 BofA CEO jobs down ~30%.

@IPPR new analysis "*up to 8 million UK jobs at risk from AI unless govt acts*"

1st wave "already" here, 11% of tasks exposed.

2nd wave, 59% of tasks exposed....

Show more



> **Dan Tsubouchi** @Energy_Tidbits · Mar 19
>
> 
>
>
> Digitization/AI wiping out non-producer, non-revenue generator white collar jobs.
>
> "*300,000 people, we have 212,000 today*"
> "*It's going to have less labor content. Are those peopl...*

1 2 1 3K

Dan Tsubouchi @Energy_Tidbits · 22h

IEA's peak oil demand by 2030 is more than how many & how quick EVs are sold.

A huge overlooked ass. in IEA's peak oil demand before 2030 is 👇 04/26/23 tweet. The IEA assumes every new EV displaces the distance driven by an ICE. ie. infers an ICE is effectively junked.

#OOTT

> **Dan Tsubouchi** @Energy_Tidbits · Apr 26, 2023
>
> Replying to @Energy_Tidbits
>
> 3/7
>
> Oil bulls also note KEY assumption to @IEA #EVs replacing 6 mmbd is that distance travelled by EVs basically replaces the distance an ICE or hybrid would have driven. ie. infers a new EV is added to fleet, an ICE ...
> Show more
>
> Excerpt IEA Global EV Outlook 2023, released Apr 26, 2023 https://iea.blob.core.windows.net/assets/dacf14d2-eabc-498a-8263-9f97fd5dc327/GEVO2023.pdf
>
> 
>
> **Box 3.2 How much oil really gets displaced by electric vehicles?**
>
> Oil displacement through the use of EVs can be estimated by assuming that the distance (total kilometres) travelled by EVs by segment each year would have otherwise been travelled by ICE vehicles or hybrid electric vehicles (HEVs) (based on the stock shares of each). In the case of PHEVs, only the distance covered by electricity gets included. The stock average fuel consumption of gasoline and diesel vehicles determines the total liquid fuel displacement, where the biofuel portion is taken out of the estimate based on regional blending rates. As a result, it can be estimated that in 2022, the stock of EVs displaced 700 000 barrels of oil per day.
>
> This method of estimation assumes that EVs replace ICE or hybrid vehicles of the same segment, as opposed to some other means of transport, i.e. an electric car replaces an ICE car. The accuracy of this assumption is uncertain. In particular with respect to two-wheelers. In IEA analysis, only motorcycles (L3e in the United Nations Economic Commission for Europe (UNECE) classification of L1 or L3 are considered. This definition excludes micromobility options such as electric-assisted bicycles and low-speed electric scooters, leading to a significantly lower stock (around 80% lower) than when including micromobility segments.
>
> Whether or not electric micromobility avoids oil use is uncertain, as it might displace manual bicycles or walking rather than ICE two-wheelers. At the same time, there is evidence that in some cases micromobility displaces personal car or taxi trips. The estimate of the amount of oil use that is avoided by two-wheeled micromobility therefore strongly depends on the assumptions about the mode that is being displaced.
>
> The case of China, which represents over 95% of the global stock of two-wheeled electric micromobility, is a good example. Assuming that all two-wheeled micromobility in China replaces conventional ICE two-wheelers would increase oil displacement by 200 kbd (or 160%). If instead electric micromobility was assumed to replace only bus trips, then the total oil displacement from two-wheelers in China would increase by just 10 kbd (10%). However, if it was assumed that they displaced car trips, then oil use avoided by two-wheelers in China would be more than 1 mbd higher. Including oil displacement from the two-wheeled electric micromobility segment in China alone can therefore increase the estimated 2022 global oil displacement from all electric vehicles anywhere from 1% to 150%. But there is significant uncertainty as to whether any oil is displaced at all.

2 5 7 4.1K

Dan Tsubouchi @Energy_Tidbits · Mar 25

Hydrogen = More #NatGas Demand

US forgot to note $0.5b for $CLF "*hydrogen-ready flex-fuel*" to replace coal for steel means NatGas driven until makes sense for hydrogen.

