

COVID-19 pandemic's impacts on China's energy sector

A preliminary analysis

Kevin Tu

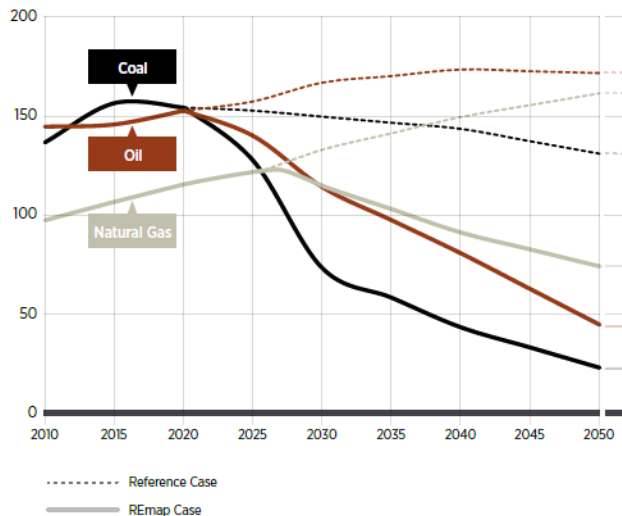
BEIJING & RIO DE JANEIRO, 22 APRIL 2020

A world turning upside down by black swans

- Competing narratives regarding global energy transitions:
 - *Energiewende first appeared in 1980, with key policy document published by BMWi in 2010*
- Black swan events underlying the resetting of Sino-U.S. relations:
 - *Mar 2012 – downfall of Bo Xilai against the backdrop of political succession in China*
 - *Nov 2016 – Trump's unexpected win of 2016 U.S. presidential election*
 - *Mar 2018 – outbreak of U.S.-China trade war*
 - *Aug 2028 – outbreak of African swine fever that killed millions of pigs across China*
 - *Jun 2019 – outbreak of Hong Kong protests*
- *Black swan in 2020: COVID-19 pandemic*
 - *Unprecedented lockdown of Wuhan, a city of 11 million residents, on 23 Jan 2020*
 - *A black swan with profound geopolitical, energy & climate implications*

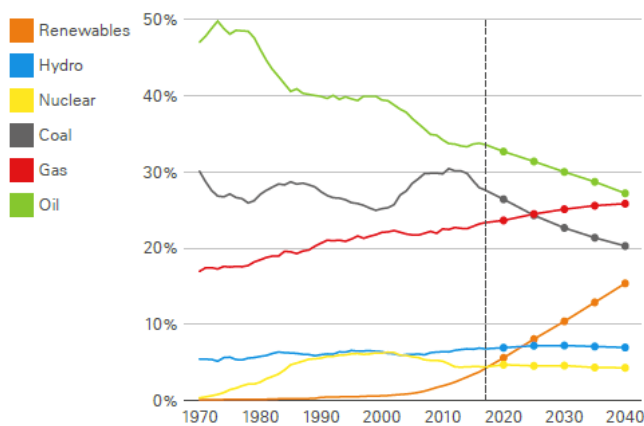
Energy paradigm without consensus

Energy-related fossil fuel demand



Source: IRENA (2019).

Share of primary energy consumption



Source: BP (2019).

国家能源局
National Energy Administration

中国实践表明：煤炭能成为清洁能源
Chinese practices prove that coal could become clean energy

2月28日，由国际能源署与国家能源局联合举办、中国中华举办的《全球煤炭市场报告（2018-2023）》中国发布会在北京举行。国家能源局副司长刘华华称，中国已建成全球最大的清洁能源供应体系，70%煤电机组实现超低排放。国家能源局总工程师、中国工程院院士刘文明表示，中国在实现煤电机组超低排放的同时，碳捕获、利用和封存（CCUS）技术也正在稳步推进。

“作为世界能源大国，中国煤炭工业清洁高效发展的实践告诉世界，煤炭能成为清洁能源。”中国煤炭工业协会会长章建华如是说。

全球煤炭仍是主力能源
清洁能源至关重要

据国际能源署（IEA）《全球煤炭市场报告（2018-2023）》预测，尽管未来煤炭对全球能源结构的贡献将略有下降，但当前煤炭仍然是全球能源系统的核心。欧洲和美国市场煤炭需求下降的份额，将被印度和其他亚洲国家的快速增长抵消。未来5年，全球煤炭需求将保持稳定，而中国仍将是世界煤炭消费第一大国。

“由于价格实惠、储量丰富和便于运输等优点，煤炭依然是很多国家的主力能源。”IEA煤炭市场研究员卡洛琳·费尔南德斯·阿尔瓦雷斯在发布会上说，尤其在中国、南亚和东南亚地区，煤炭还提供了能源安全和能源普及功能，并支持当地经济的发展。

对于全球煤炭行业而言，清洁能源至关重要。IEA报告对中国政府开展的“赢得蓝天保卫战”致力于煤炭清洁发展的实践给予高度评价。报告认为，中国的环境政策，特别是清洁能源推广，减少了煤炭需求。减少了因燃煤以及商业和工业部门的直接煤炭使用和小型锅炉、水泥、钢铁和小煤电生产商也是中国空气质量改善行动的对象；同时，煤炭也开始大规模向煤制油、煤制气、煤化工等城镇清洁能源转化。

中国煤炭消费的最重要领域是发电。IEA报告称，全球煤炭每4吨就有1吨用于中国的电力生产。因此，煤炭的命运在很大程度上取决于中国的电力体系。自2016年以来，中国用电量的反弹支撑了全球煤炭使用量的增长。报告预测，中国不断壮大的中产阶级将增加交通和供暖的电气化，用电量也将增加，全球煤炭需求对中国的用电趋势非常敏感。

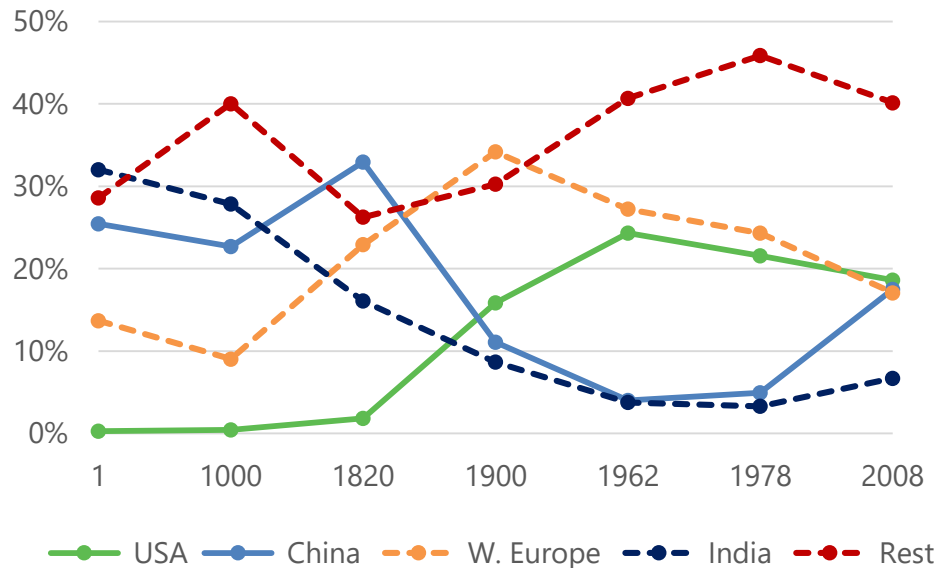
“事实上，中国近年来在煤电机组减排方面做出非常重要的贡献。”IEA输入长保罗·塞雷斯在讨论环节时表示。他强调，中国在氮氧化物、二氧化碳和粉尘等方面的减排取得举世瞩目的成就。

