

# **Küresel Enerji Politikalarına Genel Bakış ve Enerji Jeopolitiğindeki Paradigma Değişimleri**

## **7. Elektrik Tesisat Ulusal Kongre ve Sergisi** **Güç ve Enerji Sistemleri Sempozyumu**

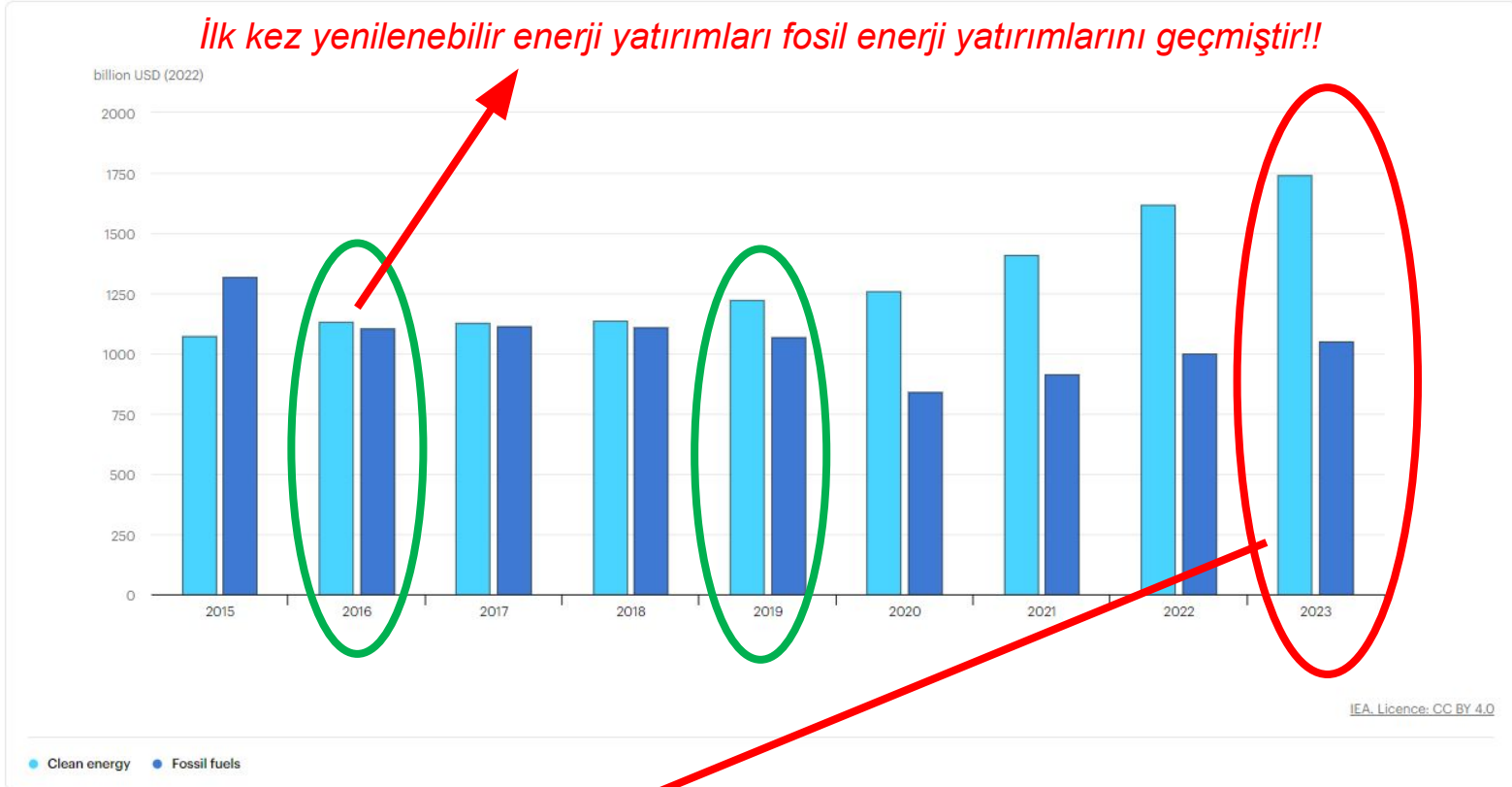
**02 Kasım 2023, İzmir**

**Doç.Dr.Cenk SEVİM**

# Kapsam



## Küresel Enerji Yatırımları (2015-2023)



**2023 yılında,**

**toplam enerji yatırımları; 2,8 trilyon dolar**

**Fosil enerji kaynakları; 1 trilyon dolar** (yaklaşık)

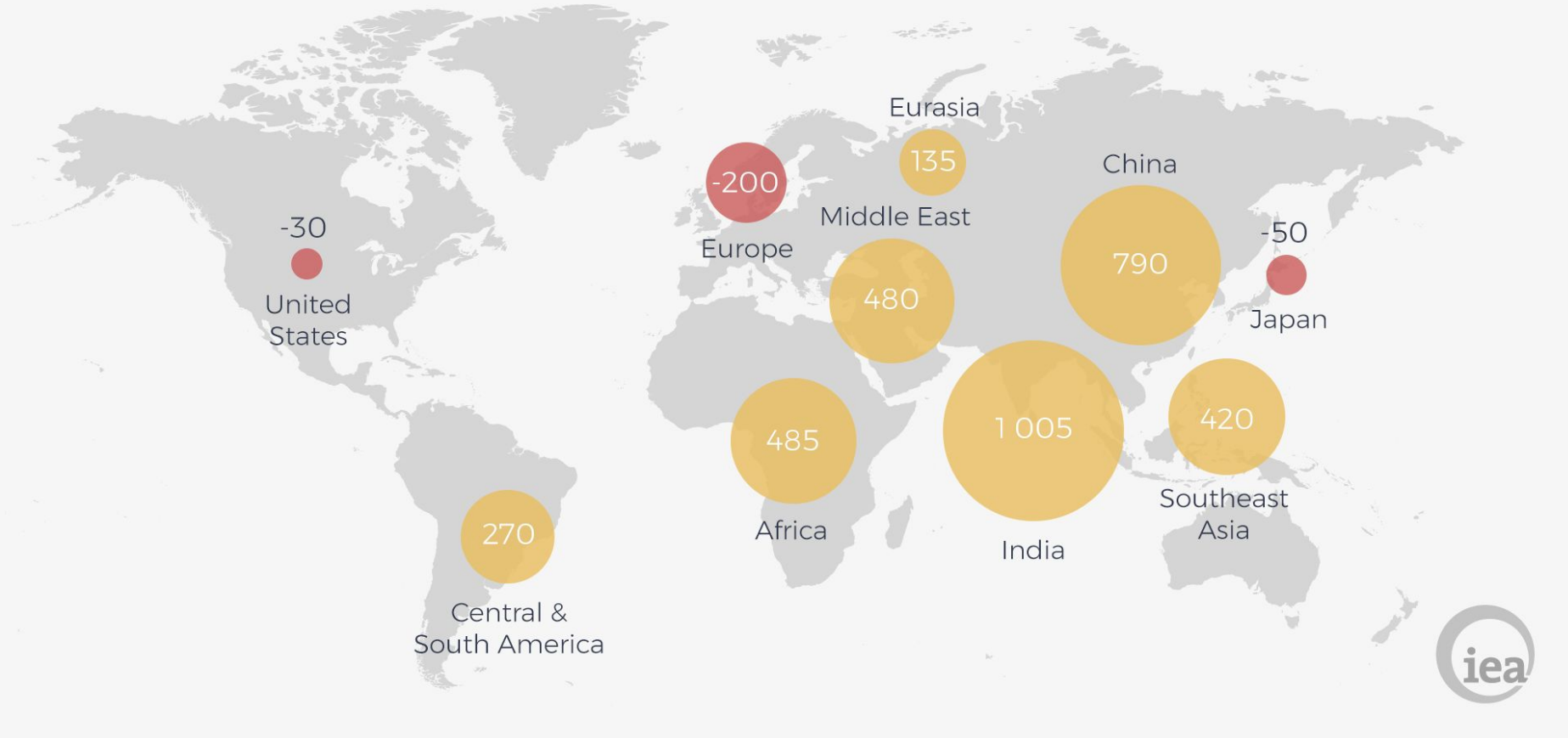
**Yenilenebilir enerji kaynakları ; 1,8 trilyon dolar** (yaklaşık)

**Doç. Dr. Cenk Sevim**

# 2016-2040 Birincil Enerji Talep Projeksiyonu

Change in primary energy demand, 2016-40 (Mtoe)

