

世界能源中国展望 (2018—2019)

中国社会科学院世界经济与政治研究所世界能源室 著

WORLD ENERGY CHINA OUTLOOK 2018-2019

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摘要：当前，全球能源供给和需求格局正在发生变革，美国页岩油气革命改变了全球能源供应格局，欧美发达国家的煤炭、石油消费已达到峰值，其能源消费向清洁能源和可再生能源转移的趋势日益清晰。在新能源和可再生能源替代煤炭、石油等化石能源的过程中，各国电气化程度将不断提高，能源效率在减少能源消费中起着关键作用。同时，作为相对清洁的化石能源，天然气在新一轮能源革命中作为过渡能源的作用愈加突出。作为全球最大的能源生产国和消费国，以及最大的清洁能源生产国，中国必将处于新一轮全球能源革命的核心位置。中国可借助于在可再生能源和清洁能源领域的产业链、投资和市场优势，加快推进能源结构的低碳化、清洁化转型，但也面临着油气资源不足、煤炭依赖度高、风电光伏并网不畅、技术创新障碍等问题的制约。

2017年，在原油需求强劲、产油国联合减产和地缘政治风险上升等因素的共同作用下，国际石油市场出现明显回温。石油价格整体呈现先降后升的走势，且在年末上升至自2015年以来的最高水平，而价格均值水平较上一年增长了约24%。2018年，国际原油价格继续保持强劲上涨态势。通过对影响油价走势主要因素的分析可以看出，OPEC及其他产油国减产执行、全球经济回暖所带来的需求增速是推动本轮油价持续上行的主要因素；美国产油量、能源效率、能源结构调整是油价增速放缓的主要因素；非计划的短期供给扰动以及金融市场投资是增大油价波动的主要因素；在供需收紧的状态下，美元与本轮油价走势呈现微弱的正相关性，却无法撼动石油市场价格的走向。2019—2020年世界经济的稳定增长将导致全球石油需求增长加速，但市场供给弹性空间较大，若减产执行失效，美国石油供给加速增长，则市场供需局面可能恢复到减产前的状态，石油价格受挫下行，原油价格有可能下跌至60—70美元之间；而石油供给若能得到良好的控制，则预计可以维持石油生产国共同

努力而来的市场供需收紧局面，原油价格将可能继续保持稳步上涨，并涨至 80—85 美元/桶的水平。

2017 年，中国原油需求继续维持快速增长，原油需求增量达 60 万桶/日，为 2016 年的两倍，约占世界石油需求增量的 40%，成为推动全球原油需求增长的重要力量。2017 年，中国全年原油消费表观消费量 43 亿桶，较 2016 年增长 5.9%；原油产量下滑至 3.87 百万桶/日；石油净进口量为 29 亿桶，较 2016 年增长 10.8%，石油对进口依存度已达到 67.4%，上升 4.7 个百分点。展望 2020 年，预计中国原油产量仍有持续下降趋势，原油需求将继续保持增长，但增长速度将有所减缓，预计石油需求量增至 1380 万桶/日。国内成品油市场格局向民营化倾斜，随着国内石油产业基础设施的完善，成品油产量将会进一步扩大。

2017 年，全球天然气市场供需均出现近七年以来的最大增幅，天然气平均价格出现明显的回弹，较 2016 年上涨超过 20%。受欧洲和亚洲天然气强劲的需求增长以及油价大幅上涨的影响，天然气市场需求比上一年增长了 2.9 亿立方米/日，增幅达 3%。其中，LNG 贸易增长幅度达 10.3%，是推动天然气贸易增长的主要因素。当前，电力用气仍然在天然气消费占比最高，为 46.8%，其次是工业用气，占比 27.2%。预计未来数年，亚洲国家仍是天然气需求增长的主力，工业生产将逐渐取代发电成为天然气主要消费用途。同时，随着 LNG 贸易比例的增长，全球天然气定价将趋于竞争化发展，贸易形式和种类将趋于多样化发展以满足买卖双方的市场需求。

受国内经济增长强劲、空气污染治理等因素推动，2017 年中国天然气消费量创历史新高，增幅超过 15%。国内天然气产量保持 8% 以上的增长速度，但由于上游供给无法跟上下游需求的增长，国内天然气生产—消费的缺口日益扩大，2017 年冬季出现“气荒”。预计未来数年，环保因素将持续推动能源转型，

