Enerjide Analitik Gözlemler

Barış Sanlı

barissanli.com

Kriz var mı?

- Gaz/petrol/elektrik
- ABD/Avrupa/Asya
- Sanayi/tüketici

- 1980'lere benzer mı?
  - Büyüme düşük
  - Yeni nesil bir serbestleşme
  - Tekrar fosil yakıtlar

Enerji krizleri sonrası ne oluyor

- Verimlilik artıyor
  - Tüketici?
  - Eşya/otomotiv
- Yeni teknolojiler devreye giriyor
- Yeni kanunlar
- Biraz da konsolidasyon
- Üreticiler piyasa gücünü kaybediyor
- Ne kadar yüksek fiyat ne kadar uzun sürerse, etki o kadar büyük

Piyasalar

- Elektrik piyasaları
  - Arz/talep ekonomik teorileri?
- “Fiyat artmalı ki talep düşmeli”
  - Teminat sorunu
- Yeni mekanizmalar, skandallar
- Tüketici entegrasyonu neden zor?
- Para kimde, kazanan kim?

Enerji dönüşümü neden başarısız oldu

- Elektrik =? Enerji
- Excel’de sayı üretimi
- Mühendislik detaylar es geçildi
- Finansal isterler
- Gelişmekte olan ülkelerin borçlanması gereken rakam
- Tüm üretimler neredeyse Çin’de
- Çok katı bir ideoloji

Enerji dönüşümü neden devam eder?

- Teknolojik gelişme devam eder
  - Verimlilik
  - Elektrikli arabalar
- Daha yavaş daha maliyetli
  - Güneş ucuzdu ama görünmeyen maliyetler var
- Elektrik payı artar
- Enerji dönüşümü daha iyi bir yere geçiş değil, daha kaldıraçlı bir yere yolculuk
- İklim değişikliği gerçek

Temiz enerji

Evaluating the causes of cost reduction in photovoltaic modules

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[a]Institute for Data, Systems and Society, Massachusetts Institute of Technology, Cambridge, MA, USA
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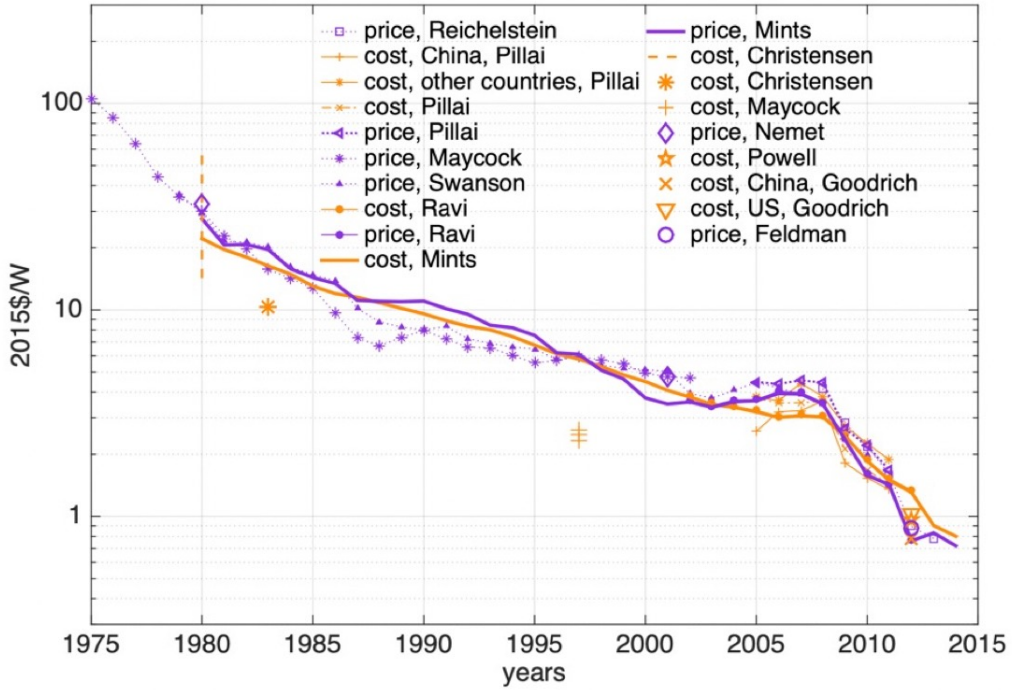
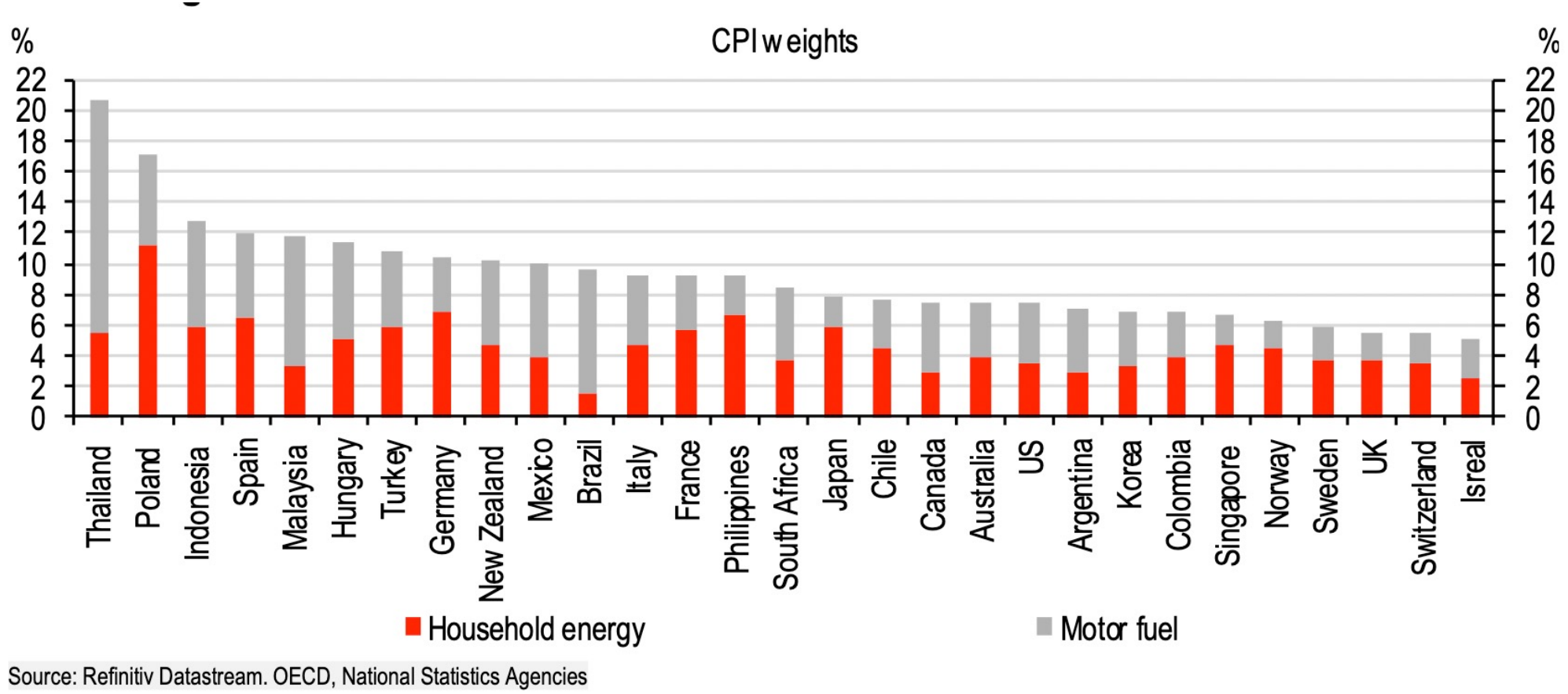
Abstract

Photovoltaics (PV) module costs have declined rapidly over forty years but the reasons remain elusive. We advance a conceptual framework and quantitative method for quantifying the causes of cost changes in a technology, and apply it to PV modules. Our method begins with a cost model that breaks down cost into variables that changed over time. Cost change equations are then derived to quantify each variable's contribution. We distinguish between



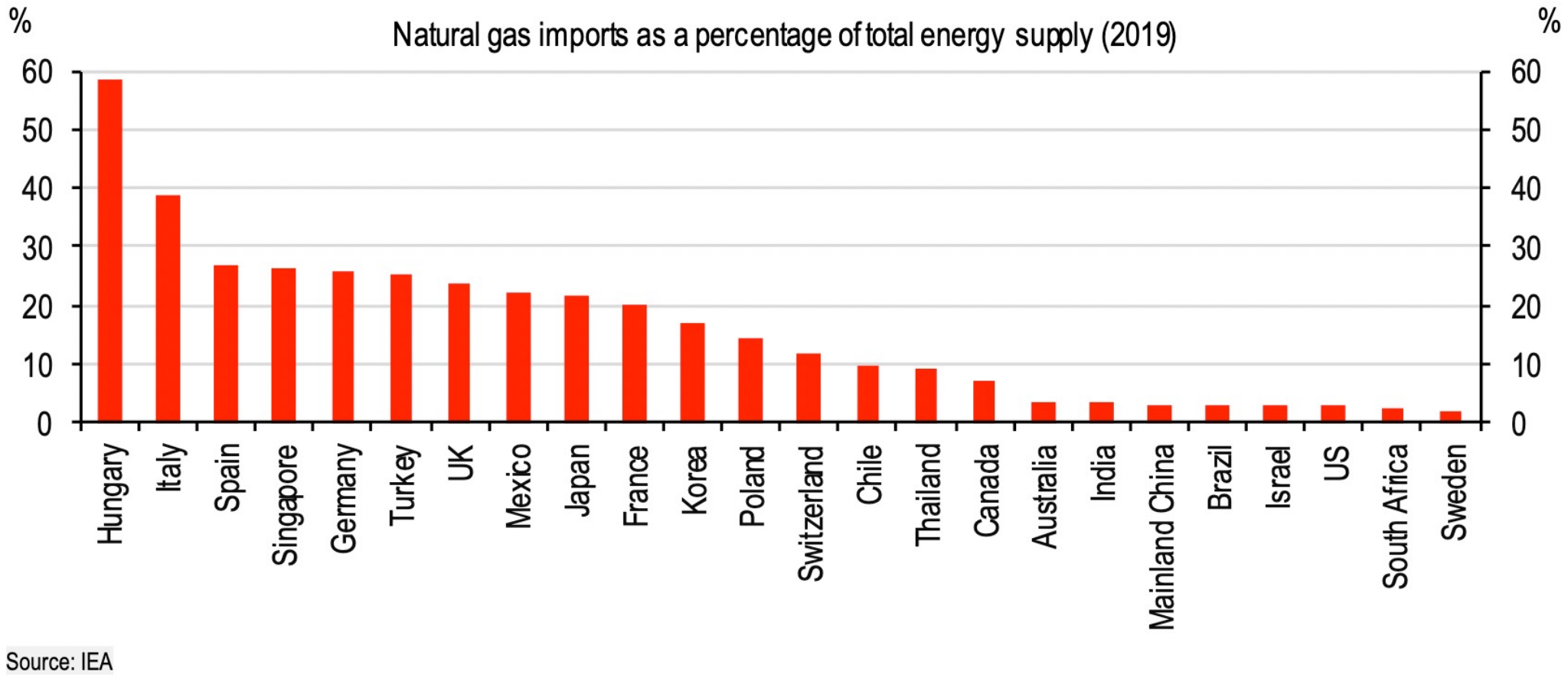
https://www.sciencedirect.com/science/article/pii/S0301421518305196

Enflasyon hesabında enerji ağırlığı

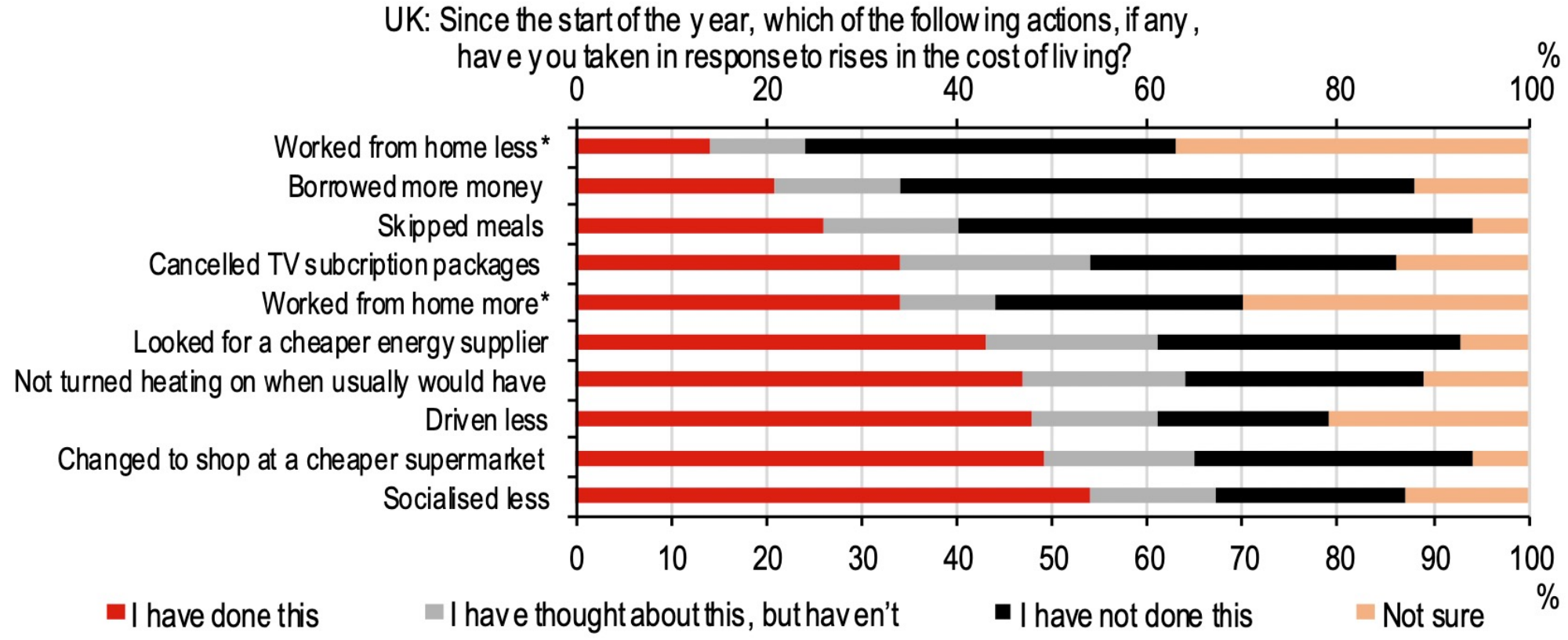


Source: Refinitiv Datastream. OECD, National Statistics Agencies

Doğalgazın enerji arzında payı



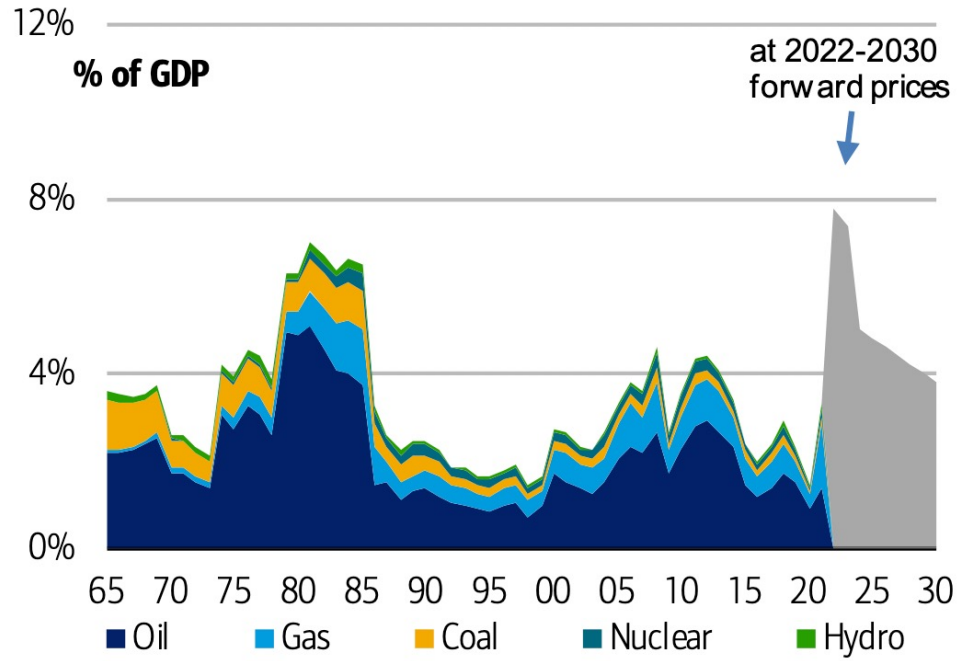
İngiltere'de tüketicilerin yüksek fiyatlara tepkisi



Source: Ipsos. Note: 2000 online British adults, aged 18-75, 22-24 August 2022, *only asked to those currently in work.

Enerji fiyatlarının büyüme üzerinde etkisi

Energy prices as a share of GDP in Europe are at exceptionally high levels due to record gas prices



Source: Bloomberg, BofA Global Research

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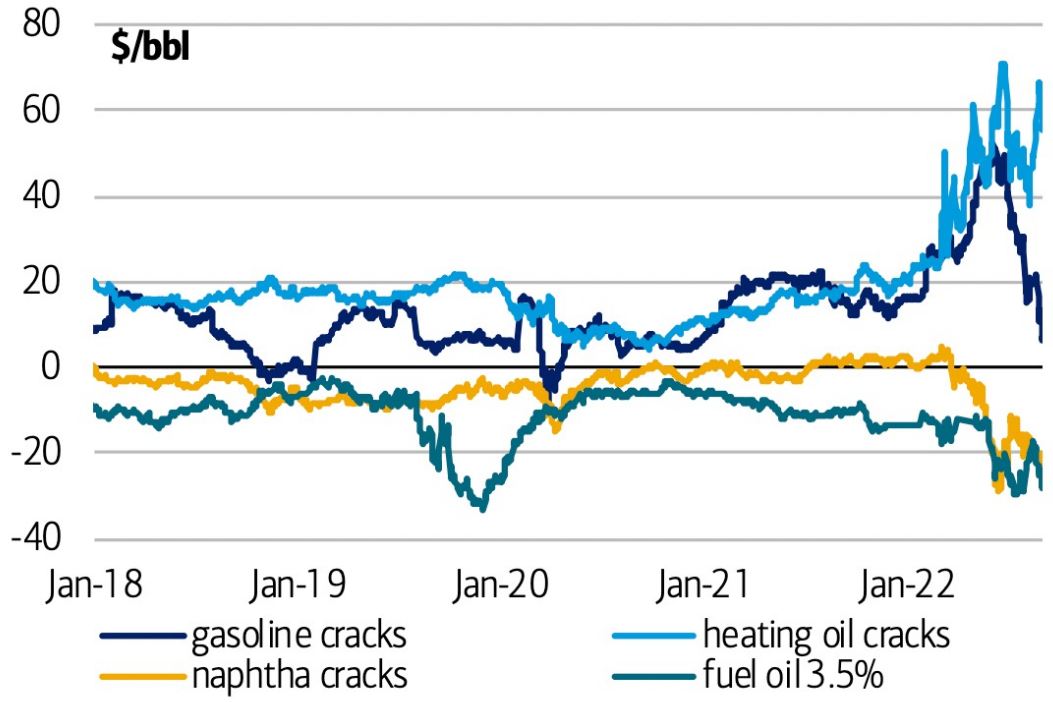
...leading to extreme movements in key crack spreads including naphtha, gasoline, diesel, or fuel oil



Source: Bloomberg

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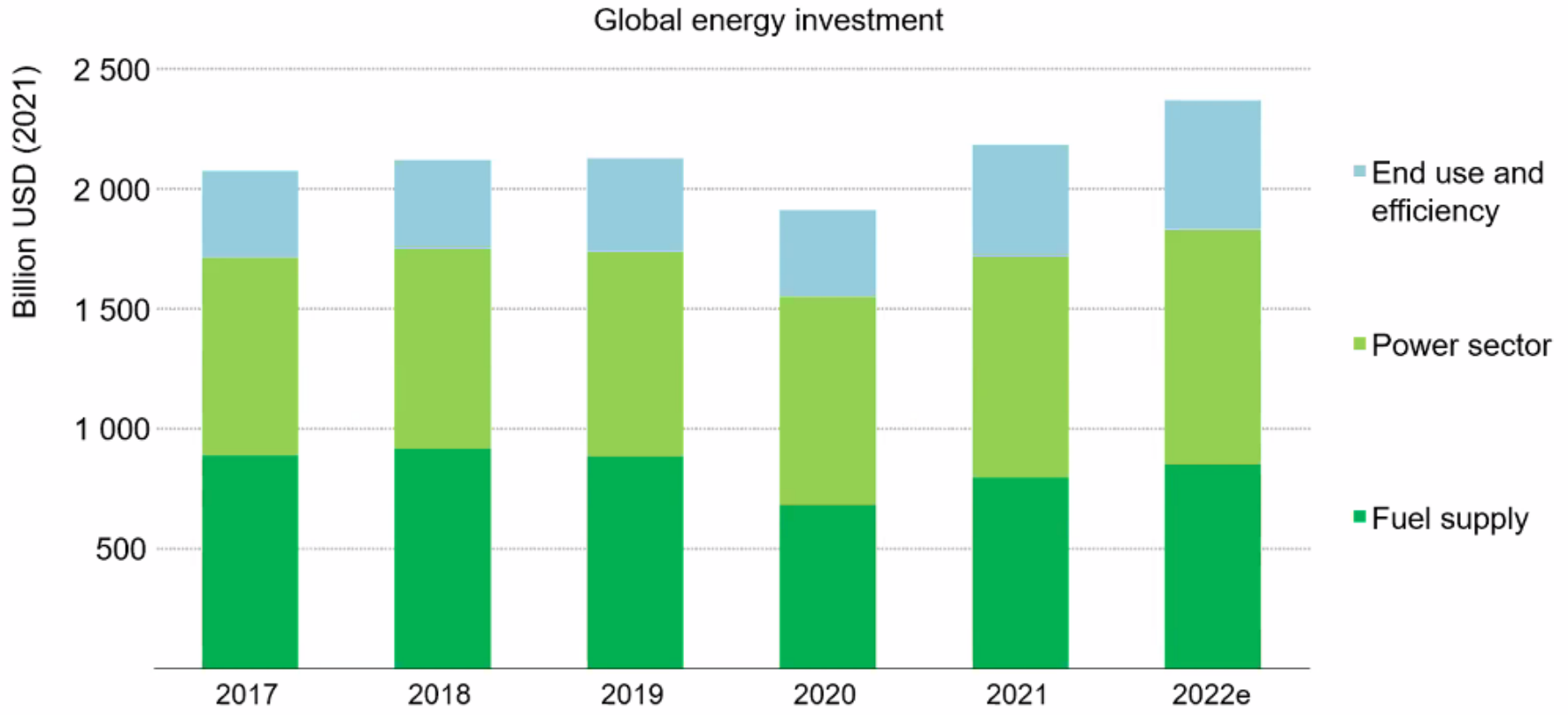
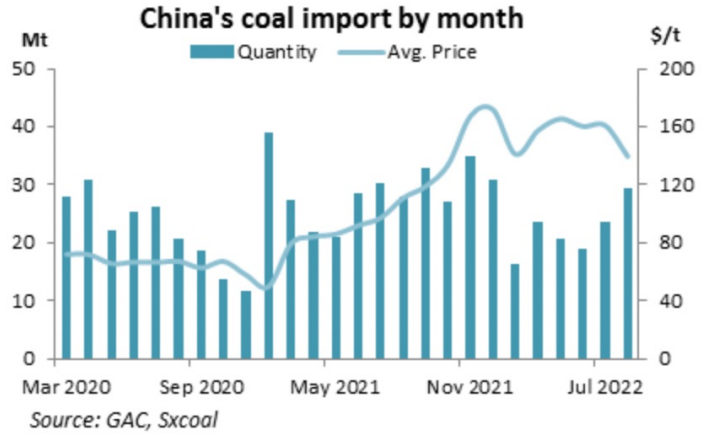
Küresel Enerji Yatırımları

Global energy investment is picking up



Energy investment is set to rise by 7% in 2022 to reach $2.3 trillion against the backdrop of the global energy crisis, but more than half of the increase in capital spending is linked to higher costs

Çin’de durum

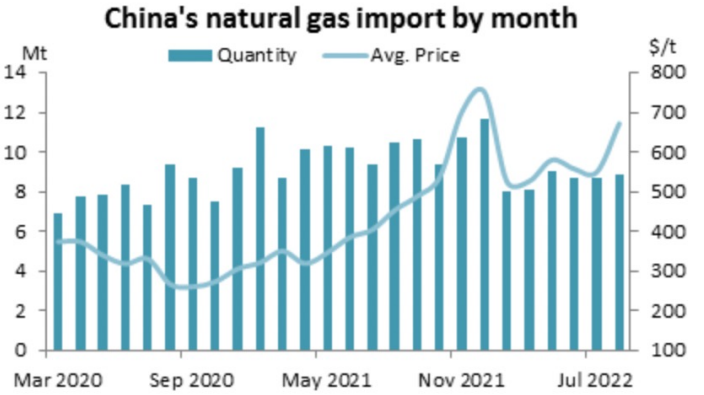


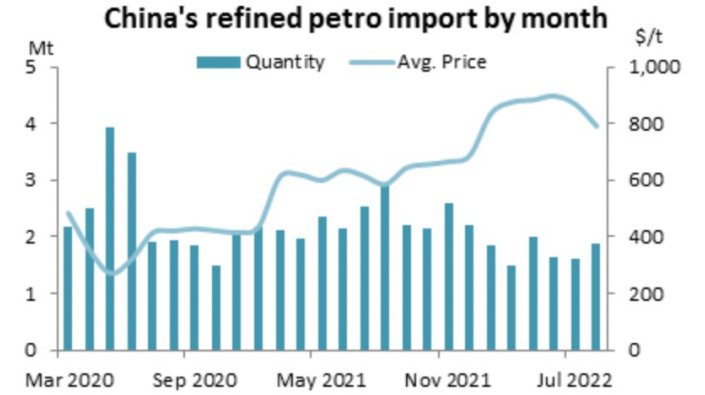
Source: GAC, Sxcoal

Source: GAC, Sxcoal

Source: GAC; Sxcoal

Source: GAC, Sxcoal

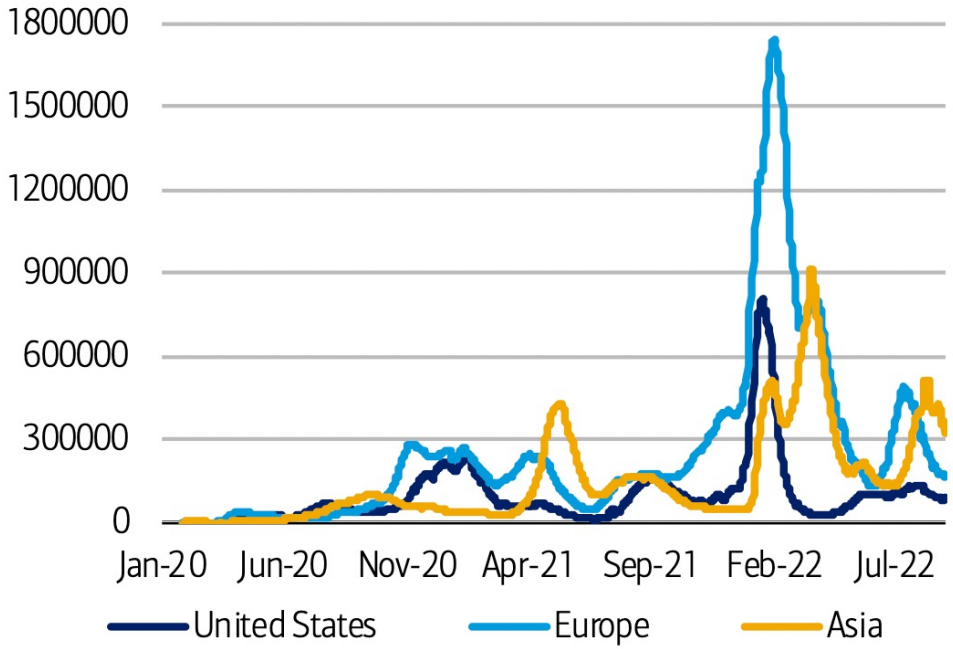




http://www.sxcoal.com/news/4660677/info/en

Havayolu

Recent Covid-19 related lockdowns in Shanghai, Sichuan, and Hebei have spooked energy investors but...



