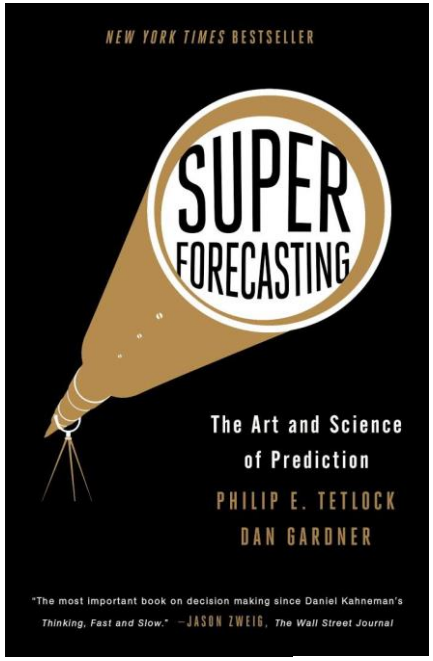
Enerji 101 – Ders 6

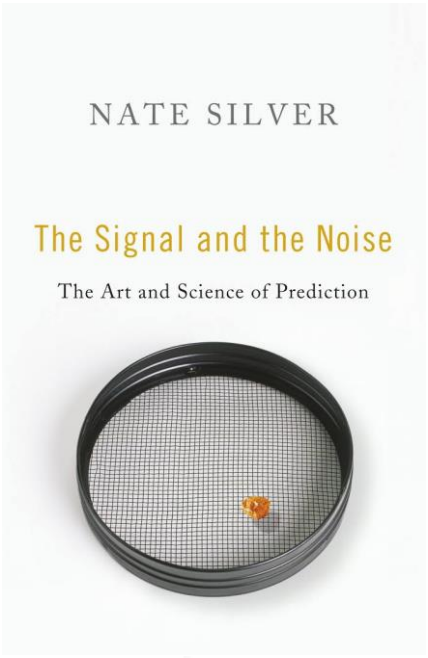
Enerji Projeksiyonları ve Gelecek Tartışmaları

Barış Sanlı

Gelecek

Tüm modeller yanlıştır, bazıları kullanışlıdır





Thoughts for the 2001 Quadrennial Defense Review

CF: An

- If you had been a security policy-maker in the world's greatest power in 1900, you would have been a Brit, looking warily at your age-old enemy, France.
- By 1910, you would be allied with France and your enemy would be Germany.
- By 1920, World War I would have been fought and won, and you'd be engaged in a naval arms race with your erstwhile allies, the U.S. and Japan.
- By 1930, naval arms limitation treaties were in effect, the Great Depression was underway, and the defense planning standard said "no war for ten years."
- Nine years later World War II had begun.
- By 1950, Britain no longer was the world's greatest power, the Atomic Age had dawned, and a "police action" was underway in Korea.
- Ten years later the political focus was on the "missile gap," the strategic paradigm was shifting from massive retaliation to flexible response, and few people had heard of Vietnam.
- By 1970, the peak of our involvement in Vietnam had come and gone, we were beginning détente with the Soviets, and we were anointing the Shah as our protégé in the Gulf region.
- By 1980, the Soviets were in Afghanistan, Iran was in the throes of revolution, there was talk of our "hollow forces" and a "window of vulnerability," and the U.S. was the greatest creditor nation the world had ever seen.
- By 1990, the Soviet Union was within a year of dissolution, American forces in the Desert were on the verge of showing they were anything but hollow, the U.S. had become the greatest debtor nation the world had ever known, and almost no one had heard of the internet.
- Ten years later, Warsaw was the capital of a NATO nation, asymmetric threats transcended geography, and the parallel revolutions of information, biotechnology, robotics, nanotechnology, and high density energy sources foreshadowed changes almost beyond forecasting.
- All of which is to say that I'm not sure what 2010 will look like, but I'm sure that it will be very little like we expect, so we should plan accordingly.

Certified As Unclassified
January 5 2009
IAW EO 12958, as amended
Chief, RDD, ESD, WHS

Lin Wells

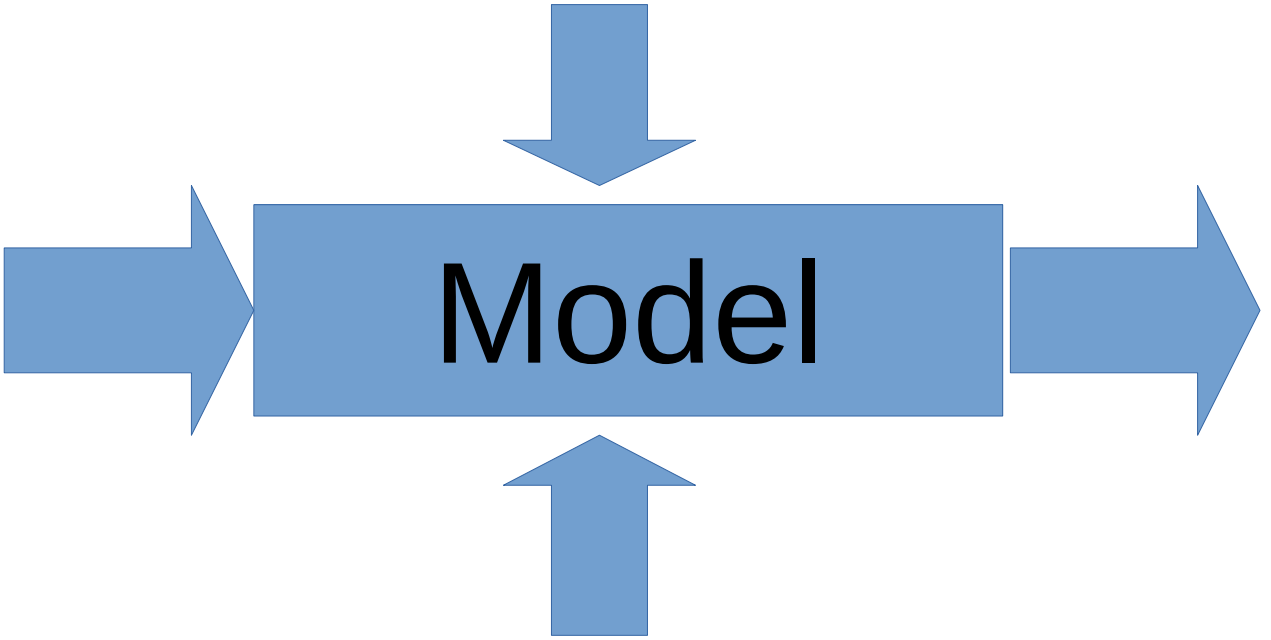
https://library.rumsfeld.com/doclib/sp/2382/2001-04-12%20To%20George%20W%20Bush%20et%20al%20re%20Predicting%20the%20Future.pdf

