Module 2: Oil Markets

Contents

Early history, fundamentals

The road to 1973

1973 to 2019

2019 to present day

Current outlook

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Early History of oil (1)

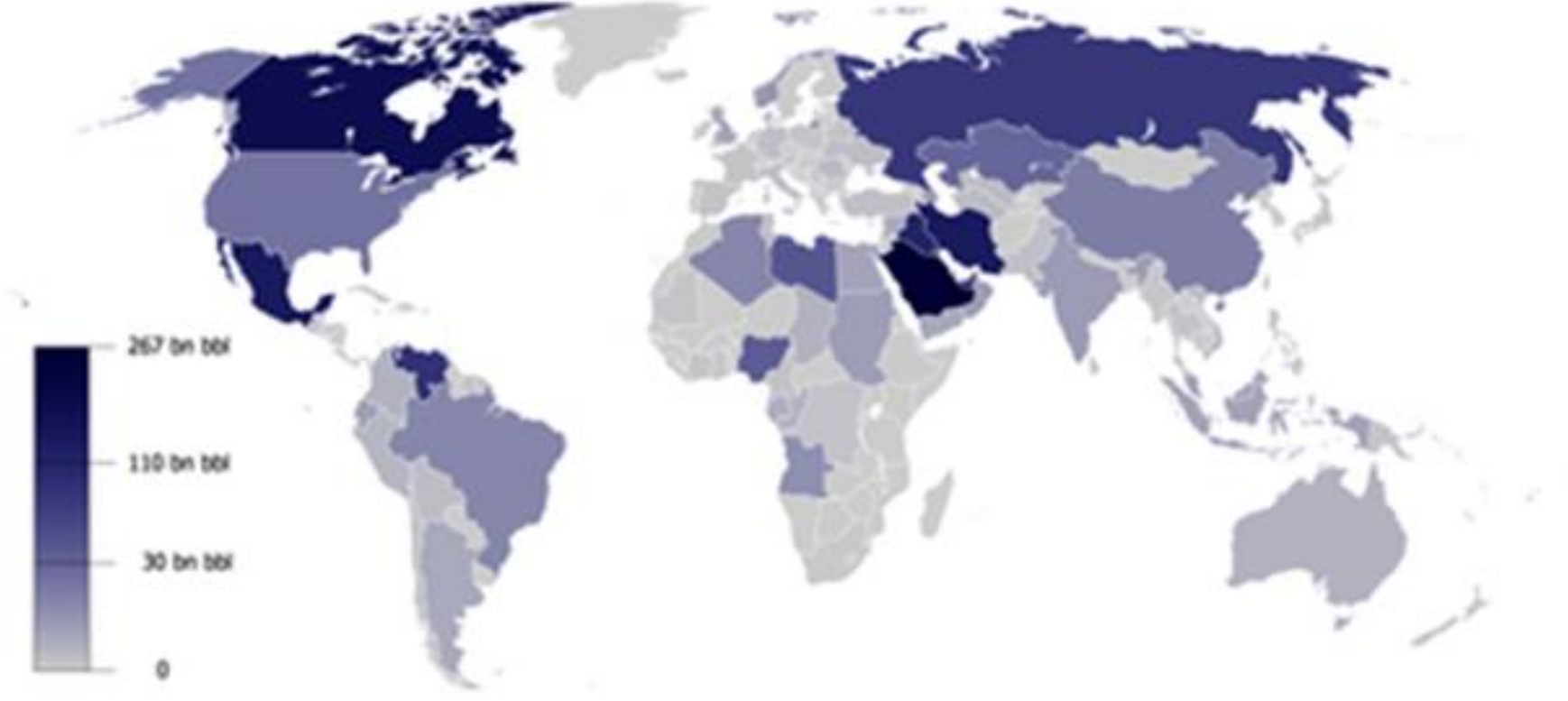
- Primitive uses of oil long back in human history, some oil found on surface e.g. in tar pits
- One problem was how to refine naturally occurring crude oil
- Distillation process to kerosene invented by Polish Chemist, Filip Neriusz Walter, 1810-1847
- First oil refinery 1856 by Ignacy Łukasiewicz (who also invented the Kerosene lamp)

Early History of oil (2)

- First Modern (drilled) oil well, Pennsylvania, USA, 1859
- Oil first used for lighting, cooking and heating
- Revolution occurred with first modern internal combustion engine (ICE) 1864, first mobile gasoline engine, Siegfried Marcus
- First four-cycle ICE in a commercially available ”car”, Karl Benz, 1886 onwards

1886: Benz – First internal combustion engine (ICE) car

Distribution of world oil reserves



Oil reserves: Proven, probable, possible

One way to describe reserves (going further from Module 1, similar concept)

- **PROVEN: Total possible conventional crude oil reserves include: all crude oil with 90-95% certainty of being technically possible to produce (from reservoirs through a wellbore using primary, secondary, improved, enhanced, or tertiary methods)**
- **PROBABLE: Crude with a 50% probability of being produced in the future**
- **POSSIBLE: Discovered reserves which have a 5-10% possibility of being produced in the future Possible (5-10%)**

- **These definitions do not include the unconventional reserves…e.g liquids extracted from mined solids or gasses (oil sands, oil shales, gas-to-liquid processes, or coal-to-liquid processes)…NEXT SLIDE**

Oil reserves: conventional & unconventional

Conventional oil field utilisation is moving to more difficult locations (Deep-sea, Arctic areas, nature reserves etc.)

Unconventional oil :

- Oil shales
- Oil sands-based synthetic crudes and derivative products
- Coal-based liquid supplies
- Biomass-based liquid supplies
- Liquids arising from chemical processing of natural gas

=> higher & more volatile prices

Use of unconventional oil reserves increases GHG emissions

Theory on oil price formation

Hotelling (1931). The Economics of Exhaustible Resources, Journal of Political Economy. Hotelling's rule: the theoretical price of an exhausting natural commodity is based on the future expectations.

If resources and demand are well known, the value of a resource increases according to the general expectation of investment return (interest rate, e.g. on government bonds)

- If prices rise slowly, produce early
- If prices rise rapidly, produce later
- Theory concerns the profit margin between the sales price and variable costs of production. In addition to this, production from more difficult locations etc. increases the prices.

