China Refining Industry Outlook and Oil Demand Peak

Report series of China energy and petrochemical industry

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The refining industry in China ranking among the top in the world
The refinery capacity in China ranks among the top in the world, and is still in expansion.

- State-owned refineries increased capacity to meet the growing rigid demand.
- Independent refiners began to accelerate their expansion.
- Structural adjustment is coming.

- In 2018, China’s refinery capacity came to 16.8 Mb/d. New capacity mainly came from independent refiners.
- In response to the upgrading of oil quality, refineries in China are becoming increasingly complex.

![Graph showing stages of growth in refinery capacity (kb/d)](image)

![Bar chart showing the share of new capacity from independent refiners is increasing](image)
The increasing crude oil processing meets domestic demand

- By 2018, China’s refining throughput was 12.1 Mb/d, and the dependency on imported crude oil came to 70.8%.
- Since the release of imported oil quotas in 2015, the growth rate of refining throughput has risen from 4.1% to 5.4%.
- The utilization rate of independent refineries increased from 30% in 2014 to 60% in 2018, and the share of imported crude oil in processing feedstock increased from 21% to 71%.
Urgent issue: large numbers of refineries with small average capacity

By 2018, the average refinery capacity in China was only 87 Kb/d, which is only half of the global average level.

Excluding the outdated capacity of less than 40kb/d, the average utilization rate could be around 82% in 2018.
In the future:
Oil demand growth shifting from fuel-driven to petrochemical feedstock-driven
Outlook for demand-The key driver for China oil demand is shifting from fuel to petrochemical feedstock

The rough picture:
- The future oil consumption will peak due to factors such as economy, population, fuel economy and EV deployment.
- Compared with the relative rigid demand of jet fuel and petrochemical feedstock, gasoline and diesel are more likely to be replaced.
- There is still uncertainty about vehicle fuel economy improvement and the development of electric vehicles.
Driver shifting--Fuel-oriented oil consumption in China is decreasing

China's oil demand reached 12.4 million b/d in 2018. What’s more, the oil consumption structure has changed or is about to change.

Instead of transportation fuel, petrochemical feedstock will become the major refining product by 2050.
Macro driver- Large potential of per capita consumption and the gradually emerging demographic impact

- Compared with other countries, the energy consumption per capita GDP of China is still rising.
- In the future, China's GDP growth will slow down, but the quality of economic growth will be improved.
- The fertility rate is declining in China and the population will peak before 2030.
Industrial driver-Broad prospects for China auto industry in the take-off period

Currently, the vehicle ownership in China was 130 vehicles per 1000 people, which is still in the take-off period of auto industry compared with developed countries.

Considering the high density of population and the lack of oil and gas resources in China, the saturation level of vehicle ownership will not be too high. Even so, the vehicle ownership will still double that of now by 2050.
Industrial driver-Improved fuel economy offsets the growth in transportation fuel demand

- Compared with Japan and Europe, China still has great potential to improve the fuel economy. Downsizing and hybrid technologies are feasible.
- If the fuel economy target of China is on schedule, it will save about 100 million tons of oil by 2050.
Currently, natural gas and coal-to-liquid, coal-to-olefin are the main oil substitutes.

After 2025, electric vehicles will replace natural gas as the first alternative.
Electric vehicles-The leading role of China in the global market

In 2018, China EV sales accounted for about half of global EV sales.

- EV Sales: 1.26 million, market penetration rate: 4%
- EV ownership: 3.1 million, accounting for 1.6% of the total domestic vehicle stock

With clear government targets, EV may become the direction for the future auto industry in China.

### Targets for EV development in major countries

<table>
<thead>
<tr>
<th>Country</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>Technology roadmap</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>5 million Penetration rate: 7%</td>
<td>20 million Penetration rate: 15%</td>
<td>80 million Penetration rate: 40%</td>
<td>Mainly BEV</td>
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<tr>
<td>US</td>
<td>1.2 million</td>
<td>/</td>
<td>/</td>
<td>BEV &amp; PHEV</td>
</tr>
<tr>
<td>Japan</td>
<td>/</td>
<td>/</td>
<td>Penetration rate: 50%-70%</td>
<td>BEV, HEV &amp; PHEV</td>
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<tr>
<td>Germany</td>
<td>1 million</td>
<td>/</td>
<td>5 million</td>
<td>BEV &amp; PHEV</td>
</tr>
<tr>
<td>France</td>
<td>2 million</td>
<td>/</td>
<td>/</td>
<td>Clean energy vehicles</td>
</tr>
<tr>
<td>UK</td>
<td>1.6 million</td>
<td>/</td>
<td>/</td>
<td>Ultra-low emission vehicles</td>
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<tr>
<td>Norway</td>
<td>400,000</td>
<td>100% zero emission</td>
<td>/</td>
<td>BEV/HEV/PHEV/FCV</td>
</tr>
</tbody>
</table>
Electric vehicles-The decisive period: 2025-2030

