



RYSTAD ENERGY

COVID-19 REPORT

5TH EDITION

GLOBAL OUTBREAK OVERVIEW AND ITS IMPACT
ON THE ENERGY SECTOR

7 APRIL 2020
PUBLIC VERSION

Table of contents

Executive summary

Outbreak status and outlook

Impact on oil demand

Impact on the oil and gas industry

Appendix

Table of contents

Executive summary

Outbreak status and outlook

Impact on oil demand

Impact on the oil and gas industry

Appendix

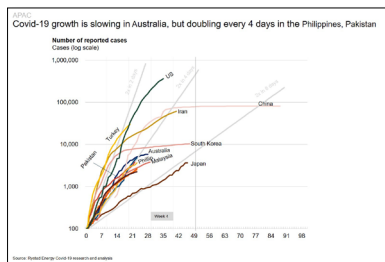
Covid-19 growth slows, destroying 27 million bpd of oil demand in April

Over the last six weeks, the Covid-19 outbreak has completely changed the global political and economic agenda. The outbreak is still in its infancy, and we do not know how long the pandemic will last or how deep the impact will be. The number of global active cases is still growing, however we see that growth is at a slower pace than what was seen two weeks ago. Updated figures from around the world enable us to better calibrate our model to project beyond reported numbers, estimating true infected cases globally. We have now increased our figure for true infected cases to 25 million, of which 19 million are *active* cases. Of these, only about 5% are actual reported cases.

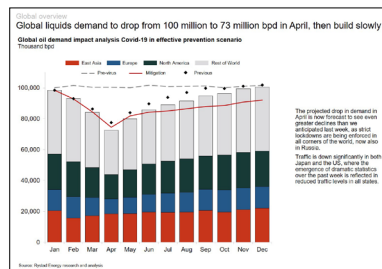
True active cases in Southern Europe are probably close to peak, while cases in Western, Eastern and Northern Europe are still growing. In six European countries more than 5% of the population has been infected, a level which already exceeds Intensive Care (ICU) capacity in many locations. In the coming weeks a number of large countries will join these ranks, reaching ICU capacity. These countries will likely regain control through additional quarantine measures in the near future. However, we see that if quarantine measures are loosened prematurely the number of true active cases in these countries may fluctuate above and below the level of ICU bed capacity for 12 months, for those countries with an average ICU capacity of 10 beds per 100,000 population.

Asian countries outside China still appear to be in the early phase of the outbreak, and it is too early to conclude how deep the impact will be in these countries. Iran and Turkey seem to have the highest number of cases so far, and may reach the levels seen in Southern Europe in the near future. In this edition of the Covid-19 report, we will focus on selected countries in Asia Pacific. We note how China and South Korea have curbed the outbreak, whilst in Japan the spread is still growing. We also see that Australia and Singapore look to have flattened, or are about to flatten their curve due to the social distancing measures implemented.

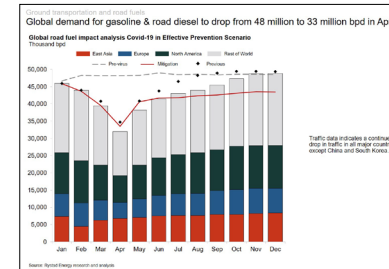
We now estimate that oil demand destruction in April could amount to 27 million barrels per day, of which nearly 5 million barrels per day will come from the three largest consumers; China, Japan and India. As a result we caution that the world may run out of storage capacity, causing refineries to shut-in and crude oil prices to reach extreme lows. With the very low oil prices expected in 2020, and high prices expected in 2022, oil companies might see a business case to close down fields today and reopen in 2022.



APAC Covid-19 virus scenarios, page 15



Global oil demand destruction outlook, page 30



Impact on global gasoline and road fuel, page 41

Table of contents

Executive summary

Outbreak status and outlook

- Global overview
- Asia Pacific focus
- Managing the virus - concepts and measures

Impact on oil demand

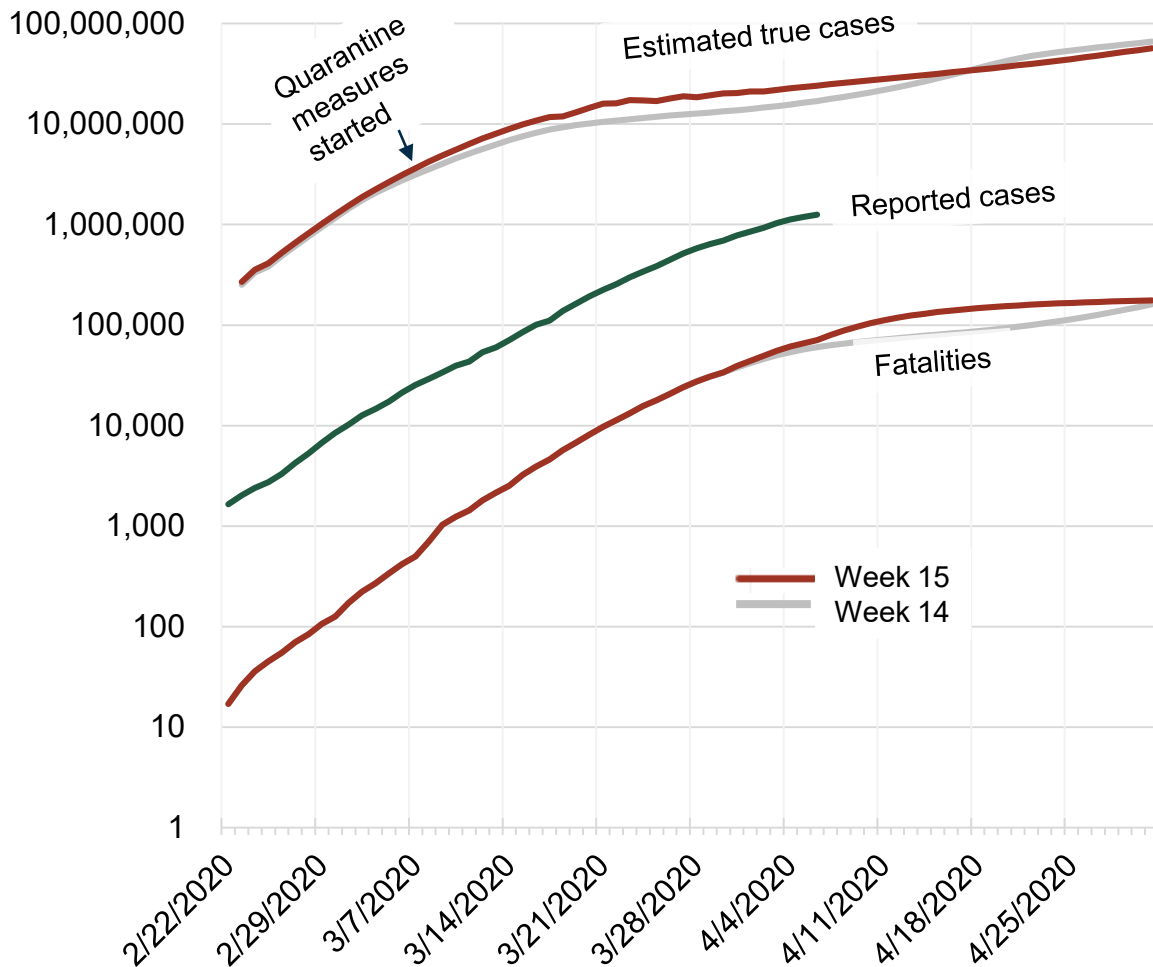
Impact on the oil and gas industry

Appendix

The true number of people infected globally is likely near 25 million

Number of true and reported cases outside China

Cases (log scale)



As of 6 April, 25 million people outside of China have been infected with Covid-19, according to our updated model.

Reported cases were 1.26 million as of 6 April, a number which represents just 5% of true cases according to our model. Reported cases grew last week by 9%, down from the 13% growth seen the previous week and 17% growth seen two weeks ago. This indicates that quarantine measures are working and that growth no longer is exponential.

Registered fatalities outside of China were 71,000 as of 6 April, a number which grew by 11% over the last week versus the 14% growth seen one week ago and 19% growth two weeks ago. Thus, growth in fatalities is also slowing. However, real growth is lagging behind true cases by 18 days and therefore we expect growth in fatalities will slow further over the next two weeks. Nevertheless, growth in fatalities was higher than expected last week, resulting in an upward revision of our historical estimates for *true cases*. As a result, we adjusted our empirical figures upwards for the effective Reproductive number R_E and corresponding Contact Rate (CR) during quarantines.

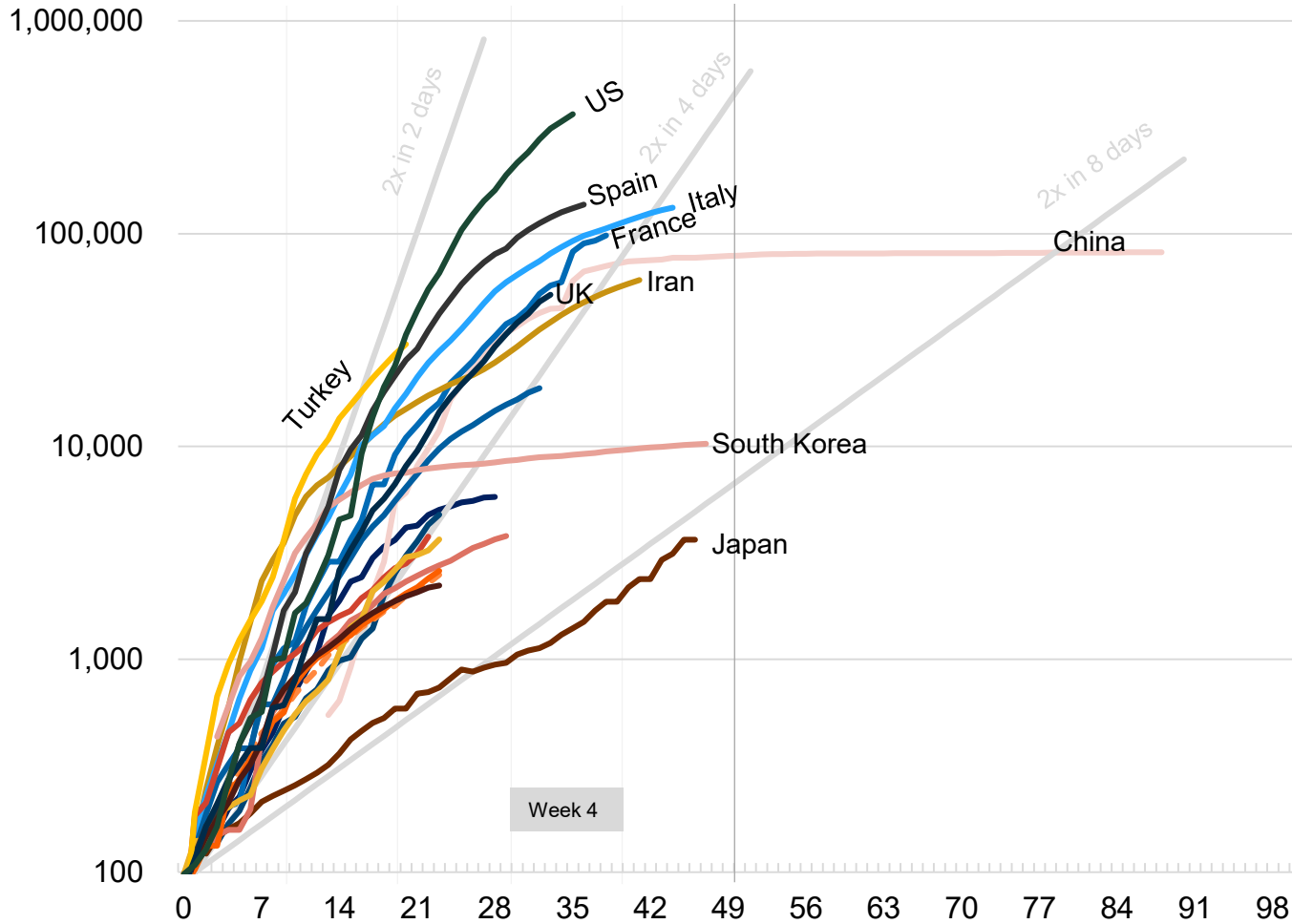
In this edition we are only presenting one scenario (an Effective Prevention Scenario) for the rest of April, where current strict quarantine measures are maintained through the end of the month, but the CR is adjusted to 3 interactions per person per day. In this scenario 57 million people will be infected across the globe by the end of April. We are comparing this with the «soft mitigation» scenario from last weeks report

* Reason for 0.5% given in the methodology chapter "Calibrating ICU bed capacity"
Source: Rystad Energy Covid-19 research and analysis

All countries are seeing slower growth, but the US and Turkey are growing the quickest

Number of reported cases

Cases (log scale)



Source: Rystad Energy Covid-19 research and analysis

Traffic data for Asia and the Middle East shows clear signs of lockdown

Traffic in Asia and the Middle East versus normal, pre-virus traffic patterns

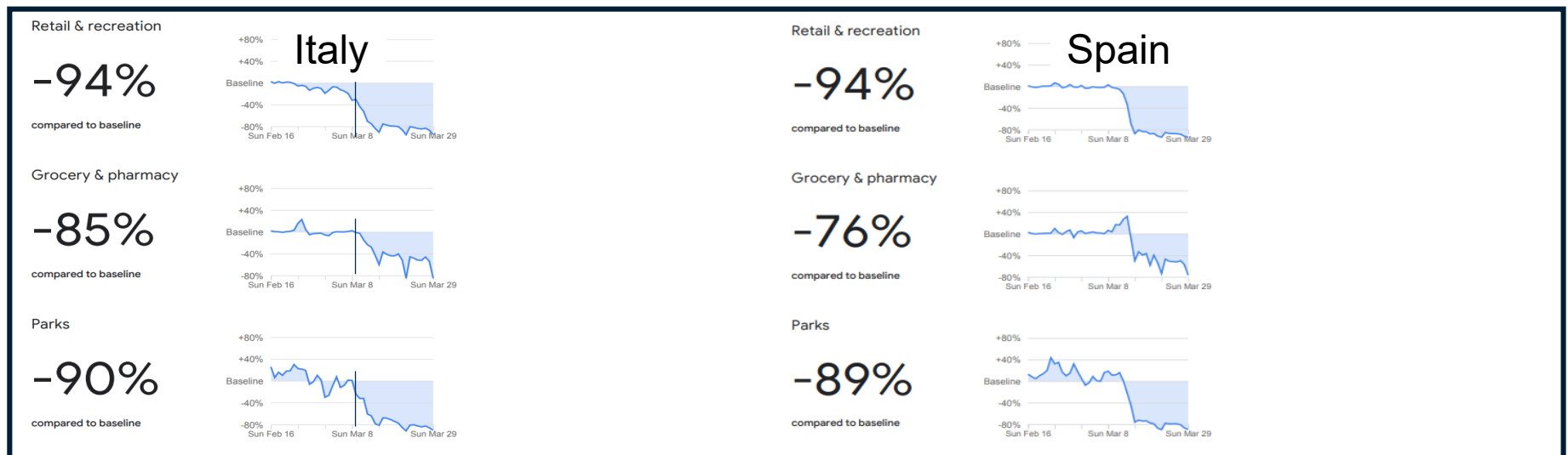
		20.03.2020	21.03.2020	22.03.2020	23.03.2020	24.03.2020	25.03.2020	30.03.2020	01.04.2020	02.04.2020	03.04.2020	04.04.2020	
Continent	Country	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Monday	Wednesday	Thursday	Friday	Saturday	
Middle East	Bahrain	-17%	-15%	-37%	-37%	-35%	-34%	-45%	-53%	-45%	-30%	-37%	
	Iran (Islamic Repu)	-49%	-53%	-57%	-56%	-54%	-53%	-60%	-75%	-58%	-49%	-51%	
	Iraq	-91%	-92%	-92%	-92%	-92%	-92%	-91%	-92%	-88%	-87%	-89%	
	Israel	-38%	-28%	-50%	-52%	-52%	-52%	-53%	-51%	-52%	-35%	-35%	
	Jordan	-3%	-84%	-61%	-62%	-52%	-40%	-36%	-46%	-41%	-83%	-31%	
	Kuwait	-4%	-5%	-44%	-39%	-36%	-35%	-34%	-41%	-37%	-4%	-14%	
	Lebanon	-33%	-33%	-37%	-52%	-54%	-57%	-45%	-39%	-49%	-50%	-39%	
	Oman	-5%	-1%	-23%	-20%	-25%	-25%	-27%	-39%	-25%	-45%	-42%	
	Qatar	7%	4%	-20%	-23%	-21%	-22%	-23%	-25%	-24%	4%	9%	
	Saudi Arabia	5%	-2%	-32%	-31%	-31%	-28%	-16%	-13%	-15%	27%	22%	
	State of Palestine	-3%	-24%	-17%	-20%	-20%	-17%	-22%	-24%	-20%	-11%	-37%	
	Turkey	-19%	-19%	-15%	-25%	-25%	-25%	-30%					
	United Arab Emira	-5%	-11%	-23%	-34%	-37%	-43%	-38%	-42%	-39%	-13%	-25%	
	Asia	Afghanistan	-30%	-59%	-44%	-39%	-49%	-49%	-85%	-92%	-85%	-87%	-90%
Armenia		-37%	-33%	-35%	-34%	-37%	-49%	-51%	-37%	-39%	-35%	-32%	
Azerbaijan		-33%	-32%	-20%	-32%	-31%	-33%	-37%	-39%	-39%	-40%	-28%	
Bangladesh		-31%	-34%	-37%	-41%	-33%	-41%	-90%	-87%	-89%	-87%	-84%	
Cambodia		-17%	-14%	-21%	-11%	-16%	-18%	-19%	-21%	-20%	-19%	-27%	
China		-5%	-2%	0%	5%	7%	5%	3%	3%	3%	8%	-11%	-69%
Georgia		-31%	-31%	-30%	-45%	-44%	-41%	-39%	-35%	-41%	-43%	-39%	
India		-17%	-17%	-62%	-36%	-45%	-55%	-55%	-62%	-57%	-57%	-55%	
Indonesia		-14%	-23%	-25%	-24%	-24%	-42%	-30%	-34%	-29%	-33%	-34%	
Japan		-20%	-5%	4%	-11%	-12%	-12%	-13%	-10%	-10%	-17%	-15%	
Kazakhstan		-26%	-13%	-23%	-38%	-41%	-37%	-38%	-50%	-52%	-52%	-39%	
Kyrgyzstan		-25%	-24%	-38%	-34%	-38%	-42%	-43%					
Lao People's Dem		6%	21%	24%	3%	5%	11%	1%					
Malaysia		-50%	-40%	-33%	-42%	-39%	-39%	-41%	-45%	-37%	-38%	-28%	
Mongolia		-27%	-22%	-25%	-22%	-24%	-25%	-24%	-19%	-21%	-20%	-17%	
Myanmar		-17%	-17%	-20%	-18%	-12%	-17%	-43%					
Pakistan		-26%	-29%	-34%	-59%	-57%	-58%	-66%	-64%	-59%	-58%	-55%	
Philippines		-62%	-64%	-63%	-64%	-66%	-65%	-70%	-74%	-71%	-68%	-70%	
Singapore		-33%	-23%	-33%	-27%	-33%	-32%	-35%	-40%	-34%	-31%	-33%	
Sri Lanka		-49%	-95%	-93%	-89%	-44%	-91%	-85%	-84%	-84%	-85%	-87%	
Tajikistan	-14%	-21%	-17%	-35%	-35%	-30%	-27%						
Thailand	-28%	-29%	-43%	-38%	-40%	-35%	-49%	-51%	-50%	-47%	-48%		
Turkmenistan	-71%	-84%	-81%	-78%	-75%	-83%	-79%						
Uzbekistan	-11%	-27%	-15%	-30%	-21%	-27%	-55%						
Viet Nam	-13%	-13%	-1%	9%	-14%	-10%	-19%						

As observed last week, the strongest reduction in traffic was seen in South Asia (India, Pakistan, Sri Lanka, Bangladesh) and Central Asia.