Talep

Senaryolar

Kabuller

Ekonomik büyüme
Nüfus
Fiyat tahminleri



Çıktılar

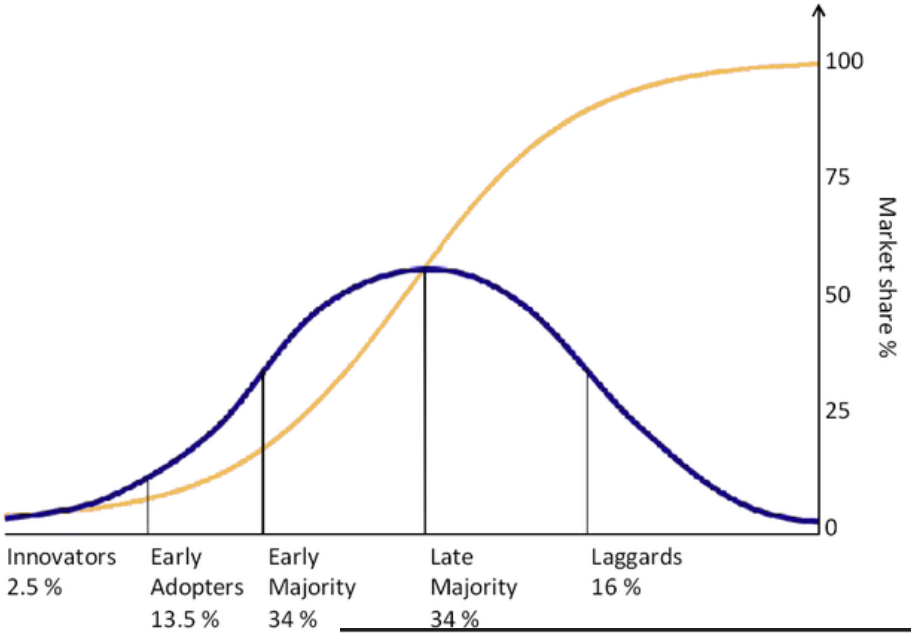
İlişkiler, Fonksiyonlar, Esneklikler

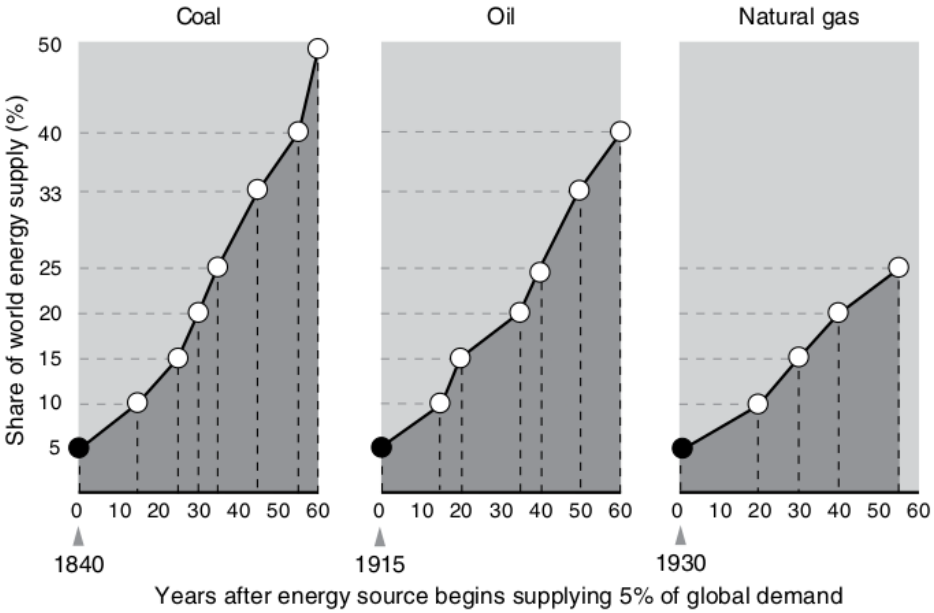
Onlarca farklı kurgu mümkün

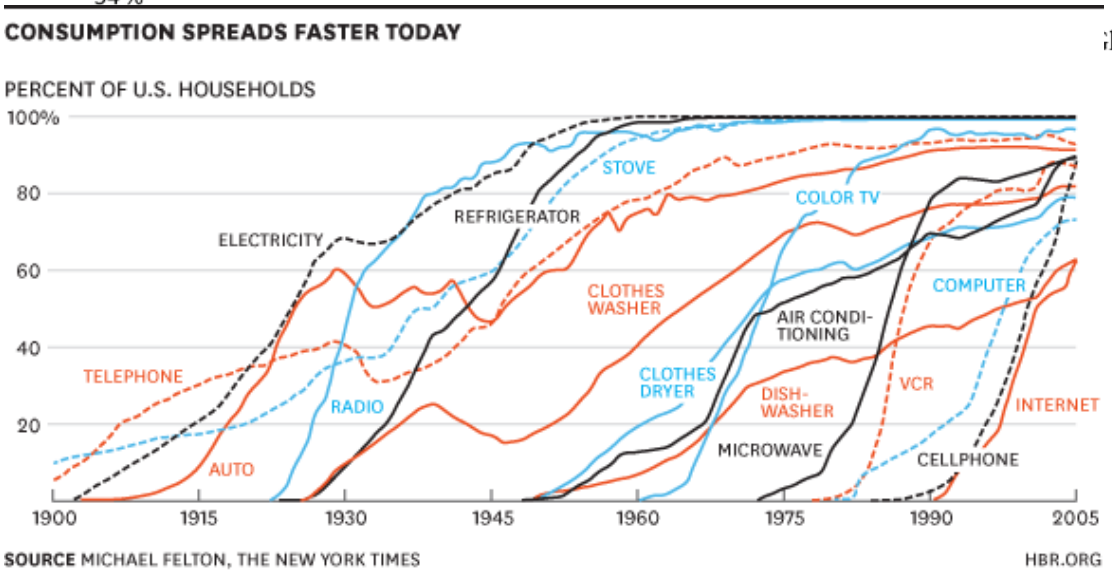
- Bir çok “Enerji Talebi” model kurgusu
  - Kişi başı enerji talebi
  - $ GDP başına enerji talebi
  - Alt sektörler bazında enerji talebi
- Birden çok farklı sonuç. Mesela konutlarda
  - %100 kömür
  - %100 doğalgaz
  - %100 elektrik
  - %100 yenilenebilir

Hepsi Farklı Sonuç Verir

Bu talebe cevap verecek arz







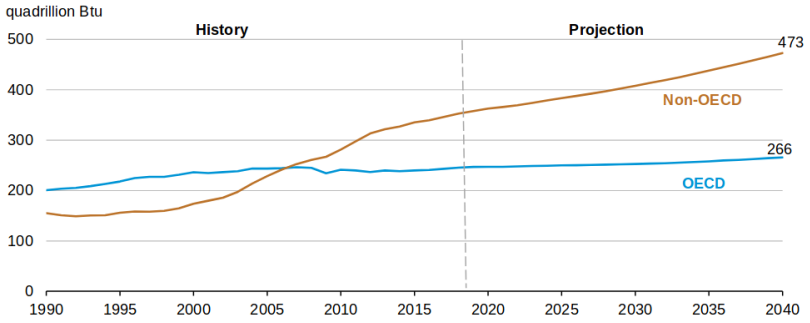
global fuel transitions.

http://www.foresightguide.com/logistic-growth-s-curves/, Natural Gas: Fuel for 21st Century, Vaclav Smil

Amaçlar da önemli

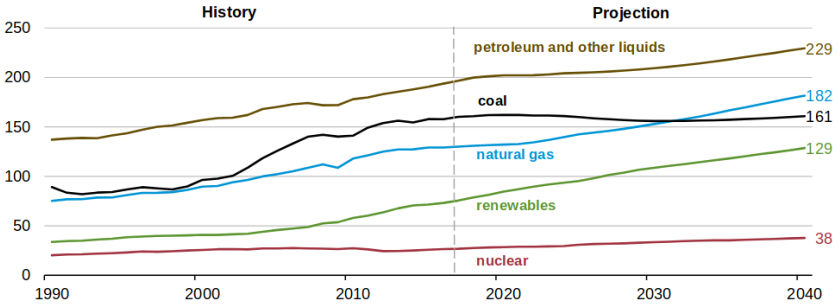
- Devlet – EIA
  - International Energy Outlook
- Uluslararası Kurumlar – IEA, IRENA
  - Future of /* Outlook (Oil, Petrochemical
- Petrol şirketleri
  - BP, Shell,Equinor, ExxonMobil
- Danışman/ticari
  - WoodMackenzie, BNEF

EIA International Energy Outlook



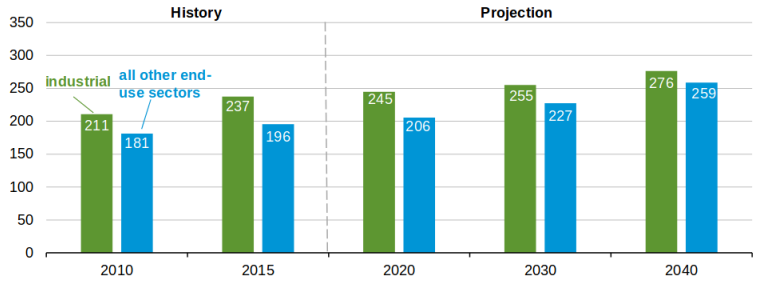
Source: EIA, International Energy Outlook 2018

IEO2018 Reference case
world energy consumption by energy source
quadrillion Btu



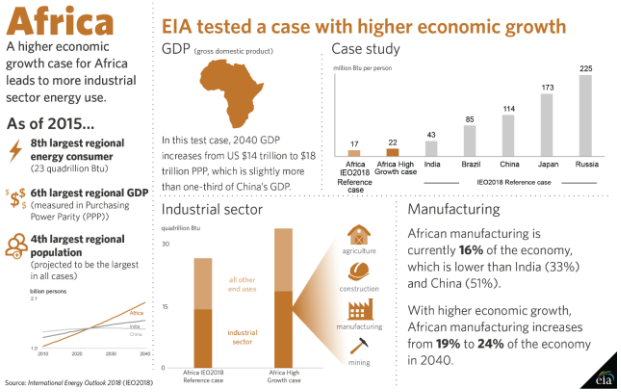
Source: EIA, International Energy Outlook 2018

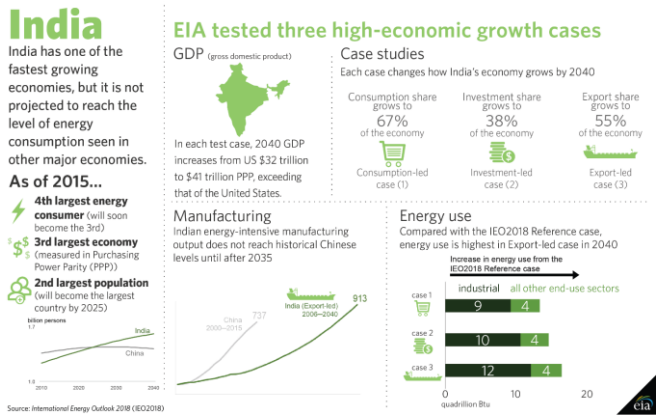
IEO2018 Reference case
world delivered energy consumption in the industrial and all other end-use sectors
quadrillion Btu

