RYSTAD ENERGY

COVID-19 REPORT
2ND EDITION

SCENARIOS AND IMPACT ON GLOBAL ENERGY MARKETS

17 MARCH 2020

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The numbers are clear: **the coronavirus pandemic should be expected to last for the entirety of 2020.** Since our first Covid-19 Report last week, Rystad Energy has closely monitored the spread and impact of the virus. Our analysis of the updated data shows that novel coronavirus has spread with unprecedented speed, and many nations are turning away from the goal of containment in favor of "flattening the curve", mitigating the acute impact of the virus in an effort to spread out the number of infected over time and prevent hospitals from becoming overwhelmed.

Controlling the rate of infection is a vital tool to ensure the number of seriously ill does not exceed a country's intensive care capacity. We find that European countries typically have 10 to 25 Intensive Care Unit (ICU) beds per 100,000 inhabitants. Recent literature indicates that 1.0% to 1.5% of infected people (including those who do not know they are infected and/or are an unregistered case) will need hospital treatment and 0.25% will need ICU beds. In other words, for every 400 infected people, one ICU bed will be required.

If then a country has 10 ICU beds per 100,000 people, not more than 4% of the population should be infected at any one time. The average treatment time in an ICU bed is 15 days. Thus, in one month, two groups of infected people could be treated, or 2*4% = 8% of the population could be infected and still receive sufficient treatment. Therefore in 10 months, we can surmise that European nations have sufficient capacity to accommodate 80% of the population being infected, at which point society begins to exhibit herd immunity. The rate of contamination will then slow.

Our research indicates that this process of slowing the spread of the virus such that a population can responsibly contend with the infection over a course of time requires 6 to 12 months. Even then, countries

will experience fatalities however, these will not be the result of a lack of treatment capacity. For countries with less developed intensive care, slowing the spread of coronavirus even further is essential for responsible treatment. Only the immediate development of an effective vaccine, or another type of biological or technological intervention, holds the power to reduce this timeframe.

Given this insight we see two strategies for governments to cope with the pandemic; either they attempt to "manage" the pandemic as prescribed above, or alternatively, attempt to stop the spread completely through drastic social isolation measures, as the governments in China and South Korea have successfully done.

The management scenario still requires a fairly strict quarantine imposed upon the entire population, but allows for some sustained activity. Halting the virus completely requires extremely strict quarantines. And still, within this scenario, the pandemic could resurge when quarantines are loosened. Without any quarantine measures governments may see infection rates explode, far exceeding a country's intensive care capacity.
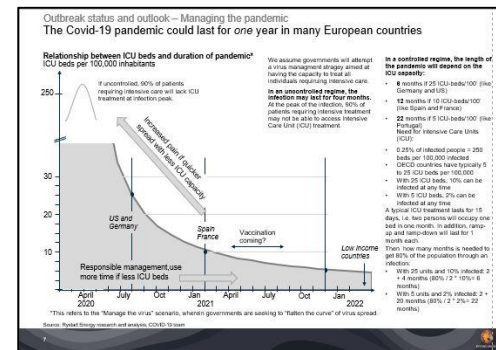
Slide 7 covers the relationship between time and ICU beds

Only 5% of coronavirus cases are actually reported

Looking at the current global situation, several countries are at risk of explosive infection spread if immediate quarantine measures are not implemented. In the first chapter of this edition of our Covid-19 Report we take look at nine countries that have seen dramatic coronavirus developments over the last week. Our simulations show that less than 5% of coronavirus cases are actually reported and that millions of people in Europe are likely already infected. This indicates that some countries are already approaching a very critical stage where hospital capacity will be at risk.

The epidemic may collapse global oil demand by more than 10 million bpd in April 2020

The second chapter of this report shows the impact on global oil demand for two scenarios: the Effective Prevention Scenario, wherein governments attempt to stop the spread of the virus completely through drastic quarantine measures, and a Managed Scenario which sees governments "manage the spread" through loser quarantine measures. As with the health ramifications mentioned above, the impact of the latter scenario will be longer, while the impact of the first scenario will be much more acute. In an Effective Prevention Scenario global oil demand could contract by more than 11 million barrels per day (bpd) year-over-year in April, with jet fuel down 2 million bpd, road fuel down 5 million bpd and other demand segments down 3 million bpd. In this scenario, demand could begin to see year-over-year growth as soon as September or October. In a Mitigation Scenario aimed at managing the spread of the virus, global oil demand could decrease by 10 million bpd in April compared to last year, and see a slower recovery period.

With a glum oil price outlook, the oil and gas industry will be severely impacted

Additionally, we see that free cash flow (FCF) for E&P companies will fall considerably in 2020. In a $40 per barrel (bbl) scenario, the global sum of FCF from E&P companies is expected to drop to around $54 billion. If the average Brent oil price ends up at $30 per bbl, FCF may evaporate completely. In other words, if the current oil price persists, 2020 FCF may be even more challenged than in 2015 and 2016. Global E&P investments are expected to fall by 8% in a $40 per bbl scenario, a situation which would also plunge North American Shale investments down 25%. Sanctioning activity would also fall considerably. Offshore sanctioning would drop from $104 billion worth of greenfield projects in 2019 to just $39 billion in a $40 per barrel world, and to a paltry $31 billion in a $30 per bbl environment. Onshore sanctioning could drop from $88 billion to $43 billion and $30 billion, in the same respective cases.

The actual impact on oil prices will be determined by global storage capacity, as the recent flood of oil from Saudi Arabia will be multiplied by the coming tsunami of demand destruction. Implied stock builds could amount to as much as 1 billion barrels by the coming summer, above the remaining capacity for crude and products in the entire supply chain. As such, production must halt when oil prices fall below a field's marginal cost of production, which ranges from $10 to $25 per bbl for fields globally.

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Scenario definitions

This regular report addresses the novel coronavirus situation through three possible scenarios, hinging upon one key factor – the probability of transmitting the virus between individuals. This can be understood as the number of interactions per person per day over a given time frame, multiplied by the probability that each contact will transmit the virus to the other persons. We assume a basic reproduction number of 2.1, meaning that one infected individual will pass novel coronavirus, or Covid-19, to 4% of the 10 people they interact with over the course of one day. We also assume this will occur over 5.2 days, until they are aware they have become infected and change their behavior.

The precise virility of Covid-19 remains unclear, subject to a variety of as-yet-unknown variables. Nevertheless, if the virus behaves similarly to its cousin influenza A, we can assume that warmer weather will reduce the rate of transmission. This possible "spring effect" however seems less likely based on data this week, as many warm countries see strong growth of Covid-19.

The **Effective Prevention** Scenario plots the spread of Covid-19 under the assumption that drastic social distancing measures are taken, which are considered to be a strict and lasting quarantines. This scenario will suppress the virus, but could be in conflict with maintaining vital functions in society as well as human rights, as free movement is very limited.

The "**Manage the virus**" Scenario still exhibits strong social distancing regulations, but is somewhat less strict than the Effective Prevention Scenario. In this scenario, governments no longer aim to stop the virus completely, but are focused on managing the rate of infection to prevent overloading Intensive Care capacity.

We considers "quarantines" to mean social distancing measures that reduce contact rates to 1 or below, low enough to completely control the spread of Covid-19.

Red tones
Includes those that understand they are infected and/or behave as if they were infected. This group complies with preventative measures and exhibit low transmissibility once diagnosed.

Blue tones
Includes those who do not understand they are infected or do not behave as if they were infected. This group does not comply with preventative measures and exhibit high transmissibility if infected.

Hospital treatment and critical
Those who are admitted to a hospital for treatment, including fatalities.

Minor symptoms
Those who either have been diagnosed, or suspect they may be infected and behave accordingly

Reported recovered
Those who have recovered after a known infection

Infected, undiagnosed
Those who are infected but have not been diagnosed and do not behave as if they were infected

Recovered, undiagnosed
Those who have recovered without ever realizing they were infected.

Reported cases
Official reported cases of Covid-19 infection

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The Covid-19 pandemic could last for *one* year in many European countries

Relationship between ICU beds and duration of pandemic*
ICU beds per 100,000 inhabitants

If uncontrolled, 90% of patients requiring intensive care will lack ICU treatment at infection peak.

Increased pain if quicker spread with less ICU capacity

US and Germany

Spain France

Vaccination coming?

Low income countries

Responsible management,use more time if less ICU beds

| April 2020 | July | Oct | Jan 2021 | April | July | Oct | Jan 2022 |
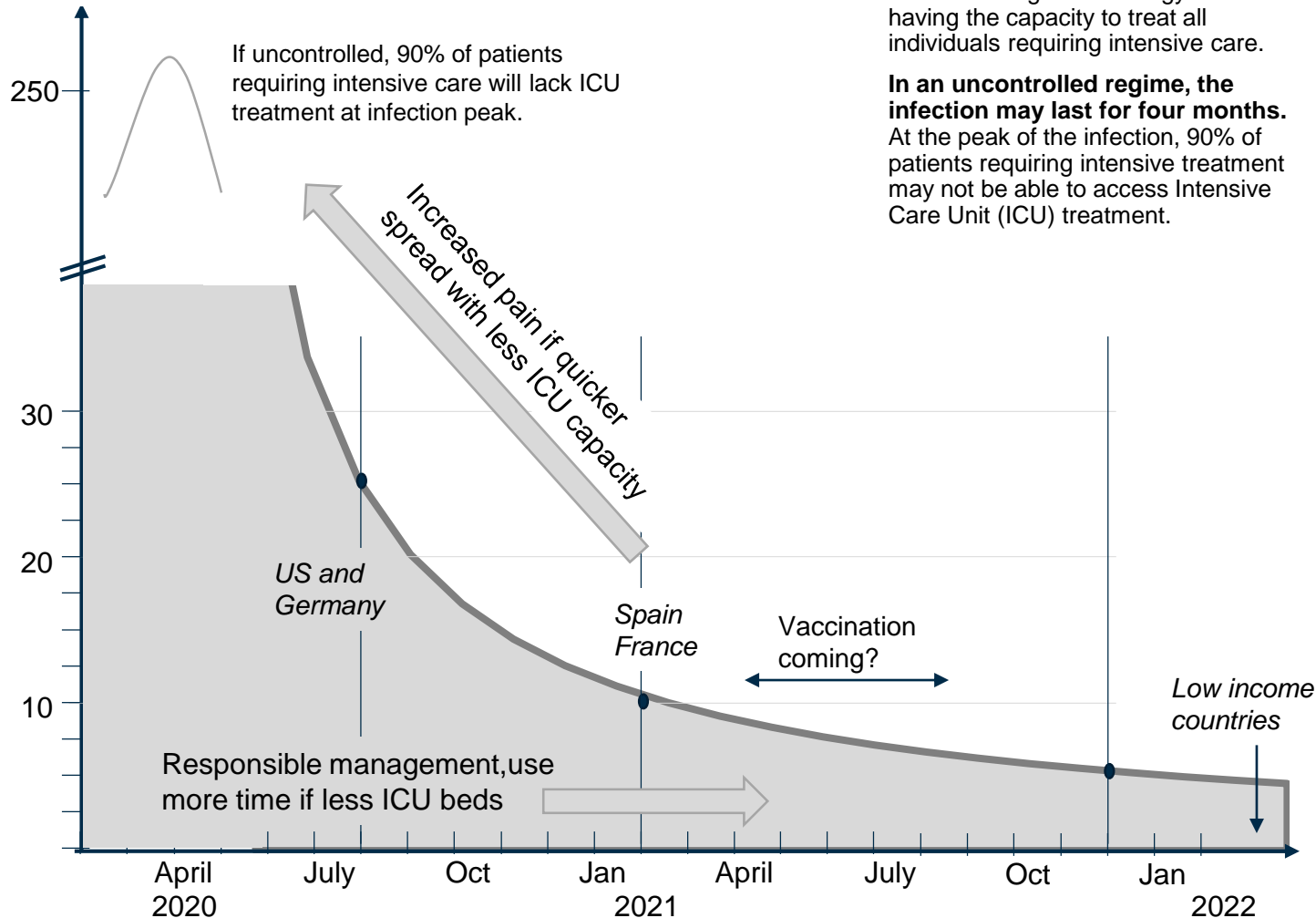
We assume governments will attempt a virus managment strategy aimed at having the capacity to treat all individuals requiring intensive care.

In an uncontrolled regime, the infection may last for four months. At the peak of the infection, 90% of patients requiring intensive treatment may not be able to access Intensive Care Unit (ICU) treatment.

In a controlled regime, the length of the pandemic will depend on the ICU capacity:

- **6** months if 25 ICU-beds/100' (like Germany and US)

- **12** months if 10 ICU-beds/100' (like Spain and France)

- **22** months if 5 ICU-beds/100' (like Portugal)

Need for Intensive Care Units (ICU):

- 0.25% of infected people = 250 beds per 100,000 infected
- OECD countries have typically 5 to 25 ICU beds per 100,000
- With 25 ICU beds, 10% can be infected at any time
- With 5 ICU beds, 2% can be infected at any time

A typical ICU treatment lasts for 15 days, i.e. two persons will occupy one bed in one month. In addition, the time required to ramp up or down will last for 1 month each.

Then how many months is needed to get 80% of the population through an infection:
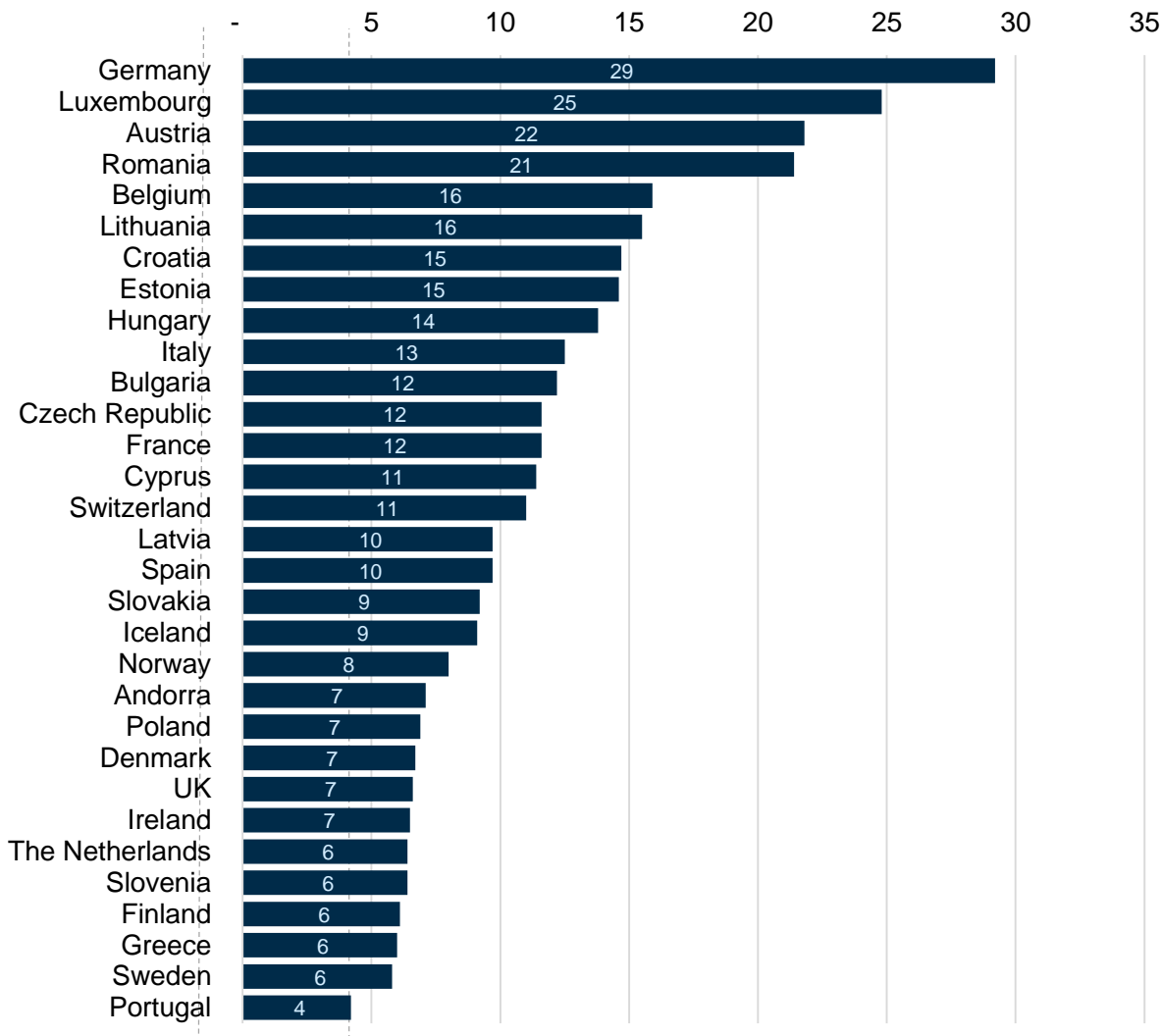
- With 25 units and 10% infected: 2 + 4 months (80% / 2 * 10%) = 6 months
- With 5 units and 2% infected: 2 + 20 months (80% / 2 * 2%) = 22 months

*This refers to the "Manage the virus" scenario, wherein governments are seeking to "flatten the curve" of virus spread.