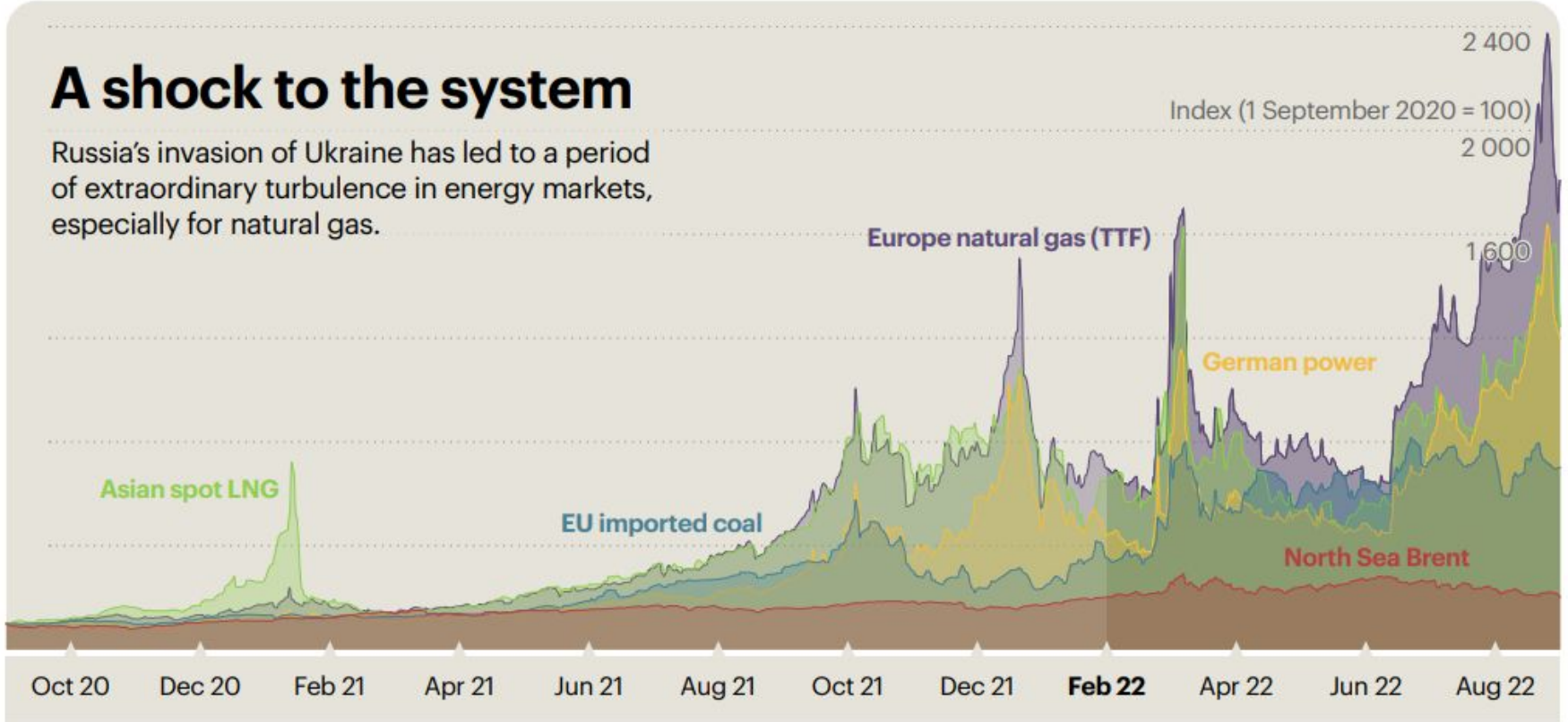
World Energy Outlook 2017



# Rusya- Ukrayna Çatışmasının Gaz Fiyatları Üzerindeki Etkisi

## A shock to the system

Russia's invasion of Ukraine has led to a period of extraordinary turbulence in energy markets, especially for natural gas.



# AB'nin Rusya Fosil Enerji Kaynaklarına Bağımlılık Oranı



# Klasik Enerji Jeopolitiđi

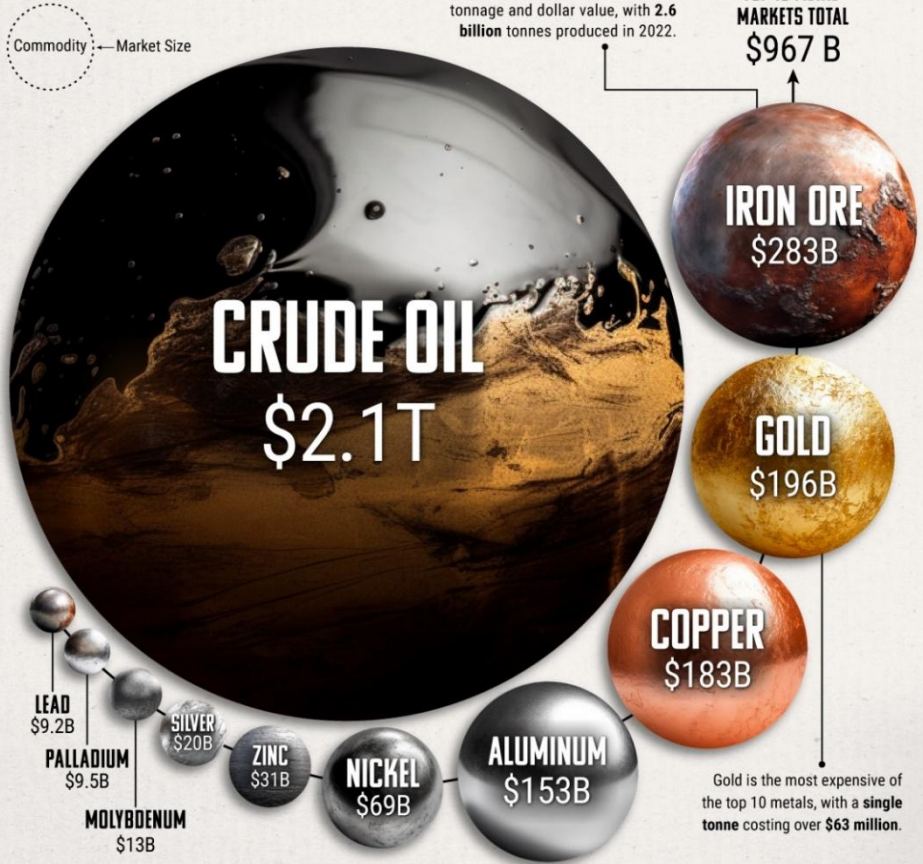
## Jeopolitik ve Enerji Jeopolitiđi Nedir?

Jeopolitik kavramı ilk kez askeri kavramlar içinde kullanılmaya başlanmıřtır. Jeopolitik, cođrafi alandaki etkileřimleri ve bunlardan kaynaklanan g¼c m¼cadelesini incelemektedir. K¼resel enerji paradigmasının simetrik dađılıma sahip bir enerji kaynađı olan k¼m¼rden, asimetrik dađılıma sahip bir enerji kaynađı olan petrole dođru deđiřim g¼stermesiyle ¼lkeler için enerji arzı ve enerji kaynaklarına eriřim ulusal g¼venlik konusu haline gelmiřtir.

# HOW BIG IS THE OIL MARKET?

The oil market is bigger than the top 10 metal markets combined in terms of production value, surpassing \$2 trillion in 2022.

## CRUDE OIL MARKET SIZE VS TOP 10 METAL MARKETS

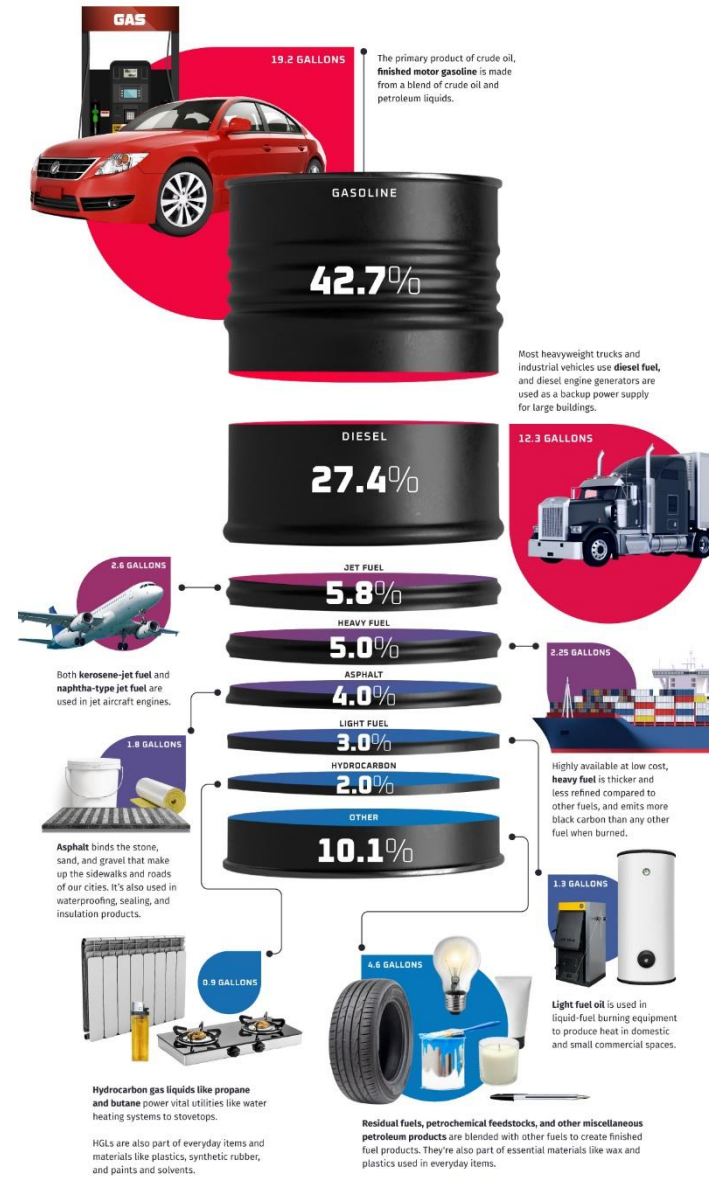


Source: USGS Mineral Commodity Summaries 2023, TradingEconomics, Cameco, FastMarkets  
Market sizes are calculated by multiplying annual production in 2022 with spot prices as of June 7, 2023.

# THE PRODUCTS DERIVED FROM A BARREL OF CRUDE OIL

A barrel of crude oil (42 gallons) produces just under 45 gallons of refined products, from transportation fuels to essential materials for everyday products.

This graphic uses a barrel of oil to represent the proportions of how the majority of crude oil is processed.



