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LONG-TERM IMPACTS OF COVID ON GLOBAL OIL DEMAND

NETL & the USAEE Three Rivers Chapter Welcome

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Scenario Study on the Impact of COVID-19 on Long-Term Oil Demand

Marianne Kah
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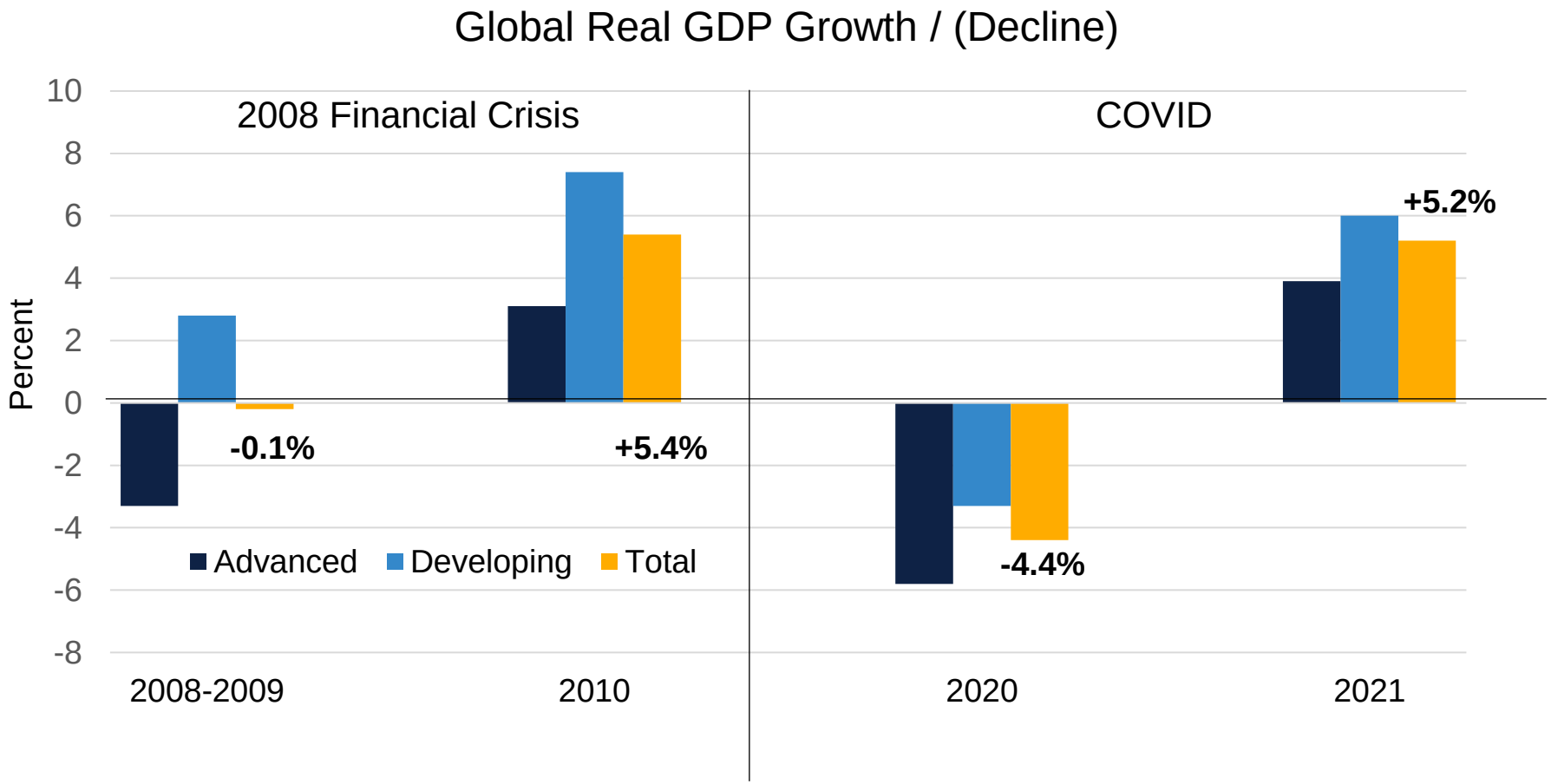
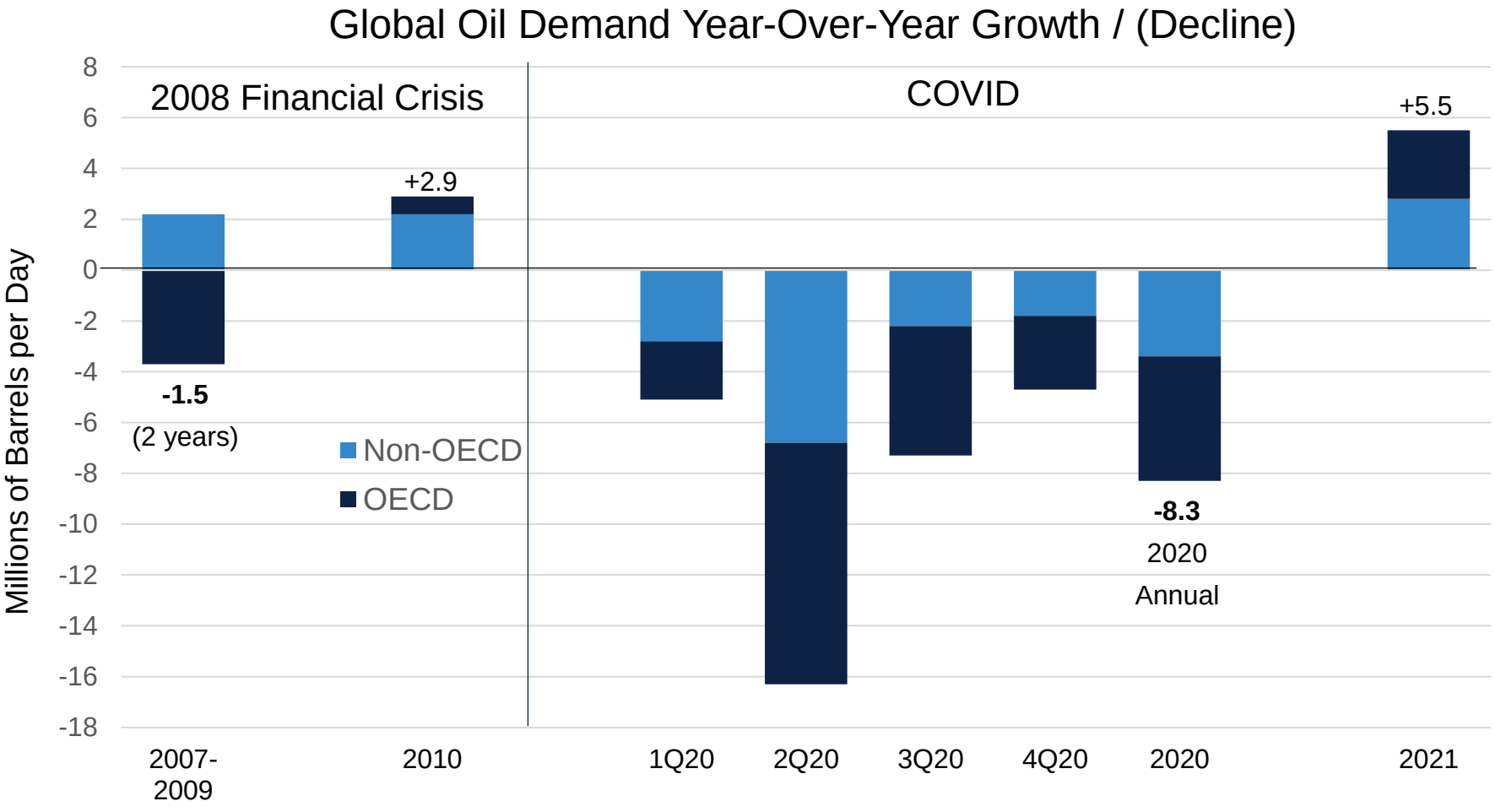
IMF Global Economic Growth Forecasts: COVID vs. the 2008-2009 Financial Crisis



The COVID-19 economic decline is on a different scale than the 2008 financial crisis

Source: International Monetary Fund, World Economic Outlook, October 2020 forecast for 2020 and 2021; Historical IMF for 2009 and 2010

