

ENERGY

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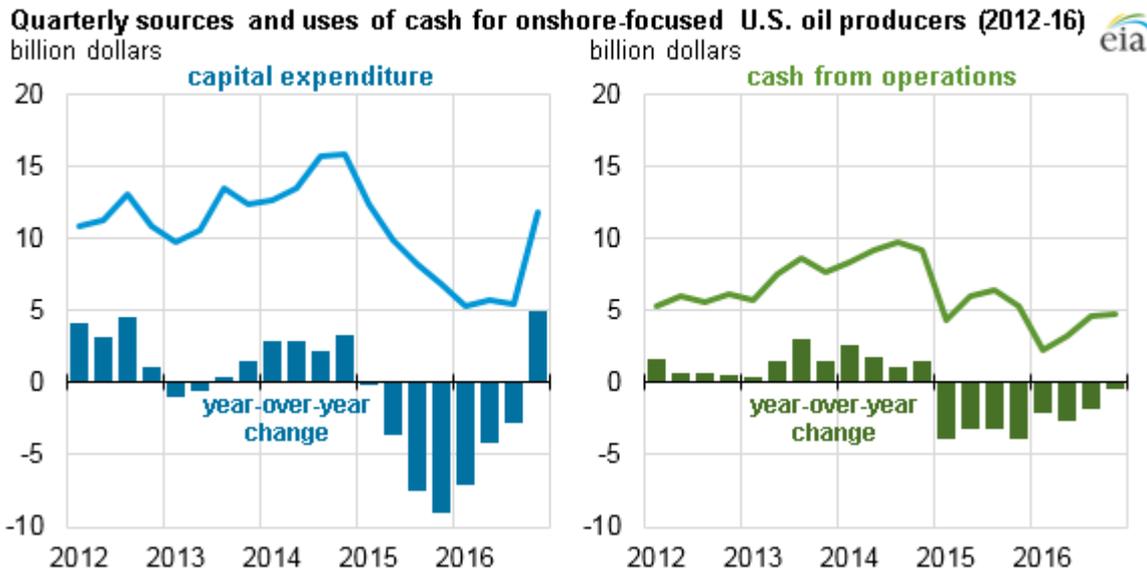
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Oil (石油)

U.S. oil producers increased investment in fourth quarter of 2016



Source: U.S. Energy Information Administration, based on Evaluate Energy

Capital expenditure for 44 U.S. onshore-focused oil production companies increased \$4.9 billion (72%) between the fourth quarter of 2016 and the fourth quarter of 2015 based on their public quarterly financial statements. This increase in investment spending was the largest year-over-year increase for any quarter by these 44 companies since at least the first quarter of 2012.

Higher oil prices are contributing to an increase in upstream earnings for U.S. producers, prompting some companies to increase their investment budgets. Company announcements and increases in the number of active oil rigs suggest U.S. oil production companies are continuing investment growth in the first quarter of 2017. The U.S. active oil-directed rig count reached 662 on March 31, 2017, up from 525 at the end of 2016.

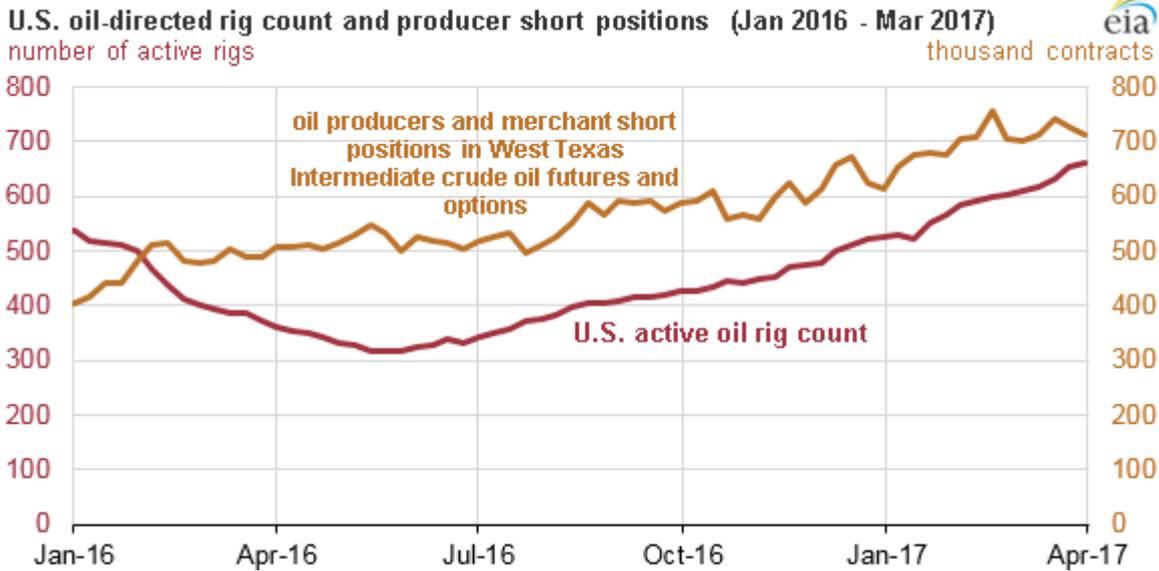
Lower investment levels over the previous two years likely contributed to a reduction in cash from operations for these 44 companies despite an increase in crude oil prices. The reduction in cash from operations for these 44 companies totaled \$475 million year-over-year in the fourth quarter of 2016. Significant reductions in exploration and development spending in 2015–16 led to less drilling, which reduced oil production in the fourth quarter of 2016, offsetting increased revenue that came from higher prices. Cash from operations lags capital expenditure for these companies because they invest to develop reserves that will increase oil production and cash flow in the future.