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# SHARE OF GLOBAL Oil Reserves

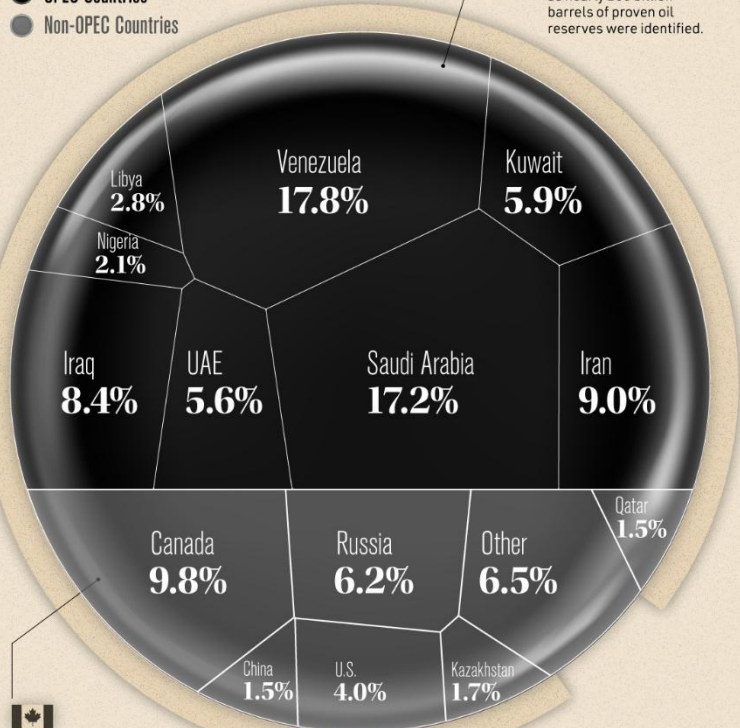
Across the globe, oil remains a key component of the energy mix. Of course, resources aren't distributed equally between countries, and oil is no exception.

Here's how oil reserves are spread between countries:

- OPEC Countries
- Non-OPEC Countries

## BY COUNTRY

Between 2005 and 2015, Venezuela jumped from 5th in the world to number one as nearly 200 billion barrels of proven oil reserves were identified.



In 2002, Canada's proven oil reserves jumped from 5 billion to 180 billion barrels based on new estimates of Oil Sands reserves.

Source: BP Statistical Review of World Energy 2020

93.5% of known oil reserves are discovered in these top 14 countries.



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# THE LARGEST PRODUCERS OF NATURAL GAS

Russia's invasion of Ukraine has exacerbated the tightening supply of natural gas underway since mid-2021, further pushing up prices. Besides having the largest natural gas reserves, Russia is the second biggest producer, only behind the United States.

**i** Natural gas is a naturally occurring hydrocarbon gas and non-renewable fossil fuel that forms below the Earth's surface. Liquefied natural gas (LNG) is a natural gas that has been cooled to -162°C, a process that is commonly done for gas export purposes as it reduces the volume of the transported gas.

Production in billion cubic meters\* (2021)

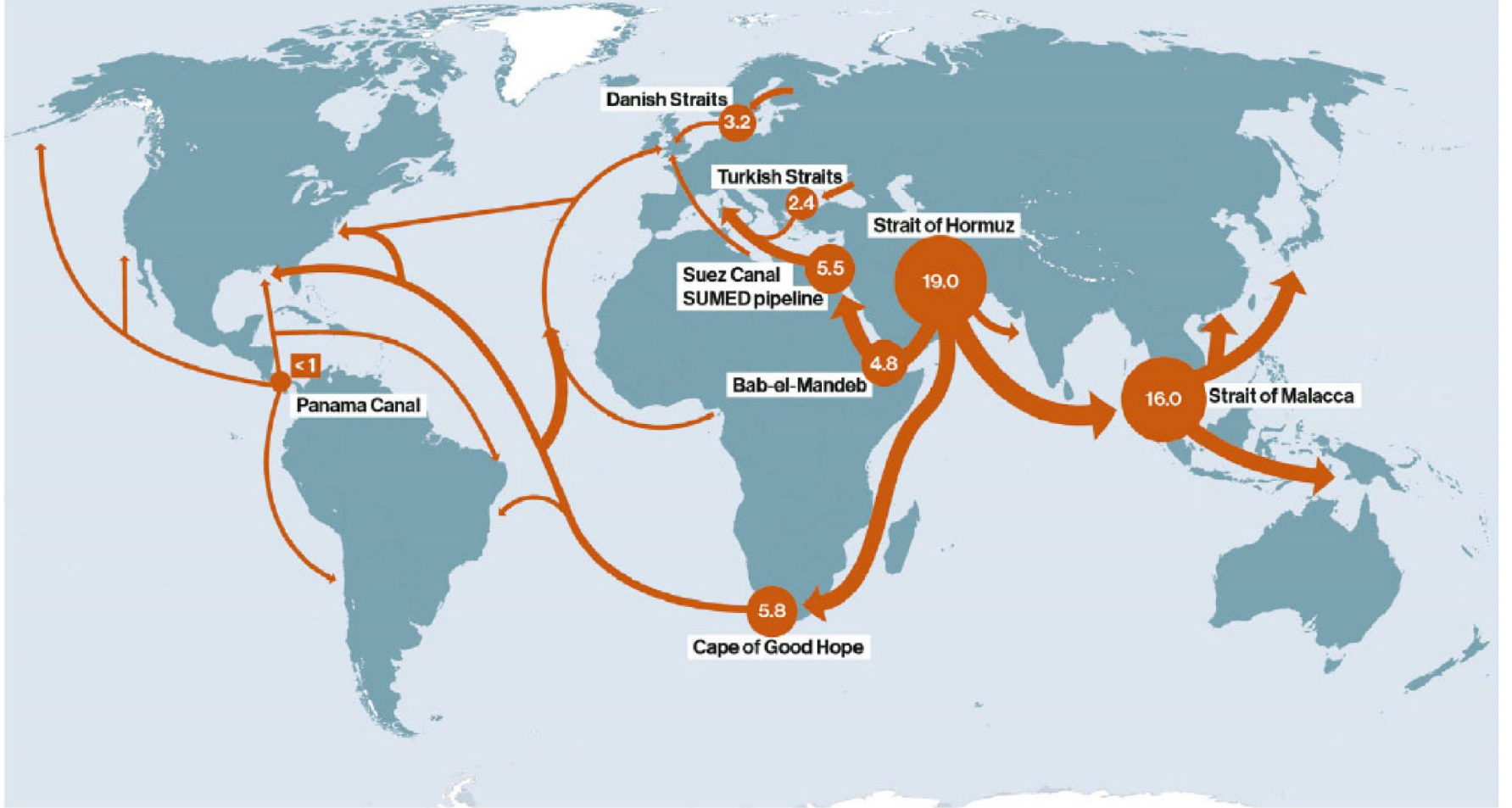


\*Excludes gas flared or recycled. Includes natural gas produced for Gas-to-Liquids transformation. Source: bp Statistical Review of World Energy 2022



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## Petrol Lojistiğindeki Düğüm Noktaları





# Yeni Enerji Jeopolitiđi

# Gelecek İçin Enerji Senaryoları

Fuels: Renewables

Renewables are the largest source of energy growth...

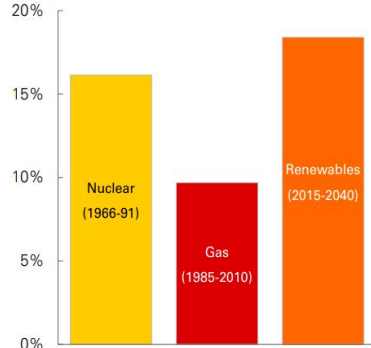
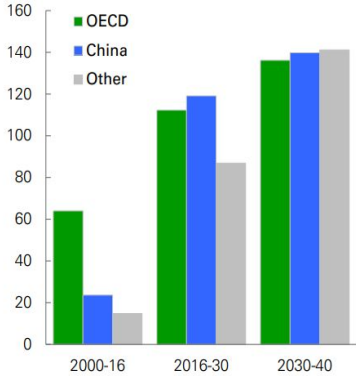


Growth of renewable power

Pace of power market penetration

TWh, average annual growth

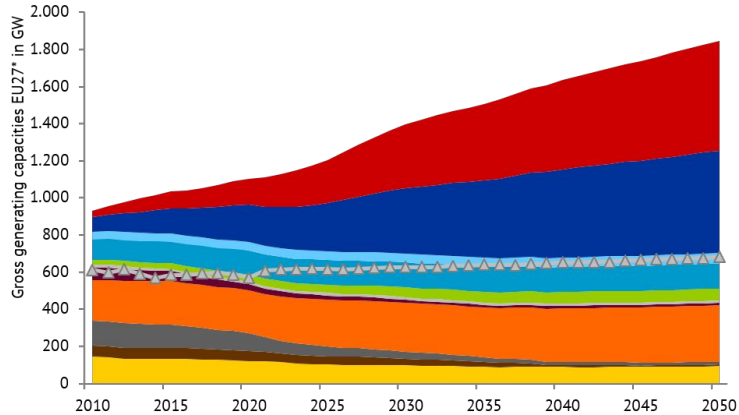
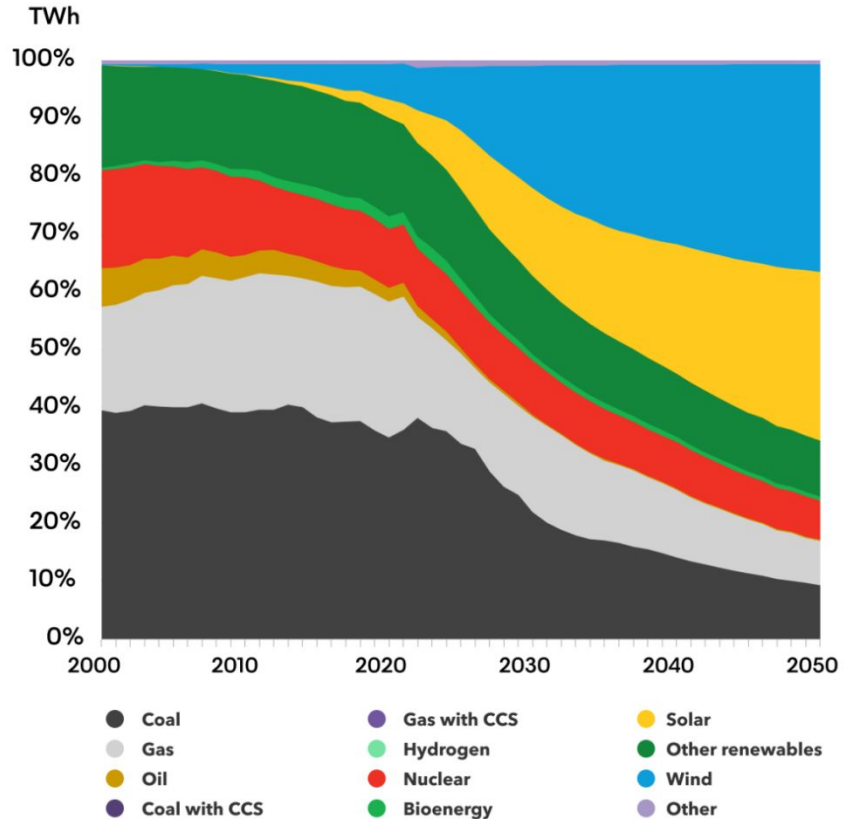
Largest gains in market share over 25 years, %pts