Also is CLF's "clean Hydrogen" vague to incl NatGas? Most use "Green Hydrogen" to mean from wind/solar....

Show more

1 2 4 3.3K

Dan Tsubouchi @Energy_Tidbits · Mar 25

2/2

$CLF CEO gives clear credit to #NatGas as being the reason why US is technologically ahead of Japan.

Also CEO says "*No. We could not*" in response to question could this be done without the $0.5b grant.

Hydrogen = More NatGas demand

Thx @adsteel @RomaineBostick....

Show more

"we are a technologically ahead of our competitors outside of the United States. Let me give you an example. Japan talks a good game on technology. Japan doesn't have natural gas. We do." Cleveland-Cliffs CEO on grants from US for hydrogen-ready to replace coal.

SAF Group created transcript of comments by Cleveland-Cliffs CEO Lourenco Goncalves with Bloomberg's Alix Steel and Romaine Bostick on Bloomberg Markets The Close on March 25, 2024. https://www.bloomberg.com/news/videos/2024-03-25/cleveland-cliffs-ceo-on-decarbonization-grant-us-steel-video

Items in "*italics*" are SAF Group created transcript

At 0:45 min mark, Steel "*without the money from the Biden Administration could you make any of this possible? Sort of move from coal to natural gas to hydrogen?*" Goncalves "*No. We could not. These are real infrastructure type of projects. It takes policy. It takes resolve to make these investments. Because these are multi-year, multi-decade type of investments. So we cannot change the landscape, just the way the company changing the landscape. Because we need the infrastructure to feed the project. We can't generate the feed of hydrogen by ourselves. So these things need to come in a more co-ordinated way. And the Department of Energy Secretary Granholm, President Biden are doing the right thing.*" Bostick "*So the money is there and it looks like you are onboard with this Lorenzo, I am curious about the competitive nature of this. Do you have worries here, that the net result of this, relative to your competitors outside the US, those not getting this money. Does that help you or hurt you?*" Goncalves "*Look, at the end of the day, we are a technologically ahead of our competitors outside of the United States. Let me give you an example. Japan talks a good game on technology. Japan doesn't have natural gas. We do. That gave us a head start on the ability to use hydrogen. I've already tried hydrogen in two blast furnaces. The one in Middletown, that's a small one. And the one in Indiana Harbor, that's the largest in the eastern, the western hemisphere. So we are technologically ahead. We supply steel for the same automakers they supply. And we can do anything we want with our workforce.*"

Prepared by SAF Group https://safgroup.ca/news-insights/

2 4 3.3K

Dan Tsubouchi @Energy_Tidbits · Mar 25

Hummer EV.

GM highlights zero tailpipe emissions.

But evaded @FerroTV question if making the Hummer EV is good for the environment.

GM "*we're very responsible not only on the tailpipe but on the holistic nature of that battery development as well*".

...

Show more

GM "Zero tailpipe emissions [electric Hummer]" Bloomberg "Okay, but to make the thing? ... are we saying its good for the environment?" GM "... we're very responsible not only on the tailpipe but on the holistic nature of that batter development as well"

SAF Group created transcript of comments by Duncan Aldred (Global VP Buick and GMC, General Motors) with Bloomberg's Jonathan Ferro on Bloomberg Surveillance March 25, 2024.
https://www.bloomberg.com/news/videos/2024-03-25/gm-buick-s-aldred-on-evs-china-sales-brand-refresh