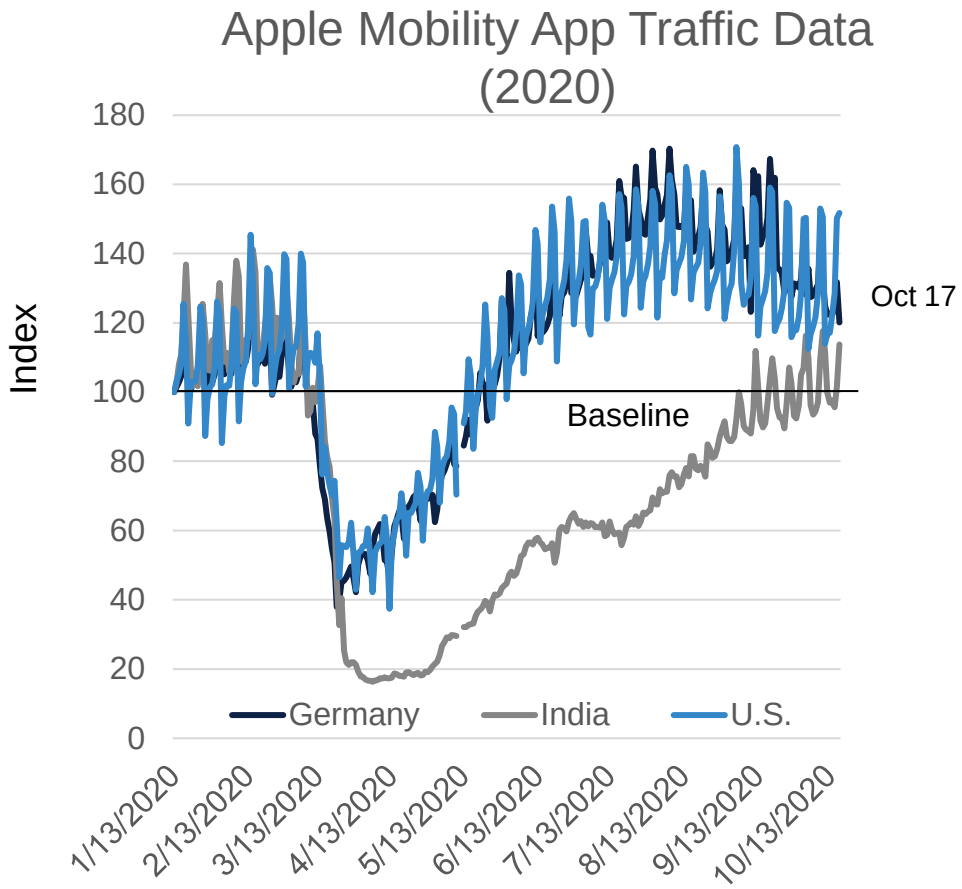
Change in Global Oil Demand: COVID vs. the 2008-2009 Financial Crisis



*Year-over-year except where noted

Source: International Energy Agency, Oil Market Report, October 14, 2020 and IEA Annual Statistical Supplemental 2007-2009

Driving Has Already Shown Green Shoots



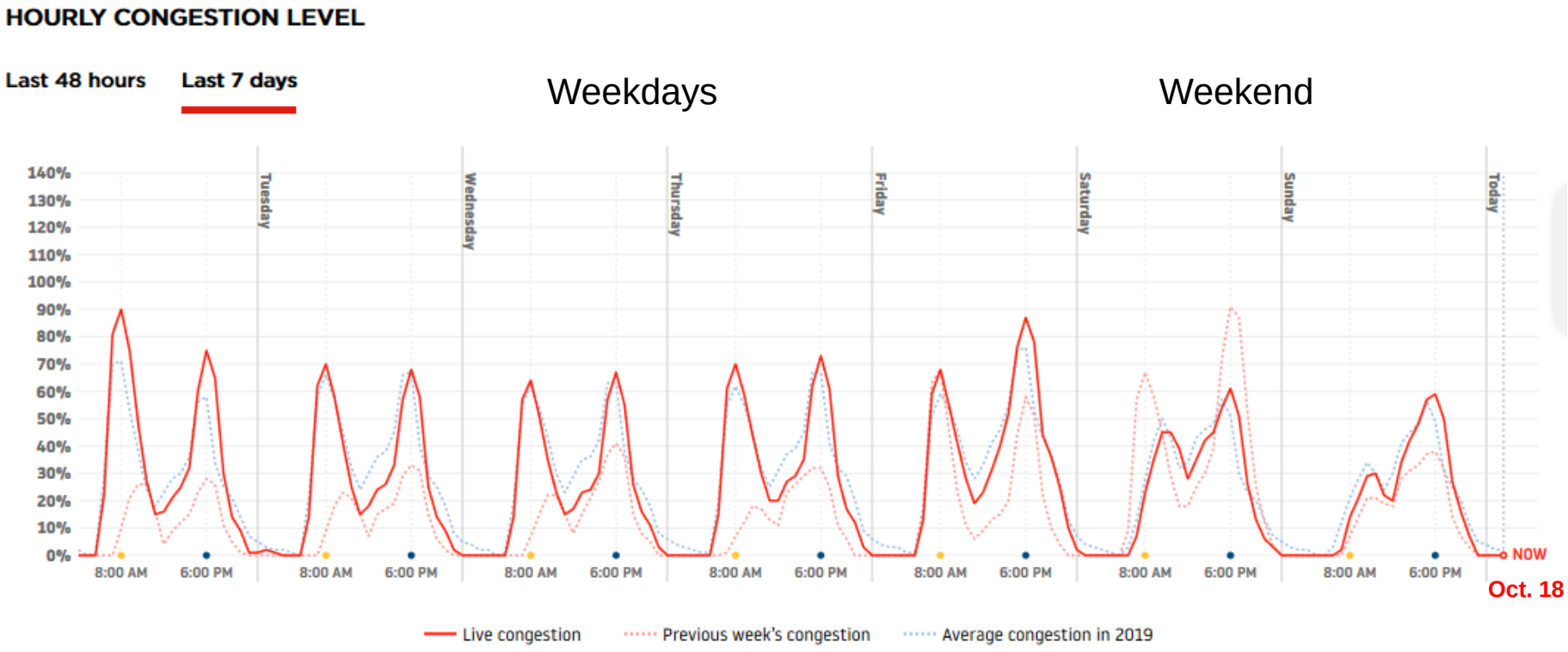
- Driving in major nations around the world has risen above the baseline at the start of 2020.
- However, in the industrialized world, driving has come off of the summer peak seasonally and as there are additional waves of the virus.

Represents the change in volume of people driving in their communities, based on requests to Apple Maps for directions.
https://www.apple.com/covid19/mobility

Source: Apple Mobility App, October 17, 2020

China's Traffic Has Returned to 2019 Levels Except During Non-Peak Times on Weekdays