Source: Rystad Energy research and analysis, COVID-19 team

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Number of ICU beds is typically 10 to 20 per 100,000 inhabitants in Europe

Intensive Care Unit (ICU) beds per 100 000 population in Europe

Country	ICU beds per 100,000
Germany	29
Luxembourg	25
Austria	22
Romania	21
Belgium	16
Lithuania	16
Croatia	15
Estonia	15
Hungary	14
Italy	13
Bulgaria	12
Czech Republic	12
France	12
Cyprus	11
Switzerland	11
Latvia	10
Spain	10
Slovakia	9
Iceland	9
Norway	8
Andorra	7
Poland	7
Denmark	7
UK	7
Ireland	7
The Netherlands	6
Slovenia	6
Finland	6
Greece	6
Sweden	6
Portugal	4

Consensus figures indicate that 1 out of 400 infected people will require an ICU bed.

To the left, the number of beds for intensive care is given for European countries. As all countries are now preparing for the pandemic, we believe the number of Intensive Care Unit (ICU) beds could perhaps be doubled with extraordinary efforts.

Thus, 10 to 60 ICU beds per 100,000 inhabitants should be possible in Europe. However half of these will be in regular use for other conditions.

According to some studies, the US has up to 30 beds per 100,000 however half of these are designated for special purposes and are not necessarily possible to convert for use with Covid-19 cases.

Global figures indicate that low income countries may have as few as 0 to 1 ICU beds per 100,000 inhabitants (0.1 for Uganda and 1.7 for Nepal in one study).

With these figures, we can calculate how long governments will aim to spread out the rate of infection in a "Manage the virus" Scenario.

Source: Robert Verity et al, Imperal College: medrxiv.org; SpringerLink https://link.springer.com/article/10.1007/s00134-012-2627-8/tables/2; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4305307/

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France

In France the number of reported cases has increased six fold over the last week, rising to 6,633. Our simulations indicate however, that the true number of infected is likely around 150,000. With efficient prevention, meaning strict quarantines, the country could still manage to mitigate the pandemic such that required ICU beds will not exceed capacity.
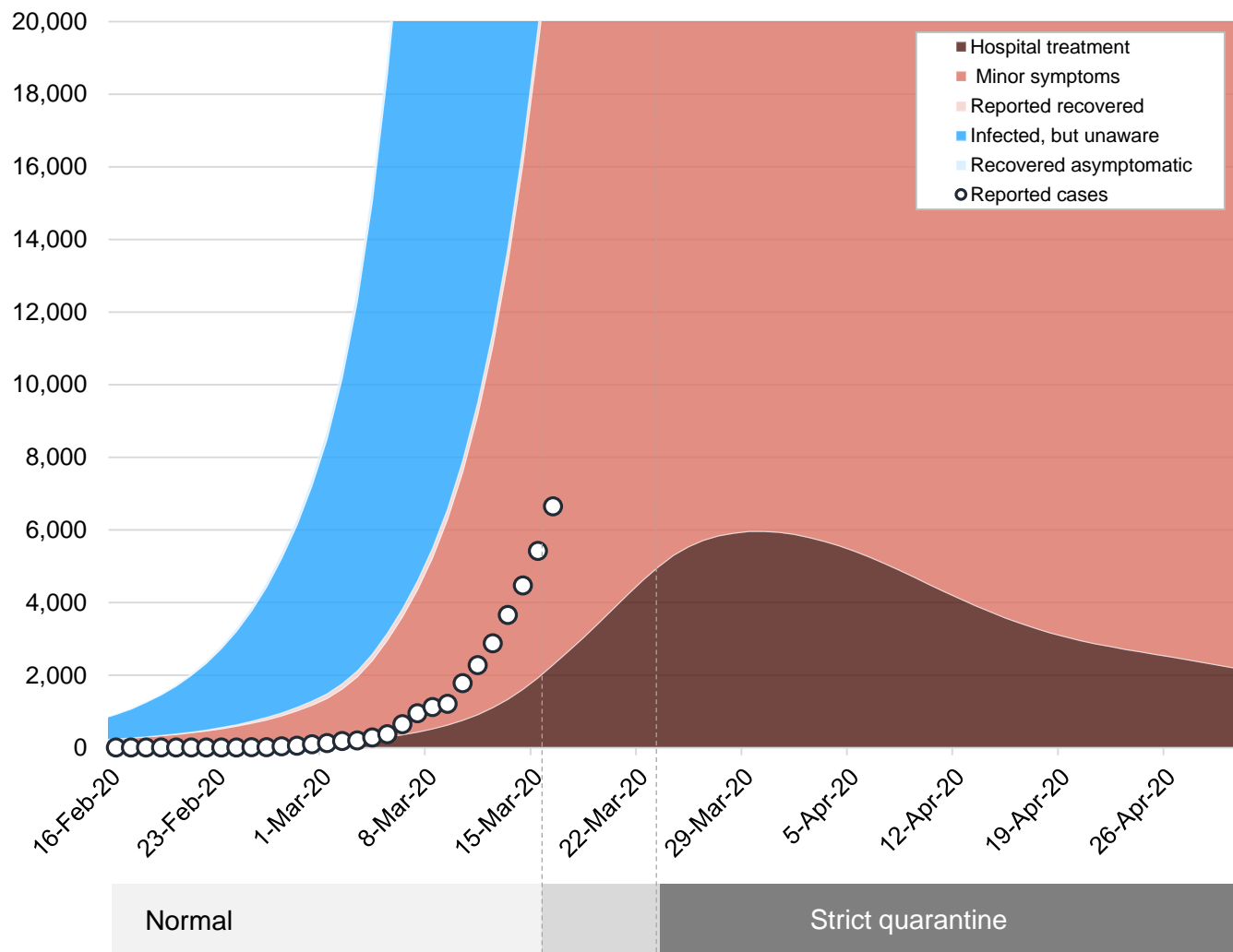
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With effective prevention, the need for hospital treatment could peak at 12,000 in April

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
16 February–30 April

Legend:
- Hospital treatment
- Minor symptoms
- Reported recovered
- Infected, but unaware
- Recovered asymptomatic
- ○ Reported cases

Phases: Normal | Strict quarantine

- On 1 March 130 cases were reported in France, but the true number was probably 7,000. Since then this number has been doubling every 3.6 days.

- Currently there are 6,633 reported cases as of 16 March. According to our simulation, this is only the tip of the iceberg, with the actual number around 150,000.

- About 1.0% to 1.5% (2,000 people) are hospitalized, of whom 400 to 500 are in serious condition and in need of a bed in an intensive care unit (ICU). There have been 148 fatalities as of 16 March.

- We assume that France has begun gradually implementing a very strict quarantine beginnig on 14 March to 22 March, aiming to restrict interactions to one contact per person per day.

- If successfull, the number of hospital cases will be around 6,000 by 1 April, of whom 1,500 are expected to need ICU beds.

- According to one source, the number of ICU beds in France in 2009 was 11.6 per 100,000, or around 7,500. Thus, there is currently enough ICU capacity provided that France is succesfull in stopping the virus from spreading.
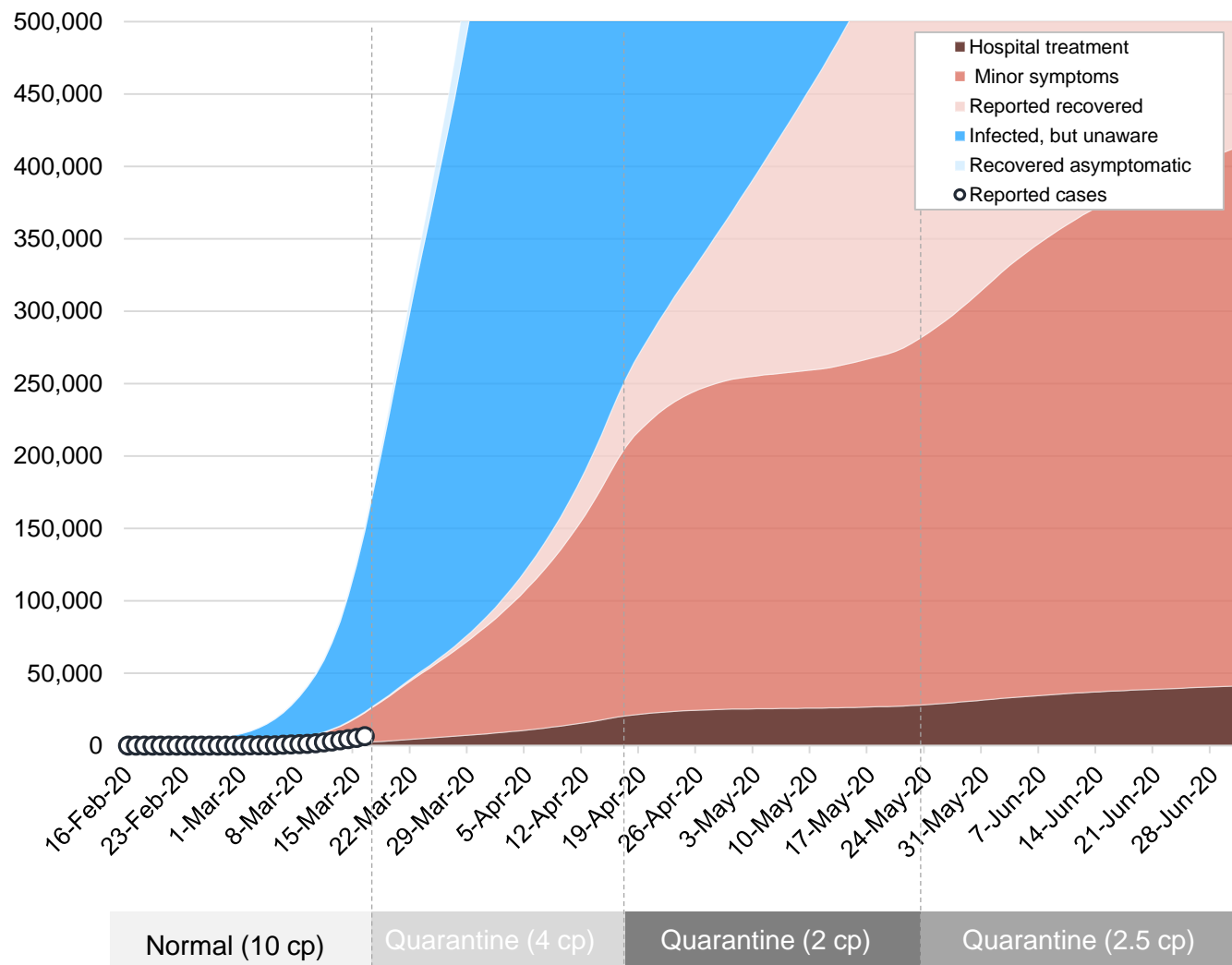
Source: www.healthmanagement.org

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In the "Manage the virus" Scenario, hospital cases will reach 45,000 by the end of June

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
16 February – 30 June

Legend:
- Hospital treatment
- Minor symptoms
- Reported recovered
- Infected, but unaware
- Recovered asymptomatic
- Reported cases

Scenario phases:
- Normal (10 cp)
- Quarantine (4 cp)
- Quarantine (2 cp)
- Quarantine (2.5 cp)

- With slightly less strict quarantines, the number of infected people in France will grow steadily with up to 150,000 new cases per day. Over the course of 100 days, 15 million people will be infected, and the number of sick people needing hospital treatment will peak at around 45,000.

- Of those, up to 11,000 people will need intensive care in ICU beds in July. This is more than the current capacity of around 8000 beds and require that the government mobilize extra treatment beds during April and May to be prepared for these cases in June and July.

Source: Rystad Energy Covid-19 simulations

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Spain

The Covid-19 situation in Spain has reached heightened levels of emergency, with more than 200,000 people currently infected according to our simulations. The need for intensive hospitalized care is growing by 16% every day, and will likely exceed national capacity within a week. Spain declared a state of emergency on 14 March in an attempt to mitigate the effect of the pandemic in the country.
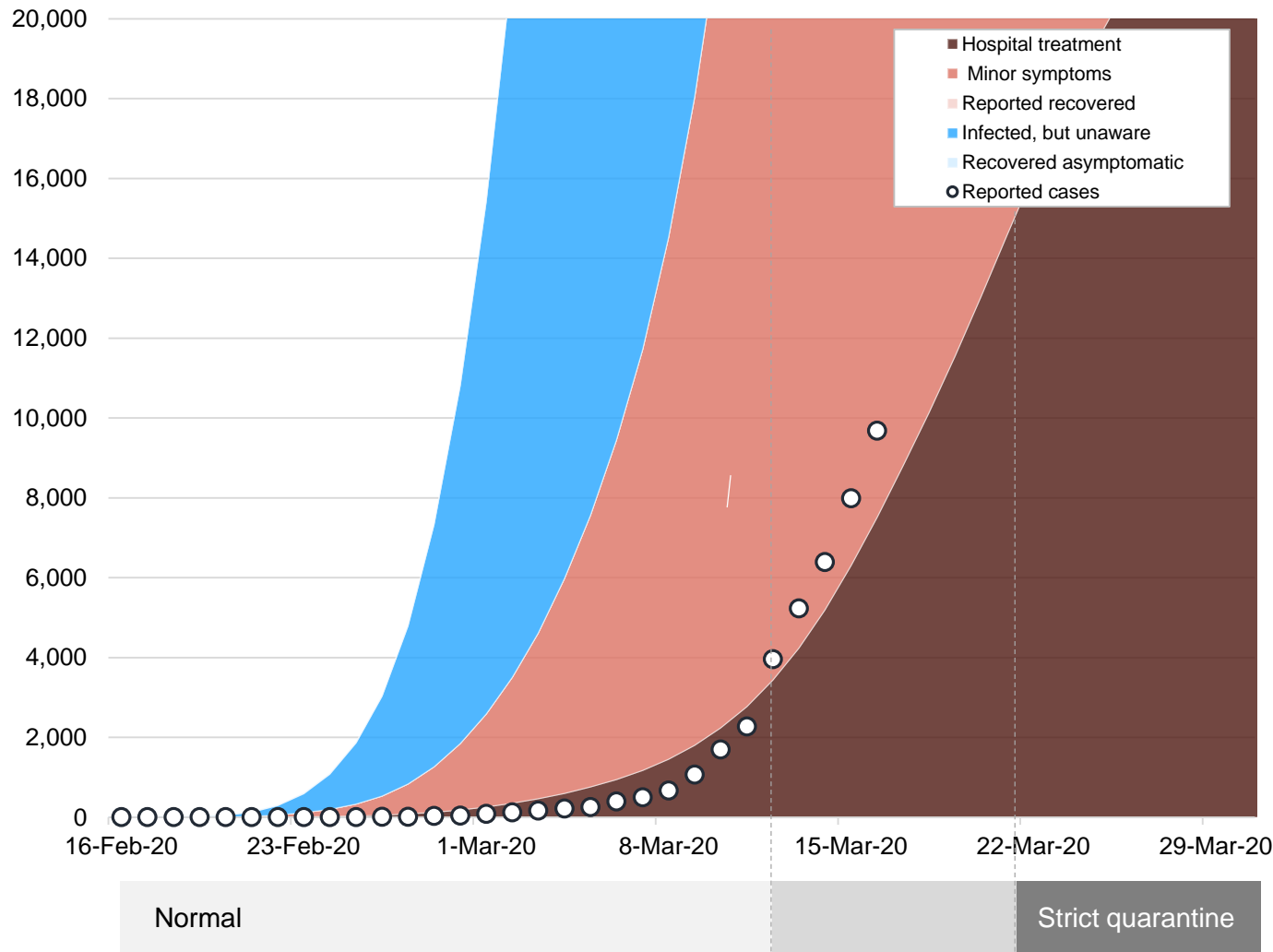
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Even with effective prevention, the number of cases will quadruple by end of March