国内天然气需求将保持增长趋势，中国将有望超过日本成为最大的 LNG 进口国。在 2017 年产量的基础上，若中国天然气产量保持 10.6% 的增速，则至 2020 年可能实现“十三五”规划中 2020 亿立方米的产量目标。

随着全球能源转型的加速和各国更为关注碳排放对环境的影响，煤炭行业受到了严重冲击。近年来，全球煤炭生产、消费和贸易快速下降。2017 年，煤炭消费结束了 2014—2016 年三年的连续下降，消费量达到 37.3 亿吨，比 2016 年增加约 1%。目前，煤炭的生产和消费主要集中在中国、美国和印度三个国家，而澳大利亚、印度尼西亚、俄罗斯是主要煤炭出口国。尽管 2017 年煤炭生产和消费有所反弹，但未来煤炭的前景依然不被看好。预计未来欧洲、加拿大、美国等发达国家和地区的煤炭消费需求会持续减少，煤炭消费的增长主要来自于发展中国家和地区，集中于印度和东南亚国家，消费东移趋势明显。根据国际能源署的预测，未来煤炭在全球能源结构中的份额将从 2016 年的 27% 降至 2022 年的 26%。

煤炭是中国的主体燃料，也是重要的工业原料，在中国的能源生产和消费结构中居于主导地位。2017 年，中国消费了 18.9 亿吨油当量的煤炭，占全球煤炭消费的 50.7%。未来，随着中国能源转型的继续推进，煤炭去产能将会继续执行，煤炭产业转型将加速。我们预计在现行政策条件下，中国煤炭需求将在 2020 年左右基本进入高峰期，在 2025 年左右达到峰值（约 21.0 亿吨油当量）；如果政策执行更为严厉，最早在 2019 年左右可能达到峰值（约 18.9 亿吨油当量）。2020 年，煤炭在我国能源消费中的比例将下降到 60% 以下，2030 年进一步降至 50%—52%。未来，对煤炭的替代主要在发电领域，核电、风电、光伏发电和生物质发电将会在其中发挥重要作用。

电力在经济社会中的作用逐步增大，在全球能源体系中扮演着越来越关键的角色。目前，全球电力生产和消费持续增长，

主要源自于中国、印度、巴西等新兴市场国家电力需求的大幅增加。发达国家的电力生产和消费已经向可再生能源转移，其电力消费在产业、居民用电、商业和公共服务用电等方面均衡发展，而发展中国家的电力消费则以产业用电为主。电力贸易业主要在欧美等发达国家间进行。尽管2017年电力投资略有下降，但仍然超过化石燃料，成为能源领域投资最大的行业。未来电力投资会继续增加，电力将向数字化、减少贫困、分布式和清洁化方向发展。中国将重点发展清洁电力，水电、核电、风电、太阳能光伏发电、生物质发电和地热发电将会逐步替代煤电。据预测，在现行政策下，2040年中国常规水电装机容量将达3.9亿千瓦；抽水蓄能达2亿千瓦；核电的装机容量将达1.65亿千瓦，发电1287太瓦时，占全部发电量的11.2%。2020年、2030年和2050年，中国风电装机容量将分别达2亿、4亿和10亿千瓦；中国太阳能光伏发电装机容量在2030年将达3.5亿千瓦，在2040年达4.3亿千瓦，在2050年达5.5亿千瓦，约占发电量的12%—13%。

为了应对全球气候变化，世界主要经济体正在逐步调整能源结构，积极发展以光伏太阳能为代表的可再生能源和核能等清洁能源。从光伏产业来看，全球市场规模继续扩大，但发达国家市场装机增长趋缓，而发展中国家潜力巨大，光伏产业技术创新层出不穷，发电成本逐步降低。作为全球最大的光伏市场，中国光伏产业的市场容量和新增规模仍在持续扩大，分布式光伏成为市场发展的新亮点。世界主要能源研究机构对光伏发电前景都比较乐观，并认为中国将对全球光伏太阳能的发展起到巨大的推动作用。核能是一种低排放、高效率的清洁能源，尽管福岛核事故一度使人们对核电前景产生了疑虑，但核能因其在低碳减排方面的积极作用，正在重新引起不少国家的重视。全球核电机组数量稳中有升，核电在部分国家的电力来源中占有重要地位。从各国核电发展政策来看，美国对发展核能持积