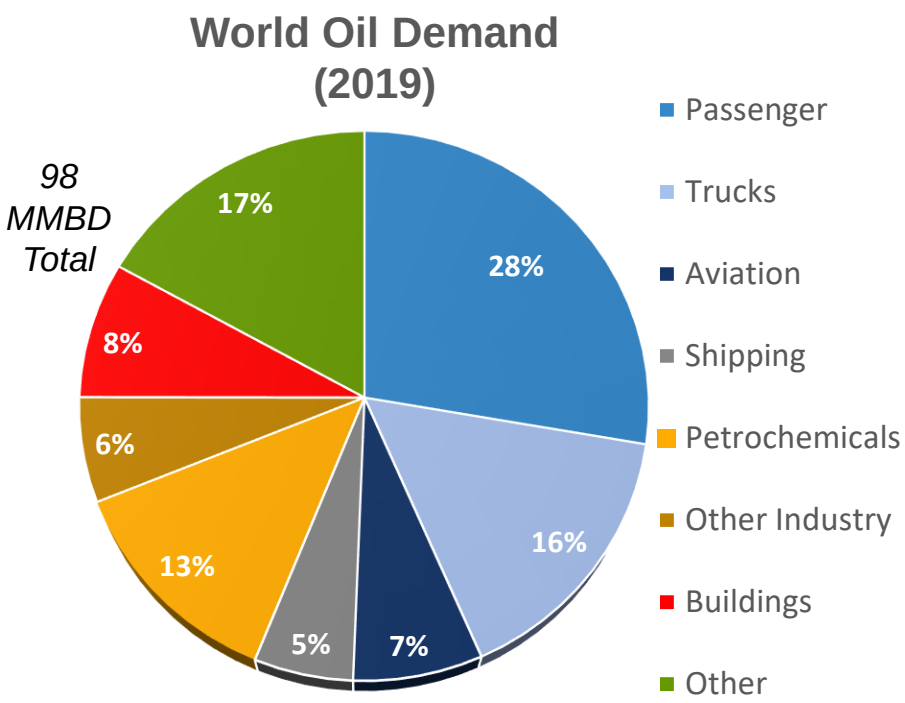
Beijing traffic

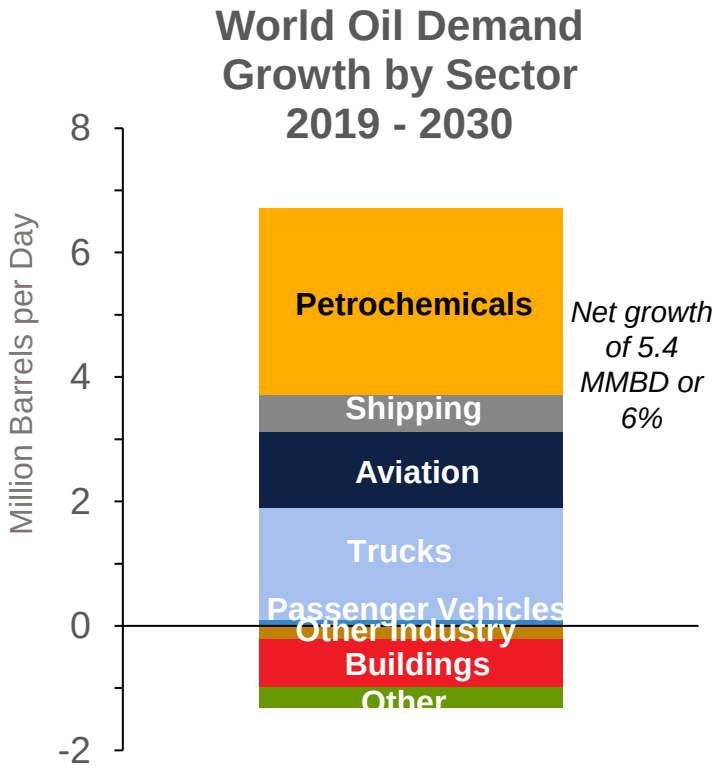


Source: TomTom, October 18, 2020; based on GPS data obtained from navigation devices and applications.
mhttps://www.tomtom.com/en_gb/traffic-index/beijing-traffic/

World Oil Demand Growth by Sector

International Energy Agency 2020 Forecast

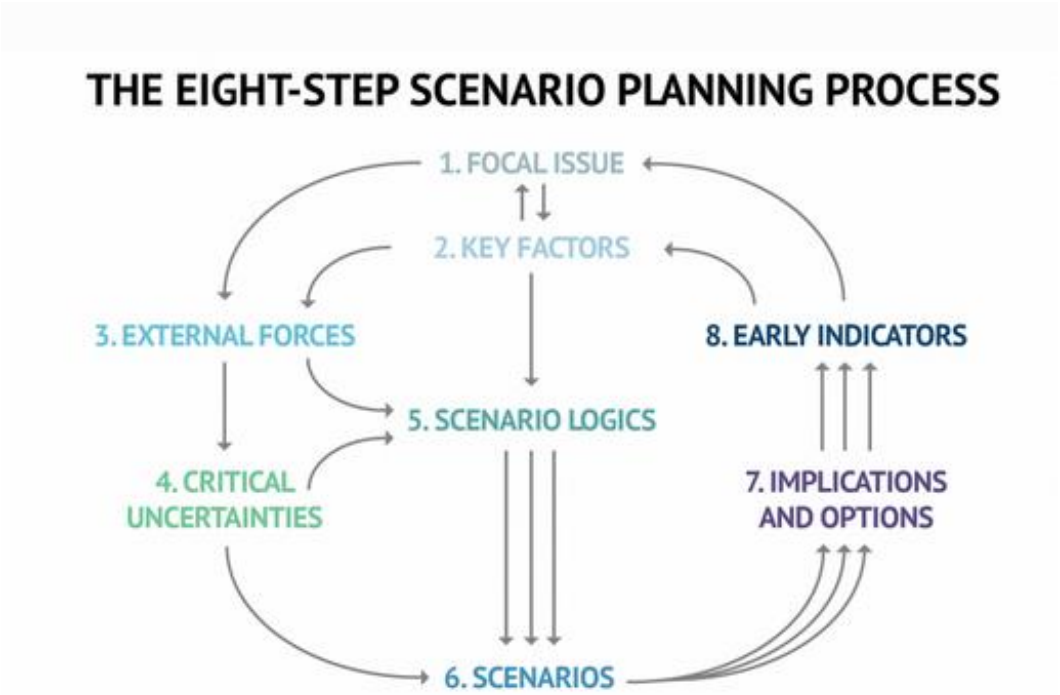




Source: International Energy Agency, 2020 World Energy Outlook, Stated Policies scenario, Other includes other transportation and power.

Largest expected growth in petrochemicals and trucks with only slight growth in the passenger vehicle sector

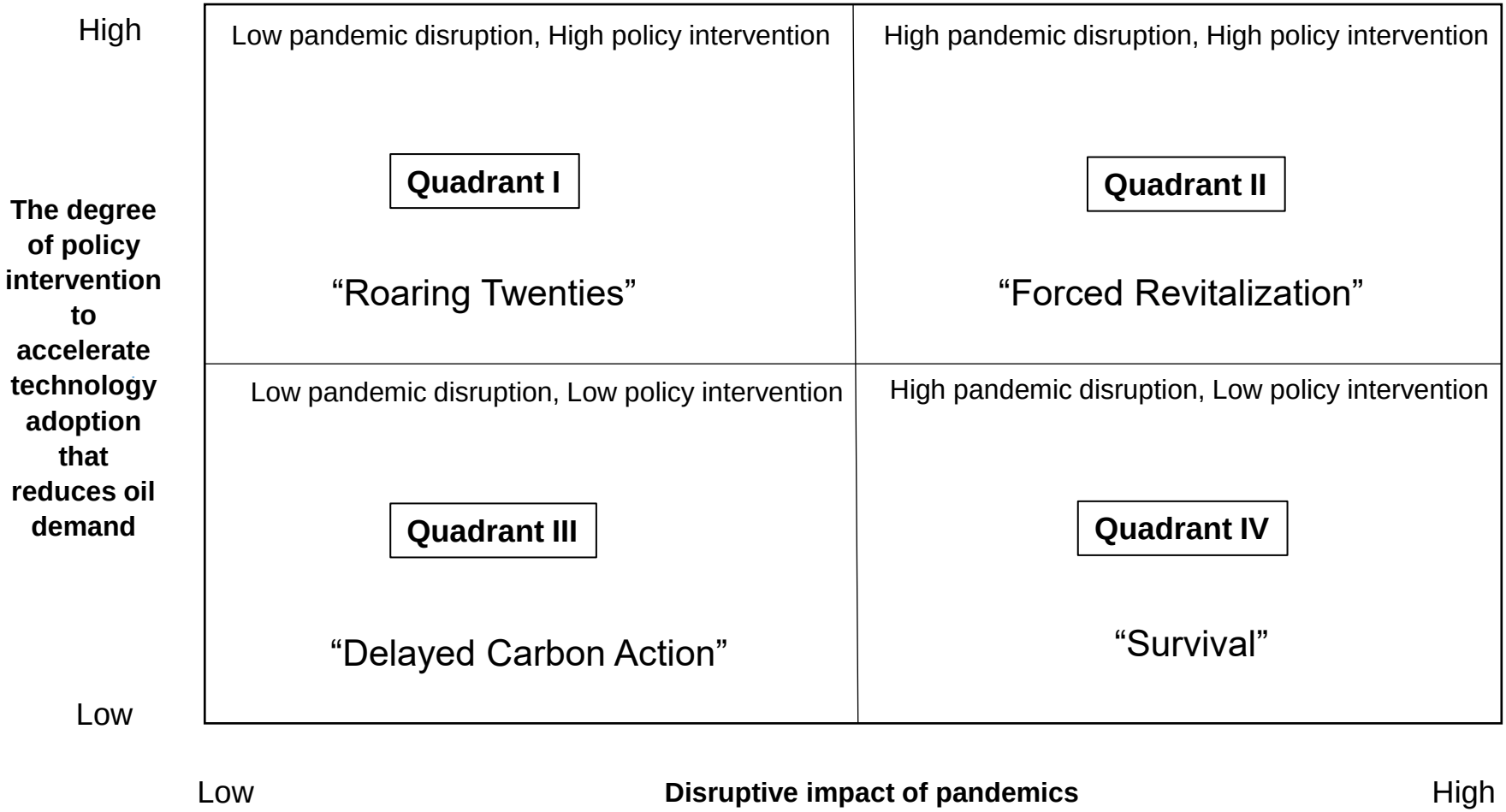
Scenario Planning Process



Critical Uncertainties: **Time Period: through 2030**

- **Disruptive impact of pandemics** to the global economy and mobility (including duration, recurrence or new diseases)
- **The degree of policy intervention** to accelerate technology adoption that reduces oil demand.

