

Küresel İklim Değişikliği: Malzeme Etkinliğinin Rolü

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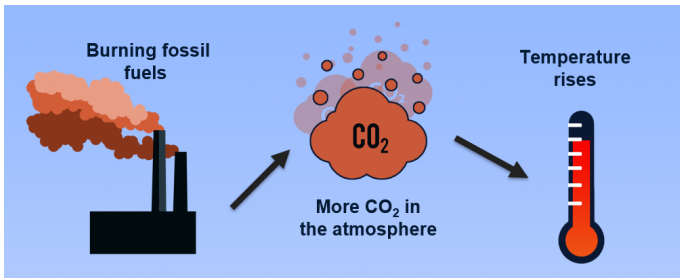
Haziran 7, 2022

İçerik

- 1 Nedenleri
- 2 Etkiler
- 3 Çözümler
- 4 Malzeme
- 5 Proje

İklim Değişikliği!

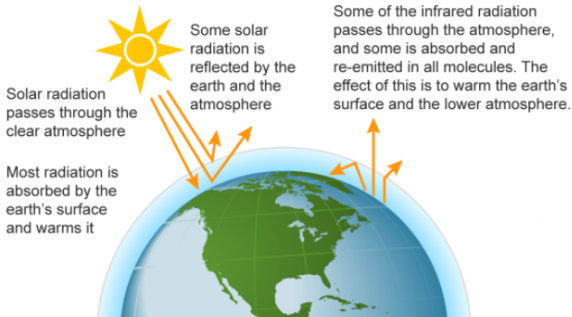
Şekil 1 İklim Değişikliği



- **Weather:** conditions like rain, temperature over hours to days
- **Climate:** average weather conditions over a long period of time

Sera Gazı Etkisi

Şekil 2 Sera Gazı Etkisi



- Nitrogen (78) + Oxygen (21)= 99
- CO₂, N₂O, and methane=greenhouse gases

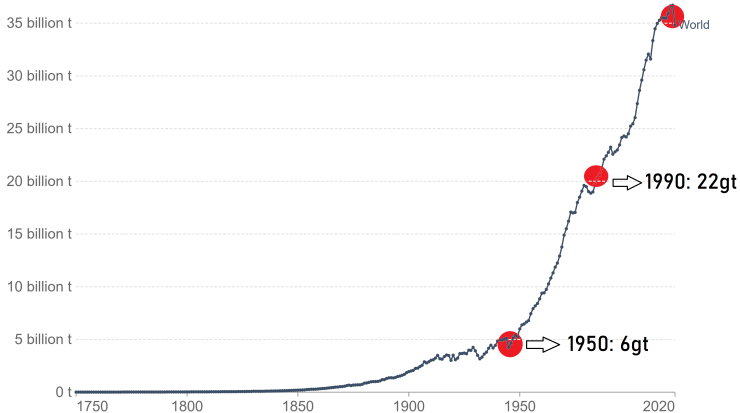
CO2 Emisyonları

Şekil 3 Yıllık CO2 Emisyonları

Annual CO₂ emissions

Carbon dioxide (CO₂) emissions from the burning of fossil fuels for energy and cement production. Land use change is not included.