Hotelling's rule

EXAMPLE: An owner of an oil well:

Case A: Expects 10% appreciation of oil price the next 12 months, and the prevailing real interest rate (nominal rate less inflation) at which he can invest is 5% per year >> Owner will choose not to extract the oil

=If prices rise rapidly, produce later

Case B: Expects 5% appreciation of oil price over next 12 months and interest rate of 10% >> Owner would extract the oil, sell it and invest the sales proceeds at a 10% yield.

=If prices rise slowly, produce early

RESULT: Increase in price of resources (oil) should track real interest rate increases.

REALITY: But rule has been proven to be highly imperfect as a way to predict commodity prices, as we will see during this lecture…

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Pre-WW2 development of oil

East Texas, first commercial well, 1930).

Iran, 1923 exclusive concession to Anglo-Persian Oil Company (APOC)

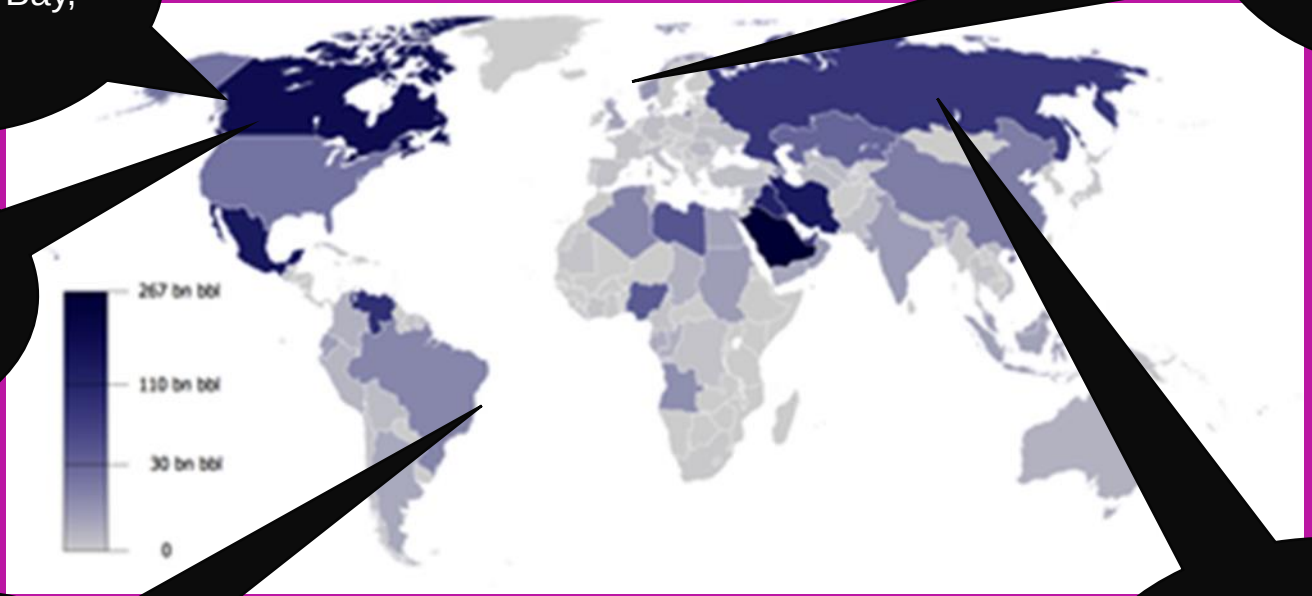
Growth of Venezuelan production from 1920s

Saudi Arabia, first commercial well 1938, California-Arabian Standard Oil (CASOC), later Saudi Aramco (initially entirely US owned)

Post-WW2 development of oil

Alaskan oil production start at Prudhoe Bay, 1977

North Sea: gas in 1960s, oil from 1970

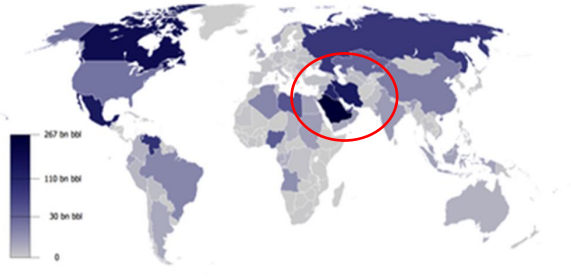


Canadian oil sands, late 1960s onwards

Brazil offshore (from 1980s)

Russia (major exporter from 1960s)

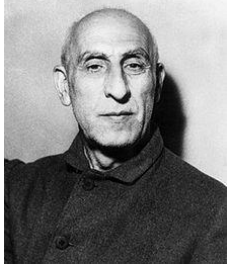
Oil in the Middle East



- **The world's oil reserves show a marked concentration in the Middle East**
- **This has had remarkable economic and geopolitical consequences. Economic development of certain countries (Saudi, Qatar, Libya) is almost exclusively built on oil and gas**
- **From the 1950s, strains emerged between western companies exploiting oil and local governments who were not getting a fair deal**
- **These countries originally needed outside technical expertise to exploit the oil > exclusive concessions were often signed with western oil companies in early days with most profit taken by west**

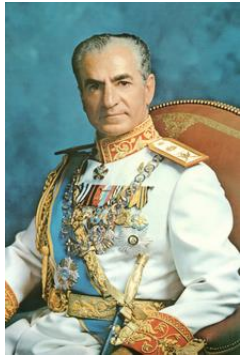
Iran, 1951; 1st Attempt to nationalise oil

- **Anglo-Iranian oil company (AIOC) was British owned; responsible for almost all Iranian oil production (became British Petroleum BP in 1954). AIOC has exclusive arrangement brokered with Shah (”King”) of Iran in 1920s**
- **In 1950, Saudi Aramco had agreed to share profits 50-50 with Saudi; AIOC/British govt refused to offer same arrangement to Iranians**
- **1951, Iranian parliament (Majlis) votes to nationalise AIOC, shortly after, Mohammed Mossadegh is voted in as democratically elected prime minister**



Iran, 1951; 1st Attempt to nationalise oil

- Mossadegh pursued nationalisation process, British officials and workers pushed out in 1952, Iran blockaded
- 1953; CIA and UK SIS arrange a coup to depose Mossadegh and restore absolute rule to the Shah
- Coup served as a clumsy warning over control of oil from the West to the Middle East and fomented resentment in Middle East and especially in Iran itself



OPEC

- OPEC was created as an oil cartel in 1960 (5 countries in Middle East, now 13 countries globally)
- OPEC was primarily a response to western domination of oil, especially as represented by the “Seven Sisters” of oil companies.

Vs.