Source: Rystad Energy Covid-19 research and analysis

Evidence for effective reproduction number (R_E) after onset of quarantine measures

- The Basic Reproduction Number (R_0) is the number of new people infected per one infected person. R_0 is a function of the Contact Rate (CR) which is defined as the average number of new people one person meets per day (typically 10), Transmissibility (T), which is the likelihood of infecting others (typically 4%), and "d" which is the duration of infectiousness in days (typically 7 days). The Basic Reproduction Number is: $R_0 = CR * T * d$. In the typical case described here $R_0 = 10 * 4% * 7 = 2.8$
- The Effective Reproduction Number (R_E) is the number of new people infected after quarantine measures are introduced. This number can be indirectly measured after observing growth trends for true infected cases based on an analysis of reported fatalities and ICU bed occupancy. One month after Italy went into quarantine, we have empirical evidence for what this number could be.
- Italy:** After an escalating number of reported cases and fatalities, Italy was the first European nation to go into lockdown on 9 March. Increasingly strict quarantine measures were announced by the prime minister up to 21 March, locking down all non-essential industries and business. In Lombardy, all outdoor physical activity was banned. Google's overview of personal mobility changes can be seen below. Here we see that it took about one week to decrease mobility from -40% to -80% lower presence at public places such as retail and recreation and transit stations from 9 March to 15 March. Our empirical CR number (assuming no changes in T and d) fell from 10 before 4 March to **2.9** between 15 March and 28 March based on latest observed fatalities and ICU bed use.
- Spain:** Similar to the developments seen Italy, but initially 10 days later in terms of reaching thresholds for reported cases and fatalities, currently five days later. Spain declared national lockdown 15 March with the closure of all non-essential activity, mandating that all individuals stay home. According to Google location data, the mobility of the Spanish population fell even more quickly than in Italy. Still, our empirical CR number from 15 to 28 March is **3.9**, slightly less effective than Italy.
- Asia:** Similar studies for China show an empirical CR of **3.0** for 8 February to 21 February. In South Korea, we see a CR of **4.0** from 1 March to 20 March and in Japan we see a CR of **4.8** from 4 March to 26 March.
- With this, we assume that a CR of **3.0** is the best a nation can achieve, which means that $R_E = 3 * 4% * 7 = 0.84$. This is below 1 which means that the infection will peak and decline. In our model, we will use CR 5, 4 and 3 for three defined levels of quarantine measures



Source: Rystad Energy Covid-19 global model; Google Community Mobility Reports; Worldometer (5 April); James Holland Jones *Notes on R_0* ; <https://web.stanford.edu/~jhj1/teachingdocs/Jones-on-R0.pdf>

Table of contents

Executive summary

Outbreak status and outlook

- Global overview
- **Asia Pacific focus**
- Managing the virus - concepts and measures

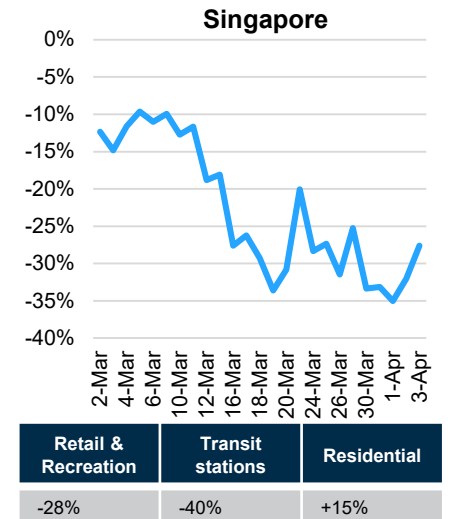
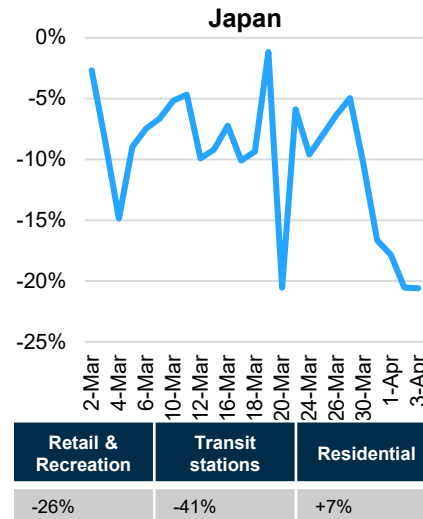
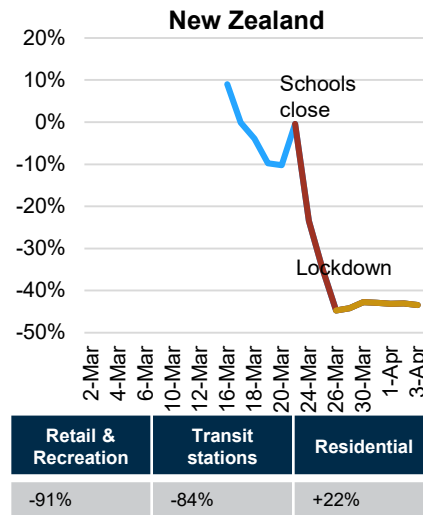
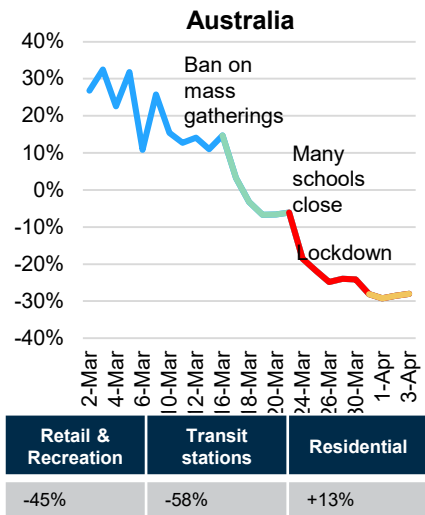
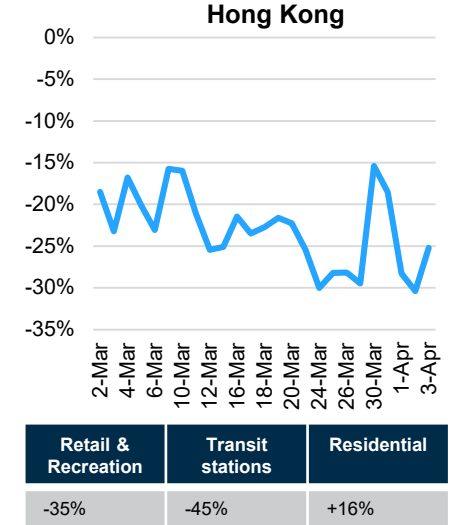
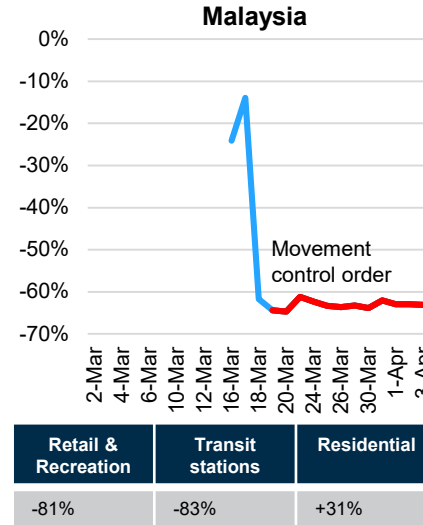
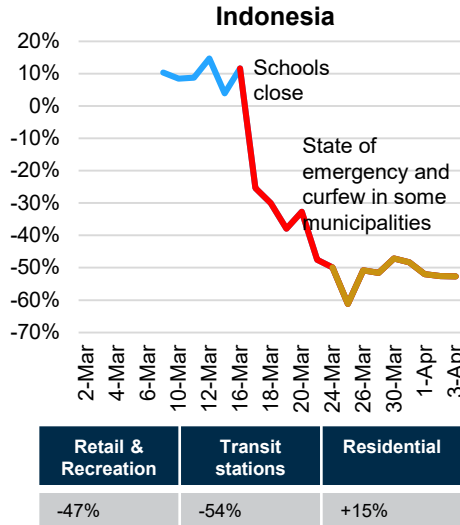
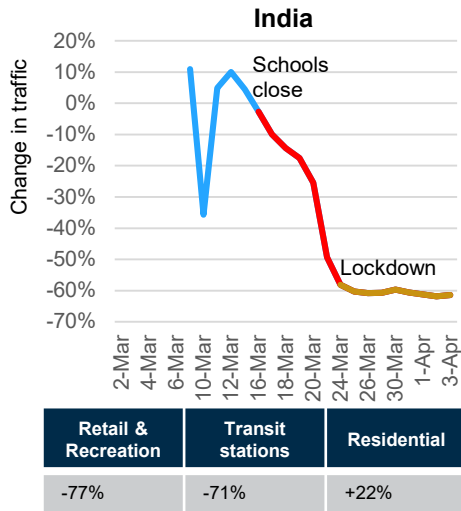
Impact on oil demand

Impact on the oil and gas industry

Appendix

Traffic has decreased in APAC countries as government restrictions are imposed

The drop in countries' mobility for recreation and transit purposes shows good compliance with government measures



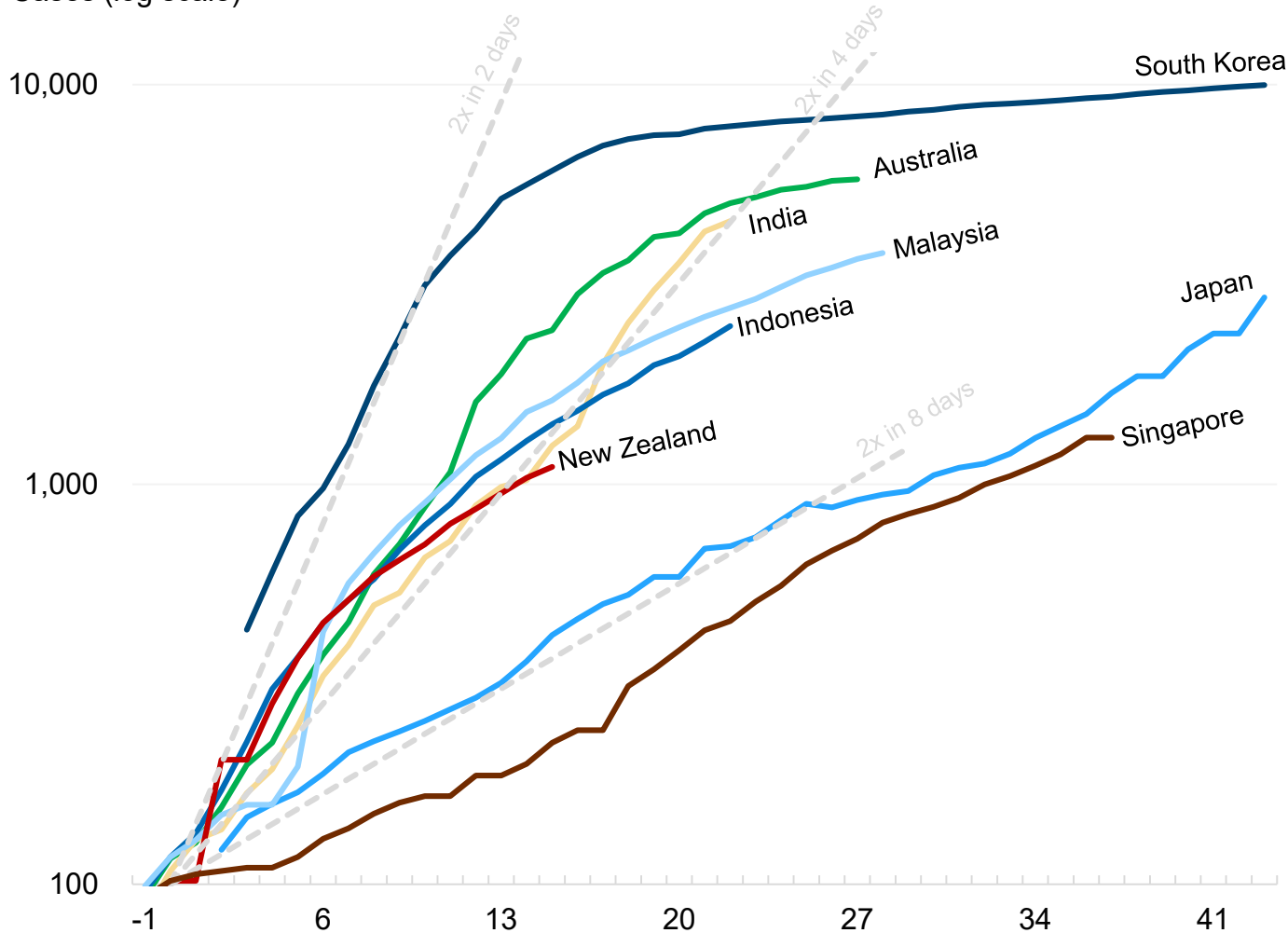
Source: Rystad Energy data manipulations; Google Community Mobility Reports

APAC

Preventive measures are having an effect in APAC, although less in Japan, Singapore

Number of reported cases

Cases (log scale)



Preventive measures seem to be having an effect in APAC countries. South Korea is a well-known case of success, where social distancing measures as well as wide-spread testing and tracking led to the flattening of the curve.

We are seeing that measures are having an effect in Australia, India, Malaysia, Indonesia and New Zealand as well, although we note the inherent uncertainty in reported numbers.

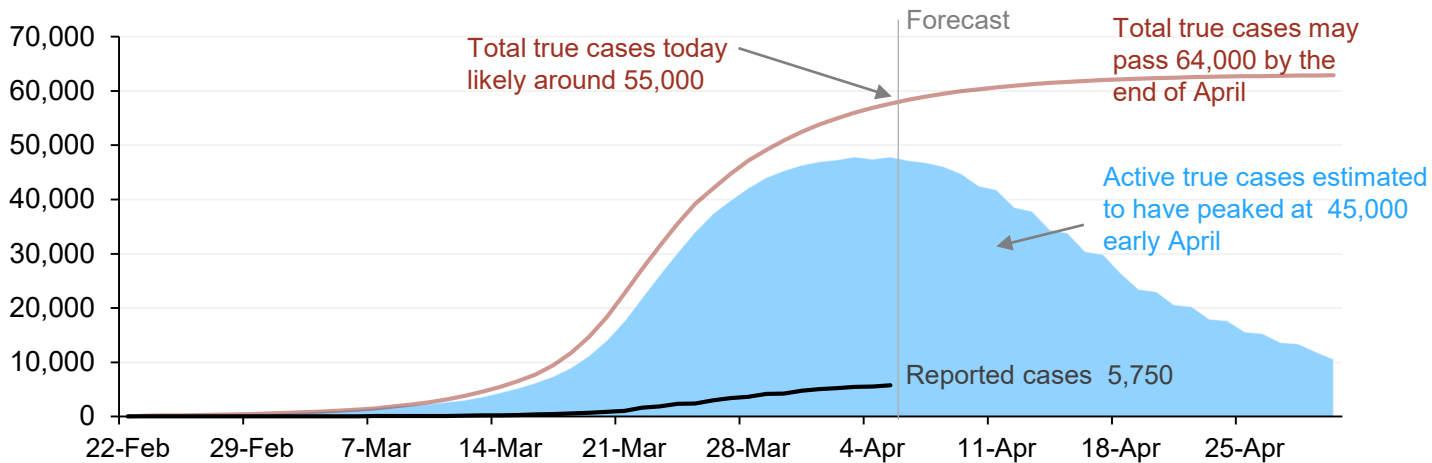
Japan and Singapore do not seem to be flattening out, however they do show a slower spread than seen in other countries. The recent lockdown in Singapore will take some days to appear in reported numbers due to the time from infection to symptoms, which encourages testing.

Source: Rystad Energy Covid-19 research and analysis

Australia's measures may be having an effect; active cases have probably peaked

Australia, estimated total and active true cases

Number of cases; Current measures scenario*

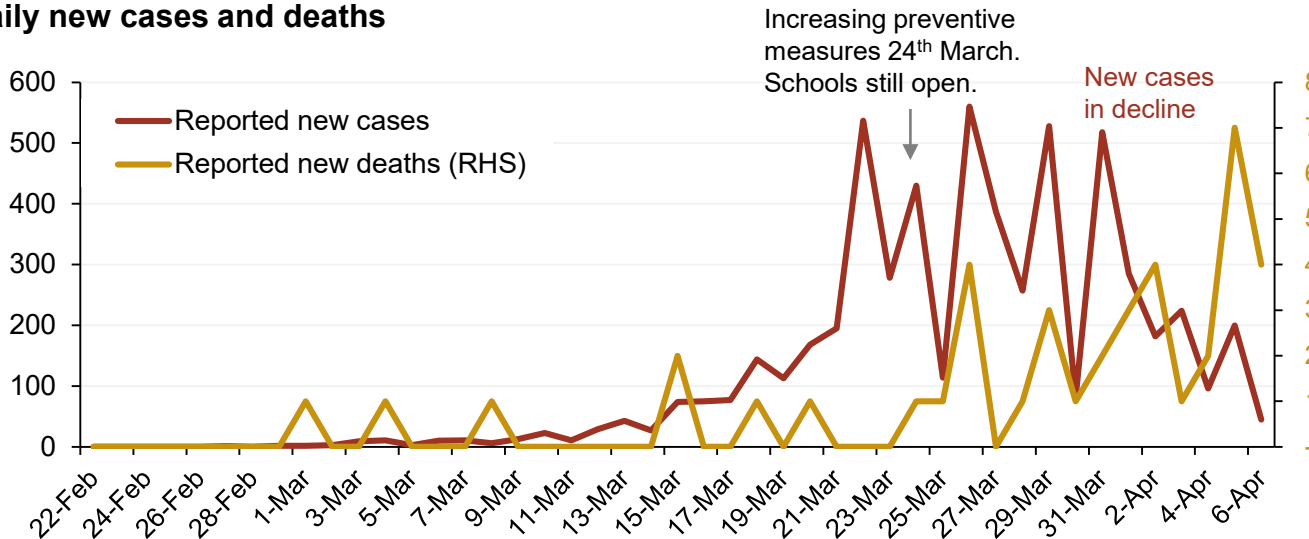


Australia has not implemented the same strict measures seen in many other countries. The most recent significant government measures introduced were implemented on 24 March, when Australians were told to stay at home except for essential outings. Public locations such as libraries and amusement parks have been shut down, but schools remain open.