极的态度，欧洲各国对待核电的态度出现明显分化，日本的核电政策面临着巨大的挑战，发展中国家对核能的兴趣不减。随着一些国家老化的核反应堆陆续退役，以及部分发达国家宣布逐渐退出核电，发展中国家将成为全球核能发展的主要推动力量，尤其是中国在未来全球核电发展中将起到关键作用。

海洋能形式多样，储量丰富，但勘探、开发和利用尚处初级阶段。目前，世界海洋石油业发展较成熟，近年来全球重大油气发现中的近 50% 来自深海地区。全球可燃冰总资源量约 2100 万亿立方米，但尚未进入商业化开采阶段。海上风能资源丰富，经济性优势明显，是最有可能大规模发展的能源之一，近年来海上风电装机量以每年约 30% 的速度递增。在其他形式的海洋能中，潮汐能发展相对成熟，预计到 2030 年世界潮汐电站年发电总量将达 60 太瓦时；波浪能、潮流能、盐差能、温差能均处于研发阶段或商业化初期阶段。中国海洋能开发利用进步显著，但与国际先进水平还有差距。中国是世界海洋石油生产大国之一，在勘探开发、工程技术等领域居世界先进行列。在可燃冰领域，中国取得重大突破，成为首个在海域连续稳定产气的国家。潮汐能技术实现了商业化开发利用，波浪能、潮流能技术进入了示范应用和商业化开发阶段，温差能和盐差能技术研究取得了阶段性成果。随着海洋能相关政策的完善，中国海洋能开发利用将不断取得新的突破。

关键词：能源市场；世界；中国；回顾；展望

Abstract: The supply and demand of global energy are changing. The revolution in the shale oil and gas in United States has changed the pattern of global energy supply. Coal and oil consumption has reached the peak in developed countries in Europe and the United States. It is increasingly clear that the energy consumption will tend to clean energy and renewable energy. While replacing coal, oil and other fossil energy with new and renewable energy, the degree of electrification will be improved continually in various countries, and energy efficiency plays a key role in reducing energy consumption. At the same time, as a relatively clean fossil energy, natural gas plays an increasingly prominent role as a transitional energy in the new round of energy revolution. As the world's largest energy producer and consumer, as well as the largest producer of clean energy, China is bound to be at the core of a new round of global energy revolution. China will be able to accelerate the low-carbon and cleaning transformation of energy structure by virtue of the advantages of industrial chain, investment and market in renewable energy and clean energy. However, the transformation in China is also constrained by insufficient oil and gas resources, high dependence on coal, poor grid-connection of wind and photovoltaic power and obstacles to technological innovation.

The international oil market had a significantly turnaround in 2017 due to strong demand for crude oil, joint production reduction by oil-producing countries and rising geopolitical risks and other factors. Oil prices has increased after a decline, and reached the highest price since 2015 at the end of the year, while the average price increased by about 24% over the previous year. Oil prices have maintained strong growth momentum in 2018. After analyzing the main factors affecting the trend of oil prices, we can see that the production reduction by OPEC and other oil-producing countries and demand growth caused by

the global economic recovery are the main factors to drive the sustained upward trend of oil prices. The adjustment of oil production, energy efficiency and energy structure in United States are the main factors that slow down the growth of oil price. Unplanned short-term supply disruption and investment in financial market are the main factors that accelerate the fluctuation of oil price. With the tight supply and demand, the US dollar has weak positive correlation with the current trend of oil price, and cannot change the trend. The stability of world economic growth in 2019 – 2020 will lead to the increasing growth of global oil demand. However, the market supply is significantly flexible. If the production reduction fails and oil supply of United States accelerates, the supply and demand in the market may return to the original state before production reduction and the oil prices will fall. Then, the price of crude oil may fall between \$ 60/barrel and \$ 70/barrel. If the supply of oil is well controlled, it is expected that the tight supply and demand created by joint efforts of oil-producing countries will be maintained, and the price of crude oil will probably continue to rise steadily to \$ 80/ barrel and \$ 85/barrel.