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
16 February–30 March

Legend:
- ■ Hospital treatment
- ■ Minor symptoms
- ■ Reported recovered
- ■ Infected, but unaware
- ■ Recovered asymptomatic
- ○ Reported cases

Y-axis: 0, 2,000, 4,000, 6,000, 8,000, 10,000, 12,000, 14,000, 16,000, 18,000, 20,000

X-axis: 16-Feb-20, 23-Feb-20, 1-Mar-20, 8-Mar-20, 15-Mar-20, 22-Mar-20, 29-Mar-20
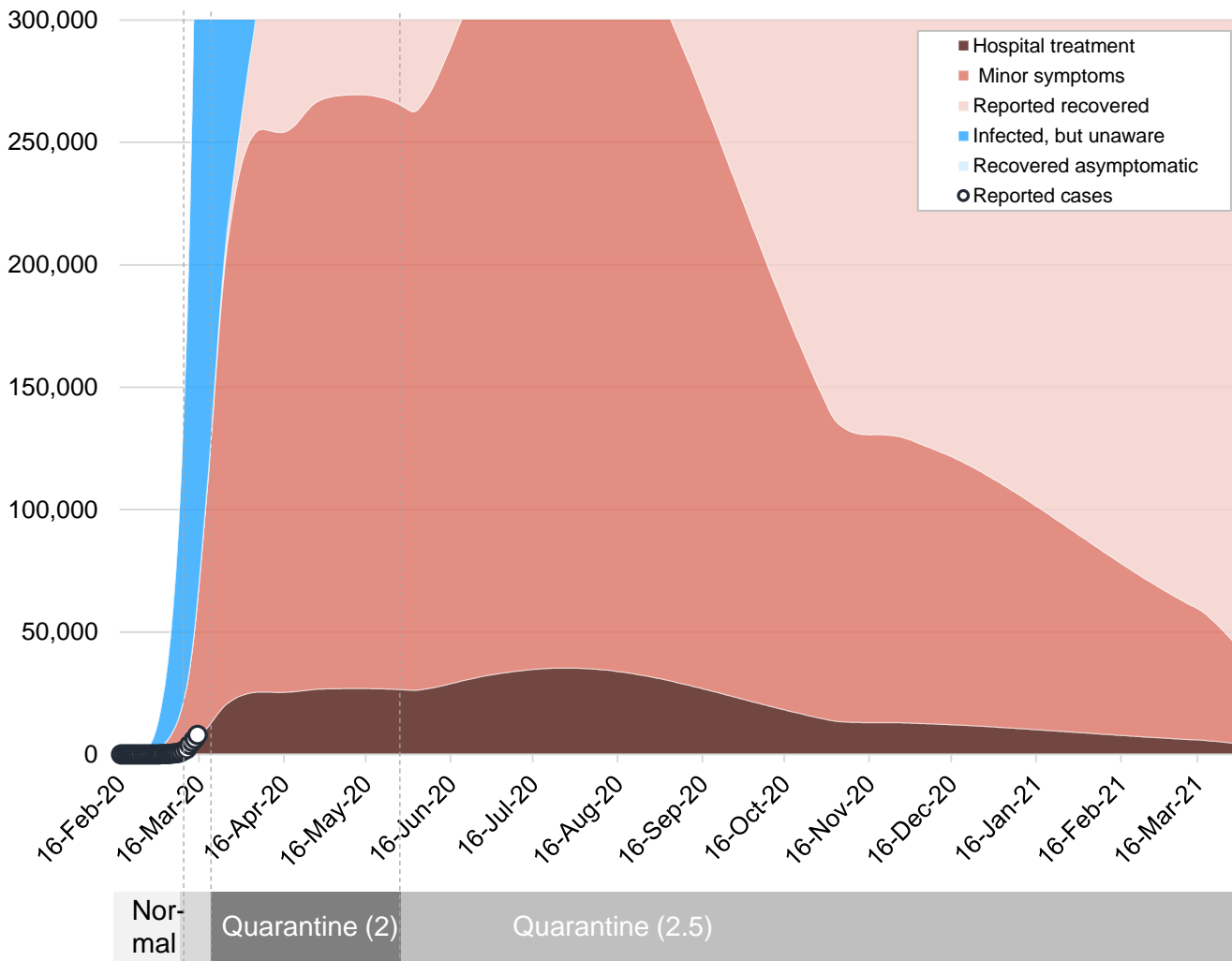
Normal | Strict quarantine

Source: Rystad Energy Covid-19 simulations

- Until 3 March there were 165 registered cases in Spain, of which 33 were confirmed to have been infected outside Spain, primarily in Italy. However, our simulations show that most likely more than 13,000 people were already infected then.

- As of 16 March, most likely 200,000 people are infected. The large majority of those will only have minor symptoms, but about 7,500 will be in need of hospital treatment, of whom 1,900 will need ICU units.

- Spain's population is 46.6 million people. With an ICU bed capacity of 10 per 100,000, there are 4,700 ICU beds. Thus, already the coronavirus will take up 40% of that capacity. Within nine days, the ICU need will exceed current capacity.

- The government declared a state of emergency on 14 March, which will allow the government to restrict free movement and take over control e.g. of private hospitals. Strict quarantine measures were implemented.

- In our Effective Prevention Scenario simulation, we assume that the daily contact rate for an infected-but-unaware person was 15 until 13 March, and will swiftly be reduced to one by 22 March. Still, the number of people needing intensive care will grow to 5,800 by the end of March.

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Spain can "manage" the virus with a fairly strict quarantine for 12 months

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
16 February–30 March

Legend:
- Hospital treatment
- Minor symptoms
- Reported recovered
- Infected, but unaware
- Recovered asymptomatic
- ○ Reported cases

Timeline bar: Normal | Quarantine (2) | Quarantine (2.5)

- In this simulation we have changed the floor of contacts per day per person from one to two from 23 March, then kept it there until 1 June, after which it is slightly increased to 2.5.

- From November, we have increased the transmissibility from 3% to 4% due to cold weather.

- With this regime, the number of ICU beds needed will peak at around 8,800 in late July and then decline slightly to March 2021.

- By then, 26 million people will have been infected, with a total of 170,000 fatalities. Over 12 months, Spain would normally expect 425,000 deaths.

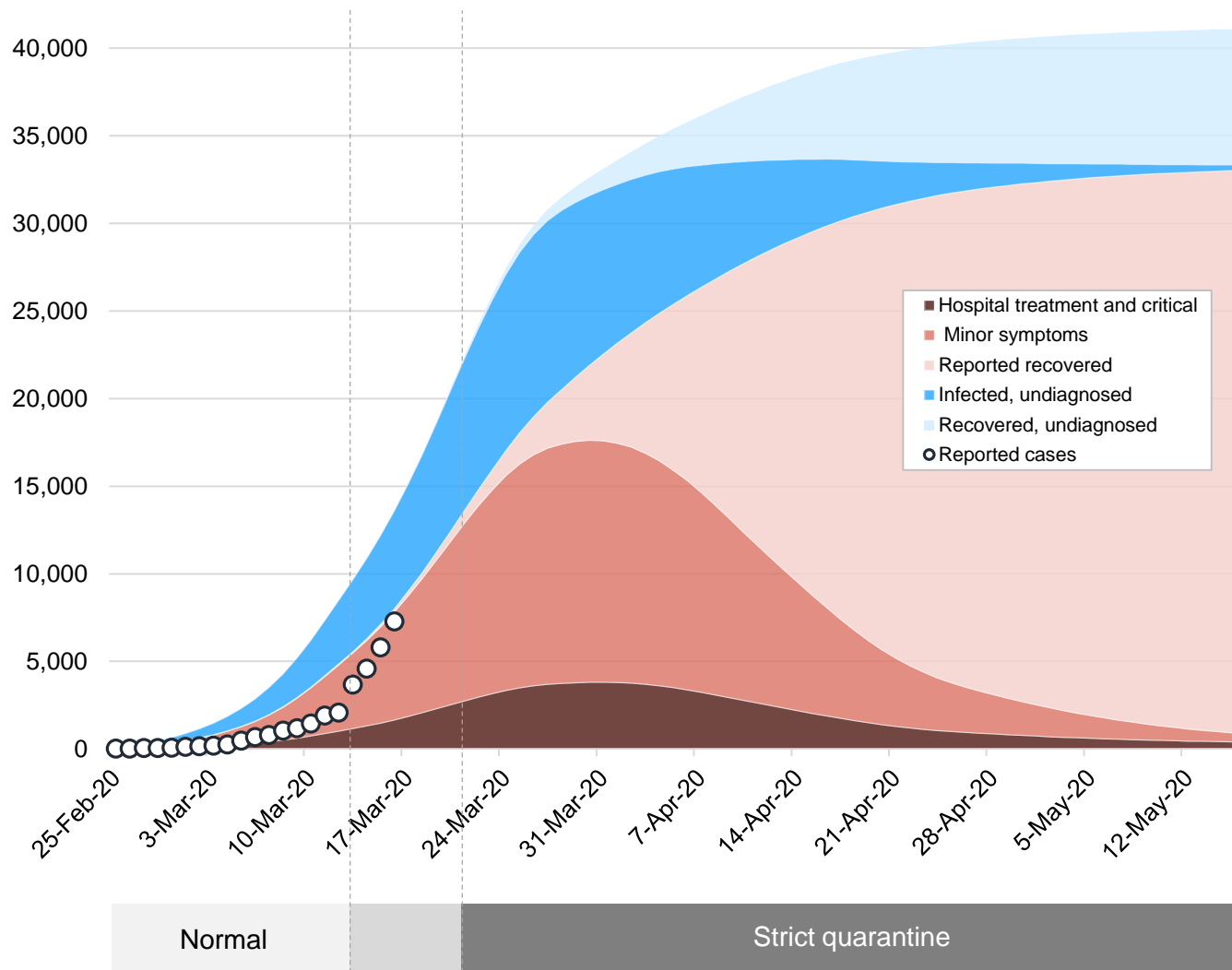Source: Rystad Energy research and analysis;

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Germany

Recent numbers suggest that cases of coronavirus in Germany are rising sharply, although the fatality rate remains low. Until recently there have been no coordinated measures on a national level, but that changed on 16 March when a national quarantine was announced. Based on the low fatality rate observed, we assume that the number of unknown infection cases is low. We estimate the number of people currently infected is around 12,000. With strong quarantine measures, this could peak in late March with nearly 4,000 people in need of hospital treatment.

Effective Prevention Scenario has outbreak largely contained by June

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
25 February–15 May

Legend:
- Hospital treatment and critical
- Minor symptoms
- Reported recovered
- Infected, undiagnosed
- Recovered, undiagnosed
- Reported cases

Phases: Normal | Strict quarantine

- Germany on 16 March introduced stronger measures on a national level to prevent further spread of the virus.

- Prior to this, large gatherings were already forbidden, and other measures were implemented on a local level.

- As of 15 March there were 5,795 reported cases in Germany, with only 11 fatalities. A fatality rate below 0.2% suggests that there are fewer unknown cases.

- In this scenario we implement a strict quarantine where the number of contact points per day goes from 10 to 1 gradually over nine days.

- If this quarantine is respected, we will see a peak in hospital cases in late March at 3,800 patients.

- By 1 June the outbreak is mostly contained in this scenario, and the the ICU capacity more than sufficient.

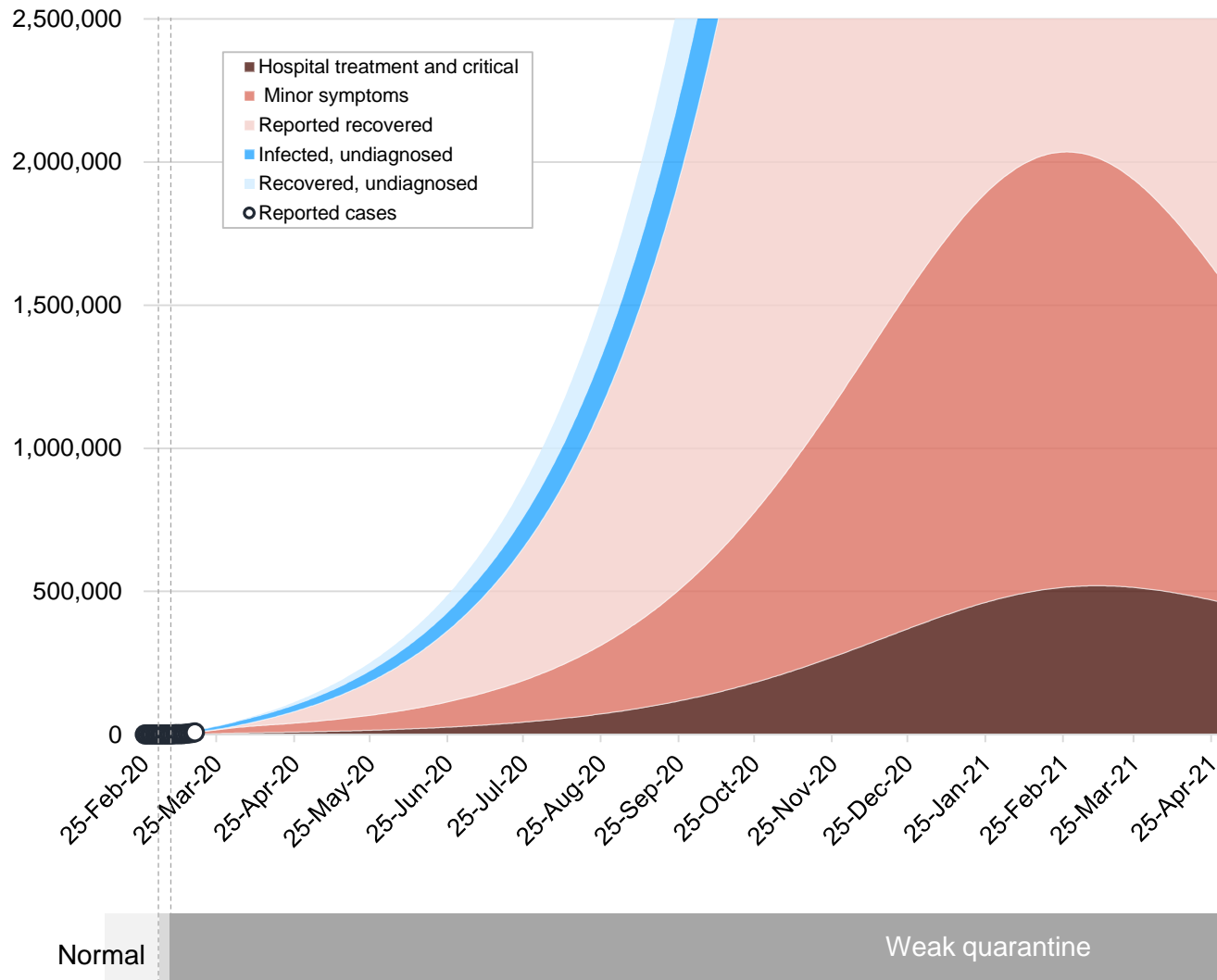Source: Rystad Energy research and analysis; Reported cases from Worldometer.

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In the "Manage the virus" scenario in Germany, infection will continue through 2021

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
25 February 2020–1 May 2021

- In the Mitigation Scenario, we assume that the German strategy will be to keep the number of infected people within manageable limits.

- We assume that the health care system is able to handle that 2.5% of the population is infected at any point in time.

- To achieve this, a moderate quarantine where the number of contact points per day is reduced from 10 to 5 is necessary after government measures were introduced on 16 March.

- With that assumption, the infection will peak in February 2021 with nearly 2.1 million infected simultaneously, before the number of infected people starts declining.