Source: CEIC

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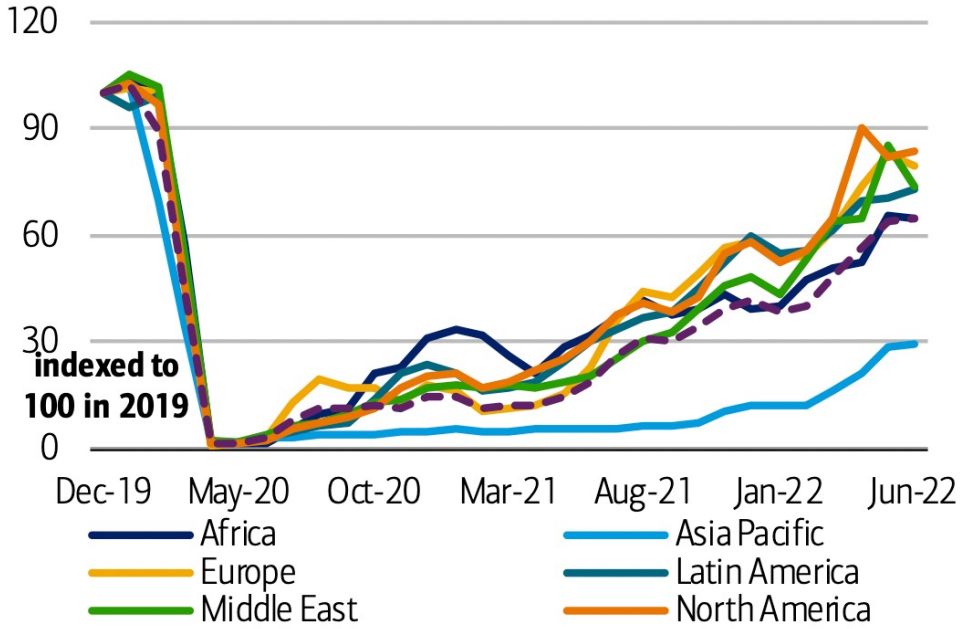
...international air traffic is now above 60% of pre-pandemic levels everywhere except in Asia



RPK: Revenue passenger kilometres

Source: IATA, BofA Global Research

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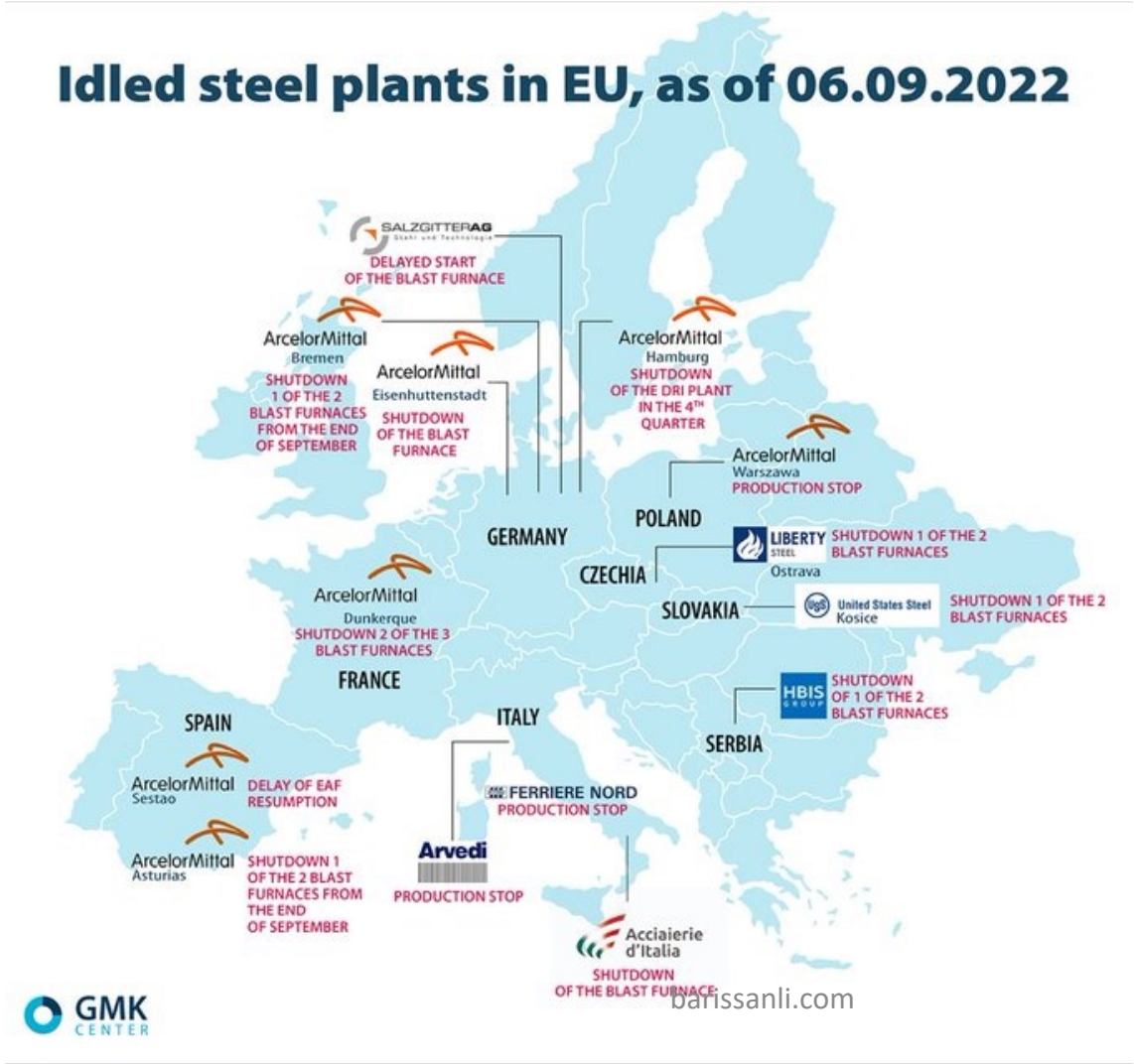
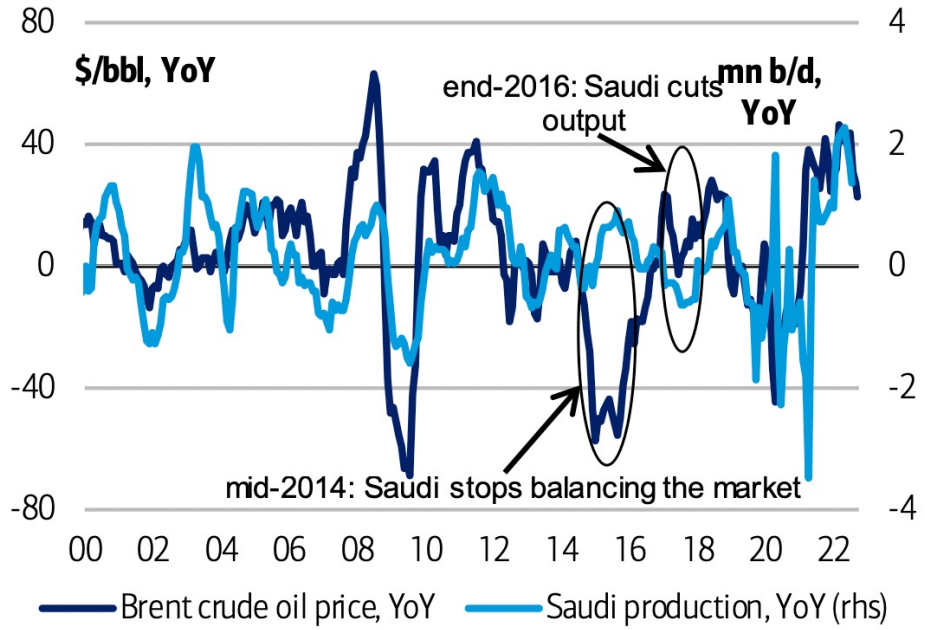
Avrupa’da duran çelik tesisleri



Petrol

Petrol

Saudi Arabia has historically moved production around as Brent prices pushed up or down

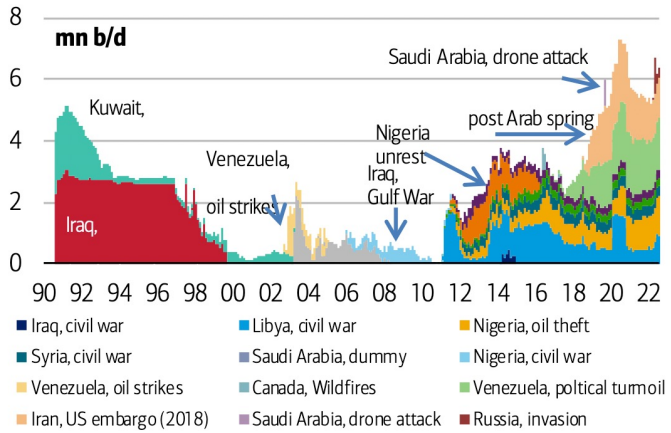


Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 14: Major oil supply disruptions (excluding disruptions due to OPEC policy changes)

The level of oil supply disruptions has pushed again above 6mn b/d on Russia and Libya...

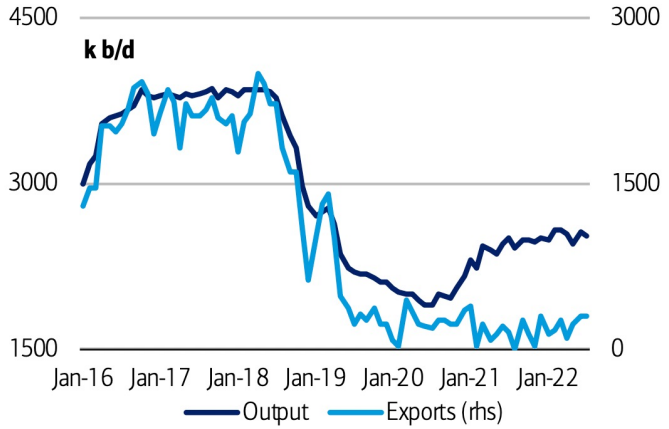


Source: IEA, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 15: Iran crude oil output and exports

...while Iranian output has recovered in the past two years to 2.5mn b/d although reported exports remain depressed



Source: Bloomberg, IEA

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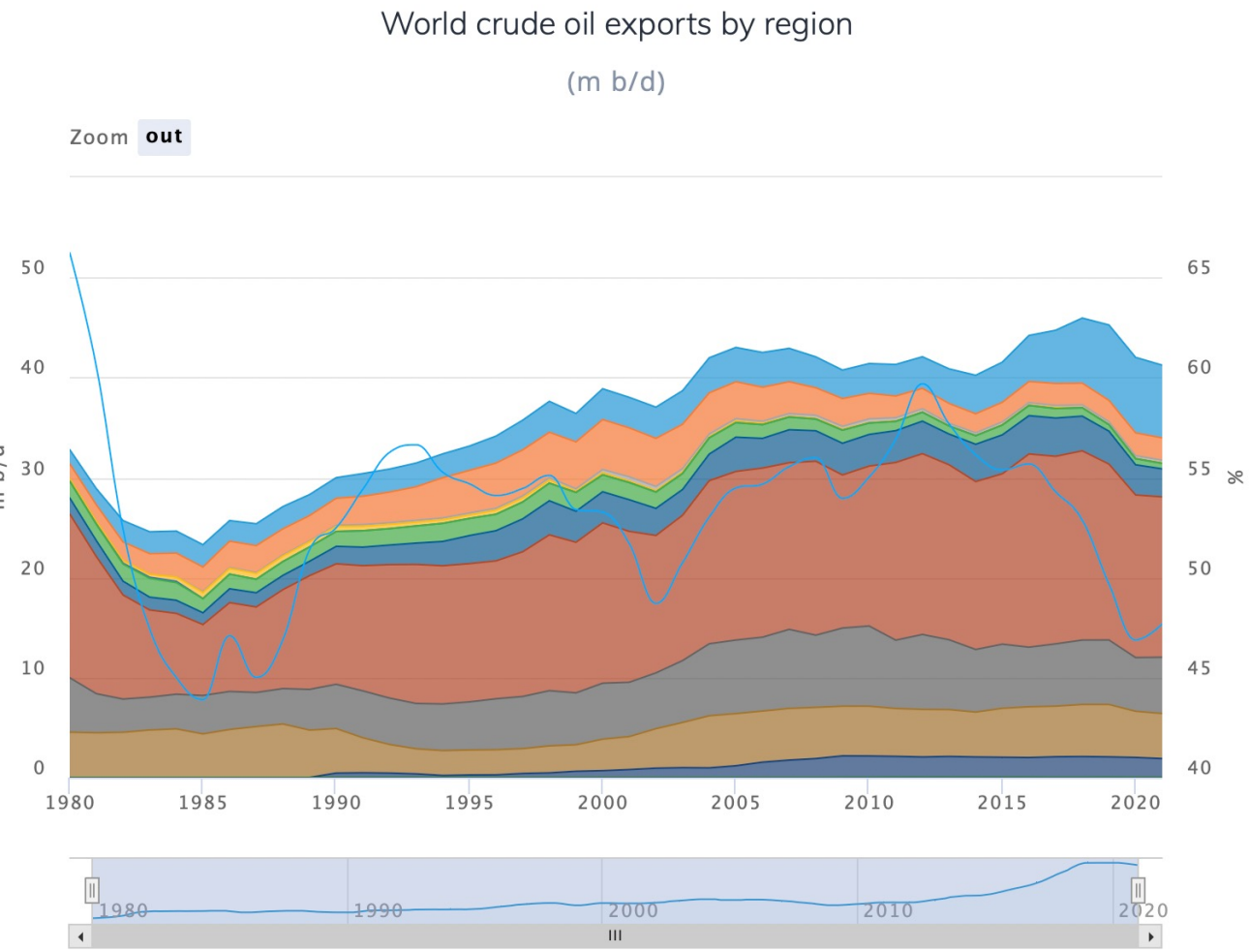
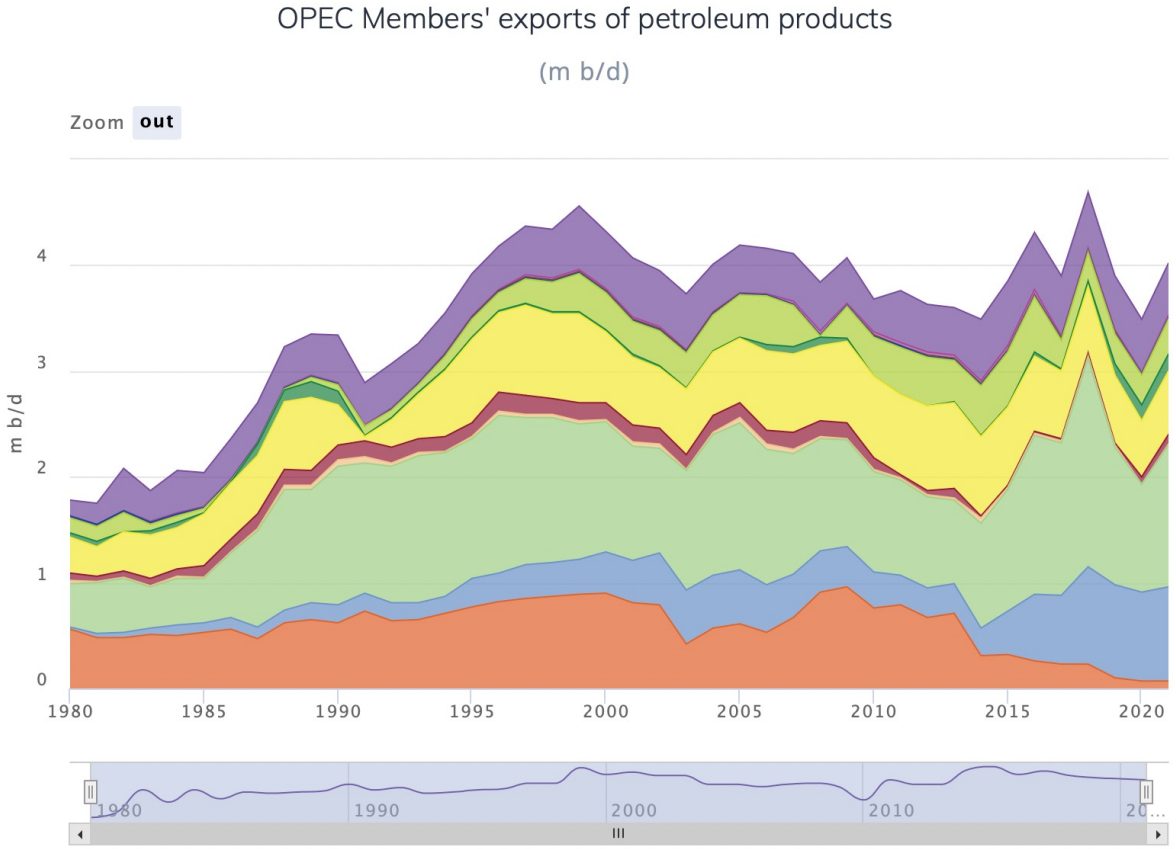
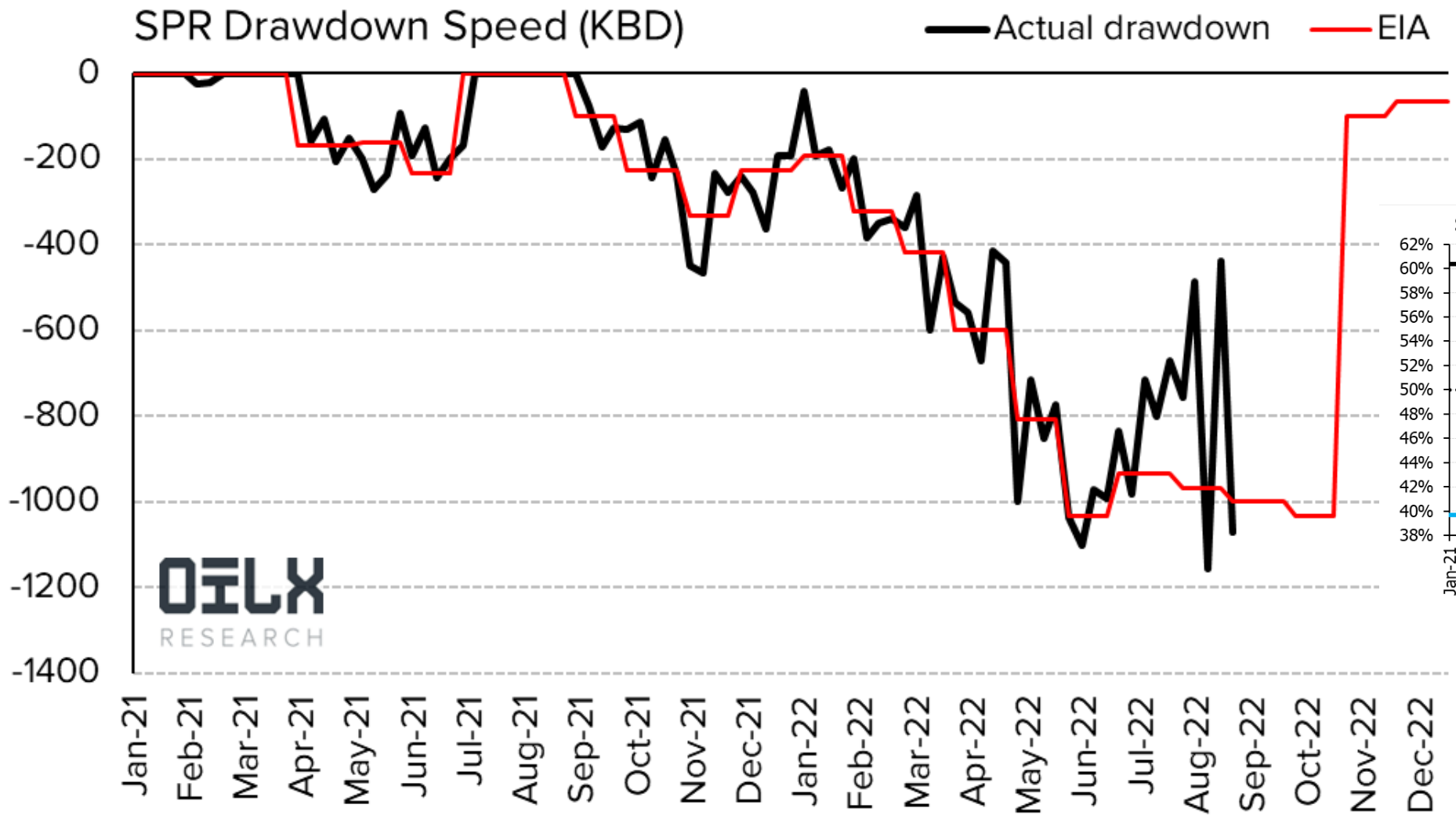
OPEC denklemi

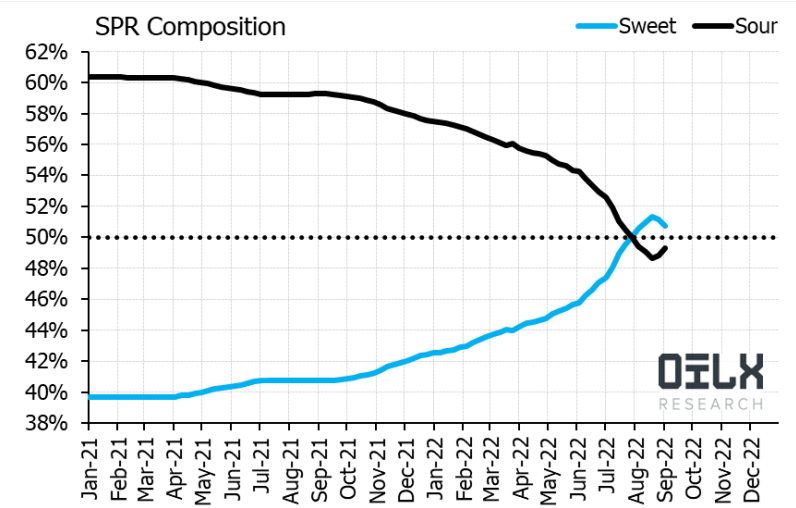




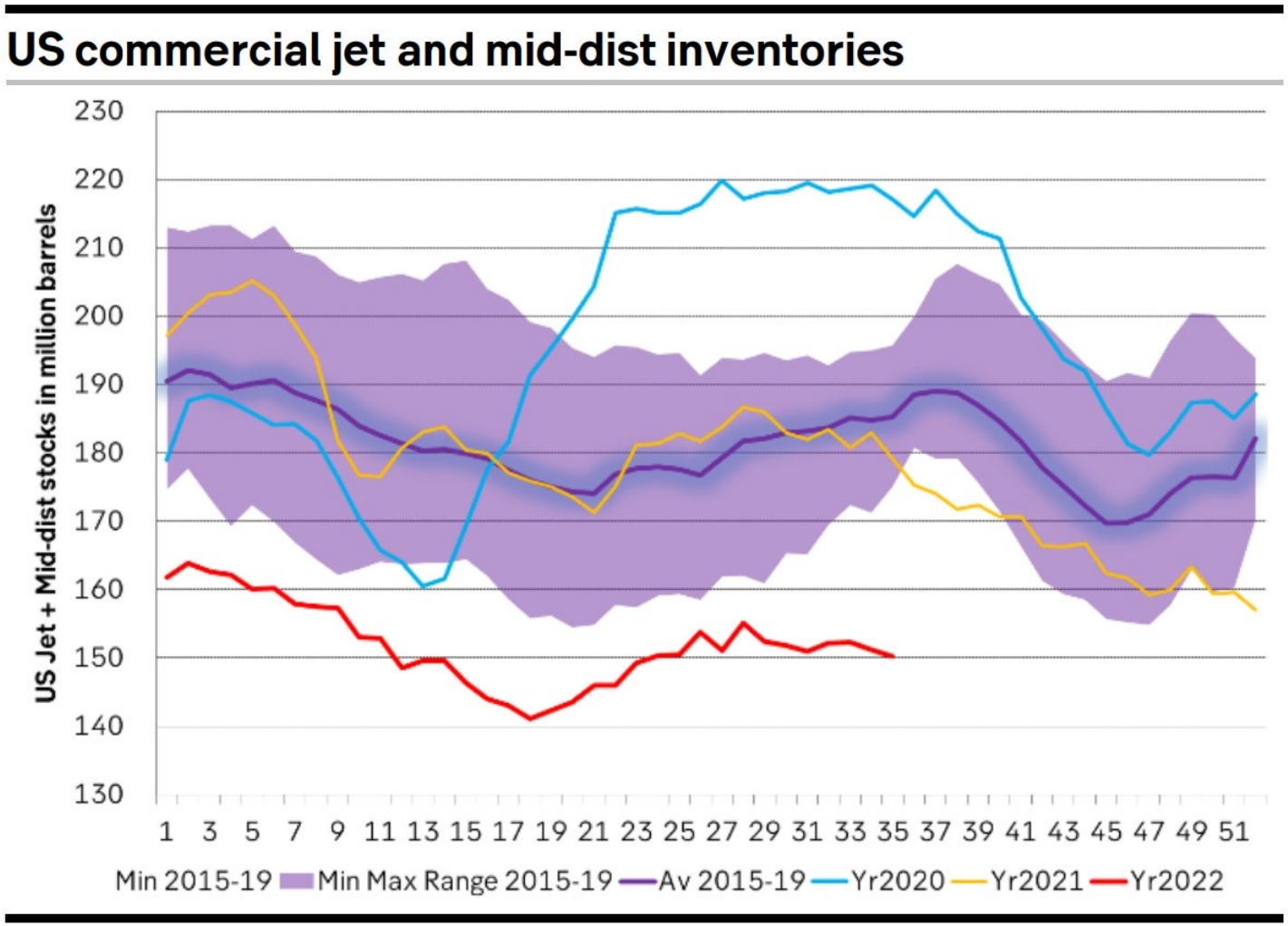
https://asb.opec.org/ASB_Charts.html?chapter=225