1973 oil crisis, Yom Kippur war, Sheikh Yamani

- The Libyan experience is said to have inspired Sheikh Yamani, the Saudi Oil minister to get a better deal for their oil
- Eventually events overtook the situation….
- When Arab countries invaded Israel in 1973, OPEC agreed to an oil embargo against all countries supporting Israel
- At same time, US oil production was declining

> This led to a massive rise in prices (quadrupling $3/bbl>>$12)


PUMPS
CLOSED
STOP
YOUR
MOTOR
PLEASE
NO
SMOKING
When did you last
change your oil ?
SHELL REGULAR
SUPER REGULAR
SUPER SHELL
SHELL
GASOLINE

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Trans-Alaska Pipeline system

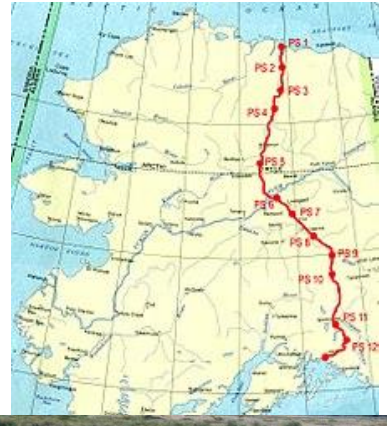
One reasons why lessons of ‘73 oil crisis was not acted upon?

Under development since 1960s to bring the massive oil reserves in North Alaska to the year round ports in southern Alaska

But delayed by environment and native land title issues until the ’73 crisis led to rapid approval

Reduced America’s concern following 1973 crisis – was on stream by 1977

But could also be argued to have played against the development of RES and Energy efficiency that may otherwise have occurred after the 1973 crisis?

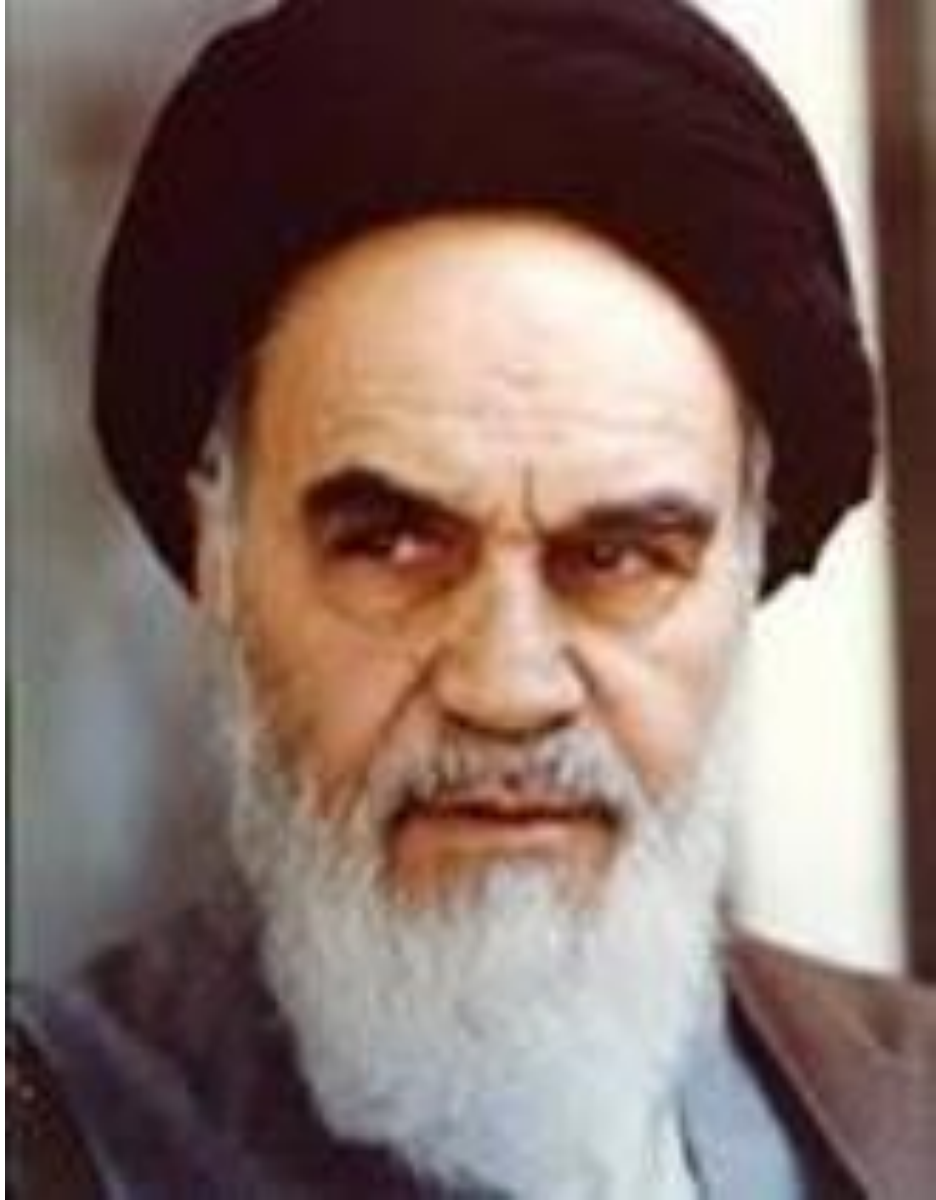


…but the next oil shock was yet to come….

Iran, 1979

Iranian regime of the Shah taken over by coalition of Islamic clerics (Ayotollah Khomenei)