- **2025:** EV will reach cost parity with conventional vehicles, which makes large-scale promotion possible.
- **After 2030:** Level 5 autonomous driving will be ready to be commercialized.
- **There is still uncertainty in the development of EV.**

**Battery material**
- Scarcity of lithium and cobalt resources
- Technology progress

**Tax reform issues**
- Fuel tax
- Purchase tax reduction for EV

**Technologies for car sharing**
- Sensing techniques
- Infrastructure such as high-precision maps
- Revisions of policies and regulations

**Infrastructure**
- Charging facilities
- Charging service economy
- Impact of peak charging load on the grid

**Technology roadmap for EV development**

- **High specific energy and safer**
  - 1G lithium battery
  - 2G lithium battery
  - Next generation Lithium metal
  - Fuel cell battery

- **2025:** EV will reach cost parity with conventional vehicles, which makes large-scale promotion possible.
- **After 2030:** Level 5 autonomous driving will be ready to be commercialized.
- **There is still uncertainty in the development of EV.**
In the future, with the improvement of living standards, auto, home appliances, textiles and real estate industries in China will continue to develop. Significant growth is expected in ethylene and PX consumption.

Despite the diversification trend, Ethylene feedstock will still be dominated by petroleum-based feedstock.
Transformation and upgrading of refining industry in China under a new round of investment
Advanced capacity will replace outdated capacity in the future

- China will have 4.32 million b/d new capacity and phase out 2.1 million b/d backward capacity before 2025.
- The total capacity will reach 18.8 million b/d by 2025.
New capacity will be more concentrated, larger and more integrated

The new capacity is mainly located in bases in the eastern coastal areas.

- Under competition and the pressure of environmental protection, new capacity will be larger, more concentrated and integrated, and be more involved in the export market.
- Crude oil will be fully used in the processing.
Refineries are seeking a way out according to their own characteristics

Transformation path

**State-owned existing enterprise**
- Expansion: 15 Mtons/year refining capacity and 1.2 Mtons/year Ethylene capacity
- Overall optimization to produce petrochemical feedstock

**Integrated independent enterprise**
- Expansion: 20 Mtons/year refining capacity, 1.4 Mtons/year Ethylene capacity and 5.2 Mtons/year PX capacity
- The adoption of Diesel HC process

**State-owned new enterprise**
- Expansion: 16 Mtons/year refining capacity, 2 Mtons/year Ethylene capacity and 1.6 Mtons/year PX capacity
- The adoption of H-oil process and cancel FCC units

**Local independent refineries**
- Phasing-out: outdated capacity less than 2 Mtons/year
- Expansion: 30 Mtons/year integrated units

**Environmentally friendly & Digital**
- Emission reduction from the source
- Process control enhancement
- End treatment

- IOT in refineries
- Process optimization
- Monitoring of operation
Increasing influence of China in the Asia-Pacific refined oil export market

In 2018, China's refined oil exports increased by 1.9 times compared with 2010 and became the fourth largest exporter in the Asia-Pacific region. (Top 3: Korea, Japan and India)

Due to the low yield of refined oil in new capacity, the net export of refined oil will not increase much by 2020-2025.

In the future, large refineries in coastal areas will target both domestic and international markets.
A more opening-up refining market in China welcomes cooperation in various fields

**Investments overseas**
- Yanbu Aramco Sinopec refinery put into operation in Saudi Arabia
- The “Belt and Road Initiative” boosts oil and gas cooperation among countries along the route

**Domestic refining**
- PDVSA-CNPC Jieyang refinery is under construction.
- Saudi Aramco joins Huajin Petrochemical and Zhejiang Petrochemical.
- BASF plans to build an integrated petrochemical base in Guangdong

**Retail market**
- BP will build 1,000 gas stations in China
- Saudi Aramco plans to enter the retail market in Zhejiang

**Charging service**
- Tesla has built supercharging stations in 27 provinces and cities.
- Shell’s first charging station was put into operation in Tianjin in September, 2018.
- In January 2019, BP’s first supercharging station was put into operation in Shanghai

**Crude oil import**
-Oil import quotas for independent refineries

**Refined oil export**
-refined oil exports will become ordinary

**Refined oil sales**
-Relax market access and scrap limits on foreign holdings

**Refined oil pricing mechanism reform**
-Coming soon……
Thank you