Scenario Logics



Roaring Twenties: Description

Low Pandemic, High Policy Intervention

- Effective COVID vaccine and large government stimulus lead to strong and fast global economic rebound.

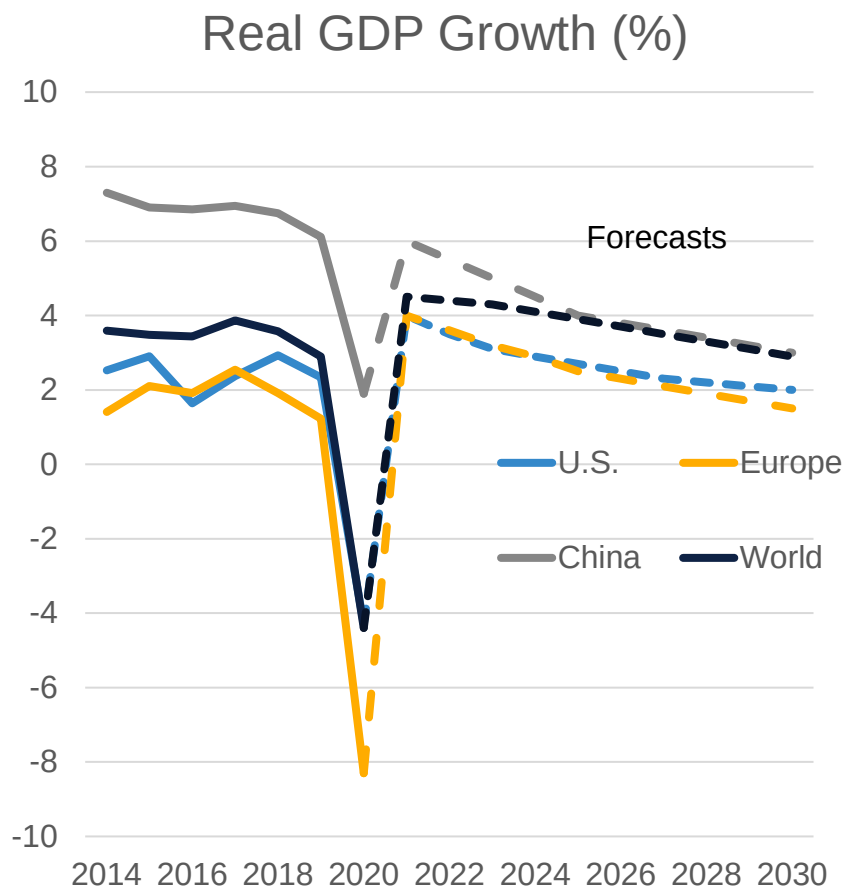
- The mid-2020s are marked by rapidly rising global oil demand, congestion, pollution and increased GHG emissions.

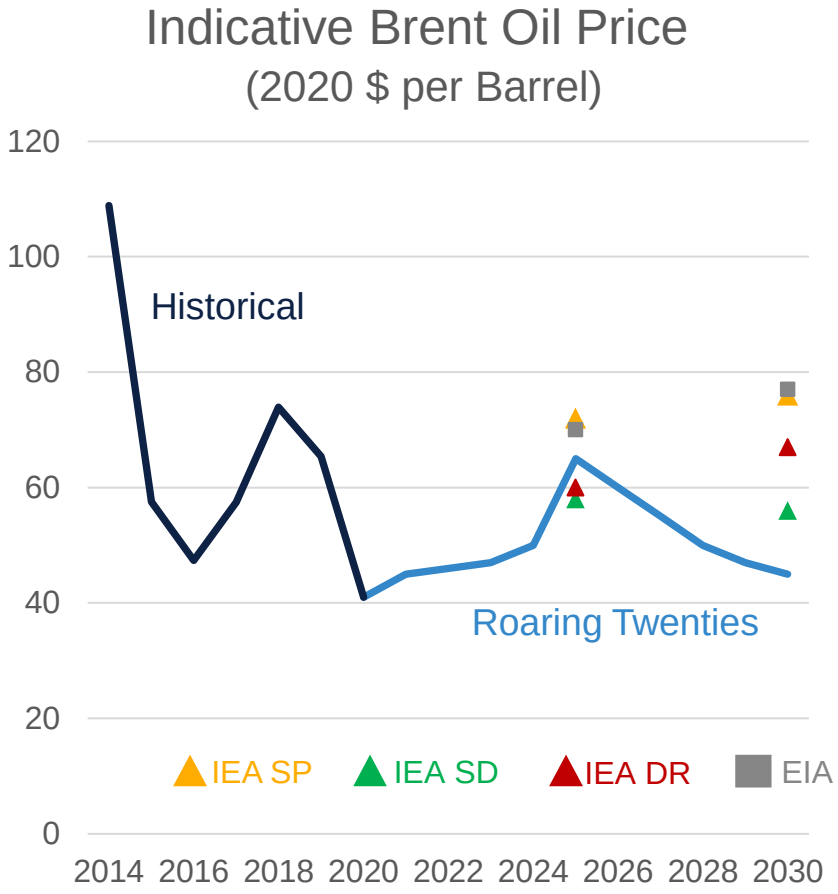
- Re-globalization shifts government focus from domestic economies to global issues like climate change.
  - U.S. and China work on carbon policies jointly
  - $50/tonne global carbon shadow price in 2030

- Stringent government policies to address these issues lower oil demand growth.

Roaring Twenties: Macro Drivers

Low Pandemic, High Policy Intervention





Source: Historical data – IMF for GDP and EIA for Brent spot price; IEA 2020 World Energy Outlook forecast, Stated Policies (SP), Sustainable Development (SD), and Delayed Recovery (DR) scenarios; EIA 2020 Annual Energy Outlook

Roaring Twenties: Impact on Transportation and Petrochemicals

Low Pandemic, High Policy Intervention

- Rise in transportation activity
  - Improved global economic growth increases driving, particularly with the return of ride-hailing services.
  - Improved global trade causes rebound in long distance trucking and marine shipping
  - Air travel returns to 2019 levels in 2024

- Governments increase fuel efficiency regulation post 2025 in all modes of transport

- Government zero emissions vehicles policies drive electrification of cars and trucks globally. By 2030:
  - Electric vehicle passenger car sales are 30% of new global car sales.
  - For light-duty commercial trucks, nearly 20% of global sales are electric
  - For heavy-duty trucks, 15% of global sales are for alternative vehicles (e.g., electric, LNG, fuel cell)

- For marine fuels by 2030, more than one-quarter are alternative to oil (e.g., LNG, biofuels, other).

- For petrochemical feedstock by 2030:
  - Global recycling has doubled (from 12% to 24%)
  - Alternative feedstock becomes 10% of the mix (e.g., bioplastics, other low carbon feedstock)
  - Ban on single use plastics increases to 6% of global plastic supply

Forced Revitalization: Description

High Pandemic, High Policy Intervention

- Successive waves of pandemic lower economic growth, and governments view technology innovation as the key to recovery. There is a high-tech competition between the U.S., Europe and China.

- The U.S. develops an industrial policy that incentivizes investment in green technology and innovations in bio-tech and other strategic industries.