Our World
in Data

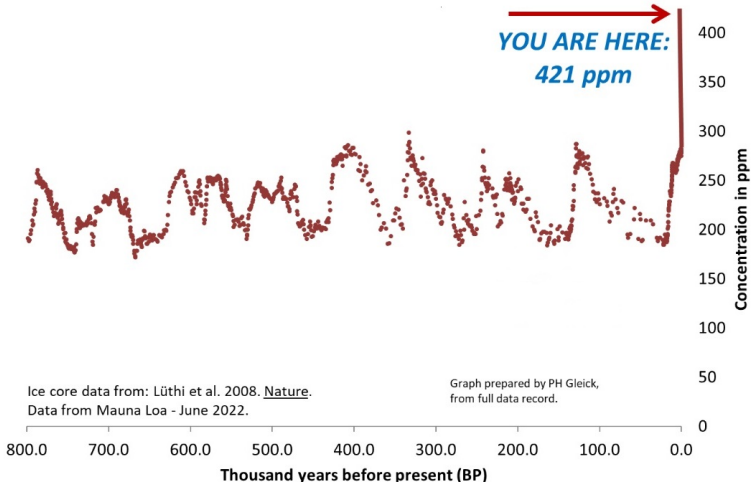


Source: Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

CO2 Yoğunlaşması

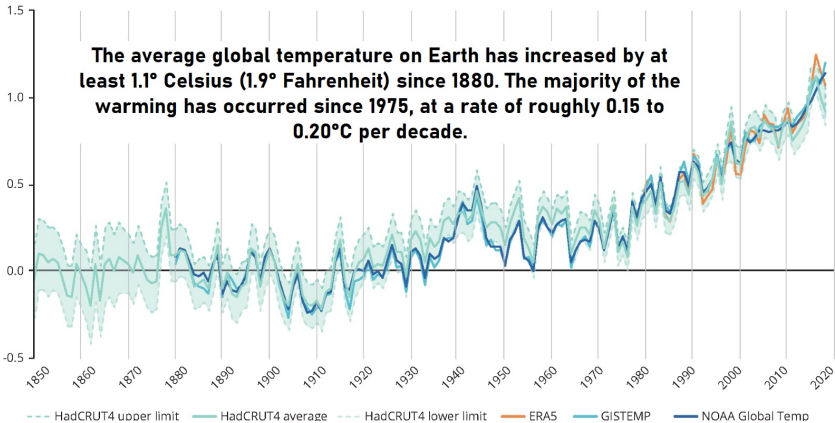
Şekil 4 CO2 Yoğunlaşması



Küresel Ortalama Sıcaklık

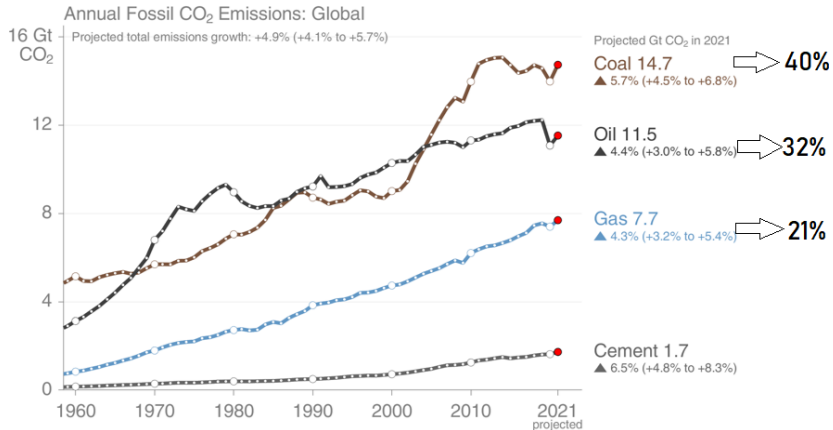
Şekil 5 Küresel Ortalama Sıcaklık

Annual average °C



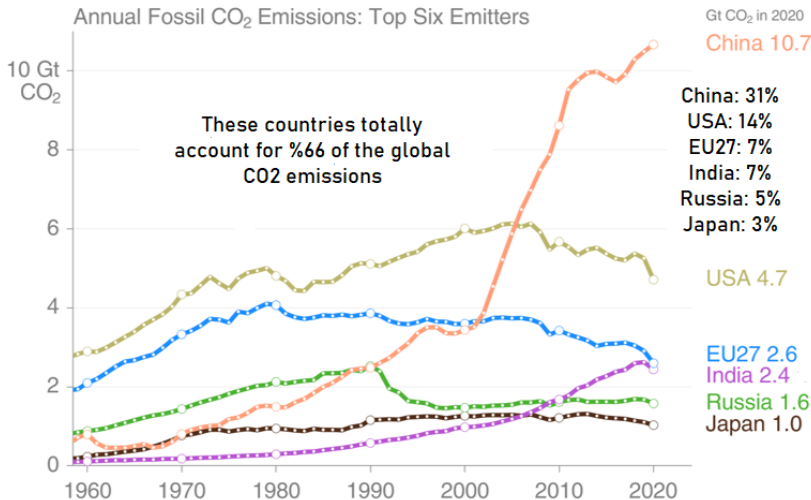
Kömür, Petrol ve Doğalgaz

Şekil 6 Kömür, Petrol ve Doğalgaz



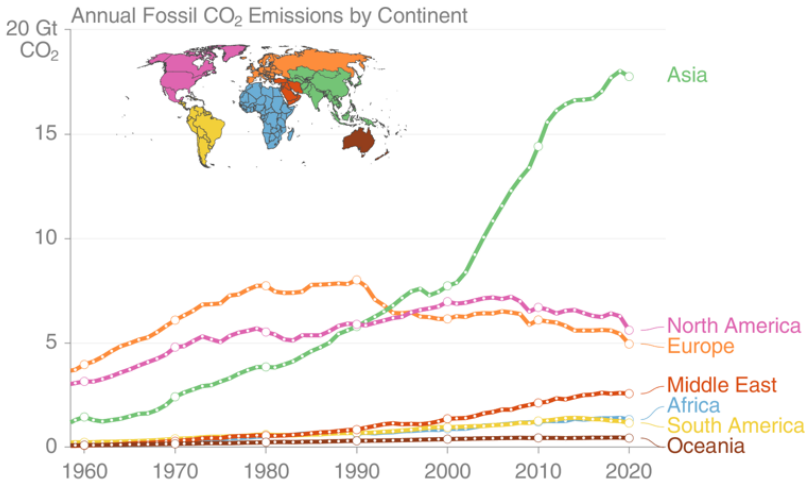
Çin, ABD, AB, Rusya ve Hindistan...