Many of these companies use oil futures and options to hedge their investment in production into the future. Financial hedging for producers reduces the effect of a fall in revenue if prices were to decline. A measure for the amount of future production oil companies have hedged is the number of short positions, or future sales into these markets. These short positions consist of futures and option contracts held by producers and merchants. Producers have begun using them more since crude oil prices rose above \$50 per barrel in the fourth quarter of 2016. In mid-February 2017, the number of short positions in U.S.-based futures and options reached 756,000 contracts,

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close to the 10-year high of 802,000 contracts.

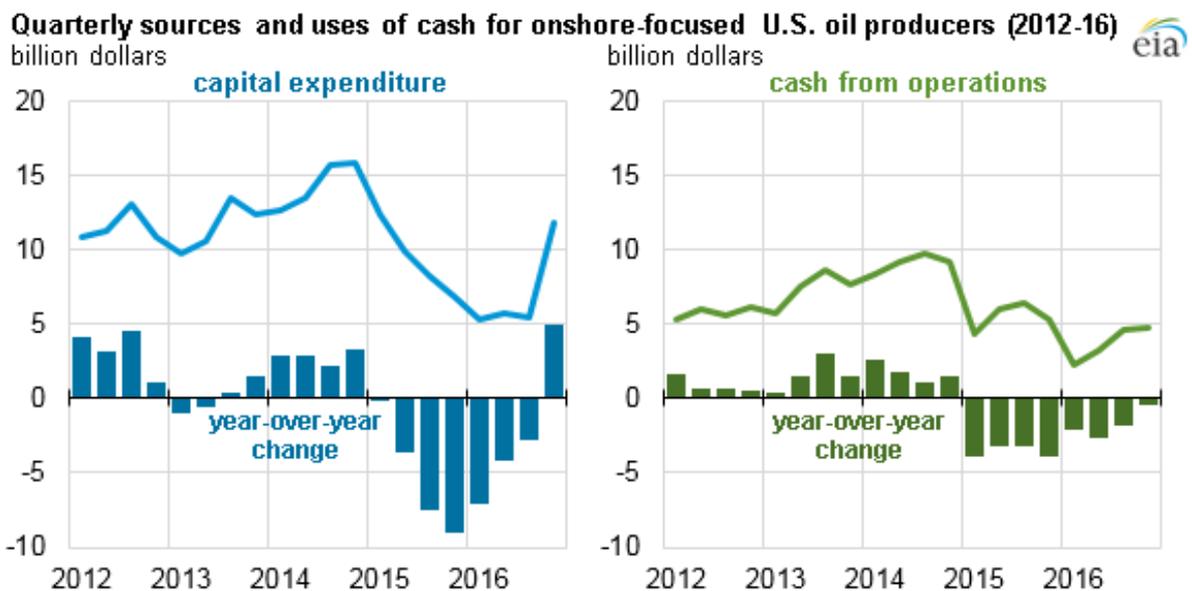
Financial indicators from these 44 U.S. onshore-focused oil production companies with quarterly financial reports suggest that they are continuing to increase capital expenditures in exploration and development, supporting continued production growth in the United States. Financial results for the first quarter of 2017 will be released in May.



Source: U.S. Energy Information Administration, based on Baker Hughes, U.S. Commodity Futures Trading Commission, Bloomberg L.P.

More information about U.S. oil companies' financial statements and indicators for oil production is available in EIA's This Week in Petroleum.

美国石油生产商 2016 年第四季度投资增加



资料来源：美国能源信息管理局，以能源评估为基础

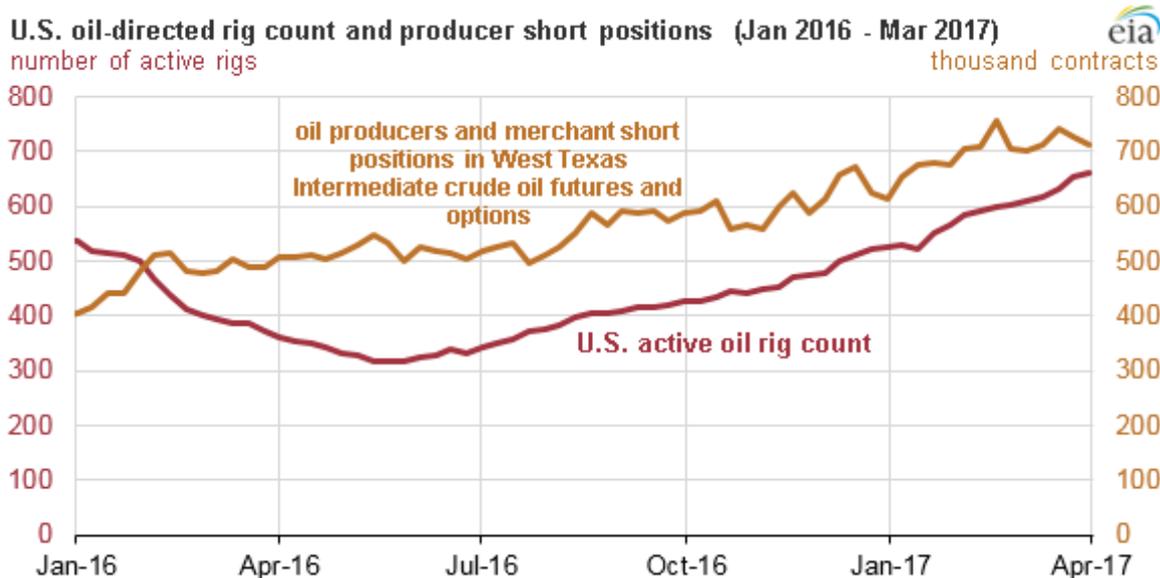
根据其公开季度财务报表，44 家美国陆上石油生产公司的资本支出在 2016 年第四季度和 2015 年第四季度之间增加了 49 亿美元（72%）。至少在 2012 年第一季度以来，这 44 家公司的投资支出增长是这一季度最大的同比增幅。