ABD petrol stoklarının satış hızı (siyah)





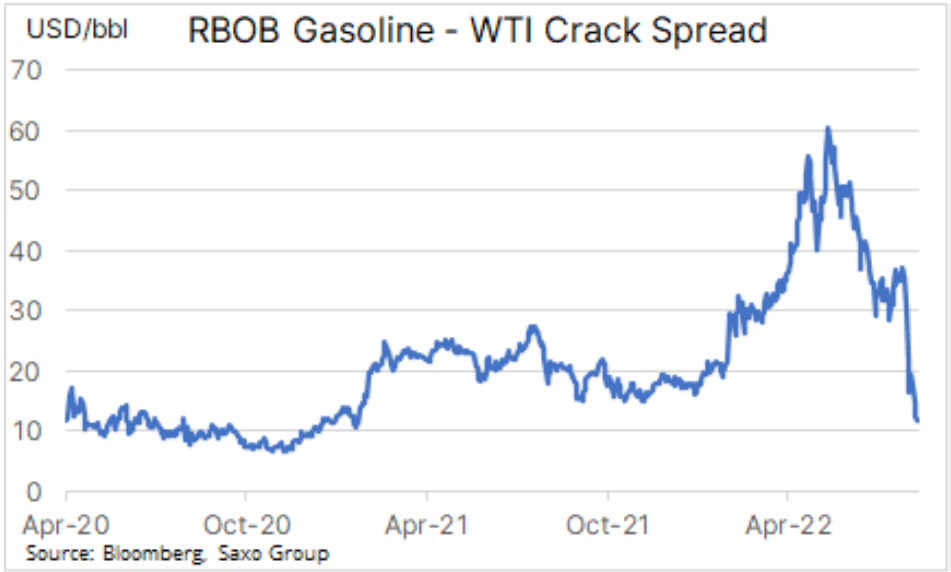
Stoklar

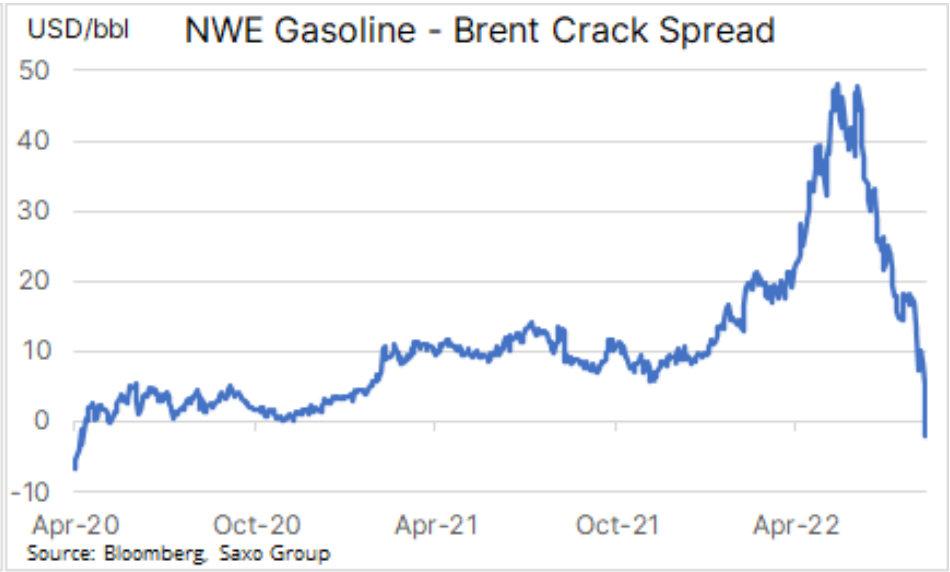


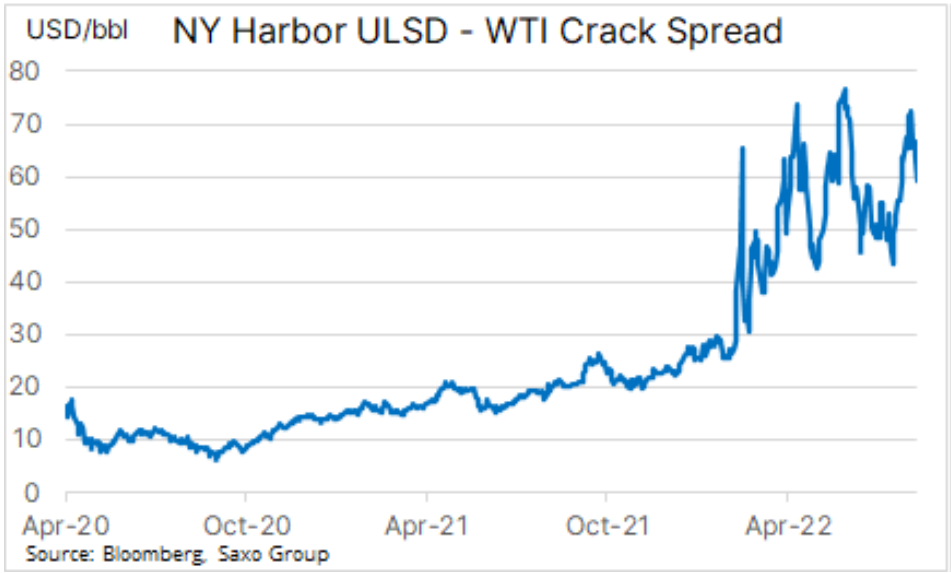
Source: SEB, Bloomberg

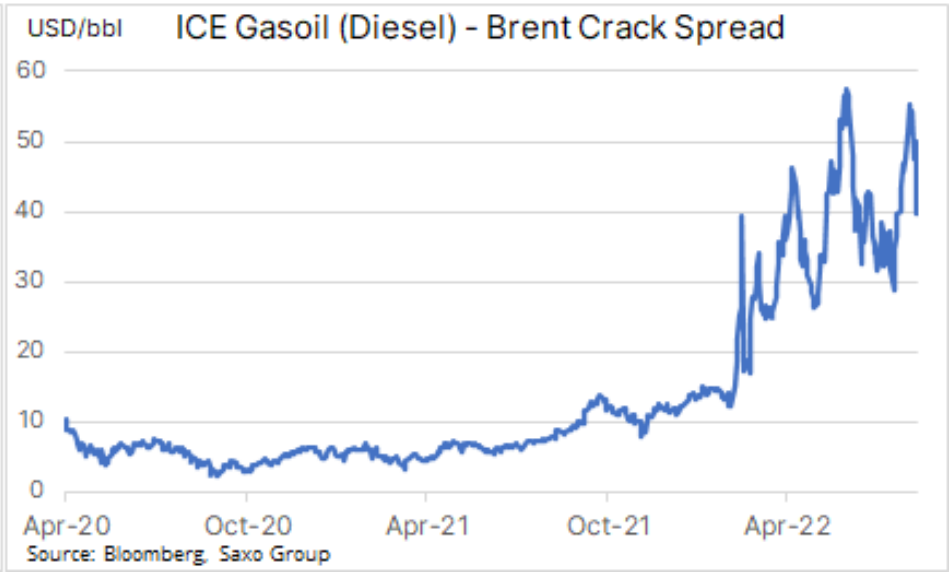
@PiQSuite

Diesel


USD/bbl
RBOB Gasoline - WTI Crack Spread
70
60
50
40
30
20
10
0
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Source: Bloomberg, Saxo Group

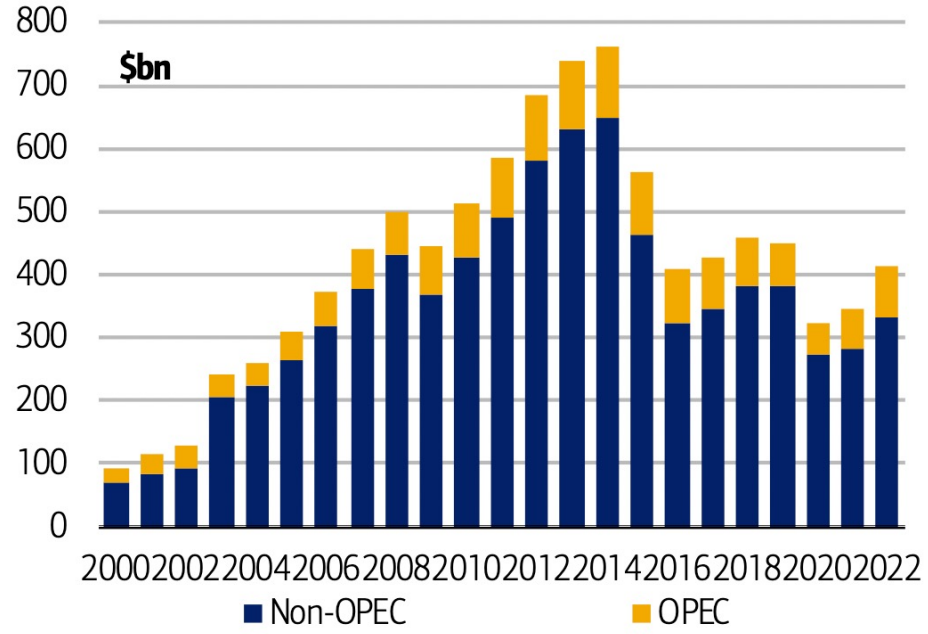

USD/bbl
NWE Gasoline - Brent Crack Spread
50
40
30
20
10
0
-10
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Source: Bloomberg, Saxo Group


USD/bbl
NY Harbor ULSD - WTI Crack Spread
80
70
60
50
40
30
20
10
0
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Source: Bloomberg, Saxo Group


USD/bbl
ICE Gasoil (Diesel) - Brent Crack Spread
60
50
40
30
20
10
0
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Source: Bloomberg, Saxo Group

Petrol – Yeterli üretim gelir mi?

Global upstream oil & gas capex collapsed in 2020 and 2021 driven by low demand and prices



Source: Woodmac

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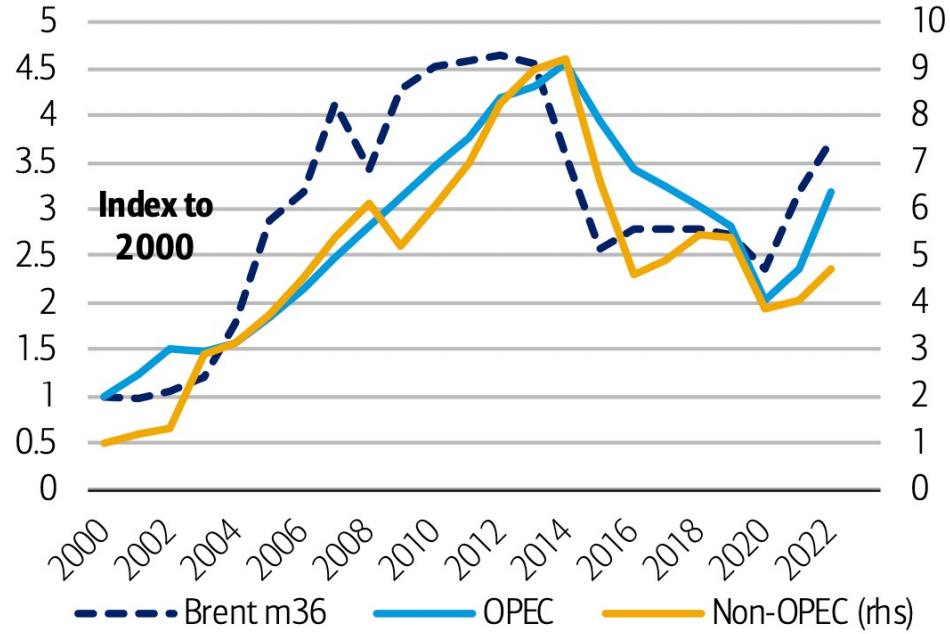
With Brent prices recovering in the past two years, capex has been on the rise



Source: Woodmac

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Küresel akaryakıt marjları (crack)

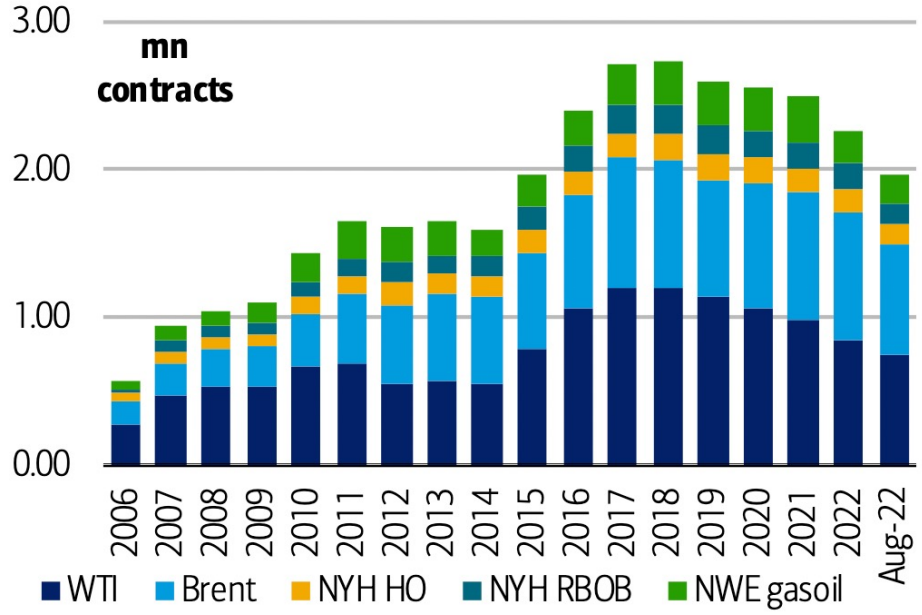
Note: Regional crack spreads are based on local product prices vs regional crude benchmark (USGC = WTI Houston, NWE = Brent, Singapore = Dubai)
Sources: Commodity Context, Bloomberg.
Disclaimer: These materials incorporate third-party data, are provided for informational purposes only, and do not constitute advice or opinion of any kind. Commodity Context does not warrant or guarantee the accuracy or completeness of these materials.

Commodity Context

Daralan piyasalar – Oynaklığı arttırıyor

Exhibit 34: Daily average volume for benchmark petroleum contracts

Traded volumes for key petroleum contracts have fallen to 1.97mn so far this year from a high of 2.73 in 2018



Source: Bloomberg

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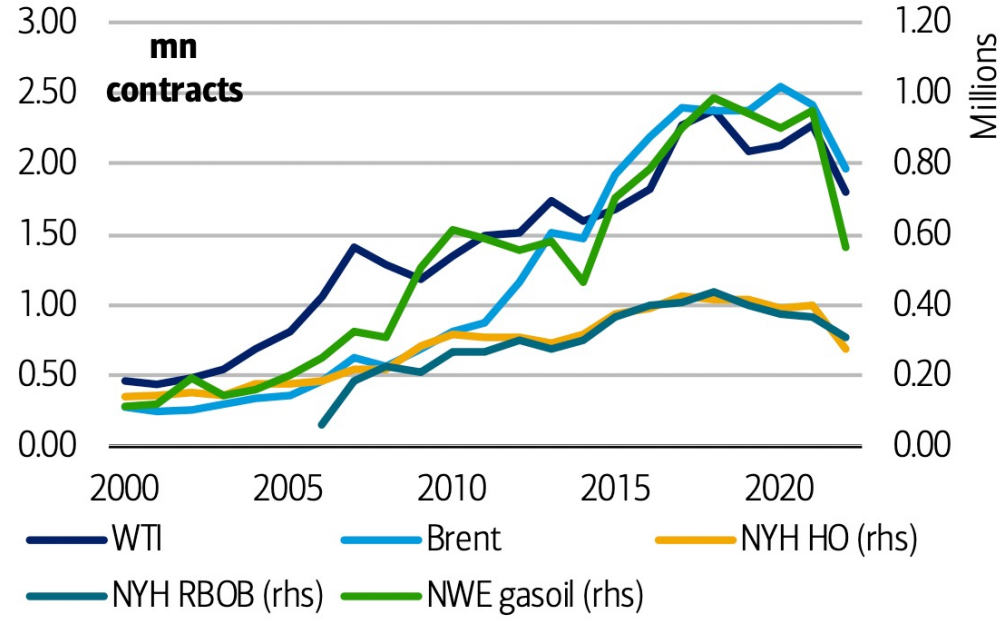
Exhibit 35: Daily average open interest for benchmark petroleum contracts

Open interest has also come down sharply in the past year, particularly for volatile gasoil (European ULSD)



Source: Bloomberg

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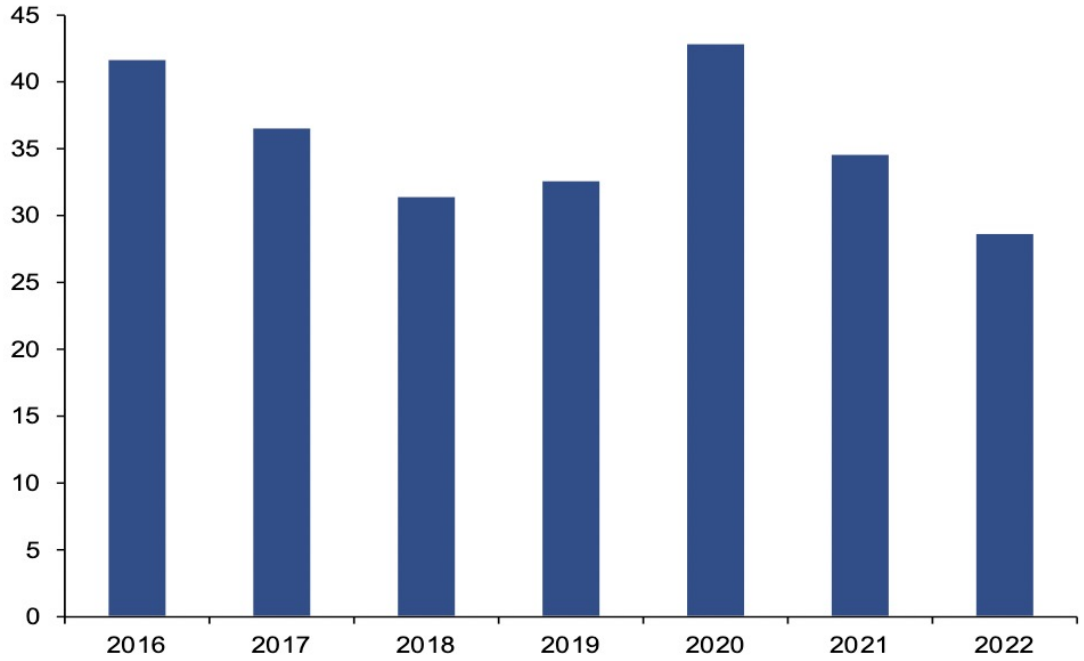
Dizel sorununda - ABD

Source: Citi Research, EIA

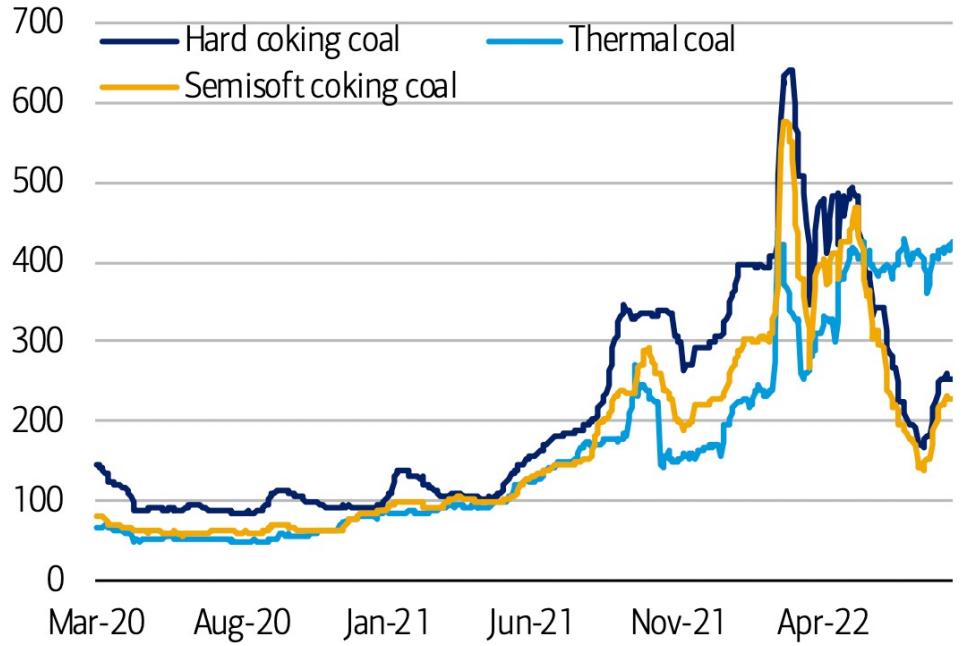
Figure 69. Distillate Days of Forward Cover



Kömür

Kömür fiyatları

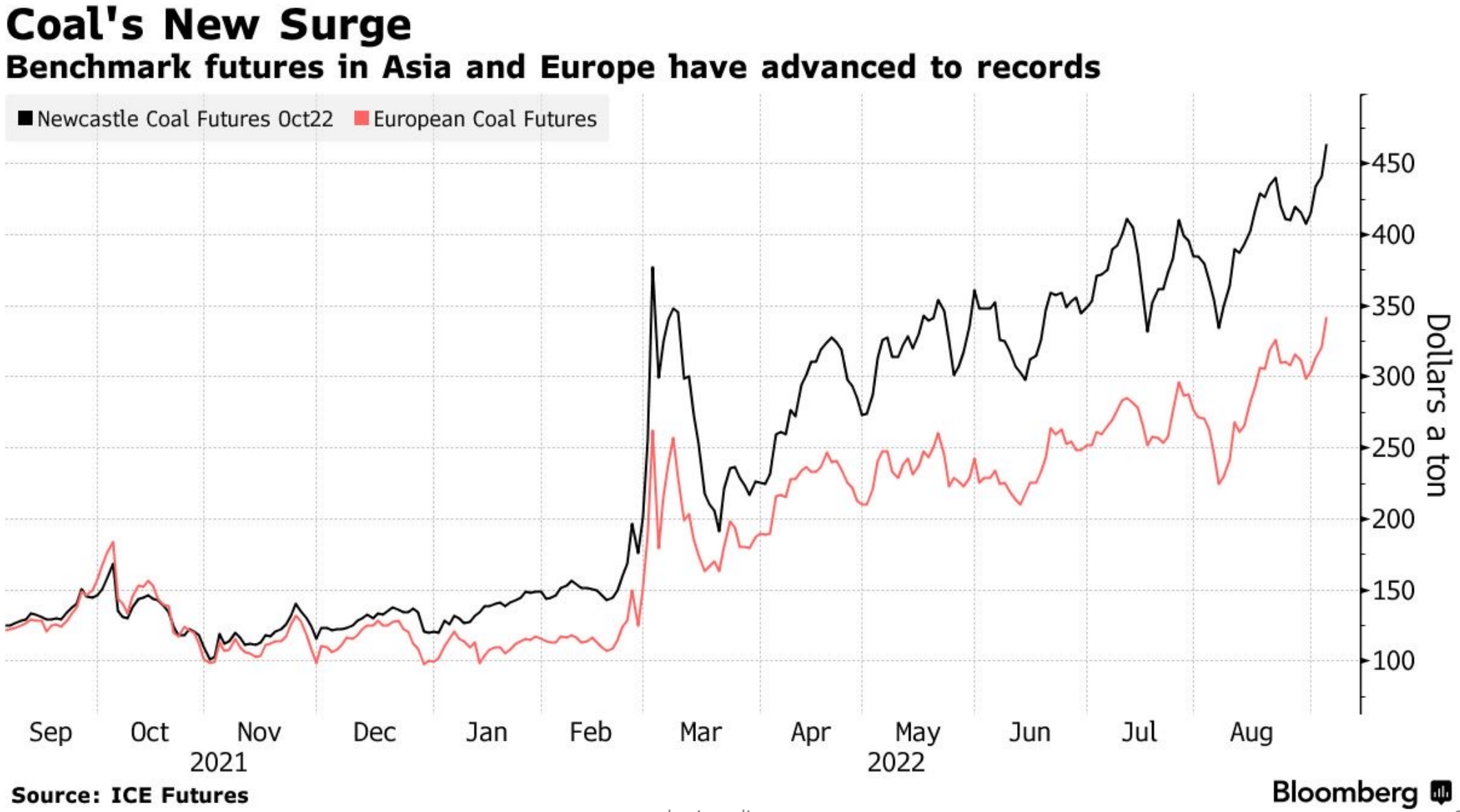
Exhibit 14: Coal prices (Australia)
The energy crunch in Europe has pushed thermal coal prices to trade at a premium to its metallurgical counterpart