Our forecast assumes that current preventive measures will remain during the forecast period. We estimate the current total true number of cases is at approximately 55,000, around nine times the 6,000 cases reported. In our Effective Prevention Scenario we expect the total true number of cases to grow to 64,000 by the end of April.

The lower chart shows daily new cases, which have flattened out since 22 March, an indication that measures may be working.

Daily new cases and deaths

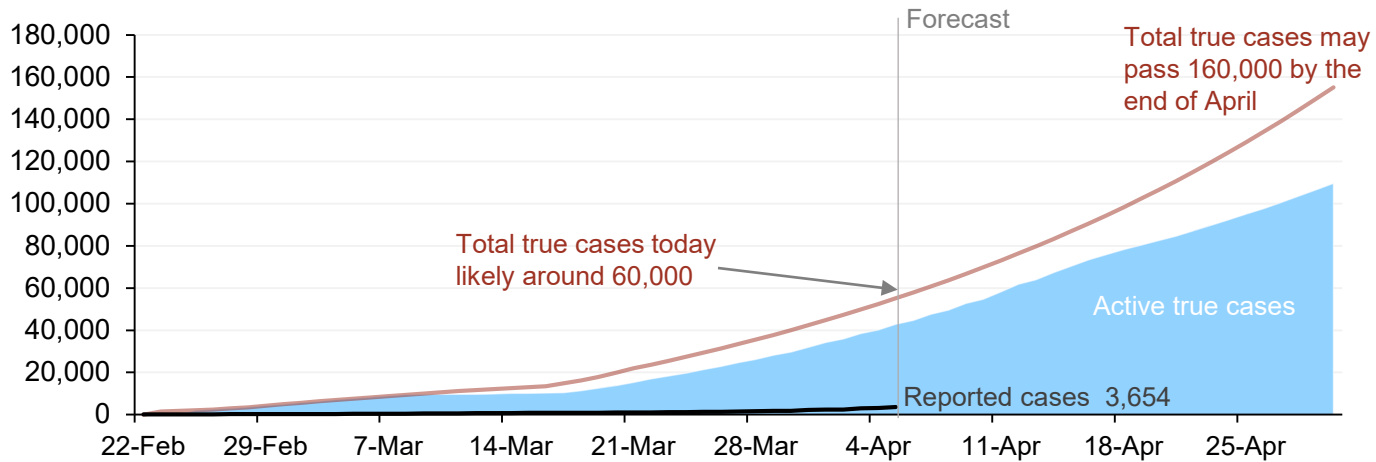


Source: Rystad Energy research and analyses; Worldometer; *Assumes current measures in place during forecasting interval

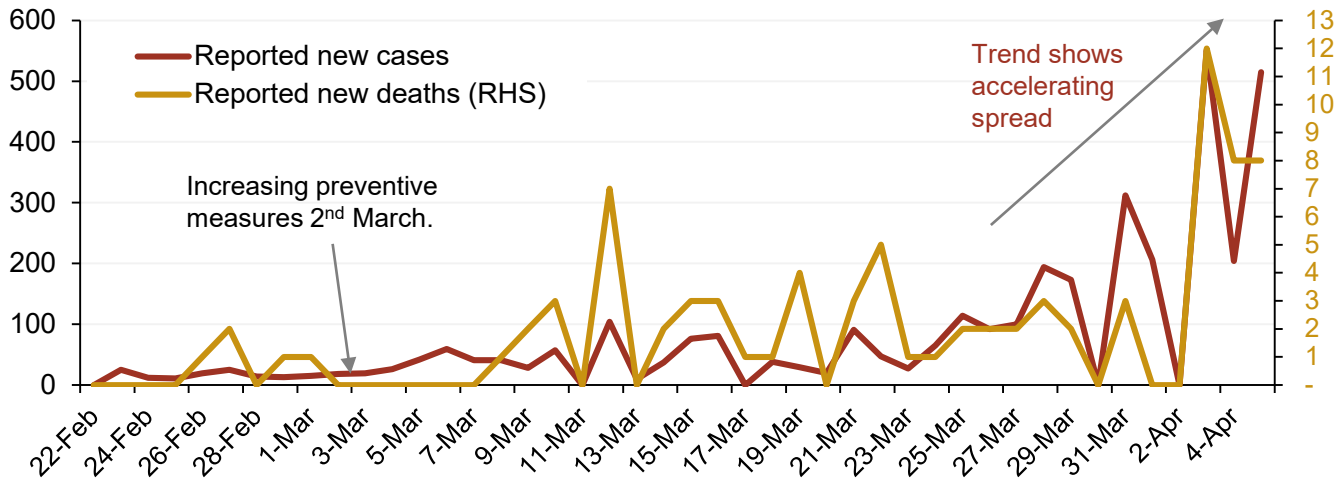
For further details please see our Covid-19 dashboard at [rystadenergy.com](https://www.rystadenergy.com).

Japan is reporting accelerating spread. True cases may reach 160,000 by the end of April

Japan, estimated total and active true cases
 Number of cases; Current measures scenario*



Daily new cases and deaths

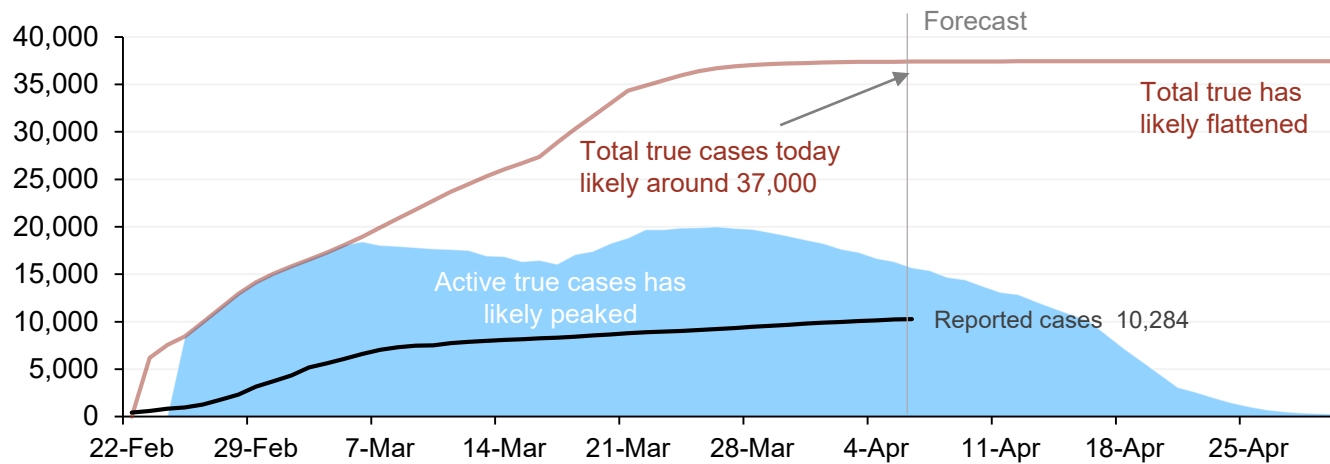


For further details
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 at rystadenergy.com.

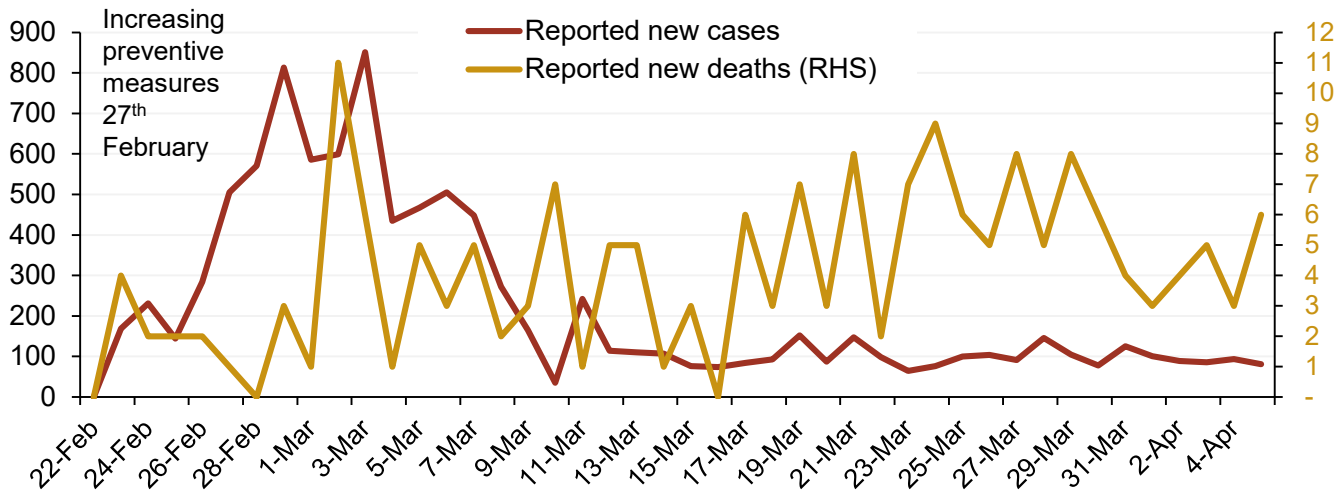
Source: Rystad Energy research and analyses; Worldometer; *Assumes current measures in place during forecasting interval

South Korea: virus is under control – active cases are in decline

South Korea, estimated total and active true cases
 Number of cases; Current measures scenario*



Daily new cases and deaths



For further details please see our Covid-19 dashboard at rystadenergy.com.

Source: Rystad Energy research and analyses; Worldometer; *Assumes current measures in place during forecasting interval

Table of contents

Executive summary

Outbreak status and outlook

- Global overview
- Asia Pacific focus
- **Managing the virus - concepts and measures**

Impact on oil demand

Impact on the oil and gas industry

Appendix (any changes here?)

Countries are imposing strong measures in order to cope with Covid-19

Countries that have taken various measures in order to “flatten the curve” per 31 March 2020*

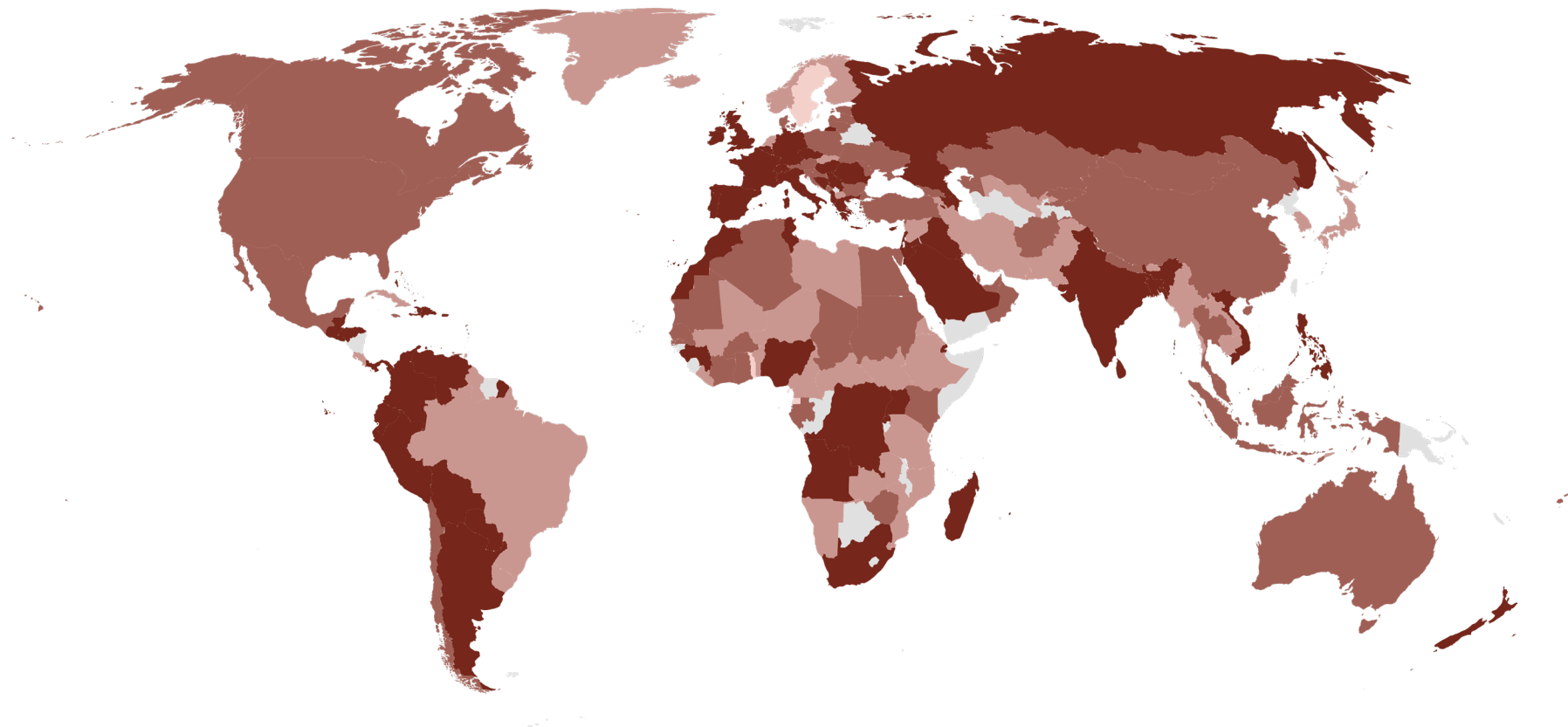
Stringency level of measure

Rules against mass gatherings

Closure of schools

*Closure of other businesses***

Lockdown








*The geographical extent of the preventive measures can vary within a country. For a small number of the countries, the measure is not yet imposed, but planned imposed in a short period of time

**Other businesses are businesses where it is hard to take measures in order to prevent the transmission of diseases, but they are not critical to the society. E.g. gyms, hairdressers, etc.

Source: Rystad Energy research and analysis

***Singapore will enter a lockdown from 7 April 2020

France and the United States are showing good compliance

	France	United States	United Kingdom	Spain	Italy
 Population affected	65 million	330 million	68 million	47 million	60 million
 Last quarantine measure	Full lockdown	Light lockdown**	Full lockdown	Full lockdown	Full lockdown
 Traffic reduction after quarantine measure	-53%	-47%	-44%	-46%	-46%
Mobility changes	Recreation: -88% Transit: -87% Residential: +18%	Recreation: -62% Transit: -68% Residential: +16%	Recreation: -85% Transit: -75% Residential: +15%	Recreation: -94% Transit: -88% Residential: +22%	Recreation: -94% Transit: -87% Residential: +24%
 Implied quarantine measure*	Full lockdown	Light lockdown	Light lockdown	Light lockdown	Light lockdown
 Indicative compliance	Very high	High	Medium	Medium	Medium

- Data on countries' government measures has been taken from government websites and national newspapers.
- We compare average traffic reductions across different continents for the quarantine regimes defined earlier, and compare this number to the actual drop in traffic for countries where quarantine measures are imposed.
- In cases where a country's traffic level has dropped more than the average traffic level for a given quarantine regime, we assign a high indicative compliance rate.

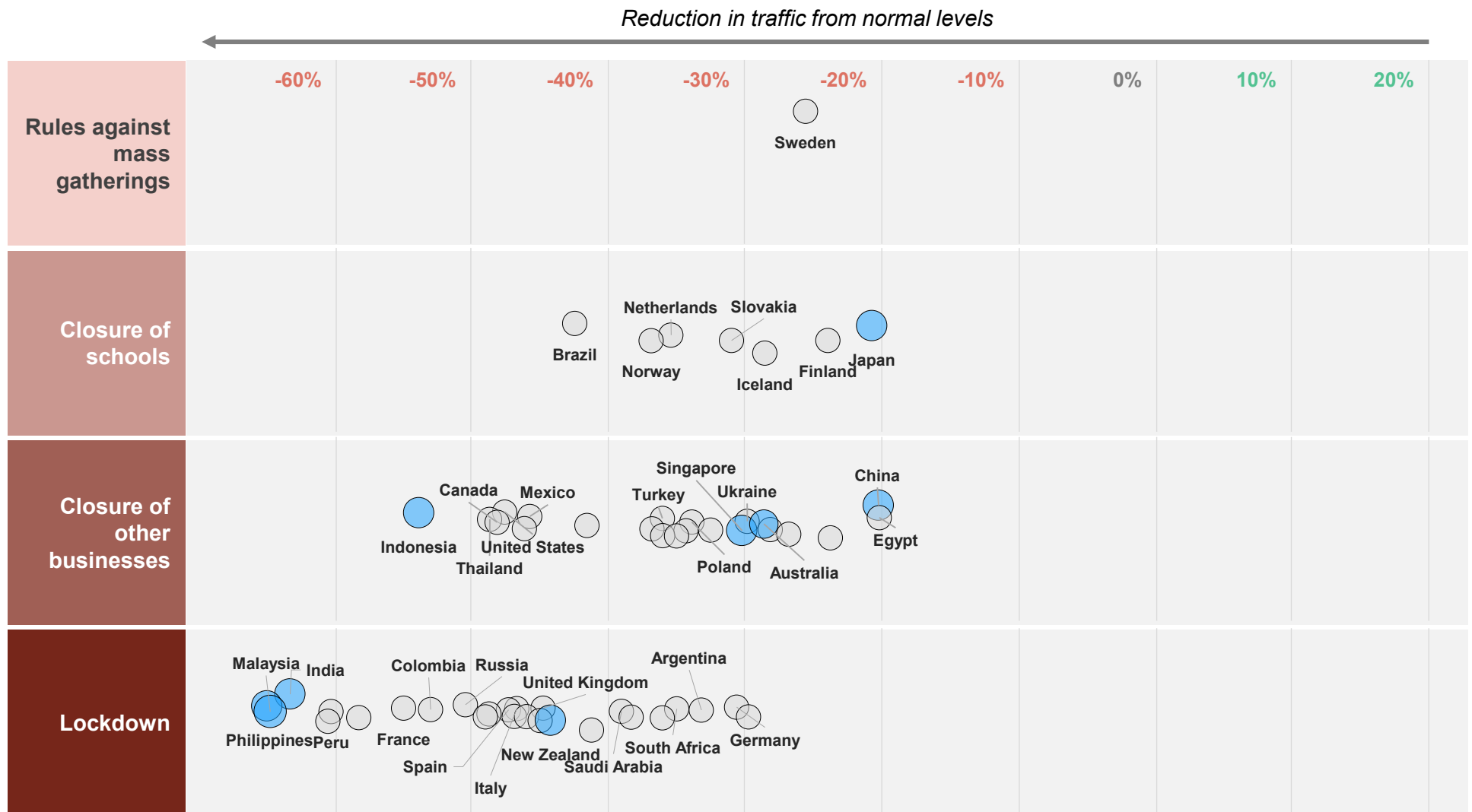
*Implied quarantine measure is based on traffic data from countries

**Measures may differ at a state level, as of 6 April 2020, 5 US states have not imposed any form of "stay at home" order.