94

Energy Brainpool 2018 BP Energy Outlook © BP p.l.c. 2018

## Bloomberg New Energy Outlook 2022



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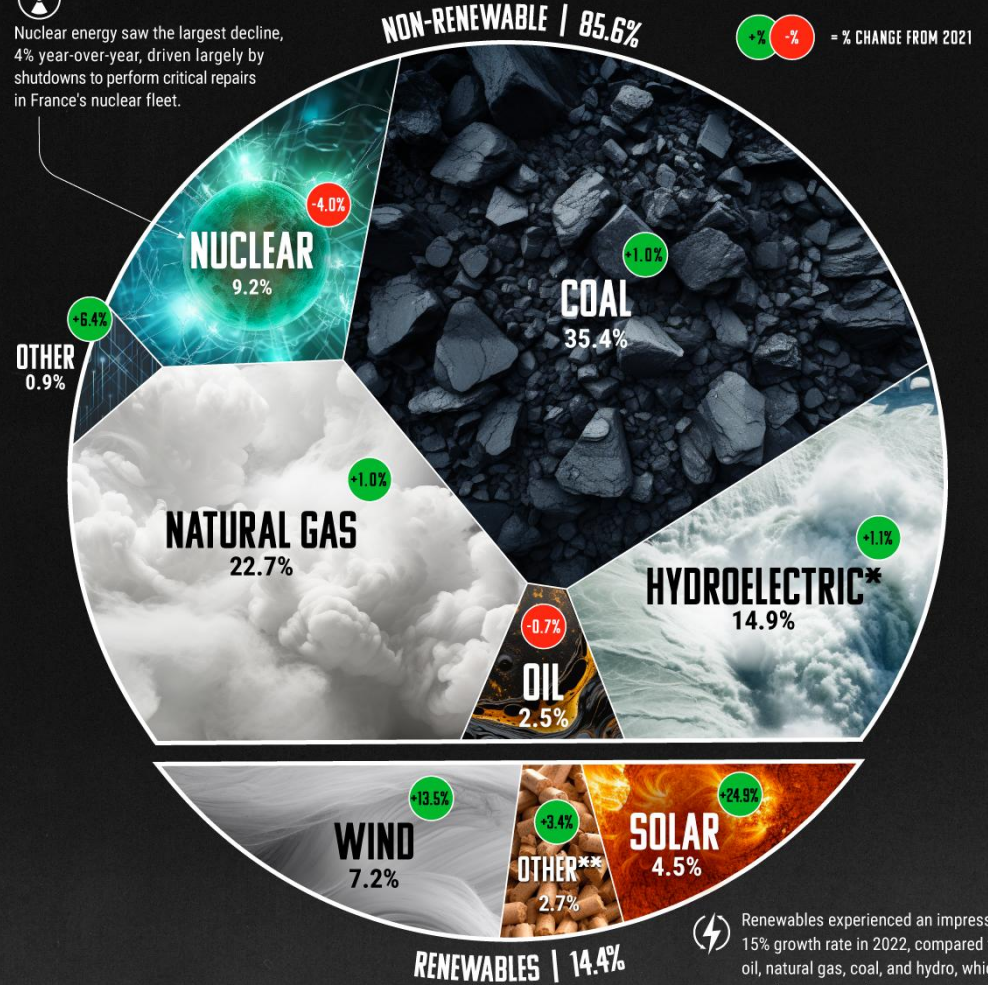
# WHAT POWERED THE WORLD ⚡ 2022?

Coal still leads the charge when it comes to electricity, representing 35% of global power generation in 2022, followed by natural gas at 23%, and hydroelectric at 15%.

## ELECTRICITY SOURCES BY FUEL 2022



Nuclear energy saw the largest decline, 4% year-over-year, driven largely by shutdowns to perform critical repairs in France's nuclear fleet.



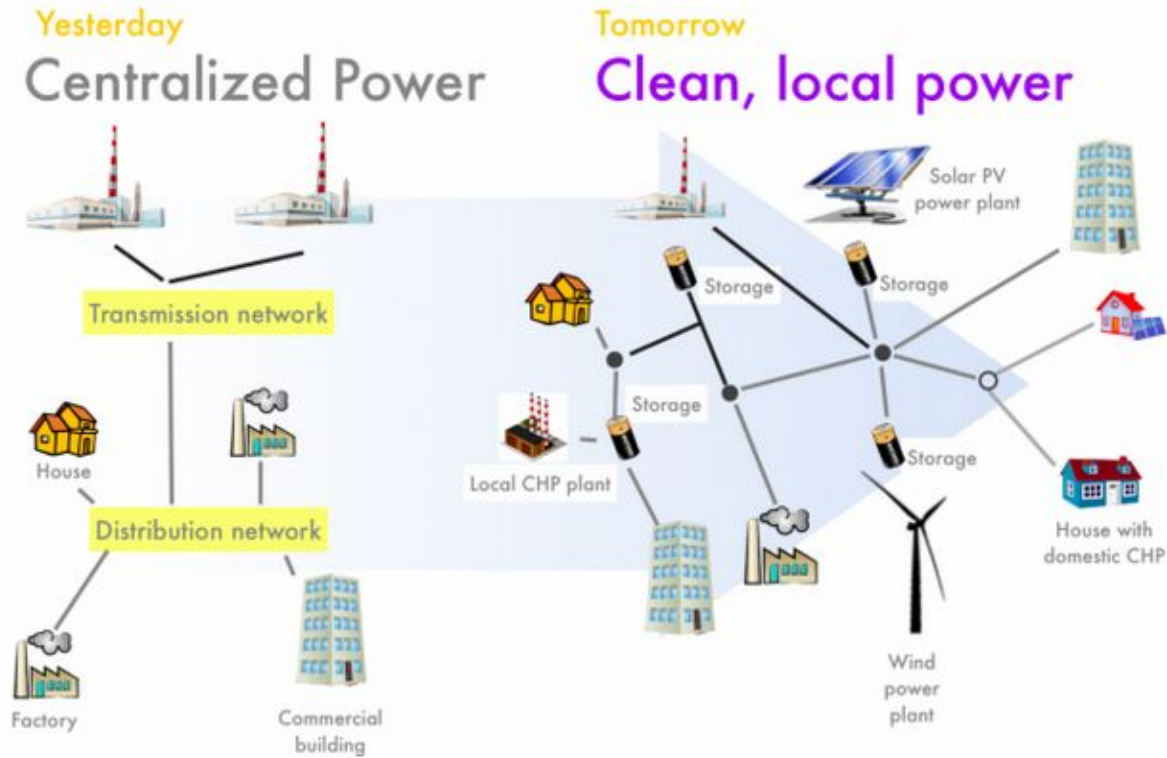
Renewables experienced an impressive 15% growth rate in 2022, compared to oil, natural gas, coal, and hydro, which together mustered an anemic 0.4%.

\*The Statistical Review excludes hydroelectric energy in their renewable calculations; renewables, including hydro, represented 29% of global electricity generation in 2022.  
\*\* Other Renewables includes geothermal, biomass, and other renewable fuels.