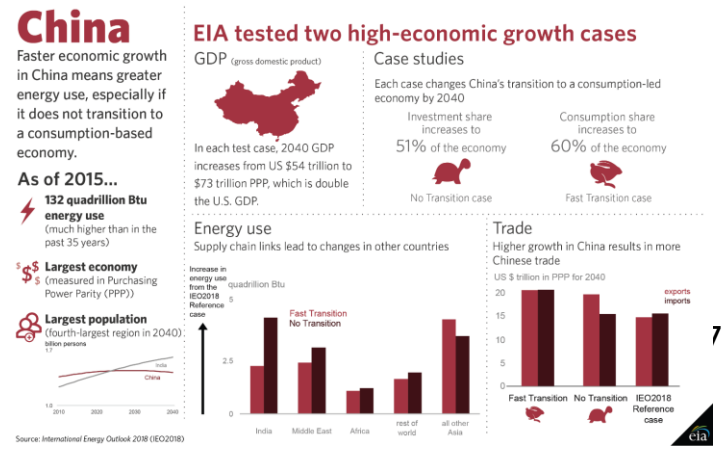


Source: EIA, International Energy Outlook 2018

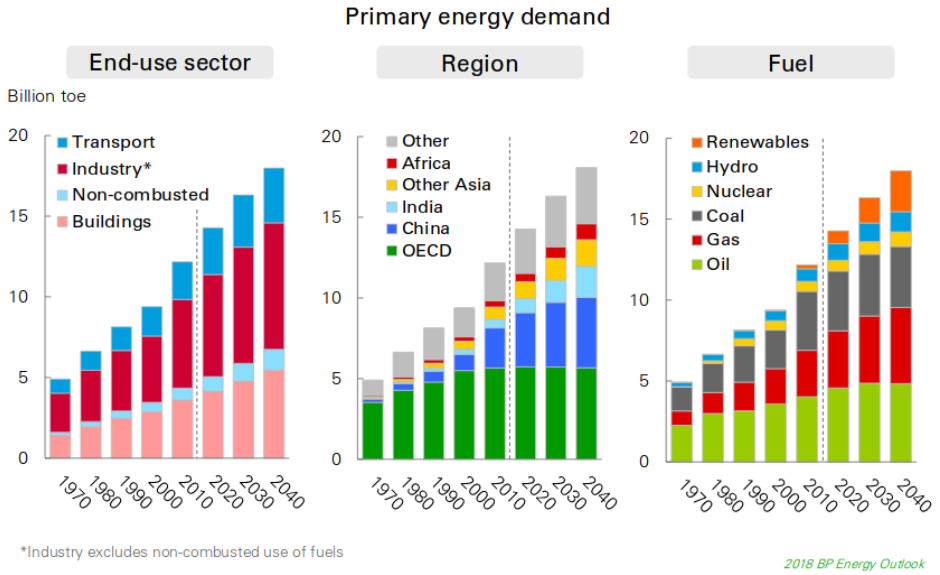
https://www.eia.gov/outlooks/ieo/

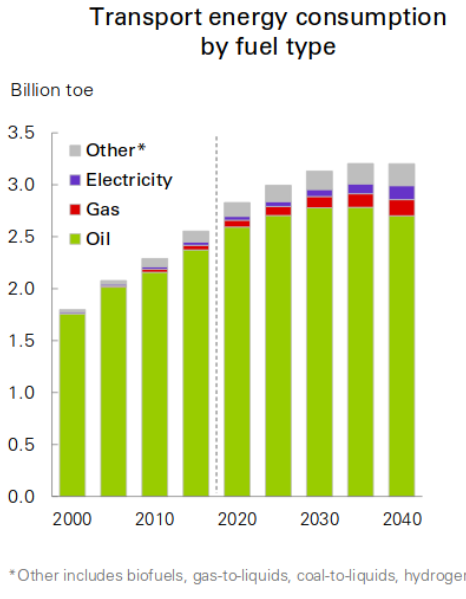


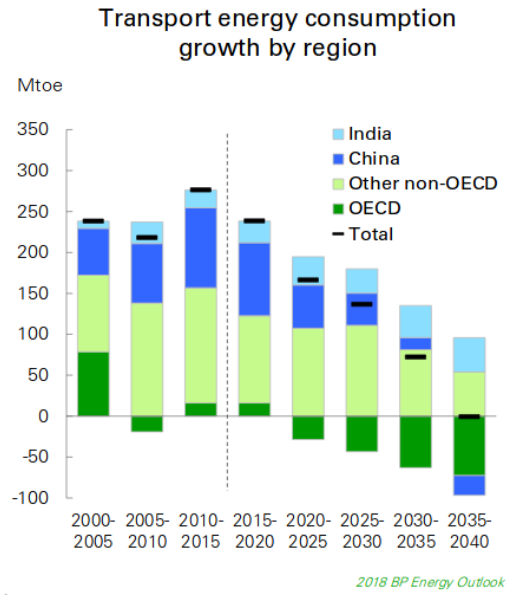


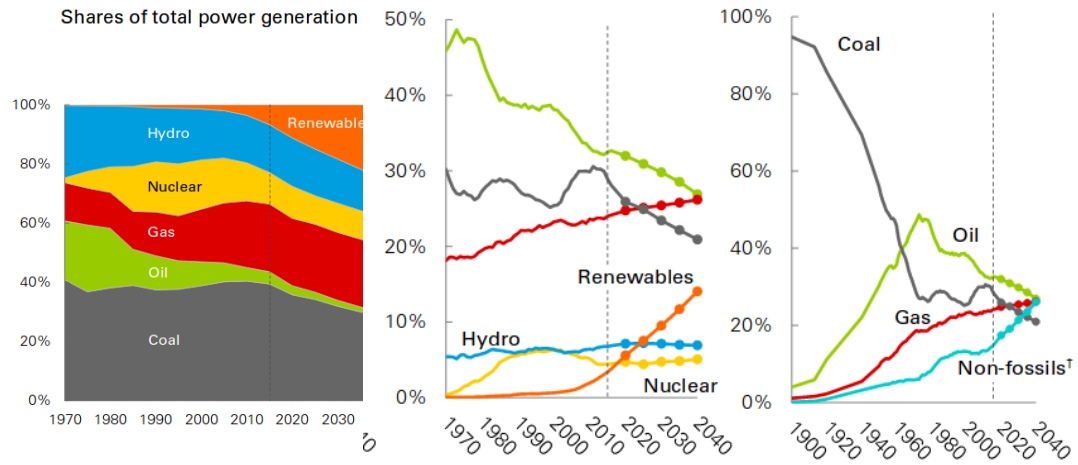


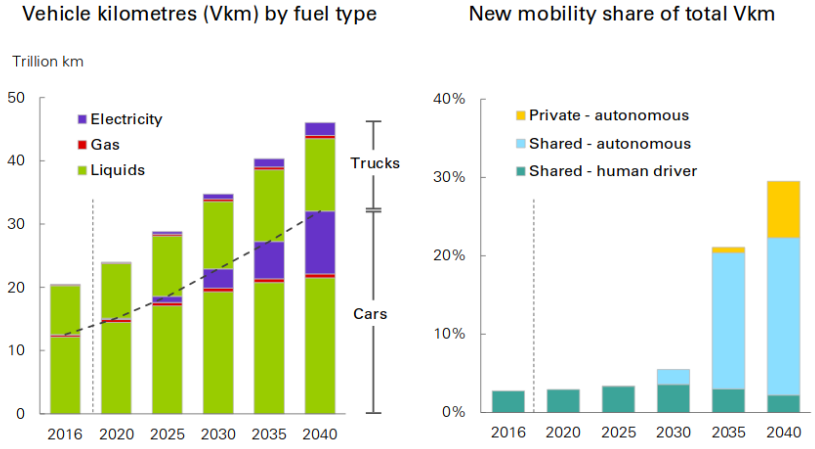
BP Energy Outlook







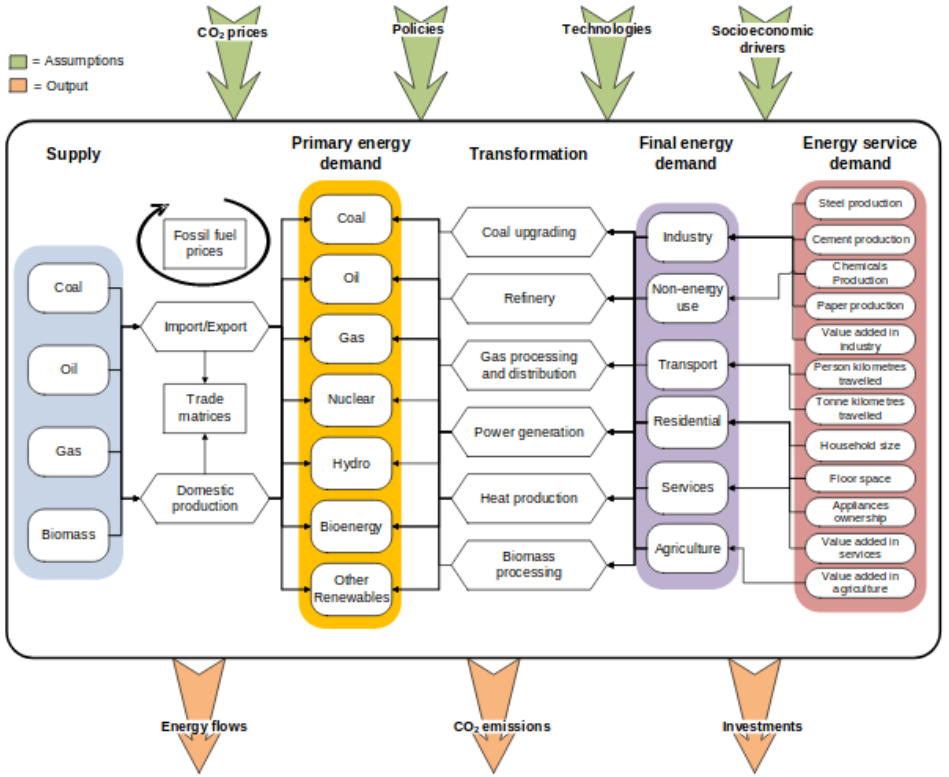


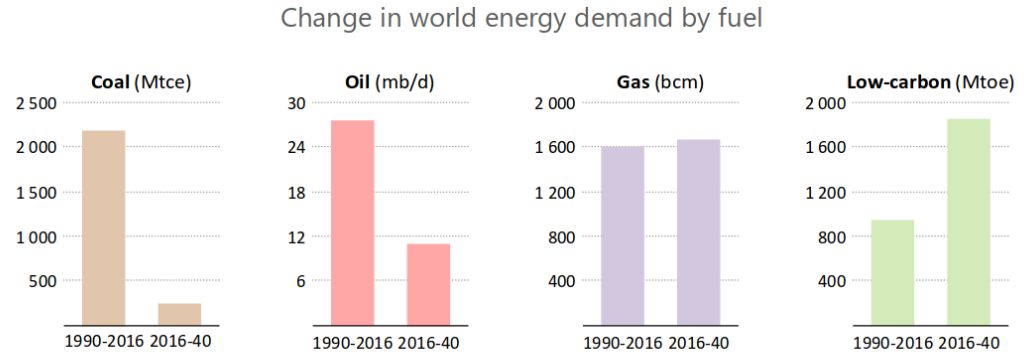


https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/energy-outlook/bp-energy-outlook-2018.pdf

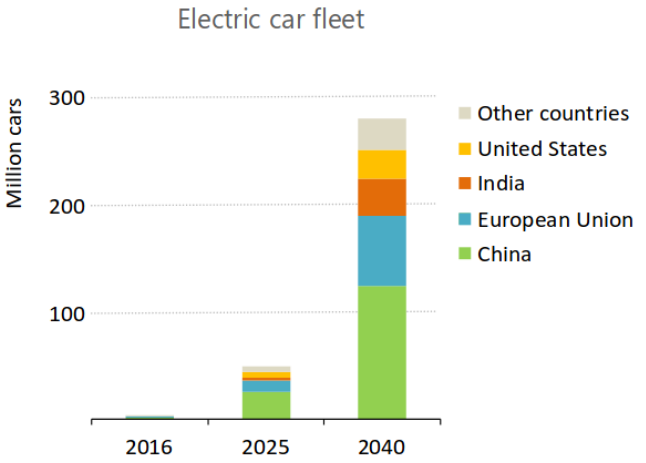