**Mobility measures in the United States refer to New York State.

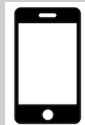


Sources: World Bank; Worldometer; TomTom Traffic Index; Rystad Energy research and analysis

Global traffic reductions under different quarantine regimes



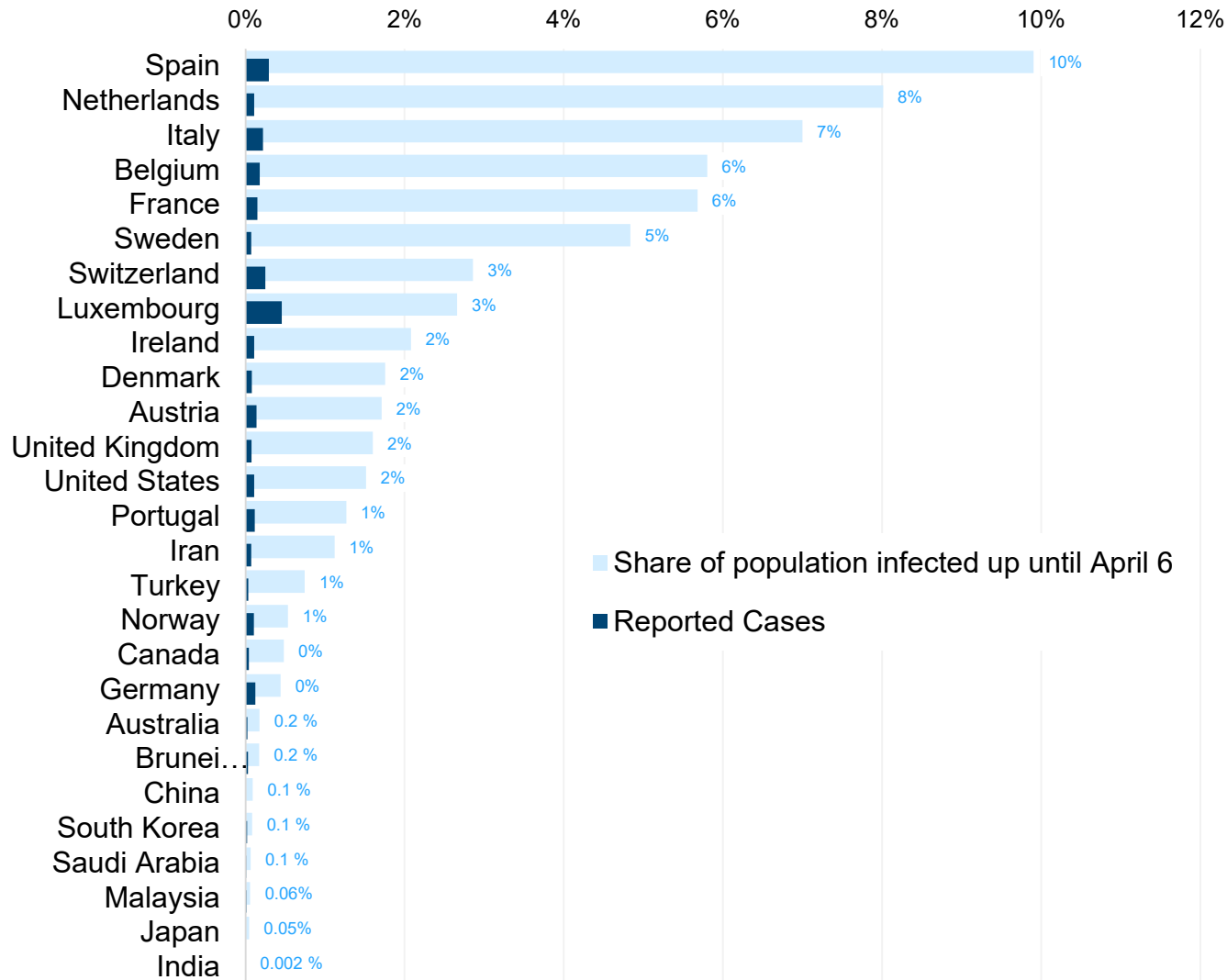
Sources: Rystad Energy research and analysis

We are likely months away from anything that can ease the need for social distancing

	Description	Time frame
<p>New technology: control spread</p> 	<ul style="list-style-type: none"> • Several countries are testing out new technologies to trace infected people and control the spread of the virus • South Korea successfully used this in February and March • Some argue the infringes on privacy, but this may be overcome technologically or legally 	<p>Now in pilot phase 1-3 months away?</p>
<p>Medications*: reduce symptoms until vaccine comes</p> 	<ul style="list-style-type: none"> • Remdesivir is effective against a variety of coronavirus diseases and is considered by many experts to be the most promising antiviral drug. Five Italian centers are participating in clinical trials. • Avigan (favipiravir) is a Japanese flu medicine that – if taken early – claims to have shortened the recovery time for 340 patients tested in Wuhan. This report was abruptly and mysteriously withdrawn. • Plaquenil (hydroxychloroquine) is the most well-known potential Covid-19 drug and has been used against Malaria. It has shown promising anecdotal evidence, but some studies have shown no effect. Claims to speed the recovery of mildly ill patients. There are some supply constraints already. 	<p>Testing ongoing At least 3-6 months away?</p>
<p>Vaccine: Immunity</p> 	<p>The real goal of social distancing, new technologies and medications is that they will reduce the virus from spreading until an effective vaccine can knock out the pandemic. Several countries have already developed candidate vaccines; animal studies are encouraging and volunteers are receiving a first dose. It takes time to develop a vaccine, prove it effective, and produce and administer it to a sufficient number of people that herd immunity will protect the uninfected. To improve the success rate of a vaccine development, The Gates Foundation is funding the building of seven factories in parallel with various national efforts.</p>	<p>2Q-3Q 2021 at the earliest</p>

Source: Rystad Energy research and analysis; *Not all drugs under testing shown

More than 5% of the national population likely already infected in six European countries



More than 5% of the national population is already infected in six European countries, according to our simulation model.

Several of these countries are already exceeding their respective ICU bed capacity. Strong quarantine measures have been introduced in these places to reduce the number of active cases. For these countries, herd immunity could be reached within 6 to 18 months.

Asian countries have a significantly lower share of infected people, for example, only about 1% of the population of Turkey is infected. Asian countries have typically implemented preventive actions earlier than their European counterparts and could therefore potentially be more successful in suppressing the virus.

Source: Rystad Energy covid-19 database

Table of contents

Executive summary

Outbreak status and outlook

Impact on oil demand

- **Global overview**
- Aviation and jet fuel
- Ground transportation and road fuels
- APAC focus

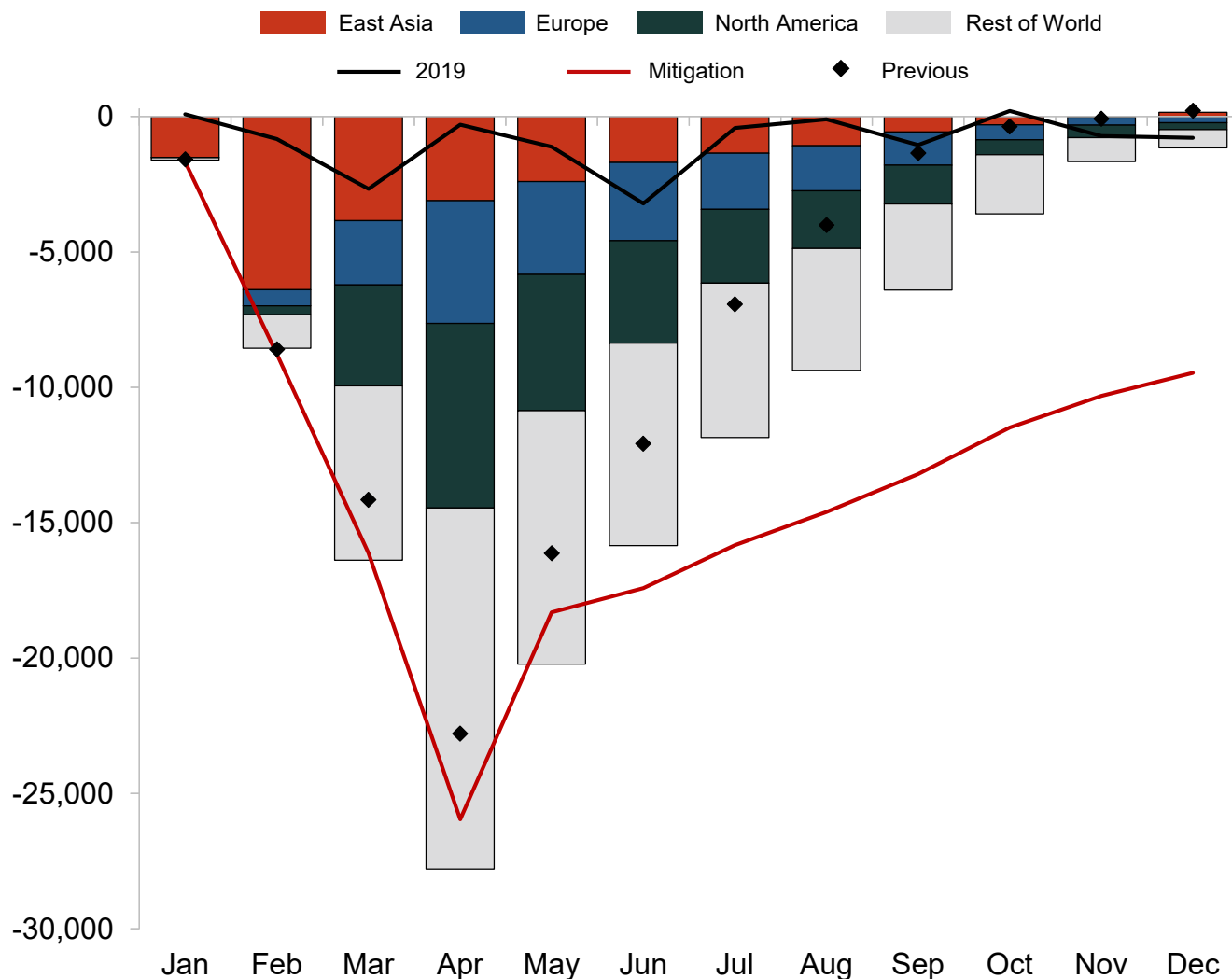
Impact on the oil and gas industry

Appendix

Global liquids demand now projected to nosedive by 27 million bpd in April

Global oil demand impact analysis Covid-19, impact versus pre-virus estimates

Thousand bpd



The projected drop in demand in April is now forecast to see even greater declines than we anticipated last week, as strict lockdowns are being enforced in all corners of the world, now also in Russia.

Traffic is down significantly in both Japan and the US, where the emergence of dramatic statistics over the past week is reflected in reduced traffic levels in all states.

Half of the impact is now seen in "Rest of World", ie South Asia, Southeast Asia, Australia, Latin America and Africa.

We now project the impact to last longer, as the spread of the virus will resist restrictions more than we first expected.

Source: Rystad Energy research and analysis

Table of contents

Executive summary

Outbreak status and outlook

Impact on oil demand

- Global overview
- **Aviation and jet fuel**
- Ground transportation and road fuels
- APAC focus

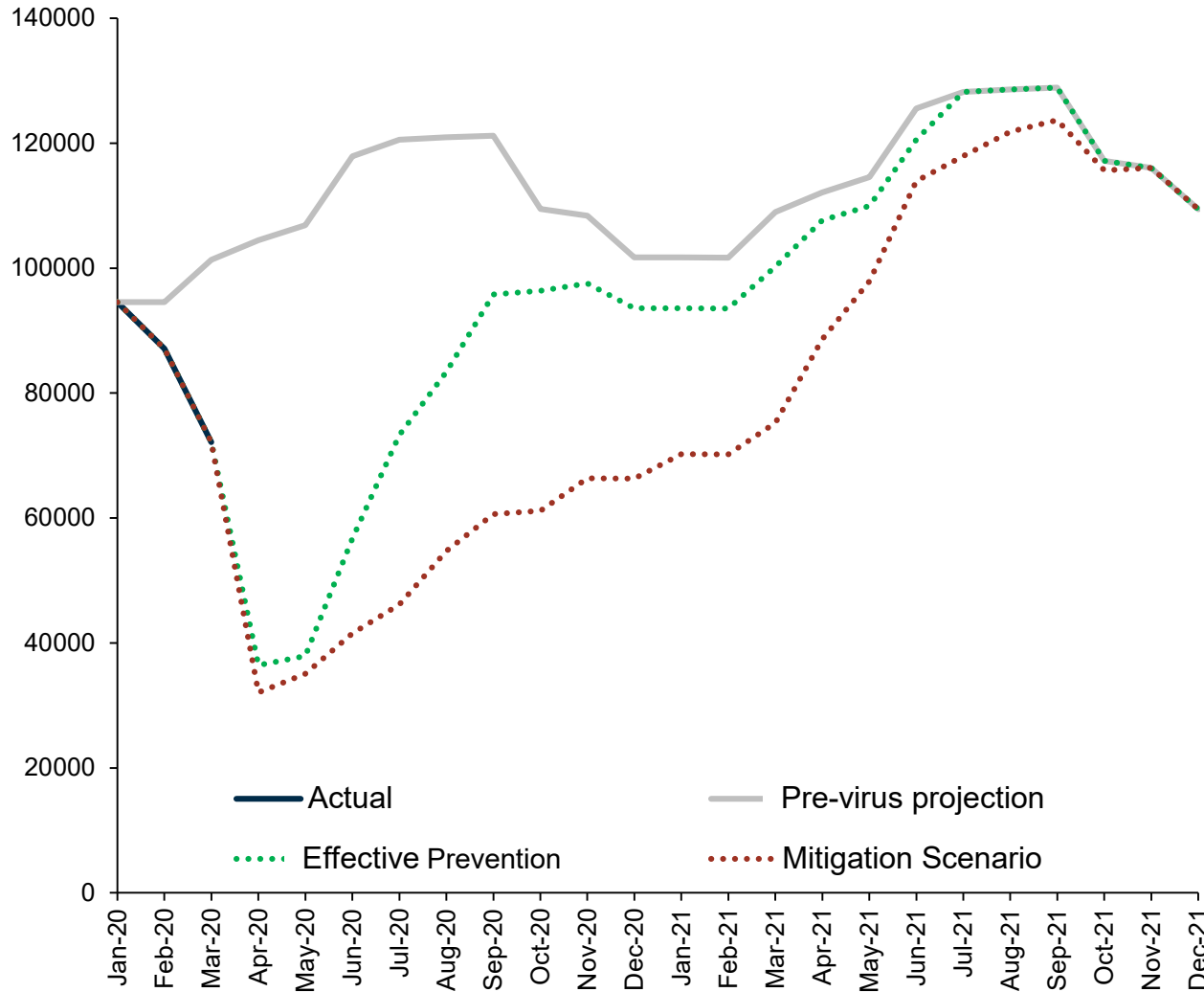
Impact on the oil and gas industry

Appendix

Peak cancellation of passenger flights in 2Q20, at over 60% reduction

Daily number of commercial passenger flights, monthly average

Number of flights



For 2020 we forecast the global reduction of flights at 30% and 40%, respectively, in our two scenarios.

Looking back on 1Q20, we note a 13% global reduction in the number of passenger flights.

Since airlines have now suspended most of their fleets, the biggest impact is expected to be seen in 2Q20, with reductions of more than 60% in both scenarios.

Under the Effective Prevention Scenario, the reduction in flight traffic averages 20% during 2H20.

Under the Mitigation Scenario, the reduction in flight traffic averages 45% during 2H20.

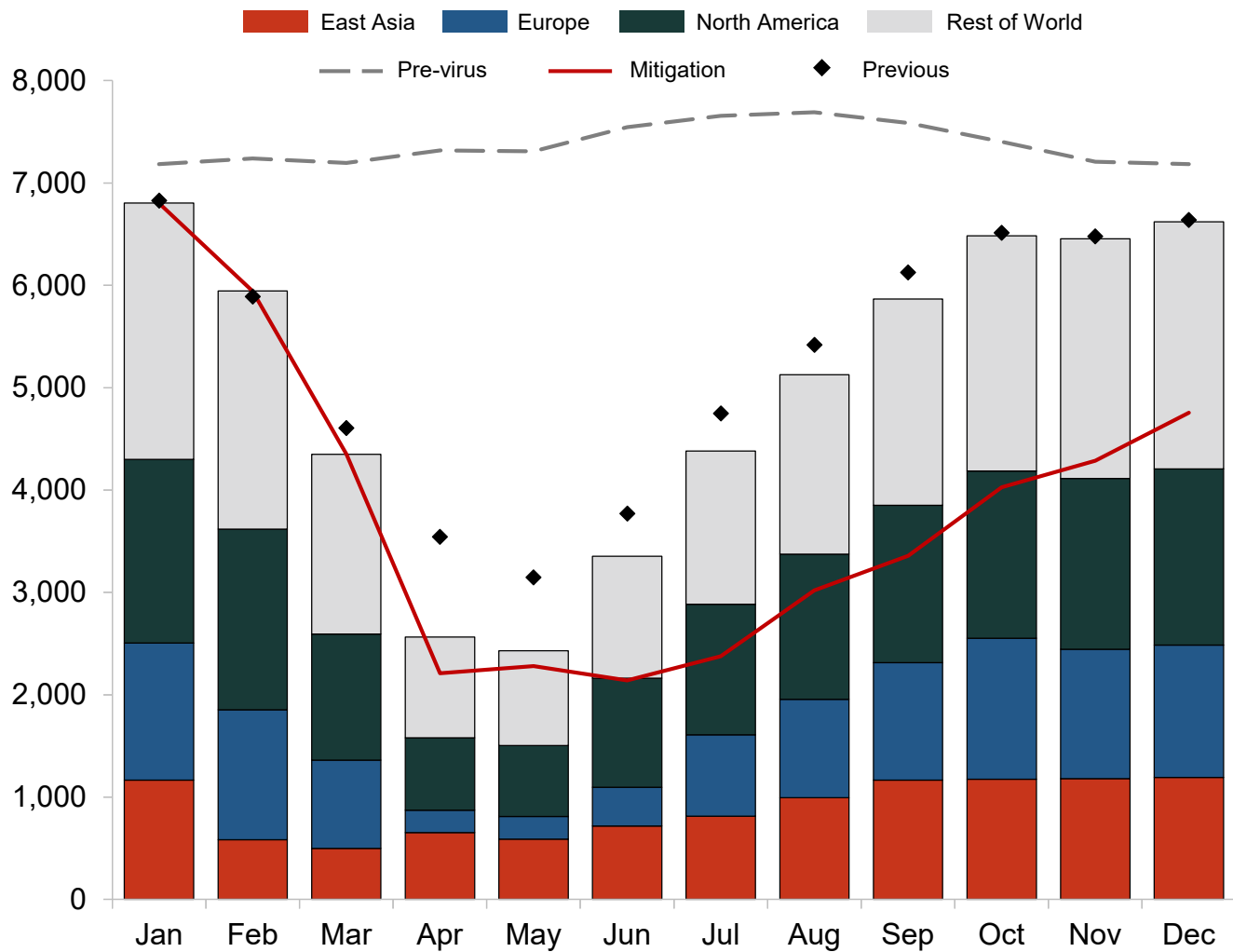
Flight traffic is forecast to return to normal levels starting in 3Q21 under the Effective Prevention Scenario, and in 4Q21 under the Mitigation Scenario.