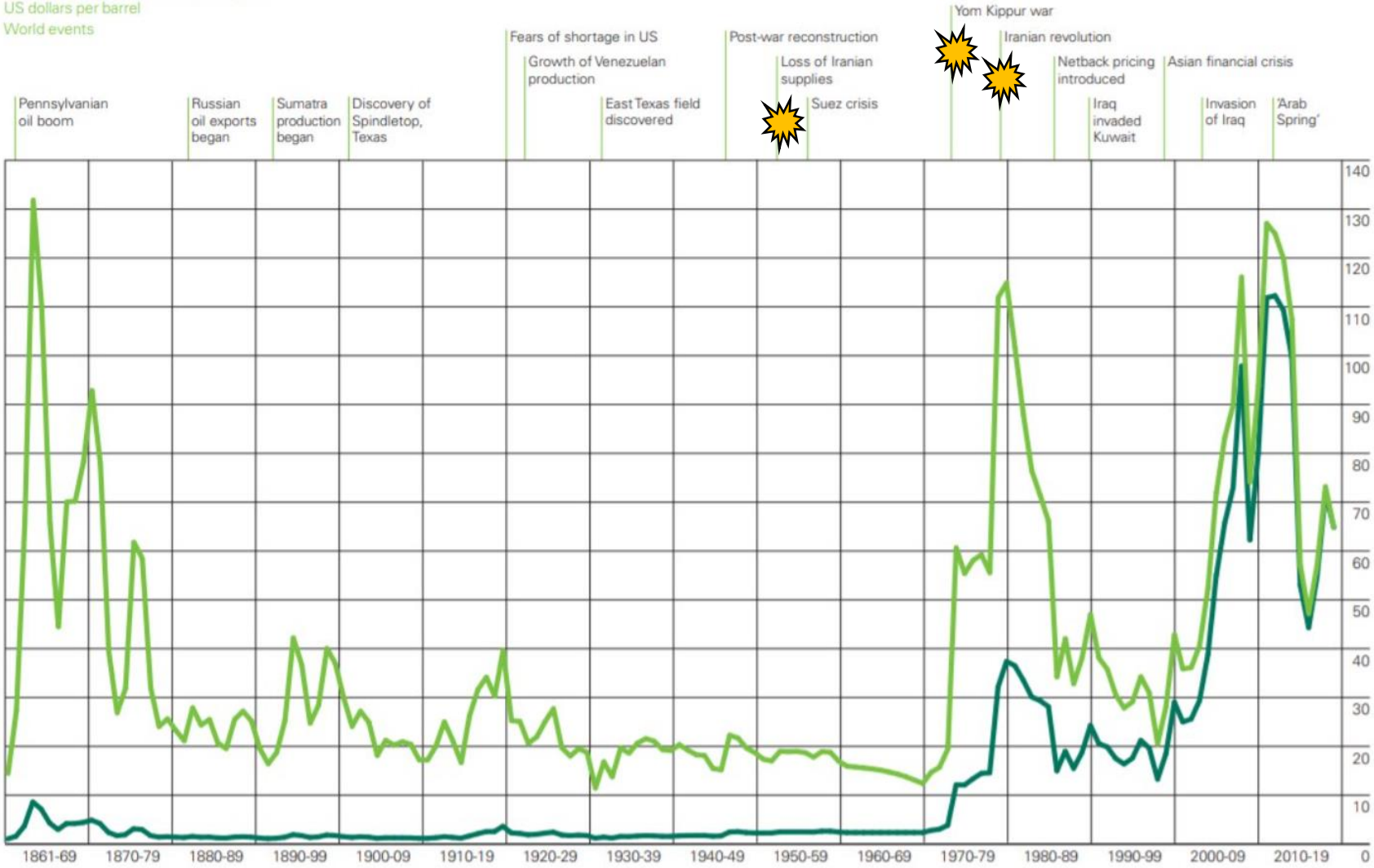
The Iranian Revolution precipitated another oil crisis, global oil supply fall of 4%, subsequent market panic led to a tripling of prices



Crude oil prices 1861-2019

US dollars per barrel

World events



$ 2019 (deflated using the Consumer Price Index for the US)

$ money of the day

1861-1944 US average.
1945-1983 Arabian Light posted at Ras Tanura.
1984-2019 Brent dated.

Oil market history from 1980s

- **Then the Rest of the World increased production**
  => OPEC share down to 50% in early 1980's, price decreased greatly, oil "glut" (key contributors: new production from Alaska, North Sea, Russia)
- **OPEC production decreased also in nominal terms from 1980.**
- **In 1985 OPEC production was down by 50% from the top level and 30% of world total production.**
- **Sharper decrease of oil prices in 1985-86. Average price fell from 50 $/bbl to 25 $/bbl (in 2005 currency).**
- **1986 – 2003 prices mostly between 20 - 30 $(2005)/bbl.**

2000s oil markets

OPEC market power was broken by the increase of production in other countries.

- At present OPEC market share about 40%

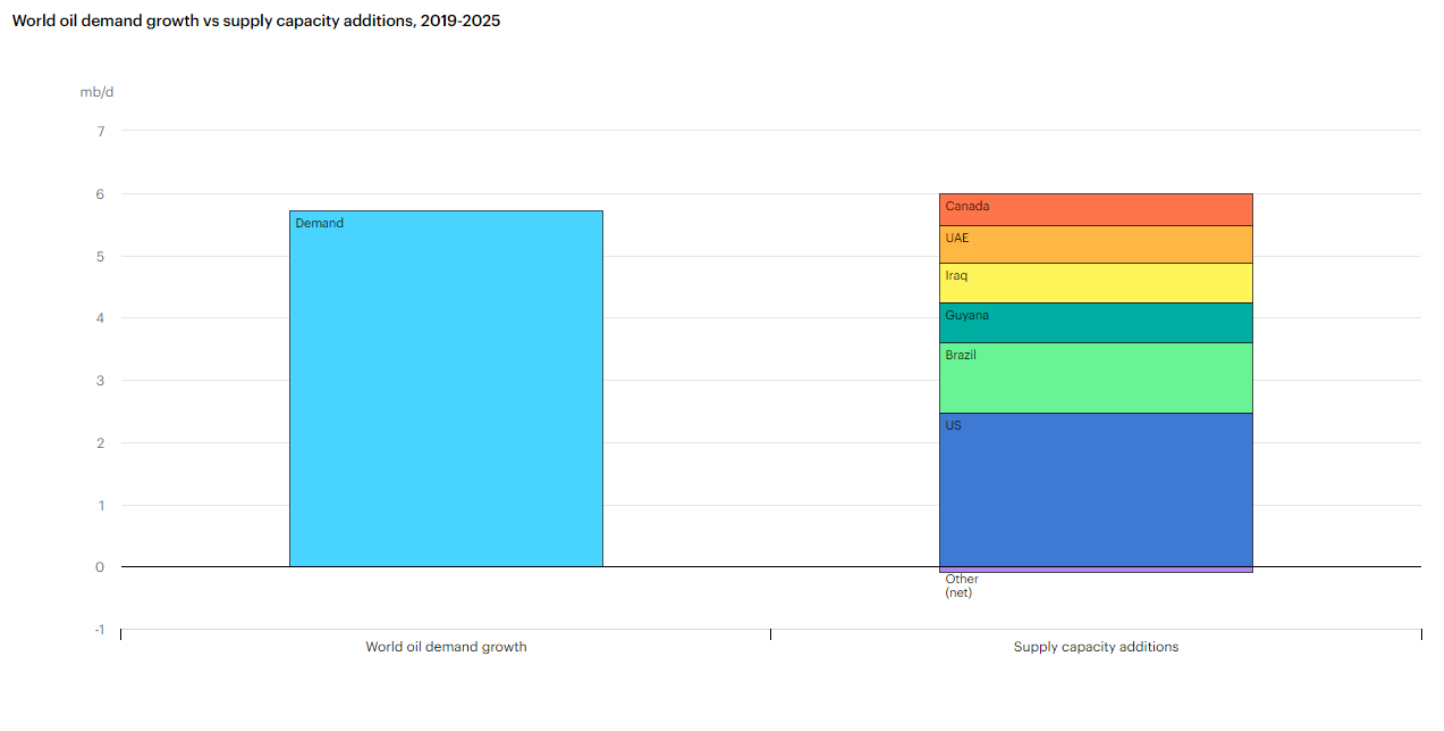
BUT: 2003-2012 oil dollar price increased, because:

- Dollar weakening (no decrease in euros)
- Strong increase in demand, CHINA + Other South Asia !
- To increase the production typically takes a couple of years + uncertainty of coming market situation
- Peaks with invasion of Iraq (2005) & Arab Spring (2011)

But then from 2012, prices went down again…why?

The OPEC domination is over…

Much of future demand increases met by US….



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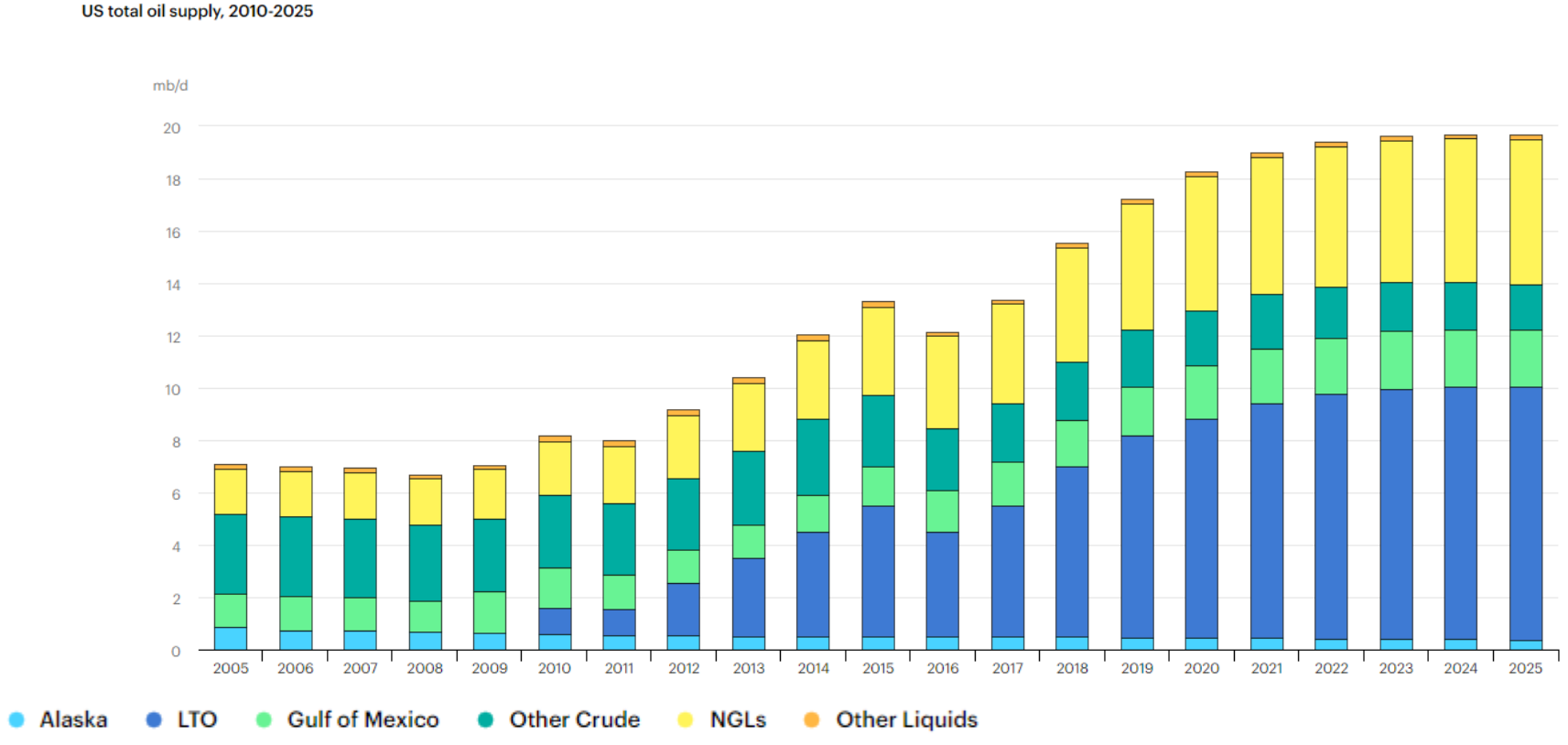
IEA, 2020