## Elektrik Üretiminde Kullanılan Edilen Enerji Kaynakları (2022)

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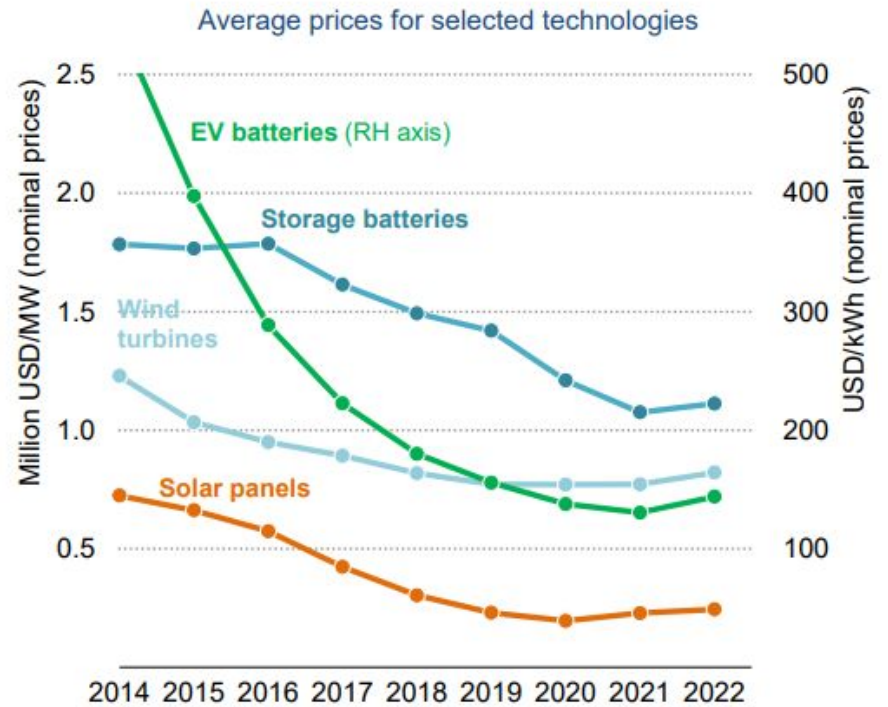
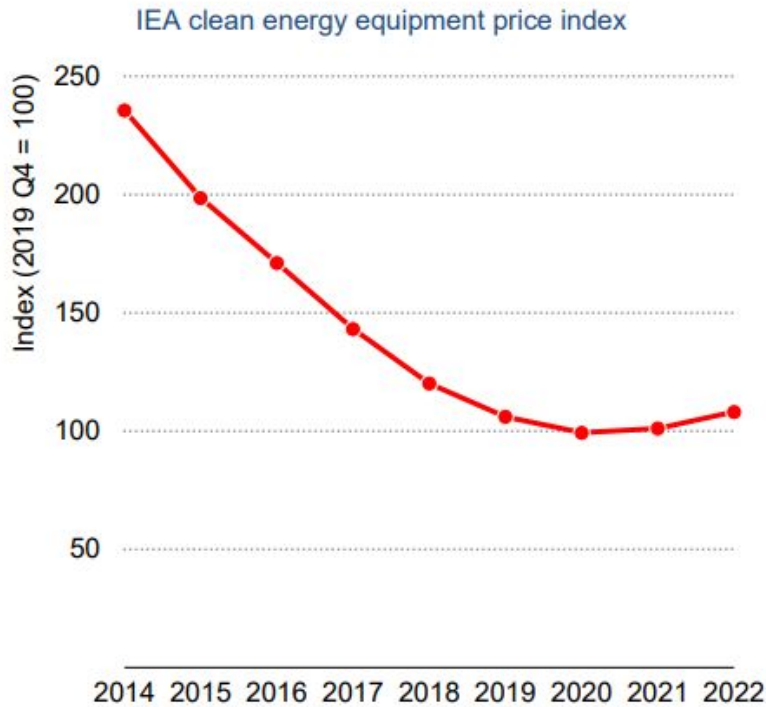
# Merkezi Enerji Paradigması mı Dağıtık Enerji Paradigması mı?



- Dağıtık enerji paradigması ile enerji kayıplarında düşüş
- Daha çok yenilenebilir enerji=Daha az enerji kaybı

# Enerji Teknolojilerinin Ekipman Fiyat İndeksleri

Clean energy costs edged higher in 2022, but pressures are easing in 2023 and mature clean technologies remain very cost-competitive in today's fuel-price environment



IEA. CC BY 4.0.



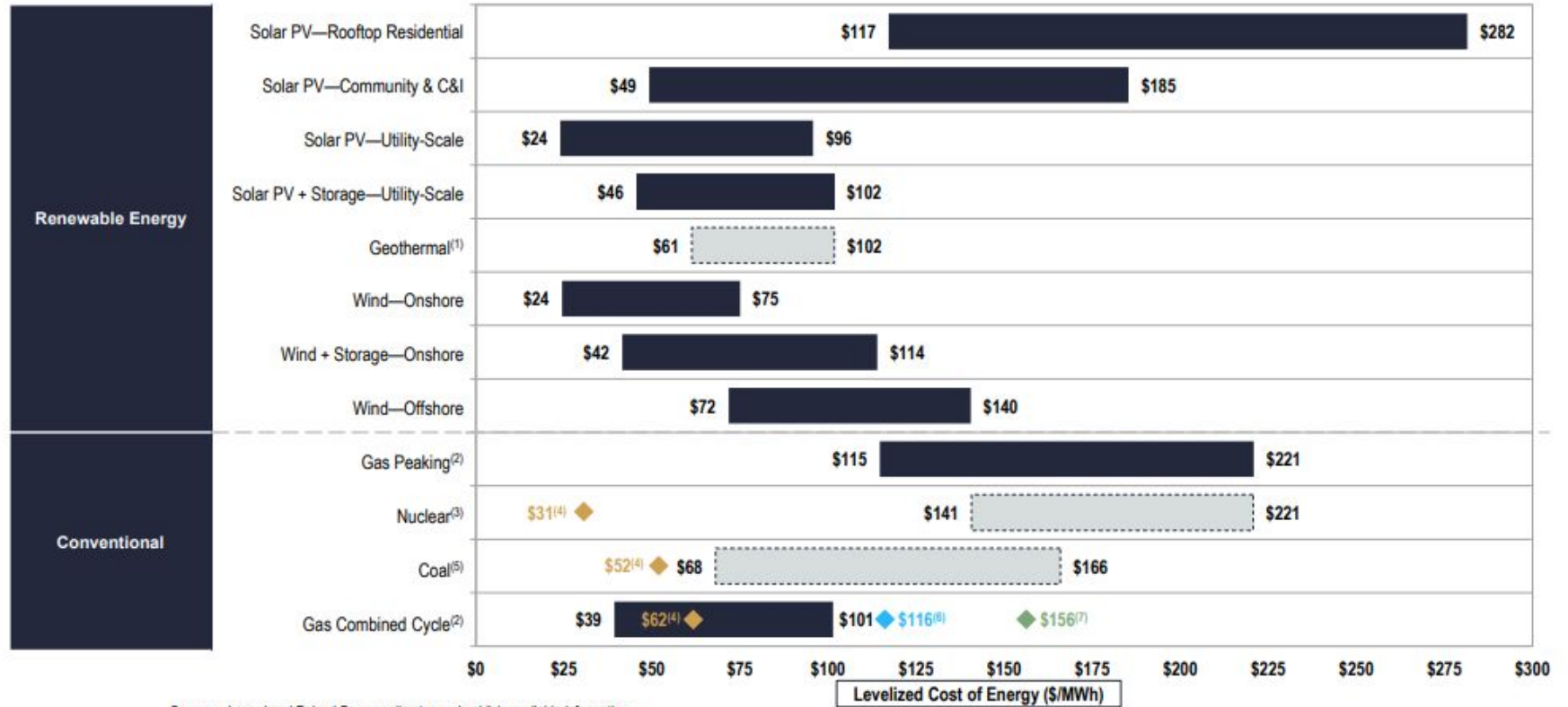
# Enerji Teknolojilerinin LCOE Karşılaştırılması

$$\text{LCOE} = \frac{\text{Total costs over lifetime} \text{ (€)}}{\text{Electricity produced over lifetime} \text{ (€)}}$$

LCOE= Hizmet ömrü maliyetlerinin toplamı / Hizmet ömründe üretilen toplam elektrik

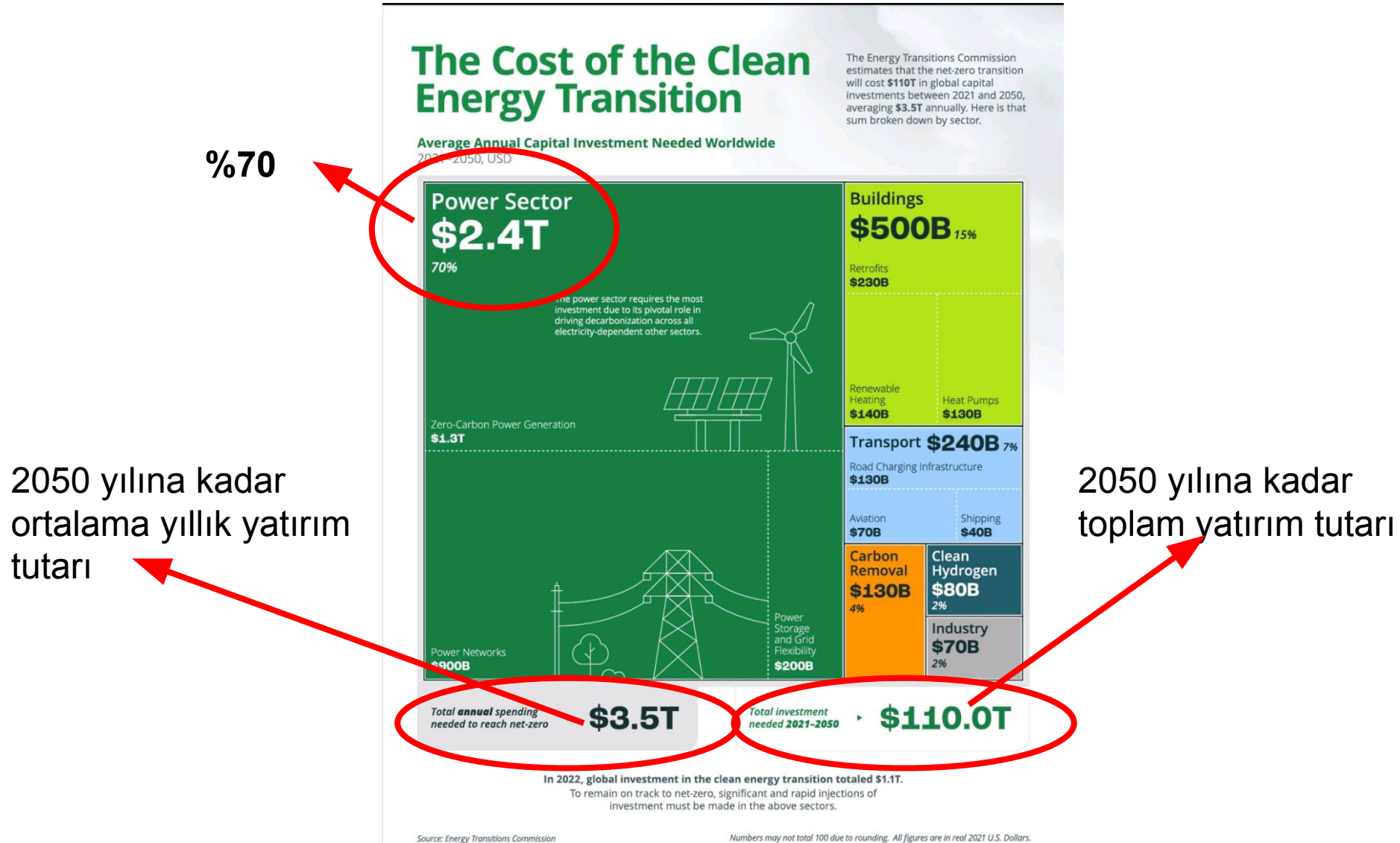
## Levelized Cost of Energy Comparison—Unsubsidized Analysis