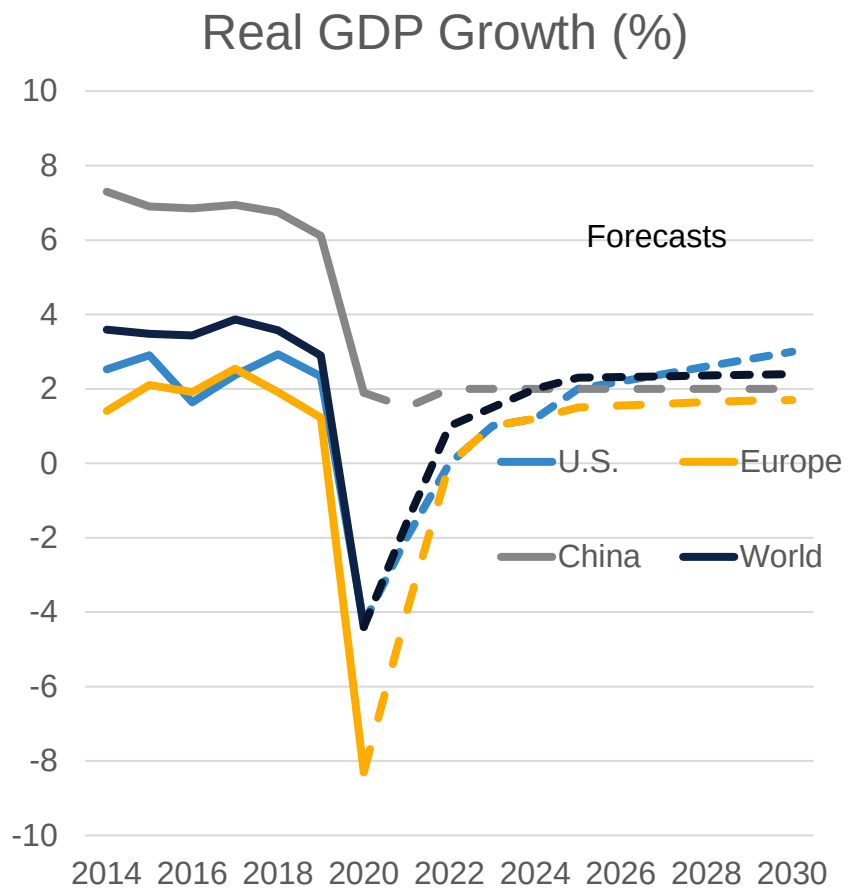
- R&D reduces the cost and increases the range of batteries and helps develop affordable low carbon bio-fuels.

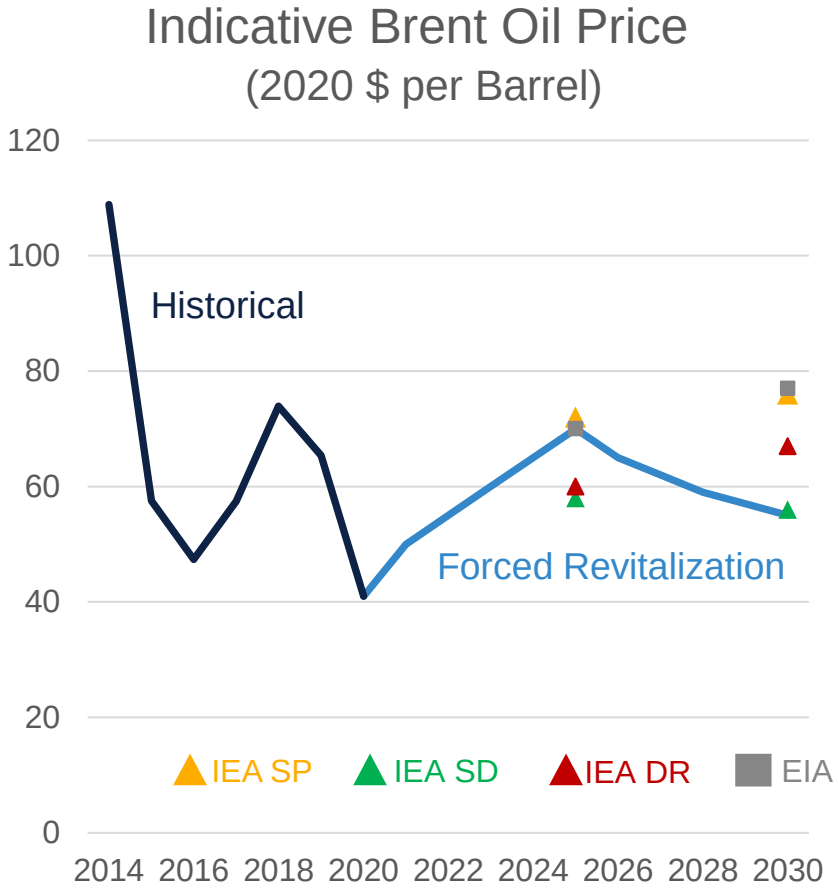
- The U.S. and Europe cut China out of their supply chains, which hurts China's economy and reduces global trade. Advances in 3-D printing shorten trading distances.

- A sustained period of low oil prices leads to political instability in oil-producing countries and a temporary supply disruption and higher oil prices in the mid 2020s.

Forced Revitalization: Macro Drivers

High Pandemic, High Policy Intervention





Source: Historical data – IMF for GDP and EIA for Brent spot price; IEA 2020 World Energy Outlook forecast, Stated Policies (SP), Sustainable Development (SD), and Delayed Recovery (DR) scenarios; EIA 2020 Annual Energy Outlook

Forced Revitalization: Impact on Transportation and Petrochemicals

High Pandemic, High Policy Intervention

- Travel activity weakened somewhat
  - Passenger VMT down due to telecommuting and weaker economic growth but offset by significant reduction in use of mass transit and ride-hailing.
  - Weak global trade hurts long distance trucking and marine shipping. Large volume of e-commerce deliveries.
  - Air travel returns to 2019 levels in 2027

- Cost declines from advanced R&D drives vehicle electrification and an increase in the use of biofuels post 2025 across modes of transport. By 2030:
  - Electric vehicle passenger car sales are 30% of new global car sales.
  - For light-duty trucks, nearly 20% of global sales are electric
  - For heavy-duty trucks, 17% of global sales are for alternative vehicles (e.g., electric, LNG, fuel cell)

- For marine fuels by 2030, more than 40% are alternatives to oil (e.g., LNG, biofuels, other), with half of them based on biofuels.

- For petrochemical feedstock by 2030:
  - Two-thirds increase in global recycling (from 12% to 20%)
  - Alternative feedstock becomes 13% of the mix (e.g., mostly bioplastics)
  - Ban on single use plastics increases to 3% of global plastic supply