- Since preventive measures were introduced while the number of unknown infection cases was low, it will take a very long time before the outbreak is over, and many people can avoid being infected as a vaccine becomes available in 2021.

Source: Rystad Energy research and analysis; Reported cases from Worldometer.
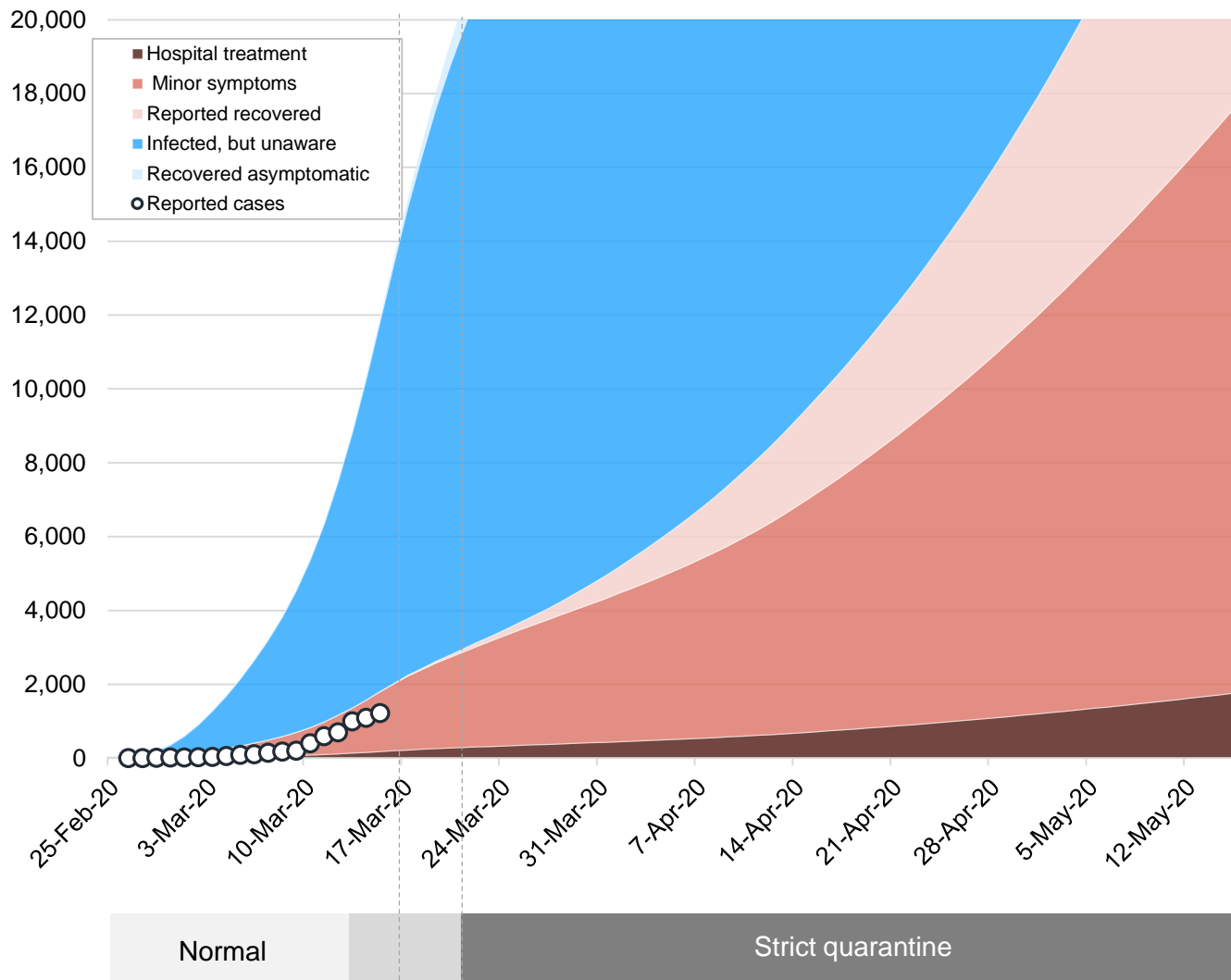
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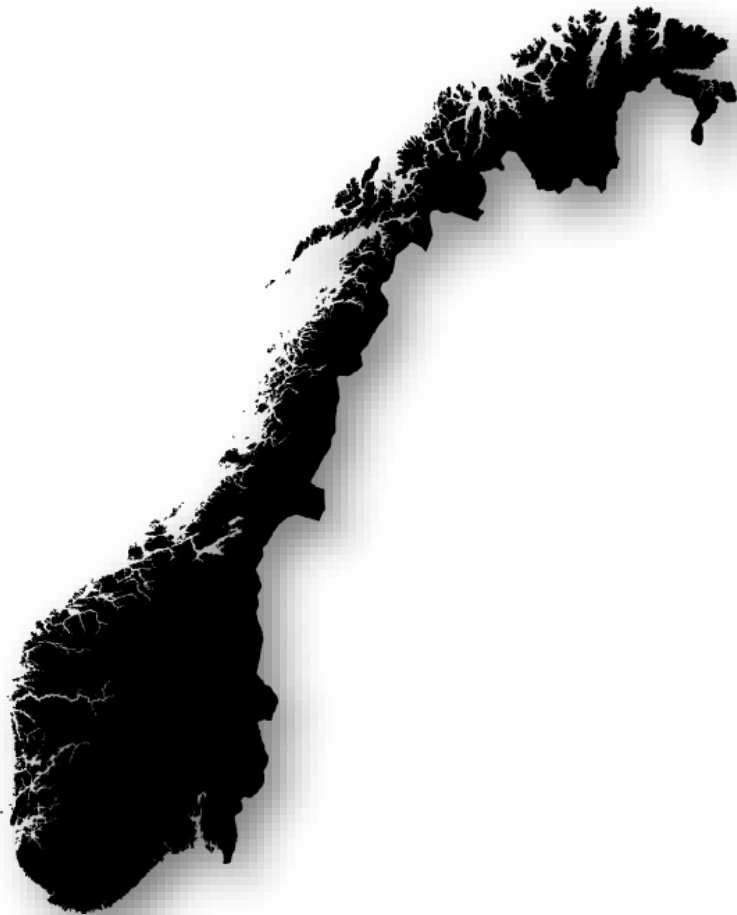
Norway

The cases in Norway have increased rapidly over the last two weeks. According to our simulations, about 14,000 people are currently infected, of which 30 are in need of intensive care. Within a "Manage the virus scenario", cases could stabilize at around 200,000 infected at any point in time, indicating the need for about 500 intensive care beds.

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Norway appears to be aiming for a managed scenario with fairly strict quarantines

Reported and potential total COVID-19 cases by disposition
Number of individual cases

Time period:
25 February – 15 May

Legend:
- Hospital treatment
- Minor symptoms
- Reported recovered
- Infected, but unaware
- Recovered asymptomatic
- Reported cases

Normal | Strict quarantine

- Currently there are 1419 reported cases in Norway. But the true number of infected people is probably at least 14,000. New people entering from high infection areas like ski resorts in Austria are now tested even if they carry symptoms

- The government implemented large scale measures to prevent further spread of the virus 12 March. Kindergartens, schools and universities have been closed, all cultural and sports arrangements are forbidden, and travel is strongly discouraged

- In this "Manage the virus" scenario we implement this as a fairly strict quarantine where number of contact points per day goes from 10 to 3 gradually over nine days

- If this quarantine is respected, 240,000 will be infected by mid May, most of them unaware. 15 May there will be around 1800 hospital cases, of which 450 will need ICU beds.

Source: Rystad Energy research and analysis; Reported cases from Worldometer.
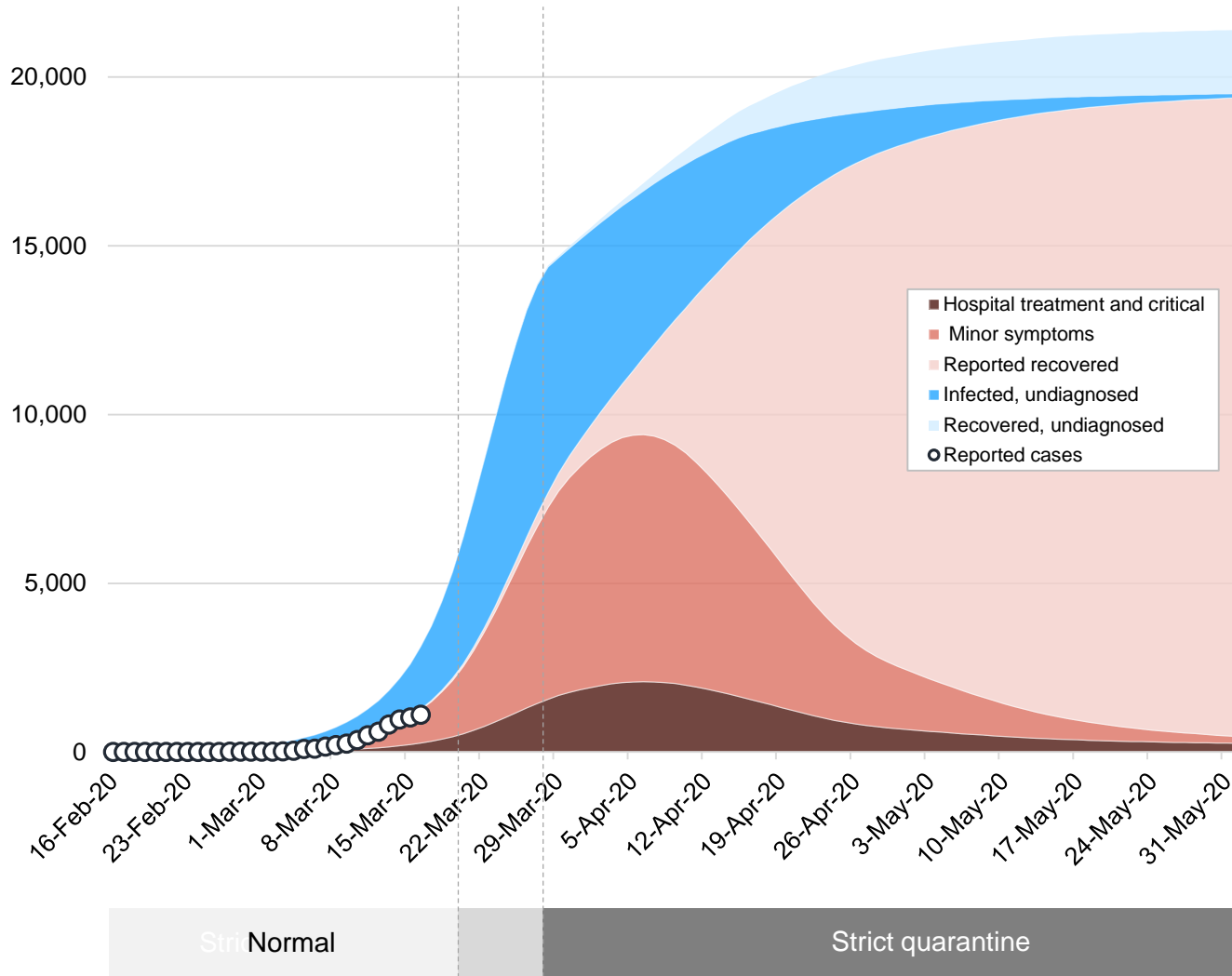
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Sweden

The number of Covid-19 patients in Sweden has risen sharply, similar to the rest of Northwest Europe. However, the Swedish government has been reluctant to introduce the strong measures seen in similar countries, choosing instead to keep schools and social institutions open. We assume the increasing number of cases in the near future will force Sweden to introduce strict quarantine measures at some point soon. If these measures are successful, we may see a peak in early April with 2,100 patients requiring hospitalization. In a Mitigation Scenario we expect to see a peak of 220,000 active cases in July, after which the infection will decline until June 2021.

Effective Prevention Scenario would require swift action to contain outbreak by June

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
16 February–1 June

Legend:
- ■ Hospital treatment and critical
- ■ Minor symptoms
- ■ Reported recovered
- ■ Infected, undiagnosed
- ■ Recovered, undiagnosed
- ○ Reported cases

- There are currently no strong measures implemented in Sweden. In this base case we assume that an increasing number of cases will force also Sweden to implement large-scale measures to prevent further spread of the virus.

- In this scenario we model this as a strict quarantine where the number of contact points per day goes from 10 to one gradually over nine days.

- If this quarantine is respected, we will see a peak in hospital cases in early April at nearly 2,100 patients.

- By 1 June the outbreak is mostly contained in this scenario.

Normal | Strict quarantine

Source: Rystad Energy research and analysis; Reported cases from Worldometer.
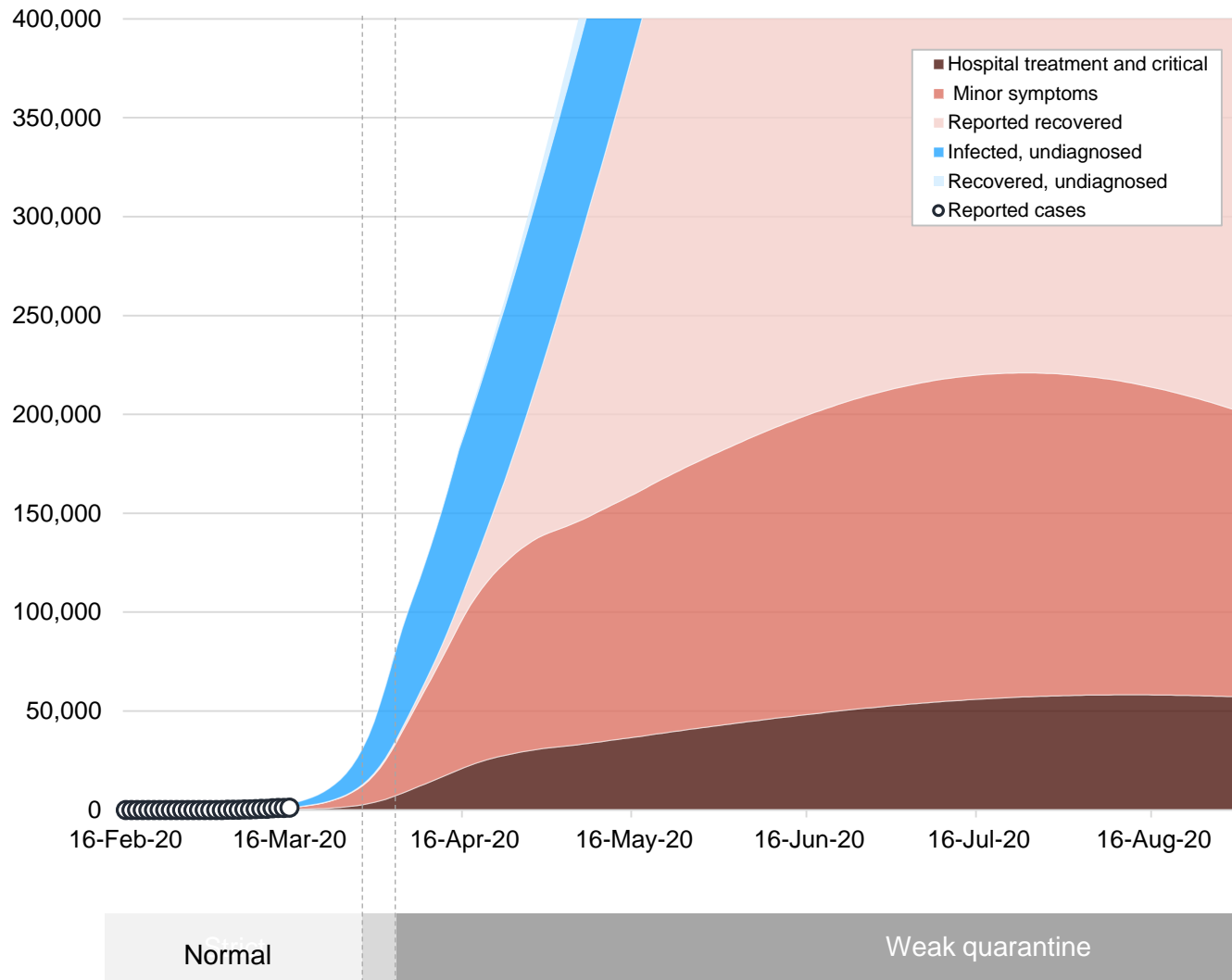
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"Manage the virus" Scenario in Sweden means the outbreak could last to mid-2021

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
16 February–1 September

Legend:
- ■ Hospital treatment and critical
- ■ Minor symptoms
- ■ Reported recovered
- ■ Infected, undiagnosed
- ■ Recovered, undiagnosed
- ○ Reported cases

- In this scenario, we assume that the Swedish strategy will be to keep the number of infected people within manageable limits.