IEA World Energy Outlook

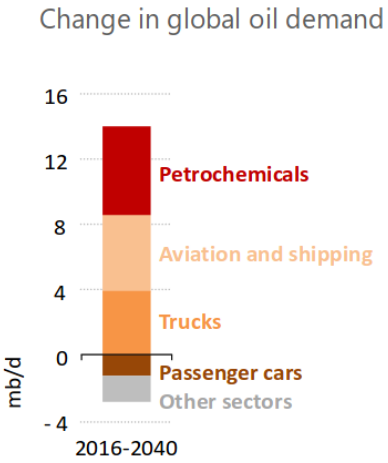
Figure 1: World Energy Model Overview





Low-carbon sources & natural gas meet 85% of the increase in global demand:





https://www.iea.org/media/weowebsite/2017/WEM_Documentation_WEO2017.pdf

IEA Future of Cooling

Map 2.1 • CDDs across the world, mean annual average 2007-17

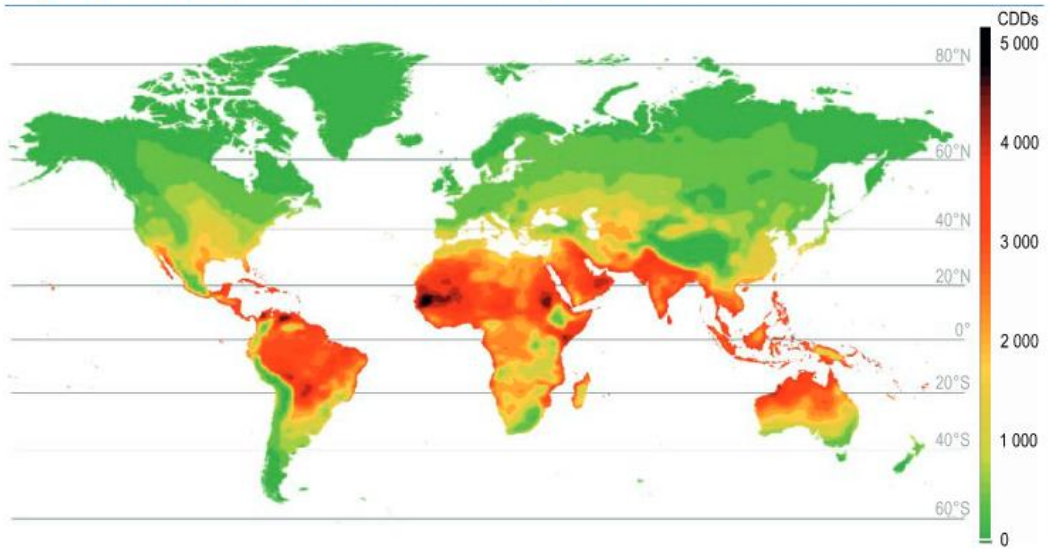
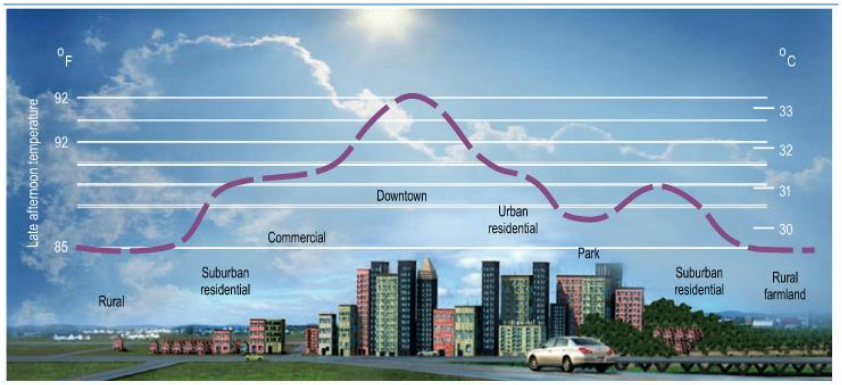


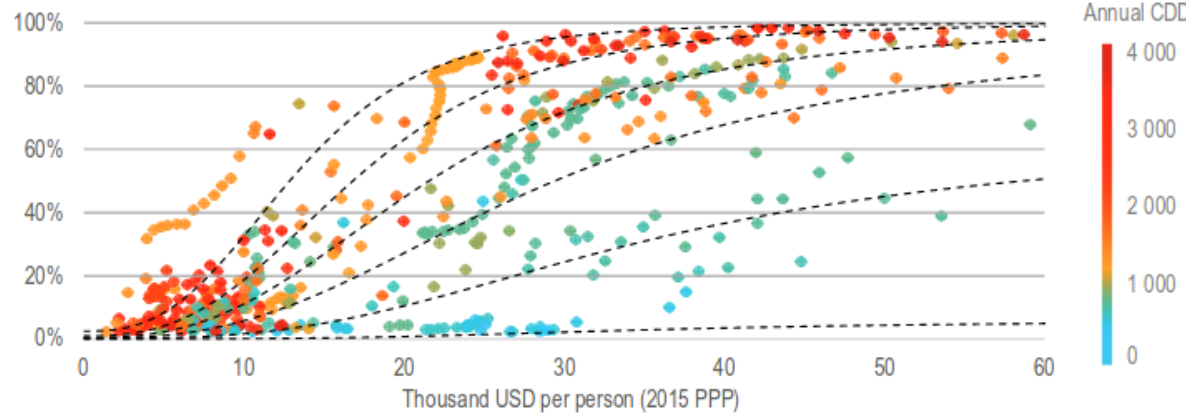
Figure 2.2 • Illustration of the heat island effect



Source: LBNL (2013), Heat Island Group, http://heatisland.lbl.gov/.