Selected renewable energy generation technologies are cost-competitive with conventional generation technologies under certain circumstances

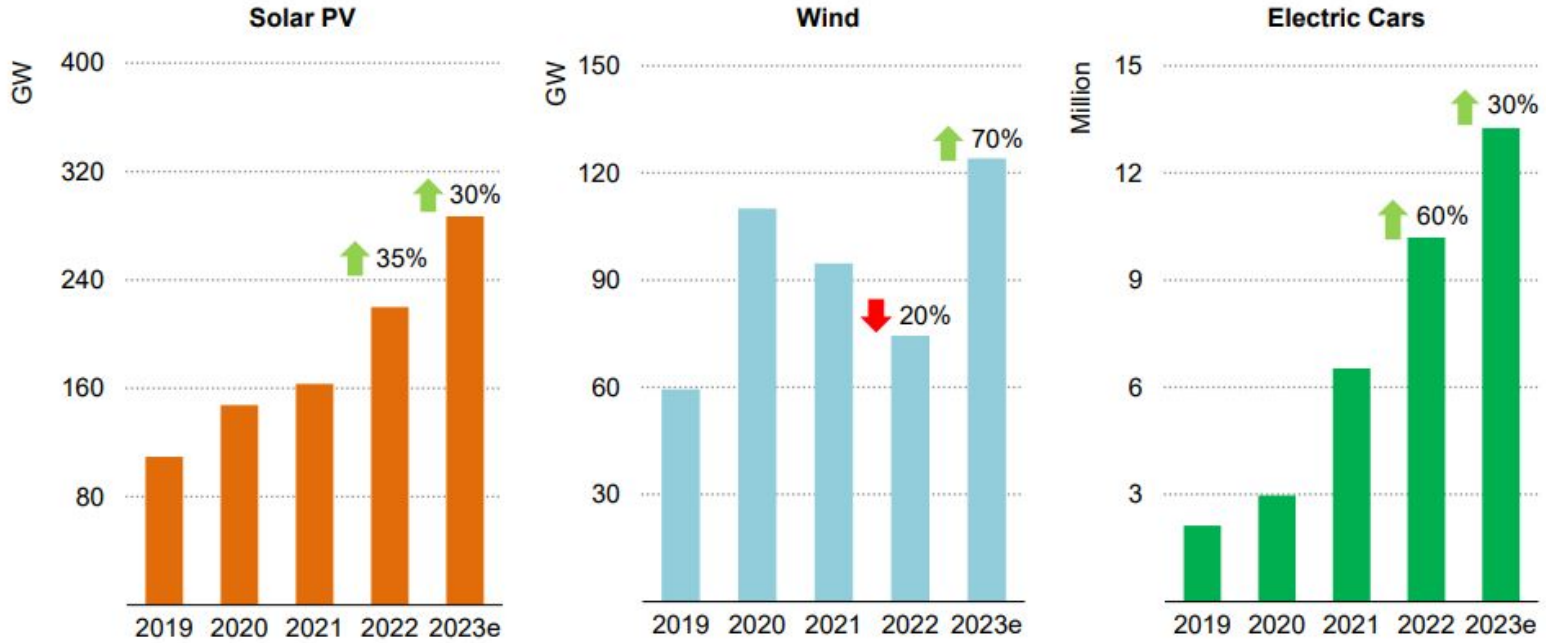


**Not: Teşviklerden arındırılmış fiyat**

# Temiz Enerji Teknolojilerine Geçiş İçin Gerekli Yatırım Tutarı



# Yenilenebilir Enerji Kaynakları Yıllık Kapasite Değişimleri



IEA. CC BY 4.0.

**PV Güneş Enerjisi Teknolojileri;** boksit, alüminyum, kadmiyum, bakır, galyum, germanyum, indiyum, demir, kurşun, nikel, selenyum, silikon, tellurium, kalay, çinko

**Rüzgar Enerjisi Teknolojileri;** boksit, krom, kobalt, bakır, demir, kurşun, manganez, molibden, nadir toprak elementleri, çinko

**Elektrikli Araç ve Enerji Depolama Teknolojileri;** boksit, alüminyum, kobalt, bakır, grafit, demir, kurşun, lityum, manganez, nadir toprak elementleri, silikon, titanyum

# Yenilenebilir Enerji Teknolojilerinde Kullanılan Mineraller

## The Metals Behind **CLEAN POWER**

From the copper in cables to the lithium in cathodes, certain metals are key to building and growing clean energy capacity.

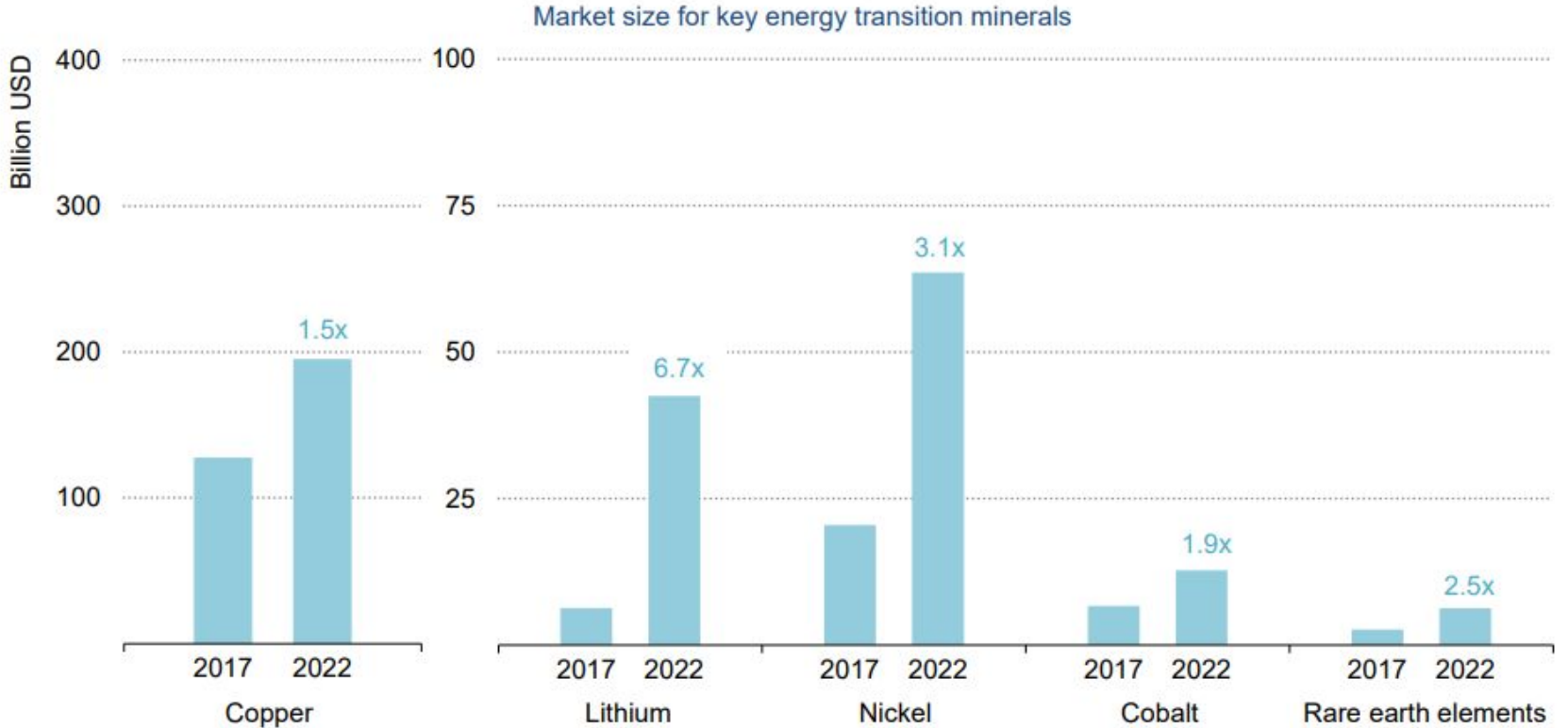
**Material requirements per megawatt (kg):**

Source: IEA



# Yenilenebilir Enerji Teknolojilerinde Kullanılan Mineraller

Thanks to heightened demand and rising prices, the market size for energy transition minerals doubled over the past five years, reaching USD 320 billion in 2022