Items in "italics" are SAF Group created transcript

At 5:25 min mark, Aldred "*I think it's [hybrids] going to be part of the development. We still maintain an all EV future. We still maintain a zero emissions strategy or vision is what we want to achieve. But I think hybrids will part of that journey to get there.*" Ferro "*I'm always interested by this zero emissions climate when I hear about the electric, the EV Hummer, I've got to ask you this question. I ask it out loud all the time. How on earth is that good for the environment? I've seen the size of these things, they are massive. How is that good for the environment? Help me understand that.*" Aldred "*Well, they are nowhere as big as you think first of all. I actually bought one, it's not a company car. I bought one. It's the best vehicle ever you could buy. It's really easy to drive around town here, like somewhere in Manhattan. It's super easy. Four wheel steer make it turning circle the size of a small car*". Ferro "*creating potholes because it is so heavy.*" Aldred "*No, no, no. It's got air suspension so it glides along the potholes this great city. The roof comes off making it a convertible vehicle. Zero to 60 in three seconds. Goes really anywhere off-road. It's got something we call extract mode. And of course, if you're on the highway, it drives hands-free with super cruise technology. So this really is the world's first super truck and an outstanding vehicle. And again, zero tailpipe emissions.*" Ferro "*Okay. But to make the thing?*" Aldred "*To make the thing?*" Ferro "*That's what I'm getting at here. Zero tailpipe emissions, I understand that. But to make an electric Hummer an EV, are we saying that's good for the environment?*" Aldred "*well clearly, we are very responsible in the sourcing of materials that go into the batteries that then create the Altium battery technologies that go into the Hummer. So we're very responsible not only on the tailpipe but on the holistic nature of that battery development as well.*"

Prepared by SAF Group https://safgroup.ca/news-insights/

Dan Tsubouchi @Energy_Tidbits · Mar 25

Whatever the reason, less RUS oil in market = support for prices.

RUS to cut #Oil output to "*facilitate a seasonal peak in maintenance at refineries....*"

OR is it the oil supplying refineries hit by drones can't be physically moved to export terminals?

#OOTT Thx @Reuters

https://www.reuters.com/markets/commodities/russia-orders-companies-cut-oil-output-meet-opec-target-2024-03-25/

Exclusive: Russia orders companies to cut oil output to meet OPEC+ target

Reuters
March 25, 20248:57 AM MDTUpdated 7 hours ago

MOSCOW, March 25 (Reuters) - Russia's government has ordered companies to reduce oil output in the second quarter to ensure they meet a production target of 9 million barrels per day (bpd) by the end of June in line with its pledges to OPEC+, three industry sources said on Monday.

Earlier this month, Russian Deputy Prime Minister Alexander Novak said that Russia would cut its oil output and exports by an additional 471,000 barrels per day (bpd) in the second quarter, in coordination with some members of the Organization of the Petroleum Countries and allied producers (OPEC+).

Russia plans to gradually ease the export cuts and focus on only reducing output. Novak has not provided the targeted level for output, but production would drop to almost 9 million bpd in June if the reduction is implemented as planned.

The sources, who declined to be named because they were not authorised to speak publicly, said the government had given specific targets to each company, indicating its intention to meet its OPEC+ pledge to cut output to support international oil prices.

Russia's Energy ministry declined to comment. Alexander Novak's press office did not reply to Reuters' request for comment.

Reuters sources said the production cuts would facilitate a seasonal peak in maintenance at refineries, many of which had already reduced fuel production as a result of outages and Ukrainian drone attacks.

Novak late last month said Russian oil output was 9.5 million bpd.

Russian oil and gas condensate production have declined from an annual peak of 11.7 million bpd in 2019 to around 10.8 million in recent months as a result of coordinated actions with OPEC.

Russia decided not to disclose statistics on crude oil production as it treated large amounts of data as classified following the start of what it calls a special military operation in Ukraine in February 2022.

Russian oil production in April, May and June is set to fall by around 3.6%, 4.1% and 4.9% respectively from March, in line with Russia's promises to voluntary reduce production, the data provided by sources and Reuters calculations showed.

Novak has said Russia will reduce output by an extra 350,000 bpd in April, with exports will be cut from March levels by 121,000 bpd. In May, output will be cut by 400,000 bpd and exports by another 71,000 bpd. In June, all the additional cuts will be from oil output.

That does not include production of gas condensate, a type of very light oil, which in 2023 was around 1.3 million bpd.

Reporting by Reuters; editing by Barbara Lewis

3 9 37 3.6K

Dan Tsubouchi @Energy_Tidbits · Mar 25

Accurate or every time lucky.

UKR drone knocks out crude distillation unit tower at Kuibyshev refinery @Reuters

CDU is the 1st critical step in refining process. Processes #Oil into intermediate products for crackers to make final end-use product ie. jet fuel, diesel.