Source: Flightradar24, IATA, ICAO, OAG, WorldBank, FlightStats, FlightAware, Airline Websites, Airport Websites; Rystad Energy research and analysis

Global oil demand for jet fuel evaporates to 35% of normal levels in April and May

Global jet fuel impact analysis of Covid-19 in Effective Prevention Scenario

Thousand bpd



Source: Rystad Energy research and analysis

Table of contents

Executive summary

Outbreak status and outlook

Impact on oil demand

- Global overview
- Aviation and jet fuel
- **Ground transportation and road fuels**
- APAC focus

Impact on the oil and gas industry

Appendix

Global traffic down 40%, but countries are reaching a floor for traffic reductions

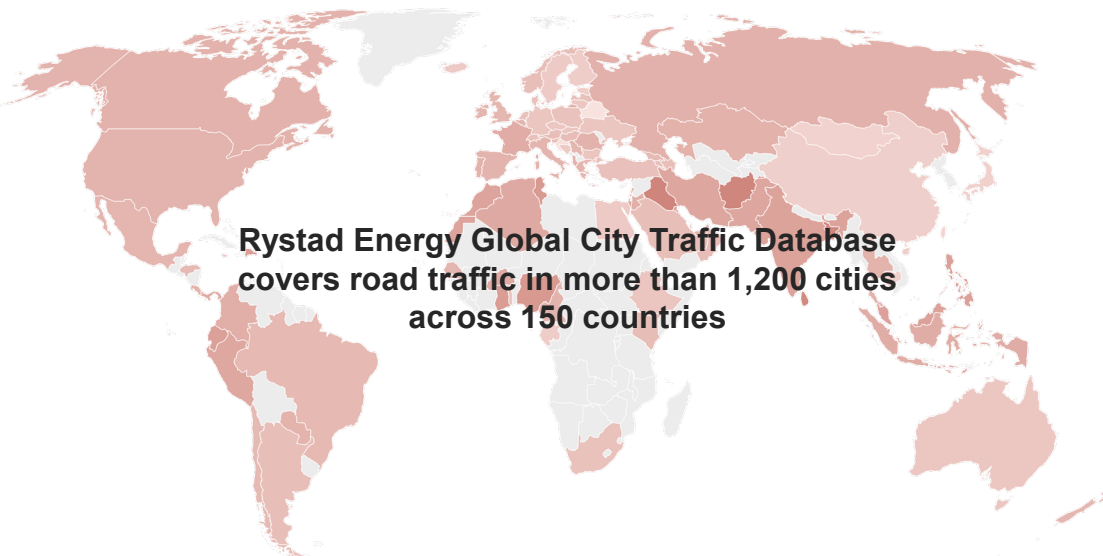
Reduction in traffic* versus normal levels for selected countries

Percent difference year-on-year, three-day moving average

Average**

This week **↓ -39%**

Last week **↓ -36%**



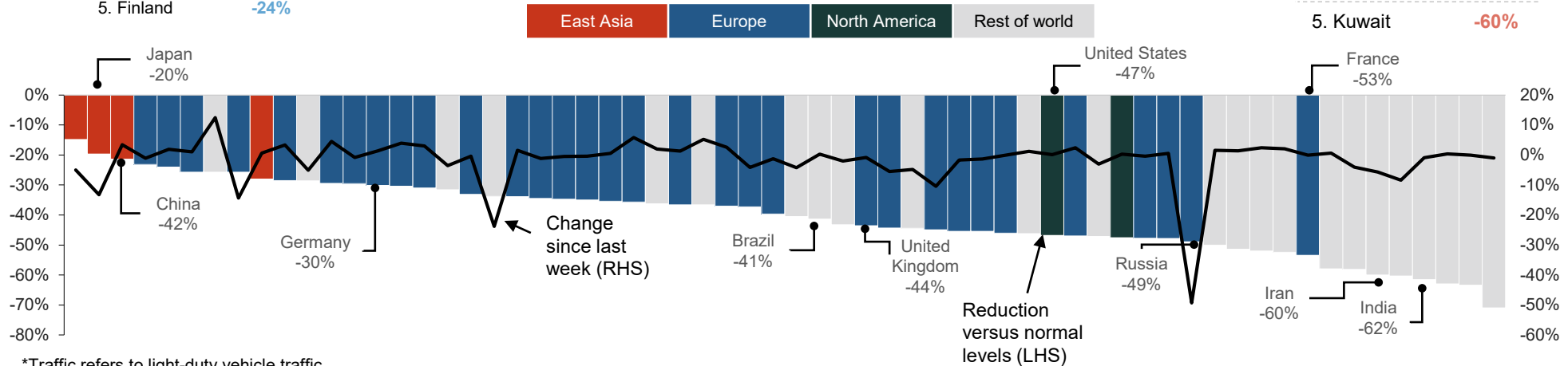
Rystad Energy Global City Traffic Database covers road traffic in more than 1,200 cities across 150 countries

Smallest drops in traffic

1. Taiwan -15%
2. Japan -20%
3. China -21%
4. Estonia -23%
5. Finland -24%

Largest drops in traffic

1. Iraq -71%
2. Philippines -63%
3. Malaysia -63%
4. India -62%
5. Kuwait -60%



*Traffic refers to light-duty vehicle traffic.

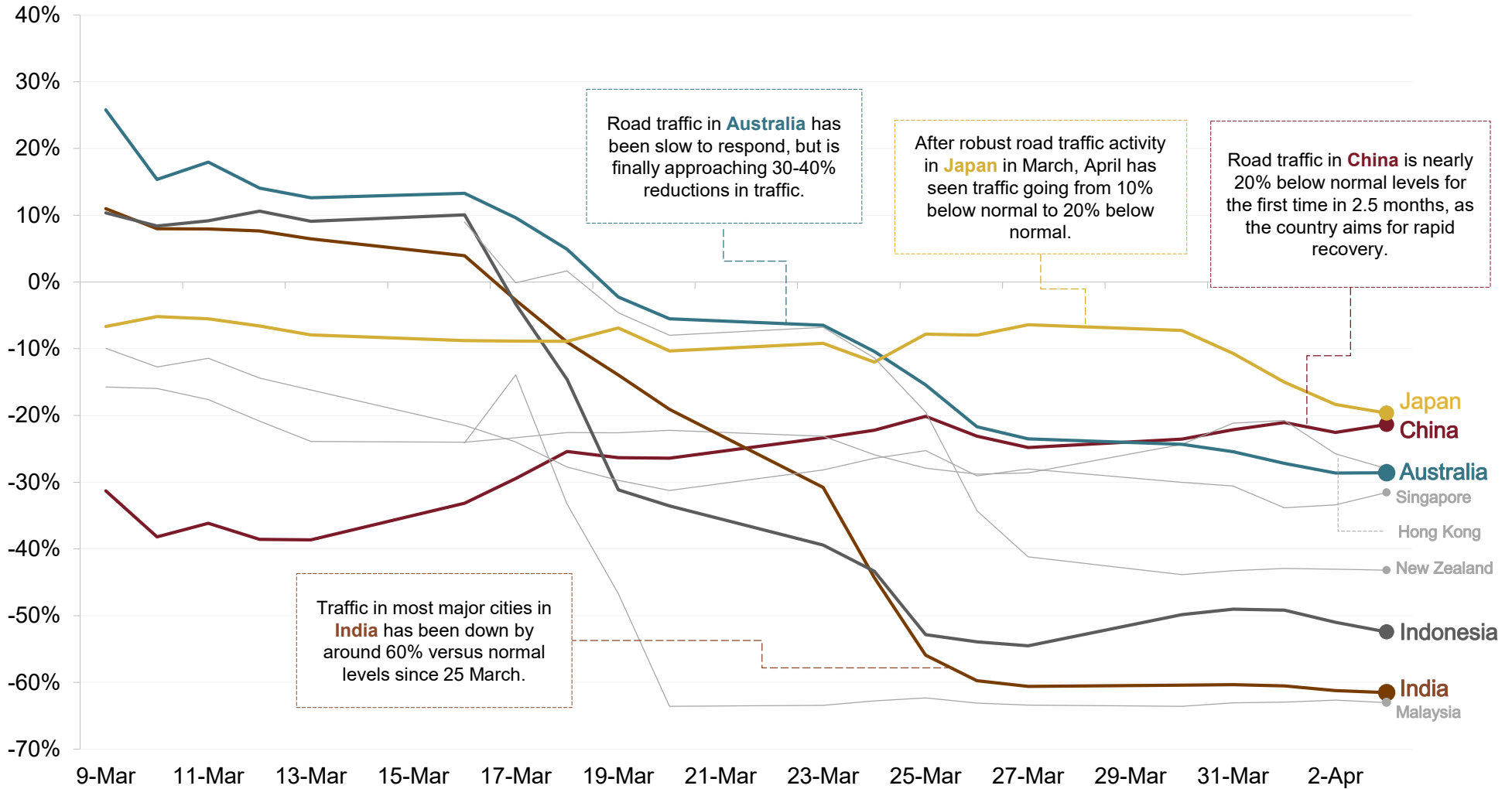
**Average is population-weighted, and numbers for both weeks use a three-day moving average.

Source: Rystad Energy Global City Traffic Database; TomTom Traffic Index; Google Maps; Rystad Energy research and analysis

APAC road traffic down 40% as the region braces for strict measures throughout April

Traffic reduction versus normal levels

Percent difference, three-day moving average



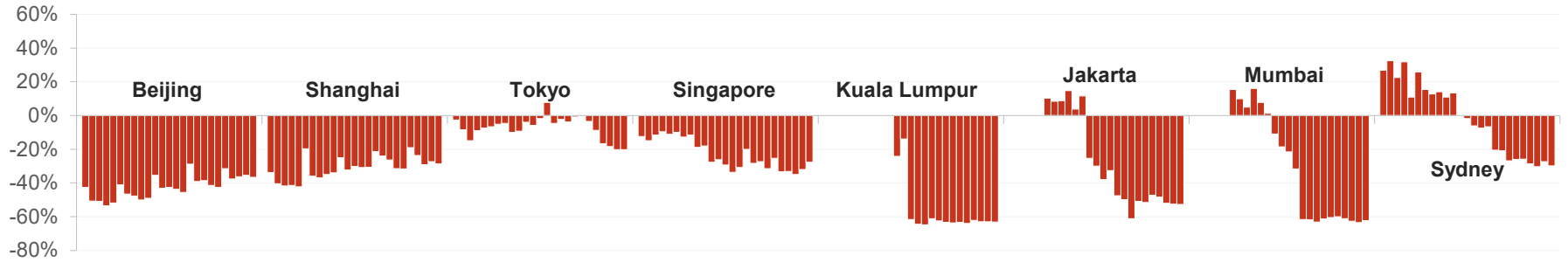
Source: Rystad Energy Global City Traffic Database; TomTom Traffic Index; Google Maps; Rystad Energy research and analysis

Road traffic in most major global hubs is down by more than 40% from normal levels

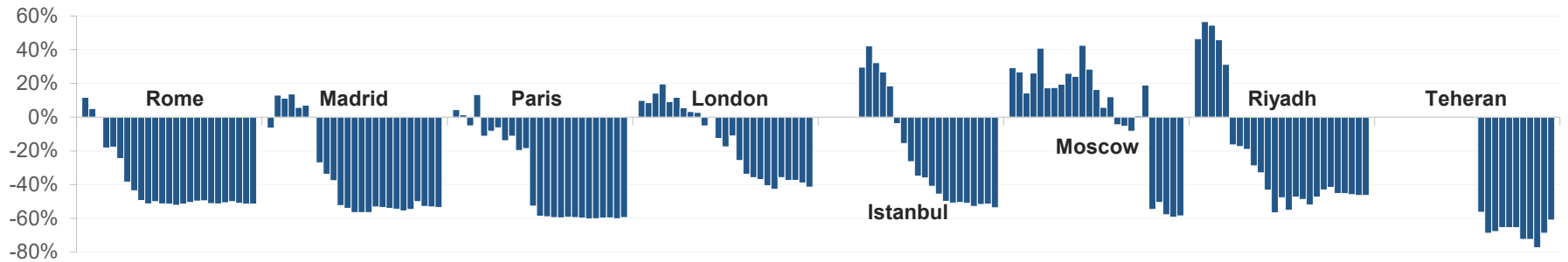
Traffic levels for last 25 working days compared to average 2019 levels

Percent difference, year-on-year

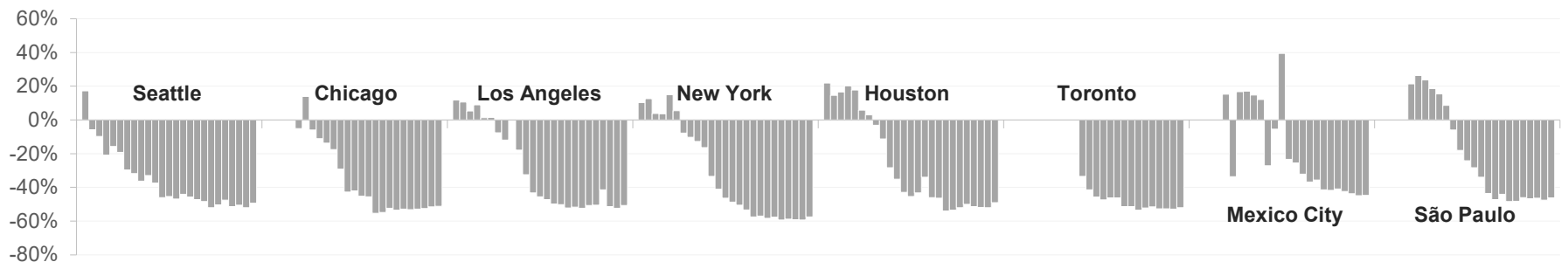
Asia



Europe & Middle East



Americas

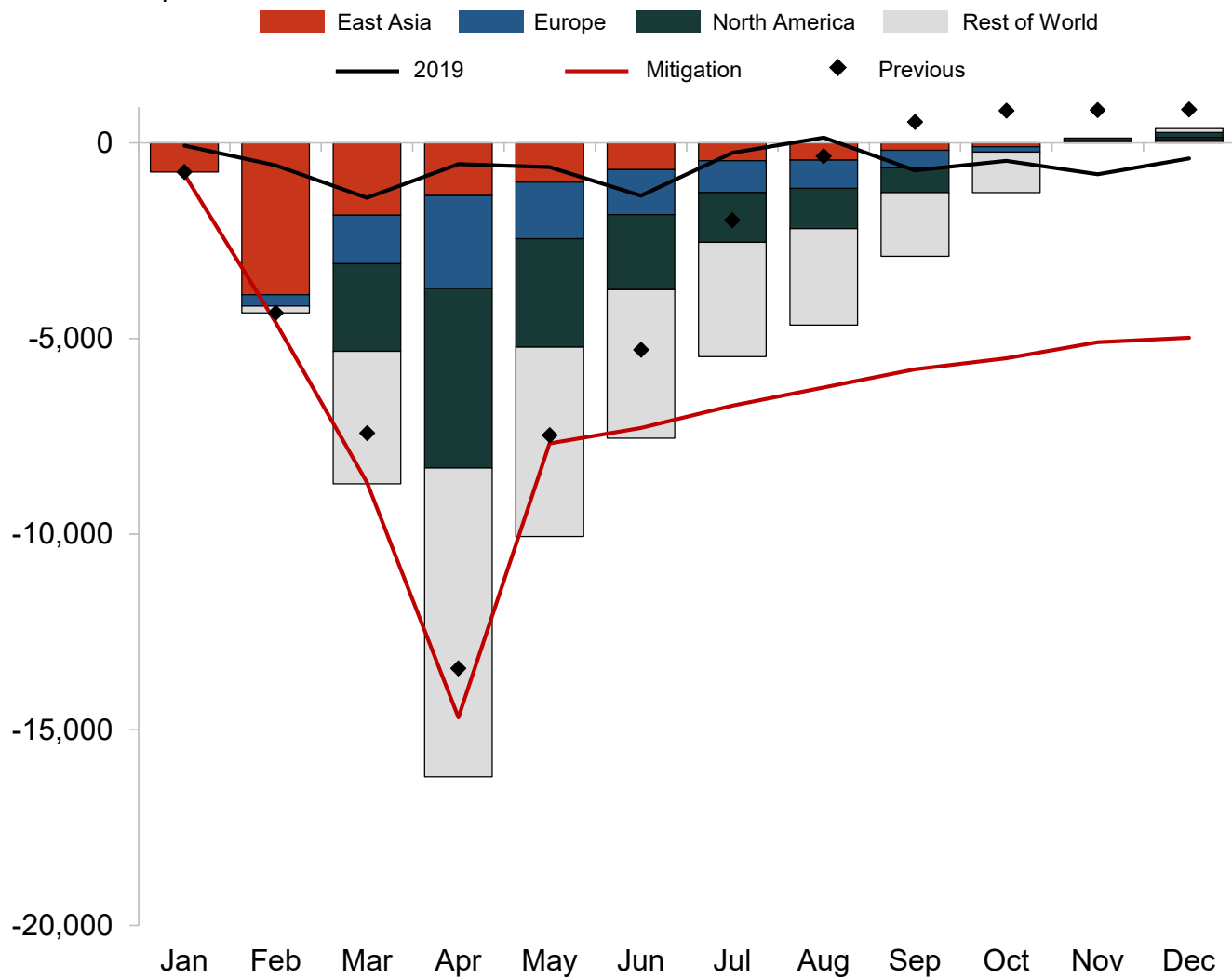


Source: Rystad Energy Global City Traffic Database; TomTom Traffic Index; Google Maps; Rystad Energy research and analysis