Şekil 7 Ülkelere Göre CO2 Emisyonları



Bölgelere Göre CO2 Emisyonları

Şekil 8 Bölgelere Göre CO2 Emisyonları

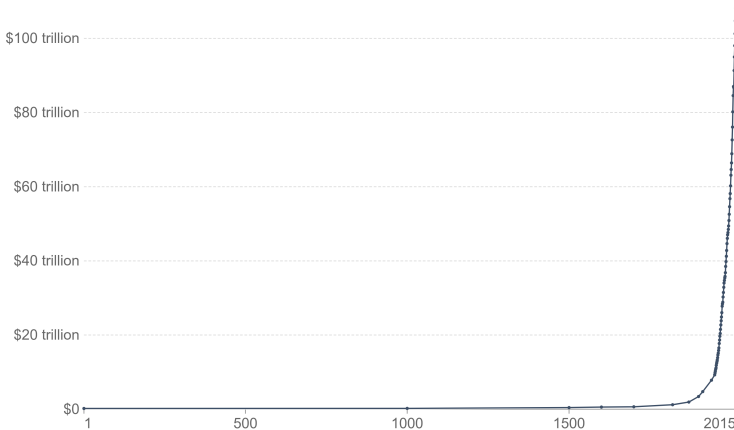


Dünya Üretimi

Şekil 9 Dünya Gayri Safi Yurtiçi Hasılası

World GDP over the last two millennia

Total output of the world economy; adjusted for inflation and expressed in international-\$ in 2011 prices.



Source: World GDP - Our World In Data based on World Bank & Maddison (2017)

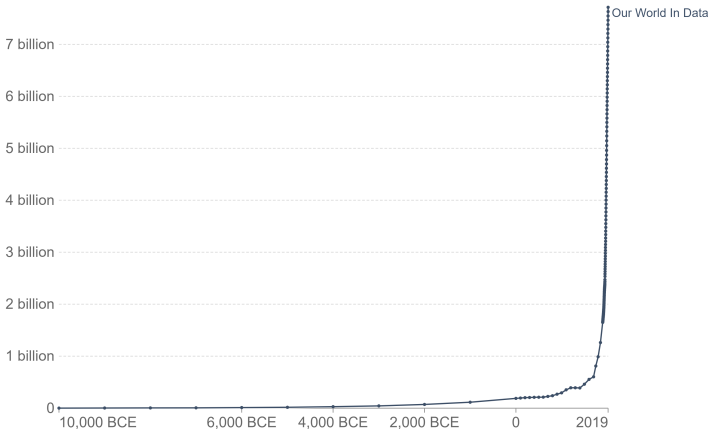
OurWorldInData.org/economic-growth • CC BY

Dünya Nüfusu

Şekil 10 Dünya Nüfusu

Historical world population: comparison of different sources

This chart compares estimates of the world population published by different sources.



Source: World Population over 12000 years - various sources (2019)

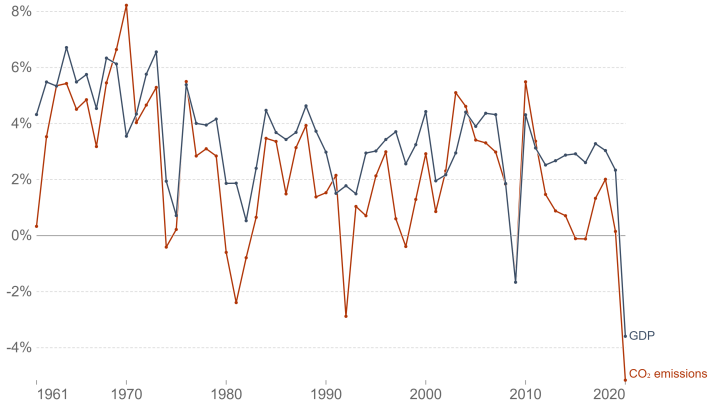
OurWorldInData.org/world-population-growth/ • CC BY

GDP ve CO2 Emisyonları

Şekil 11 GDP ve Emisyonlardaki Yıllık Büyüme

Annual growth in GDP and CO₂ emissions, World

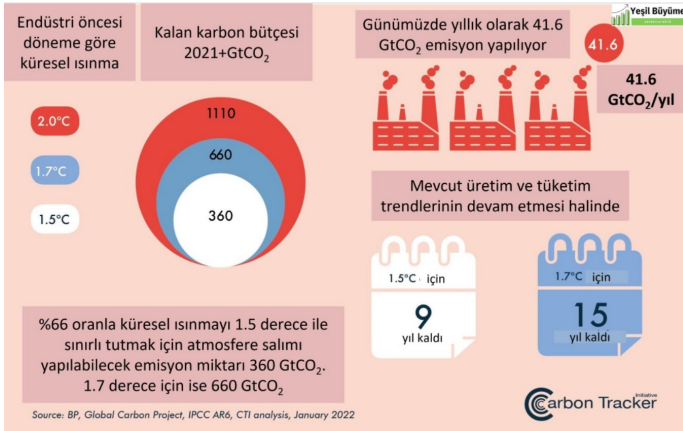
Annual percentage change in total gross domestic product (GDP) and annual carbon dioxide (CO₂) emissions.



Source: World Bank and OECD, Our World in Data based on the Global Carbon Project
Note: GDP is measured in constant 2010 dollars, and therefore adjusts for inflation.
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

1.5°C?

Şekil 12 Kalan Karbon Bütçesi



Etkiler!