US increase from tight oil production

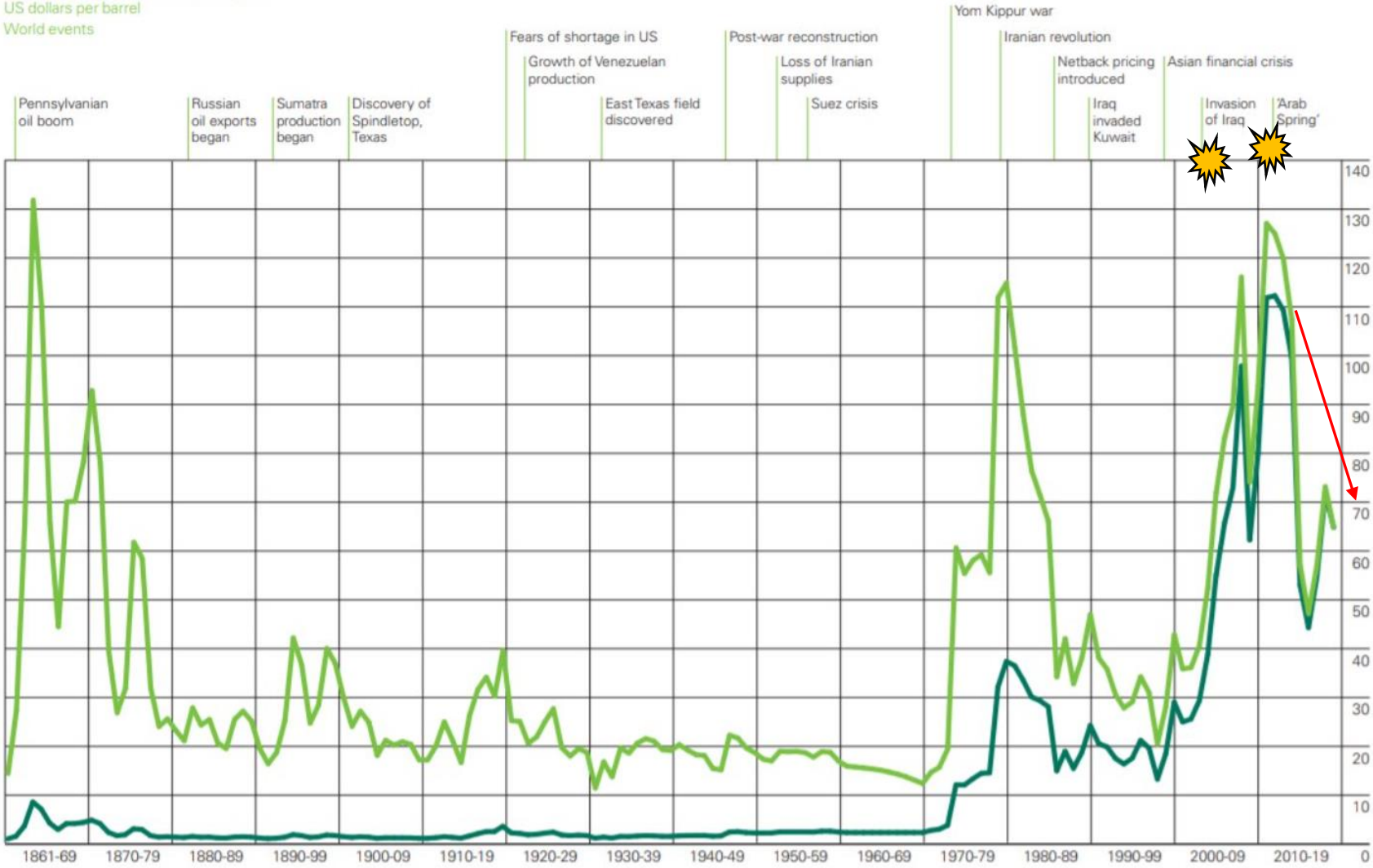


IEA, 2020

Crude oil prices 1861-2019

US dollars per barrel

World events



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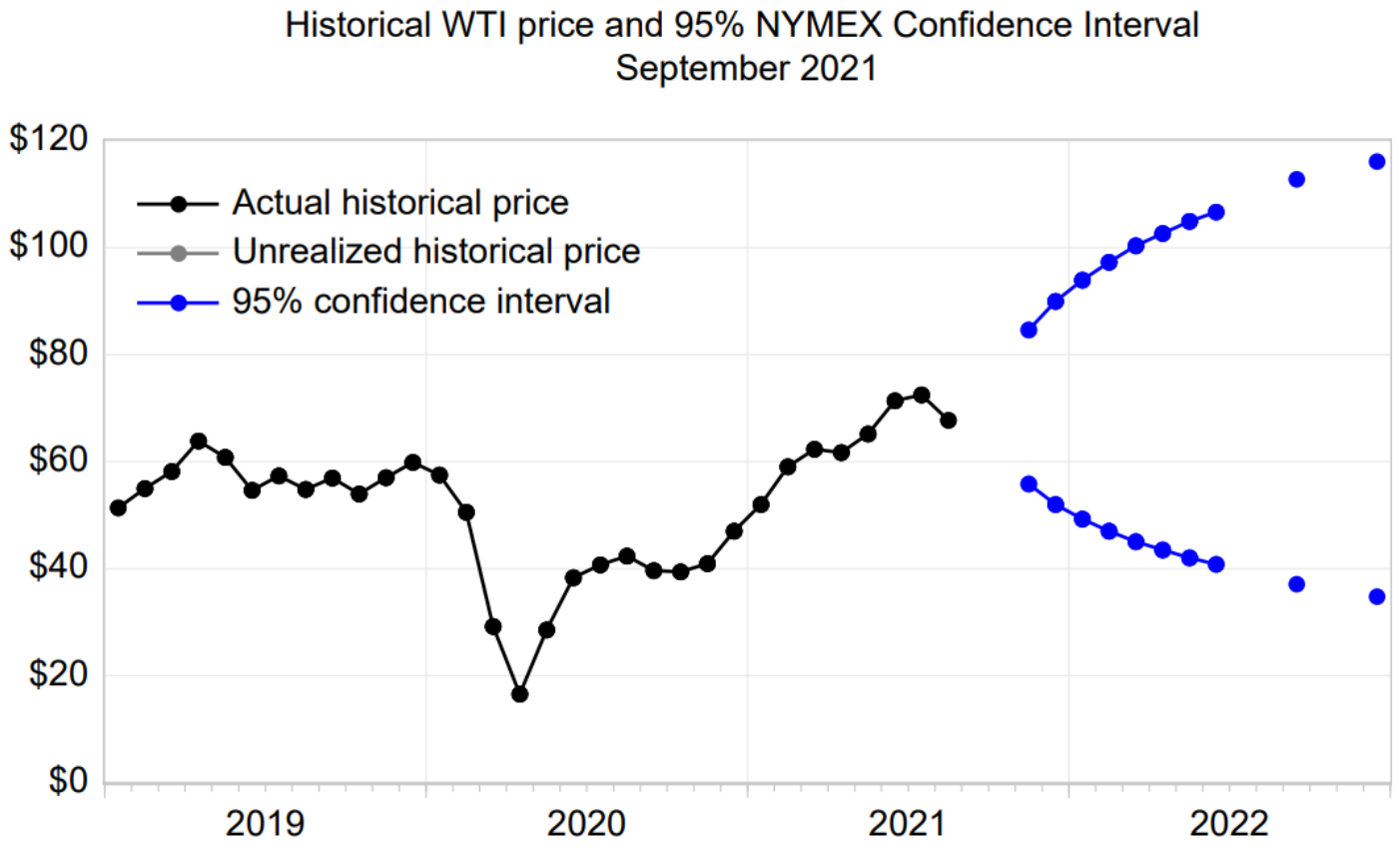
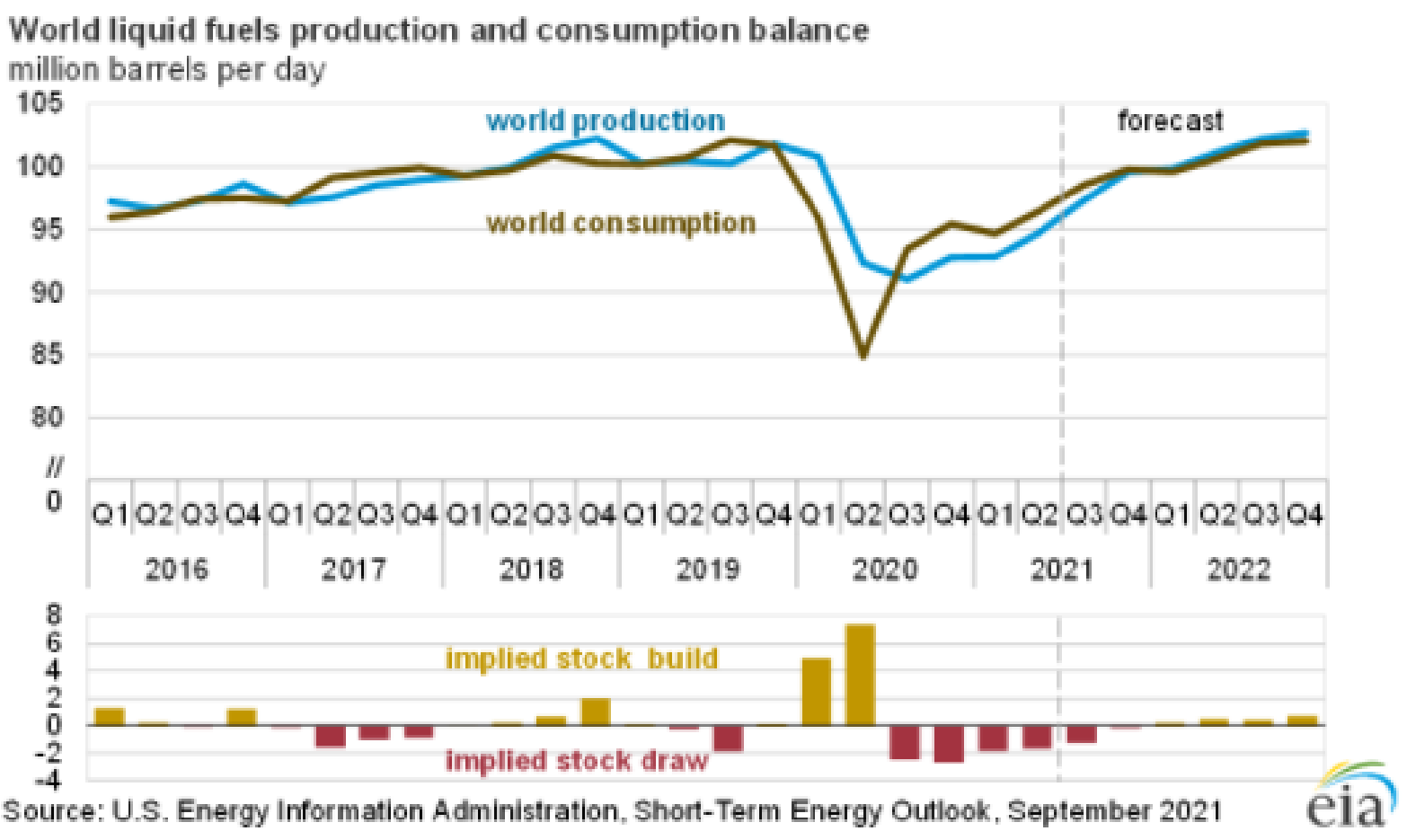
Then after 2019: What happened to oil markets during COVID-19 pandemic?

Evolution of oil markets during pandemic



Source: EIA Short-Term Energy Outlook, September 2021

Recent demand trend – going back to baseline?



A?

What about recent high oil prices due to Ukraine invasion…
A bit of background of how we got here…

When prices get high…funding for invasions..

> Jump to 2020 onwards >

Increase in oil prices after initial COVID slump

24.2.22 Ukraine invaded

Sources: The Economist, MarketWatch

So in order to reduce oil prices, thus indirectly revenues to Russia, how can we rapidly reduce oil use?

What does the IEA say?