石油价格上涨导致美国生产商的上游收入增加，促使一些公司增加投资预算。公司公布和活跃石油钻采数量的增加表明，美国石油生产公司在 2017 年第一季度持续投资增长。美国积极的石油钻探计数在 2017 年 3 月 31 日达到 662，高于 2016 年年末的 525。

尽管原油价格上涨，但前两年投资水平较低可能导致 44 家公司的运营现金减少。2016 年第四季度，这 44 家公司的运营现金减少了 4.75 亿美元。2015-16 年度的勘探和开发支出大幅度减少导致钻井量减少，这导致了第四季度的石油产量下降 2016 年抵消了更高的收入。经营现金滞后于这些公司的资本支出，因为他们投资于开发储备，以增加未来的石油生产和现金流。

许多这些公司使用石油期货和期权来对冲未来对投资的投资。如果价格下降，生产者的金融对冲减少了收入下降的影响。对未来生产石油公司进行套期保值的措施是空头头寸或将来进入这些市场的数量。这些空头头寸由生产商和商家持有的期货和期权合约组成。由于原油价格在 2016 年第四季度上涨至每桶 50 美元以上，生产商已经开始使用它们。在 2017 年 2 月中旬，美国期货和期权的短期数量达到 756,000 份合约，接近 10 年高达 802,000 份合约。

来自这 44 家美国陆上石油生产公司的季度财务报告的财务指标表明，他们正在继续增加勘探和开发的资本支出，支持美国持续的生产增长。二零一七年第一季财务业绩将于五月公布。



资料来源：美国能源信息署，基于贝克休斯，美国商品期货交易委员会，彭博社。
有关美国石油公司财务报表和石油生产指标的更多信息，请见 EIA 本周石油。

China and Myanmar open long-delayed oil pipeline

China and Myanmar have finally agreed to open a cross-border pipeline into south-east China, allowing Beijing to diversify oil supply routes and reduce its dependence on the contentious South China Sea.

The agreement, announced by Chinese vice-foreign minister Liu Zhenmin at the end of a state visit by Myanmar's president Htin Kyaw, comes as China presses its southern neighbour for access to more infrastructure deals following setbacks at other projects. Work on the controversial \$1.5bn Myitsone dam project — a symbol of what some see as the excesses of Chinese influence in Myanmar — has been suspended for years.

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State-owned news agency Xinhua said a ship began offloading immediately at Myanmar's Kyaukpyu port to send crude oil up the pipeline.

The twin crude and gas pipelines on the route are key to China's "two oceans" strategy to diversify energy supply away from the chokepoint of the Strait of Malacca and vulnerable shipping lanes through the disputed South China Sea. Once fully operational, the pipeline from Made island in Rakhine state can supply almost 6 per cent of China's crude oil imports. The gas line is already in use.

The opening of the long-delayed crude pipeline served to mask the two countries' inability to reach an agreement on more substantial concessions that China was trying to promote as part of its "Belt and Road" initiative, said Du Jifeng, an expert on Southeast Asia at the Chinese Academy of Social Sciences.

"China wants to use the initiative to sell more infrastructure and energy programmes overseas. But Myanmar considers there are already a lot of those type of projects in its territory and wants more investment in agriculture and light manufacturing."

Myanmar cancelled the Myitsone dam six years ago. Chinese backers have recently shifted from demanding indemnification to pushing for preferential access to other projects as compensation. "It's relatively less possible to resume the Myitsone Dam, so Myanmar is proposing other alternative projects to China," Mr Du said, adding that the contractual indemnification would be "a huge burden for a small country".

The pipeline project has been fraught with delays and opposition from citizens in both countries. It feeds a refinery in Kunming, in southwestern China's Yunnan province, that has been the target of street demonstrations from residents opposed to its expansion.

In Myanmar, the pipeline was dogged by accusations of land grabs. Other Chinese projects, including the Myitsone dam and mines operated by Wanbao, a company controlled by the Chinese military, have raised fears in Myanmar that China's influence over the isolated junta has enabled environmentally damaging projects that contribute little to the host country.

Both pipeline and refinery are operated by China National Petroleum Corp, or PetroChina. The state-owned oil company served as the standard-bearer for China's "going out" strategy to secure resources overseas under now-disgraced energy and security tsar Zhou Yongkang.

But it was also motivated by CNPC's strategy to build a refining base in south-west China, a political stronghold for Mr Zhou, and avoid the stranglehold on coastal refineries enjoyed by state-owned rival Sinopec.