Şekil 13 İklim Değişikliğinin Etkileri



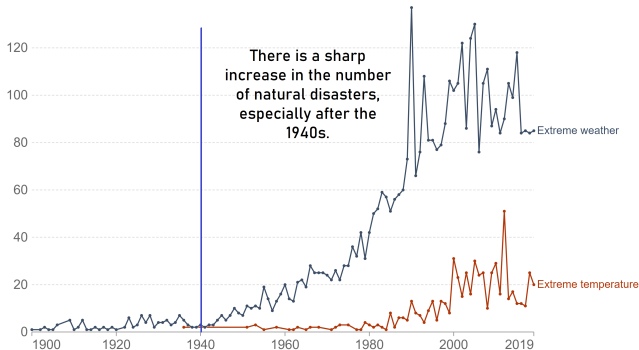
Doğal Afetler I

Şekil 14 Doğal Afetlerin Sayısı

Number of recorded natural disaster events, 1900 to 2019

The number of global reported natural disaster events in any given year. This includes those from drought, floods, extreme weather, extreme temperature, landslides, dry mass movements, wildfires, volcanic activity and earthquakes.

Our World
in Data



Source: EMDAT (2020): OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium
OurWorldInData.org/natural-disasters • CC BY

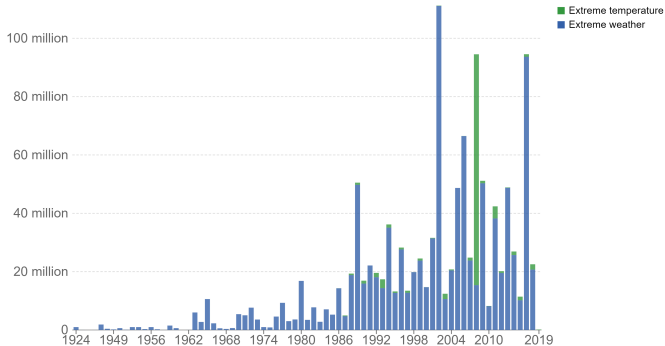
Doğal Afetler II

Şekil 15 Doğal Afetlerden Etkilenen İnsan Sayısı

Number of people affected by natural disasters, 1924 to 2019

Global number of people affected by natural disasters. This is defined as "people requiring immediate assistance during a period of emergency, i.e. requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance."

Our World
in Data



Source: EMDAT (2020): OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium
OurWorldInData.org/natural-disasters • CC BY

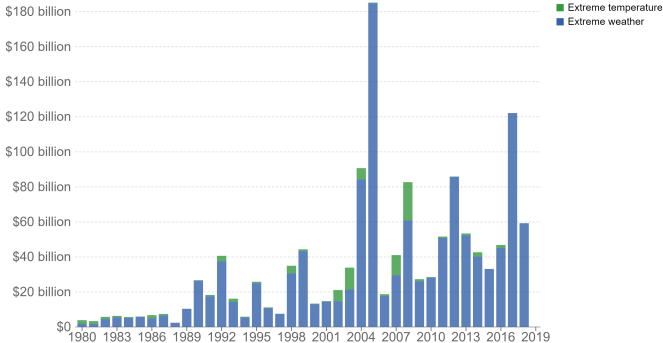
Doğal Afetler III

Şekil 16 Doğal Afetler Kaynaklı Küresel Zarar

Global damage costs from natural disasters, 1980 to 2019

Total economic cost of damages as a result of global natural disasters in any given year, measured in current US\$. Includes those from drought, floods, extreme weather, extreme temperature, landslides, dry mass movements, wildfires, volcanic activity and earthquakes.

Our World
in Data



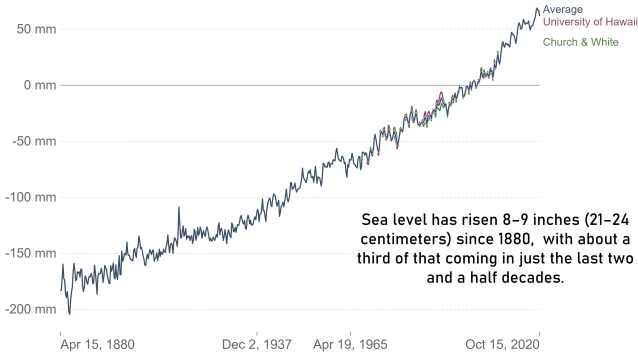
Source: EMDAT: OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium
OurWorldInData.org/natural-disasters • CC BY

Denizler

Şekil 18 Deniz Seviyesi Yüksekliği

Sea level rise

Global mean sea level rise is measured relative to the 1993 - 2008 average sea level. This is shown as three series: the widely-cited Church & White dataset; the University of Hawaii Sea Level Center (UHLSC); and the average of the two.



Source: National Oceanic and Atmospheric Administration (NOAA)

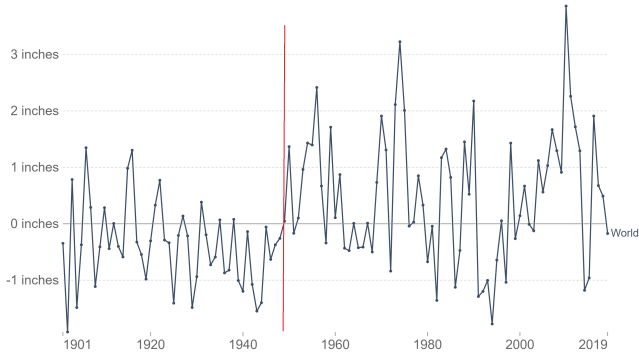
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Yağış

Şekil 20 Küresel Yağış Düzensizliği

Global precipitation anomaly

This indicator shows annual anomalies compared with the average precipitation from 1901 to 2000 based on rainfall and snowfall measurements from land-based weather stations worldwide.