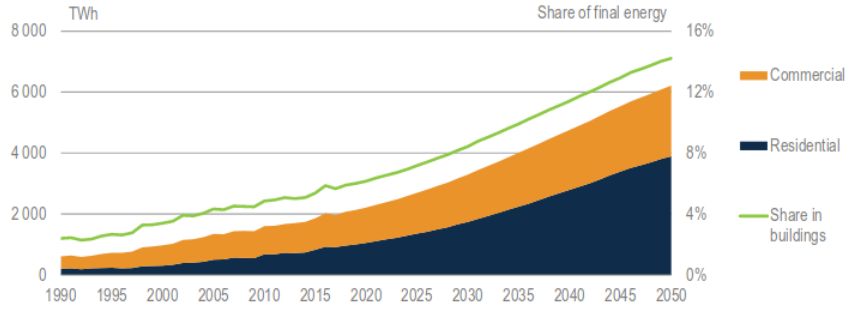
Key message • Cooling is one of several contributors to the heat island effect, which creates a need for more cooling in a classic feedback loop.

Figure 2.1 • Per-capita income and rate of household ownership of air conditioners



Notes: The dotted lines shown here are illustrative pathways for a typical place or country according to CDDs adjusted for relative humidity (see Box 2.1 for an explanation of how the heat index is calculated); PPP = purchasing power parity.

Figure 3.5 • World energy use for space cooling by subsector in the Baseline Scenario



Key message • On current trends, energy needs for space cooling – almost entirely in the form of electricity – will more than triple between 2016 and 2050, driven mainly by the residential sector.

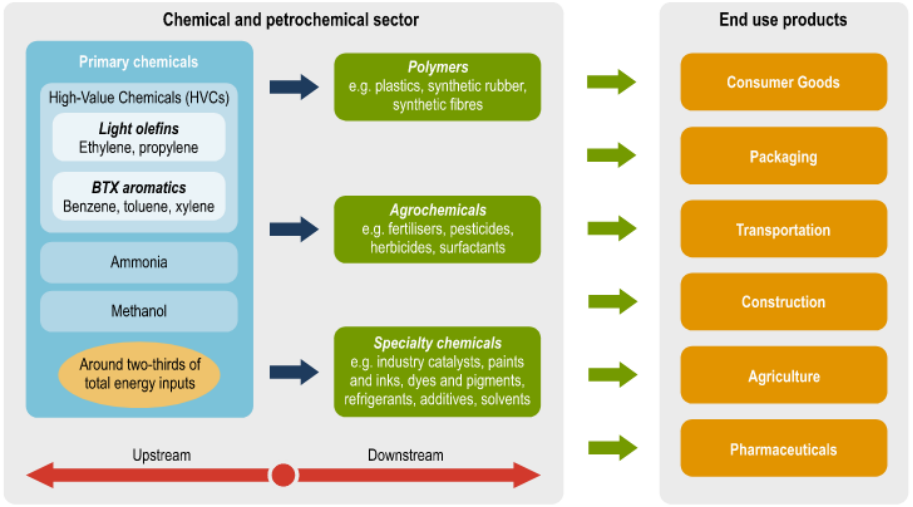
https://webstore.iea.org/download/direct/1036?fileName=The_Future_of_Cooling.pdf

Shell LNG Outlook

https://www.shell.com/energy-and-innovation/natural-gas/liquefied-natural-gas-lng/lng-outlook.html

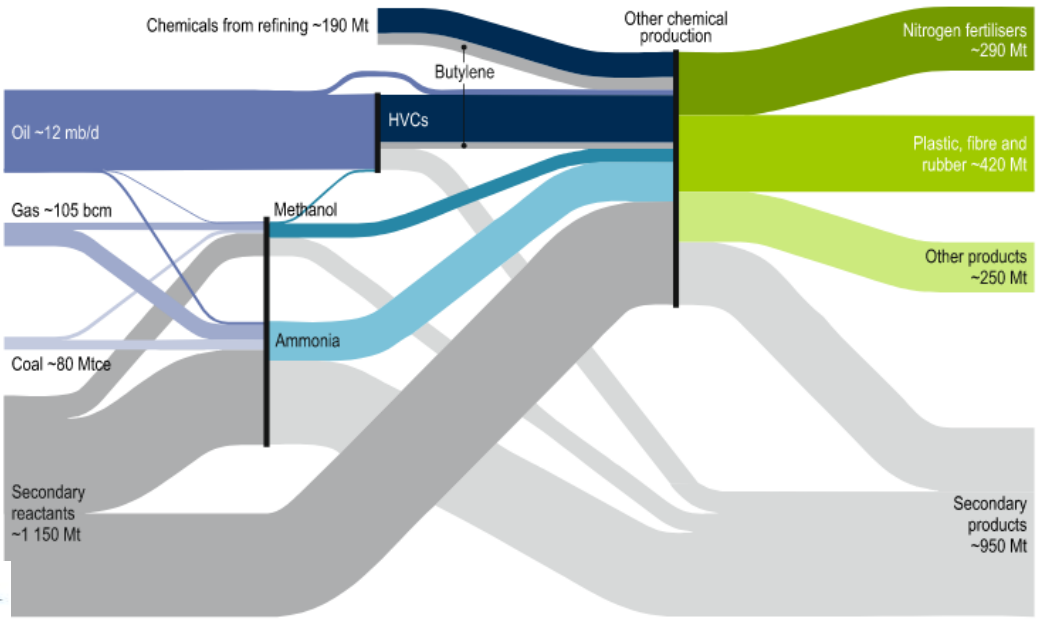
IEA – The Future of Petrochemicals

Figure 1.7 • Primary chemicals in context



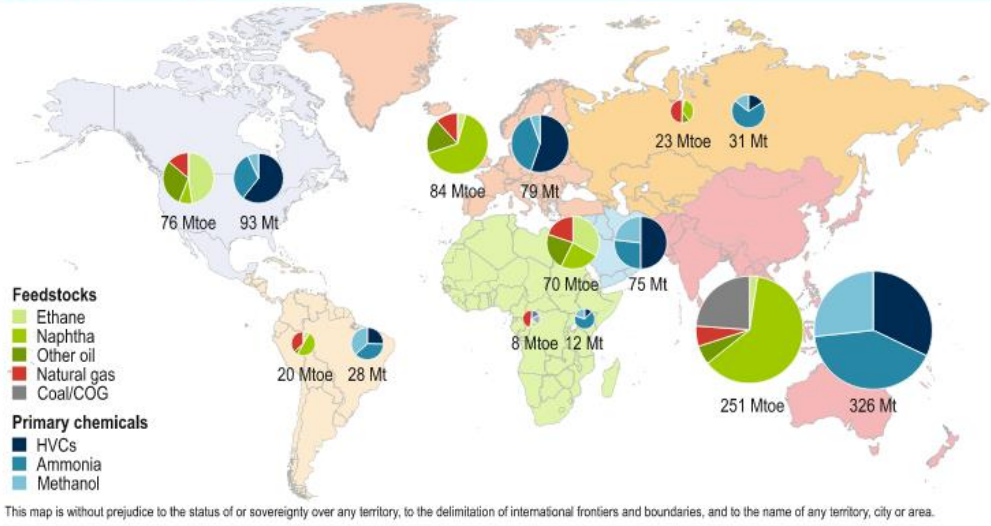
Key message • While most energy consumption in the chemical sector takes place upstream, a host of transformations, intermediates, and end-use sectors lie downstream from primary chemicals.

Figure 2.3 • Passage of fossil fuel feedstock through the chemical industry in 2017



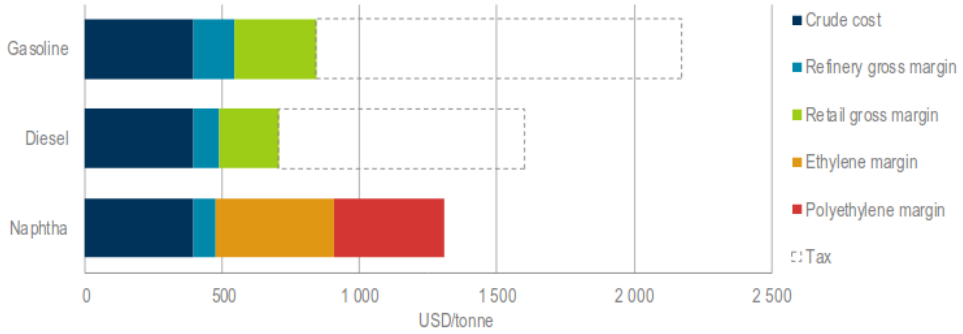
Notes: All flows in the diagram are sized on a mass basis. Secondary reactants and products are the compounds specified within chemical reactions that do not form part of the feedstock or main products. Key examples include water, CO_2, oxygen, nitrogen and chlorine. Some of the secondary products entering the sector on the left of the figure may well coincide with those leaving it on the right – CO_2 emitted from ammonia facilities and utilised in urea production is a key example. Mtce = Million tonnes of coal-equivalent.