中缅终于达成原油管道运输协议

中国和缅甸终于就开通一条通往中国西南部地区的跨境输油管道达成协议，使北京方面得以实现供油路线多元化，降低对有争议的南中国海(South China Sea)的依赖。

这项协议是在缅甸总统廷觉(Htin Kyaw)对中国进行国事访问结束时由中国副外长刘振民宣布的。在其他项目遭遇挫折之后，中国正催促这个南部邻国与自己达成更多基础设施协议。备受争议、规模达 15 亿美元的密松(Myitsone)大坝项目（有些人把该项目视为中国对缅甸影响力过大的一个标志）的工程已被搁置数年。

中国国家通讯社新华社(Xinhua)称，一艘油轮随即开始在缅甸皎漂(Kyaukpyu)港口卸下原油并送入输油管道。

这条线路上的原油天然气管道是中国“两洋”战略的关键。该战略的目的是实现能源供给线路多元化，不再过多依赖咽喉要道马六甲海峡和穿越有争议的南中国海的脆弱航线。一旦完全投入使用，这条始于若开邦(Rakhine)马德(Made)岛的管道可满足中国近 6%的原油进口。天然气管道已投入使用。

中国社会科学院(Chinese Academy of Social Sciences)东南亚问题专家杜继锋表示：“中国想利用（一带一路）计划在海外兜售更多的基础设施和能源项目。但缅甸认为其国内已有很多这类项目，希望中国在农

业和轻工制造方面投更多的资。”

6年前，缅甸取消了密松大坝项目。中国出资方最近已从要求赔偿金转为争取缅方提供其他项目的优先准入作为赔偿。杜继锋说：“重启密松水坝的可能性相对较小，所以缅甸正向中国提出其他替代性项目。”他接着说，合同赔偿金“对小国而言将是一个巨大的负担”。

这一管道项目多次被延迟，并遭到中缅两国民众的反对。该项目通往云南省昆明市一家炼油厂。当地居民曾上街示威，反对扩建该厂。

在缅甸，这条管道受到“抢地”(land grabs)指控的困扰。其他中国项目——包括密松水坝和由中国军方控制的公司万宝(Wanbao)经营的矿场——也引起了缅甸人的担忧，他们担心中国对受到孤立的军政府的影响力会使一些破坏环境、但对东道国没什么好处的项目得以实施。

上述管道和炼油厂的经营方都是中国石油天然气集团公司(CNPC)。在现已落马的能源和政法沙皇周永康领导下，这家国有石油公司曾是执行中国旨在获取海外资源的“走出去”战略的旗手。

不过，它还受到中石油一项战略的驱动，即在中国西南设立一处炼油基地，避免受到国有石油公司中石化(Sinopet)拥有的沿海炼油厂的钳制。中国西南是周永康的政治据点之一。

Latin America's oil-dependent states struggling to repay Chinese debts

The global oil crisis has forced Latin America and China to re-examine their terms of trade, reports Zhang Chun

As Chinese loans pour into Latin America, concerns over how the money is spent and how it will be repaid are growing on both sides of the bargaining table.

Of most immediate concern for China is whether economically unstable governments such as Venezuela can pay back multi-billion dollar loans amid globally low prices for crude oil.

By the close of 2015, China held US\$53 billion of Venezuelan debt. However, US think tank Inter-American Dialogue suggests it could be as much as US\$65 billion. Despite Venezuela's deepening recession, China has continued to lend, with US\$2.2 billion in November 2016 alone.

“Many thanks for all the support you have given Venezuela in 2014, 2015, and especially 2016. Our older sister China has not left Venezuela alone in moments of difficulty,” said Venezuelan President Nicolás Maduro in a televised speech.

But the changing global economic environment means that China cannot continue lending to Latin American countries worry-free. Analysis by Inter-American Dialogue shows that in 2016, 92% of China's loans to Latin America went to Ecuador, Venezuela and Brazil, nations which are all facing serious economic challenges according to the World Bank.

The Brazilian economy has been shrinking since 2011, while the economy in Venezuela also continues to deteriorate. In 2015, 15 years of sustained economic growth came to an end in Ecuador.

Experts say the main challenge facing economic cooperation between China and Latin America is whether Chinese investment could better promote sustainable development that is less risky and more environmentally responsible.

Oil loans around the globe

Take Venezuela as an example. The country's economic growth has all but ground to a halt leaving its credit rating in tatters. It is already unable to repay the US\$19 billion in loans that it owes to China, according to Barclays Capital Inc.

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Wu Guoping, a senior researcher at the Institute of Latin American Studies, part of the Chinese Academy of Social Sciences, says that Venezuela's economic difficulties are linked with the inherent limitations of its oil sector.

Venezuela has the world's largest oil reserves but produces less than 20% of Saudi Arabia's output because its oil is heavier and so more expensive to extract and refine.

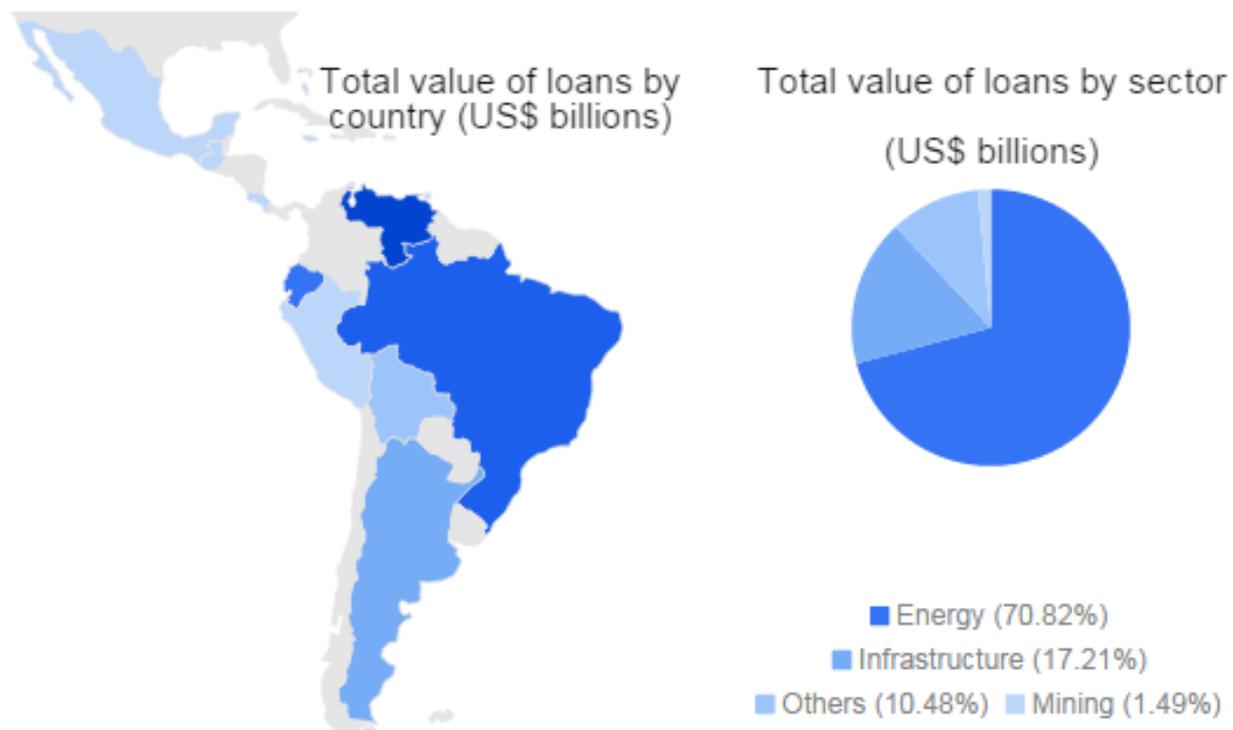
"It's only profitable if the price of oil is at US\$60 or higher," says Wu. But that price hasn't been seen since November 2014.