10-point plan to reduce oil use, March 2022

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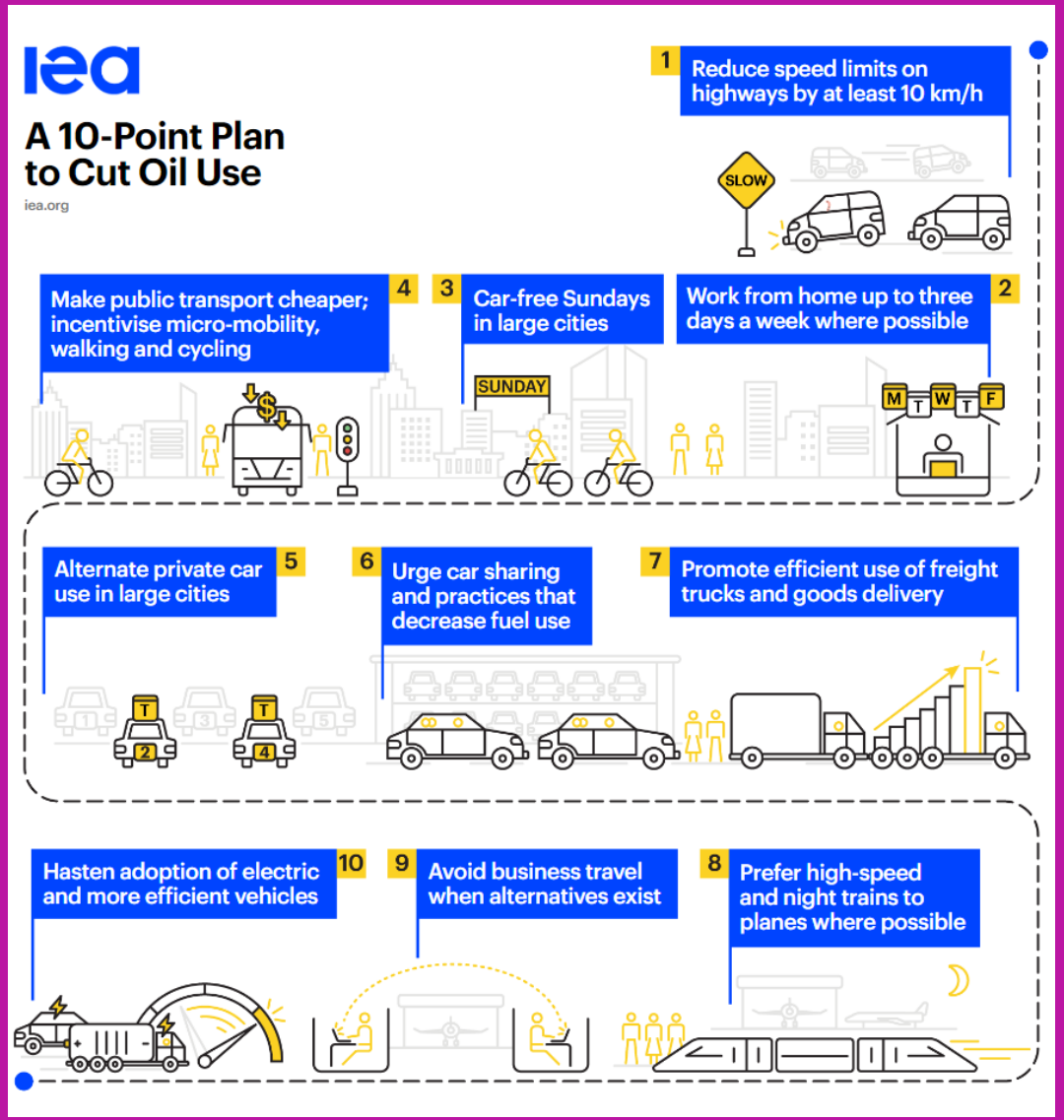
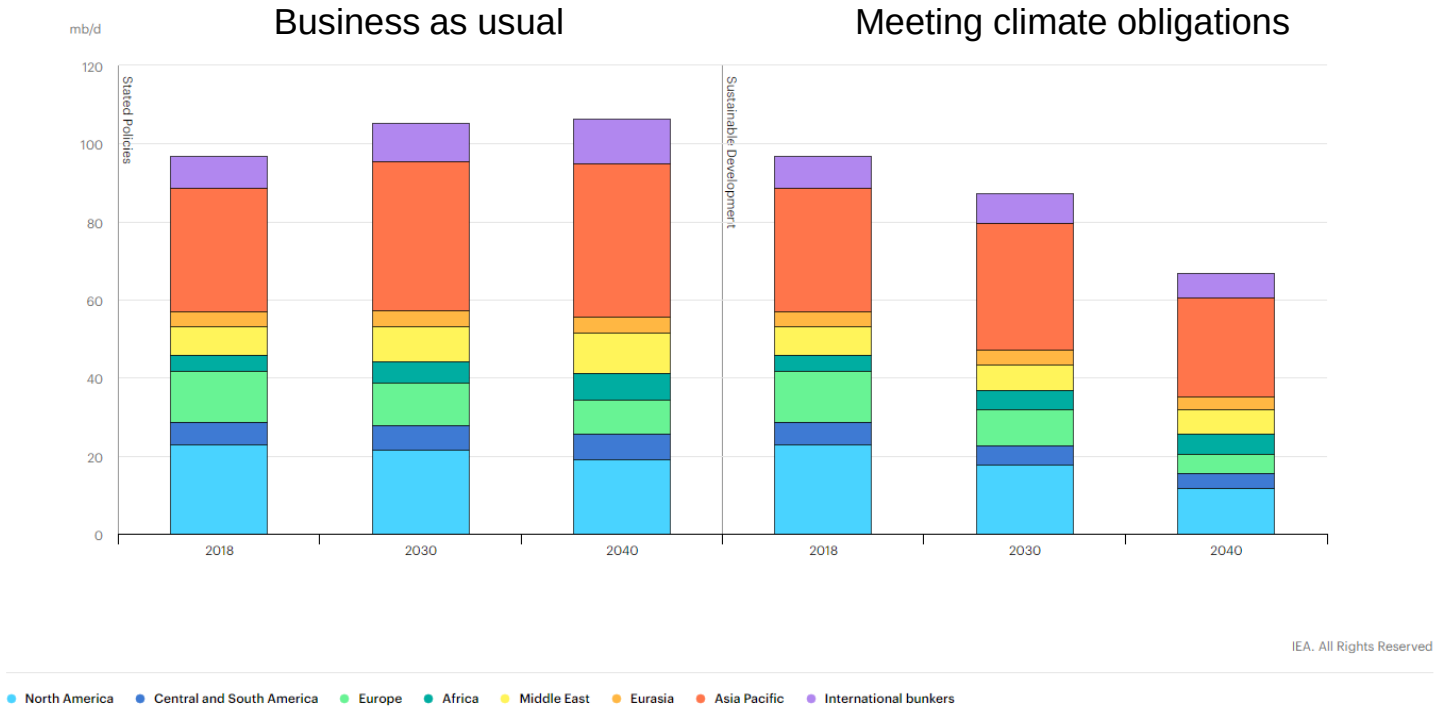


More details: https://www.iea.org/events/a-10-point-plan-to-cut-oil-use

Video: https://youtu.be/Rt9TVnx5Y_U

Do we want to use the oil at all?

Global oil demand scenarios



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IEA, 2019 World Energy Outlook

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Outlook

Oil prices are intrinsically connected to both available reserves/resources, cartels (OPEC...) and geopolitics. Key factors at present, examples of upward and downward pressure on prices:

- **Upward: Ukraine invasion, boycott of Russian oil (both supply restrictions and negative risk/market sentiment)**
- **Downward: Increased oil production from non-OPEC countries (especially US tight oil)**
- **Downward: Increased use of alternatives, electricity & biofuels, i.e. reducing demand for oil**
- **Downward: Increased efficiency/reduction in use, follow the IEA 10-point plan!**

THUS: Alternatives to oil are WIN-WIN-WIN: Lower CO_2, removing risk of oil shocks, stop funding the war machine, stop handing money to despotic regimes

Many thanks!

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