Source: Bloomberg , BofA Global Research

BofA GLOBAL RESEARCH

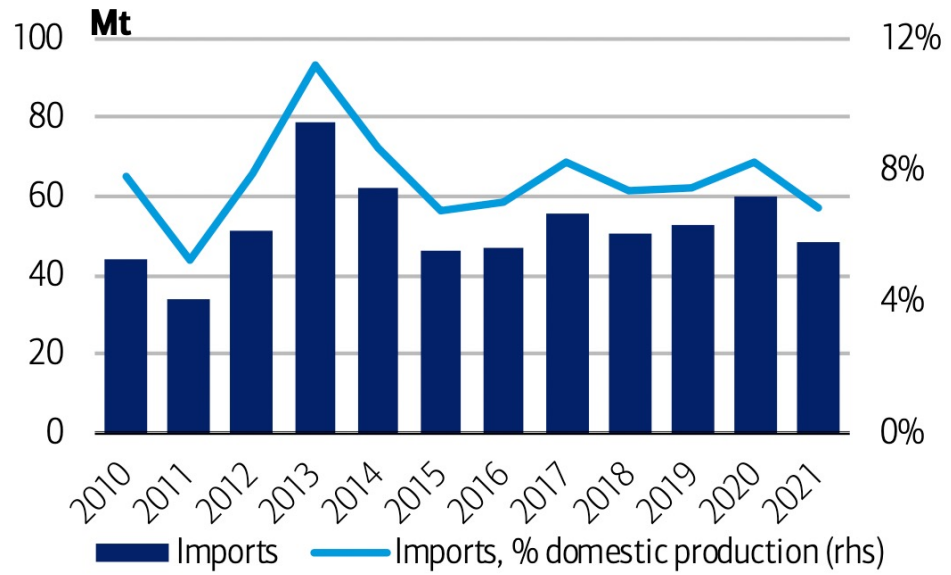
Coal



https://www.bloomberg.com/news/articles/2022-09-06/asia-coal-price-hits-record-as-global-hunt-for-fuel-escalates

Çin : met kömür – ham çelik

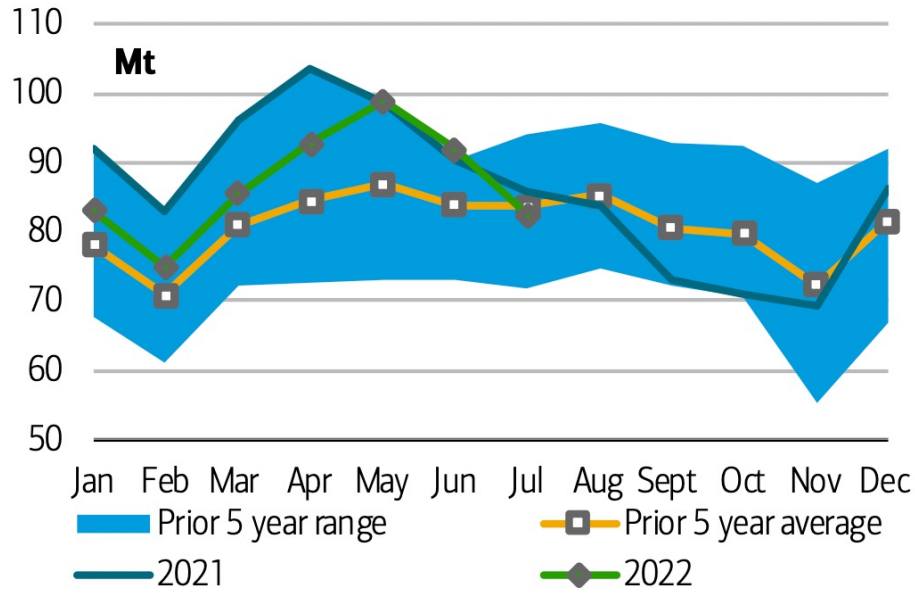
Exhibit 4: China metallurgical coal imports (seaborne)
China has become increasingly self-sufficient over the last decade



Source: Woodmac, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 5: China crude steel production
Steel production in China was significantly challenged this year



Source: Bloomberg, BofA Global Research

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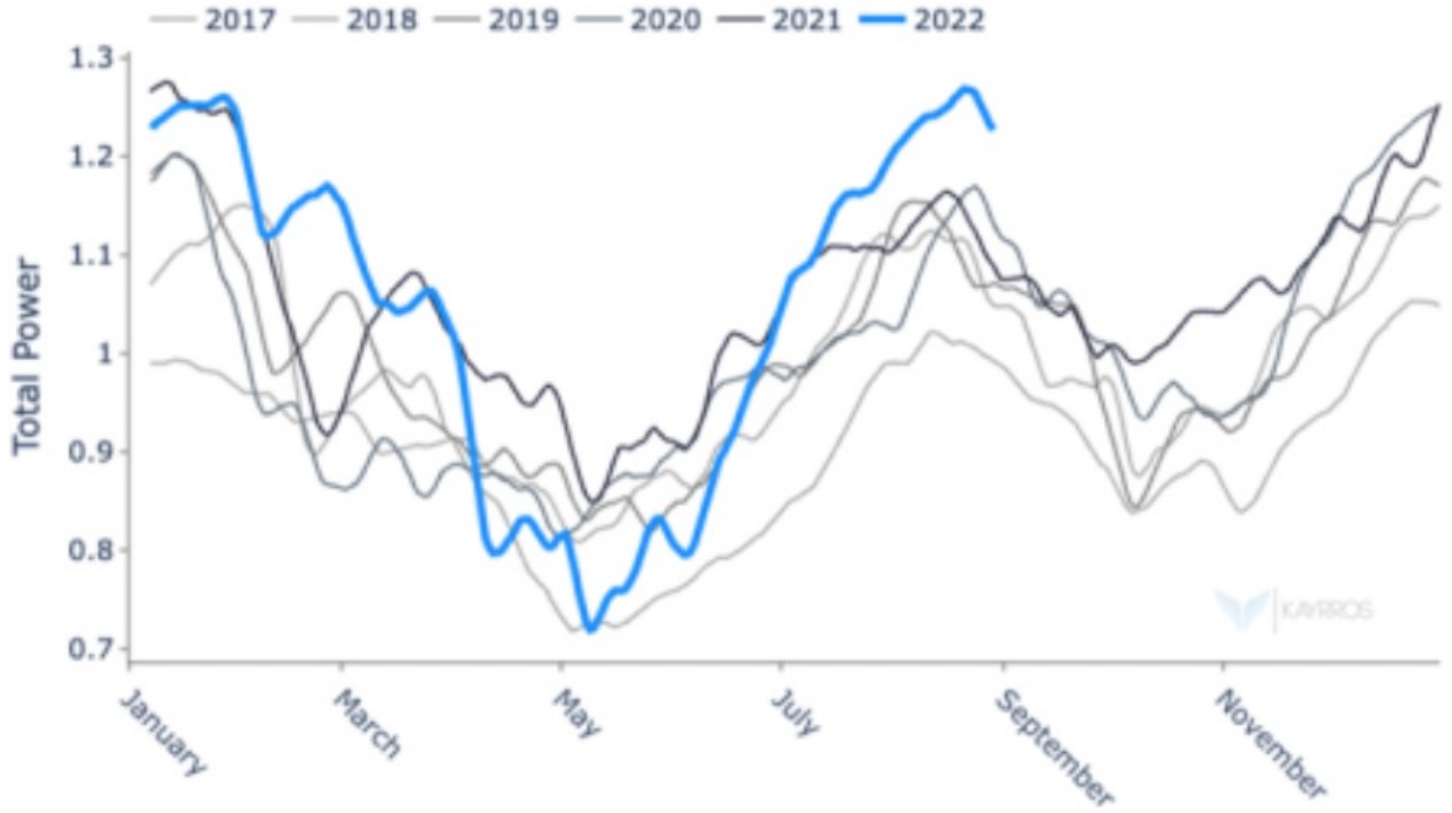
Çin 7 günlük kömürden elektrik üretimi

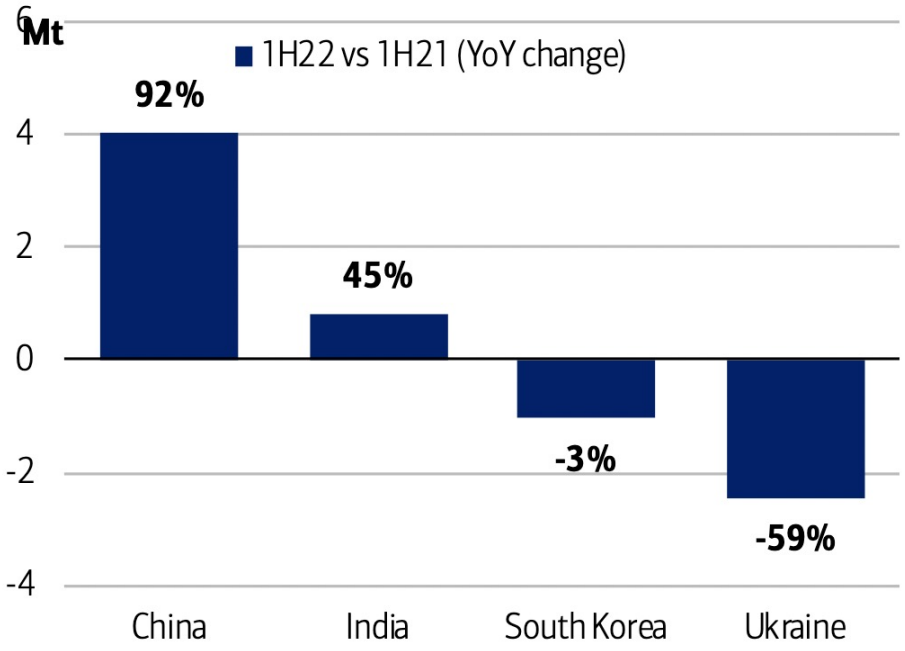
Figure 11: China 7-day rolling coal-fired power generation



Source: Kayrros

Rusya – met kömüt

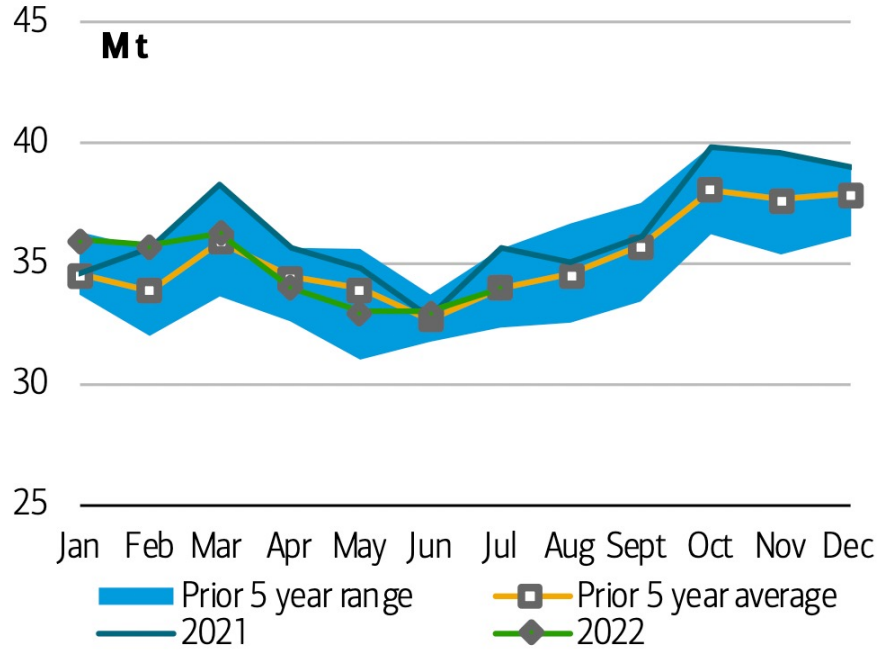
Exhibit 12: Russia met coal exports, by country destination
China and India welcomed the additional met coal units from Russia



Source: McCloskey, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 13: Russia coal production
Russian coal producers are starting to feel the pain from the EU embargo



Source: McCloskey, BofA Global Research

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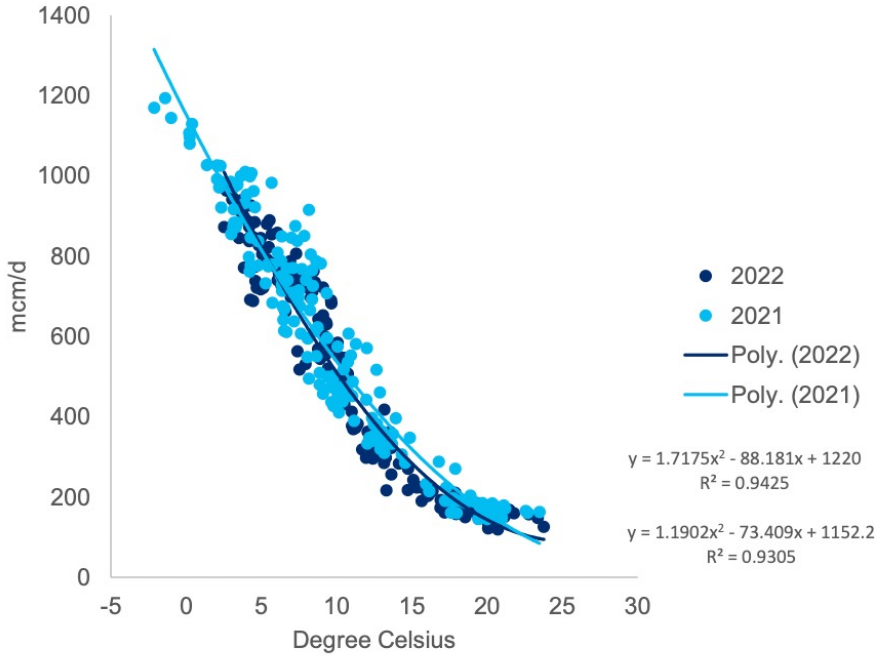
Karbon fiyatları

Gaz

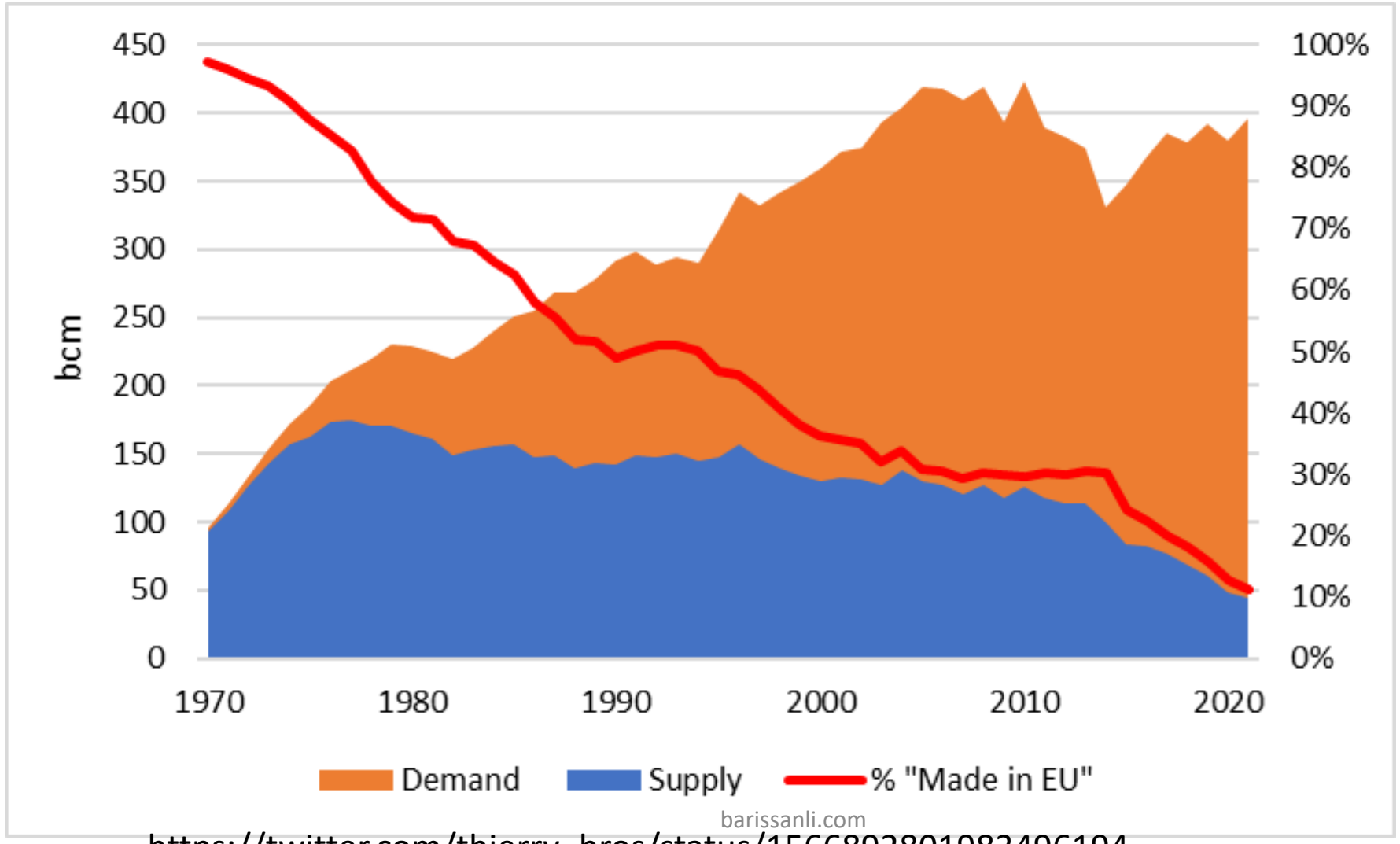
Hava sıcaklığı çok önemli

The buildings (residential/commercial) sector could save energy this winter by having consumers turning down their thermostats



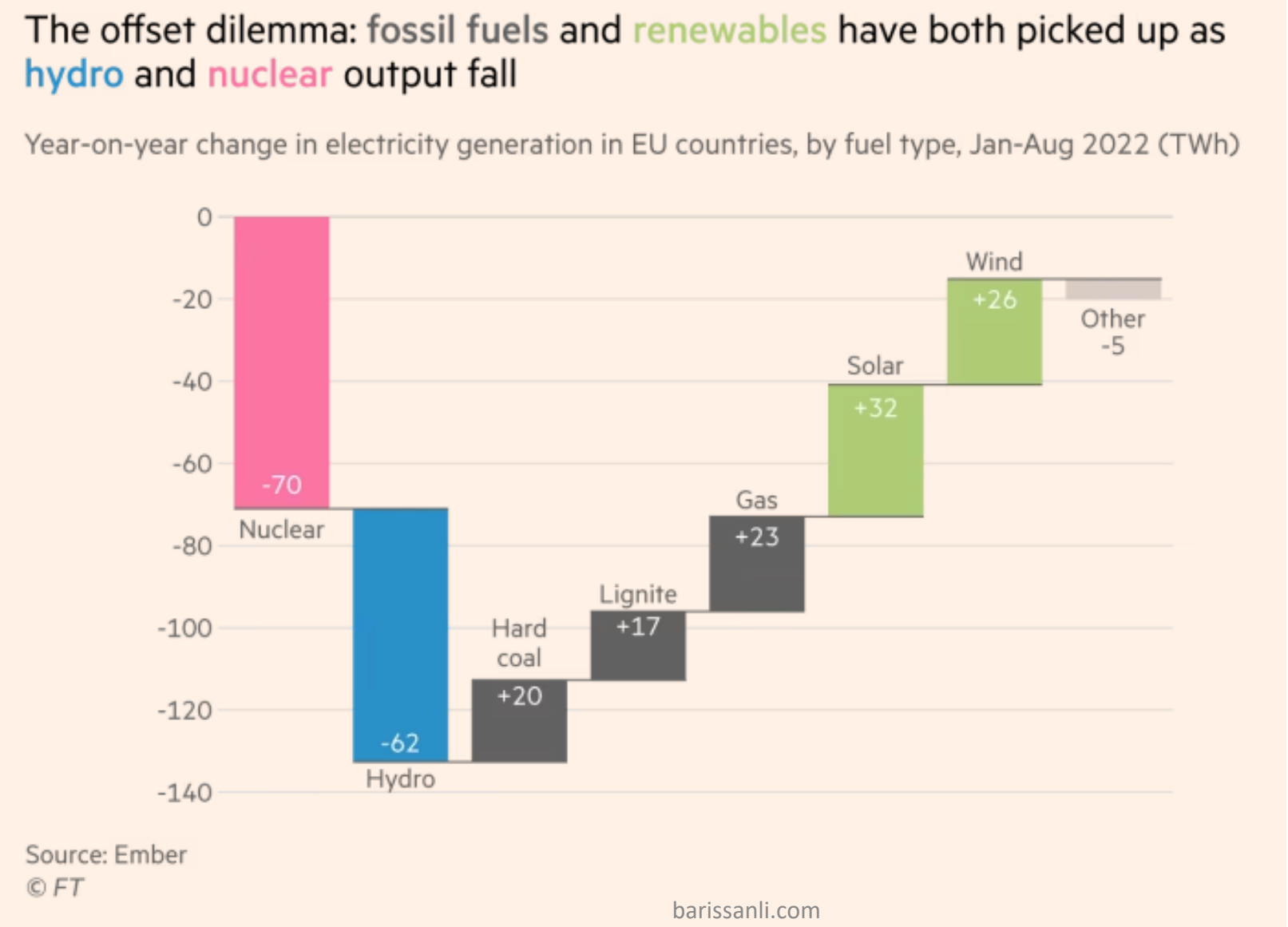
Source: Citi Research, Bloomberg

AB – arz/talep ve AB üretiminin oranı

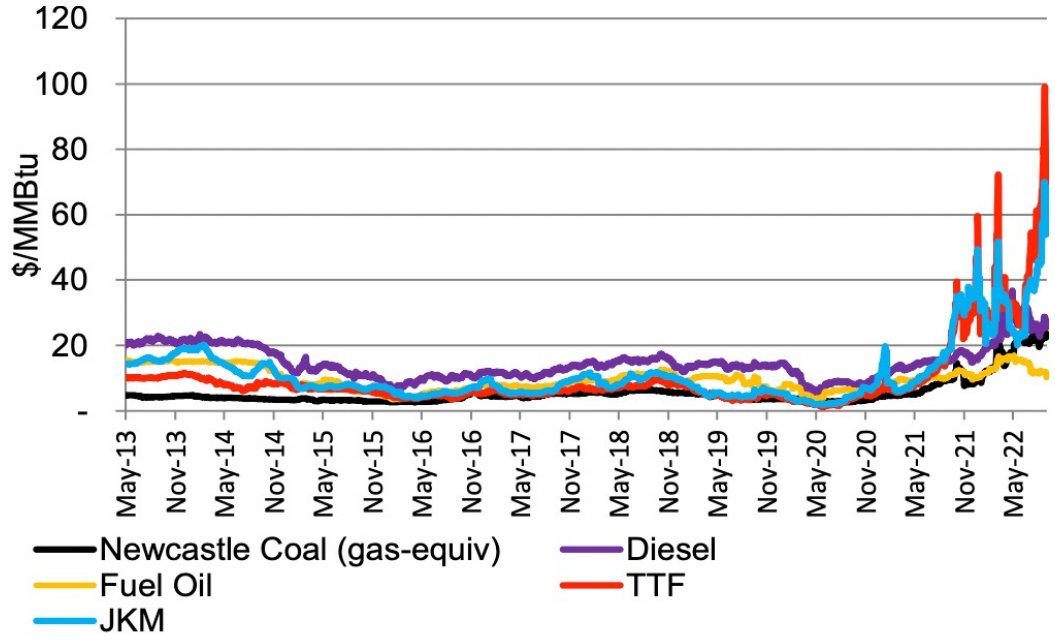


https://twitter.com/thierry_bros/status/1566892801983496194

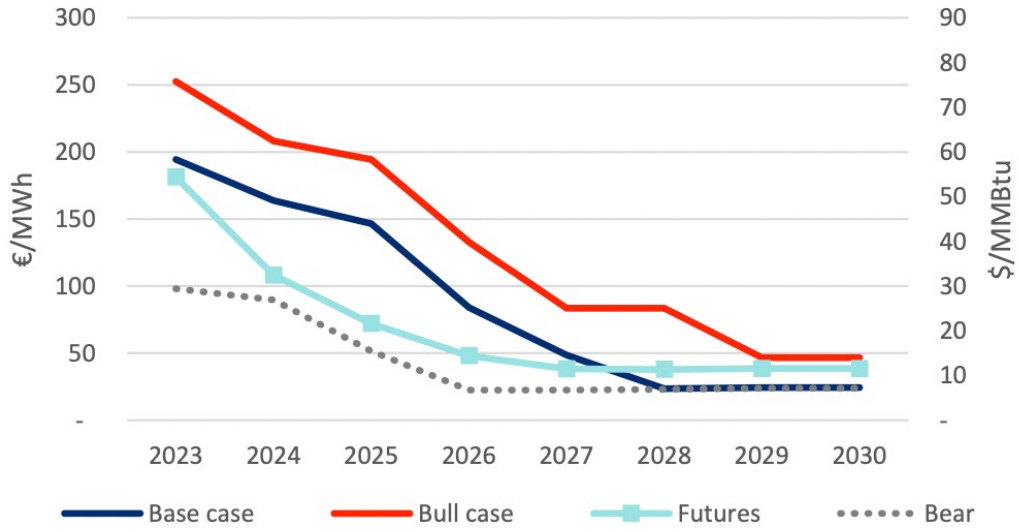
AB’de elektrik üretiminde son 1 yıldaki değişim