Source: National Oceanic & Atmospheric Administration (NOAA) via the US EPA

OurWorldInData.org/natural-disasters • CC BY

Note: Global anomalies have been determined by dividing the world into a grid, averaging the data for each cell of the grid, and then averaging the grid cells together.

Hayvanlar, Sağlık, ve Tarım...

- Kötüleşen hava kalitesi
- Isı ile ilgili hastalıklarda artış
- Hayvanlar ve besin kaynakları arasındaki uyumsuz zamanlama
- Nesli tükenmeye karşı artan kırılganlık
- Mercan resiflerinde sert düşüş
- Okyanuslar ve buzullar

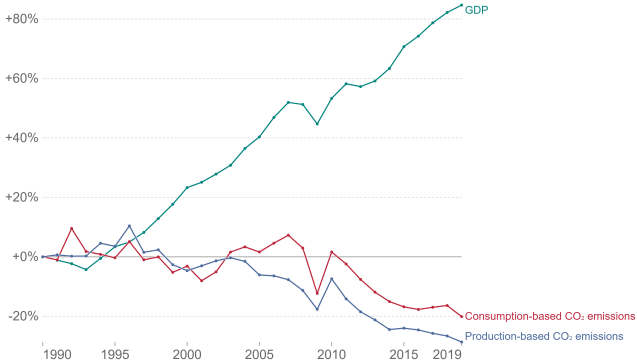
Çözümler!

Şekil 21 Emisyonların Büyümeden Ayrışması

Change in CO₂ emissions and GDP, Sweden

Consumption-based emissions are domestic emissions which have been adjusted for trade. It's production-based emissions minus emissions embedded in exports, plus emissions embedded in imports.

Our World
in Data



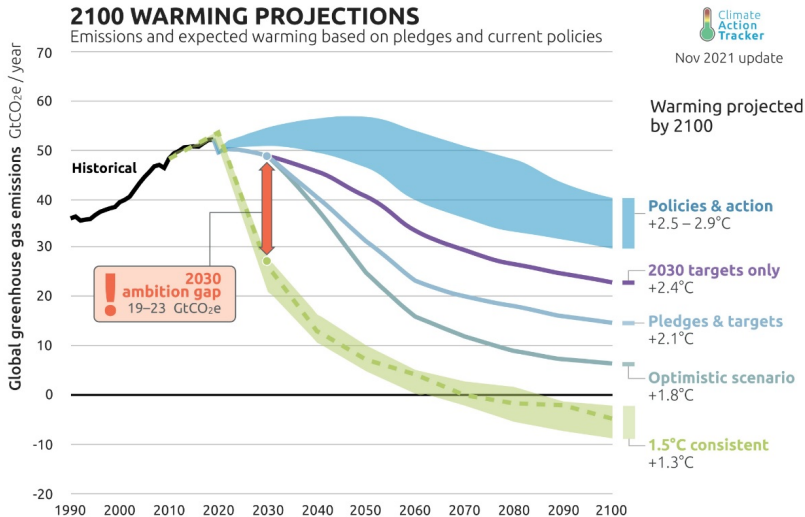
Source: Global Carbon Project; World Bank

Note: Gross Domestic Product (GDP) figures are adjusted for inflation.

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

Senaryolar

Şekil 22 Küresel Emisyon Senaryoları



Net-Sıfır Hedefleri

Şekil 23 Net-Sıfır Hedefleri

Which countries have set a net-zero emissions target?

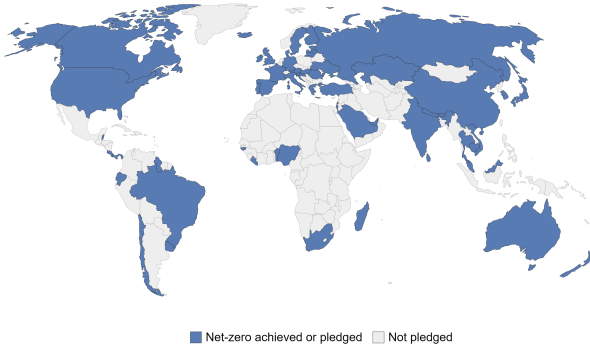
Countries are shown as having a net-zero emissions target if they have: achieved net-zero already; have it written in law; in their policy document or have made a public pledge. The year for which countries have pledged to achieve net-zero varies.

Our World
In Data

At the COP26 in Glasgow in late 2021, 197 parties agreed the Glasgow Climate Pact.

Accordingly, over 90% of the world's greenhouse gas (GHG) emissions are now covered by net-zero commitments.

Besides, 153 countries agree to revisit and strengthen their current emissions reduction targets, known as Nationally Determined Contributions (NDCs).