Figure 2.7 • Primary feedstock use and chemical production by region



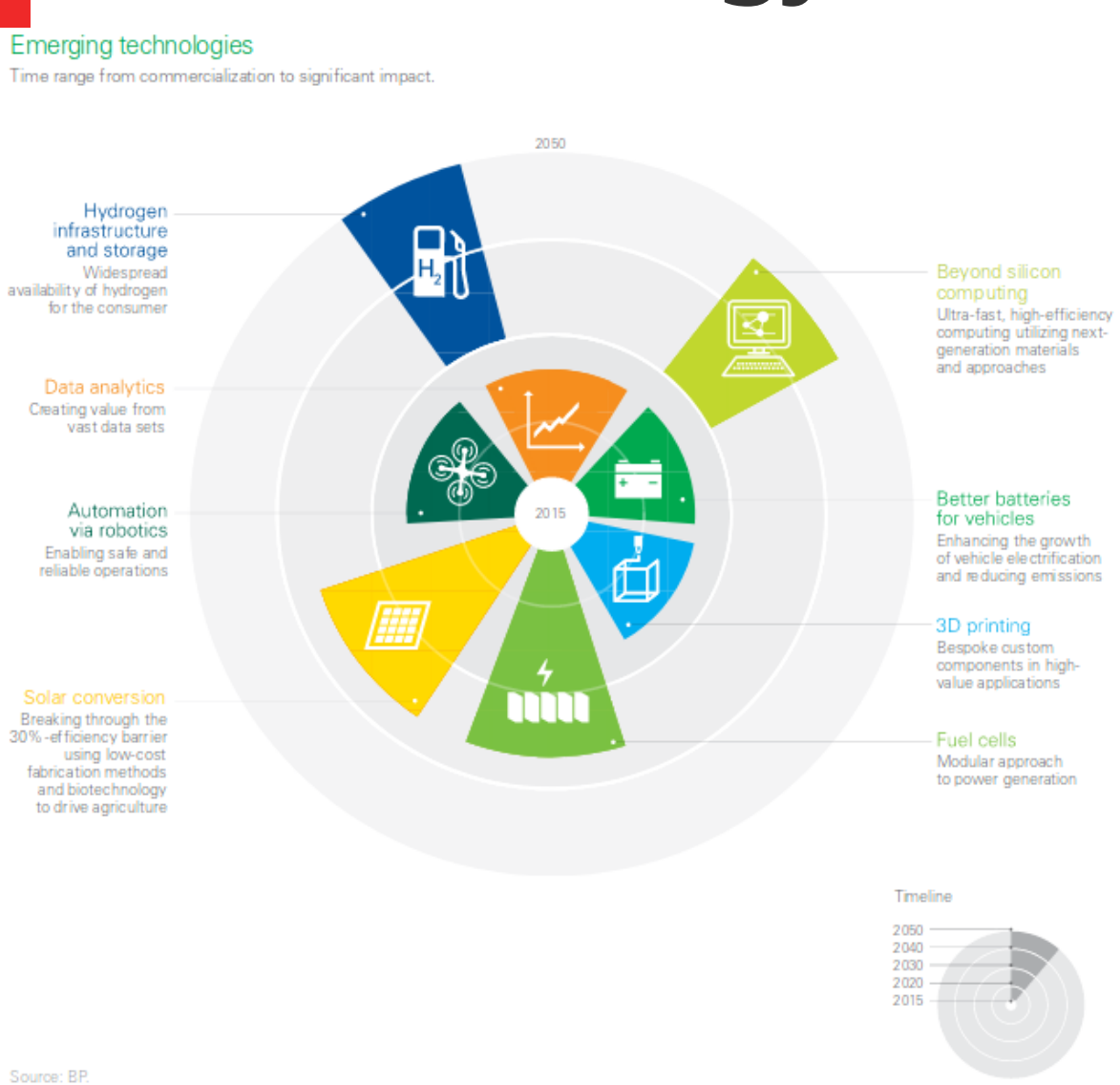
This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

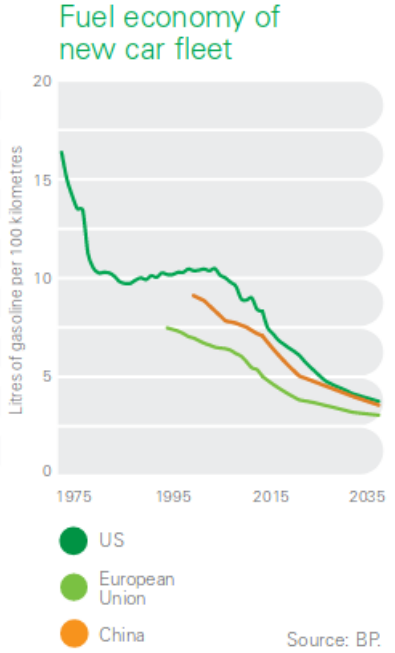
Figure 2.12 • Indicative economics for fuels and petrochemicals in Europe

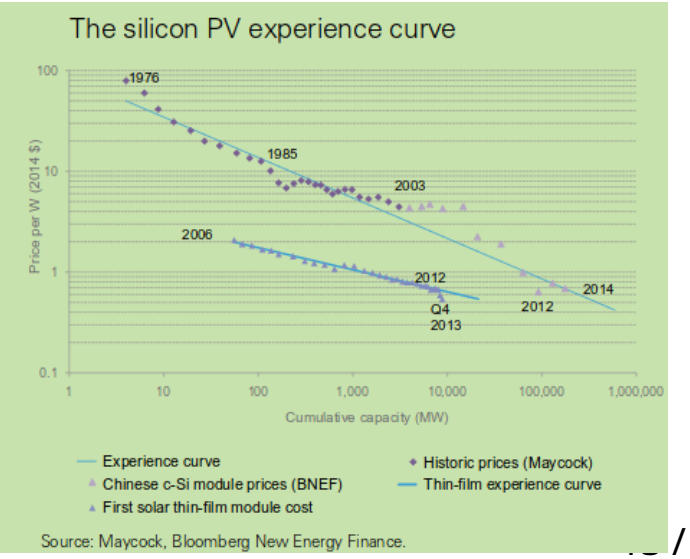


https://webstore.iea.org/download/direct/2310?fileName=The_Future_of_Petrochemicals.pdf