70%煤电实现超低排放
中国成就举世瞩目

No consensus has been reached regarding appropriate pathways for global energy transitions.

Resetting of Sino-U.S. relations: historic vs. snapshot perspective

Share of global GDP over time



Source: Augus Maddison

When did China become No.1 in the world?

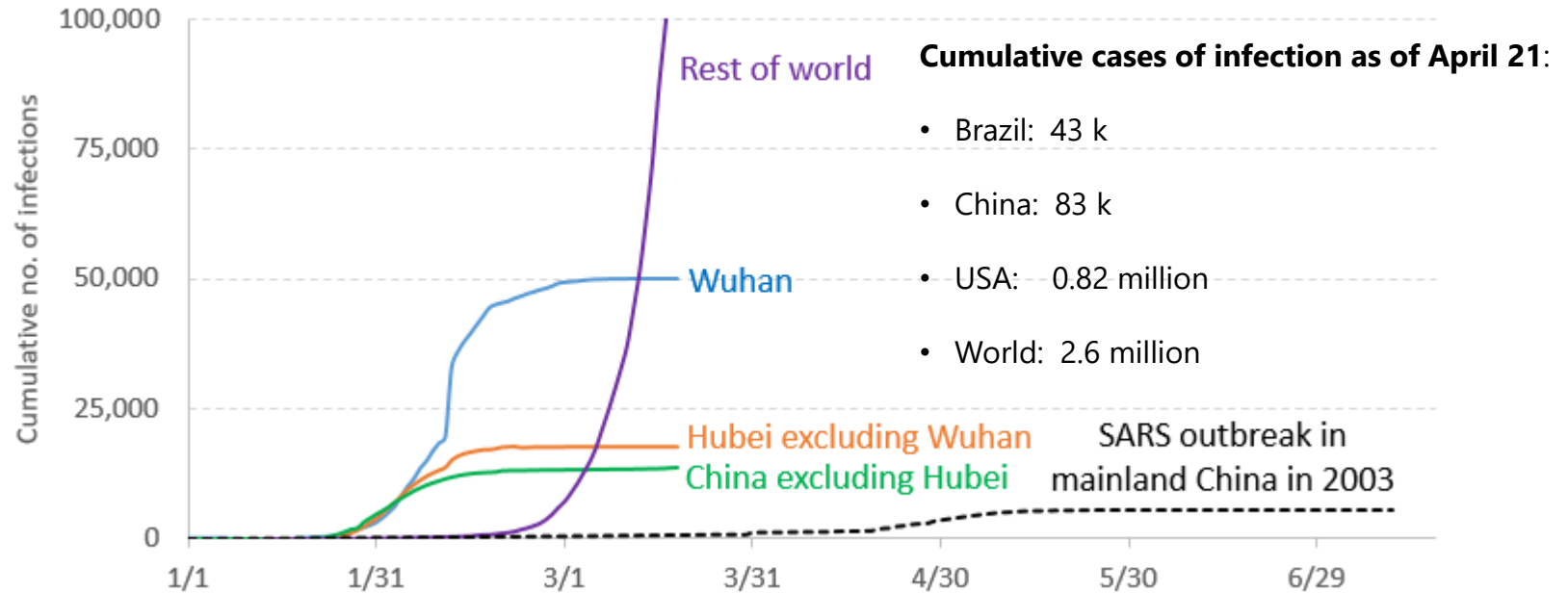
| Size of the economy (PPP) | 2013 |
|-------------------------------------|------|
| Carbon dioxide emissions | 2006 |
| Number of internet users | 2008 |
| Energy consumption | 2009 |
| Fast supercomputer | 2010 |
| Manufacturing industry | 2011 |
| Trading nation | 2012 |
| Largest middle class & billionaires | 2015 |
| Solar power capacity | 2016 |
| Crude oil imports | 2017 |
| Natural gas imports | 2018 |

Source: World Bank - size of the economy, IEA – energy indicators, and G. Allison (2017); Wikipedia.

China's rise, fall and re-emergence as a global power: self perception vs. reaction. Around 2010, China started to surpassed U.S. to become the world's No. 1 in various fronts, with profound impacts.

COVID-19 pandemic: after 17 years, another black swan.....

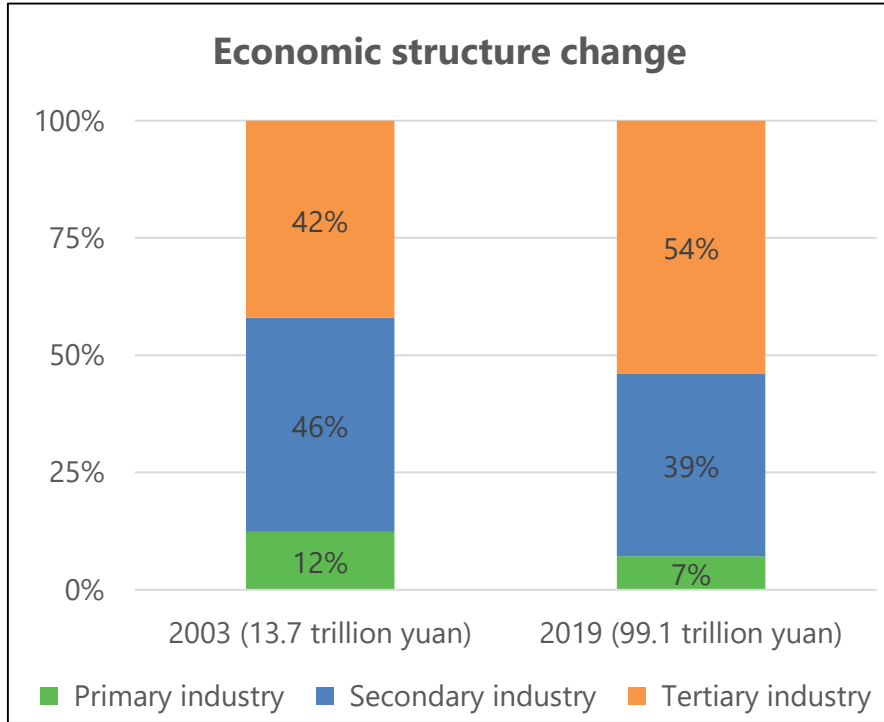
Cumulative cases of COVID-19 infections by region