Venezuela repays its loans to China with oil to the equivalent value. Many oil-for-loans contracts were signed when the price of oil was high but now the country is under pressure to supply much larger quantities than earlier expected.

According to Reuters, Venezuela started to fall behind with oil shipments to China and Russia in 2016, with the national oil company Petróleos de Venezuela failing to supply oil worth US\$750 million that year.

As well as missed shipments and refining difficulties (China had to build a new refinery specifically for the heavier Venezuelan oil), it has to be shipped halfway around the world to reach China. Taken together, Wu thinks this is too costly an option for China.

Loans from China's policy banks to Latin America



Source: www.thedialogue.org/map_list/

From exports to self-sufficiency

For Latin American countries, including Venezuela, the crucial question is how to use Chinese loans.

"China can't be the one to trigger sustainability but if Latin America got its act together the Chinese could provide some real funding," says Kevin Gallagher, a professor at Boston University who studies the region.

Latin America is rich in natural resources but these are exported as raw materials rather than as processed products. Loans from Chinese banks are focused on energy, mining and infrastructure.

According to Gallagher, Latin American governments mainly use Chinese loans to build infrastructure between mines and oil fields to refineries and ports, a far cry from real economic integration or sustainable development.

In Gallagher's new book, *The China Triangle*, he says that the situation in many Latin American nations has led to a trade imbalance where countries rely heavily on exports. Profits made from the export of natural resources are reinvested into the extractive sector rather than into sustainable economic and social development.

Domestic politics is a major factor in shaping the investment choices of Latin American governments.

In Venezuela the "Leftist" governing party used the profits from the oil sector to fund populist welfare policies. The Hugo Chavez administration offered free education and healthcare and issued occasional payments to the poor, while infrastructure that has a less visible impact on public welfare such as expressways was neglected.

Wu thinks that China's economic transition is changing the structure of its domestic imports. For Latin America this is both an opportunity to improve its industries and a challenge.

Gallagher also told chinadialogue that if China's economic transition goes smoothly, China will need fewer commodities from Latin America. For example, if renewables take a greater market share then China would potentially have less need for oil imports.

In 2013, 9% of exports from Latin America and the Caribbean went to China, including 15% of the region's exports from agriculture and the extractive industries.

The bulk of the money flowing from China to Latin America is in the form of policy loans rather than direct investment.

China has lent over US\$140 billion to Latin America since 2005 and is the region's biggest creditor. But China accounts for less than 10% of direct investment in Latin America, and 90% of that goes to two offshore financial centres, the Cayman Islands and the British Virgin Island

Investment challenges

Despite the small quantities of direct investment, a failure to adequately research local regulations has still caused problems for Chinese investors. For example, Chinamex, a Ministry of Commerce agency promoting Chinese investment in the Middle East, invested in Dragon Mart Cancun, a retail and residential development in Mexico. But the project was halted just before completion due to the felling of protected trees.

Enrique Dussel Peters, a professor at the National Autonomous University of Mexico, has said that Chinese firms, whether state-owned or private, do not have an adequate understanding of the region, and that in the Dragon Mart project the Chinese firm's local partner had failed to explain Mexican laws and systems.

Li Zhiguo, a lawyer specialising in overseas investment, told chinadialogue that Chinese state-owned firms are too fixated on obtaining raw materials rather than understanding local legal environments, and that they lack a mature "corporate culture." Any of these factors can cause an investment to fail.

Wu Guoping thinks there are at least two factors that cause Chinese firms reputational damage when investing abroad.

First, Chinese companies mainly invest in resources and mining, where there is a higher risk of environmental impacts. Second, investments are mostly undertaken by large state-owned enterprises, which receive support from China's "policy banks" and have a huge advantage compared with private banks. Government support means they struggle to be competitive in the market.

Wu thinks Chinese firms need to address this competitive weakness and give greater consideration to the rate of return on project investments, particularly when investing in infrastructure in Latin America.

Wu says that as China's overseas investments expand, the competitiveness of Chinese firms in Latin American markets will increase. This will improve the reputation of Chinese firms as informed financial market players and help to avoid unnecessary investment risks.