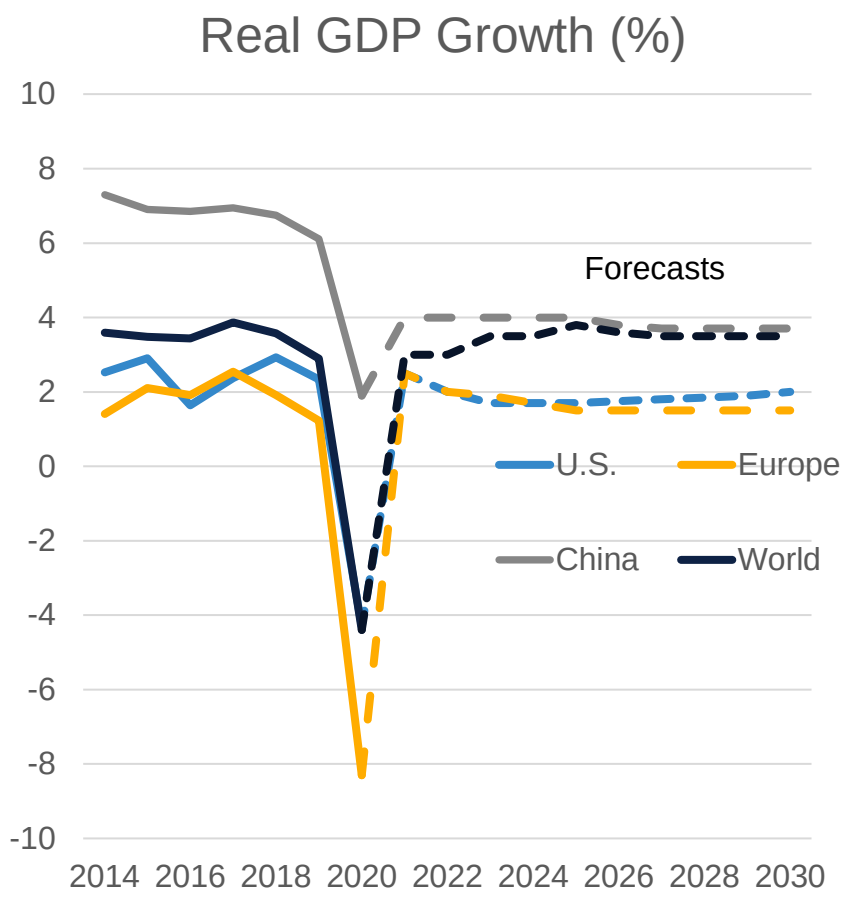
Delayed Climate Action: Description

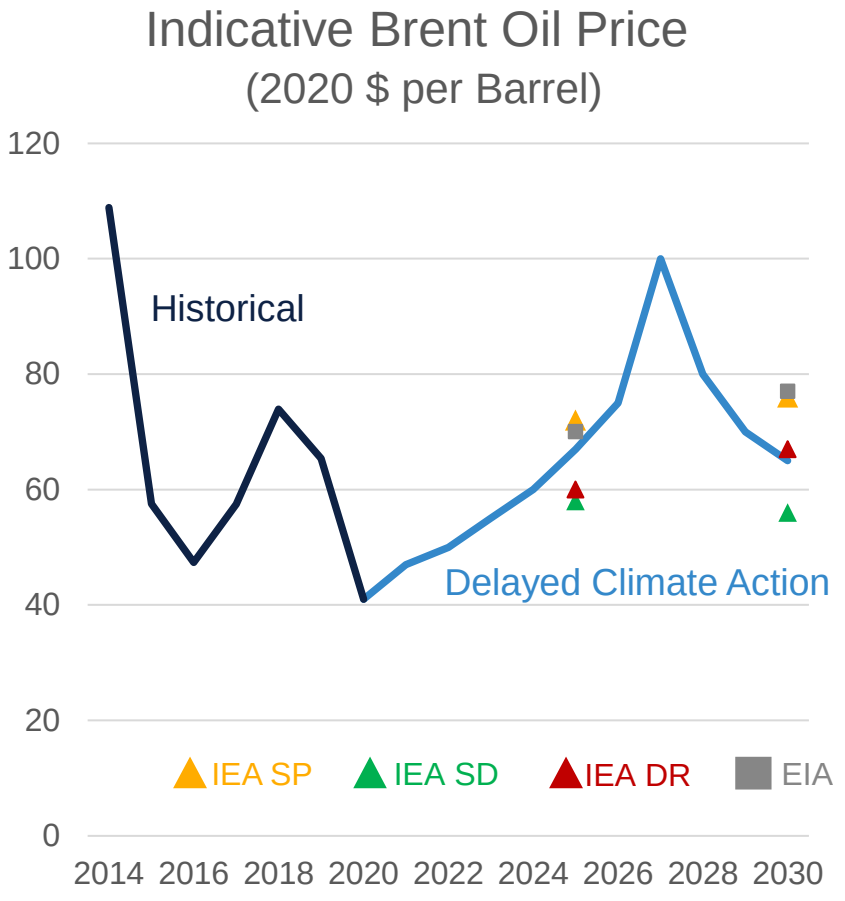
Low Pandemic, Low Policy Intervention

- There is a successful vaccine for COVID-19 in 2021, and the world regains confidence of avoiding the disease by the end of the year.
- The economic recovery is slow, and most governments focus on stimulating the brown economy and jobs.
- Protectionism and trade tariffs reduce global trade.
- Lack of prioritization of climate change delays action in the U.S., Europe and China until the mid 2020s.
- Robust oil demand growth in the face of weak supply growth causes oil prices to spike temporarily past 2025.

Delayed Climate Action: Macro Drivers

Low Pandemic, Low Policy Intervention





Source: Historical data – IMF for GDP and EIA for Brent spot price; IEA 2020 World Energy Outlook forecast, Stated Policies (SP), Sustainable Development (SD), and Delayed Recovery (DR) scenarios; EIA 2020 Annual Energy Outlook

Delayed Carbon Action: Impact on Transportation and Petrochemicals

Low Pandemic, Low Policy Intervention

- Passenger travel strengthens
  - Telecommuting is greatly reduced and telecommuters travel more miles on average daily than non-telecommuters as they have historically.
  - Ride-hailing comes back strongly, boosting passenger vehicle miles traveled
  - Air travel returns to 2019 levels in 2025

- Some national governments become more lenient on fuel efficiency standards and electrification for a few years while the global economy recovers.

- In terms of alternative vehicles and fuels, by 2030:
  - Electric vehicle passenger car sales rise to about 11% of new global car sales.
  - For light- and medium-duty trucks, 8-to-9% of global sales are electric.
  - For all trucks, about 6% of fueled used are alternatives to diesel (e.g., electric, LNG, biofuel, fuel cell)

- For marine fuels by 2030, more than 20% are alternatives to oil (e.g., LNG, biofuels, other), with 60% of those using LNG.

- For petrochemical feedstock, no single use plastics bans or increases in recycling by 2030.

Survival: Description

High Pandemic, Low Policy Intervention

- Continued fear about infection and continued weak economic growth cause governments to de-prioritize environmental concerns in favor of jobs and health and safety concerns.

- Virus concerns as well as the rise in income inequality and social unrest cause those who can afford it move out of the city.

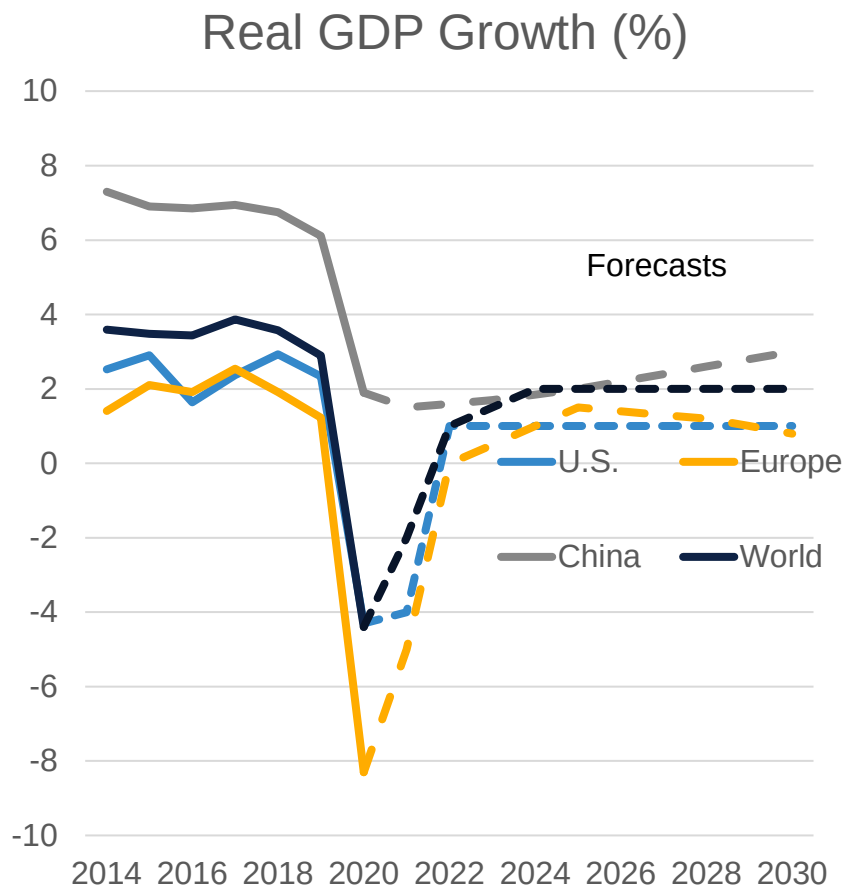
- While the weak economy & telecommuting hurts oil demand, this is partially offset by:
  - The rise of the personal vehicle as a substitute for mass transit and ride-hailing,
  - Rising purchases of used cars with lower fuel efficiency vs. higher cost EVs, and
  - People who move to the suburbs or rural areas drive significantly more.