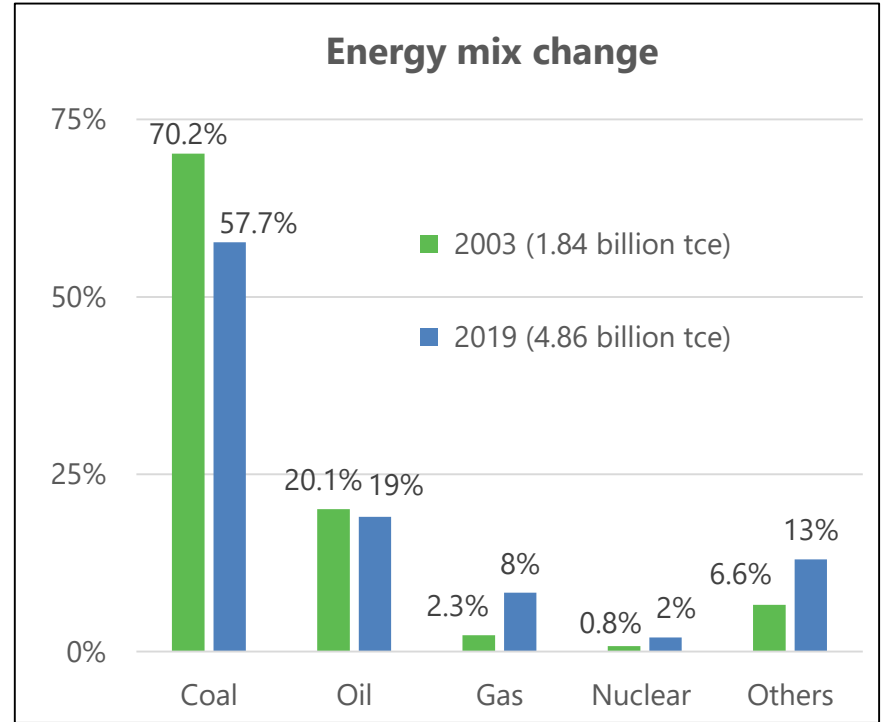
Source: China CDC, Hubei Commission of Health, and JHU.

Lessons learnt from SARS outbreak in 2003: 1) seasonal pattern of the virus matters, 2) intensity and duration of economic rebound; 3) different impacts on industry vs. service.

Overview of Chinese energy economy



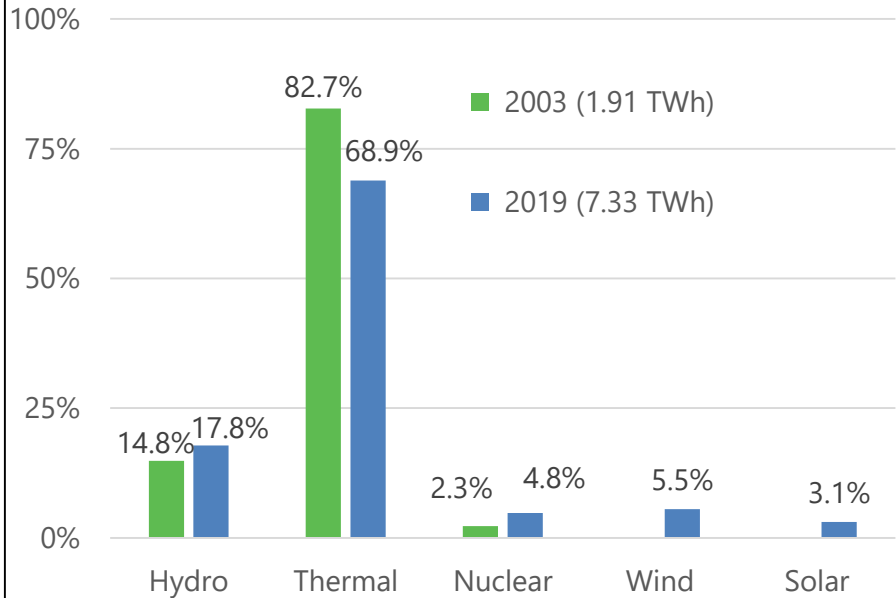
Source: NBS



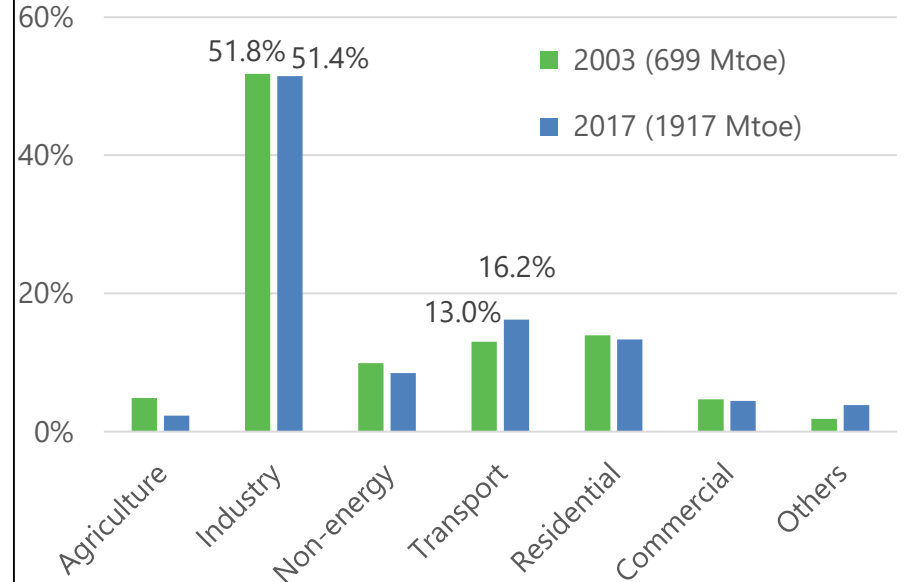
Chinese economy becomes increasing service-oriented, and coal plays a dominant but diminishing role.

Overview of Chinese energy economy (cont')

Power generation mix change



Final energy consumption mix change



Source: CEC, IEA

China leads the world in power capacity for coal, hydro, wind and solar; industry and transport are two most important sectors in terms of energy end uses.