BP Technology Outlook



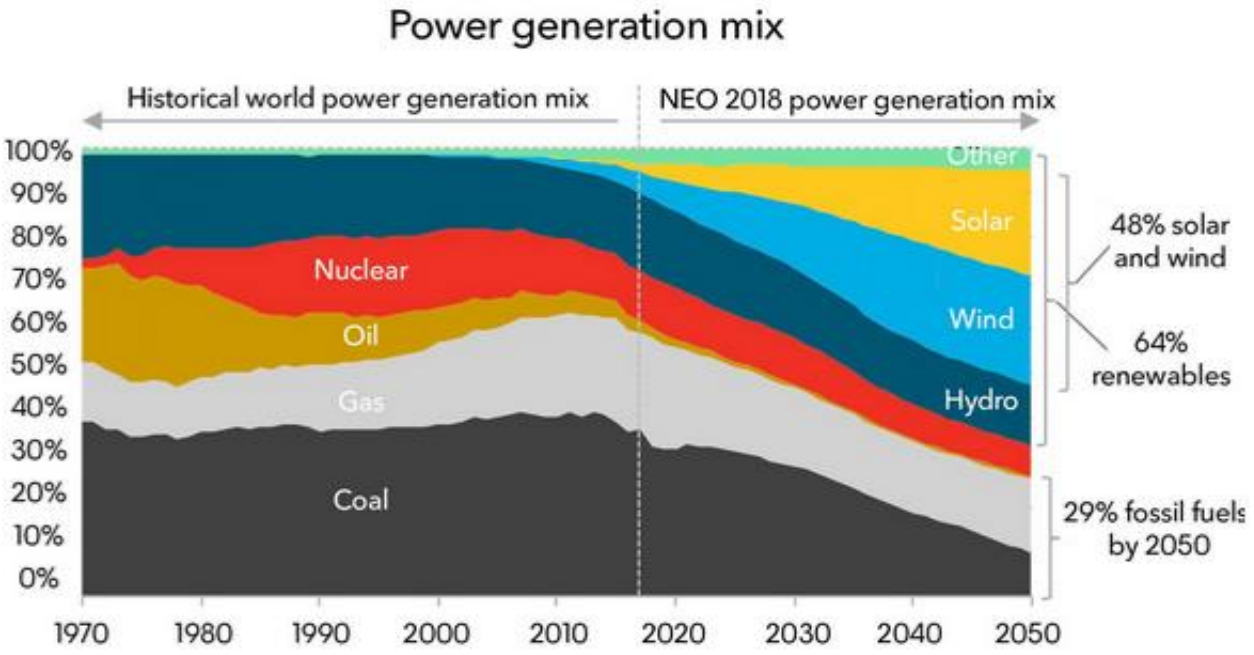


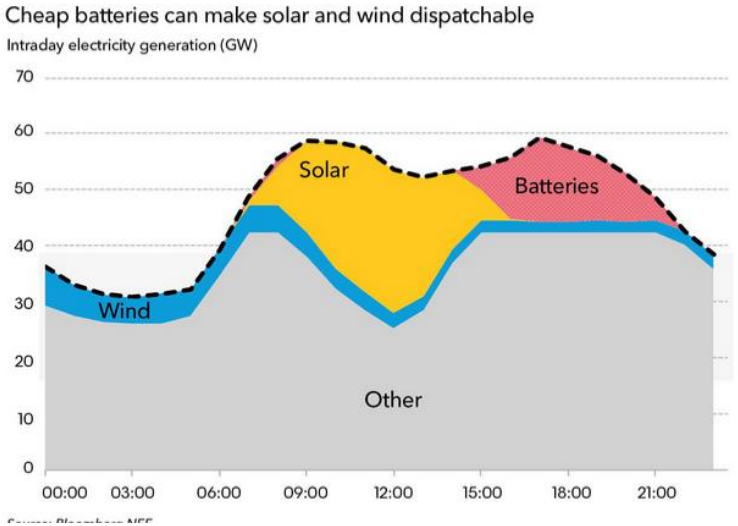


https://www.bp.com/content/dam/bp/pdf/technology/bp-technology-outlook.pdf

BNEF New Energy Outlook 2018

- 2050'de %50 elektrik rüzgar-güneş
- 2050'ye
  - Güneş %71
  - Rüzgar %58 fiyat düşüşü
- Gaz çok artmaz
- Elektrik arabaların elektrik talebi %9





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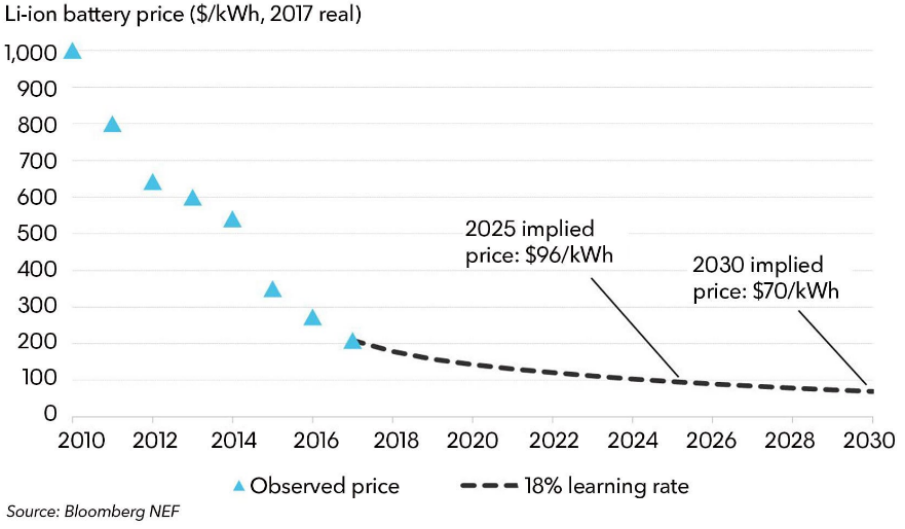
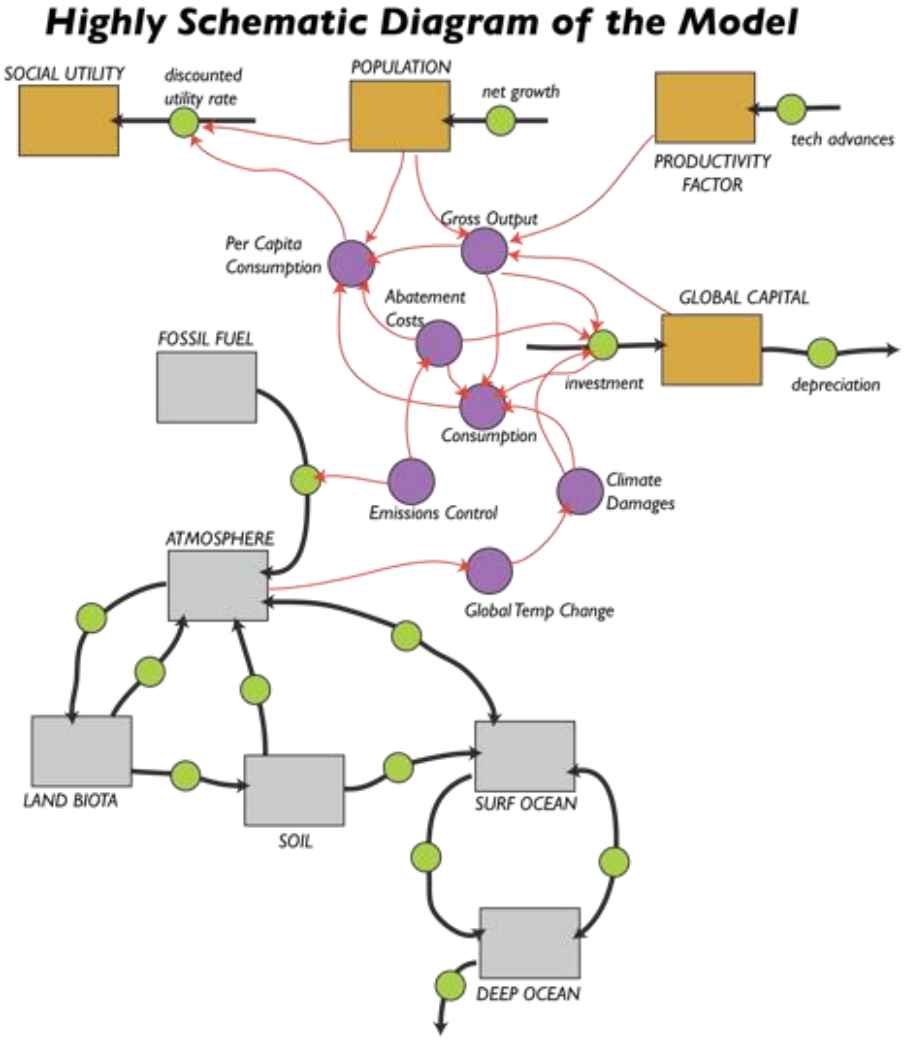