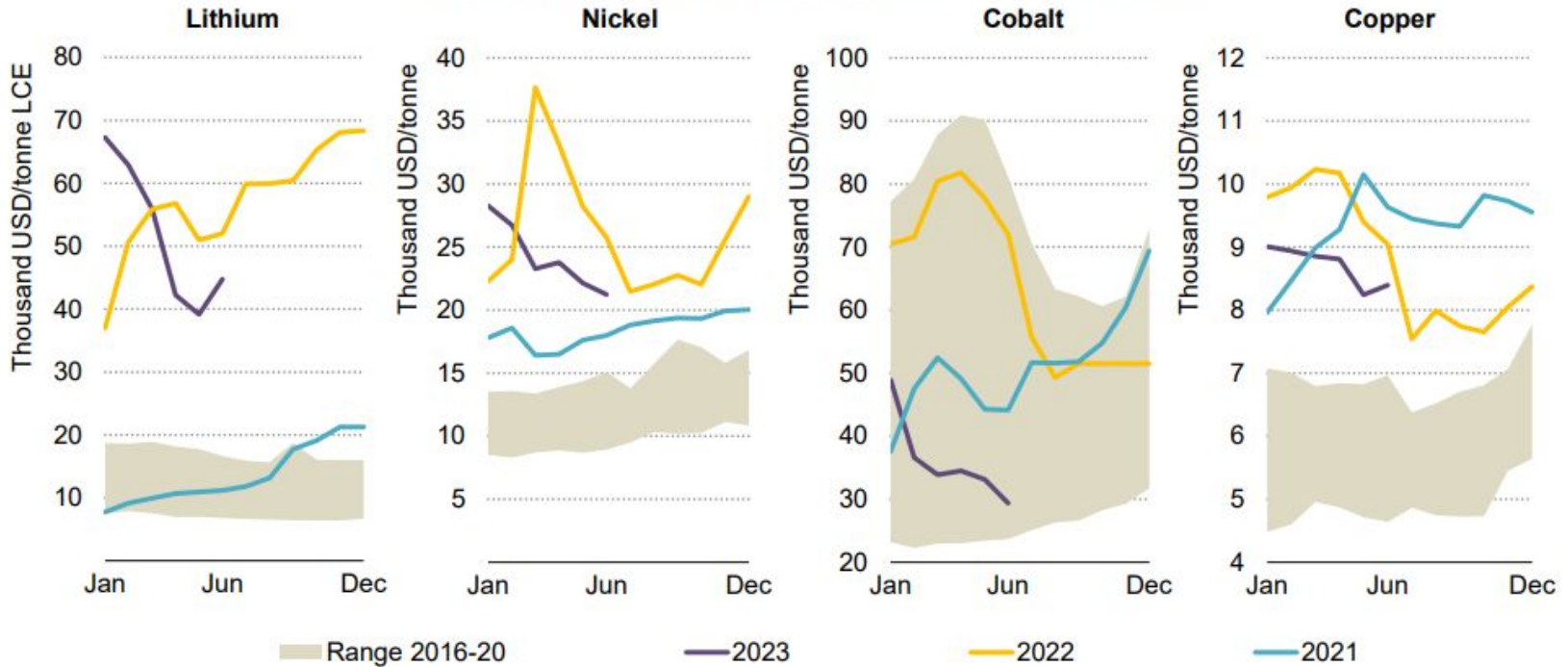


IEA. CC BY 4.0.

# Yenilenebilir Enerji Teknolojilerinde Kullanılan Mineraller

After the surge in 2021 and 2022, many critical mineral prices started to moderate in 2023, but remain well above historical averages

Price development for selected energy transition minerals and metals

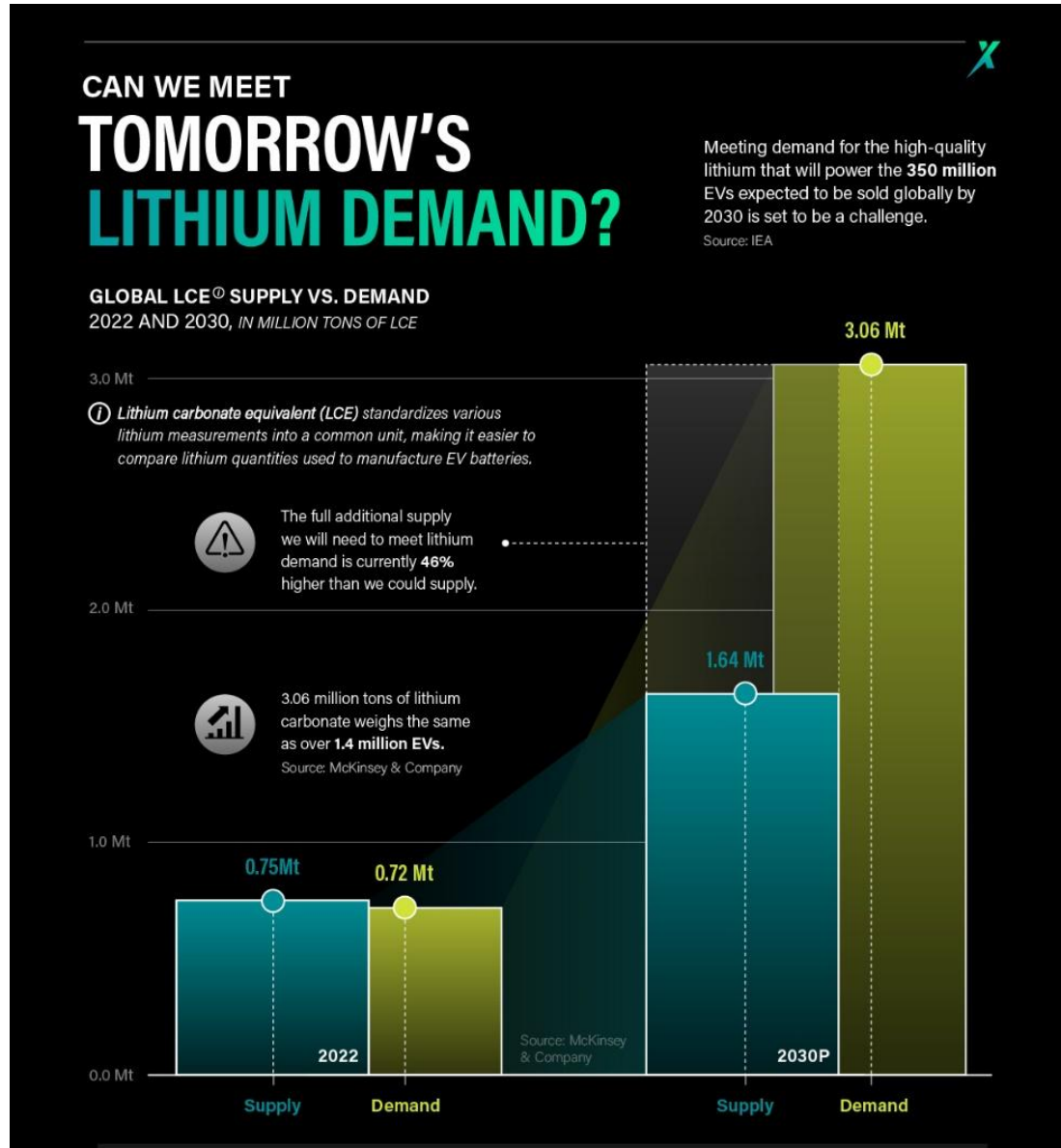


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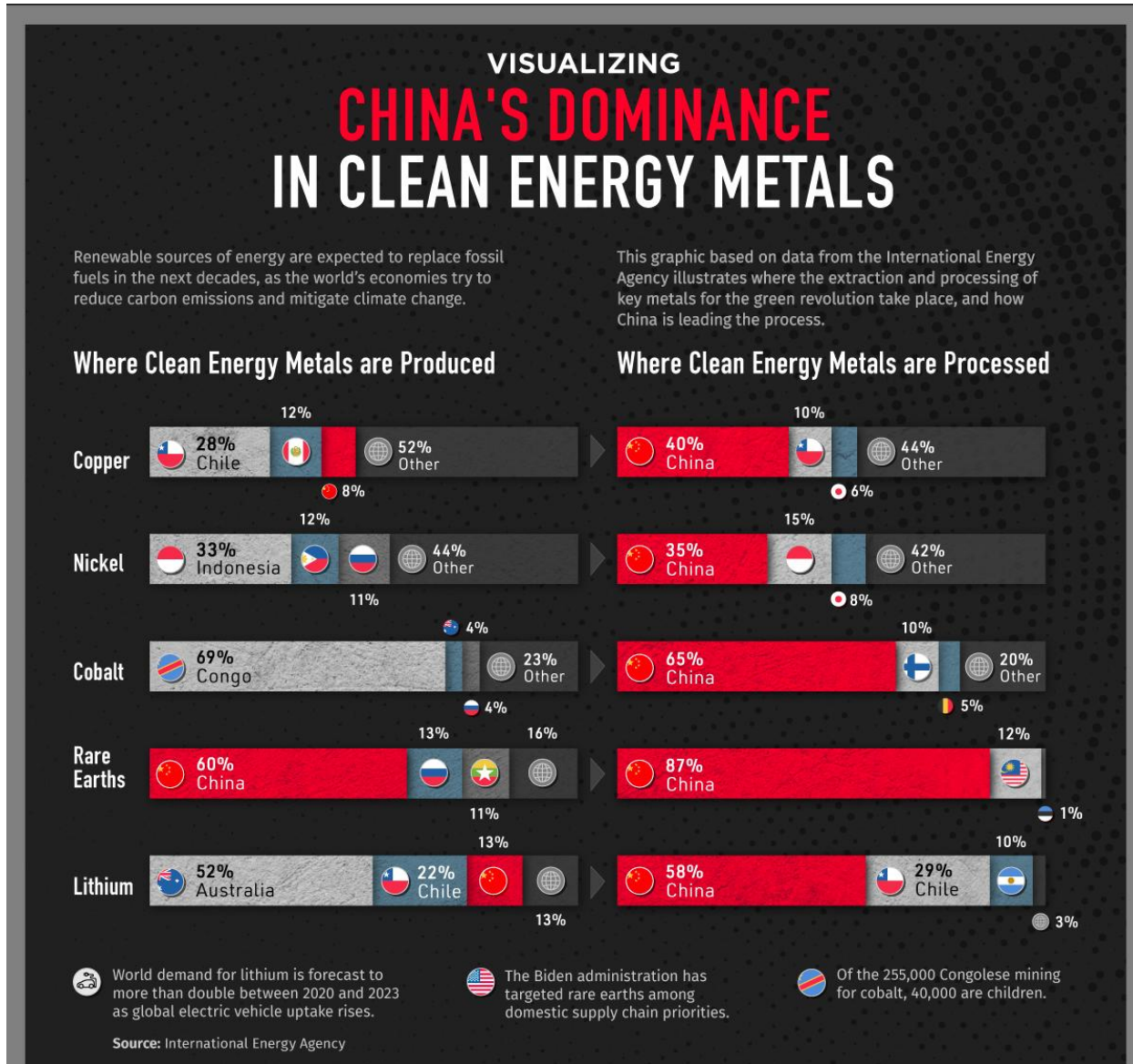
Notes: LCE = lithium carbonate equivalent. Assessment based on LME Lithium Carbonate Global Average, LME Nickel Cash, LME Cobalt Cash and LME Copper Grade A Cash prices (nominal).