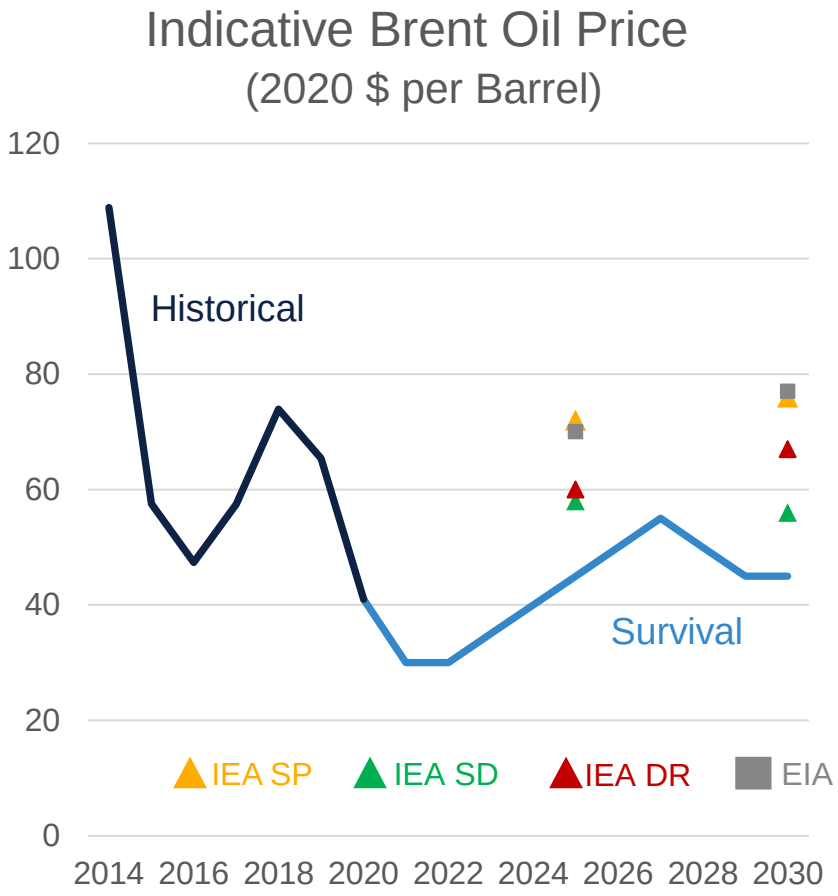
- City governments adopt policies to improve air quality and make cities more attractive

- Relatively weak oil demand and a period of sustained low oil prices lead to periodic supply disruptions in oil-producing countries and temporary price spikes.

Survival: Macro Drivers

High Pandemic, Low Policy Intervention





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Survival: Impact on Transportation and Petrochemicals

High Pandemic, Low Policy Intervention

- Passenger travel is weaker than in other scenarios
  - Passenger travel is weakened by weak economic growth and telecommuting (40% in U.S. and Europe and 21% in developing countries).
  - The weakening is partly offset by personal vehicles replacing mass transit and ride-hailing services, and people who have moved to the suburbs driving more daily miles.
  - Air travel returns to 2019 levels in 2029

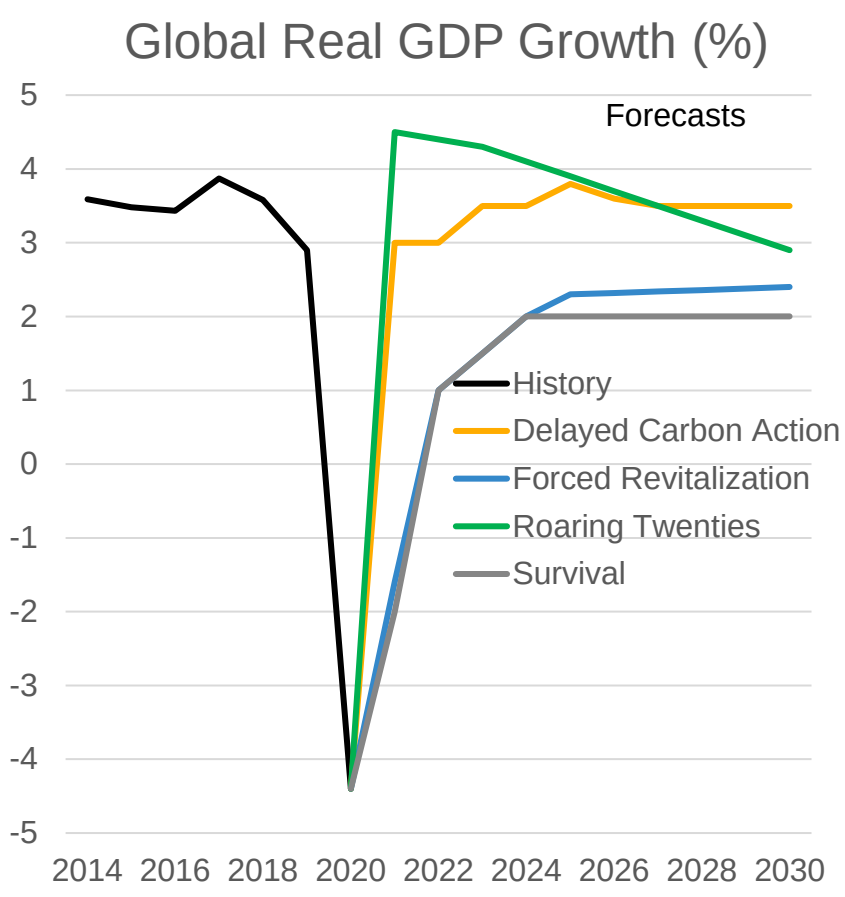
- Generally little national government support for improved fuel efficiency standards and electrification but city governments adopt some policies that encourage EVs and reduced driving.

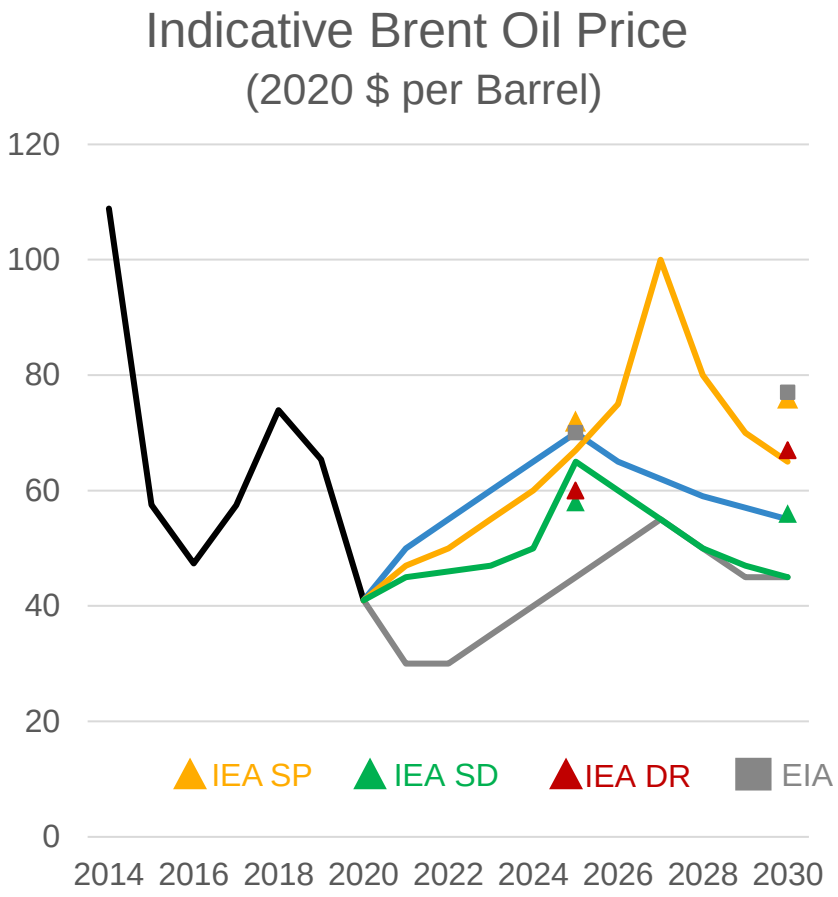
- In terms of alternative vehicles, by 2030:
  - Electric vehicle passenger car sales rise to about 10% of new global car sales.
  - For light- and medium-duty trucks, only 5% of global sales are electric.
  - For all trucks, about 3% of fuels used are alternatives to diesel (e.g., electric, LNG, biofuel, fuel cell)

- For marine fuels by 2030, more than 15% are alternatives to oil (e.g., LNG, biofuels, other), with two-thirds of those using LNG.

- For petrochemical feedstock, no single use plastics bans or increases in recycling by 2030.