- We assume that the health care system is able to handle that 2.5% of the population is infected at any point in time.

- To achieve this, a moderate quarantine where the number of contact points per day is reduced from 10 to 3.8 is necessary starting 1 April.

- With that assumption, the infection will peak in late July with 220,000 infected simultaneously, before the number of infected people starts declining.

- If the same level of interaction is kept, the outbreak will continue until June 2021, with a total of nearly 3 million people infected.

Source: Rystad Energy research and analysis; Reported cases from Worldometer.

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The United Kingdom

According to our simulations, 93,000 people in the UK are likely infected with Covid-19. We expect this number will increase to 340,000 by the end of March, even considering the national quarantine announced on 16 March. With successful quarantine measures in place, the required number of ICU beds will be lower than current capacity. Thus, it is not too late to see the controlled development of the virus in the country.

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Effective Prevention required to maintain sufficient ICU bed capacity

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
16 February–30 March
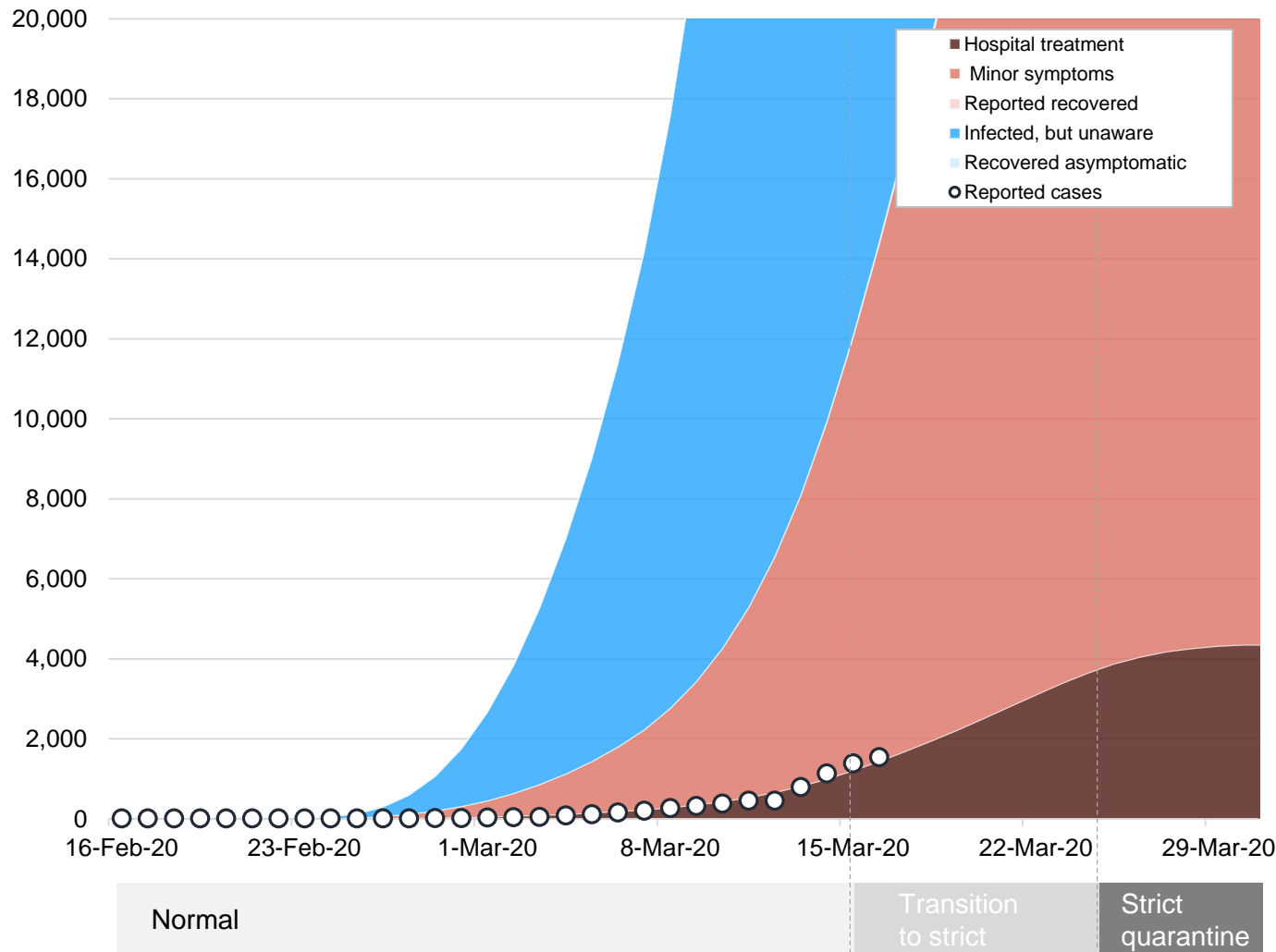
- Until 3 March, there were only 36 registered Covid-19 cases in UK. The actual number was 2,700, according to our simulations*.

- As of 16 March, our simulations show that 93,000 are infected, of whom only 2% are registered as cases. The large majority have only minor symptoms. So far there are 55 fatalities and probably around 250 people in need of intensive care.

- The government declared a complete lockdown on 16 March. We then assume that the contact rate per person goes down to one by 25 March.

- If the lockdown is successful, our simulations show that the number of infected people will be 340,000 by the end of March, of whom 1,000 will need ICU beds. The number of fatalities will reach 1,200 by then.

- The UK has a population of 66.5 million people. With an ICU bed capacity of seven per 100,000, there are 4,700 ICU beds. Thus, with successful suppression of the spread, there will still be ICU bed capacity.

*Contact rate in "normal" UK is 15 persons per day rather than 10. Thus, the virus spreads faster here. Dense population in large cities is probably the key reason.
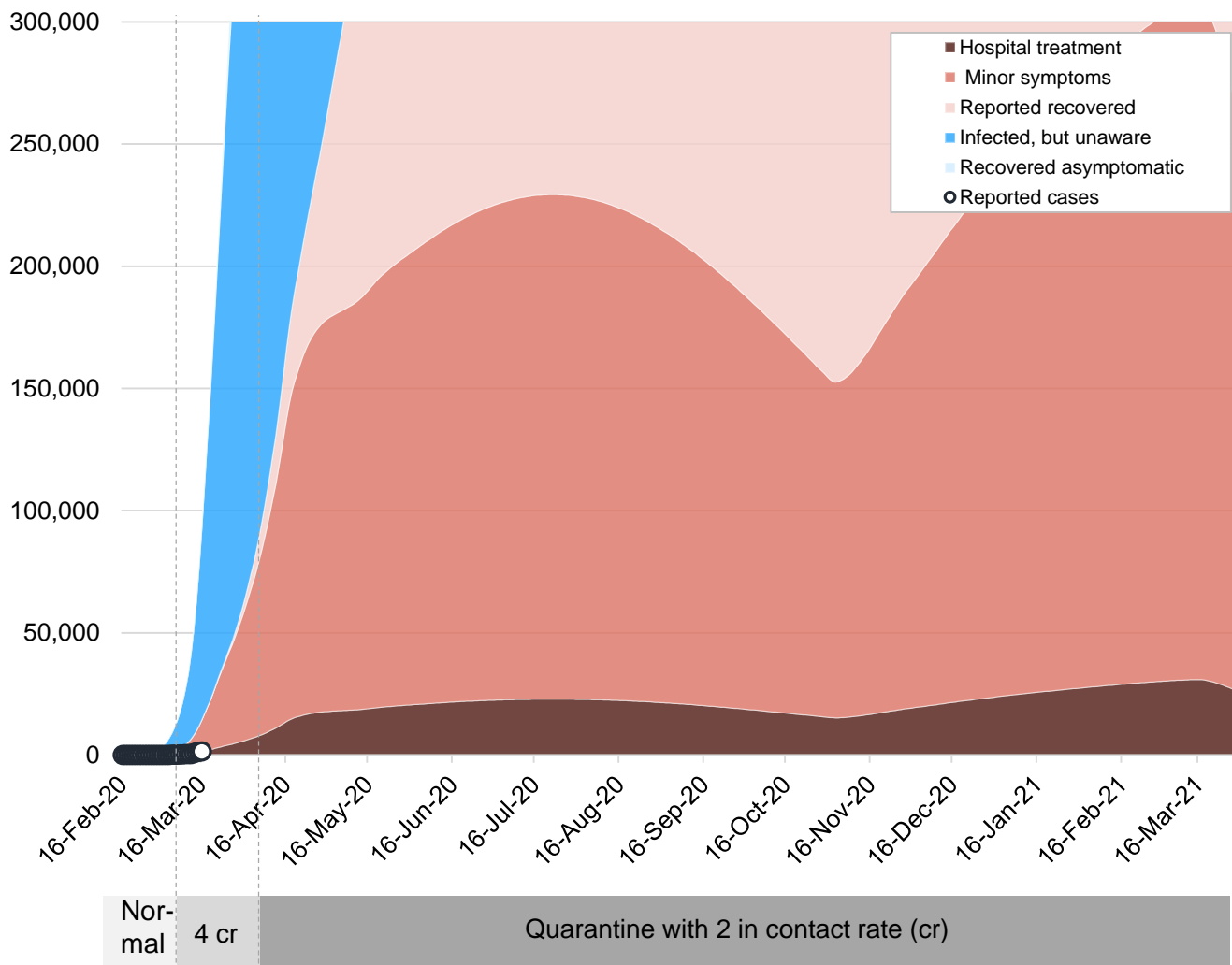Source: Rystad Energy Covid-19 simulations

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With a Mitigation strategy the UK will need 20 months to get through the outbreak

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
16 February 2020–30 March 2021

Legend:
- Hospital treatment
- Minor symptoms
- Reported recovered
- Infected, but unaware
- Recovered asymptomatic
- Reported cases

Bottom bar labels: Nor-mal | 4 cr | Quarantine with 2 in contact rate (cr)

- In the simulation shown here for the UK, we have tried to balance the pandemic within the capacity of ICU beds, assuming that this capacity can be expanded to near 8,000 beds at the peak.

- We then need to see quarantines reducing the contact rate to four until 15 April, and then further down to two for the next 18 months.

- With that, about 80% of the population will be through the infection by the end of summer 2021.

- The increase in cases from November is due to higher transmissibility in the winter months.

- Since the UK has fewer ICU beds relative to the population than many other European countries, the mitigation scenario here will last longer.

- However, vaccination or other solutions might become available before the Mitigation Scenario is completed.

Source: Rystad Energy Covid-19 simulations
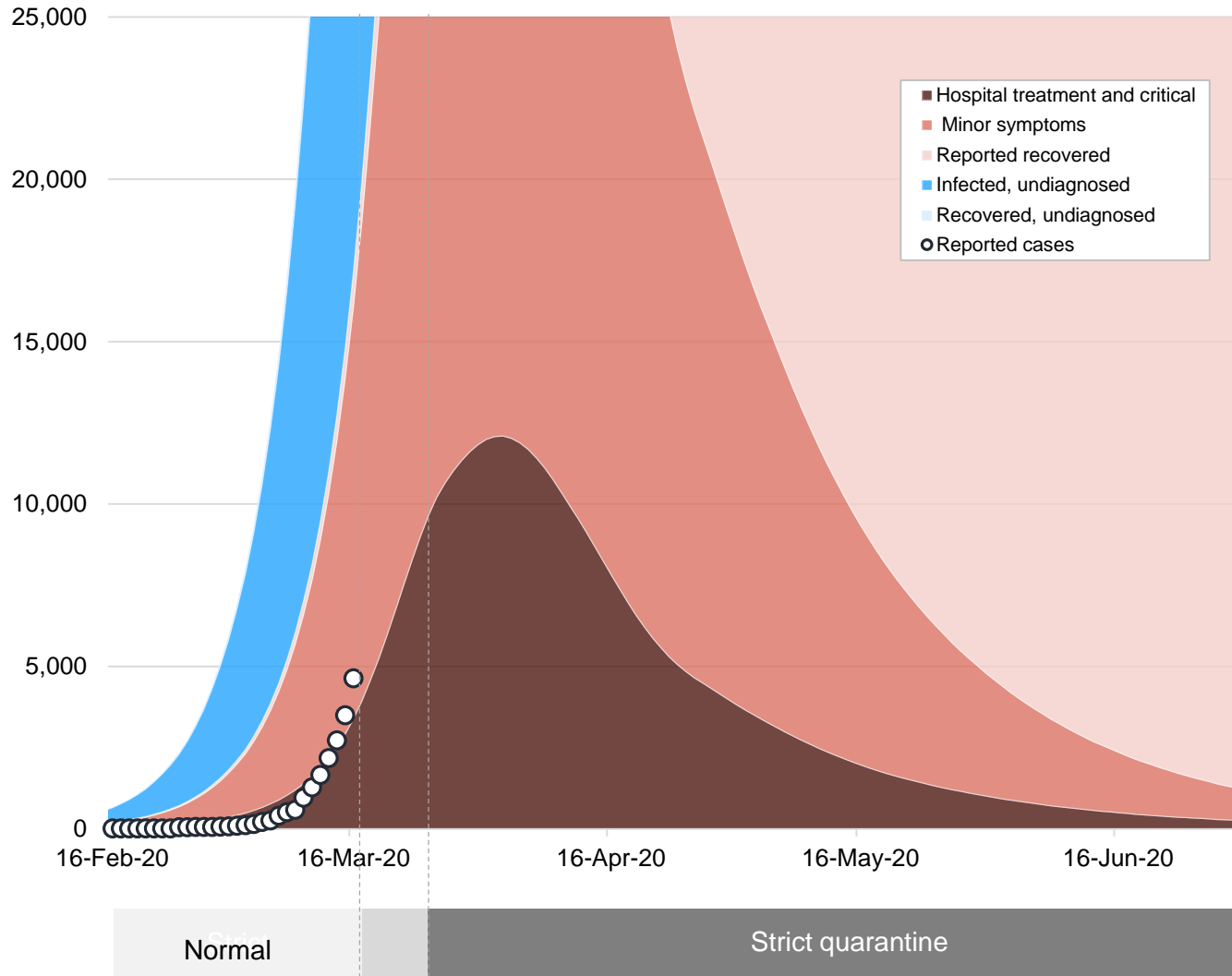
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The United States

Across the US, a significant number of coronavirus cases have been identified in major urban areas, with fewer cases seen in the South. Initially measures were introduced on the local and state level in the most affected areas. However, national measures were implemented on 16 March. Simulations show that 80,000 were likely infected already on 15 March, of which only 4.3% were reported. If strong quarantine measures are put in place, we estimate that the infection may peak in early April with nearly 12,000 hospital cases. In a Mitigation Scenario, we may see a maximum of 78,000 simultaneous hospital cases late in 2020 and early 2021. This would require 40% of all available ICU beds.

Effective Prevention Scenario could see peak hospitalization in early April

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
16 February–1 July

Legend:
- ■ Hospital treatment and critical
- ■ Minor symptoms
- ■ Reported recovered
- ■ Infected, undiagnosed
- ■ Recovered, undiagnosed
- ○ Reported cases

- The United States on 16 March introduced stronger measures on a national level to prevent further spread of the virus.

- Prior to this, measures were already implemented on a local scale in infected communities.

- Our simulations show that as of 15 March, 80,000 people were already infected, of whom only 4% are reported cases.

- In this scenario we implement a strict quarantine where the number of contact points per person per day goes from 10 to one gradually from 17 March to 25 March.

- If this quarantine is respected, we will see a peak in hospital cases in early April at 13,000 patients.

- However, a lack of social security and a general distrust in the government in parts of the population might prevent such efficient measures from reaching full effect.