Evolution of energy-related preference: a case study

■ Long march of Energy law in China

- *1st draft 2007 – background: change of energy mix (Renewable Energy Law 2005) + sector structure (power market liberalization 2002)*
- *2nd draft: April 2020 – background: further change of energy mix (RES booming decade) + sector structure (power market liberalization 2015)*

■ Rising energy security concern

■ All inclusive energy development

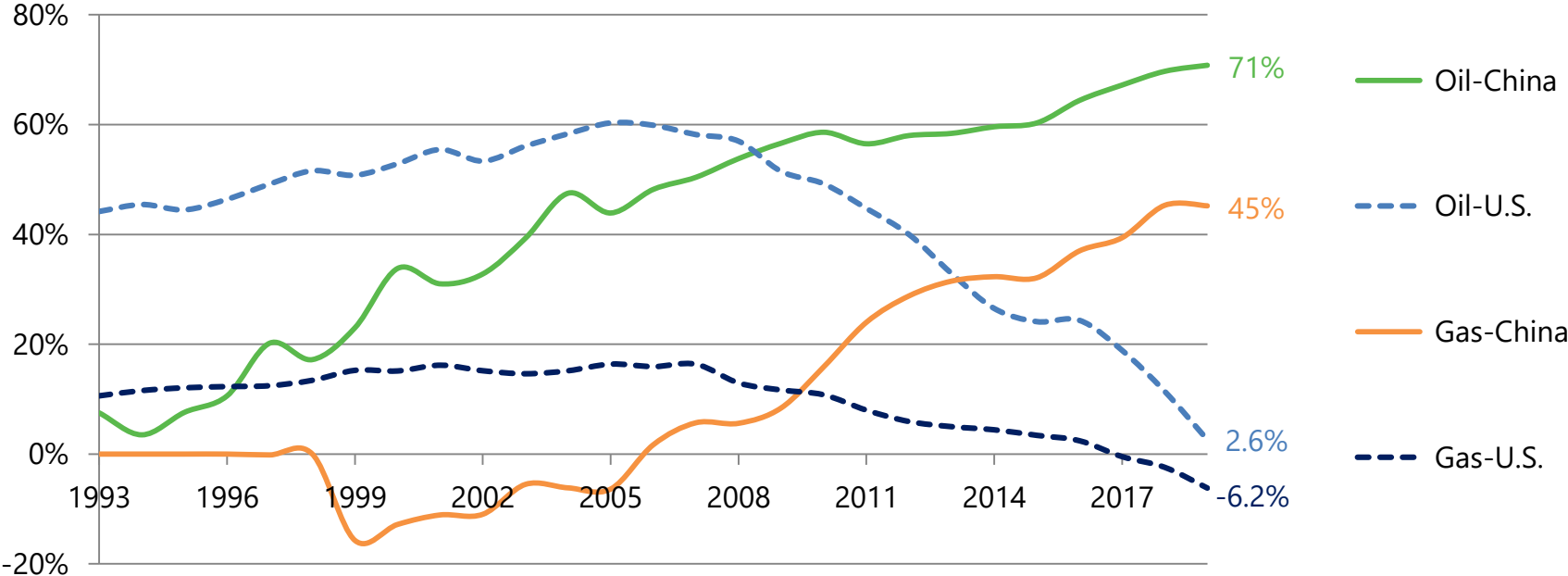
■ Desire for market-oriented reform

| Key words | 2007 | 2020 |
|---------------------------|------|------|
| Security | 30 | 64 |
| Supervision | 41 | 71 |
| Market | 22 | 38 |
| Renewables etc. | 26 | 47 |
| Fossil etc. | 36 | 64 |
| Emission reduction | 1 | 10 |
| Innovation / R&D | 15 | 23 |
| Network (pipeline & grid) | 18 | 24 |
| Government | 87 | 29 |
| Energy conservation | 81 | 23 |
| Technology | 81 | 37 |
| Rural areas | 42 | 12 |
| Universal service | 14 | 8 |
| Nuclear | 20 | 16 |
| International cooperation | 13 | 15 |

Source: Zhang Run, Agora Energiewende.

Rising energy security concern is shifting political priority

Dependency rates on oil and gas imports: China vs. U.S.

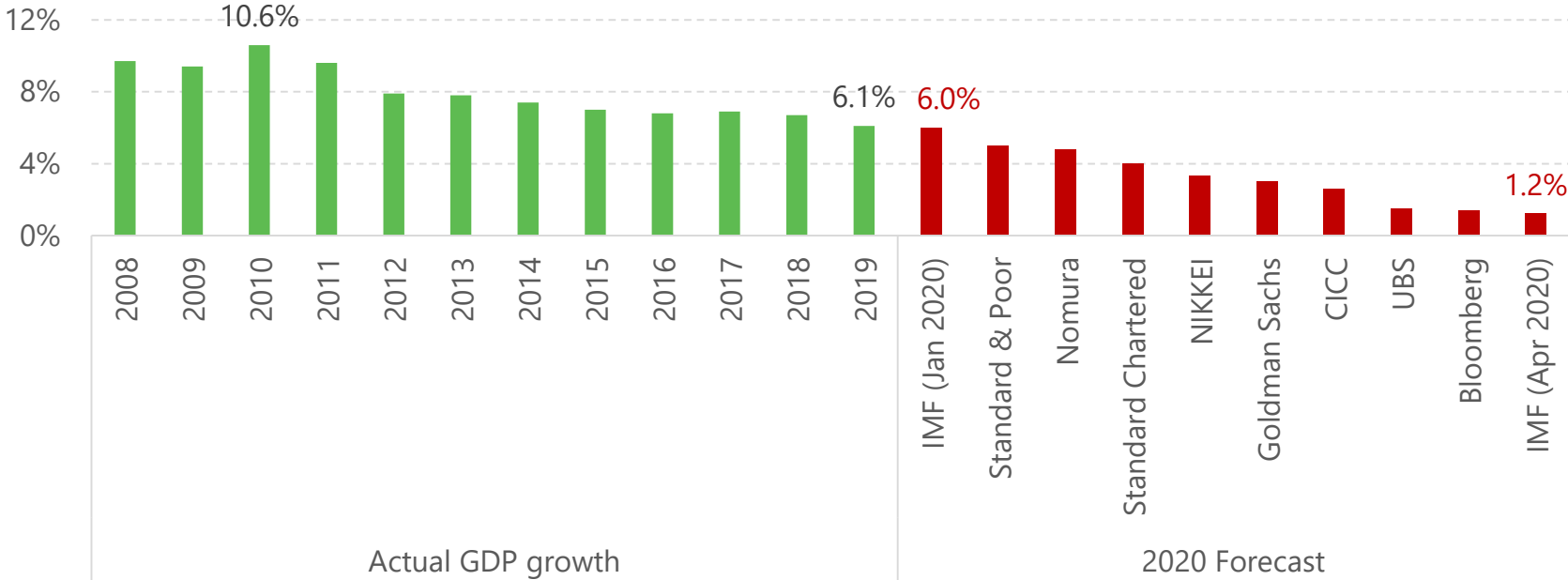


Source: NBS & U.S. EIA

U.S.-China phase one trade deal: China committed to buying additional American energy for at least \$18.5 billion in 2020 and \$33.9 billion in 2020, from a baseline of \$9.1 billion in 2017.