Source: Net Zero Tracker. Energy and Climate Intelligence Unit, Data-Driven EnviroLab, NewClimate Institute, Oxford Net Zero. Last updated: 2nd November 2021.
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

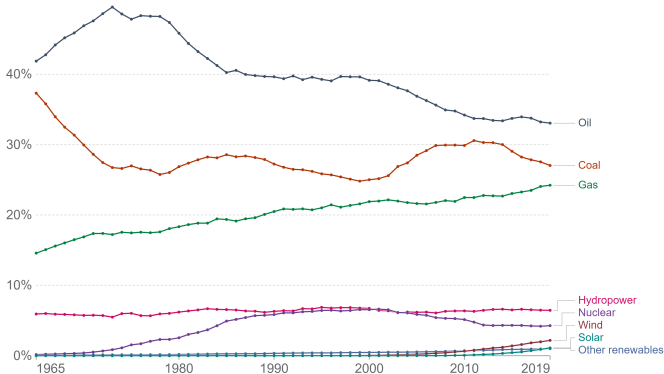
Yenilenebilir Enerji

Şekil 24 Kaynağına Göre CO2 Emisyonları

Share of energy consumption by source, World

To convert from primary direct energy consumption, an inefficiency factor has been applied to fossil fuels (i.e. the 'substitution method').

Our World
in Data



Source: Our World in Data based on BP Statistical Review of World Energy (2020)

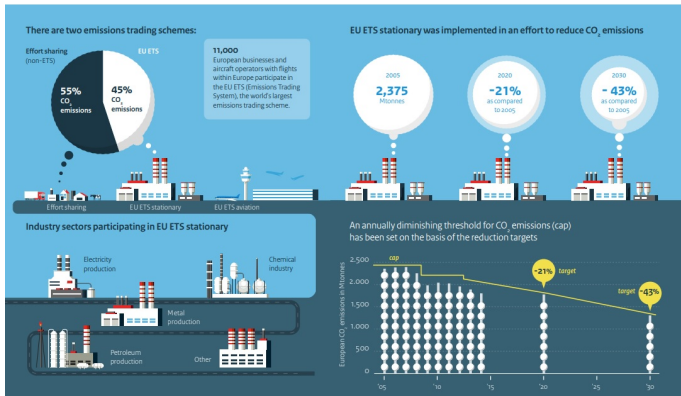
OurWorldInData.org/energy • CC BY

Emisyon Ticareti

Şekil 25 EU-ETS

Emissions trading in the EU

Emissions trading (EU ETS) is a market instrument applied by the EU in an effort to reduce the emission of greenhouse gases and achieve its climate objective.



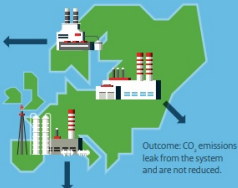
Karbon Kaçağı

Şekil 26 Karbon Kaçağı

Carbon leakage

What is carbon leakage?

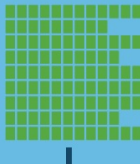
Companies that are incapable of passing on the additional CO₂ costs to their customers relocate their activities and investments to non-EU countries due to their competitive disadvantage to companies outside the EU.



Preventing carbon leakage

Companies that are susceptible to carbon leakage are allocated more free emission allowances than those that are less vulnerable. This mechanism helps reduce the portion of EU ETS participation costs that cannot be passed on and eliminates the incentive to relocate to countries that are not taking part in the EU ETS scheme.

Free emission allowances



The European Commission compiles the list of sectors facing a significant risk of carbon leakage once every five years, and may supplement this list annually.



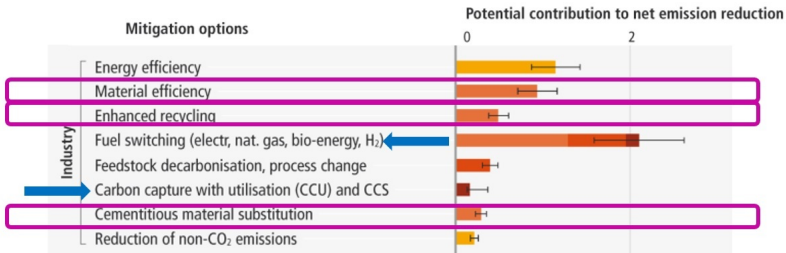
EGD-CBAM

Şekil 27 Sınırdaki Karbon Düzenlemesi



Enerji ve Malzeme Etkinliği I

Şekil 28 Enerji ve Malzeme Etkinliği



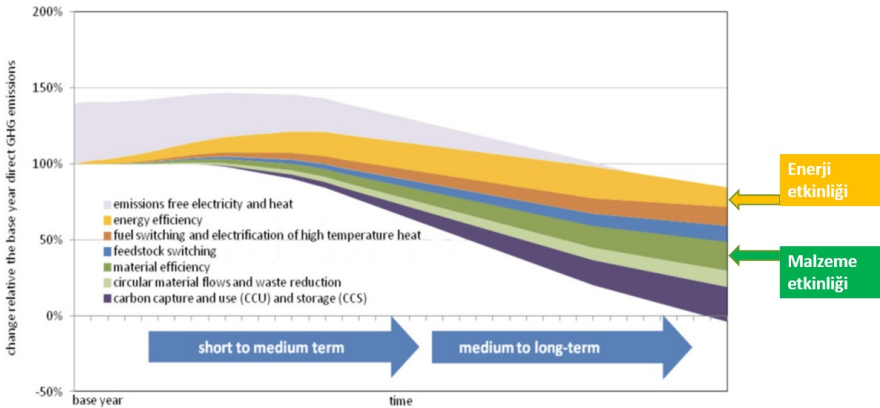
Net lifetime cost of options:

- Costs are lower than the reference
- 0–20 (USD tCO₂-eq⁻¹)
- 20–50 (USD tCO₂-eq⁻¹)
- 50–100 (USD tCO₂-eq⁻¹)
- 100–200 (USD tCO₂-eq⁻¹)
- Cost not allocated due to high variability or lack of data

IPCC (2022)

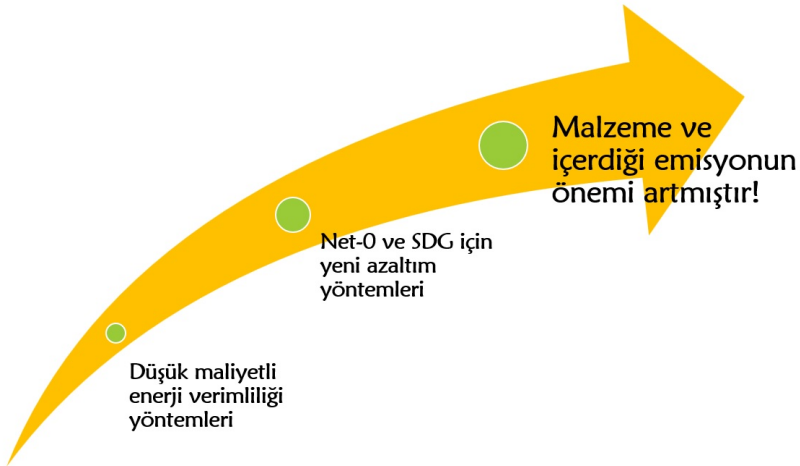
Enerji ve Malzeme Etkinliği II

Şekil 29 Enerji ve Malzeme Etkinliği



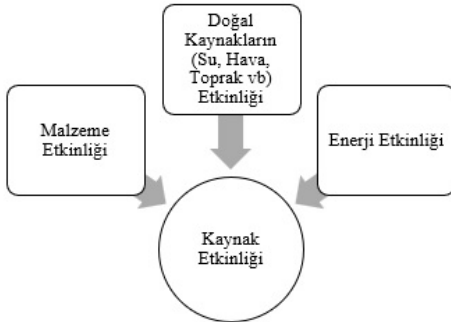
Malzeme Etkinliği

Şekil 30 Enerji ve Malzeme Etkinliği



Kaynak Etkinliği

Şekil 31 Kaynak Etkinliği

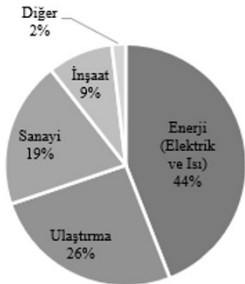


IRP (2020) ve Deckert (2016)