中拉经济合作：谈钱不简单

中国企业需要善用市场化手段降低对拉美贷款和投资的风险，拉美国家则需善用外资来塑造健康的发展模式。

尽管规模较前两年有所降低，2016年中国继续对委内瑞拉进行着大规模借贷，当年11月中国向委内瑞拉提供了22亿美元贷款。到2015年底，中国向委内瑞拉的贷款总额已经达到530亿美元。泛美对话则认为这一金额高达650亿美元。

委内瑞拉总统马杜罗在一次电视讲话中感谢了中国：“非常感谢贵国过去三年的支持，特别是2016年。我们的兄弟没有在危难时刻抛弃委内瑞拉。”

然而在全球经济环境正在发生深刻变化的当下，对中国而言，持续向拉美国家贷款并非没有隐忧。据泛美对话的统计，中国2016年对拉美贷款92%流入了厄瓜多尔、委内瑞拉和巴西。而按照世界银行的统计，这三个国家今年的经济走势都不好：巴西2011年以后一直经济下滑，委内瑞拉经济更是持续恶化，而厄瓜多尔也在2015年结束了连续15年的经济增长。

专家指出，中拉经济合作面临着来自两个方向的挑战：拉丁美洲国家如何更好地利用中国投资实现可持续发展，以及中国政府和企业如何更好地做出投资决策。

穿越半个地球的石油贷款

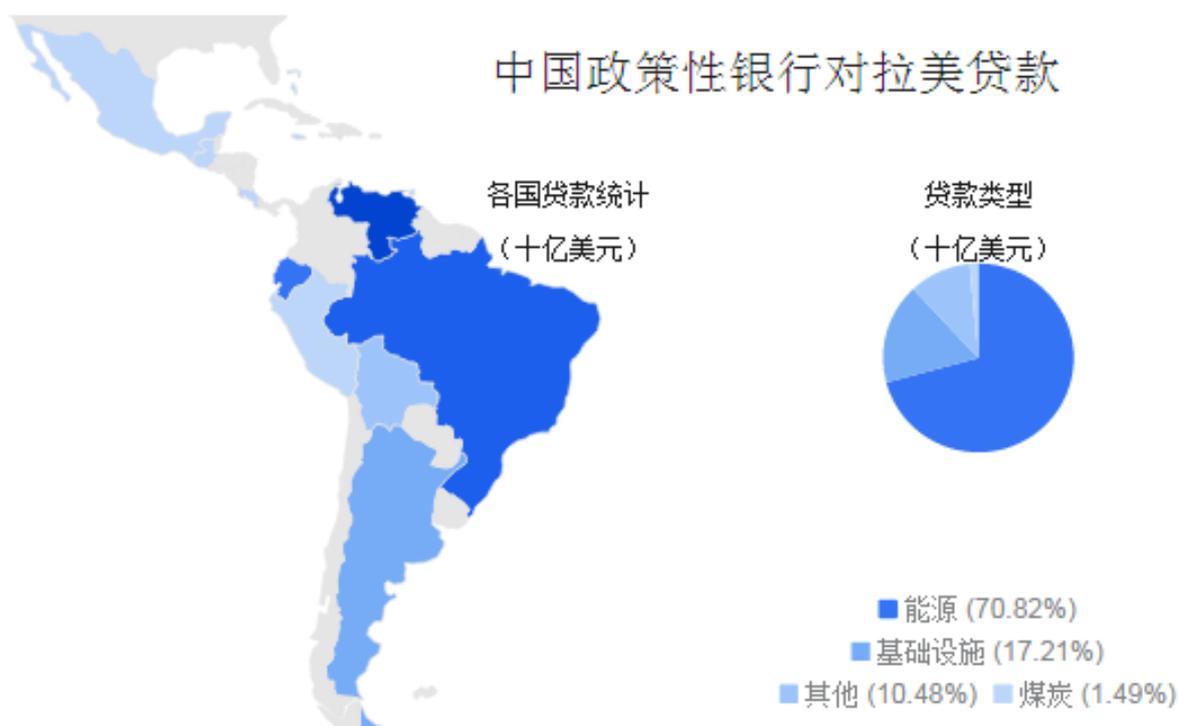
以委内瑞拉为例，该国目前实业生产几近停滞，国家信用评级全球垫底，已经无法按期偿还约190亿美元来自中国的贷款。

中国社会科学院拉丁美洲研究所资深研究员吴国平认为，委内瑞拉的经济困难与其石油生产的内在局限有关。

委内瑞拉石油储量世界第一，但当前产量还不及沙特阿拉伯的五分之一，这是由于其油质过重，开采和提炼的成本都较高。“委内瑞拉的石油每桶要卖到60美元，才可能盈利，”吴国平说。但全球石油价格自2014年11月跌破60美元大关，至今也未能恢复。

这对委内瑞拉以石油偿还外国贷款造成了额外负担，由于石油换贷款合同在油价高位时商定，油价下跌导致委国需出口比预期更多的石油才能偿还贷款。据路透社报道，2016年委内瑞拉对华对俄的石油运输有所拖欠，其中，委国营石油公司PDVSA对中国和俄罗斯拖欠了价值共约7.5亿美元的石油。

除了贷款坏账问题和炼制难度（中国需要修建专门炼油厂提炼来自委内瑞拉的重质石油），委内瑞拉石油要飘洋过海穿越半个地球才能抵达中国。吴国平认为，这样中国使用委内瑞拉石油的成本就太高了。



2005-2016年，中国对拉丁美洲政策贷款总额。数据来源：泛美对话
从输血到造血

对拉丁美洲自身而言，怎么用好来自中国的贷款也至关重要。“中国的钱不会自动促成一个可持续的社会建设，只有拉美自己做好打算，这些钱才会被引到对拉美真正有用的途径上。”波士顿大学拉美研究教授凯文·加拉格说。