Macro Drivers Across All Scenarios

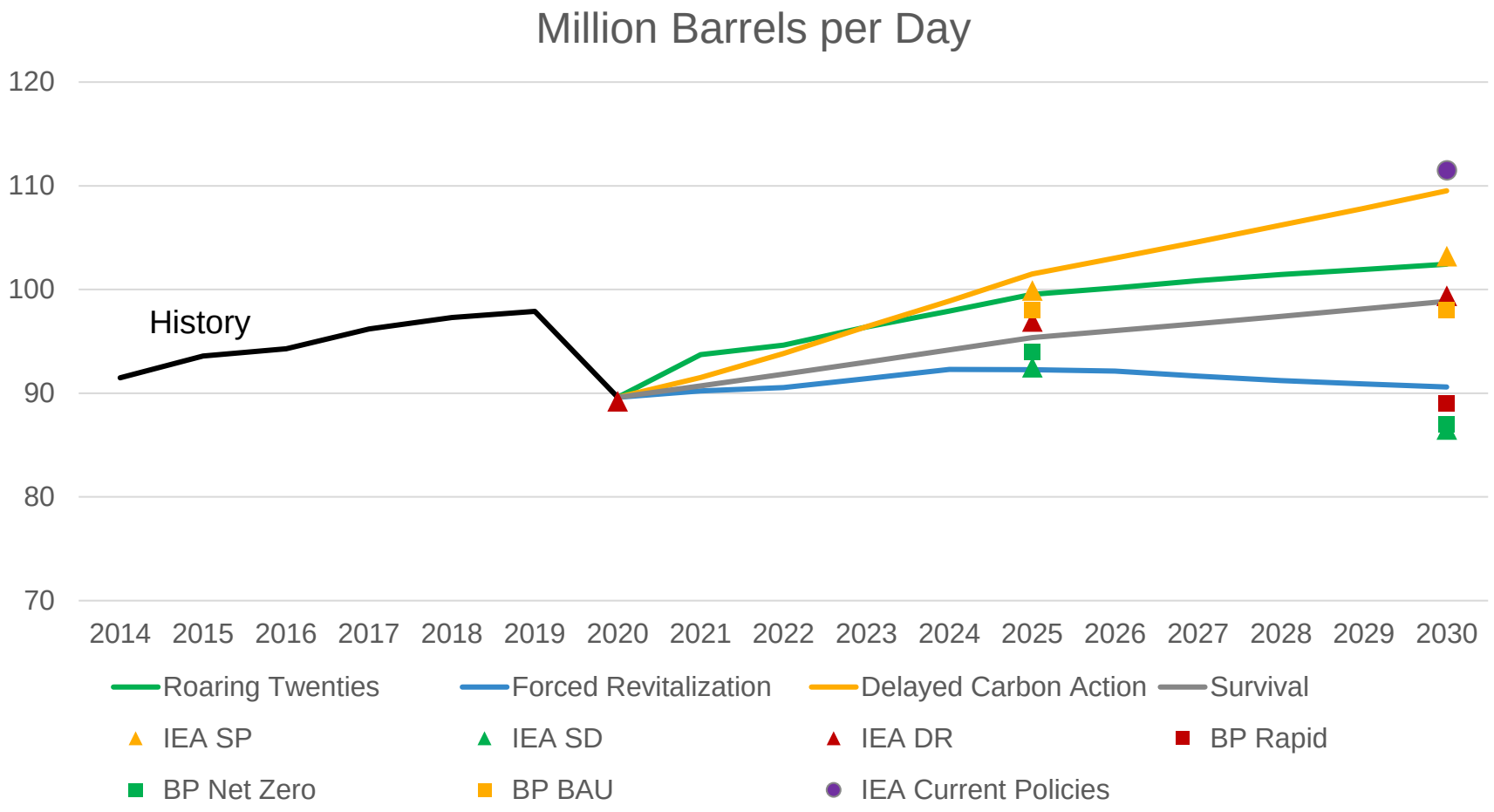




Source: Historical data – IMF for GDP and EIA for Brent spot price; IEA 2020 World Energy Outlook forecast, Stated Policies (SP), Sustainable Development (SD), and Delayed Recovery (DR) scenarios; EIA 2020 Annual Energy Outlook

Global Oil Demand* Across All Scenarios

Preliminary Results

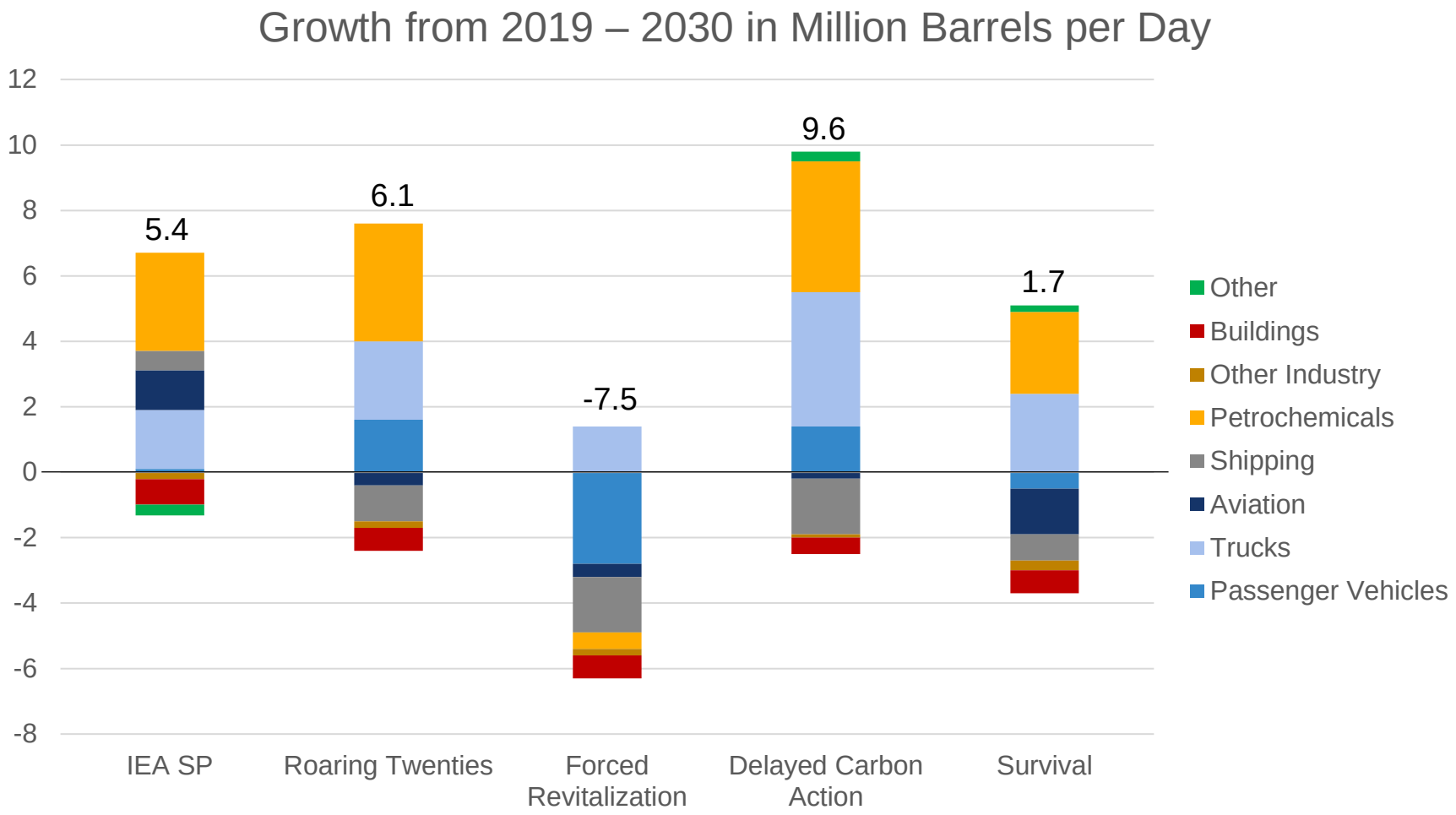


Source: Historical data – International Energy Agency Annual Statistical Supplement (2020); IEA 2020 World Energy Outlook forecast, Stated Policies (SP), Sustainable Development (SD), and Delayed Recovery (DR) scenarios; IEA 2019 World Energy Outlook Current Policies scenario; BP Energy Outlook, 2020

* Excluding biofuels

Global Oil Demand* Growth by Sector

Preliminary Results



Source: IEA 2020 World Energy Outlook forecast, Stated Policies (SP)

*Excludes biofuels

Observations on the Timing of the Peak in Global Oil Demand

- Global oil demand does not appear to have peaked already.

- Global oil demand doesn't peak before 2025 in any of the scenarios.
  - This is despite aggressive government policies that increase fuel efficiency and incentivize penetration of alternative vehicles / fuels in two of the scenarios.
  - It takes time before rising EV sales has a significant impact on fuel use for the entire global fleet.
  - There is strong growth in other demand sectors (e.g., petrochemicals, trucks)

- Global passenger vehicle oil demand peaks by 2025 in three of the four scenarios but that is generally offset by growth in two-three wheelers in the passenger sector and petrochemical feedstock and truck fuel use.

- In only one of the scenarios, does global oil demand peak before 2030. The peak is due to:
  - Aggressive government policy on fuel efficiency and alternative fuels across many modes of transportation, and
  - Very weak economic growth due to the continued disruptive impacts of the pandemic