Doğalgaz fiyatları ve tahminleri



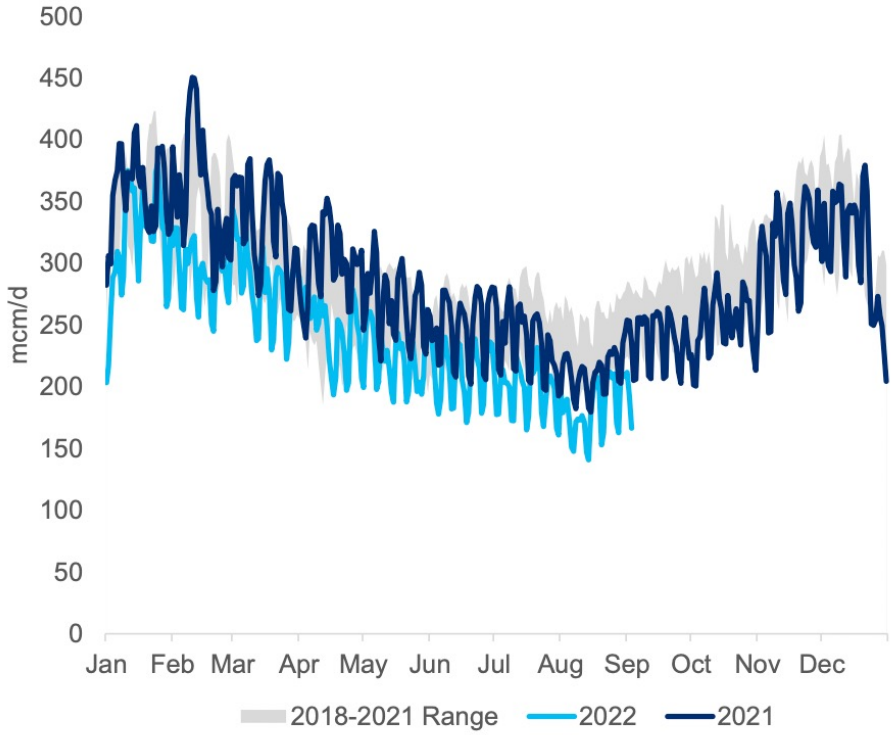
Source: Citi Research, Bloomberg



Source: Citi Research, Bloomberg

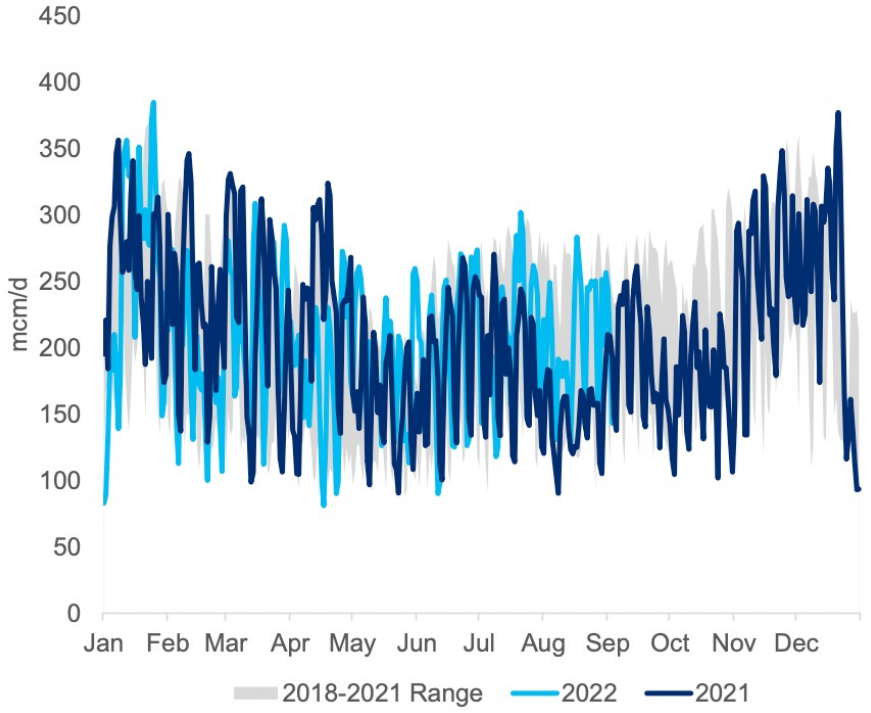
Avrupada sanayi talebi düştü ama elektrik?

European industrial natural gas demand has fallen y/y…



Source: Citi Research, Bloomberg

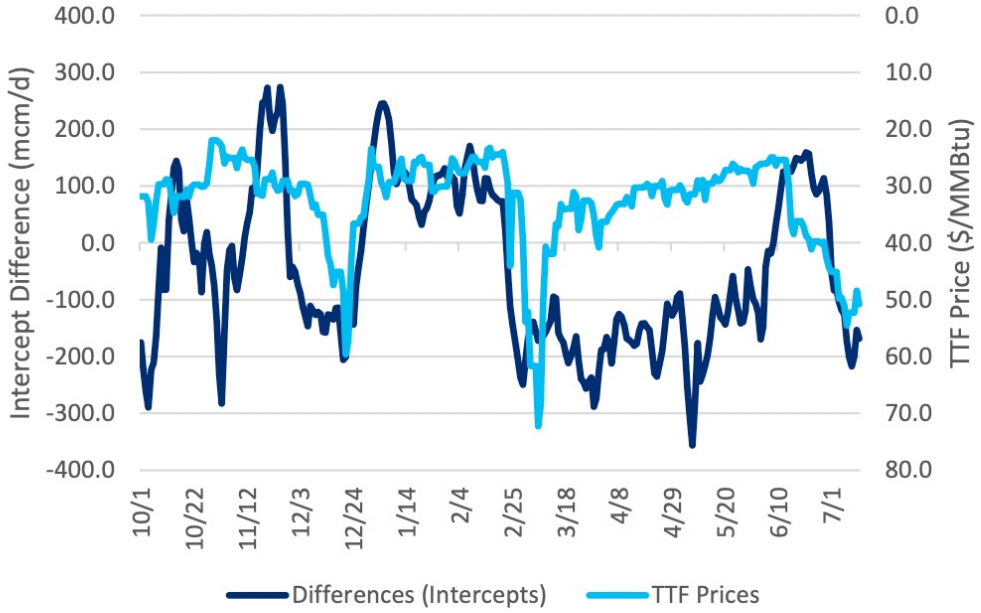
…But not natural gas demand for power generation, as Mother Nature has not been cooperative, with low hydro generation and water issues affecting nuclear generation



Source: Citi Research, Bloomberg

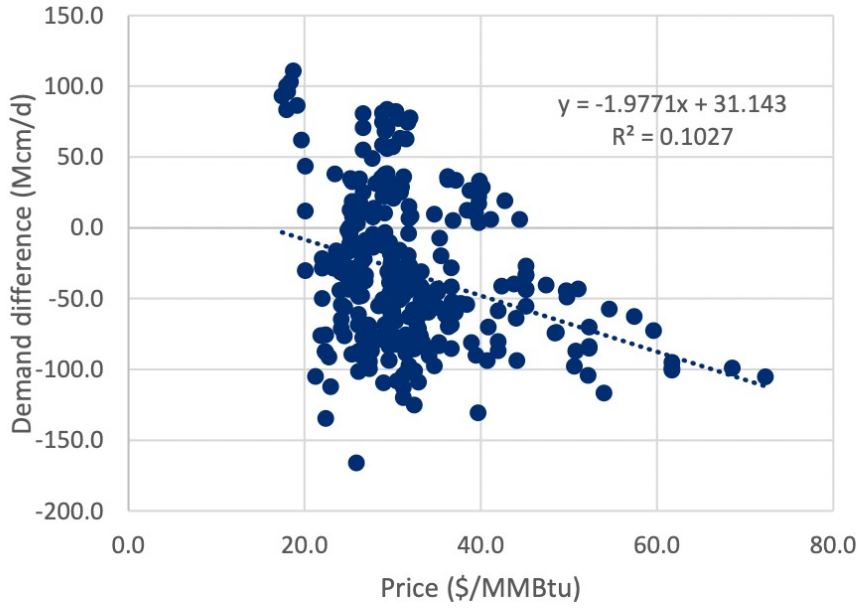
Talep zayıflığı ile fiyat düşer

Although over time there have been some correlations between the y/y weakness in European natural gas demand and higher TTF prices...



Source: Citi Research, Bloomberg

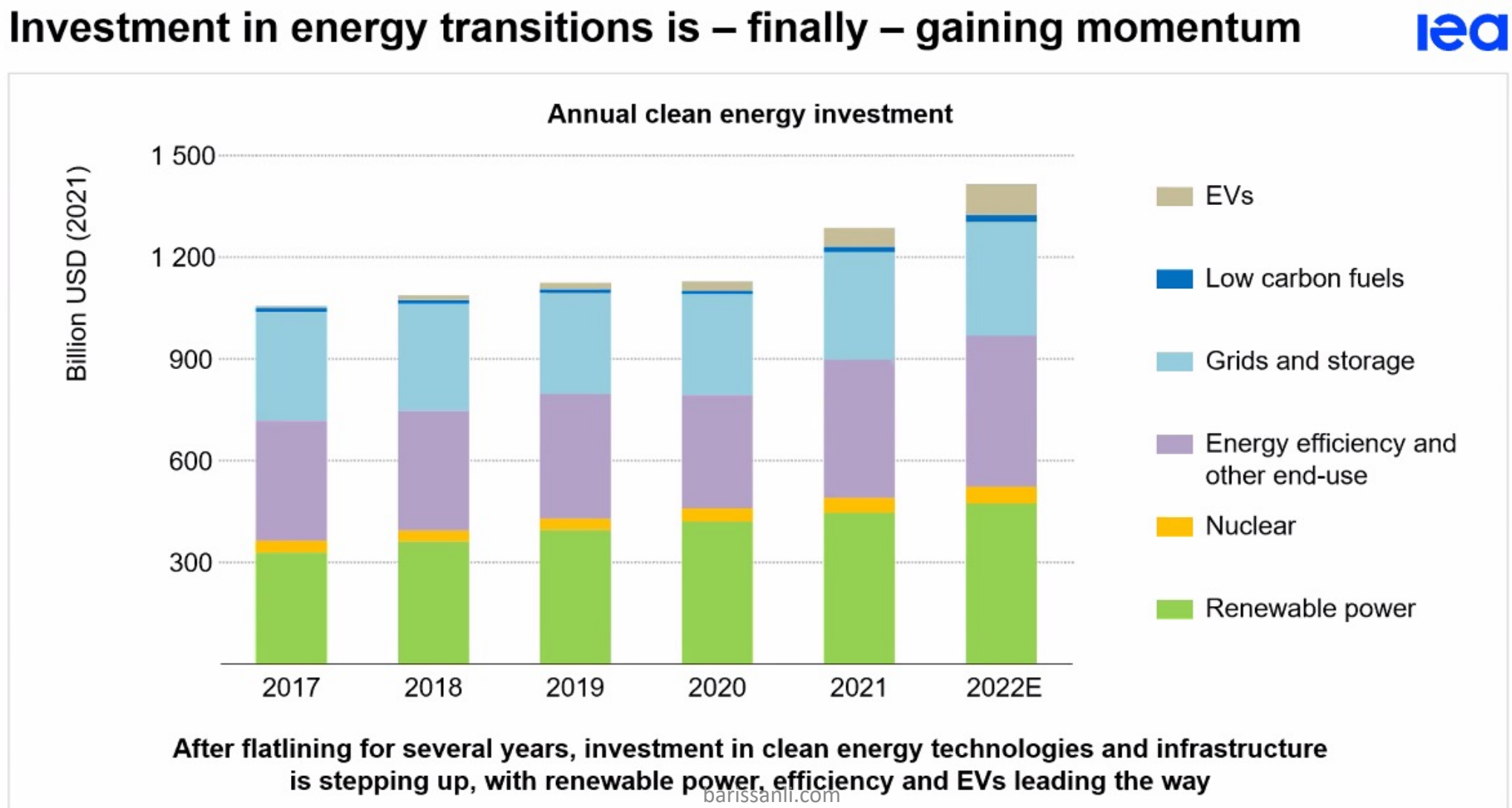
...Much of the demand curtailment might have to be borne by the industrial sector, so that prices would have to rise more to cut demand



Source: Citi Research, Bloomberg

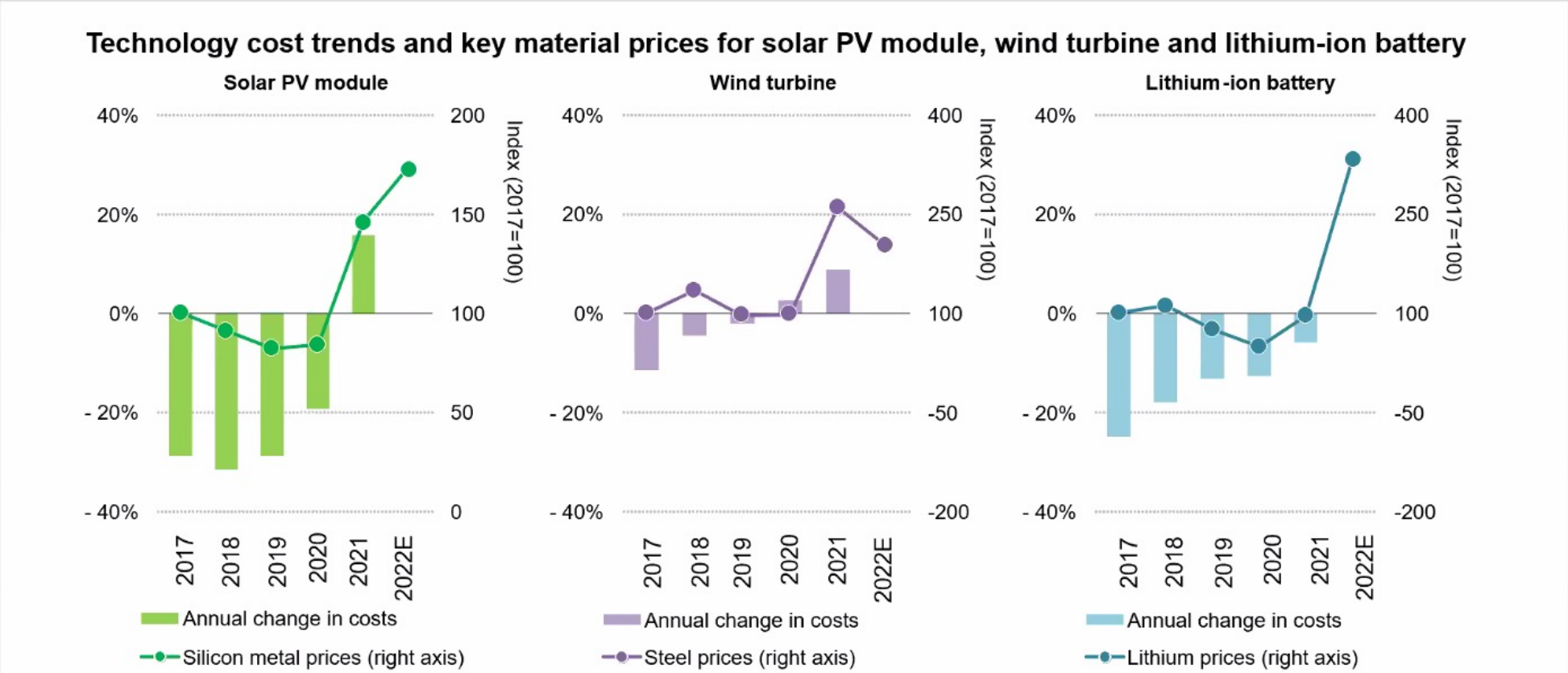
Temiz Enerji

Temiz enerji yatırımları



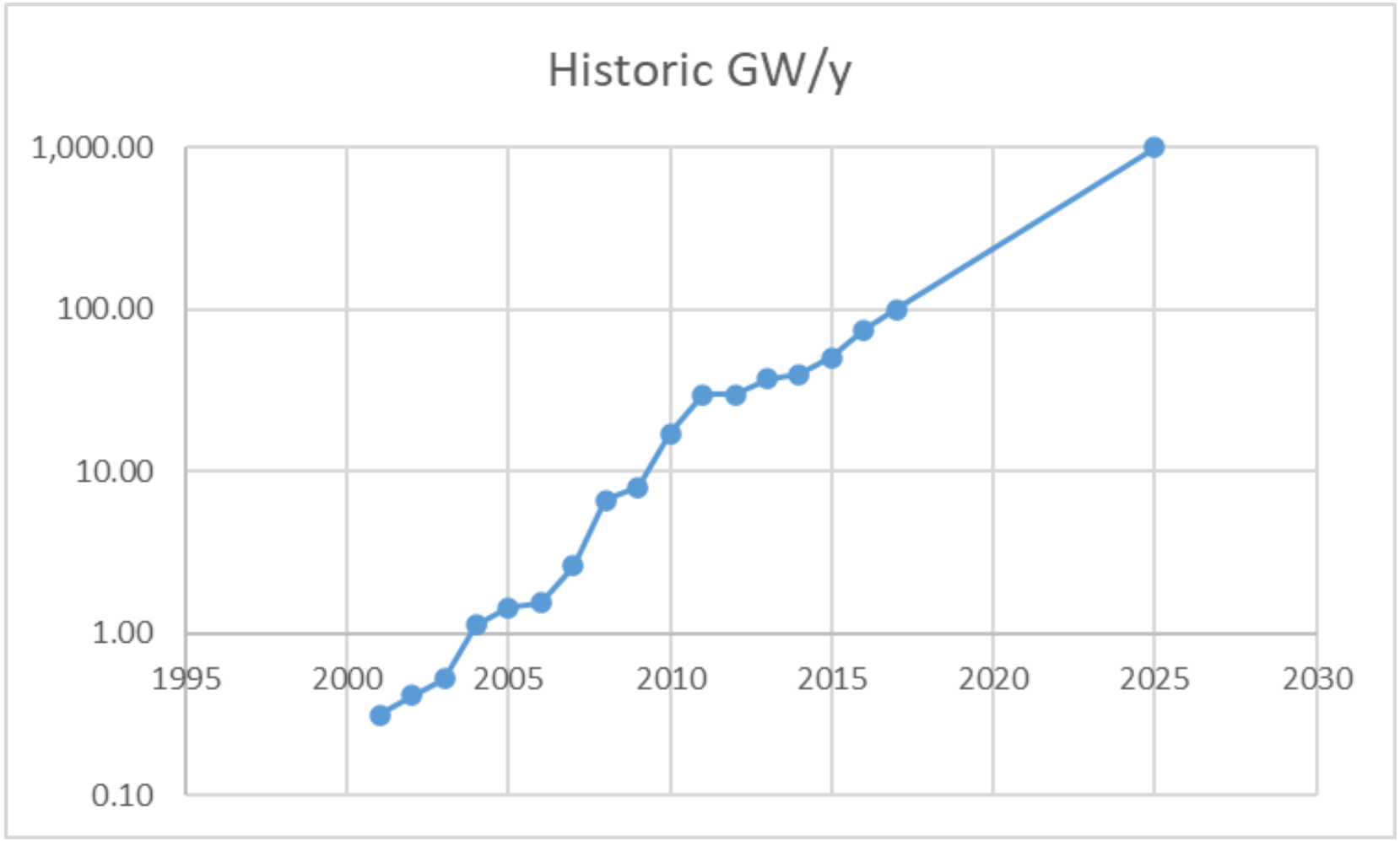
Temiz enerji maliyetleri

Investment in critical minerals is central to successful transitions



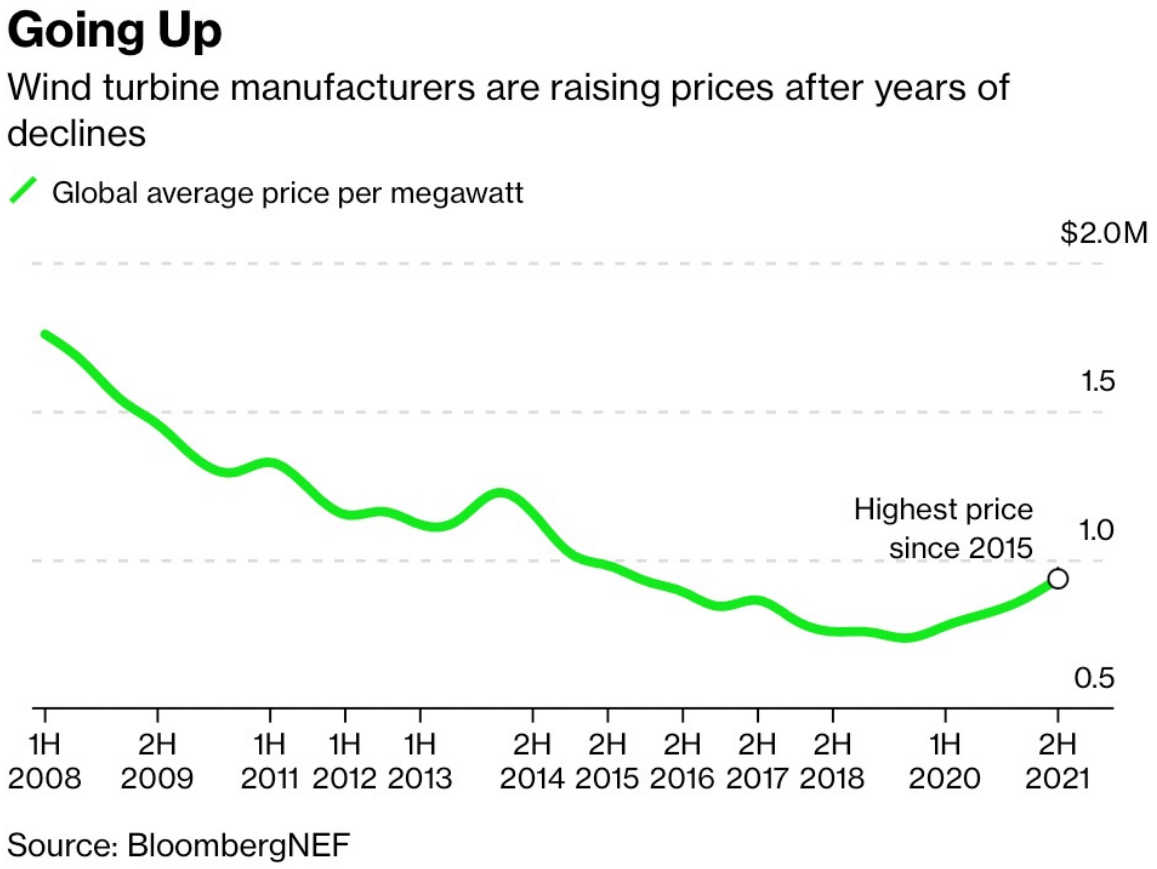
A surge in mineral prices has been a major factor in reversing the longstanding declines in the costs of clean energy, but upticks in investment offer hope for increased and more diversified supply in the years ahead