Economic impacts

Share of global GDP over time

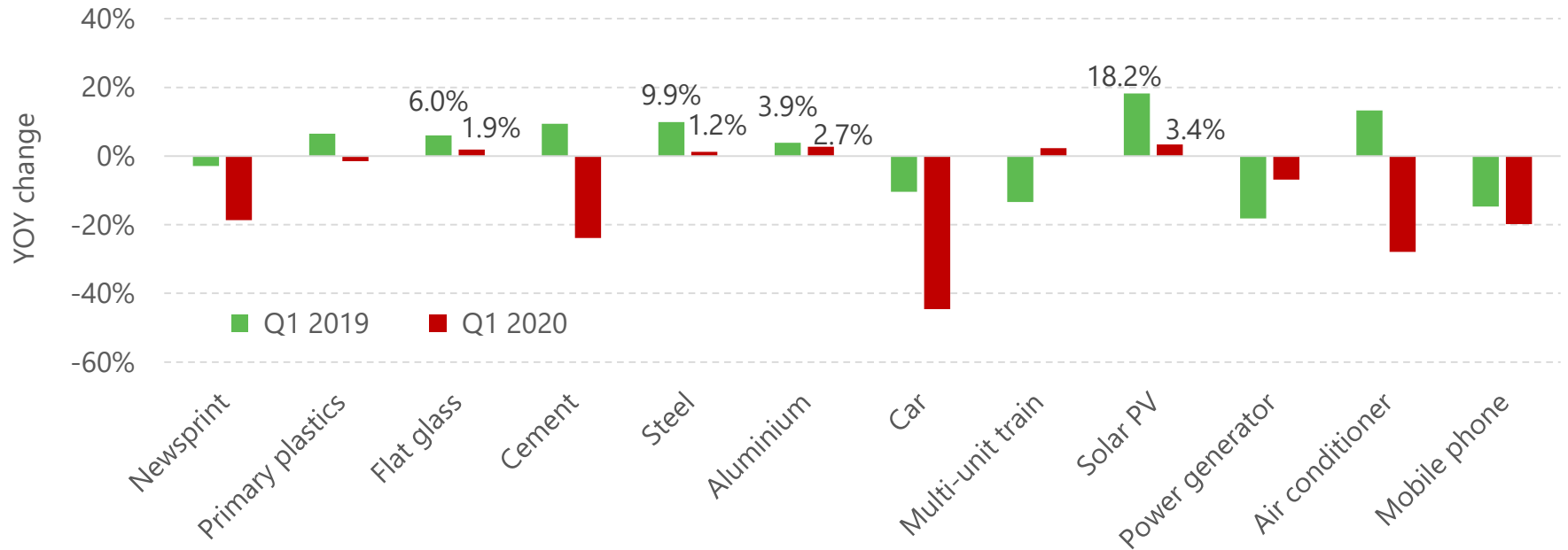


Source: NBS & various institutions.

In Q1 2020, China GDP declined by 6.8% YOY, with agriculture: -3.2%, industry: -8.5%, and service: -5.2%.

Impacts on Chinese manufacturing activity

YOY output changes of selected industrial products in China

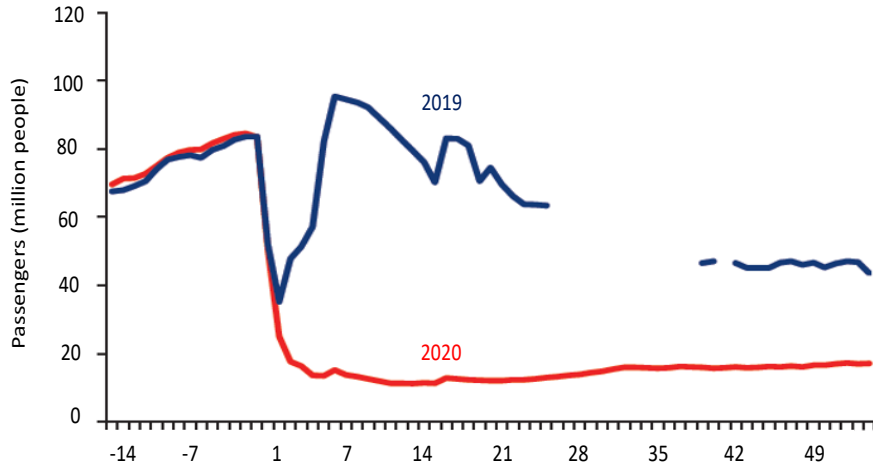


Source: NBS.

Some energy-intensive manufacturing activities have not contracted so far, how quickly downstream demand in China and abroad may rebound is key.

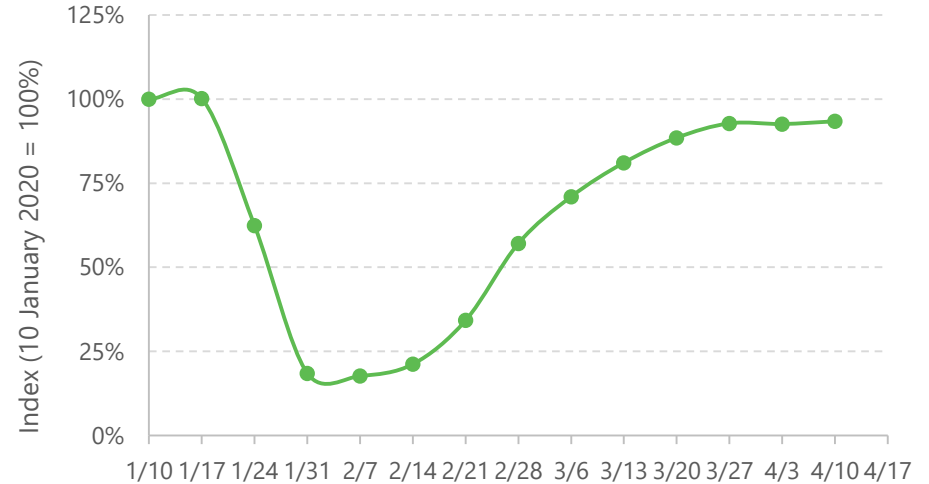
Passenger transport is the weakest link of Chinese energy economy

Severe impacts on passenger transport



Source: Sinolink Securities.