Source: Rystad Energy research and analysis; Reported cases from Worldometer.
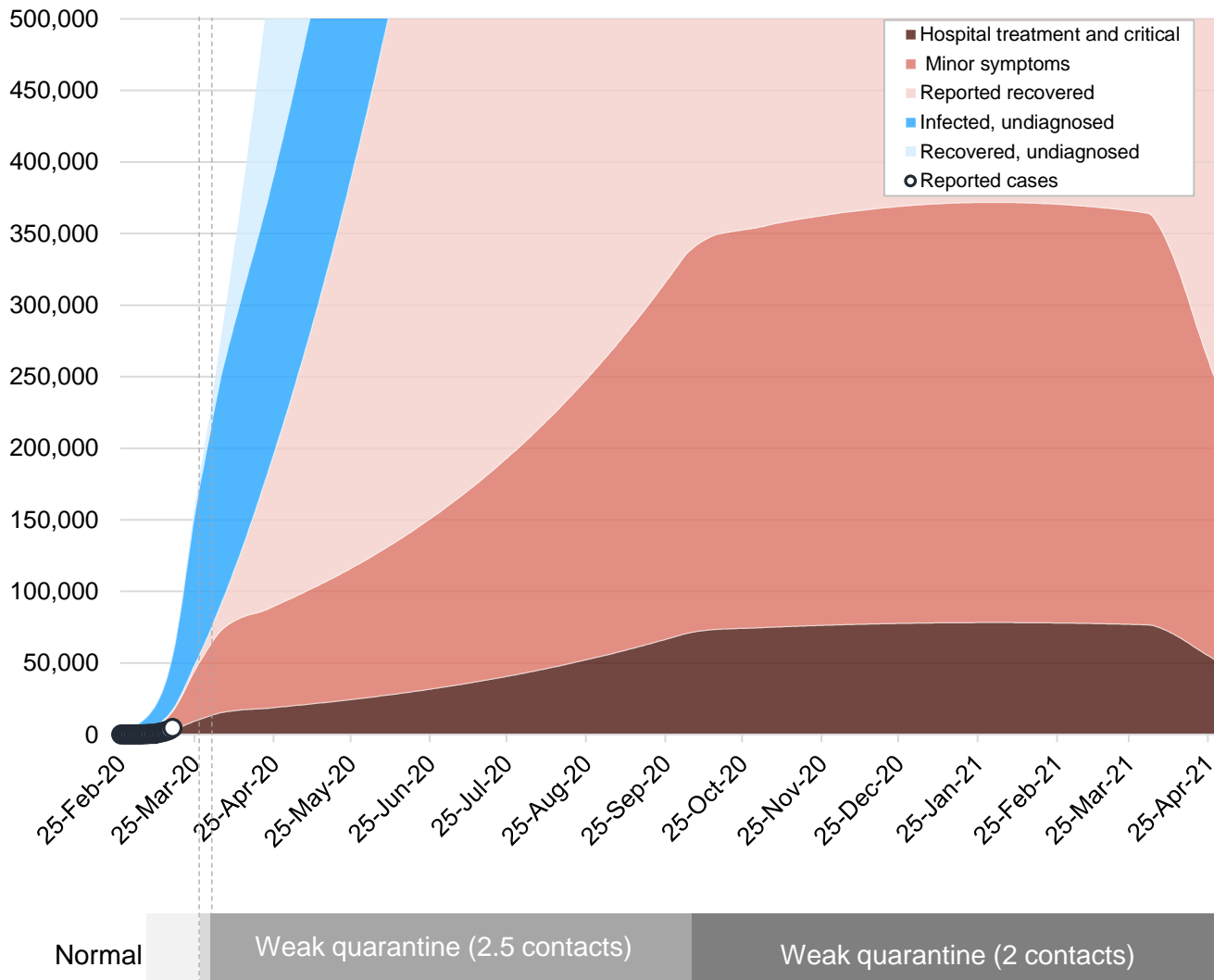
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Mitigation Scenario will prolong outbreak if more measures are introduced in 2020

Reported and potential total Covid-19 cases by disposition
Number of individual cases

Time period:
25 February 2020–1 May 2021

Legend:
- Hospital treatment and critical
- Minor symptoms
- Reported recovered
- Infected, undiagnosed
- Recovered, undiagnosed
- Reported cases

Timeline bar:
Normal | Weak quarantine (2.5 contacts) | Weak quarantine (2 contacts)

Source: Rystad Energy research and analysis; Reported cases from Worldometer.

- In the Mitigation Scenario, we assume that the US strategy will be to keep the number of infected people within manageable limits.

- In this scenario, the number of patients in hospital peaks at 78,000 in fall 2020 and winter 2021. These patients would occupy 40% of all available ICU beds if one in four patients need intensive care.

- To achieve this, a moderate quarantine where the number of contact points per day is reduced from 10 to 2.5 is necessary after government measures were introduced on 16 March, and the contact points must be reduced further when transmissibility increases in the autumn.

- Since preventive measures were introduced while the number of infected people was still well within the capacity of the health care system, it will take a very long time before the outbreak is over, with new people being infected throughout 2021 if a vaccination is not introduced

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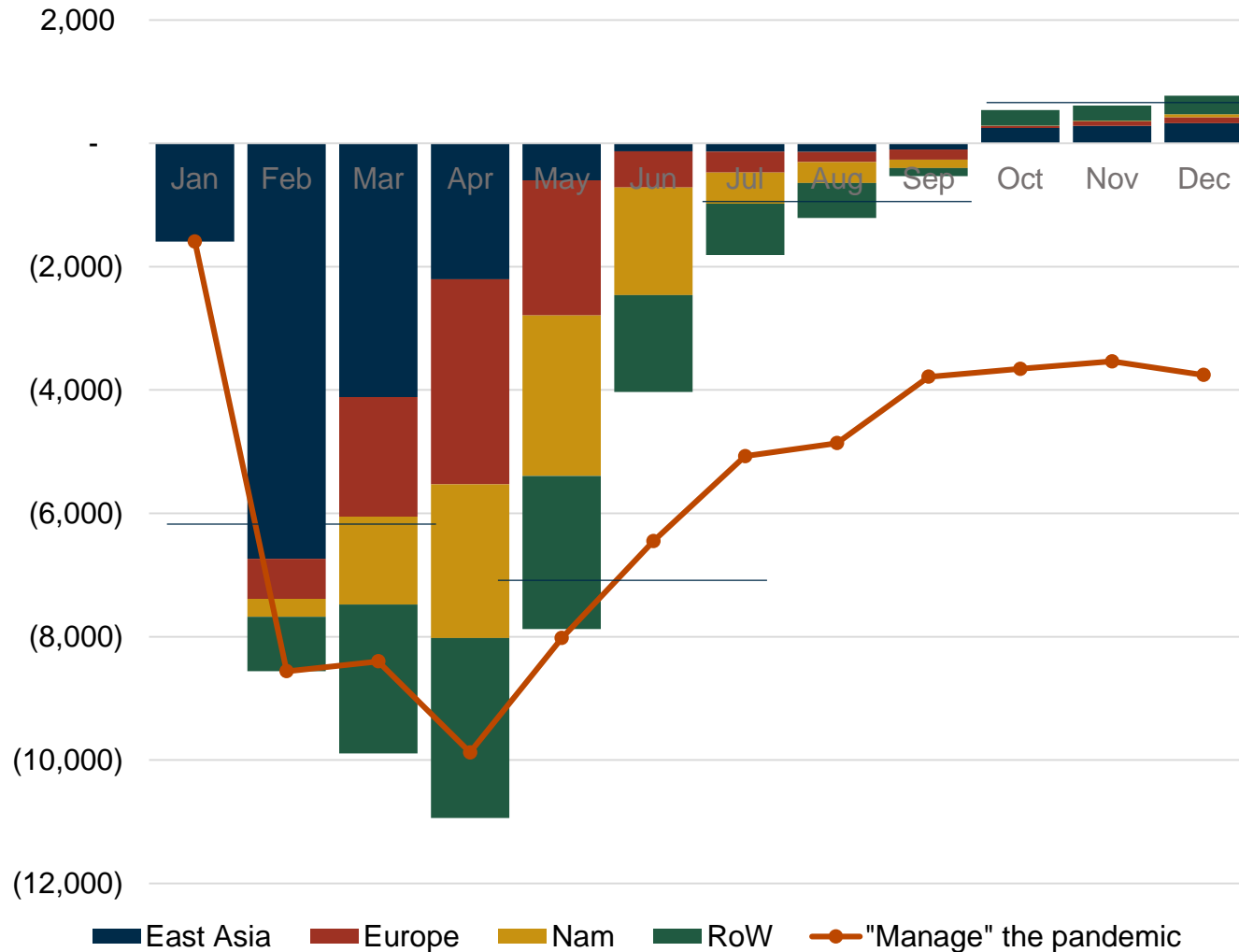
Global oil and petroleum products could contract by more than 10 million bpd in near term

Effective Prevention Scenario, supported by the spring
Thousand bpd

The negative impact on oil demand could amount to as much as 10 million bpd in the coming weeks.

The impact in East Asia is now estimated to have been a drop of 7 million bpd in February. In the rest of the world we see a comparable impact during April and May.

In the "Manage the virus" scenario, more people will have to be quarantined over a longer period, thus causing a dramatic impact on oil demand through the year.

Legend: East Asia | Europe | Nam | RoW | "Manage" the pandemic

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There is an unprecedented number of flights at risk of being suspended in 2020

Daily number of commercial passenger flights, monthly average
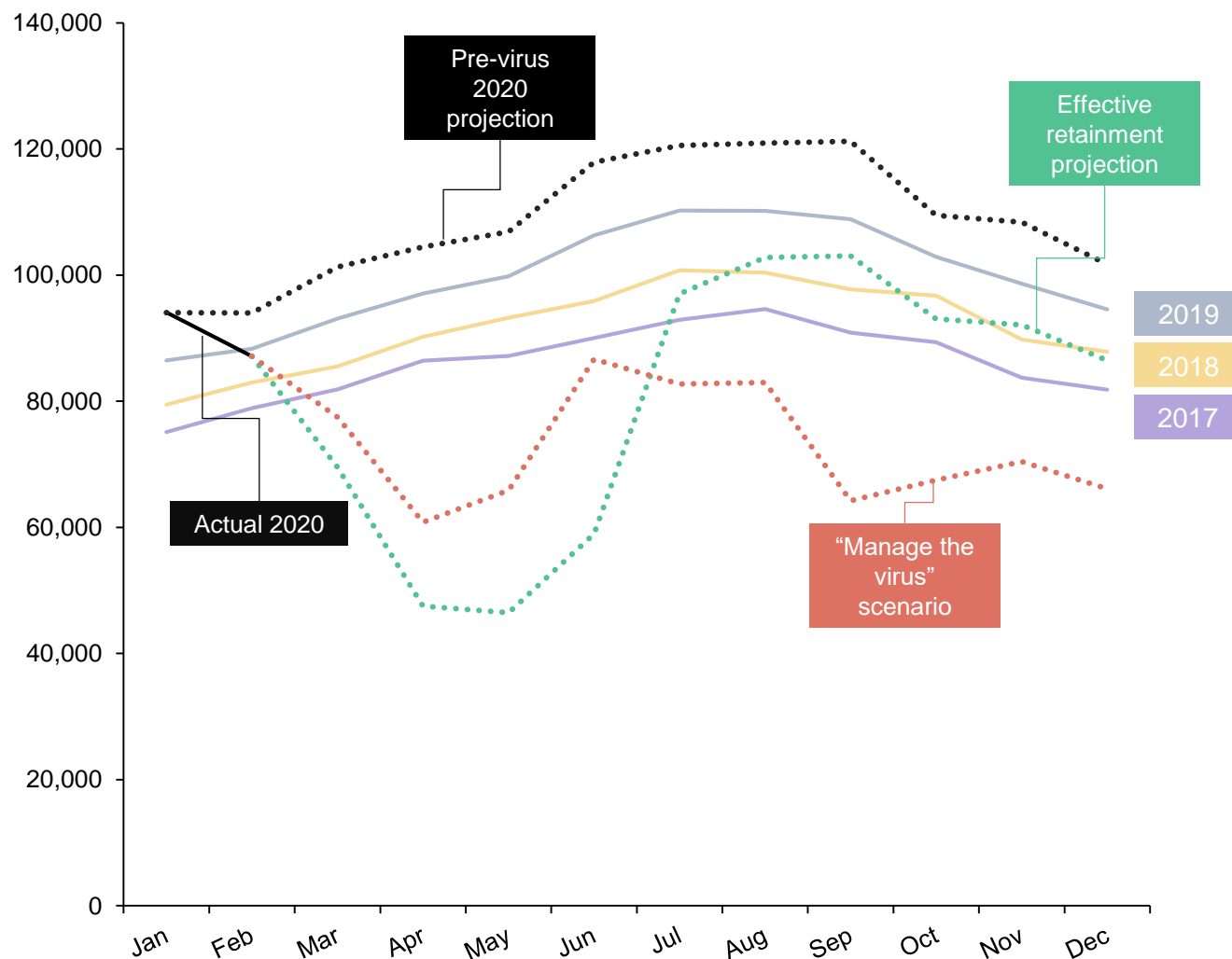
Schengen-US travel ban
Updated: 13/03/2020
Estimated to impact around 14,000 flights (**120,000+ bpd**) over the next four weeks.

United Airlines
Updated: 05/03/2020
Schedule for April reduced by 10% domestically and 20% internationally, totaling around **50,000+ bpd**.

Delta Air Lines
Updated: 10/03/2020
Domestic flights reduced by 10-15% and international flights by 20-25%, in total an estimated **70,000+ bpd**.

Singapore Airlines Group
Updated: 15/03/2020
Cancellations of around 3,000 flights per month (25% of total flights), accounting for **5,000+ bpd**.

Air France - KLM
Updated: 17/03/2020
Capacity to be cut by 70% to 90% in April and May, resulting in a fuel impact of **60,000+ bpd.**

IAG
Updated: 16/03/2020
Capacity for April and May to be cut by 75%, totaling an estimated impact of around **60,000+ bpd**.

Lufthansa Group
Updated: 11/03/2020
An estimated 23,000 flights cancelled between 29 March and 24 April, accounting for **50,000+ bpd**.