Gasoline and road diesel demand shrinks by 15 million bpd in April

Global road fuel impact versus pre-virus estimates

Thousand bpd



Source: Rystad Energy research and analysis

Table of contents

Executive summary

Outbreak status and outlook

Impact on oil demand

- Global overview
- Aviation and jet fuel
- Ground transportation and road fuels
- **APAC focus**

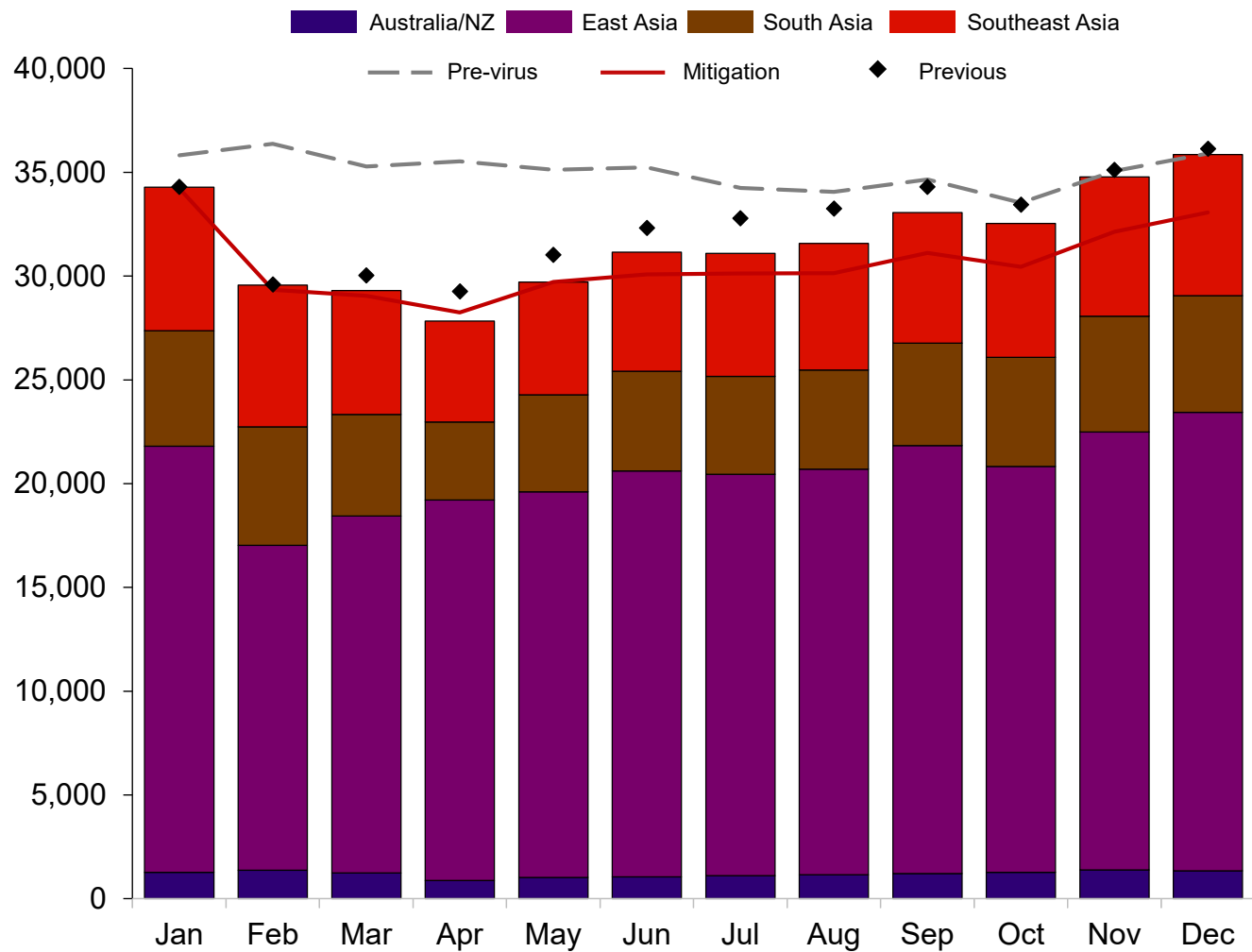
Impact on the oil and gas industry

Appendix

The APAC region will see total liquids demand down from 35 to 28 million bpd in 2020

Regional oil demand impact analysis of Covid-19 in Effective Prevention Scenario

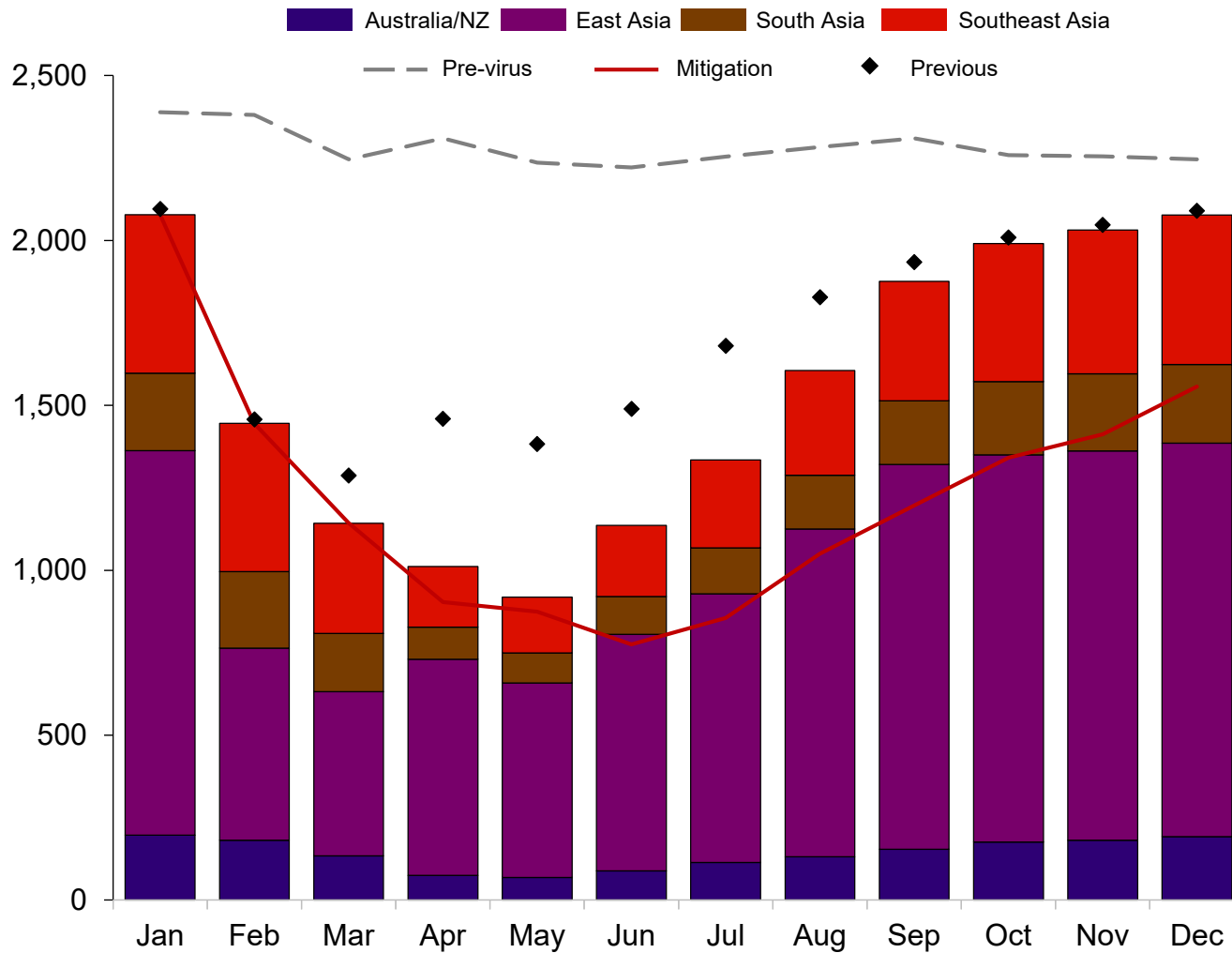
Thousand bpd



Source: Rystad Energy research and analysis

Regional jet fuel demand will tumble below 1 million bpd in May

Regional jet fuel impact analysis of Covid-19 in Effective Prevention Scenario
 Thousand bpd

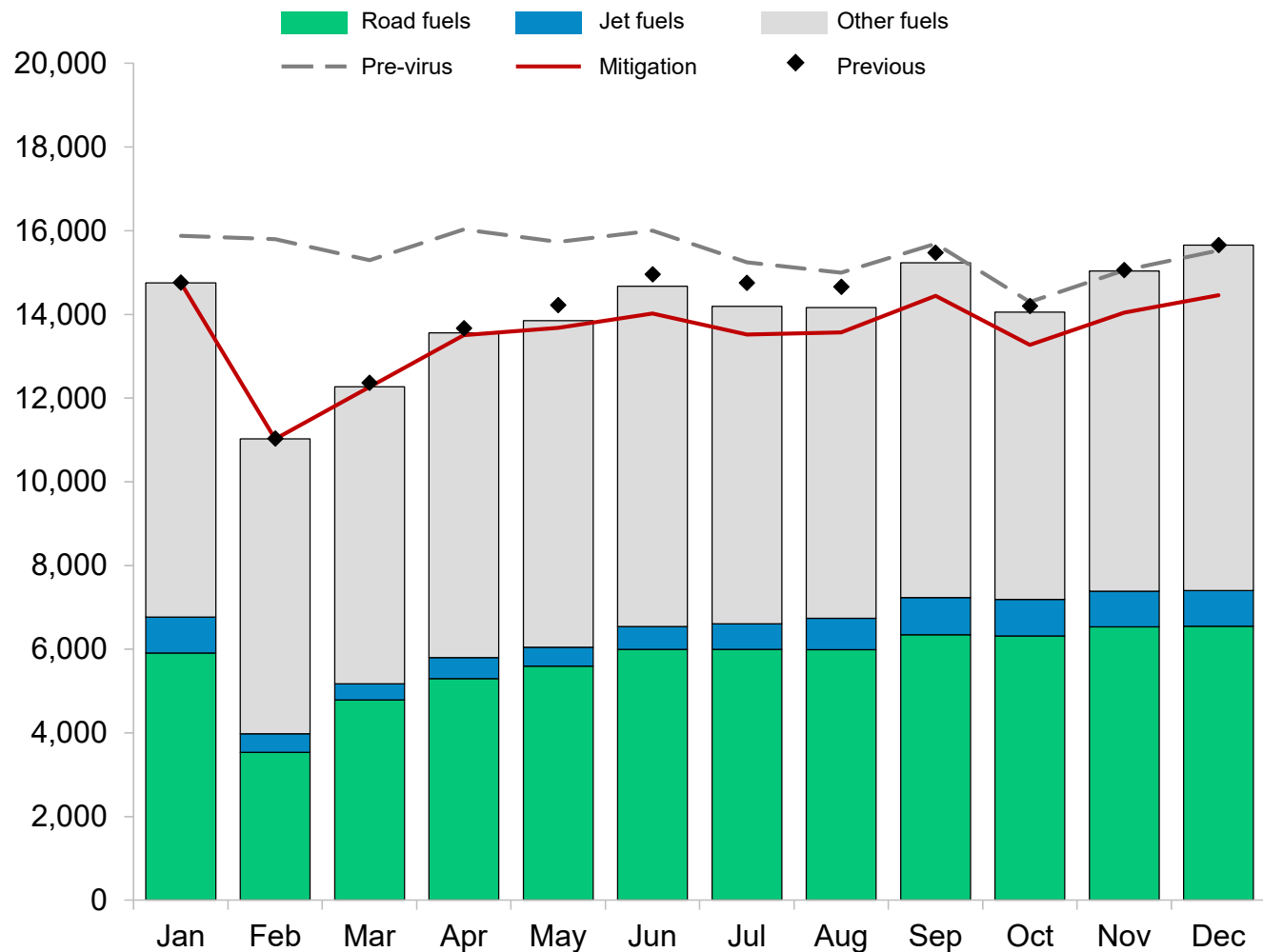


Source: Rystad Energy research and analysis

China's oil demand is already half-way back, but may not fully recover before September

China oil demand impact analysis Covid-19 in Effective Prevention Scenario

Thousand bpd



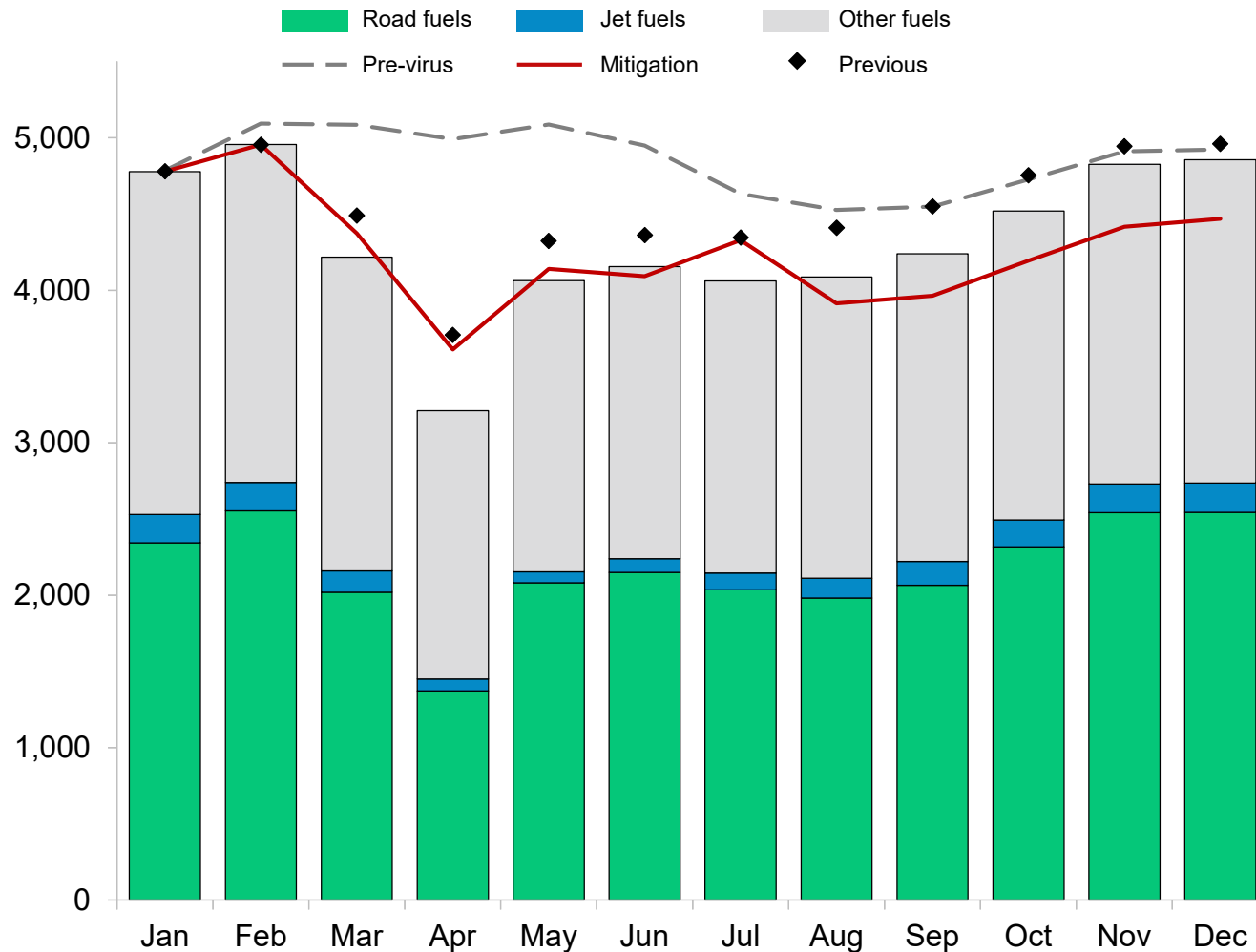
Other fuels make up almost 60% of total liquids demand in China.

We see an enduring impact on GDP with trade partners in lockdown with significant impact on other fuels (naphtha, LPG, fuel oil, ..).

India sees 40% less oil demand in April

India oil demand impact analysis Covid-19 in effective prevention scenario

Thousand bpd



Road fuel is heavily hit in India with very strict restrictions enforced since mid March.

Road fuel in India is comprised of 70% diesel, as personal transport is largely by public means or two wheelers.