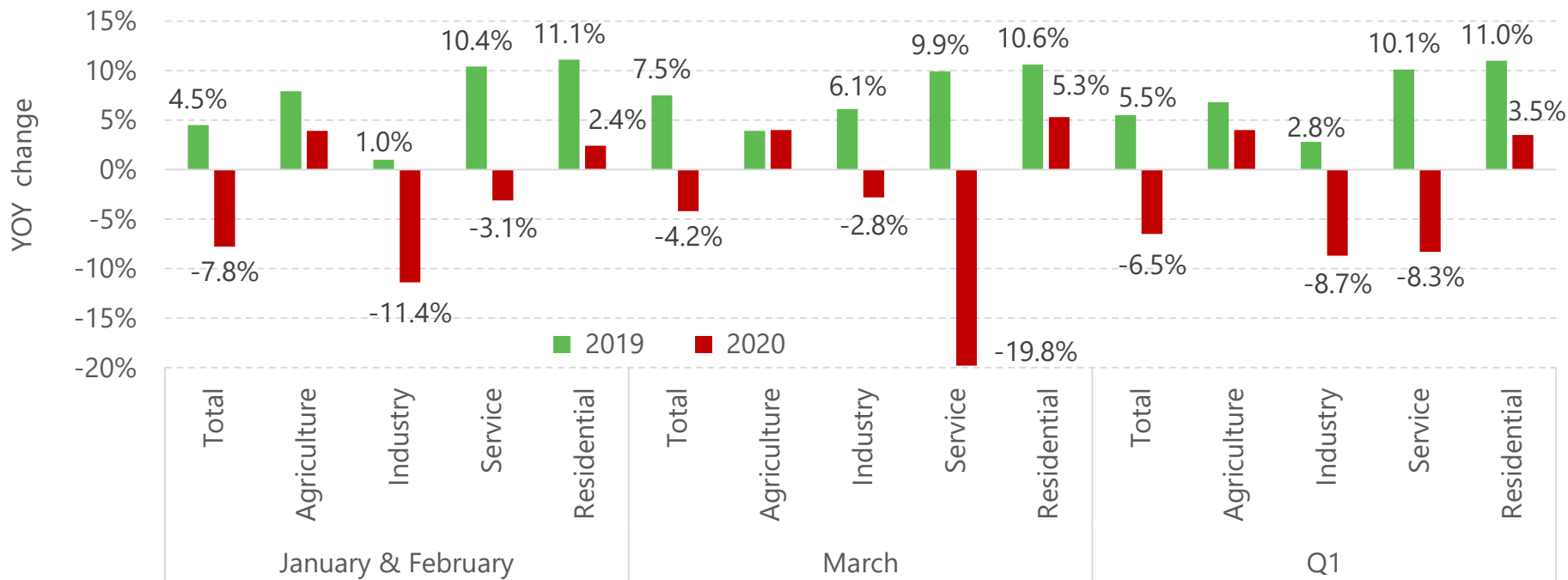
China truck freight intensity index



Due to rising concern for asymptomatic infection, many quarantine measurements remains in place across China, with severe impacts on passenger transport .

Power sector: the most reliable gauge of Chinese energy economy

YOY change of power consumption by sector



Source: CEC.

China's national power consumption breakdown in 2019: agriculture: 1%, industry: 67%, service: 16%, residential: 14%.

Impacts on 13th FYP for energy

Progress of selected 13th FYP targets

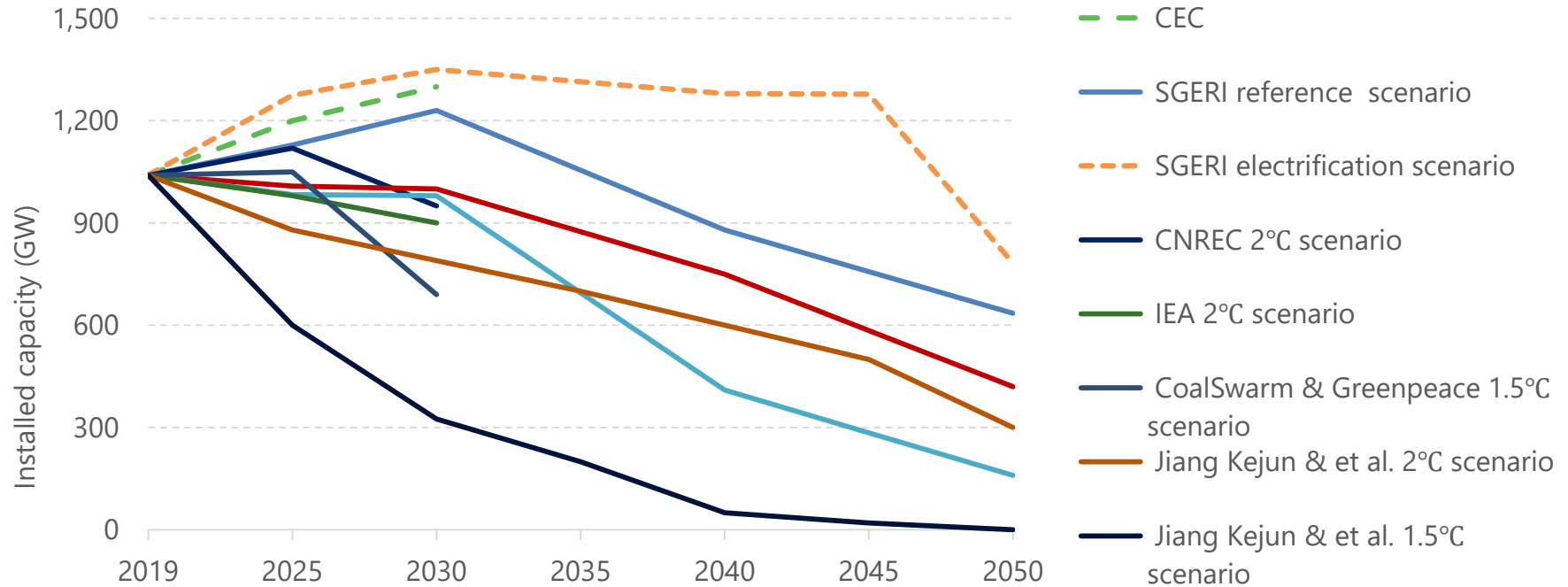
| Category | Indicator | Unit | 2015 | 2019 | 2020 target |
|--------------------|--|------|------|-------|-------------|
| Energy production | Primary energy production | Gtce | 3.62 | 3.97 | 4.0 |
| | Coal output | Gt | 37.5 | 38.5 | 39 |
| | Oil output | Mt | 215 | 191 | 200 |
| | Gas output | bcm | 135 | 176.2 | 207 |
| Power sector | Installed power capacity | GW | 1525 | 2011 | 2000 |
| | Coal-fired power capacity | GW | 900 | 1040 | < 1100 |
| | Nuclear capacity | GW | 27 | 48.8 | 58 |
| | Wind capacity | GW | 131 | 210 | 210 |
| | Solar capacity | GW | 43 | 205 | 110 |
| | Share of coal for power generation | % | 49 | 49.9 | 55 |
| Energy consumption | Primary energy consumption | Gtce | 4.3 | 4.86 | <5.0 |
| | Coal consumption | Gt | 3.96 | 3.93 | 4.1 |
| | Power consumption | TWh | 5.69 | 7.23 | 6.8-7.2 |
| | Share of non-fossil energy consumption | % | 12 | 15 | 15 |
| | Share of natural gas consumption | % | 5.9 | 8.4 | 10 |
| | Share of coal consumption | % | 64 | 57.7 | 58 |

Source: NDRC, NEA and NBS.