*Forecast is based on previous years' growth patterns. Effective retainment and less effective retainment scenarios are based on different quarantine regimes for regions.
Sources: Flightradar24; OAG; Company reporting; Rystad Energy research and analysis

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Impact on jet fuel will be dramatic in Europe; global impact twice as severe as seen in China

Global jet fuel consumption growth year-on-year, thousand bpd
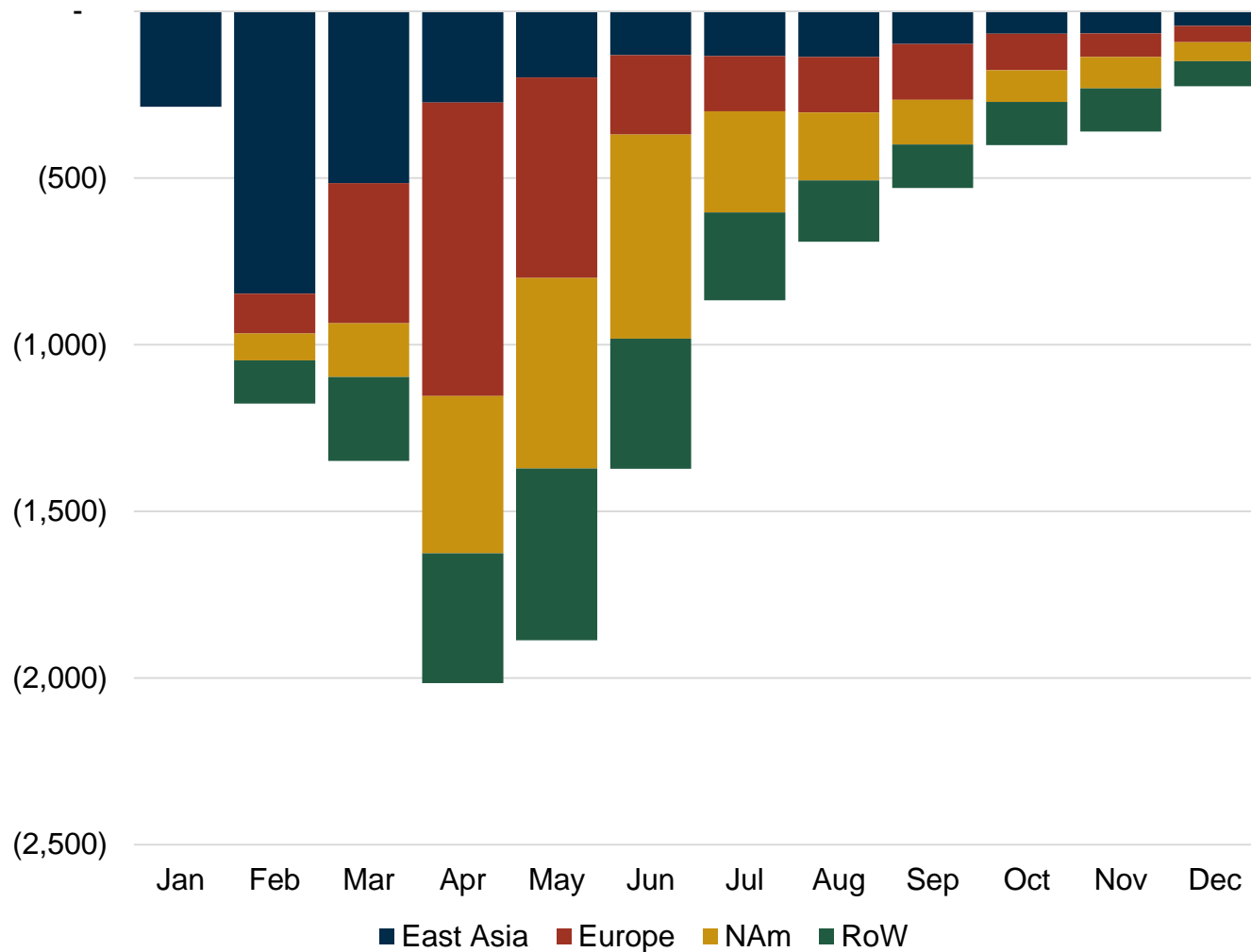
The peak of the impact will be painful in April and May as Europe and the US fight against further spread of the virus across their borders.

Above and beyond the restrictions being imposed, travelers themselves are voluntarily suspending their journeys.

We expect fewer cancellations in June as flights come back gradually ahead of the summer.
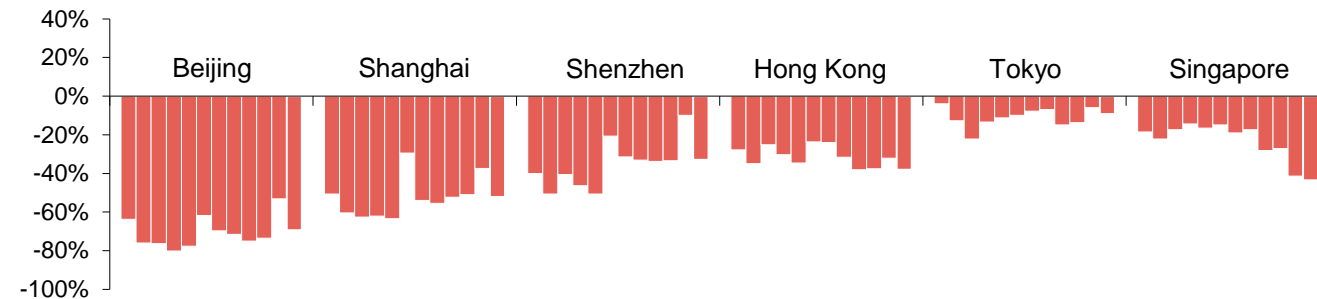
The summer peak will be lower than usual due to fewer long haul flights, as many travelers will likely prefer domestic vacations.

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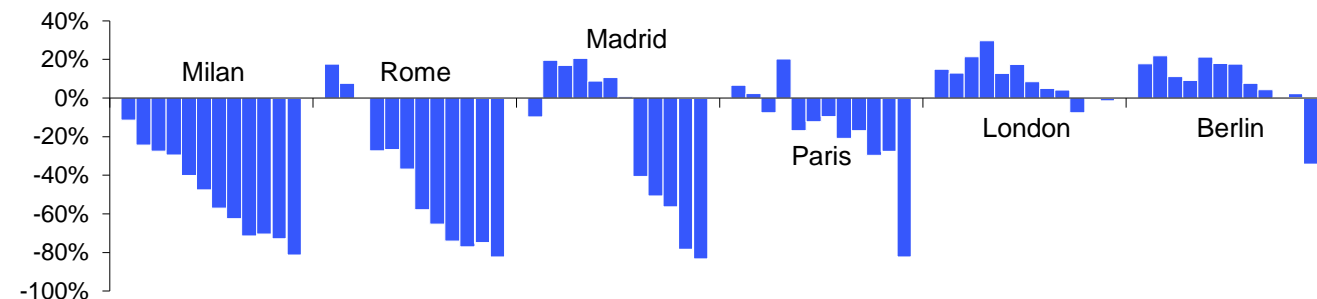# Global road traffic slowing down as congestion drops to historic lows

Congestion levels for last 12 working days compared to average 2019 levels
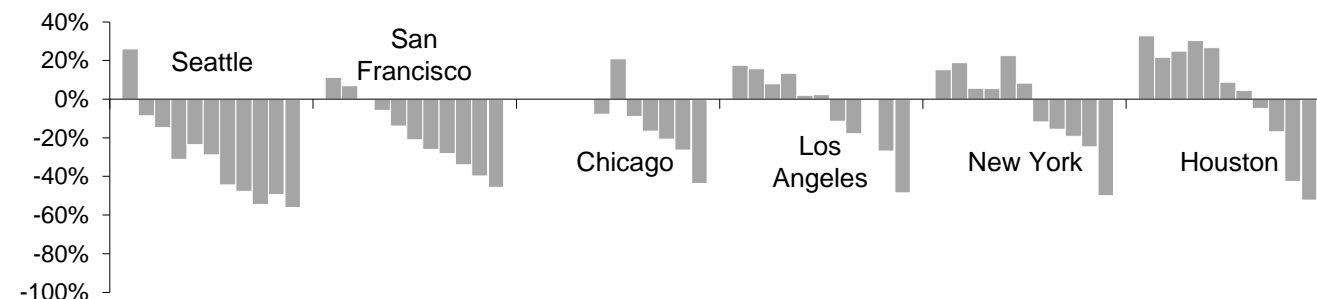Percent difference, day by day from March 2 to March 17th*

Asia

Beijing Shanghai Shenzhen Hong Kong Tokyo Singapore

Europe

Milan Rome Madrid Paris London Berlin

North America

Seattle San Francisco Chicago Los Angeles New York Houston

- The congestion level in a city is heavily correlated with the number of vehicles on the road.

- Comparing data from 18 major cities in three regions, we see that congestion has fallen significantly during the past 12 working days when comparing with 2019 levels.

- These changes are extreme, as European and American cities have seen major reductions in congestion.

- On the European continent, strict quarantine regimes in Italy and Spain have seen congestion drop by around 80% from normal levels.

- In the US, cities on the west coast like Seattle, the epicenter of the spread in the US, are seeing major drops in congestion.

Source: TomTom Traffic Index; Rystad Energy research and analysis; * data for March 14th and 15th not included

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Europe starting to follow China in seeing fewer commuting cars on the road

Number of cars for commuting before and after March
Count
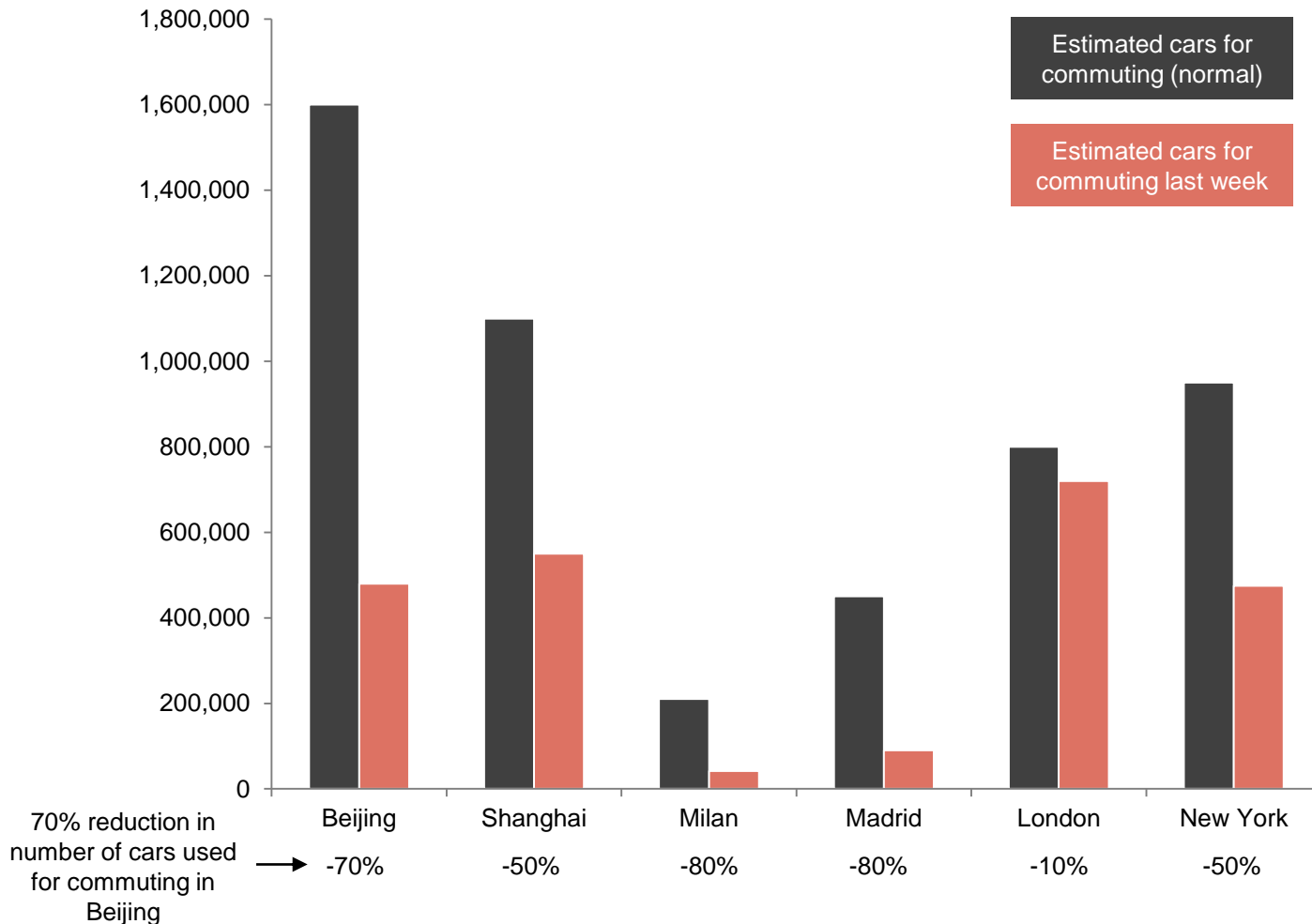
- We have estimated the number of passenger cars used for commuting in six major cities.

- As Covid-19 is spreading rapidly into Europe and North America, we have extended our analysis to include Milan, Madrid, London and New York.

- This week's analysis of traffic congestion suggests a similar reduction in the number of commuting cars in Beijing and Shanghai, at 70% and 50% respectively.

- From the usual level of 210,000 commuting cars in Milan, we estimate an 80% reduction to just 40,000, which is reflective of the recent lock-down of Italy.

- Madrid is down to fewer than 100,000 cars from the normal level of 450,000 – a reduction of 80%.

- Our analysis also shows that major cities like London and New York are starting to follow the commuting reductions seen in other major cities.

Legend:
- Estimated cars for commuting (normal)
- Estimated cars for commuting last week

70% reduction in number of cars used for commuting in Beijing →

Beijing	Shanghai	Milan	Madrid	London	New York
-70%	-50%	-80%	-80%	-10%	-50%

Source: TomTom Traffic Index; Rystad Energy research and analysis

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Global road fuel consumption will likely be down by 5 million bpd during the coming weeks

Global gasoline and road diesel consumption growth year on year, thousand bpd
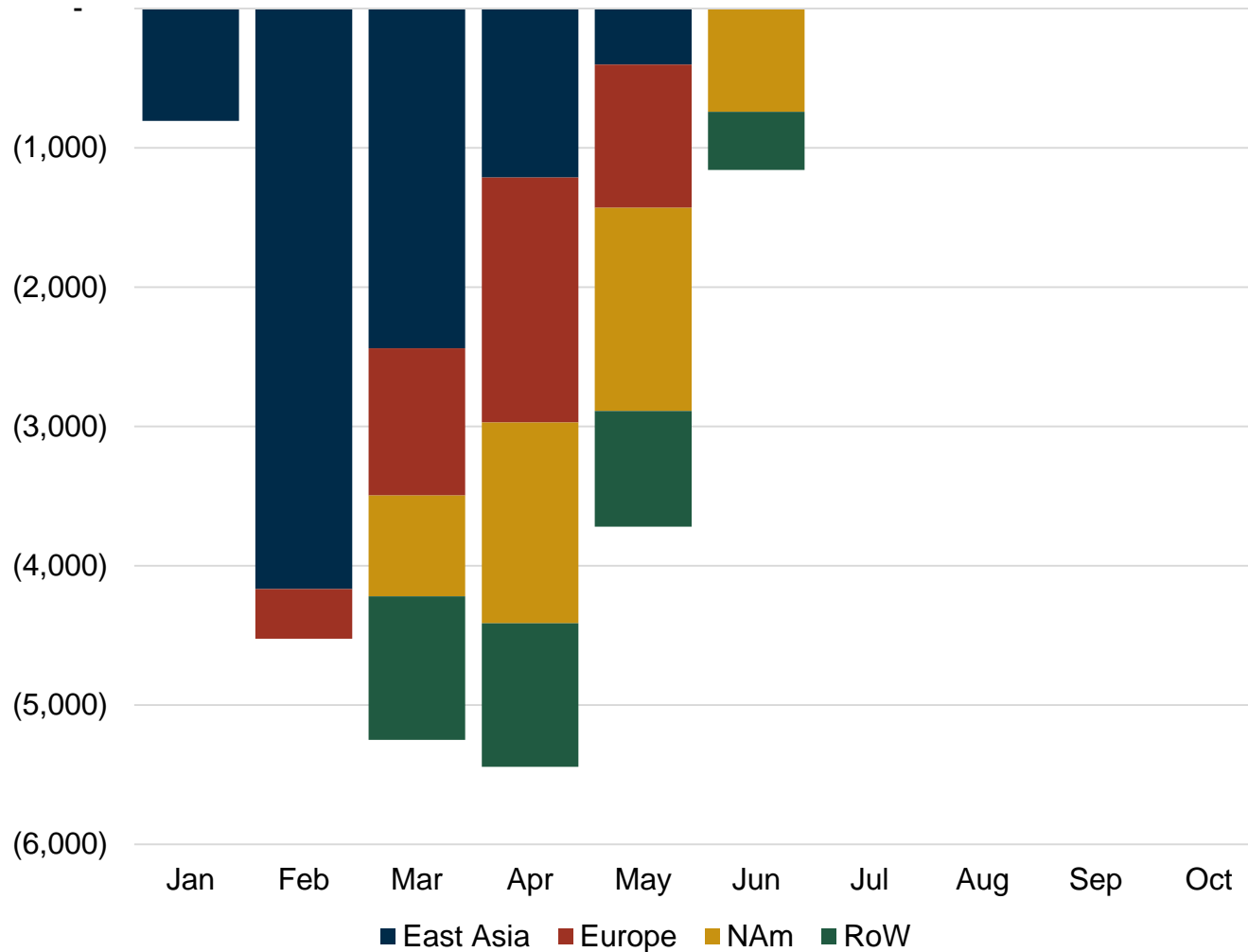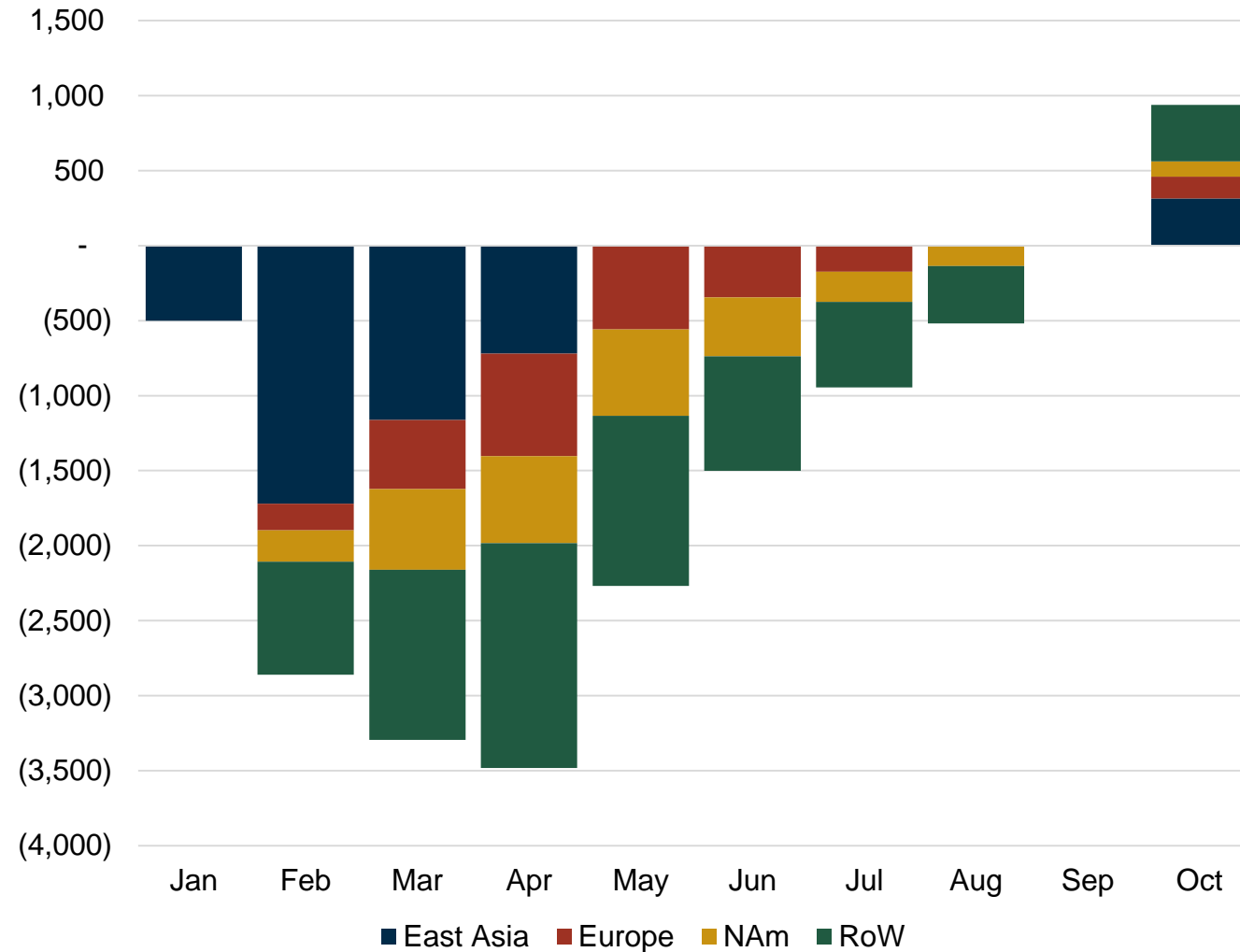