The demand for crude oil in China continued to grow rapidly in 2017, with an increase of 600, 000 barrels per day, twice that of the previous year and accounting for about 40% of the growth of world's oil demand. Thus, China becomes an important driving force for the growth of global demand for crude oil. The total apparent consumption of crude oil in China was 4.3 billion barrels in 2017, an increase of 5.9% over the previous year. The production of crude oil dropped to 3.87 million barrels per day. The net oil imports were 2.9 billion barrels, an increase of 10.8% over the previous year. The oil dependence on imports reached 67.4%, an increase of 4.7%. The production of crude oil in China is expected to continue to decline as of 2020, and

the demand for crude oil will continue to increase. However, the growth rate will slow down, and oil demand is expected to increase to 13.8 million barrels per day. More private enterprises may enter the domestic market of oil products. With the improvement of infrastructure in domestic oil industry, the production of oil products will be further increased.

Both supply and demand in the global natural gas market showed the largest increase in nearly seven years in 2017, and the average price of natural gas showed a significant rebound, rising more than 20% over the previous year. The demand for natural gas increased by 290 million m^3/day , and 3% over the previous year, as a result of strong demand for natural gas in Europe and Asia and soaring oil prices. Among them, the growth rate of LNG trade reached 10.3%, which is the main factor driving the growth of natural gas trade. At present, the gas used by power still accounts for 46.8% of natural gas consumption, which is the highest proportion. It is followed by industrial gas, accounting for 27.2%. It is expected that Asian countries will continue to be the main driving force of demand for natural gas in the coming years, and industrial production will gradually replace electricity generation as the main consumption of natural gas. At the same time, with the increased proportion of LNG trade, the pricing of global natural gas will be determined by competition. The forms and types of trade will tend to diversify to meet the market demand of buyers and sellers.

Due to the strong economic growth in domestic and air pollution control, the natural gas consumption in China reached a record high in 2017, an increase of more than 15%. Domestic natural gas production has maintained a growth rate of more than 8%. However, the production-consumption gap of natural gas in domestic is increasing and the

winter in 2017 showed gas shortage, because the upstream supply cannot keep up with the downstream demand growth. China is expected to surpass Japan as the largest LNG importer in the coming years as environmental factors continue to drive energy transformation and domestic demand for natural gas continues to grow. On the basis of production in 2017, the production target of 202 billion m^3 in the 13th Five-Year Plan may be achieved by 2020 if natural gas production keeps increasing by 10.6%.

With the acceleration of global energy transformation and more attention paid to the impact of carbon emissions on the environment, the coal industry has been seriously affected. In recent years, global coal production, consumption and trade have declined rapidly. The three-year decline coal consumption of from 2014 to 2016 ended in 2017, with consumption reaching 3.73 billion tons and an increase of about 1% over 2016. At present, coal production and consumption are mainly achieved by China, the United States and India, while Australia, Indonesia and Russia are the main coal exporters. Although coal production and consumption rebounded in 2017, the prospect of coal in the future is still not optimistic. It is expected that the demand for coal consumption in Europe, Canada, the United States and other developed countries will continue to decrease in the future. The growth of coal consumption will be mainly driven by developing countries, such as India and Southeast Asian countries. The consumption will be increasingly dependent on eastern countries. According to the forecast by International Energy Agency (IEA), the proportion of coal in the global energy structure will fall from 27% (in 2016) to 26% in 2022.

As the main fuel and important industrial raw material in China, coal plays a leading role in energy production and consumption structure. China consumed 1.89 billion tons of oil equivalent coal in 2017,

accounting for 50.7% of global coal consumption. With continuous promotion of China's energy transformation, the capacity of coal will be reduced continually and the transformation of coal industry will accelerate. Based on the current policy, the coal demand of China will basically enter a peak phase around 2020, and reach the peak around 2025 (about 2.1 billion tons of oil equivalent). If the policy is more stringent, the coal demand may reach the peak around 2019 (about 1.89 billion tons of oil equivalent). By 2020, the proportion of coal in China's energy consumption will be reduced to less than 60%, and further to 50%–52% by 2030. In the future, the coals will be replaced mainly in power generation, in which nuclear power, wind power, photovoltaic power and biomass power generation will play an important role.