Güneş kurulu güç artışı

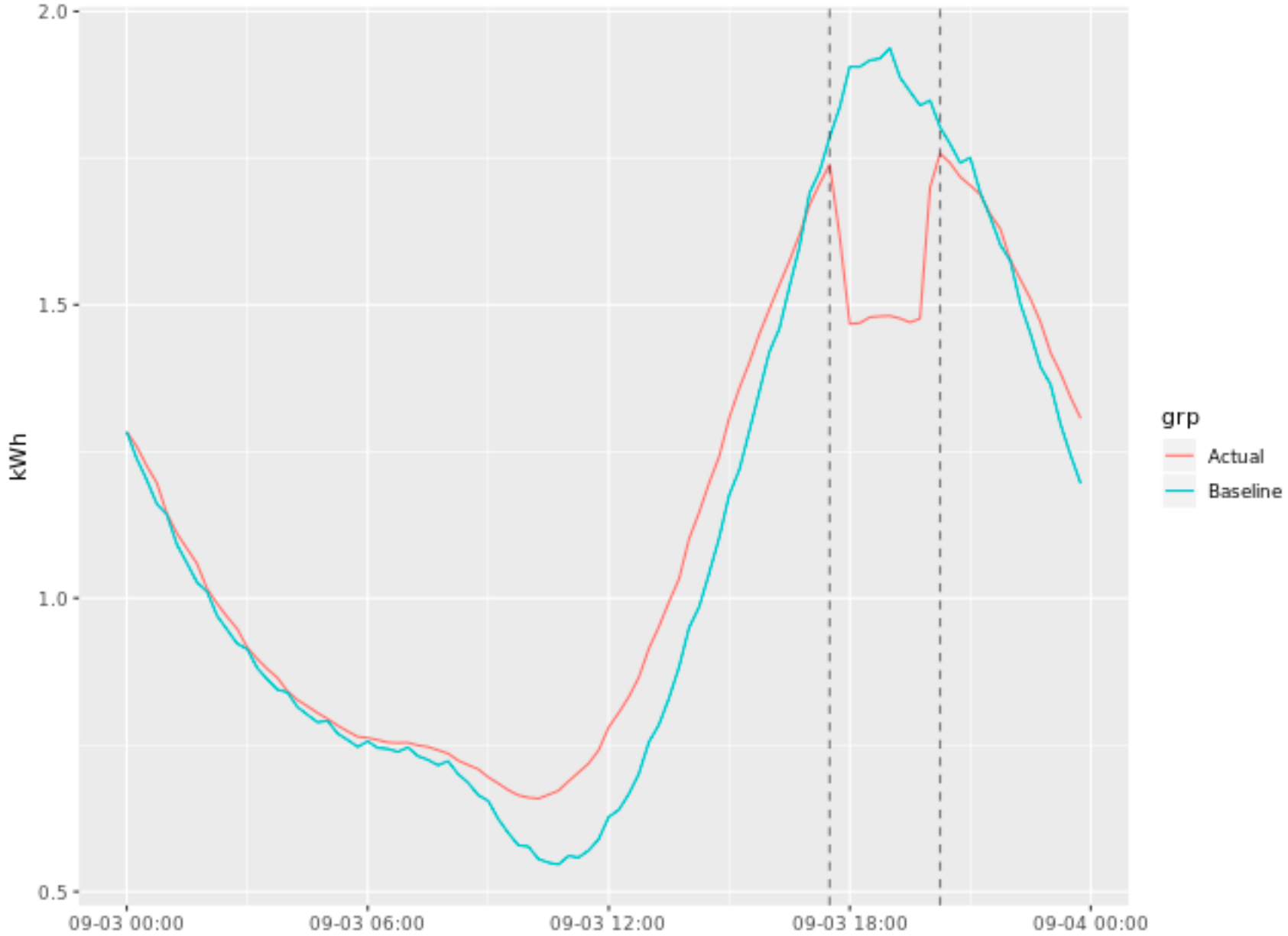


https://twitter.com/AukeHoekstra/status/1567423905962332161

Rüzgar sektörü



Talep yönetimi



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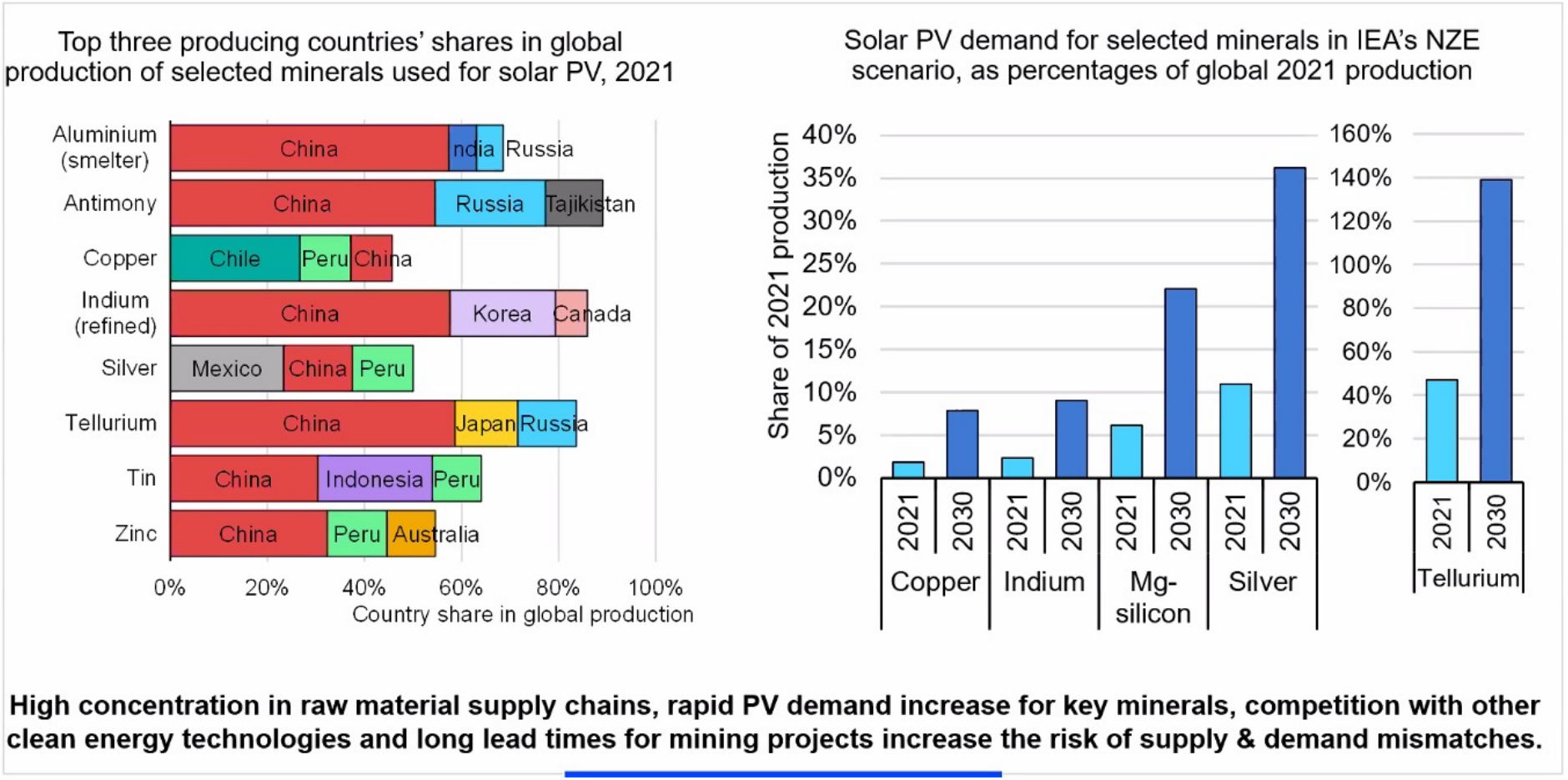
Güneşte hammadde

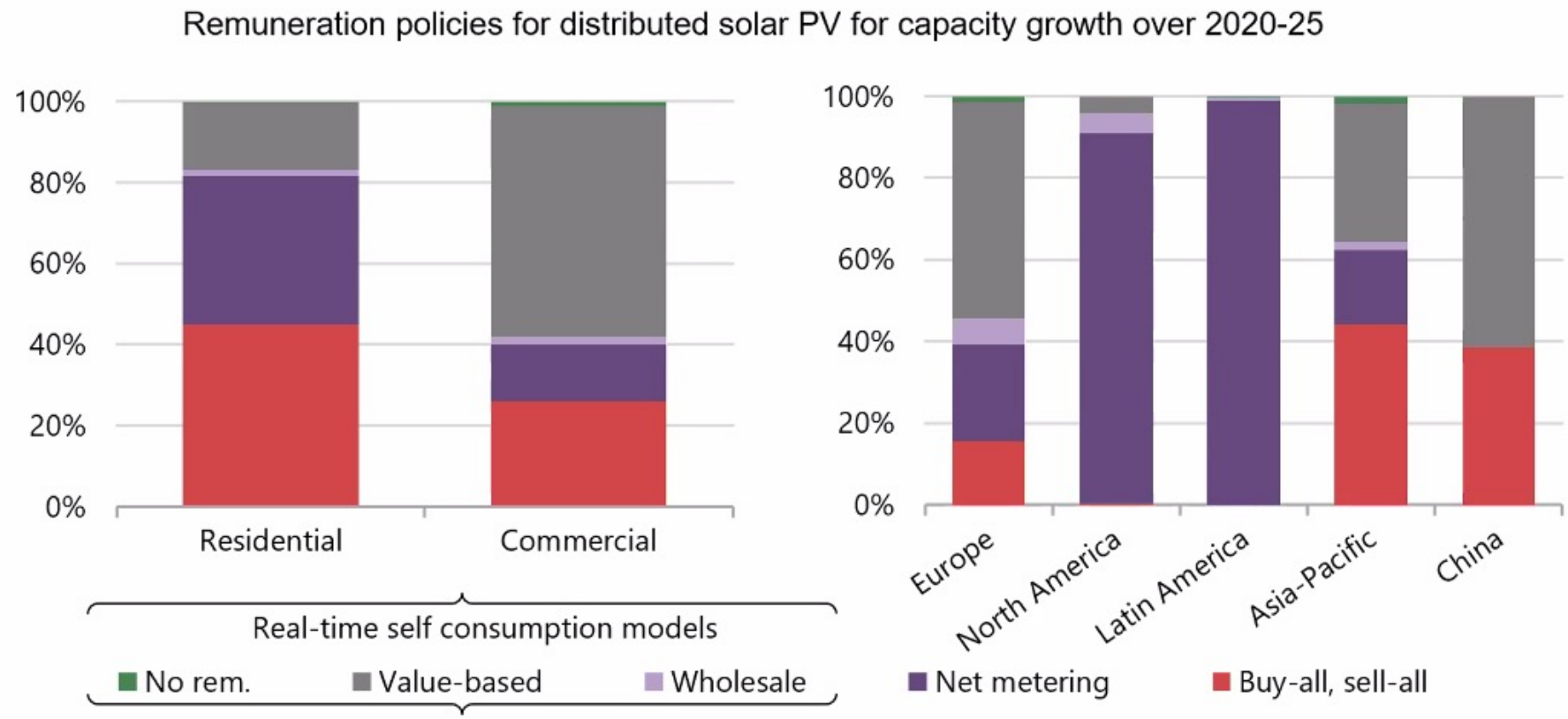
High concentration in raw material supply can exacerbate vulnerability



High concentration in raw material supply chains, rapid PV demand increase for key minerals, competition with other clean energy technologies and long lead times for mining projects increase the risk of supply & demand mismatches.

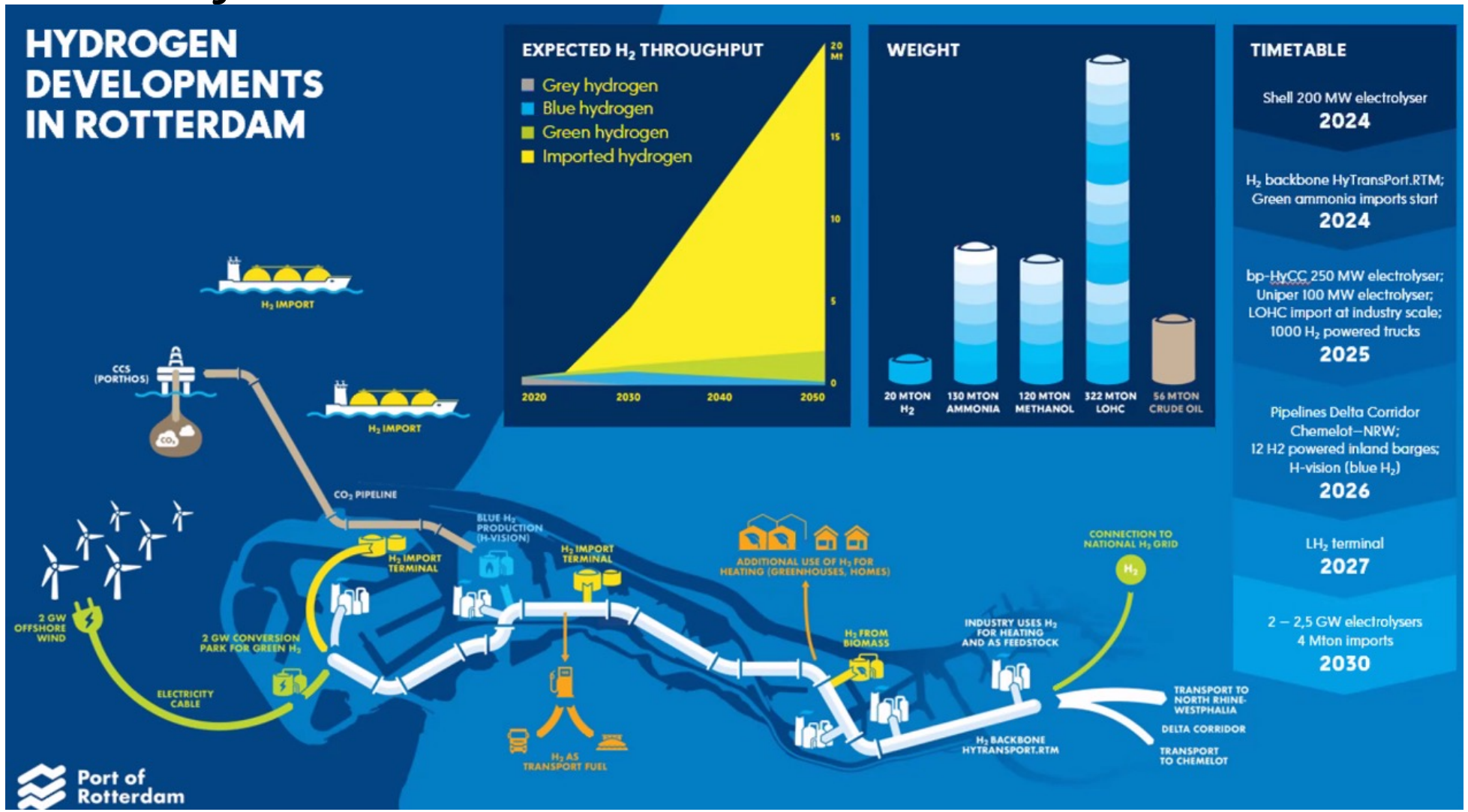
Dağıtık Güneş – Neye göre?

Distributed PV policies vary by application and country



Buy-all, sell-all and net metering models are expected to drive growth in the residential sector while real-time self-consumption models with value-based remuneration to dominate commercial applications

Hidrojen - Hollanda



Metaller - 1

Supply and demand balances

Exhibit 21: Aluminium supply and demand balance
Deficits set to increase

'000 tonnes	2020	2021	2022E	2023E	2024E
Global production	65820	67901	69563	71011	72482
YoY change	2.7%	3.2%	2.4%	2.1%	2.1%
Global consumption	63918	68744	68684	71199	74454
YoY change	-2.5%	7.6%	-0.1%	3.7%	4.6%
Balance	1902	-844	879	-187	-1972
Market inventories	9956	9142	10020	9833	7861
Weeks of world demand	8.1	6.9	7.6	7.2	5.5
LME Cash ($/t)	1704	2474	2721	3563	
LME Cash (c/lb)	77	112	123	162	

Source: SNL, Woodmac, CRU, Bloomberg, company reports, IAI, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 22: Copper supply and demand balance
Balanced market in 2022E

'000 tonnes	2020	2021	2022E	2023E	2024E
Global production	23159	24274	25054	26861	27535
YoY change	-0.1%	4.8%	3.2%	7.2%	2.5%
Global consumption	23439	24430	24915	25921	26958
YoY change	-0.9%	4.2%	2.0%	4.0%	4.0%
Balance	-280	-156	139	940	577
Market inventories	1408	1164	1303	2243	2820
Weeks of world demand	3.1	2.5	2.7	4.5	5.4
LME Cash ($/t)	6175	9321	8751	7250	
LME Cash (c/lb)	280	423	397	329	

Source: SNL, Woodmac, CRU, Bloomberg, company reports, ICSG, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 23: Lead supply and demand balance
Lead should not be in short supply

'000 tonnes	2020	2021	2022E	2023E	2024E
Global production	12677	13160	14054	14586	14527
YoY change	-3.9%	3.8%	6.8%	3.8%	-0.4%
Global consumption	12568	13127	13343	13631	13999
YoY change	-2.7%	4.5%	1.6%	2.2%	2.7%
Balance	110	33	710	955	528
Market inventories	851	884	1595	2549	3077
Weeks of world demand	3.5	3.5	6.2	9.7	11.4
LME Cash ($/t)	1824	2200	2029	1887	
LME Cash (c/lb)	83	100	92	86	

Source: SNL, Woodmac, CRU, Bloomberg, company reports, ILZSG, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 24: Nickel supply and demand balance
Class 1 nickel may remain tight

'000 tonnes	2020	2021	2022E	2023E	2024E
Global production	2580	2788	3165	3553	3841
YoY change	6.7%	8.1%	13.5%	12.3%	8.1%
Global consumption	2336	2704	2886	3194	3701
YoY change	0.9%	15.7%	6.7%	10.7%	15.9%
Balance, incl. NPI oversupply	244	84	279	359	140
Balance, excl. NPI oversupply	52	-29	-13	120	18
Market inventories	377	392	379	212	
Weeks of world demand	8.4	7.5	6.8	3.4	
LME price ($/t)	13783	18455	24439	18750	
LME price (c/lb)	625	837	1109	851	

Source: SNL, Woodmac, CRU, Bloomberg, company reports, INSG, BofA Global Research

BofA GLOBAL RESEARCH

Metaller - 2

Exhibit 25: Zinc supply and demand balance
Project pipeline not a significant risk

'000 tonnes	2020	2021	2022E	2023E	2024E
Global production	13754	14400	14300	14500	14600
YoY change	2.9%	4.7%	-0.7%	1.4%	0.7%
Global consumption	13194	14034	14327	14693	14875
YoY change	-4.3%	6.4%	2.1%	2.6%	1.2%
Balance	561	366	-27	-193	-275
Market inventories	758	1124	1098	904	629
Weeks of world demand	3.0	4.2	4.0	3.2	2.2
LME Cash ($/t)	2265	3003	3348	2625	
LME Cash (c/lb)	103	136	152	119	

Source: SNL, Woodmac, CRU, Bloomberg, company reports, ILZSG, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 26: Iron ore supply and demand balance
Flipping back into surplus

Wet Mt	2020	2021	2022E	2023E	2024E
Global production	2,242	2,264	2,264	2,325	2,438
YoY change	1.6%	0.9%	0.0%	2.7%	4.8%
Global consumption	2,314	2,301	2,257	2,286	2,305
YoY change	1.0%	-0.5%	-1.9%	1.3%	0.8%
Balance	-71	-38	7	39	133
Iron ore price (US$/t)	109	160	127	95	79

Source: company reports, CRU, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 27: Platinum supply and demand balance
Substitution, a rebound of auto and hydrogen are all bullish

'000 ounces	2020	2021	2022	2023	2024
Global production	6432	8301	8325	8515	8673
YoY change	-18.3%	29.1%	0.3%	2.3%	1.9%
Global consumption	7123	8010	8443	8912	9201
YoY change	-12.9%	12.5%	5.4%	5.6%	3.2%
Balance	-691	291	-118	-398	-528
Spot ($/oz)	886	1093	1185	1500	1465

Source: Matthey, company reports, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 28: Palladium supply and demand balance
Palladium will likely be oversupplied in the medium term

'000 ounces	2020	2021	2022E	2023E	2024E
Global production	9,121	10,422	10,706	11,192	11,596
YoY change	-7.5%	14.3%	2.7%	4.5%	3.6%
Global consumption	9,886	9,943	9,955	9,382	9,257
YoY change	-13.0%	0.6%	0.1%	-5.8%	-1.3%
Balance	-765	479	751	1,809	2,339
Spot ($/oz)	2,201	2,399	1,943	1,740	1,632

Source: Matthey, company reports, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 29: Cobalt supply and demand balance
Better supplied in 2022/23E

tonnes	2020	2021	2022E	2023E	2024E
Global production	139,221	160,200	196,024	248,643	272,012
YoY change	2.9%	15.1%	22.4%	26.8%	9.4%
Global consumption	134,158	169,279	194,478	238,407	286,106
YoY change	1.9%	26.2%	14.9%	22.6%	20.0%
Balance	5,063	-9,080	1,547	10,237	-14,095
Spot ($/lb)	15.2	23.4	33.6	27.5	

Source: company reports, CRU, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 30: Lithium supply and demand balance
Supply discipline needed in 2022/23E

	2020	2021	2022E	2023E	2024E
Global production	444,752	536,978	682,186	907,348	1,130,838
YoY change	15%	21%	27%	33%	25%
Global consumption	333,285	550,674	699,268	866,651	1,130,257
YoY change	9%	65%	27%	24%	30%
Balance	111,467	-13,696	-17,082	40,696	581
Spot ($/lb)	8067	19169	69738	48125	17933

Source: company reports, CRU, BofA Global Research

BofA GLOBAL RESEARCH

BoA – Metal fiyat tahminleri

		Current	3Q22E	4Q22E	1Q23E	2Q23E	3Q23E	4Q23E	2021E	2022E	2023E	2024E	2025E	2026E	LT price
Base metals															
Aluminium	US$/t	2,298	2,250	2,500	2,750	3,250	3,750	4,500	2,474	2,721	3,563	4,375	3,668	2,961	2,254
	USc/lb	104	102	113	125	147	170	204	112	123	162	198	166	134	102
Copper	US$/t	7,691	8,000	7,500	6,500	7,000	7,500	8,000	9,321	8,751	7,250	8,875	8,554	8,233	7,912
	USc/lb	349	363	340	295	318	340	363	423	397	329	403	388	373	359
Lead	US$/t	1,885	1,850	1,750	1,750	1,750	1,750	2,297	2,200	2,029	1,887	2,348	2,402	2,456	2,510
	USc/lb	86	84	79	79	79	79	104	100	92	86	106	109	111	114
Nickel	US$/t	20,476	22,500	20,000	17,500	17,500	20,000	20,000	18,455	24,439	18,750	25,000	21,826	18,653	15,479
	USc/lb	929	1,021	907	794	794	907	907	837	1,109	851	1,134	990	846	702
NPI, 8-12%	CNY/t		1,200	1,100	1,000	1,000	1,000	1,000	1,258	1,337	1,000	1,032	1,062	1,093	1,123
Zinc	US$/t	3,173	3,000	2,750	2,500	2,500	2,750	2,750	3,003	3,348	2,625	3,000	2,901	2,802	2,703
	USc/lb	144	136	125	113	113	125	125	136	152	119	136	132	127	123
Precious metals															
Gold, nominal	US$/oz	1,712	1,900	2,100	2,150	2,250	2,000	2,000	1,799	1,938	2,100	1,945	1,958	1,969	1,980
Gold, real	US$/oz		1,900	2,100	2,098	2,195	1,951	1,951	1,799	1,938	2,049	1,852	1,818	1,784	1,750
Silver, nominal	US$/oz	18.04	20.00	17.50	17.50	17.50	20.00	25.00	25.15	21.04	20.00	30.96	30.13	29.24	28.29
Silver, real	US$/oz		20.00	17.50	17.07	17.07	19.51	24.39	25.15	21.04	19.51	29.47	27.98	26.49	25.00
Platinum	US$/oz	839	1,250	1,500	1,500	1,500	1,500	1,500	1,093	1,185	1,500	1,465	1,453	1,442	1,430
Palladium	US$/oz	2,024	1,850	1,500	1,500	1,750	2,000	1,710	2,399	1,943	1,740	1,632	1,564	1,497	1,430

		Current	3Q22E	4Q22E	1Q23E	2Q23E	3Q23E	4Q23E	2021E	2022E	2023E	2024E	2025E	2026E	LT price
Bulk Commodities															
Hard coking coal	US$/t fob	273.5	350.0	300.0	300.0	300.0	250.0	250.0	218.1	410.9	275.0	249.3	217.7	186.1	154.5
Semi-soft	US$/t fob	195.0	235.6	201.9	201.9	201.9	168.3	168.3	151.3	281.1	185.1	167.8	146.5	125.3	104.0
Thermal Coal	US$/t fob	218.9	350.0	375.0	300.0	300.0	300.0	300.0	133.2	334.1	300.0	260.0	190.0	140.0	83.2
Iron ore fines	US$/t CIF	95.0	120.0	110.0	100.0	100.0	90.0	90.0	159.9	127.4	95.0	78.8	81.5	84.3	87.0
Other materials															
Lithium spodumene	US$/t	4,875	3,500	3,000	3,000	2,746	2,138	1,888	898	3,453	2,443	813	775	738	
Lithium carbonate	US$/t	70,700	70,000	70,000	60,000	43,999	44,250	44,250	19,169	69,738	48,125	17,933	16,122	14,311	
Lithium hydroxide	US$/t	69,025	70,000	64,050	54,050	42,733	45,800	45,800	18,315	66,983	47,096	19,624	17,750	15,875	
Alumina	$/t	328	323	323	331	331	331	331	329	360	331	340	348	357	366
Uranium	$/lb		65.00	67.50	70.00	67.50	65.00	65.00	36.29	58.18	66.88	60.00	56.67	53.33	50.00
Molybdenum	$/lb	16.48	18.37	18.37	19.10	19.10	19.10	19.10	15.89	18.55	19.10	19.10	16.50	13.91	11.31
Cobalt	$/lb	26.40	32.00	32.00	30.00	30.00	25.00	25.00	23.37	33.65	27.50		27.62	23.23	18.85
Manganese ore	$/dmtu	4.95	5.60	5.60	5.38	5.38	5.38	5.38	5.23	6.21	5.38	5.52	5.65	5.80	5.94

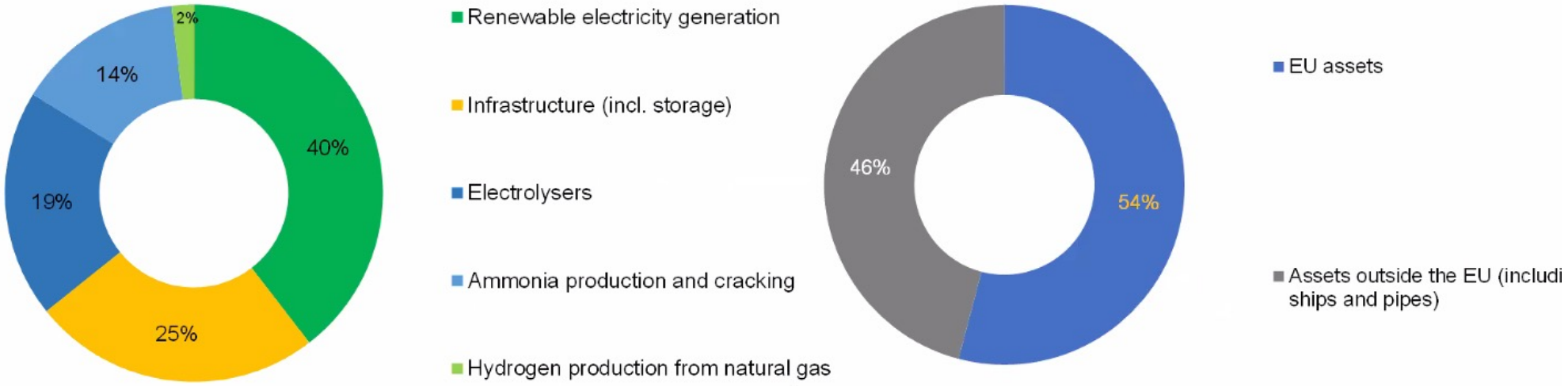
Hidrojen

Hidroien – Yatırım İhtivacı

IEA analysis: possible investment needed for +5 Mt H2 in EU and +10 Mt imported

IRENA
International Renewable Energy Agenc

Cost shares of a EUR 500 billion investment plan to secure 20 Mt H2 for the EU from local and imported supplies



Infrastructure 25% of investment needs, over half in EU.