这是一块拥有丰富的资源，却总以资源形式出口的大陆。中方银行的贷款也主要投向了能源矿产和基建领域。加拉格表示，拉美国家现在拿到中国的钱，主要想的还是修建通往连接矿区、冶炼厂和港口的基础设施，与真正的经济一体化和可持续发展相去甚远。

加拉格在他的新书《The China Triangle》中分析说，拉美很多国家因为资源优势导致了出口结构失衡，为了加强维持出口优势，出口收益又被用在资源相关领域的再投资，而能够支撑社会经济可持续发展的产业和领域没有得到应有的扶持。

吴国平则认为，拉美国家的国内政治格局也是一大因素。以委内瑞拉为例，由于石油此前带来的高收益，“左翼”执政党为了留住选民实施了具有民粹主义倾向的高福利政策。查韦斯政府实行了全民免费教育和免费医保，并且不定期向穷人发放补贴。但如高速公路等看上去并不直接增加民众福利的社会基础设施建设，大多未能在经济增长的高峰期内得到改善。

另外，他还认为中国经济转型导致其国内需求结构变化，这也意味着对华出口国的出口结构发生变化。对拉美而言，这是产业升级的机遇也是发展的挑战。

加拉格也告诉中外对话，中国若转型顺利，可能就不再需要拉美现在能提供的大宗商品。

截至2013年，拉美和加勒比海地区对华出口额已占到其总出口额的9%，其中农业和采掘业达到行业出口总额的15%。

对拉投资：在商言商

目前中国流向拉美的资金，政策性贷款远大于直接投资。自2005年以来，中国对拉美的贷款已经超过1400亿美元，是拉美最大的债主。但若论直接投资，目前中国每年直接投资还不足拉美接收的总投资的十分之一，其中大约90%又流向了开曼群岛和英属维尔京群岛这两个离岸金融中心。

尽管投资规模不大，但功课做不到家还是可能给中国投资者带来麻烦。例如，商务部下属的中国中东

贸易促进中心（Chinamax）与墨西哥合作投资的龙城商贸集散中心，在接近完成时因砍伐了受保护的树木而被叫停。

墨西哥国立自治大学教授恩里克·杜塞尔·彼得斯告诉媒体，中国不论国营还是私营公司对墨西哥都不够了解，在龙城项目中，中方的墨西哥同行也没有向他们详细解释墨西哥的法律和制度，最终造成项目因为未达到环保标准而停止。

专门从事海外投资方向业务的李治国律师也曾告诉中外对话，中国企业获取资源的目的性太强，又对当地法律制度认知不够，没有成熟的“商业文化”，这些都是可能导致其投资失败的原因。

吴国平认为至少有两个因素容易造成中国企业在投资国引起的争议，以及在国际媒体中的相对负面的形象。第一，中国企业主投的领域主要集中在资源矿产类项目上，容易对环境产生一定的影响；第二，资源型投资主要是由大型国有企业承担，并且主要投向国家主导型的经济体，难以完全适应市场竞争的游戏规则。

吴国平建议中国企业应该在市场竞争中不断提高其竞争力，对项目投资回报率如何、通过什么方式收回成本，多做功课。尤其是在拉美国家的基础设施投资项目中，要深入研究拉美自身的基础设施建设和管理等运行的特点，力争实现投资项目的经济和社会的双重效益。

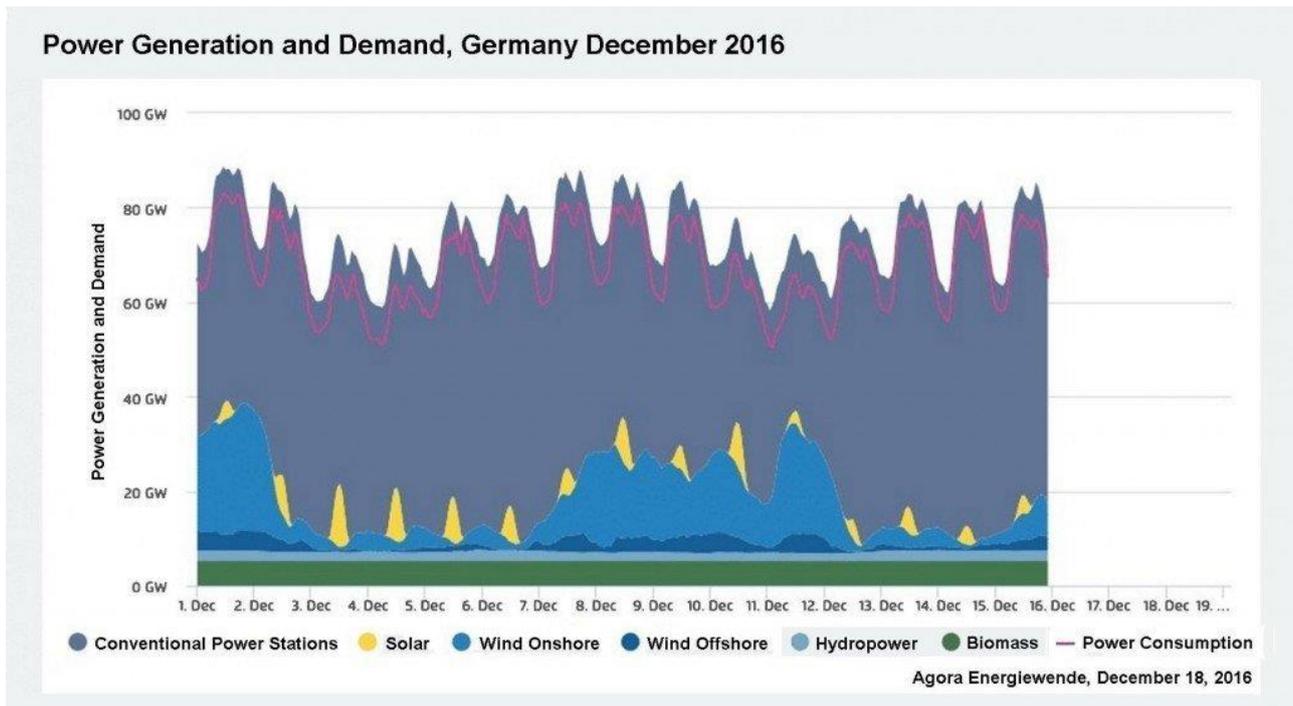
不论国企还是民企，要提高在拉美市场的投资成功率，不仅要更多地了解拉美，更应当了解并遵循当地市场的规律和游戏规则。吴国平认为，随着中国海外投资规模的扩大，越来越多的民营企业也开始拓展海外业务，这些企业的涌入有利于提高和完善中国企业在拉美的市场竞争力，逐渐建立起一个相对平衡的市场对话机制，让中国企业赢得市场尊重，也可以通过市场规则和次序规避不必要的投资风险。