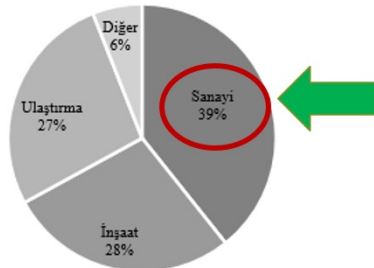
Azaltım Yapılması Zor Sektör: Sanayi I

Şekil 32 Sektörlere Göre Küresel Karbon Emisyonları

(a) Enerji (Elektrik ve Isı) Ayrı Tutulduğunda

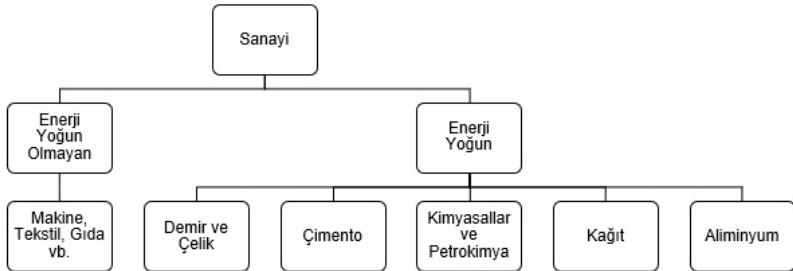


(b) Enerji (Elektrik ve Isı) Diğer Sektörlere Tahsis Edildiğinde



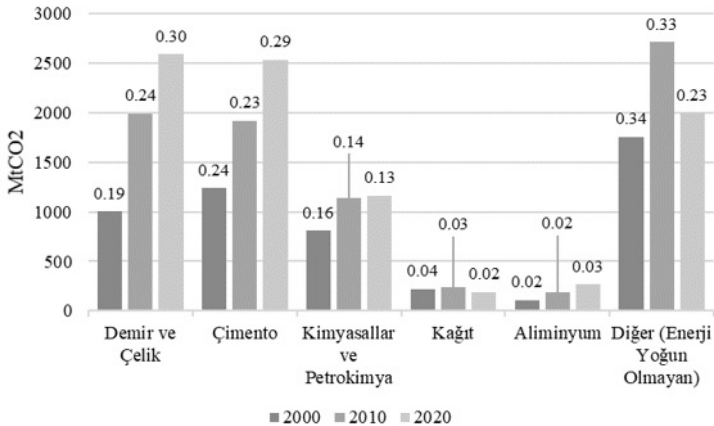
Azaltım Yapılması Zor Sektör: Sanayi II

Şekil 33 Sanayi Alt Sektörleri



Azaltım Yapılması Zor Sektör: Sanayi III

Şekil 34 Sanayi Alt Sektörlerinin Emisyon Miktarları



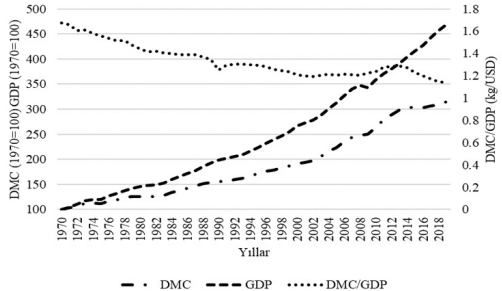
Küresel Malzeme Talebi

Şekil 35 Küresel Malzeme Tüketimi

Küresel DMC, 1970 seviyesinin yaklaşık 3 katına çıktı!



- Malzeme talebindeki bu artışın, **emisyona ilave olarak %43 artırabileceği** öngörülmüyor.
- **Gayri Safi Yurtiçi Hasıla'dan (GSYH) ayrışmasına** (decoupling) fazla katkıda bulunamayan malzemenin etkin kullanımının, azaltım için gelecekte büyük bir potansiyel ortaya koyacağı öngörülmektedir.



Kaynak: IRP (2020) ve Dünya Bankası (2022) kullanılarak yazarlar tarafından oluşturulmuştur.

Gelecekte Ne Bekliyoruz?

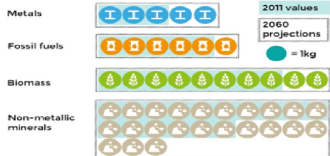
Şekil 36 2060 Projeksiyonları

Materials use increase



	2011	2060
Metals	8Gt	20Gt
Fossil fuels	14Gt	24Gt
Biomass	20Gt	37Gt
Non-metallic minerals	37Gt	86Gt

Materials use per capita per day



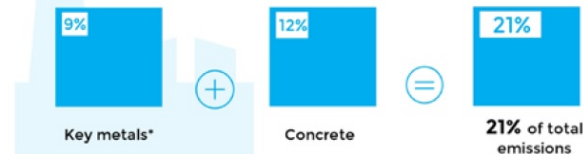
Global changes, 2011-2060



Gelecekte Ne Bekliyoruz?

Şekil 37 Malzeme Kaynaklı Emisyonlar

Greenhouse gas emissions in 2060 from materials extraction and processing



*The key metals are Al, Cu, Fe, Mn, Ni, Pb, Zn



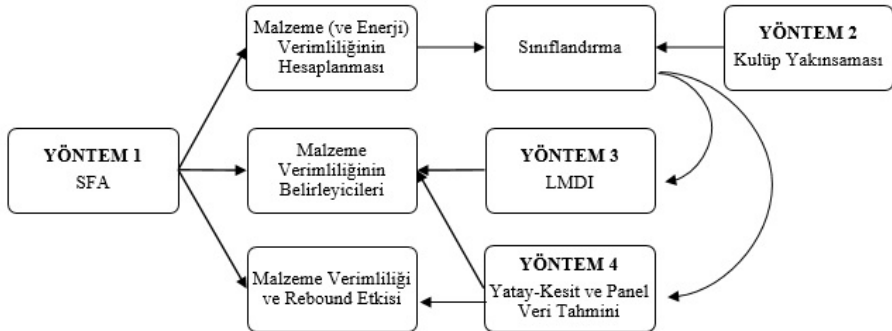
Primary **copper** and primary **nickel** have the highest *cradle-to-gate* environmental impacts per kg

TUBİTAK-1001

- Proje Başlığı
 - ▶ Malzeme Talebi ve Malzeme Verimliliğinin Sürdürülebilirlik Açısından Analizi: Ülkeler Arası Karşılaştırmalı bir Analiz ve Türkiye için Değerlendirmeler
- Amaç
 - ▶ Malzeme Talebi ve Etkinliği
 - ▶ Rebound Etkisi
 - ▶ Enerji Talebi ve Etkinliği İle İlişkisi
- Ekip
 - ▶ Yürütücü: Prof. Dr. Etem Karakaya
 - ▶ Araştırmacı: Dr. Burcu Hiçyılmaz
 - ▶ Araştırmacı: Dr. Sedat Alataş
 - ▶ Bursiyer: Tuğba Akdoğan
 - ▶ Bursiyer: Elif Erkara
 - ▶ Bursiyer: Betül Mert
- Süre
 - ▶ 18 ay (15.04.2022-15.10.2023)

Proje Yöntem

Şekil 38 Proje Yöntem



Teşekkürler!

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