#OOTT

Russia's Kuibyshev oil refinery halts primary unit after drone attack - sources

Reuters

March 25, 2024 3:21 AM MDTUpdated 2 hours ago

MOSCOW, March 25 (Reuters) - The Rosneft (ROSN.MM), opens new tab-owned Kuibyshev oil refinery in Russia's city of Samara halted CDU-5, one of two primary refining units, knocking out half of its capacity following a drone attack over the weekend, two industry sources told Reuters on Monday.

Regional Governor Dmitry Azarov has said that a fire broke out at the refinery after a Ukrainian drone attacked it on Saturday morning, according to Interfax news agency. The blaze engulfed the primary oil refining unit, he said.

Ukraine has stepped up attacks on Russian oil infrastructure since the start of the year, hitting numerous large refineries in an attempt to cripple Russia's military and curb its army's advances.

Russian oil refining capacity that was shut down in the first quarter due to Ukrainian drone attacks on at least seven refineries amounts to about 4.6 million tons (370,500 barrels per day), or some 7% of the total, Reuters calculations show, on top of maintenance related to other causes.

The United States has urged Ukraine to halt drone strikes on Russian energy infrastructure, warning they risk provoking retaliation and driving up global oil prices, the Financial Times reported on Friday, citing people familiar with the matter.

Russia's oil refining production forecast for 2024 remains unchanged and close to last year's level of around 5.5 million barrels per day, Energy Minister Nikolai Shulginov said on Wednesday.

Azarov said a simultaneous drone attack on the Novokubyshevsky refinery in the region was unsuccessful and its facilities suffered no damage.

CDU-5 has production power of 9,500 metric tons per day (70,000 barrels per day), around half its capacity.

Another primary oil refining unit, CDU-4, has production capacity of 10,500 tons per day. It was not immediately clear if the unit was working normally.

Rosneft did not respond to a request for comment.

Last year, the Kuibyshev plant was Russia's 29th biggest oil refinery by output, accounting for 1.34% of total oil refining throughput, having processed 3.687 million tons of crude oil.

It produced 624,000 tons of gasoline (1.42% of Russia's total), 1.187 million tons of diesel (1.35%),

> **Dan Tsubouchi** @Energy_Tidbits · Mar 12
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> Refining 101.
>
> Lukoil drone reportedly hitting a distillation unit.
>
> it's a critical part of refining process. See 👇 ...

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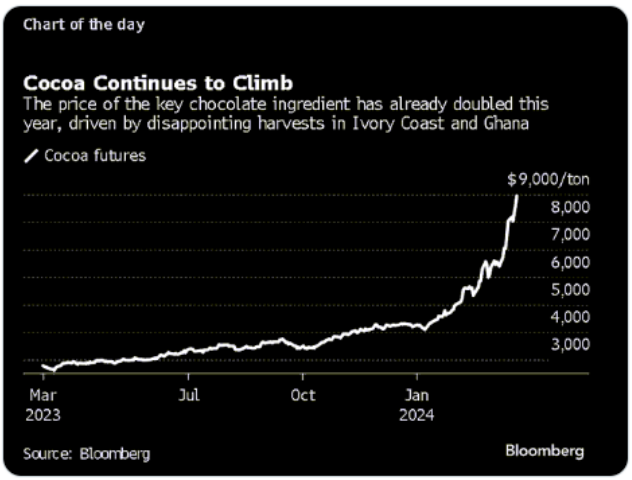
Not a big chocolate eater so hadn't realized the huge Cocoa price escalation.

#Cocoa prices already doubled this year.

This is terrible for the kids with the annual Easter chocolate rush this week.

Thx @business.



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Houthis Leader warns Saudi

Houthis/KSA in a de-escalation not a truce.

Don't let US use KSA bases/air space to transport weapons to Israel.

Don't attack Houthis.

Houthi missiles can reach KSA

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Look for Biden & Newsom to focus on #Gasoline prices and therefore #Oil #NatGas companies will be targets in election year.

Californian gasolines prices up +$0.35 MoM and about to hit $5.

US gasoline prices up +$0.26 MoM to $3.53.

#OOTT

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