https://about.bnef.com/new-energy-outlook/

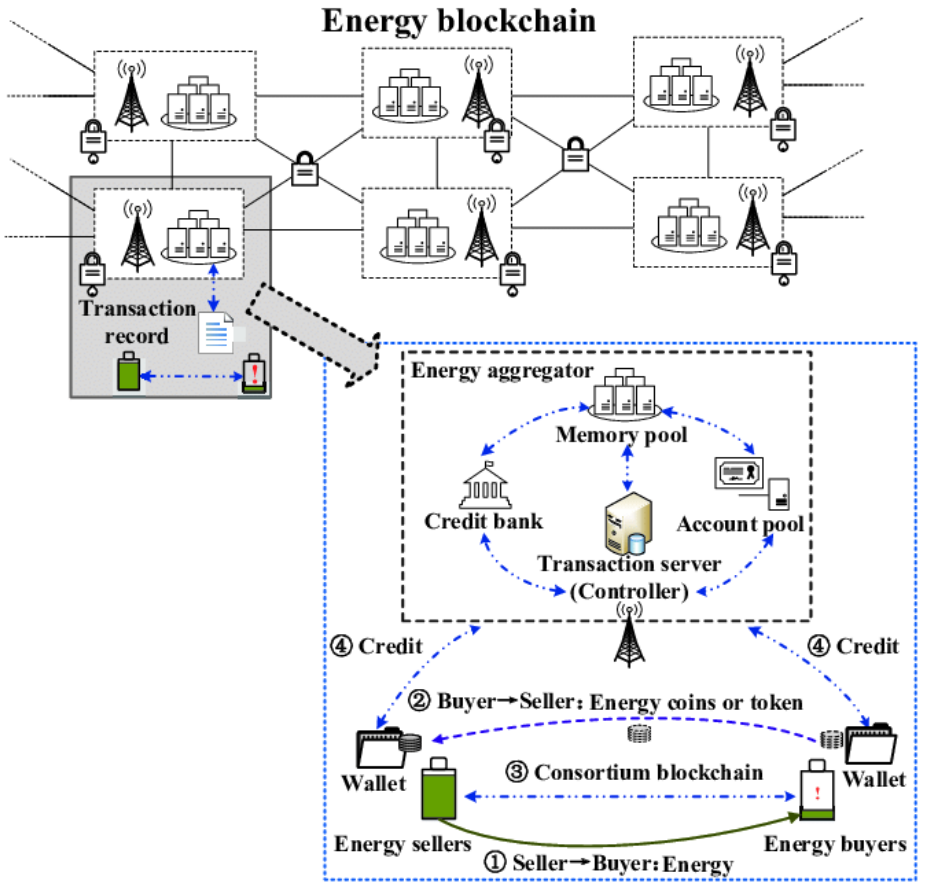
2018 Nobel Ekonomi

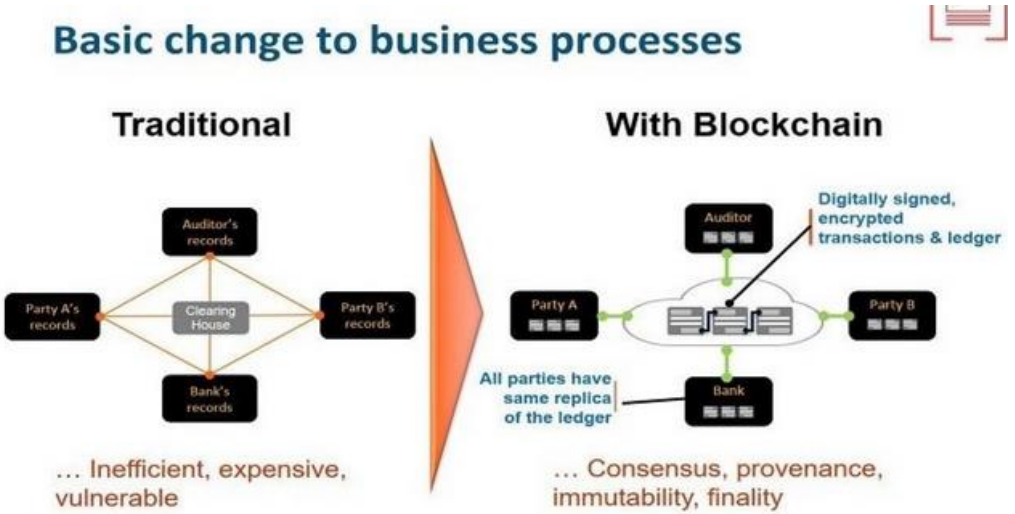
- Dynamic Integrated Climate-Economy model



http://www3.geosc.psu.edu/~dmb53/Earth_System_Models/DICE_Background.html

Kayıtzinciri - Blockchain





https://www.researchgate.net/publication/322017657_Consortium_Blockchain_for_Secure_Energy_Trading_in_Industrial_Internet_of_Things
http://resourcecenter.smartgrid.ieee.org/sg/product/education/SGWEB0063

Dağıtık enerji

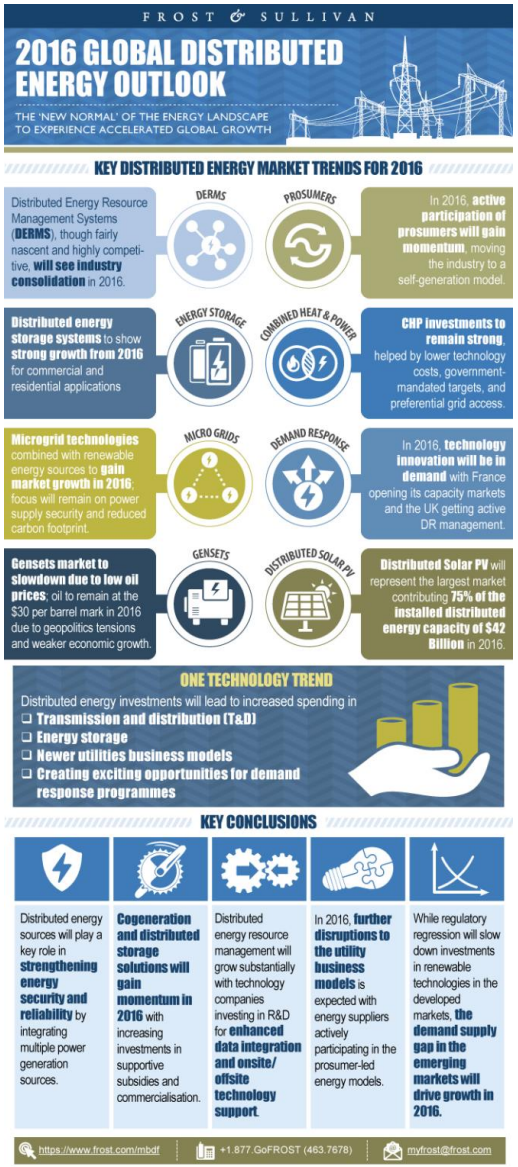
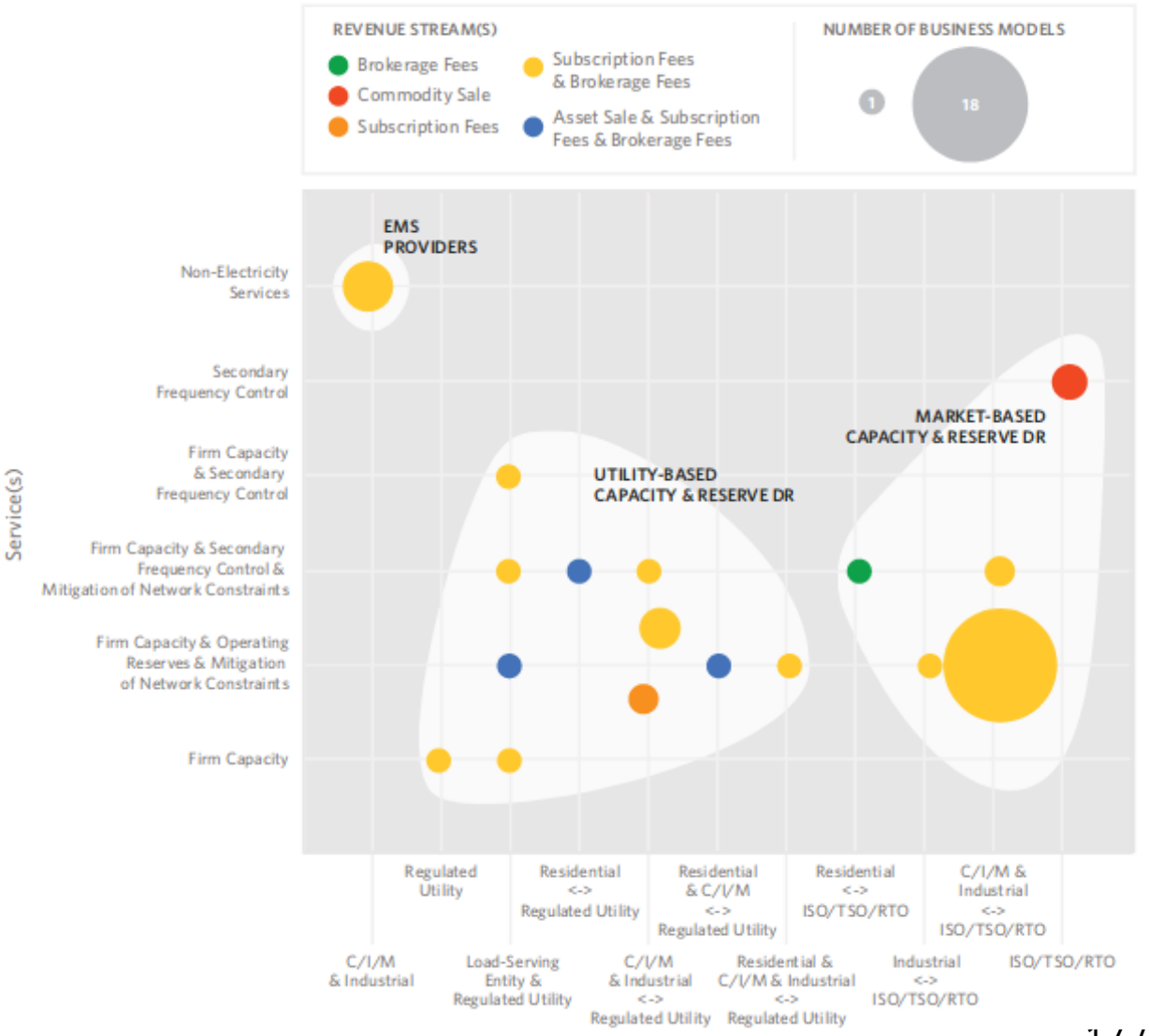


Figure B.1: Business Model Taxonomy for Demand Response and Energy Management Systems



https://energy.mit.edu/wp-content/uploads/2016/12/Utility-of-the-Future-Full-Report.pdf

Diğer teknolojiler

- Gaz hidratlar
- Yüzen offshore
- Perovskit güneş
- SMR (Small modular reactor)
- Füzyon
- CO2 yakalama sıkıştırma
- Jeotermal
- Yapay zeka, büyük veri

Talep tarafında

- Verimlilik
- IoT
- Yapay zeka
- Akıllı sistemler
- Otonom araçlar
- Araç paylaşımı

Özet

ve

Sorular