The maximum impact outside China is expected to be equal to what was observed in China in February.

Assuming effective retainment, Europe and North America will gradually come back to normal levels before the summer.

Source: Rystad Energy research and analysis

Chain impact on other uses of oil now at 3 million bpd as demand drops 8% year-on-year

Global petroleum products demand other than road fuel and gasoline, year-on-year growth
Thousand bpd

The impact on other use of oil will be high in Russia, Latin America and developing economies.

■ East Asia ■ Europe ■ NAm ■ RoW

Source: Rystad Energy research and analysis

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E&P companies' free cash flow will drop towards zero if the oil price stays at $30 per barrel

Total upstream free cash flow from public E&P companies for various oil price scenarios
Billion USD

- With the new oil price outlook driven by the Covit-19 effect on demand and the oil price war, free cash flow (FCF) for E&P companies is forecast to fall considerably during 2020. Assuming an average Brent oil price of $40 per barrel in 2020, FCF is expected to drop to around $54 billion. If the average Brent oil price were to end up at $30 per barrel, FCF would likely land at just above zero.

- This shows that if the oil price continues at the current level, FCF in 2020 might be even more challenging than it was in 2015 and 2016.

Source: Rystad Energy UCube March 2020

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Project sanctioning is slipping as the oil price is falling

Global conventional greenfield capex per approval year
Billion USD real
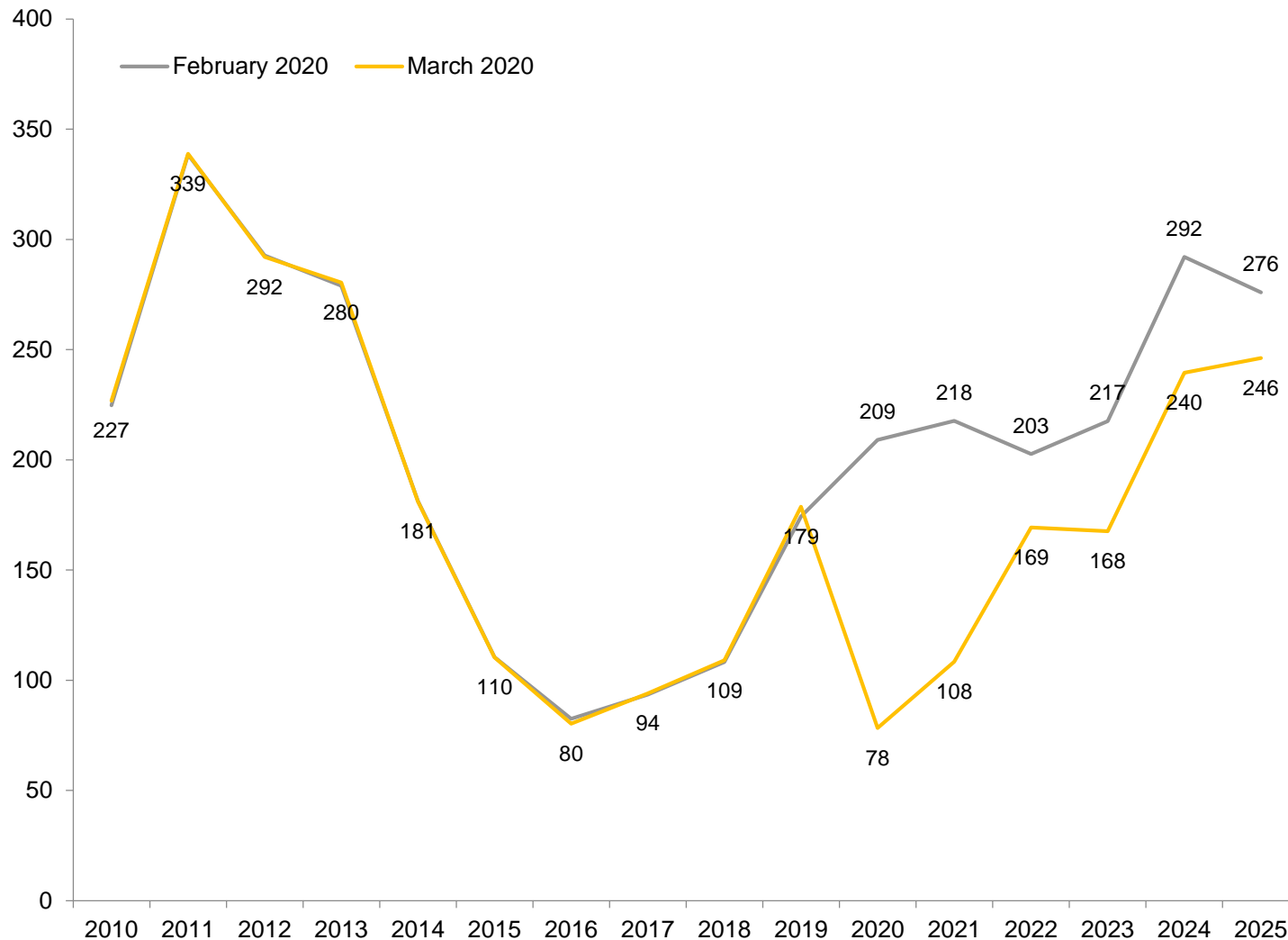
With the reduction in short and medium-term oil prices, Rystad Energy has revised its outlook for global FID (final investment decision) activity for conventional fields. We believe that the lower oil price in the first half of 2020 will delay FIDs considerably.

In 2019 the total approved conventional greenfield capex totalled $179 billion, and as recently as February we still expected FID activity to increase in 2020. However, given the current market conditions, FID activity is now expected to fall this year.

We now expect that around $80 billion worth of new greenfield capex will get the green light in 2020. This represents a return to the levels seen in 2016.

As we expect market fundamentals and prices to increase next year, FID activity is likely to increase again. For 2021 we estimate that around $110 billion of new greenfield capex will be approved.
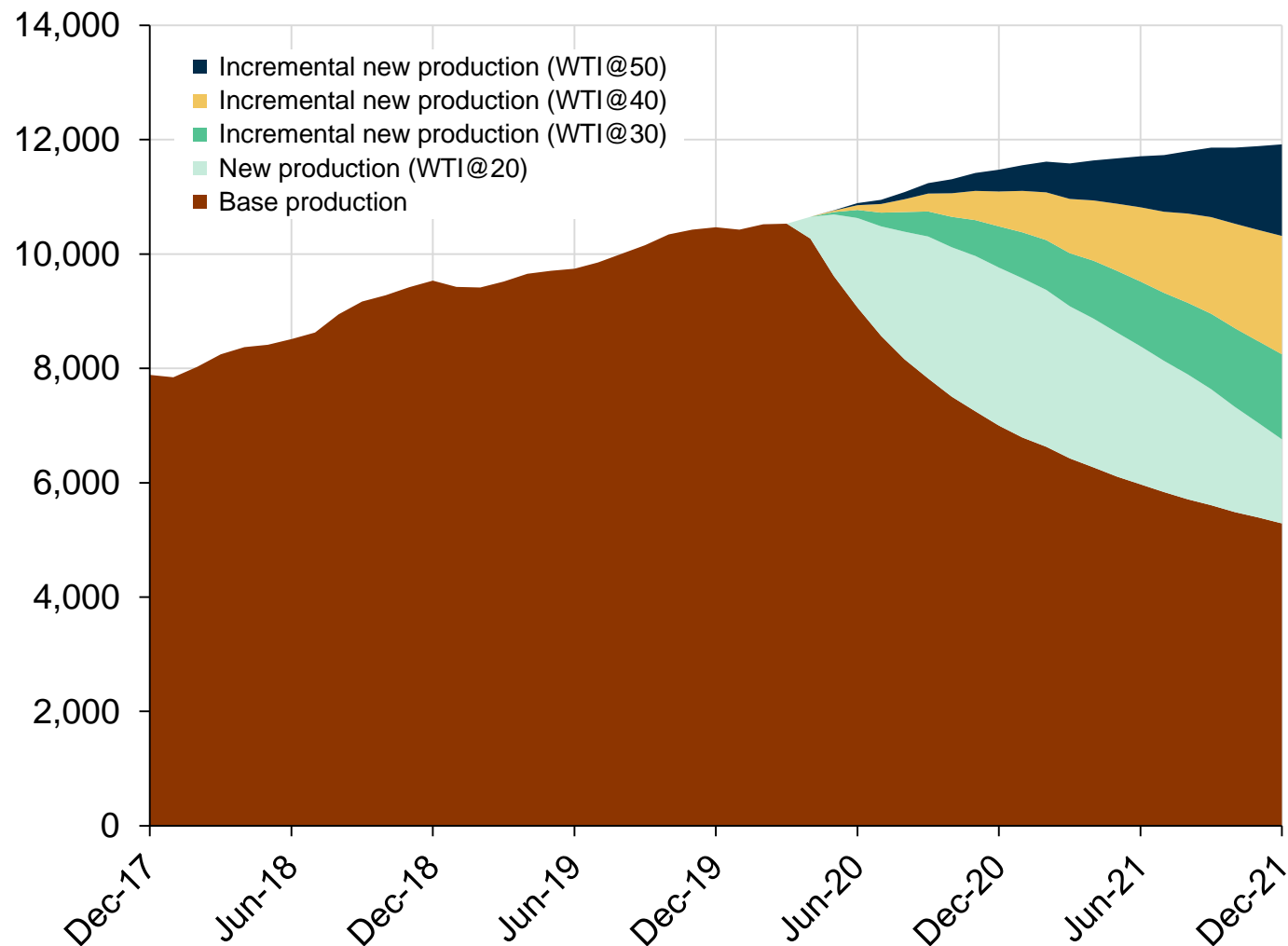
*The 2020 value is based on a Brent oil price of $40 per barrel
Source: Rystad Energy UCube March 2020

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Growth trajectory of US shale could come to a close if WTI does not return to $40 per barrel

US Lower 48 ex.GoM oil production outlook, gradual adjustment scenario
Thousand bpd

Legend:
- Incremental new production (WTI@50)
- Incremental new production (WTI@40)
- Incremental new production (WTI@30)
- New production (WTI@20)
- Base production

- The chart shows the outlook for US Land oil production in various scenarios, illustrating how sensistive shale investments are to oil price fluctuations

- Unless the WTI oil price returns to at least $40 per barrel, US oil production is likely to decline in 2020

Source: Rystad Energy UCube March 2020

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Methodology

Our simulation models the number of new people being infected every day based on the following parameters:

- Contact rate per person per day:
  - How many people one person meets every day. Assuming one person is infected, but unaware, this is the situation where the virus could be transmitted.
  - Typically one person interacts with 10 persons in one day. In an effective quarantine, this is reduced to 1 (not 0, as some people will not comply)
  - In our simulations we can manipulate this number day by day based on personal awareness or compliance and government initiated restrictions/quarantines

- Transmissibility:
  - When meeting another person, what is the likelihood of transmitting the virus? Our base assumption is 4% in the winter and 2% in the summer. This number is higher in the winter, since droplets from the breath or coughing are smaller and spread more easily in cold, dry air.
  - People who are known to be infected will exhibit much lower transmissibility, as health personnel and family will take precautions to avoid being infected. In this case, we assume 1 contact per day, and 0.5% transmissibility. I.e. for one person sick for 15 days, the likelihood of contaminating someone else is 7.5%.

- Incubation time and recovery time:
  - This is the time from exposure to the development of symptoms. We expect this to be 5.2 days, with 4 days of standard deviation, following a lognormal distribution, ranging then from 1 day to 14 days for 85% of the cases. We assume that all surviving people will recover within 35 days after initial contamination. With this, the reproduction number (R_0) becomes 10*4%*5.2 = 2.1
  - We assume that 20% of cases will exhibit symptoms severe enough to require hospitalization, of which 5% will get very sick and need intensive care. The fatality rate is assumed to be 1% based on cases in South Korea and China outside Hubei, which have had extensive testing. (We assume that reported figures elsewhere of up to 3.4% fatality rate are due to the underreporting of actual infected cases in that region.)
  - While the fatality rate is an important metric for the initial calibration of the model on a geographical basis, it is not critical for our forecasting of quarantine measures. Therefore, we do not forecast fatalities in the model. Fatalities and critical cases are grouped together with lighter hospital cases within the "hospital treatment and critical" group.

- Testing and registration of sick cases:
  - Some people will remain asymptomatic and recover without ever being aware of having been sick
  - An input to the model is the number of people that will recover without ever being tested or registered as infected. This number can change from day to day as the testing capacity and awareness in a society can changes as the virus develops

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Rystad Energy is an independent energy consulting services and business intelligence data firm offering global databases, strategy advisory and research products for energy companies and suppliers, investors, investment banks, organizations, and governments. Rystad Energy's headquarters are located in Oslo, Norway.

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