Hidrojen altyapısı

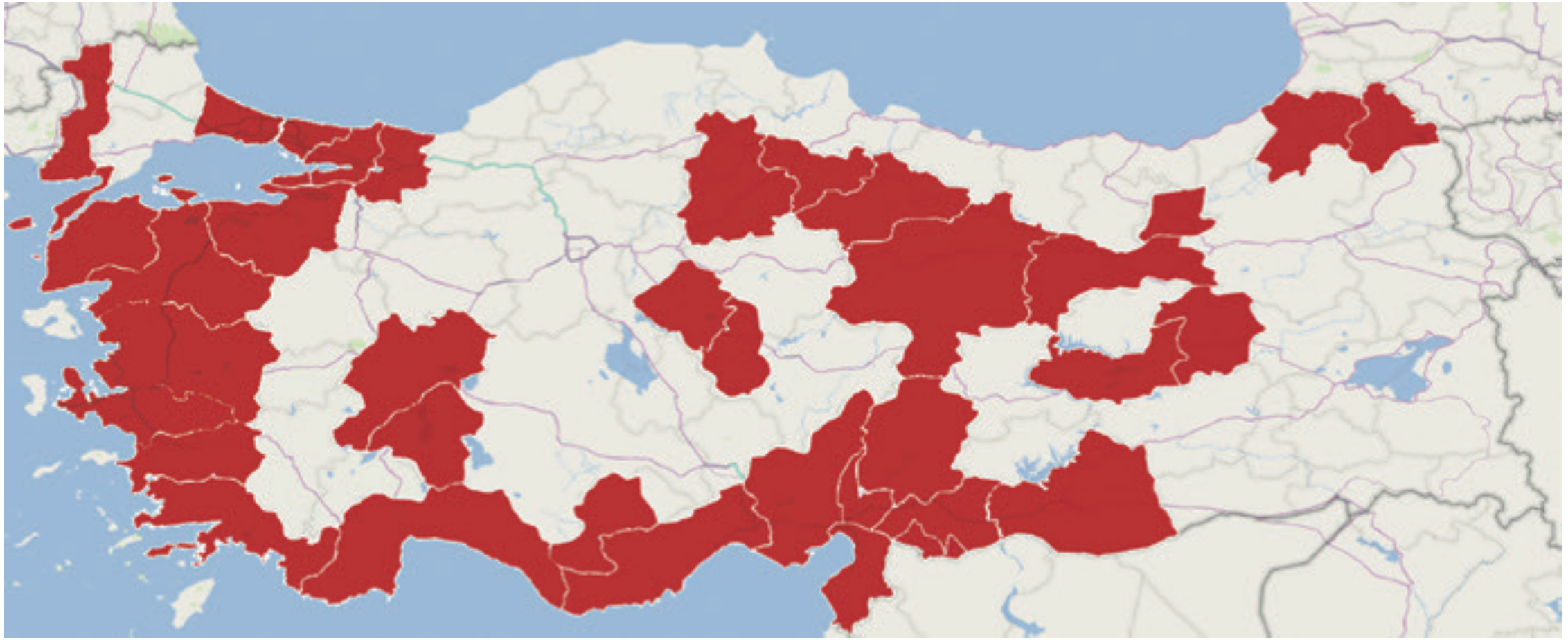
Hidrojen

Natural gas pipeline routes Shipping routes

Regions	1	2	3	4	5	6
Port Availability	+++	++	+++	+	+++	-
Industry (Refineries)	+++	-	+++	--	++	---
Renewable proximity	++	+++	+++	+++	-	+++
Water resources	+	++	+	++	-	+++
Demand centers	++	+	+++	+	+++	---
Infrastructure	++	-	+++	++	+++	+
Marine Safety	Med	Med	Med	Med	B.Sea	B.Sea

https://shura.org.tr/wp-content/uploads/2022/01/rapor_ENG-.pdf

Su kıtlığı

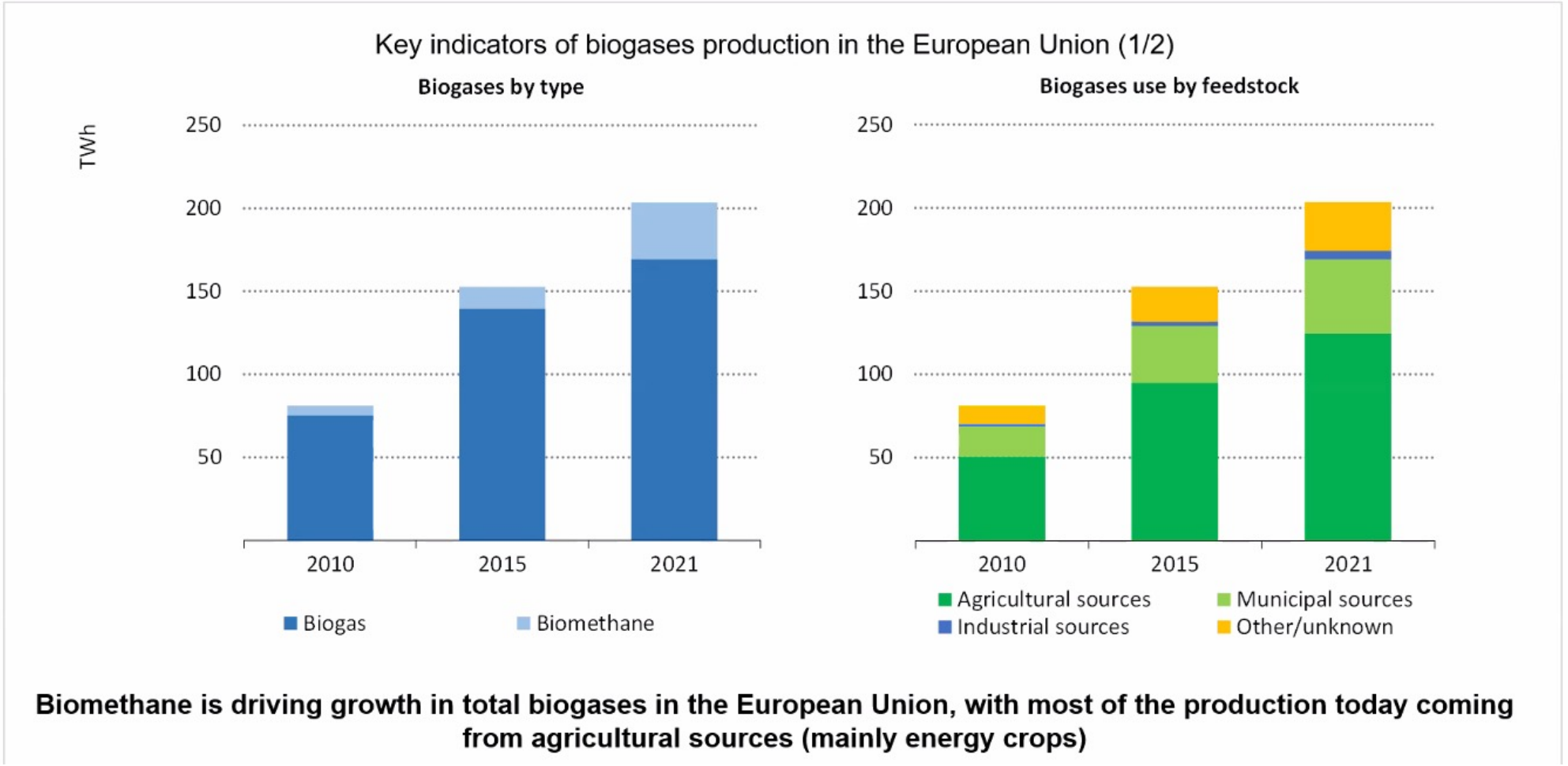


https://shura.org.tr/wp-content/uploads/2022/01/rapor_ENG-.pdf

Biyometan

Biyometan

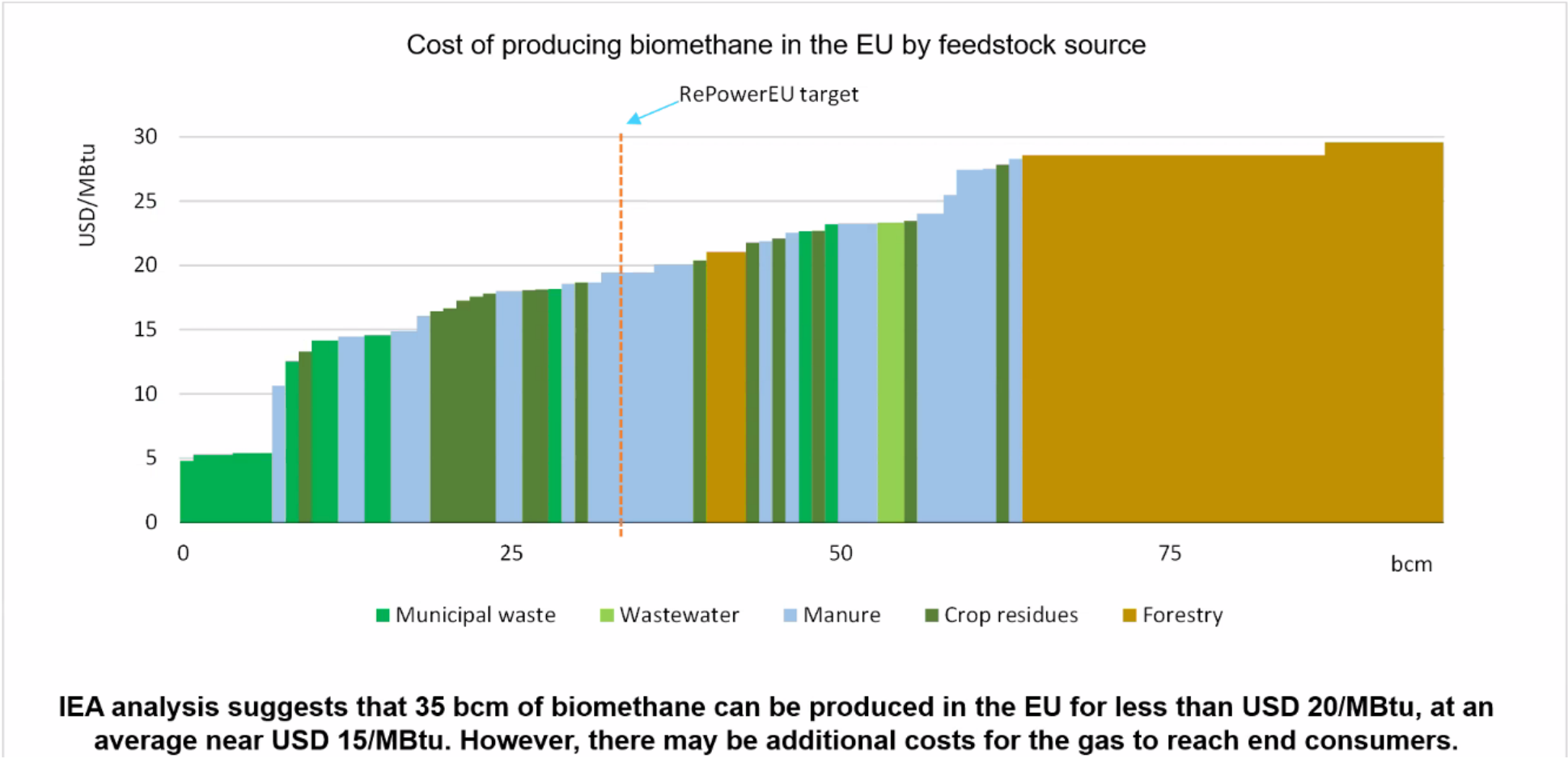
Biogases have seen strong growth in Europe in the past few years



Biomethane is driving growth in total biogases in the European Union, with most of the production today coming from agricultural sources (mainly energy crops)

Biyometan arz eğrisi

The estimated costs of developing biogases in Europe vary widely



IEA analysis suggests that 35 bcm of biomethane can be produced in the EU for less than USD 20/MBtu, at an average near USD 15/MBtu. However, there may be additional costs for the gas to reach end consumers.

Biyometan - AB

Combined biogas and biomethane production in Europe

Europe produces today (2020)

- 15 bcm of biogas
- 3 bcm of biomethane

Upgrading biogas to biomethane can highly contribute to the **REPowerEU target** (35 bcm biomethane production by 2030).

This is close to the entire natural gas consumption of Belgium and represents 4.6% of the EU gas consumption.

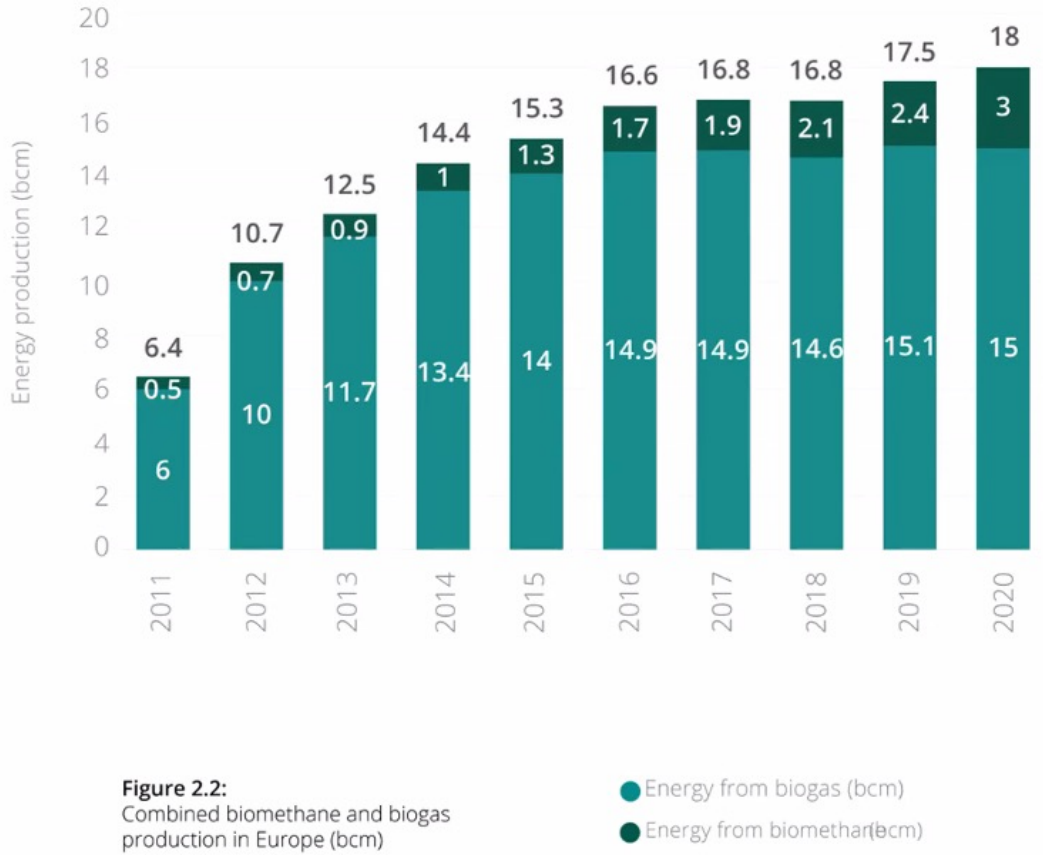


Figure 2.2:
Combined biomethane and biogas production in Europe (bcm)

Biyometan – AB hedefleri

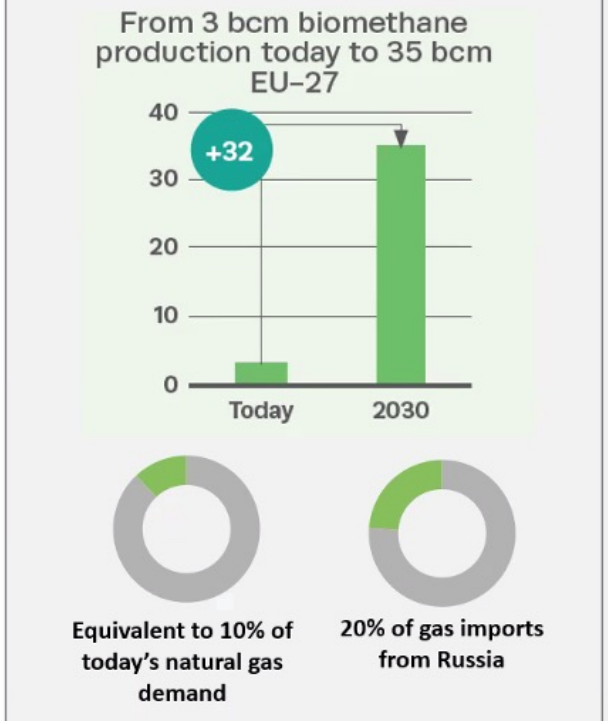
REPowerEU with biogas and biomethane

FOCUS ON BIOMETHANE:
- Biomethane Action Plan including:
  - Industrial Biomethane Alliance
  - Specific target for biomethane deployment: 35 bcm by 2030

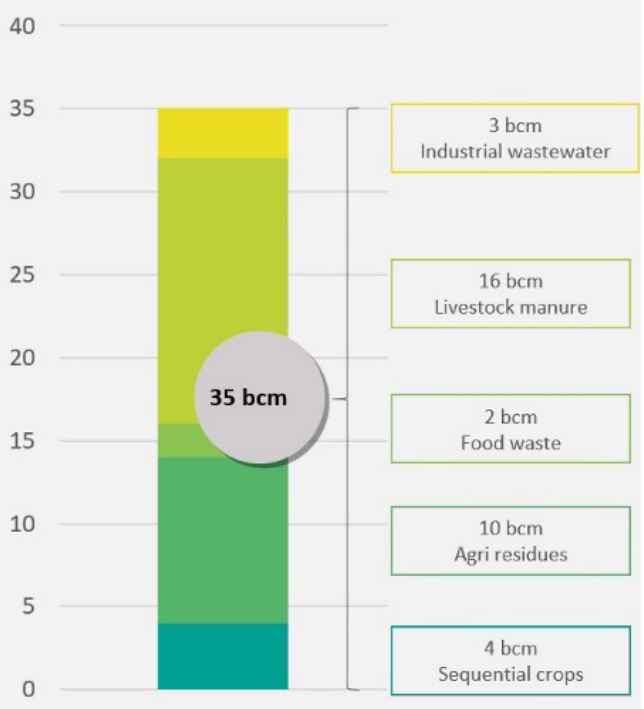
OBJECTIVE: measures facilitating the increase in production of biogas and boost its subsequent conversion into biomethane, respecting criteria agreed in the REDII.

ACTIONS:
1. Promote **sustainable production and use of biogas and biomethane** and the injection of biomethane into the gas grid
2. Provide **incentives** for biogas upgrading into biomethane
3. Address **R&D&I gaps**
4. Access to **finance**

The potential is strong enough to deliver 35 bcm in 2030



This scale-up can be done using only sustainable feedstocks

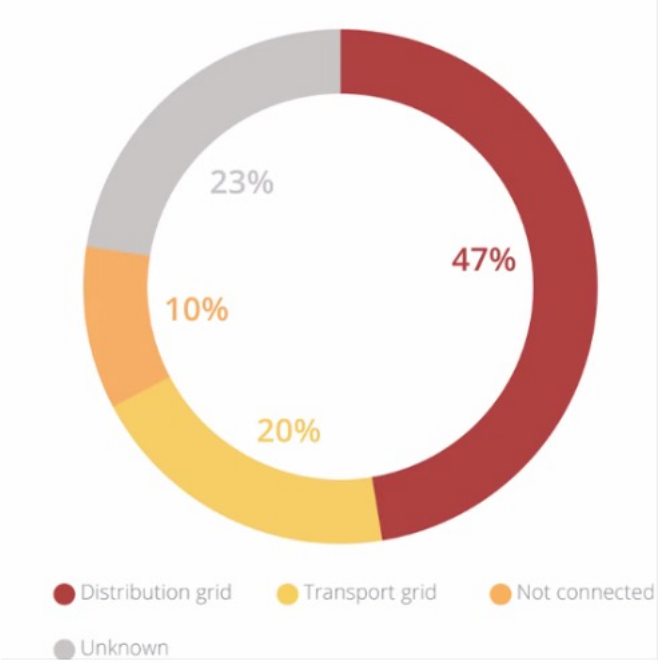


Biyometanda değişen trendler

Biomethane production in Europe: feedstocks used

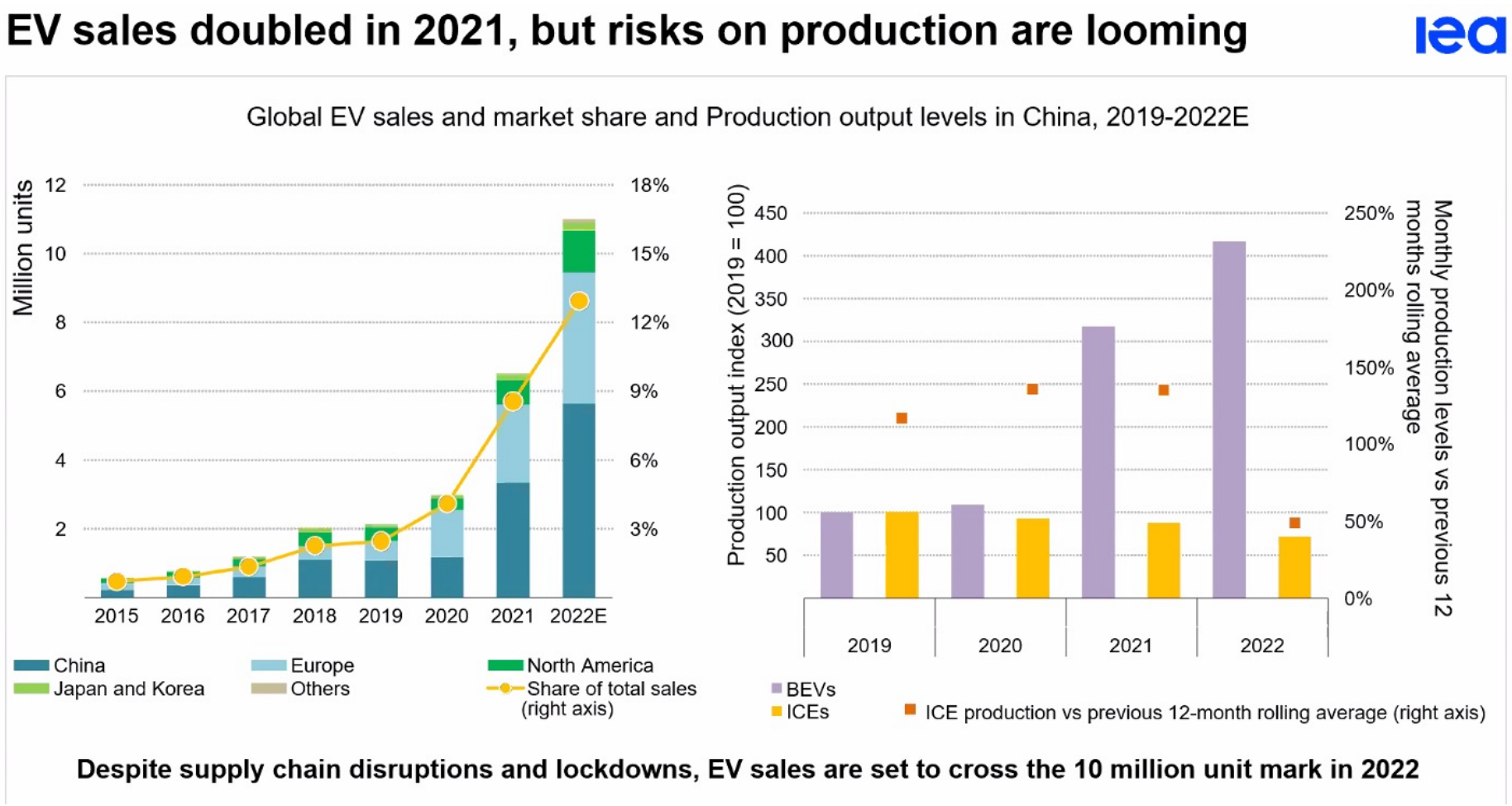
This figure shows the number of newly installed biomethane plants each year.