Source: Rystad Energy research and analysis

Table of contents

Executive summary

Outbreak status and outlook

Impact on oil demand

Impact on the oil and gas industry

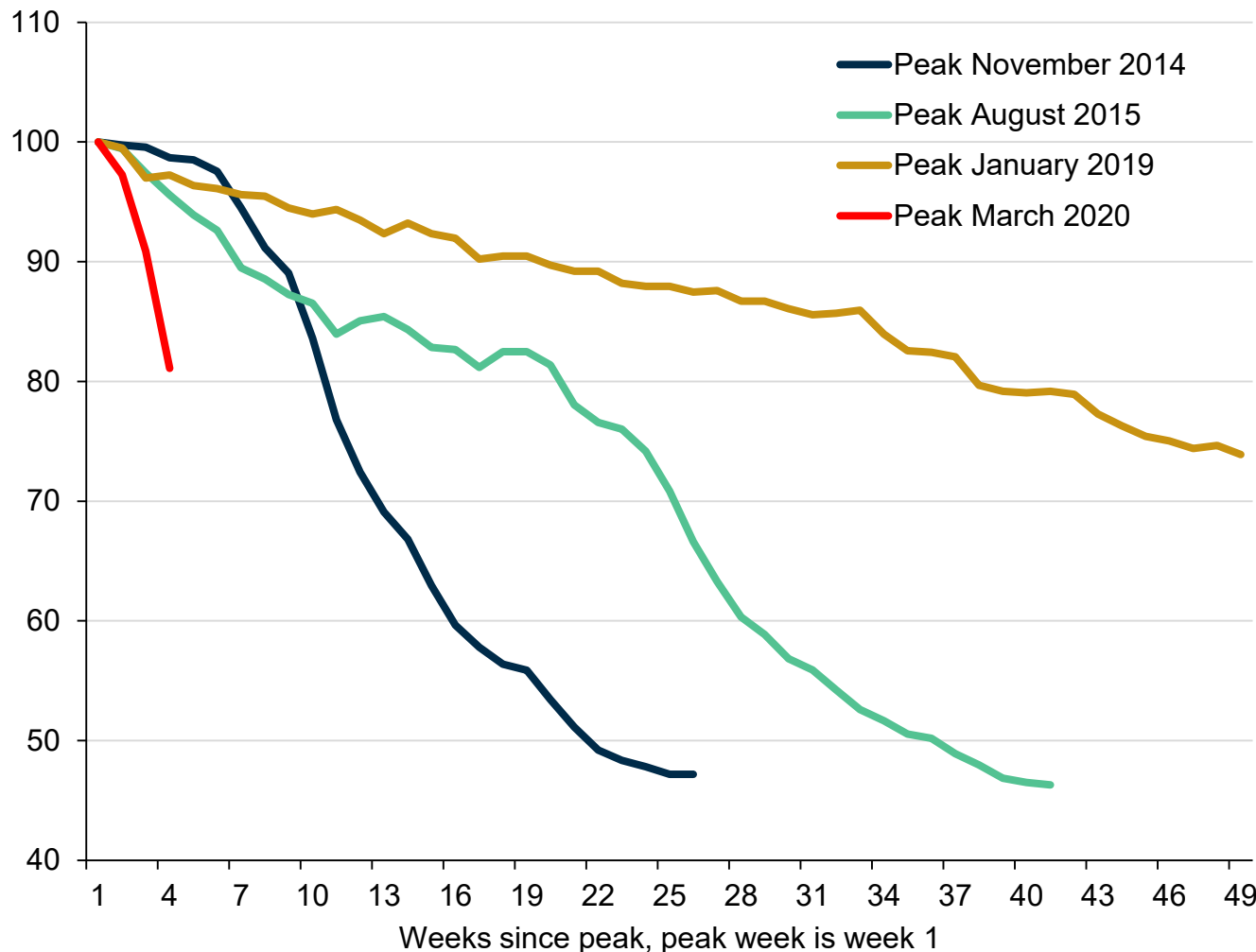
- Shale
- Gas Markets
- Energy Services
- Renewables
- E&P

Appendix

US horizontal oil drilling is down by approximately 20% over the last three weeks

Horizontal oil* rig count, speed of decline in previous down cycles

Indexed to the value of 100 for the week when peak level of activity is reached

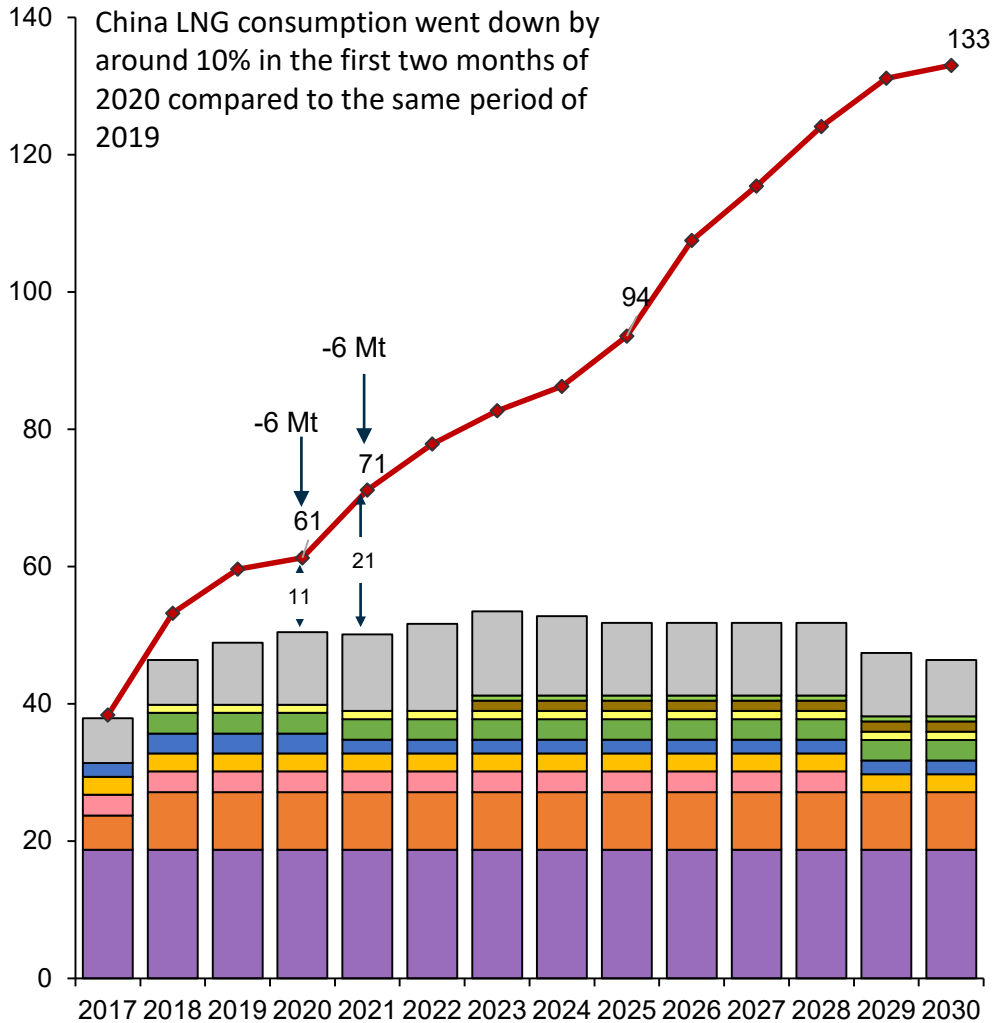


- The US Land horizontal oil rig count decline is now accelerating. Horizontal rig count has now dropped to around 500, falling by 19% from the recent peak just three weeks ago.
- In the down cycles of 2015 and 2016, it took 10-16 weeks after the peak to observe the same magnitude of decline.

*Oil – Permian, Bakken, Eagle Ford, DJ Basin, SCOOP & STACK, other horizontal drilling targeting oil
 Source: Baker Hughes, Rystad Energy research and analysis, April 2020

Chinese demand revised down due to coronavirus. Imports up marginally in 2020

China long-term LNG SPAs and LNG demand
 Million tonnes per annum



- Portfolio*
- Canada
- Mozambique
- United States
- Russia
- Papua New Guinea
- Indonesia
- Malaysia
- Qatar
- Australia

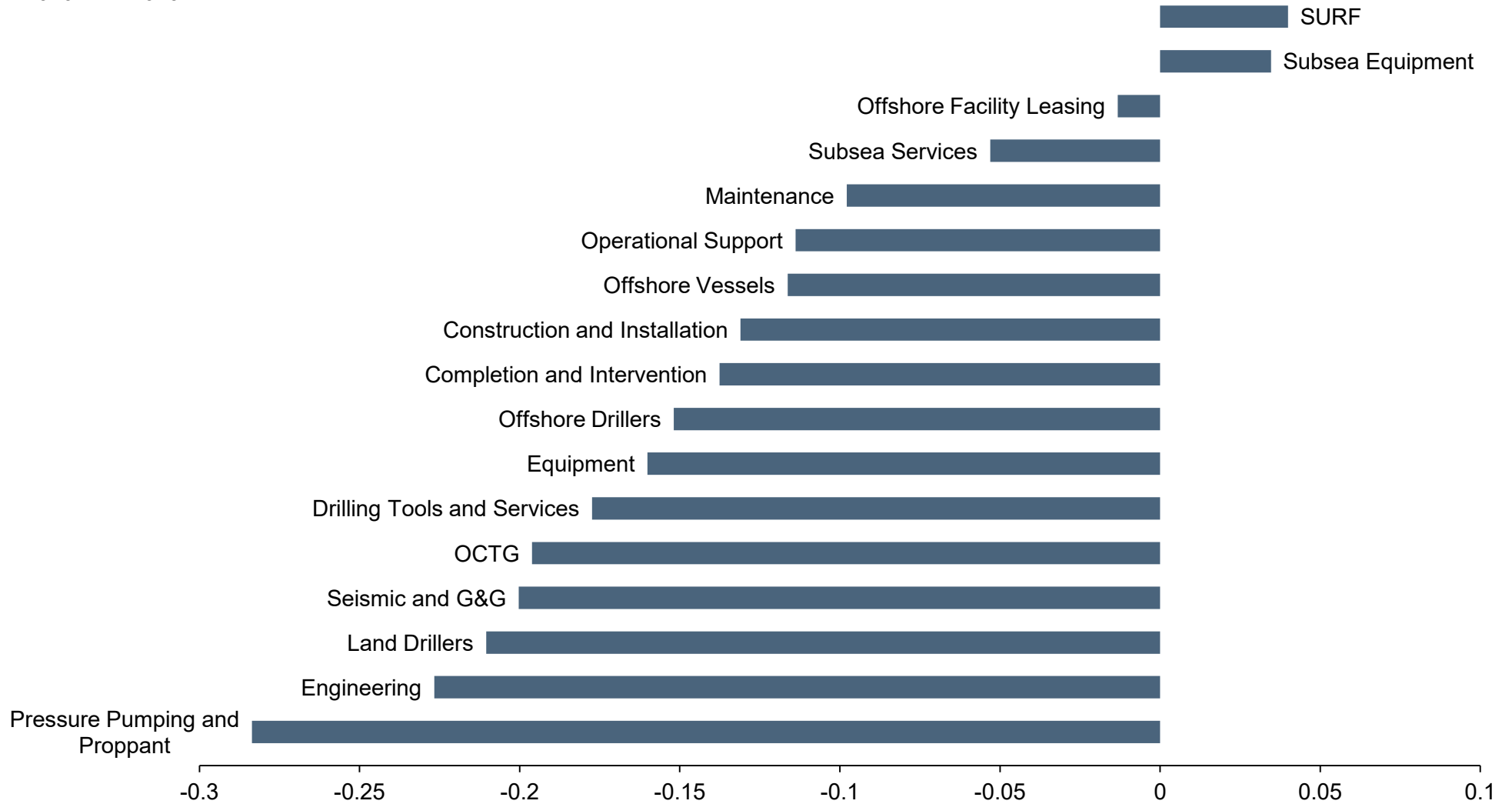
- Total natural gas demand in China has been revised down by 11 billion cubic meters (Bcm) to 323 Bcm. This still represents an increase of 7% year-on-year. Industrial activity has resumed in March, suggesting potential stabilization of growth.
- Given the slower growth in demand we expect most of the additional volumes to be supplied through the recently commissioned Power of Siberia pipeline.

Source: Rystad Energy GasMarketCube

Few segments show growth in 2020

Change in oilfield service purchases growth, offshore and onshore combined

2020 over 2019



Source: Rystad Energy ServiceCube

Renewables industry also under change – delays in auctions and lobbying for change

Global response to COVID-19

Deadline extensions and auction delays

USA – calls to extend the tax credits scheme and safe harbour deadlines

UK – extended offshore wind tender timeframe

France – timetables for auctions extended

Portugal – delays solar PV auction indefinitely

implementation deadlines for past winners

Italy – proposing delaying the upcoming renewable auction & extending deadlines

Greece – solar/Wind tender deadlines for licensing and construction extended

China – developers request extensions to subsidies deadlines

Vietnam – Binh Thuan & Soc Trang provinces requested to extend the wind FiT deadline to the end of 2022

India – renewable energy development classed as 'essential service' during the lockdown

Brazil – postponed indefinitely 2020 power auctions

Australia – WA passed the Electricity Amendment Act & Federal incentives for C&I PV

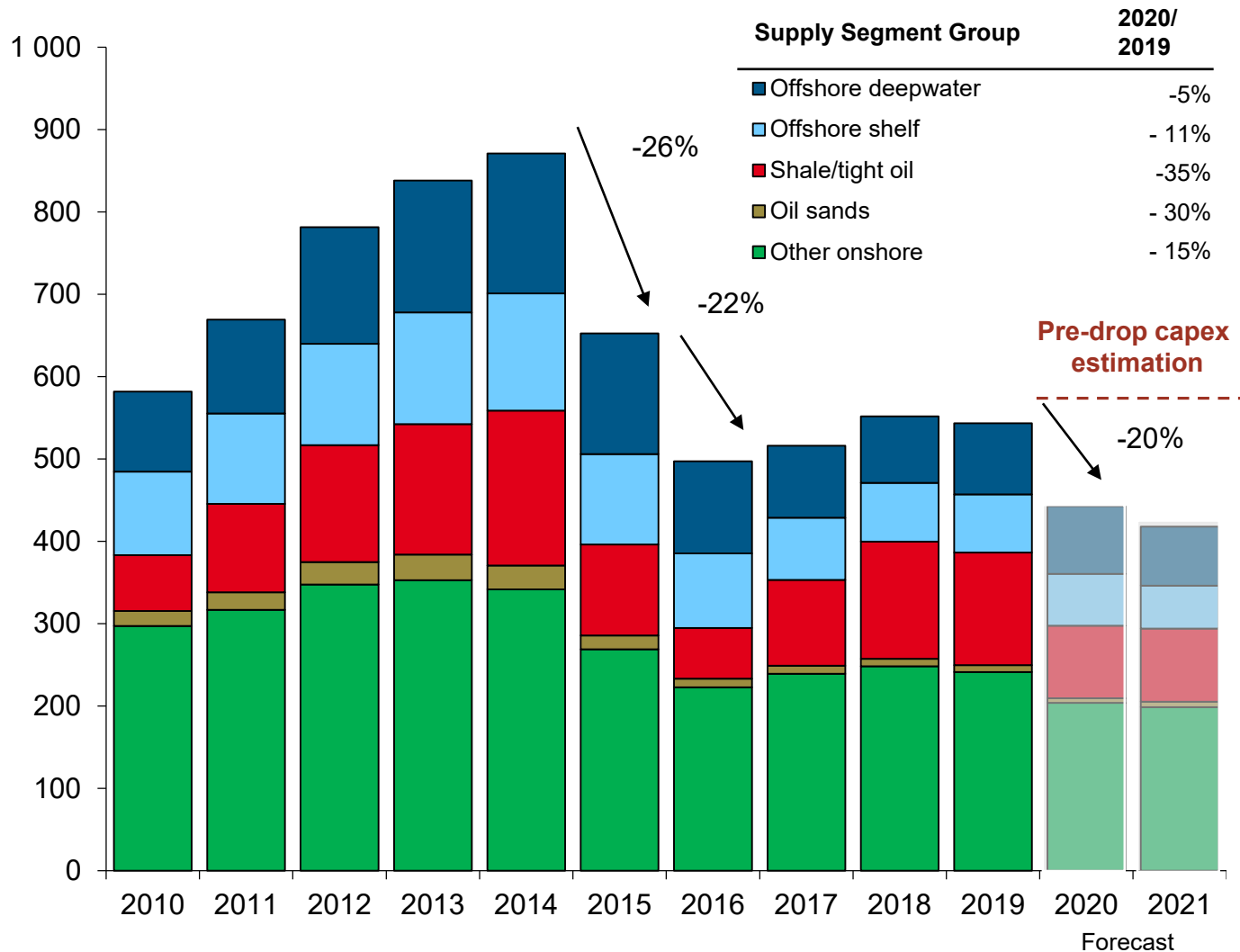
- Change implemented
- Associations/Stakeholders lobbying for change

Source: Rystad Energy analysis

Investments expected to fall \$100 billion this year

Global investments by supply segment

Billion USD



- Rystad Energy expects upstream spending may fall 20% this year, which means investments will shrink by \$100 billion from 2019 levels.
- This estimate is based on our new base case oil price scenario of \$34 per barrel in 2020 and \$44 per barrel in 2021. However, if the oil price should continue to hover around \$30, the industry will be forced to dive into even deeper cuts, potentially changing the market landscape in the medium term.

Source: Rystad Energy UCube

Table of Contents

Executive summary

Outbreak status and outlook

Impact on oil demand

Impact on the oil and gas industry

Appendix

- Scenario definitions
- Methodology behind the models

Table of Contents

Executive summary

Outbreak status and outlook

Impact on oil demand

Impact on the oil and gas industry

Appendix

- Scenario definitions
- Methodology behind the models

Scenarios for the Covid-19 pandemic

Scenario	Government policy	Benefits	Issues	Impact
Do nothing (let outbreak occur)	<ul style="list-style-type: none"> Do nothing 	<ul style="list-style-type: none"> Economy as usual Life as usual (if not sick) “Finished” in 4 months 	<ul style="list-style-type: none"> 90% of intensive care patients get no help Higher fatality rates Health sector collapse Economy hurt anyway if global recession 	<ul style="list-style-type: none"> Limited negative market impact Negative moral impact – unnecessary loss of loved ones
Manage the virus (mitigate or slow outbreak)	<ul style="list-style-type: none"> No cultural activity Case isolation, home quarantine, social distancing Travel down by ~90% 	<ul style="list-style-type: none"> Plan for health system capacity to handle intensive care cases (although this has uncertainty) Immunity for future similar epidemics Vital functions still working 	<ul style="list-style-type: none"> Takes a long time – 6 to 22 months Hurts economy Weakest groups in dire straits Quarantines challenge free movement, liberal values 	<ul style="list-style-type: none"> Severe and long-lasting economic impact Oil market collapse
Effective prevention (suppress or stop outbreak)	<ul style="list-style-type: none"> As above, plus... Curfew for all non-essential workers and penalties for non compliance Complete isolation between regions and countries 	<ul style="list-style-type: none"> Mission accomplished in 8 weeks, then back to normal Complete city/country isolation Avoid fatalities - hope vaccination will occur before virus comeback 	<ul style="list-style-type: none"> Too late to stop the virus many places May challenge human rights and liberal values When “finished”, we could see virus resurgence 	<ul style="list-style-type: none"> Very sudden market collapse, but for a short period of time Ethically the right decision, but concerns the infection will comeback

Table of Contents

Executive summary

Outbreak status and outlook

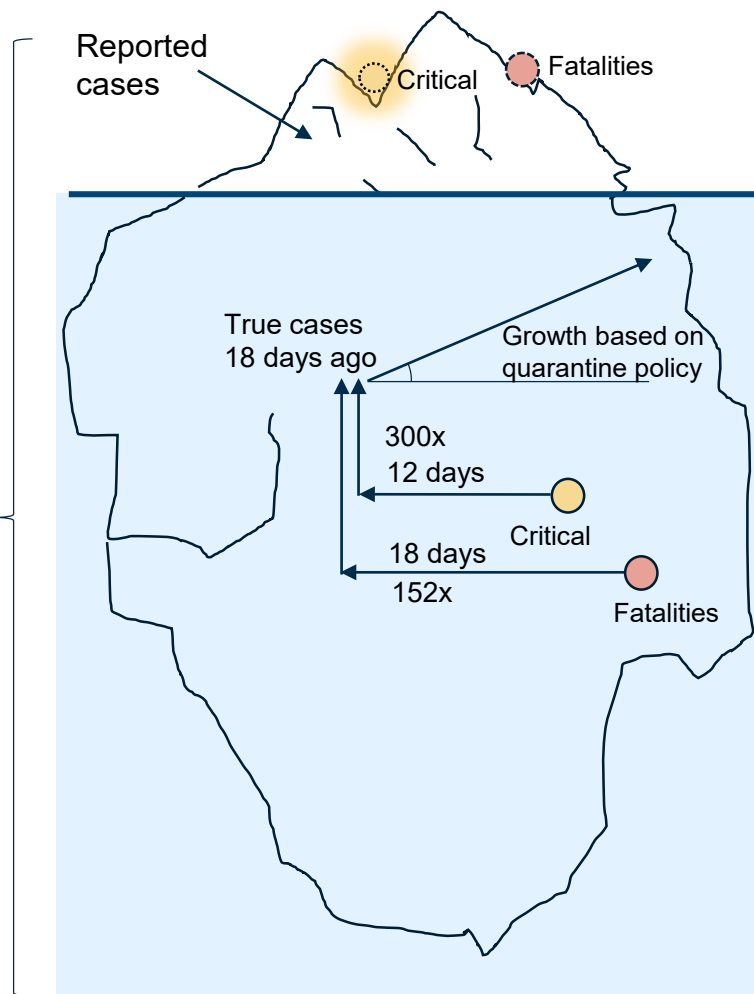
Impact on oil demand

Impact on the oil and gas industry

Appendix

- Scenario definitions
- Methodology behind the models

Reported cases are only the tip of the iceberg



True cases

Reported cases are only a fraction of the number of actual infected people:

- Many infected people are asymptomatic. They are unaware of being infected and are never tested or registered.
- Most sick people stay at home, and given the limited testing capacity in most countries, they are not registered as having been sick.