Source: IEA analysis based on S&P Global.

# Gelecekteki Lithium Talebi

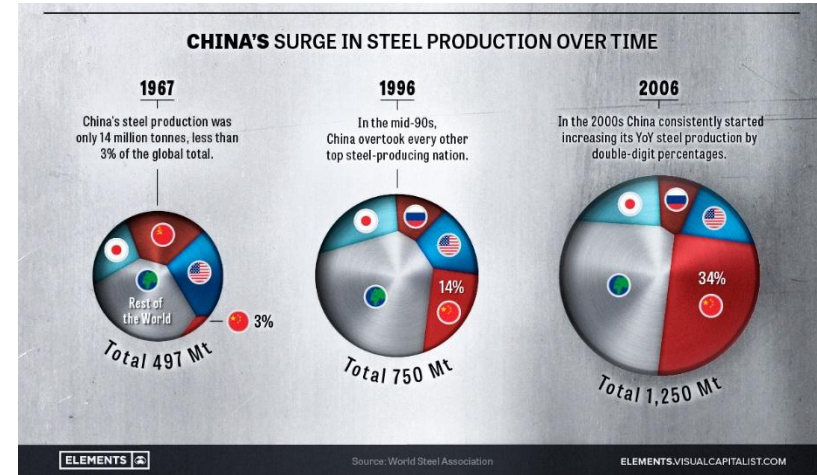
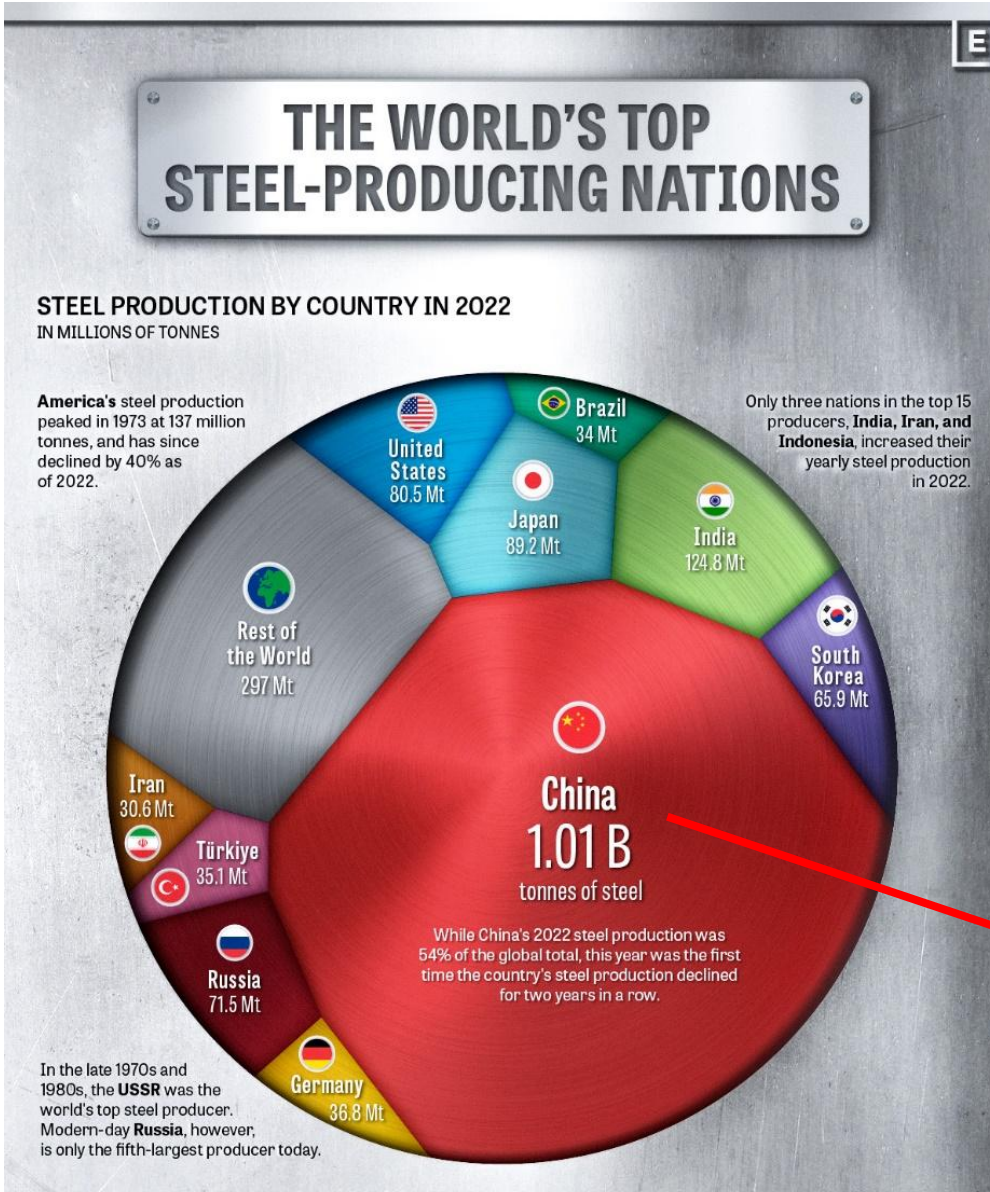


# Yenilenebilir Enerji Teknolojilerinde Kullanılan Bazı Metallerin Kaynak Ülkeleri ve Proses Edildikleri Ülkeler



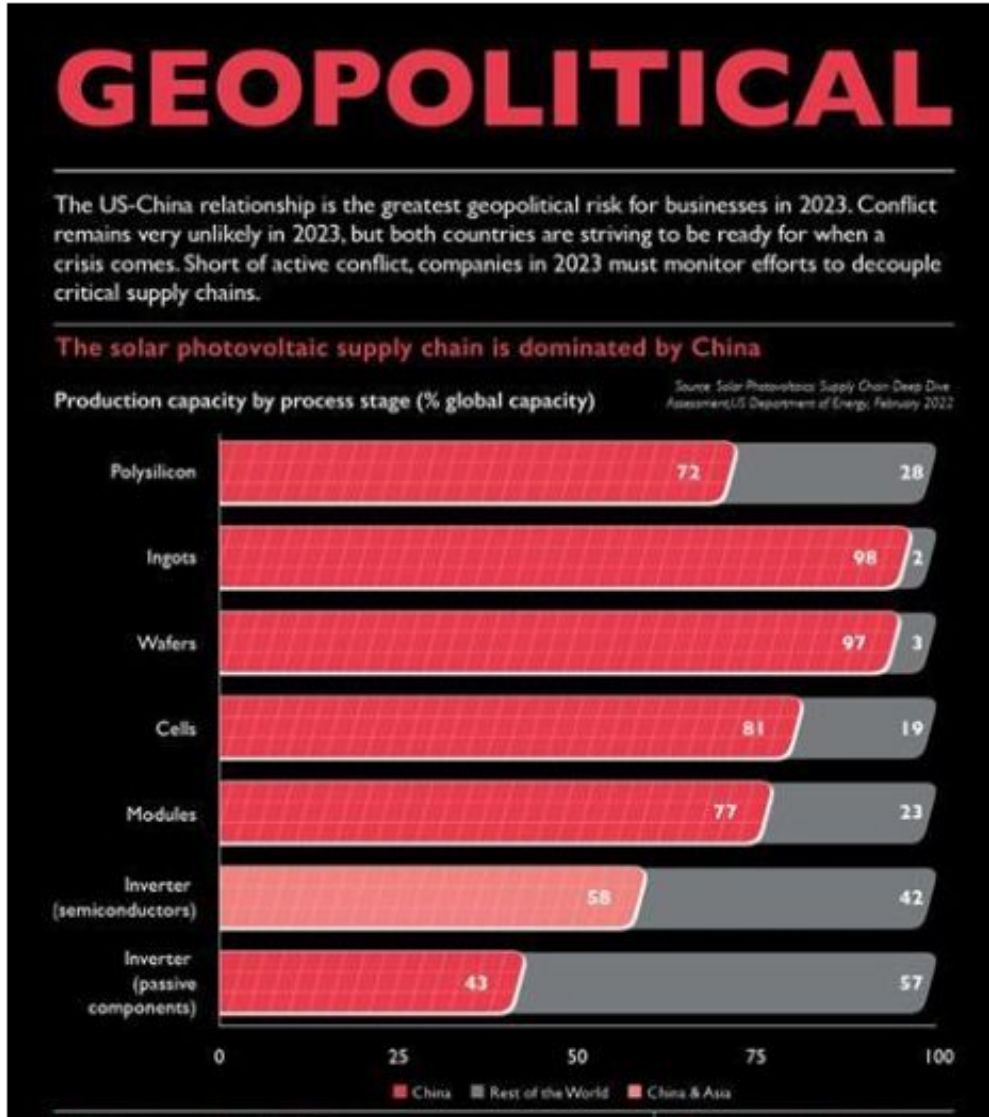


# Küresel Çelik Üretimi Tedarik Zinciri



**% 54**

# PV Güneş Enerjisi Teknolojileri Tedarik Zinciri



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