2013 saw the beginning of a move away from energy crops, **towards agriculture substrates, municipal waste and sewage sludge.**

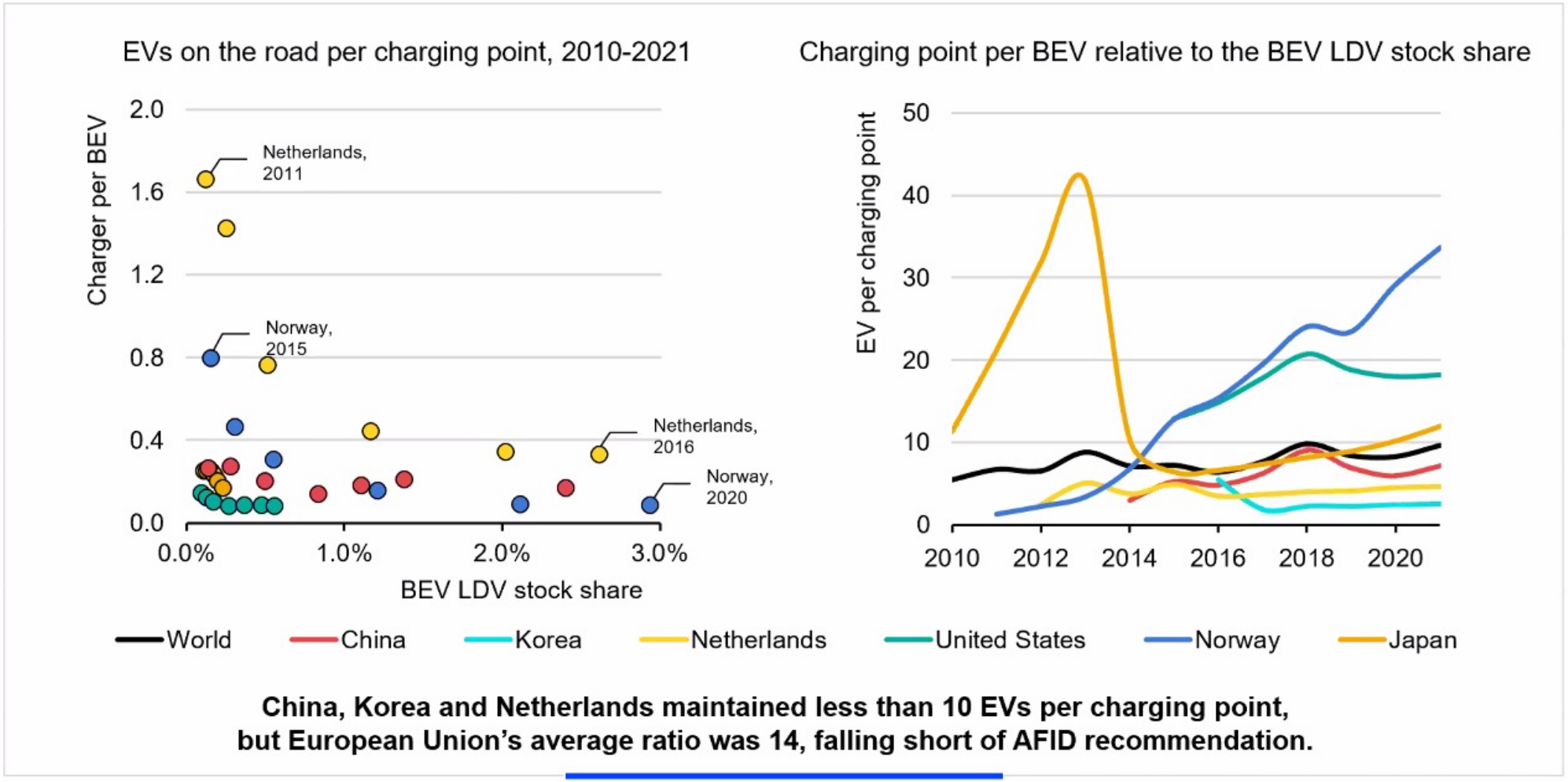


Elektrikli Arabalar

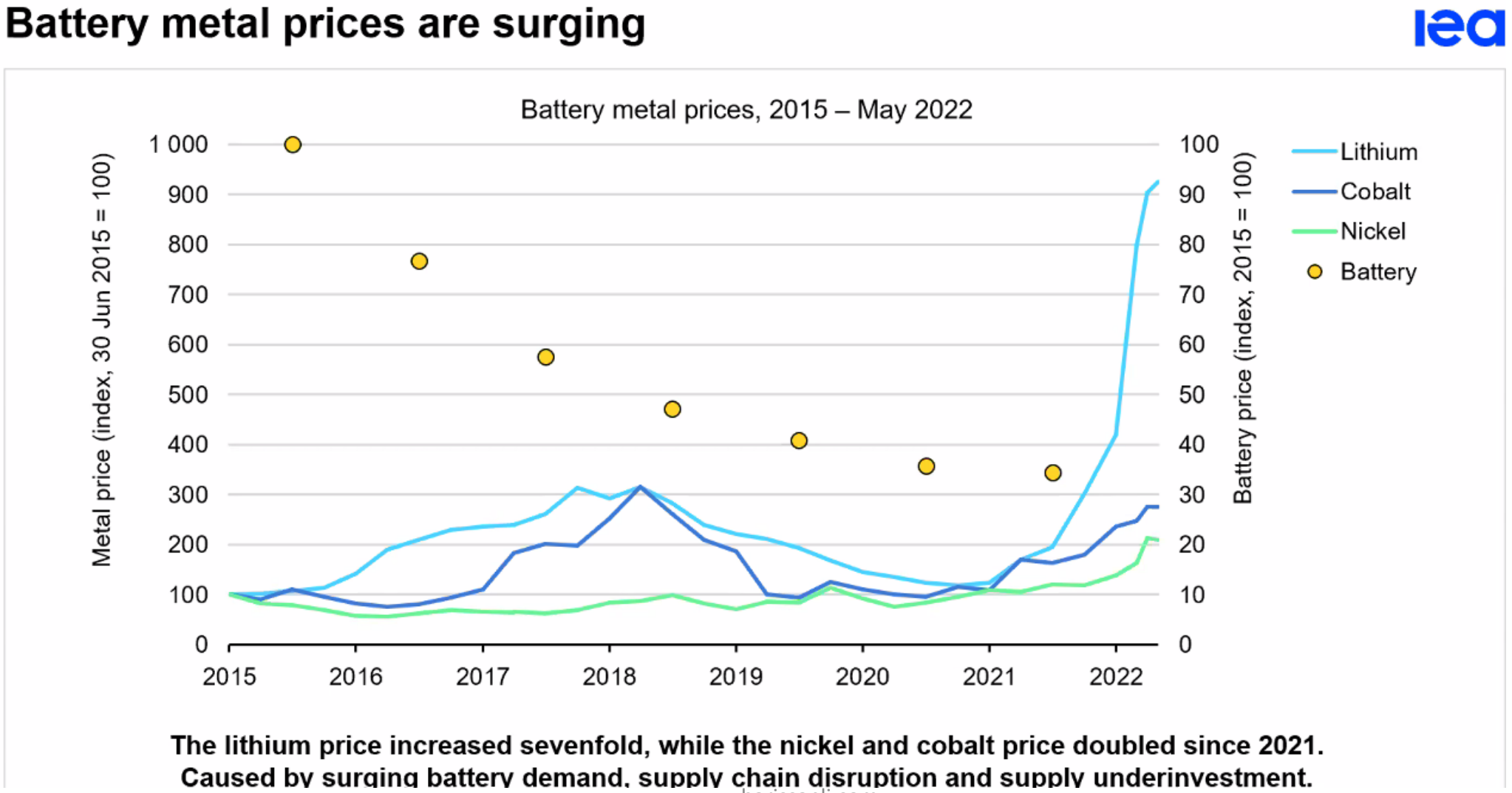
Elektrikli Arabalar



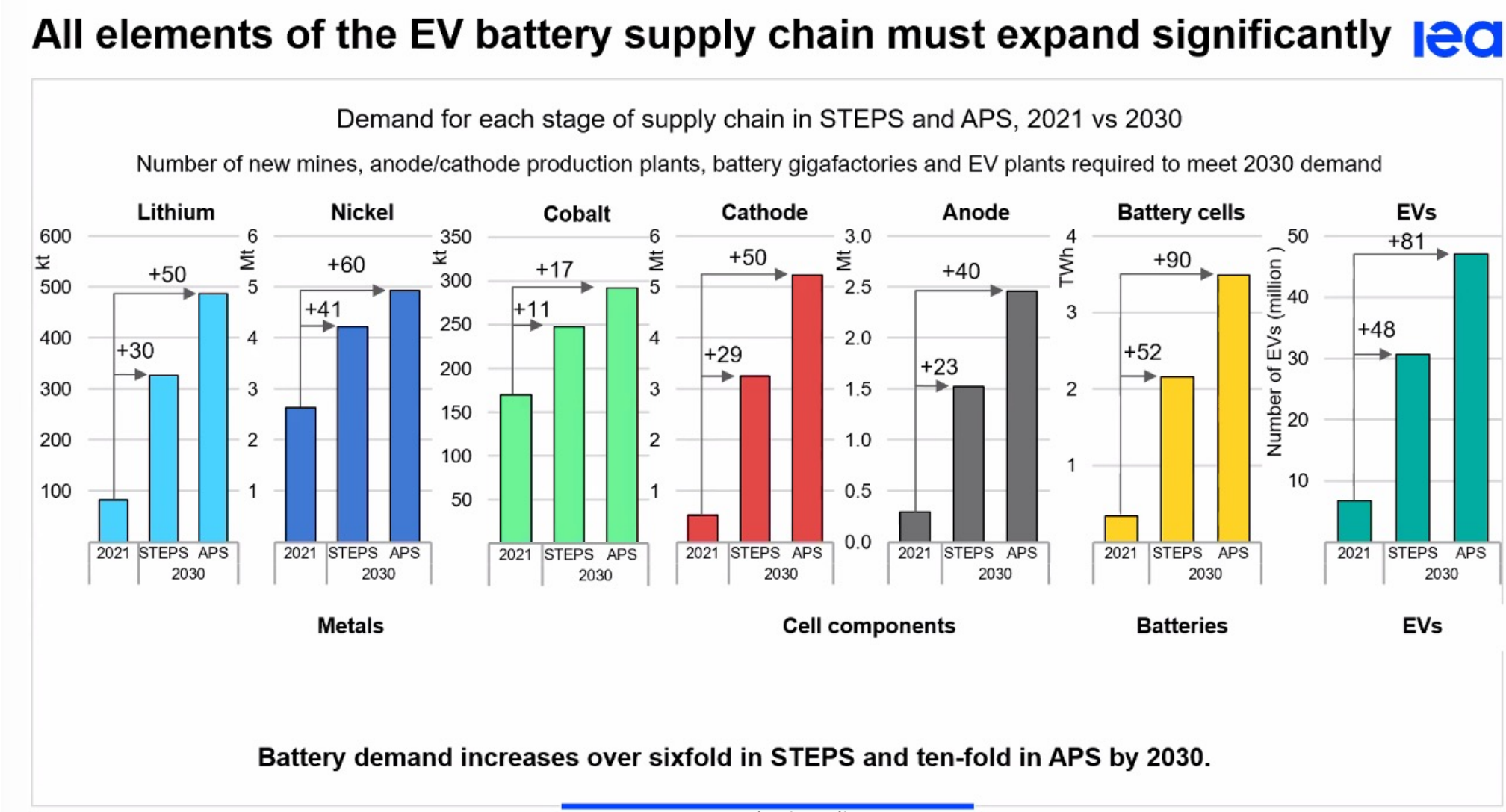
Arabalar ve Şarj noktaları



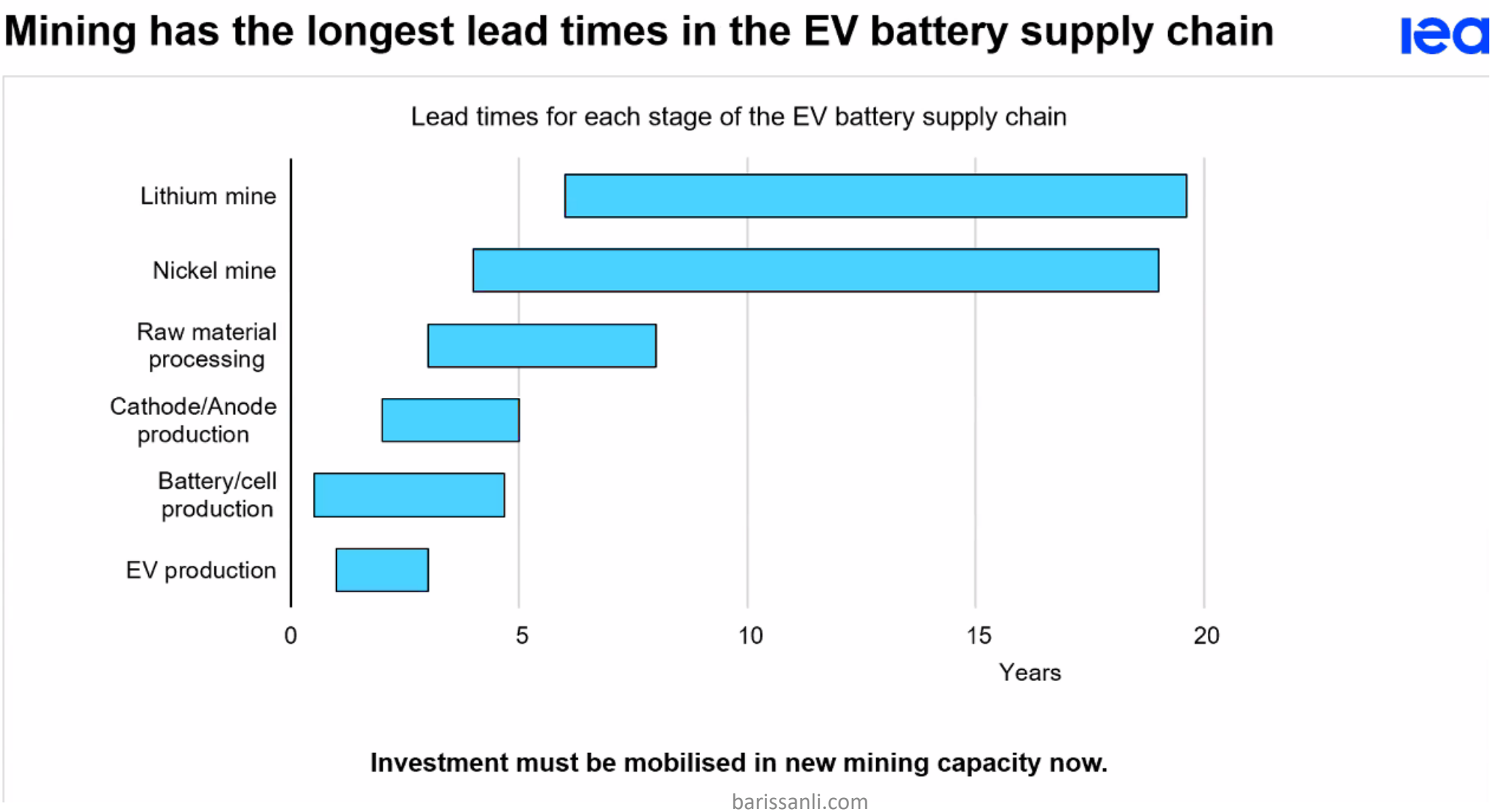
Pil metallerinin fiyatları



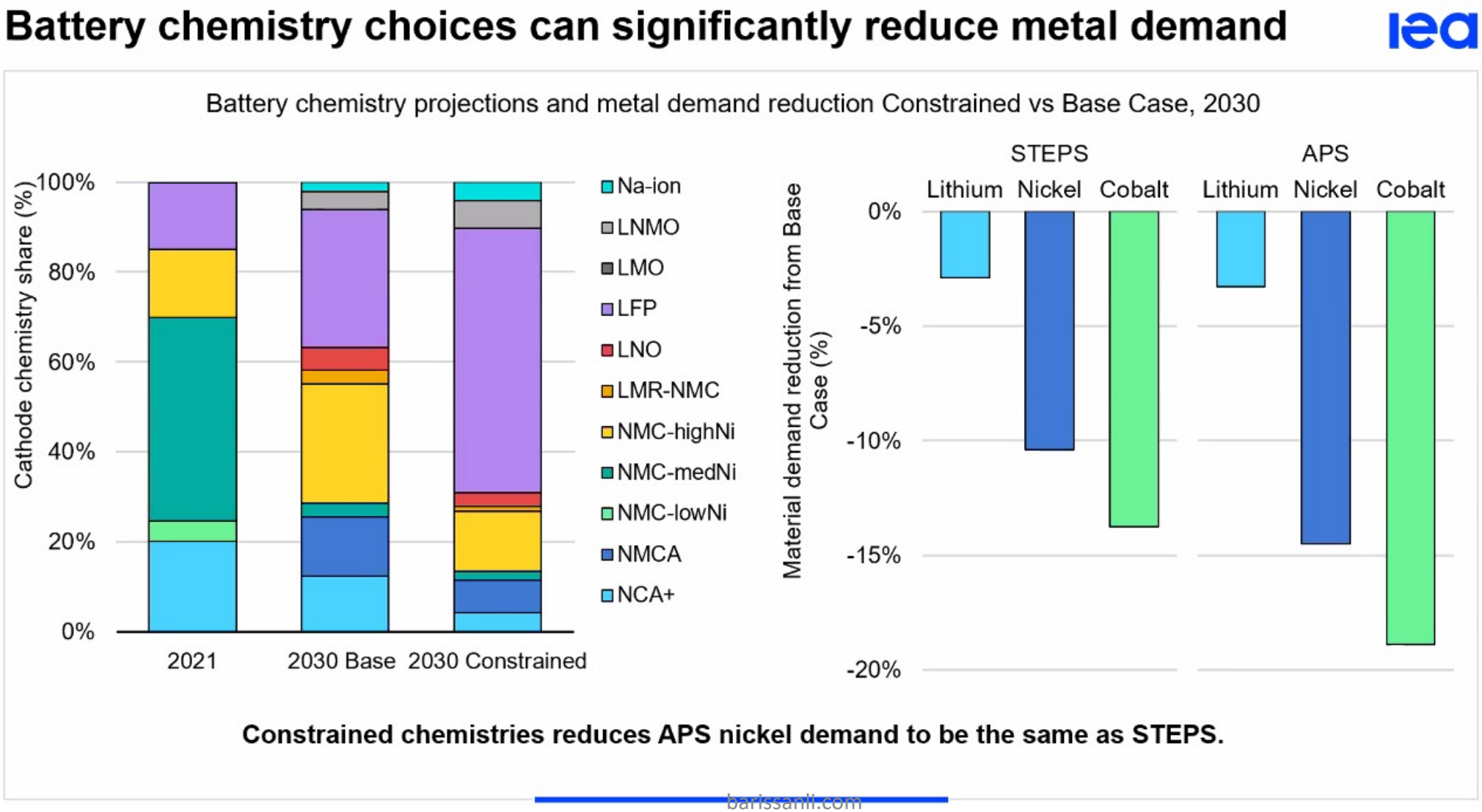
Elektrikli araba pil zinciri



Pil tedarik zinciri – fabrika yatırım süreleri



Değişen pil kimyası

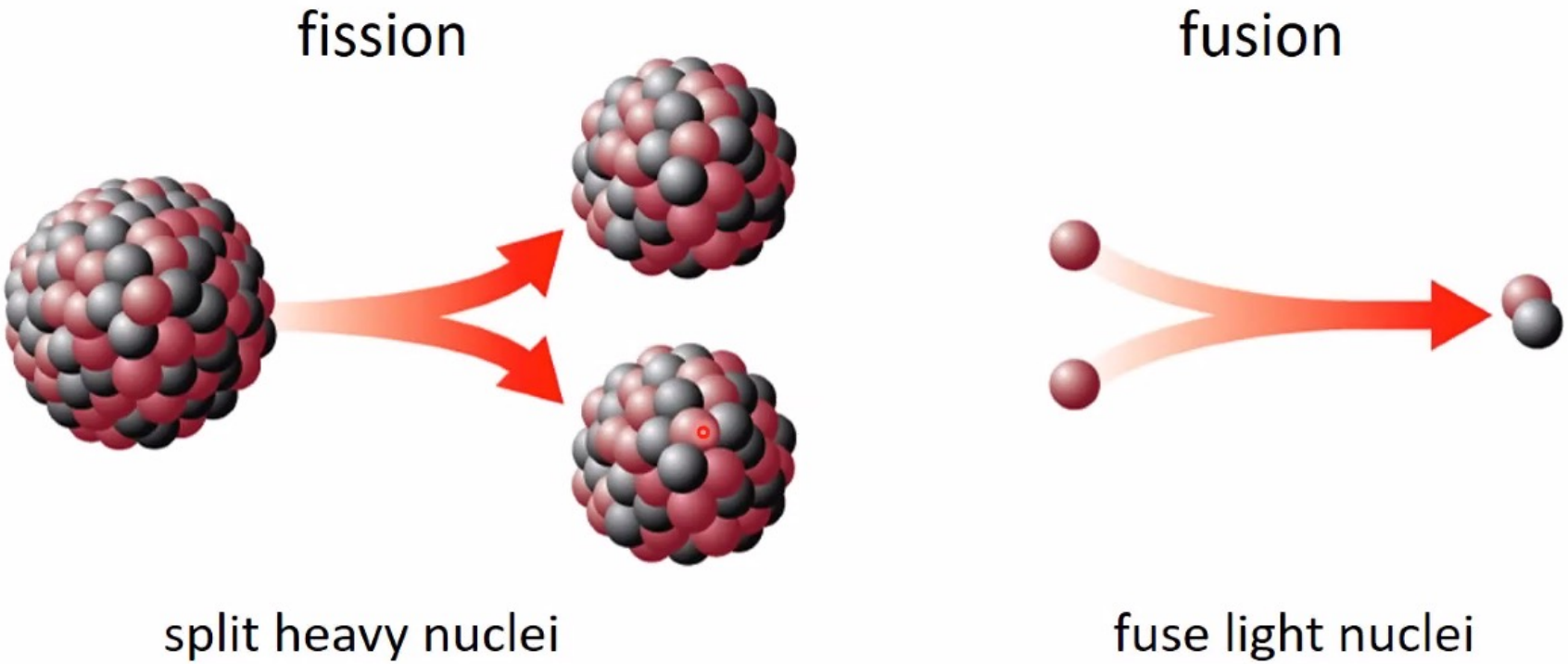


Nükleer

Small modular nuclear

Füzyon

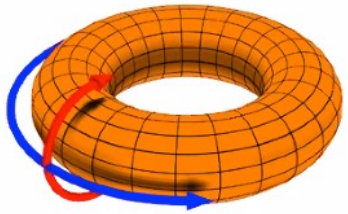
Reminder: What is fusion?



Füzyon

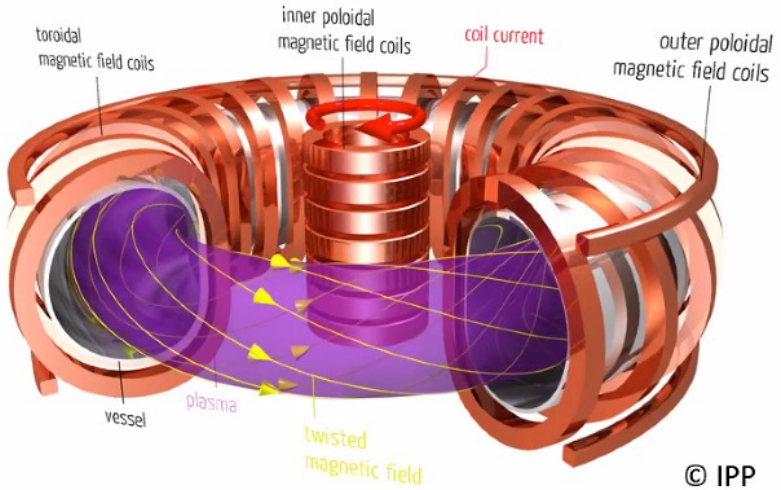
Magnetic confinement – tokamak and stellarator

plasma confinement in a strong torus-shaped magnetic field



twisted magnetic field lines to balance drift-induced charges

Tokamak тороидальная камера в магнитных катушках
toroidalnaya kamera magnitnaya katushka
magnetic field created with coils and plasma current



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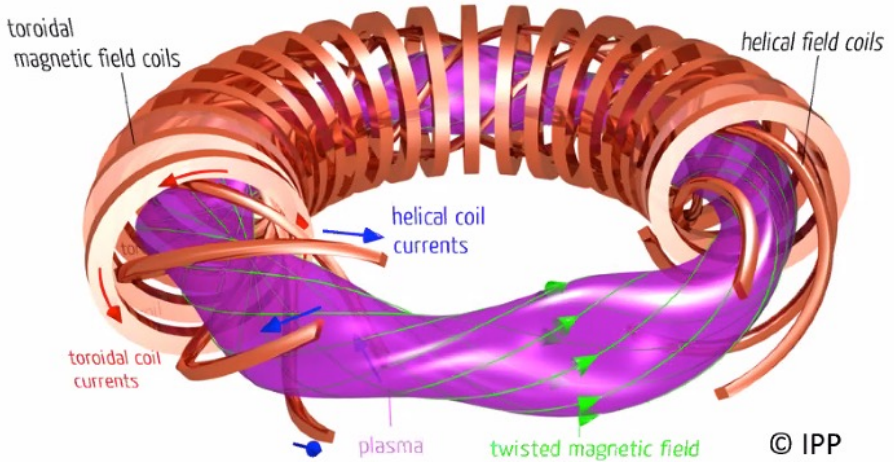
Stellarator stella [lat] the star
magnetic field created with coils only



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Füzyon – Nasıl çalışır

Principle of the fusion power plant

euterium

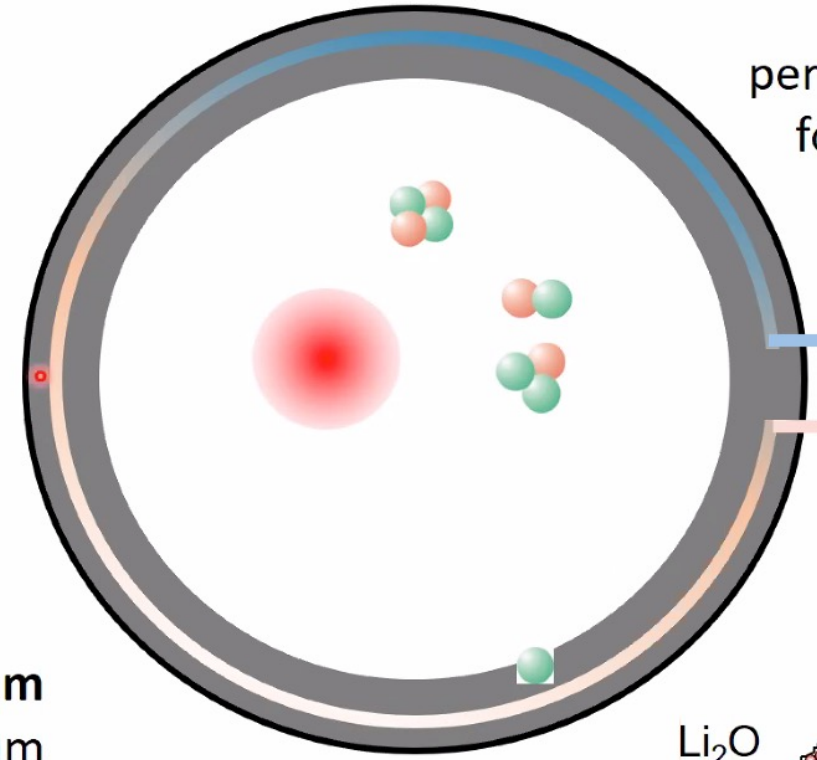
tritium

fusion →
acceleration × 1000

helium

neutron

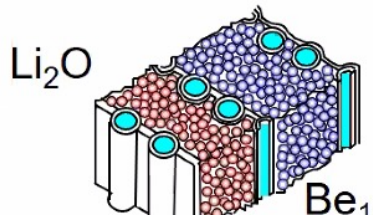
neutron + lithium → tritium
+ helium



10^{18} fusion pocesses
per second and cubic metre
for 1 GW electrical power

← coolant

→ steam generator



Teşekkürler

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