13 Five Year Plans (FYPs) between 2016 and 2020 contain detailed targets to guide national, regional and sectorial development in China.

The future of coal in China becomes increasingly uncertain

Diverse trajectories of coal-fired power capacity in China

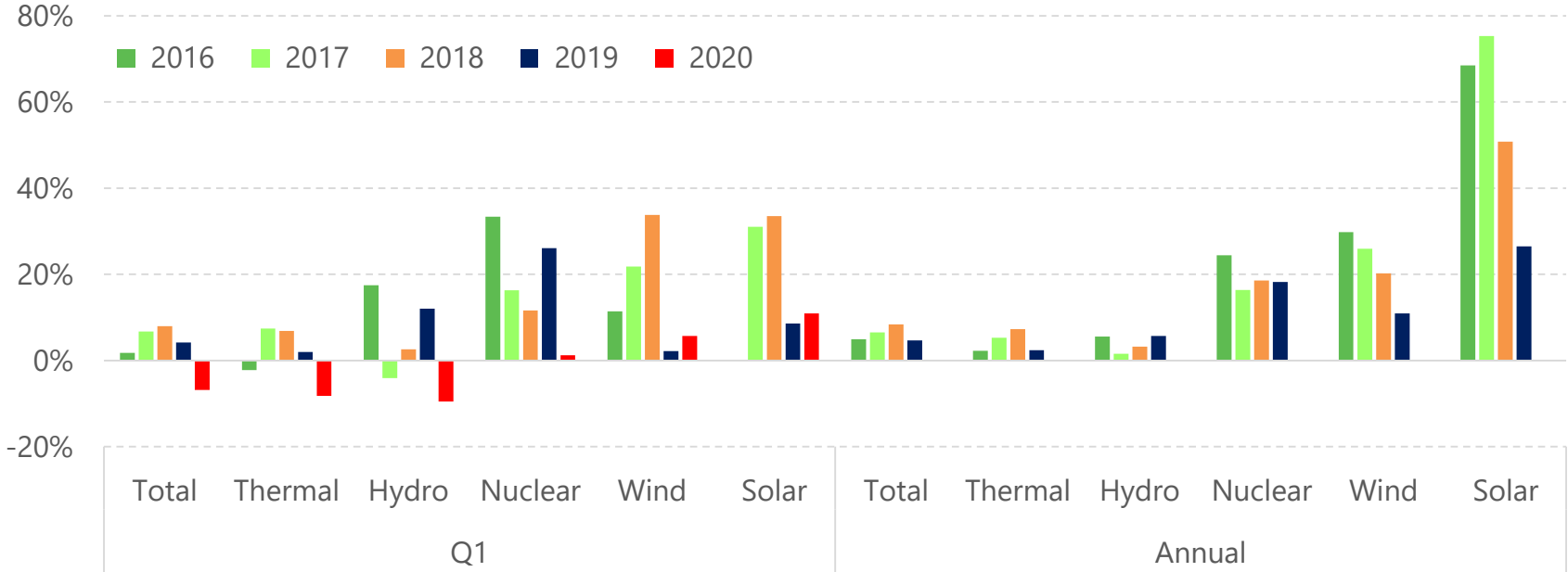


Source: Caijing Magazine & SGERI.

China consumes more than half of global coal; Chinese coal-fired power plants represents near half of global coal-fired power capacity, and accounts for more than 11% of global carbon emissions.

Prospect of renewables is a two-sided story

YOY growth of power generation by fuel in China

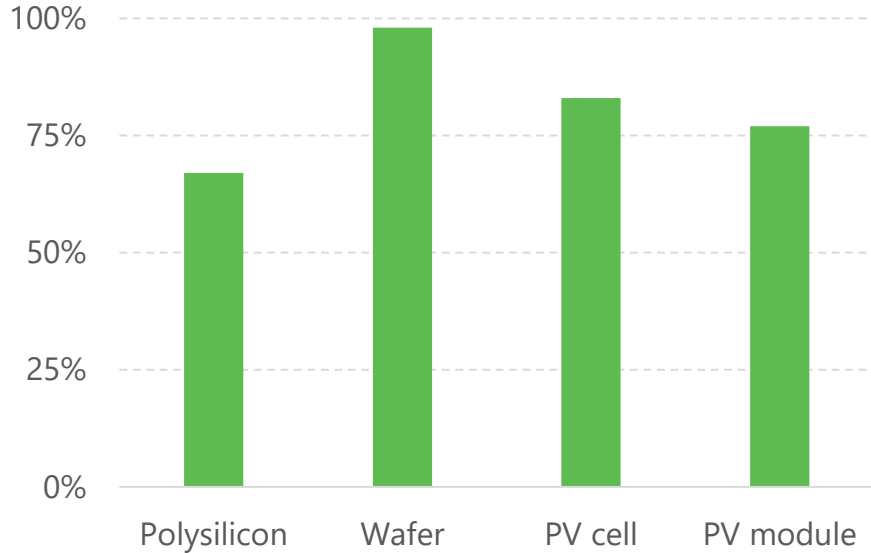


Source: NBS & CED.

Variable renewable generation outperformed market expectation in Q1 2020, though capacity addition outlook in 2020 has been downgraded due to COVID-19 pandemic.

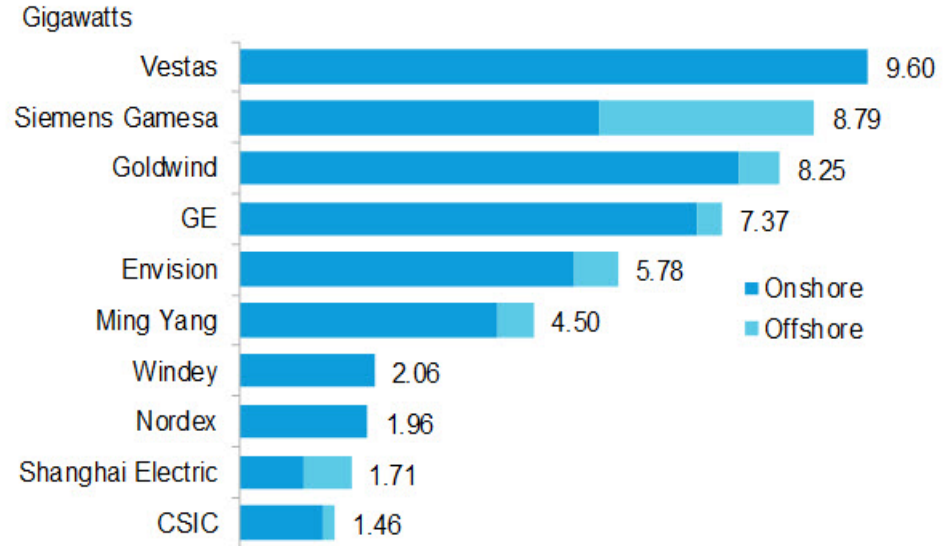
China's role in global renewal power supply chain