In populations where large groups have been tested, the following figures have been registered:

- Infection mortality rates (IFR) of 0.3%-1.0%, averaging 0.66%
- IFR appears stable across regions when adjusted for age.
- Thus, IFR is a better indicator of actual infected people, rather than reported cases. However, as the time from onset to fatality is, on average, 18 days, number of fatalities is giving a rather precise figure for «true infected» 18 days earlier.

The number of critical cases could potentially be another indicator of true cases because:

- 0.33% of all cases will need intensive care, according to our analysis as published earlier.
- However, critical case reporting practices vary from country to country, and cannot be trusted in all countries.
- Also, limited ICU capacity could lead to lower figures because people with a real need for ICU beds still do not get it.
- The time from onset to the critical phase is typically 12 days
- Still, the number of critical cases will also be used as an indicator to find the true number of Covid-19 cases.

Thus in our report, reported fatalities and critical cases are used to estimate the actual number of infected cases 12 to 18 days ago. Then we study observed quarantine measures and traffic patterns in order to produce a best possible estimate of the current true number of Covid-19 cases.

Calibrating Infection Fatality Rates and testing (1 of 2)

- As seen to the right, countries are divided into three groups based on observed Infection Fatality Rate (IFR).
- Group 3 countries have a high apparent IFR, a very high share of infected people among those tested, and relatively few people tested, indicating a large number of unknown true cases
- Group 2 countries have a medium IFR, with a medium high share of infected people among those tested and low level of testing. Thus again, this indicates a high number of unknown true infected cases.
- Group 1 countries have low IFR, with a relatively low number of infected people among those tested and a high level of testing. Thus, for this group we would expect that true cases are closer to reported cases. E.g. for UAE and Bahrain, 2% to 3% of the population is tested and only 0.8% to 1,6% were infected. IFR was 0.6%

Group 3

Group 2

Group 1

Country	Infection fatality rate	Share tested	Infected of those tested
Italy	12.3 %	1.1 %	19 %
San Marino	12.0 %	1.7 %	45 %
Algeria	11.5 %	0.0 %	39 %
UK	10.3 %	0.3 %	24 %
Netherlands	9.9 %	0.4 %	24 %
Spain	9.5 %	0.8 %	37 %
Indonesia	8.7 %	0.0 %	23 %
France	8.4 %	0.3 %	40 %
Belgium	7.3 %	0.6 %	28 %
Morocco	7.0 %	0.0 %	22 %
Iran	6.2 %	0.2 %	31 %
Sweden	5.9 %	0.4 %	19 %
Ecuador	4.9 %	0.1 %	29 %
Dominican Republic	4.7 %	0.0 %	38 %
Philippines	4.7 %	0.0 %	17 %
Brazil	4.3 %	0.0 %	19 %
Mexico	4.2 %	0.0 %	12 %
Denmark	4.1 %	0.9 %	9 %
Romania	3.9 %	0.2 %	10 %
Peru	3.6 %	0.1 %	12 %
Bosnia and Herzegovina	3.5 %	0.2 %	12 %
Switzerland	3.4 %	1.8 %	13 %
North Macedonia	3.2 %	0.2 %	11 %
Ireland	3.2 %	0.6 %	17 %
Argentina	3.0 %	0.0 %	17 %
USA	2.9 %	0.5 %	19 %
Serbia	2.7 %	0.1 %	26 %
Portugal	2.6 %	0.8 %	13 %
Ukraine	2.6 %	0.0 %	23 %
Panama	2.6 %	0.2 %	19 %
Japan	2.5 %	0.0 %	7 %
Colombia	2.4 %	0.0 %	6 %
Poland	2.3 %	0.2 %	5 %
Turkey	2.1 %	0.2 %	15 %
Canada	1.8 %	0.8 %	4.8 %
S. Korea	1.8 %	0.9 %	2.2 %
Austria	1.7 %	1.2 %	11.1 %
Malaysia	1.7 %	0.2 %	7.1 %
Lithuania	1.6 %	0.9 %	3.4 %
Germany	1.6 %	1.1 %	10.9 %
Czechia	1.5 %	0.7 %	5.7 %
Finland	1.5 %	0.6 %	6.1 %
Pakistan	1.4 %	0.0 %	9.0 %
Estonia	1.4 %	1.6 %	5.2 %
Luxembourg	1.3 %	3.8 %	11.8 %
Croatia	1.3 %	0.3 %	10.9 %
Norway	1.2 %	2.0 %	5.4 %
Thailand	1.1 %	0.0 %	8.7 %
Russia	0.8 %	0.5 %	0.8 %
Chile	0.8 %	0.3 %	8.6 %
Australia	0.6 %	1.2 %	1.9 %
Israel	0.6 %	1.0 %	9.3 %
Bahrain	0.6 %	2.6 %	1.6 %
UAE	0.6 %	2.2 %	0.8 %

Source: Rystad Energy Covid-19 global model. Raw data from Worldometer as of April 5th.

Infection Fatality Rate versus testing intensity (2 of 2)

- Infection fatality rate (IFR) is according to scientific studies expected to be 0.66% (see references below)
- Reported fatalities is currently 5.4%, or about 8 times higher than expected IFR. This is due to underreporting of actual cases.
- To shed light on this underreporting and too high IFR, we have divided the 54 countries with sufficient data into three different groups based on observed IFR. See previous page. Group 3 has IFR above 5%, group 2 between 2% and 5% while group 1 has below 2%. See table below for a summary.
- We can assume that testing in general is done for sick/suspect cases, and not as screening. However, some countries might also do testing for screening purposes. A low share of infected among those tested would be an indication of this. This is most likely then for Group 1 countries. To illustrate how one could get from *reported* to *real* IFR one can make a test for the entire population with a randomized representative selection, or one could focus on the most likely infected share of the population. We have done the latter below in the next three paragraphs:
- For Group 1, 0.48% of the population was tested and of these 5% was positive (i.e. 250 positive per million). We can assume that primarily sick people were tested positive, but also some without symptoms. If theoretically these countries tested another 2% of the population (4x more than already tested), and 1.5% (30% of current intensity) of those were positive, total number of infected people would grow by 300 per million to 550 per million. IFR would then be $2788/(550*748) = 0.68\%$, i.e. close to our assumed true IFR
- For Group 2, 0.2% were tested and 17% of those were positive (340 positive per million). Again, assuming testing another 2.2% of this population and that 5% of new test were positive (30% of current intensity) would grow the share to 1440 positive per million, with an IFR of $12967/(1540*1293) = 0.70\%$, again getting closer to our assumed true IFR of 0.66%
- For Group 3, a similar reasoning could be done. Clearly as high share positive of tested as 27% indicated that additional testing would also find high share of positive cases. Assuming 8% positive (30% of current intensity) of additional 11% tested would result in an IFR of $48467/((692+8800)*728)=0.70\%$.
- Below we have also included data for all other countries, those with very fatalities (Group 0) and those with no testing

Country Group	Infection		Infected of those tested	Total Cases	Total Fatalities	Total Tested	Total Population	
	fatality rate	Share tested					(millions)	Number of countries
Group 3	9.6 %	0.25 %	27.3 %	504 913	48 467	1 852 790	728	12
Group 2	2.9 %	0.20 %	17.1 %	442 659	12 967	2 589 597	1 293	22
Group 1	1.5 %	0.48 %	5.3 %	191 146	2 788	3 615 123	748	20
Group 0	2.0 %	0.04 %	3.0 %	27 617	566	914 546	2 522	77
Group No testing	3.9 %	0.00 %		93 464	3 631	-	2 277	79
SUM	5.4 %	0.12 %	14.0 %	1 259 799	68 419	8 972 056	7 568	210

Source: Rystad Energy Covid-19 global model. Raw data from Worldometer as of April 5th.

Calibrating our ICU bed calculation and fatality calculation – update as of 5 April

Two weeks ago, we calibrated our method based on countries that have reported both fatalities and ICU cases. In this edition, data data is now available for 108 countries which have registered both ICU cases and fatalities, of which 46 countries shown here have more than 20 cases of each category.

This allows us to again calibrate the parameters used in the model. Originally we used figures from the Norwegian Institute of Public Health (FHI), which stated that 0.25% of all infected cases will need intensive care (i.e. 1 ICU patient per 1/0.25% = 400 true infected). However, after calibrating these figures with the reported number of fatalities, we have changed this metric to 0.33% (i.e. 1 ICU patient per 1/0.33% = 300 true infected). Thus, now we use:

- 300 infected 12 days before admittance per 1 new ICU bed in use (up from 200 last calibration)
- 152 infected per fatality 18 days before death (0.66% Infection fatality rate)

As seen, applying these two independently reported figures into the model, we get a fairly good fit for most of the countries.

Some countries have the highest figures for infection when ICU bed use is used as a base, rather than fatalities (i.e. right column above 100%). A reason for this could be 1) that fatalities are underreported (e.g. people dying at home not registered as Covid-19 deaths), 2) that reported use of intensive care beds are overreported, or 3) that there is a low threshold to place people under ICU care.

For countries with relatively low figures of infection when using ICU bed occupancy versus fatalities, the reason could be underreporting of actual intensive care use or lack of access to intensive care units.

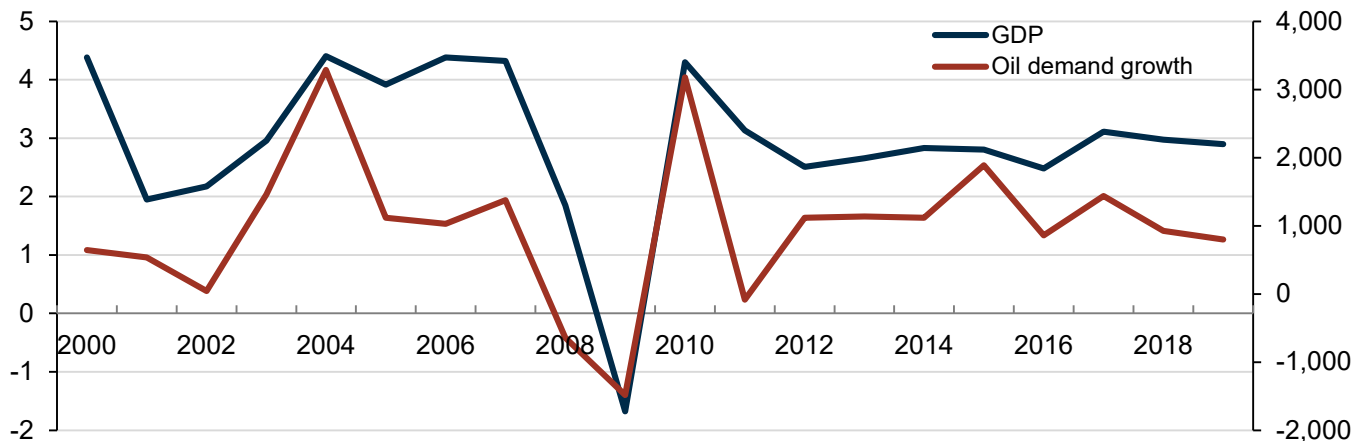
Still, the correlation between these two methods is very strong, $r=0.88$. Thus, using these two independent methods provides consistent numbers, and an indication of fairly reliable figures for true cases

Country	Calculated 18 March true infected base based on ICU use 12 days later (30 March)	Calculated 18 March true infected base based on fatalities 18 days later (5 April)	ICU method results divided by fatality model results
Spain	2 629 363	3 103 438	85 %
Italy	2 833 583	2 637 418	107 %
France	1 979 148	2 103 451	94 %
USA	1 565 607	1 732 040	90 %
Turkey	201 470	1 245 410	16 %
Iran	1 443 094	1 232 327	117 %
Belgium	363 786	846 907	43 %
Netherlands	441 244	536 430	82 %
UK	270 177	399 831	68 %
Brazil	113 611	242 646	47 %
China (18 Feb applied)	2 118 343	312 754	677 %
Israel	25 953	177 403	15 %
Switzerland	144 314	159 797	90 %
Sweden	113 711	150 452	76 %
Germany	760 226	149 387	509 %
Denmark	51 455	127 949	40 %
Portugal	65 057	101 751	64 %
Chile	4 850	100 746	5 %
Indonesia	18 602	77 078	24 %
Philippines	12 001	75 350	16 %
India	4 700	73 921	6 %
Canada	47 555	68 316	70 %
Serbia	17 502	55 935	31 %
Saudi Arabia	6 801	39 806	17 %
Greece	27 603	37 345	74 %
Australia	10 601	34 828	30 %
Ireland	33 153	29 518	112 %
Luxembourg	12 901	28 581	45 %
Ecuador	31 153	27 086	115 %
Poland	9 901	26 290	38 %
Panama	18 002	14 325	126 %
Peru	17 602	43 854	40 %
Algeria	5 501	24 836	22 %
Austria	73 807	24 798	298 %
Iraq	6 701	24 525	27 %
Dominican Republic	6 601	23 976	28 %
Japan	17 452	23 838	73 %
S. Korea	33 203	23 223	143 %
Malaysia	33 753	22 250	152 %
Romania	22 102	18 816	117 %
Egypt	6 351	17 263	37 %
Czechia	37 204	12 467	298 %
San Marino	7 851	7 032	112 %
Norway	33 353	6 674	500 %
Thailand	5 501	6 467	85 %
Finland	15 752	4 114	383 %
Total	15 698 201	16 232 648	97 %

Source: Rystad Energy Covid-19 global model. Raw data from Worldometer as of April 5th.

Global GDP growth possibly contracting by 1%, global oil demand contracting by 5.7%

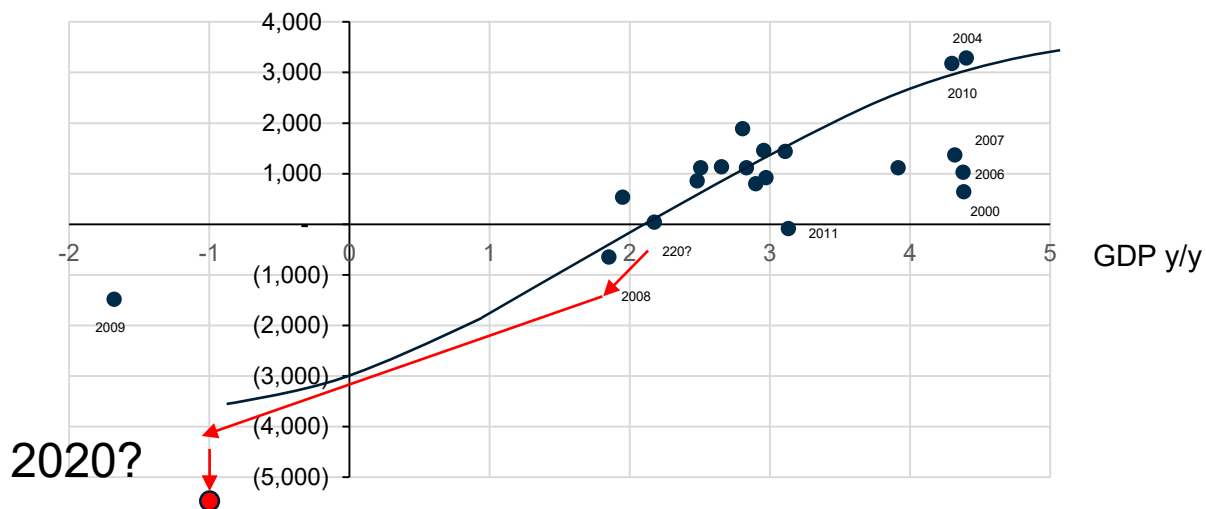
GDP growth (percent, LHS) versus oil demand growth (thousand bpd, RHS) per year



Global oil demand growth is strongly related to GDP growth. The relationship is given by oil demand intensity, which gradually decreases with improved fuel efficiency and – going forward – electric vehicle market penetration. The correlation is not fully linear due to demand elasticities.

Our research indicates that pre-virus global oil demand in 2020 would be flat if GDP growth was to slow down to 2% (IMF: “global recession”), while oil demand growth would be 1 million bpd if global GDP was to expand by 3%.

GDP growth (x-axis, percent) versus oil demand growth (y-axis, thousand bpd) per year 2000–2019



However, based on the latest reporting on the spread of Covid-19 and the state of the stock markets, some macro analysts now see global GDP contracting.

Our latest estimate for a global oil demand contraction of 4 million barrels per day is in line with this empiric model of correlation between oil demand and GDP.

Source: Rystad Energy research and analysis

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RYSTAD ENERGY

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Headquarters

Rystad Energy
Fjordalléen 16, 0250 Oslo, Norway

Americas +1 (281)-231-2600

EMEA +47 908 87 700

Asia Pacific +65 690 93 715

Email: support@rystadenergy.com

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