Electric power plays a more and more important role in the global energy system. At present, the global production and consumption of electric power is growing continuously, mainly due to the dramatic increase in electric power demand in emerging market countries such as China, India and Brazil. The production and consumption of electric power in developed countries have transformed to renewable energy sources. The consumption of electric power in developed countries has achieved in a balanced way in terms of industry, residential electricity, commercial and public services, while consumption of electric power in developing countries is mainly achieved by industry. The trade of electric power is mainly carried out in developed countries such as Europe and the United States. Although the investment in electric power declined slightly in 2017, it still surpassed fossil fuels as the largest sector of energy investment. In the future, the investment in electric power will continue to increase, and the electric power will enter in digital, poverty-reduction, distributed and clean development. China will

focus on the development of clean electric power, and the hydropower, nuclear power, wind power, solar photovoltaic power, biomass power and geothermal power will gradually replace the coal power. It is predicted that by 2040, the conventional hydropower installed capacity in China will reach 390 million kilowatts under the current policy. The pumped storage will reach 200 million kilowatts. The installed capacity of nuclear power will reach 165 million kilowatts, generating 1, 287 terawatt-hours and accounting for 11.2% of the total generation capacity. The installed capacity of wind power in China will reach 200 million, 400 million and 1 billion kilowatts, respectively in 2020, 2030 and 2050. The installed capacity of solar photovoltaic power in China will reach 350 million, 430 million and 550 million kilowatts, respectively in 2030, 2040 and 2050, accounting for about 12% - 13% of electric power generation.

In order to cope with global climate change, the world's major economies are gradually adjusting the energy structure and actively developing renewable energy and clean energy such as nuclear energy and photovoltaic solar energy. In terms of photovoltaic industry, the global market scale continues to expand, but the growth of installed capacity in developed countries is slowing down. On the other hand, the photovoltaic industry has great potential in developing countries. The technological innovation of photovoltaic industry emerges in endlessly and the power generation costs are gradually reduced. As the world's largest photovoltaic market, the photovoltaic industry of China is still expanding market capacity and scale, and the distributed photovoltaic projects have become a new bright spot of development. The world's major energy research institutions are optimistic about the prospect of photovoltaic power generation, and believe that China will play an important role in promoting the development of photovoltaic solar energy world-

wide. Nuclear energy is a kind of clean energy with low emission and high efficiency. Although the prospect of nuclear power was questionable once due to the Fukushima nuclear accident, many countries are paying attention to it because of its positive role in reducing carbon emissions. The number of nuclear power generation units worldwide has steadily increased, and nuclear power plays an important role in power sources of some countries. In terms of development policies of nuclear power, the United States has a positive attitude towards the development of nuclear energy. The European countries have diversified attitude towards the nuclear power. The policy of nuclear power in Japan is facing enormous challenges, and developing countries are still paying much attention to the nuclear energy. With the gradual decommissioning of aging nuclear reactors in some countries and the gradual withdrawal of some developed countries from nuclear power, developing countries will become the main driving force for global development of nuclear energy, especially China, which will play a key role in the future.

Ocean energy has various forms and abundant reserves, but the exploration, development and utilization are in the initial stage. At present, the offshore oil industry in the world is relatively mature. In recent years, nearly 50% of the world's major oil and gas discoveries come from deep water. The total combustible ice in the world is about 2100 trillion m^3 , but it has not yet realized the commercial exploitation. With abundant offshore wind energy resources and obvious economic advantages, offshore wind power is one of the most likely energy sources for large-scale development. In recent years, the installed capacity of offshore wind power has increased by about 30% per year. Among other forms of ocean energy, tidal energy is relatively mature, and it is expected that the total annual power generation of tidal power

stations in the world will reach 60 terawatt-hours by 2030. Wave energy, tidal-current energy, salinity gradient energy and temperature difference energy remain in the early stage of development or commercialization. The development and utilization of ocean energy in China have made remarkable progress, but there is still a gap with the-world advanced level. China is one of the largest offshore oil producing countries in the world, ranking among the world's advanced countries in exploration, development, engineering technology and other fields. China has made significant breakthroughs in combustible ice and become the first country to continuously and steadily produce gas in the sea area. Tidal energy technology has been commercially developed and utilized. The technology of wave energy and tidal-current energy has achieved demonstration application and commercialized development. The research on technology of thermal energy and osmotic energy has made staged achievements. With the improvement of ocean energy related policies, the development and utilization of ocean energy in China will continue to make new breakthroughs.

Key Words: Energy Market, World, China, Retrospect, Outlook

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