Share of China in global PV supply chain in 2019



Source: Chinapower.com

Top 10 global wind turbine makers in 2019

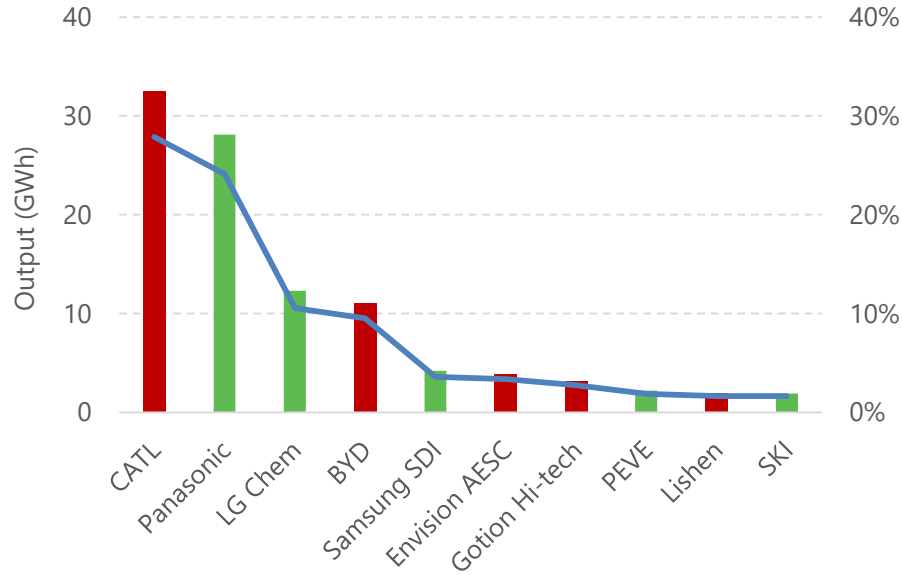


Source: BNEF.

In addition to the largest wind and solar market, China also leads the world in terms of renewable equipment manufacturing.

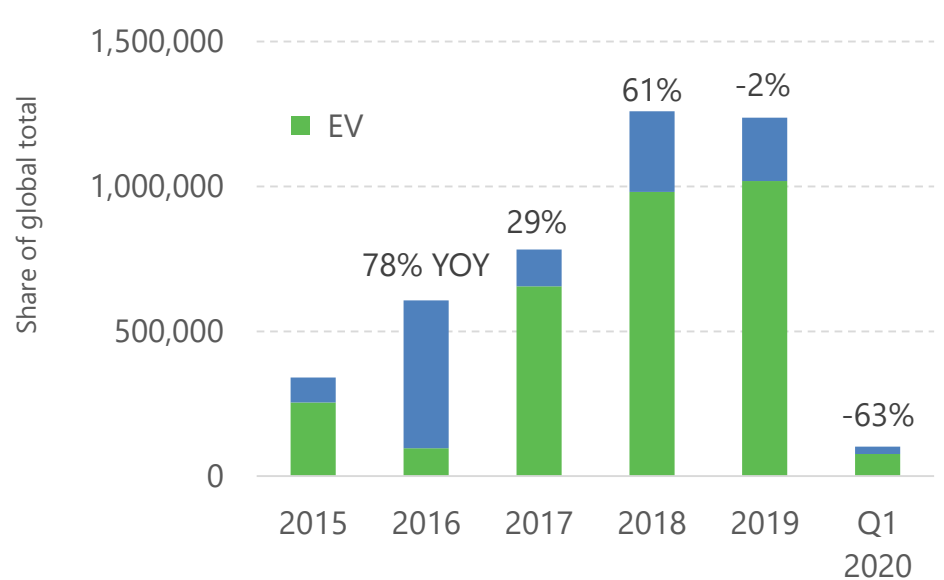
China's role in battery and EV

Top 10 battery producers in 2019



Source: SNE Research

Annual EV production in China



Source: CAAM.

As the largest EV market, China also leads the world in battery manufacturing, with 5 of top 10 battery producers as Chinese companies in 2019.

Nuclear renaissance in China is still a long way to go

Siting of nuclear power plants in China

| Category | Province | Number of sites | Number of reactors | Capacity (GWe) |
|-----------------------|-----------|-----------------|--------------------|-----------------|
| Coastal | Liaoning | 3 | 14 | 14x1.0 |
| | Shandong | 2 | 10 | 10x1.0 |
| | Jiangsu | 1 | 4 | 4x1.0 |
| | Zhejiang | 3 | 14 | 14x1.0 |
| | Fujian | 6 | 22 | 22x1.0 |
| | Guangdong | 7 | 30 | 28x1.0 + 2x1.75 |
| | Guangxi | 3 | 14 | 14x1.0 |
| | Hainan | 1 | 2 | 2x0.65 |
| Coastal subtotal | | 26 | 110 | 110.8 |
| Inland | Jilin | 1 | 4 | 4x1.0 |
| | Anhui | 3 | 12 | 12x1.0 |
| | Henan | 2 | 8 | 8x1.0 |
| | Hubei | 5 | 20 | 20x1.0 |
| | Hunan | 4 | 16 | 16x1.0 |
| | Jiangxi | 4 | 16 | 16x1.0 |
| Inland subtotal | | 19 | 76 | 76 |
| National total | | 45 | 186 | 186.8 |

Source: China Energy Research Society (2018).

Nuclear Power Plants in France



Source: World Nuclear Association

Projection of China's operational nuclear capacity in 2050 ranges from 150 GWe to 500 Gwe, with the latter depending on permitting of inland nuclear reactor construction at scale.

Concluding remarks

- In Q1 2020, China GDP: -6.8% YOY, energy consumption: -2.8 YOY, power consumption: 6.5% YOY. In 2020, energy consumption: 0.9% YOY or worse, and power demand: 1.2% YOY or worse.
- Emissions reductions caused by COVID-19 pandemic will be substantial, but they are likely to be short-lived.
- Green economic stimulus package is in urgent need to steer economic recovery towards a sustainable direction.
- How to better balance short-term political targets with long-term strategic goals is key for clean energy transition in China and abroad.
- The future of the post-coronavirus energy world depends on national governments' attitude towards international cooperation.