New Energy (新能源)

Here comes the end of the Energiewende Again

Yet again, an expert – this time, a German – has announced that Germany’s energy transition cannot succeed. He has a surprising insight for Energiewende proponents: the sun doesn’t always shine and the wind doesn’t always blow. How could we have missed that, wonders award-winning energy author Craig Morris? Courtesy Energy Transition/Global Energiewende.

German economist Heiner Flassbeck recently argued that Germany will never be able to rely on renewable electricity. His central argument is that the month of December up to the date of the original publication (20 December) shows that Germany’s energy transition is doomed to fail. Here is the chart that got Mr. Flassbeck going:



The low levels – nothing unusual, by the way: here’s me writing about exactly the same thing in December 2014 – led Flassbeck to conclude the following:

“This winter could go down in history as the event that proved the German energy transition to be unsubstantiated and incapable of becoming a success story. Electricity from wind and solar generation has been catastrophically low for several weeks.”

What Flassbeck, who says he is a “lay person,” has just discovered for himself is well known in the German debate as the *Dunkelflaute*: the “dark doldrums,” or a time of very low solar & wind power production.

I wrote about it here last year, mainly to explain my surprise at how close even the worst periods are to the original target (!) of 20 percent renewable power by 2020 (since raised to 35 percent). I have also published load duration curves going back at least to 2012 (see chart 1 in this PDF); these charts show how frequent periods of, say, low wind and/or solar power production are.

The solution to all of this is “flexibility options”: first, all power plants that can ramp; second, demand that can react; and third, storage – in that order

It is thus revealing, but not surprising, to read Flassbeck’s next statement: “We have attempted unsuccessfully to find Energiewende advocates willing to explain that inconsistency. Their silence is not easy to fathom.”

His statement is not surprising because Energiewende critics often accuse their proponents of having overlooked things already studied in depth. Here, it’s as though Flassbeck thought the best German minds didn’t know that it’s dark half the time. (The irony of Energiewende critics using charts made by Energiewende experts to show what those experts have allegedly not addressed is often lost on these critics.)

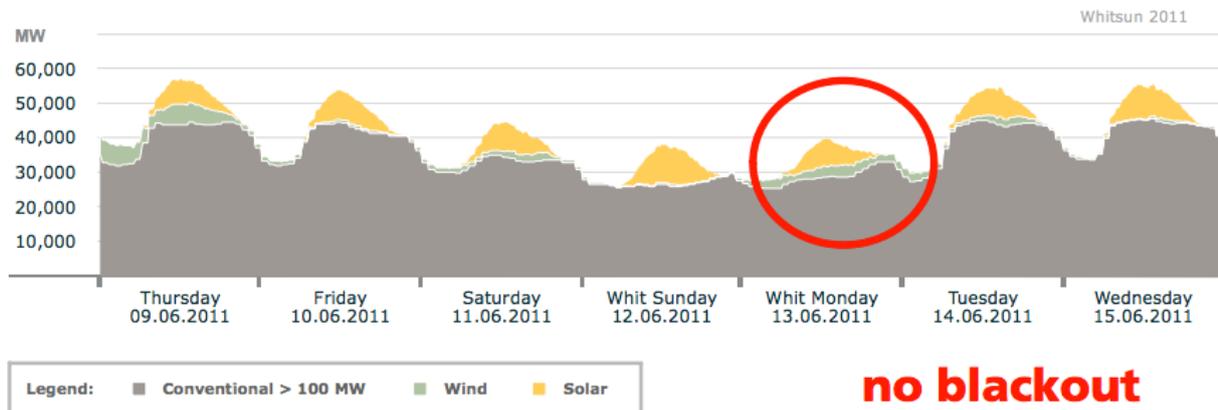
Assuming Flassbeck is using the royal “we” in the quote above, he obviously didn’t look hard. This website is not exactly unknown to those interested in the Energiewende (and I have also published at Energy Post). Likewise, the Wikipedia entry (in German) for *Dunkelflaute* (yes, there is one) specifically references texts from Agora Energiewende, the source of the chart Flassbeck uses.

At Energy-Charts.de, Fraunhofer ISE has highlighted times of the lowest annual solar & wind power production going all the way back to 2011. The chart below from 2011, for instance, emphasizes a long-forgotten concern

about a possible power outage that June.

Electricity Production in Germany at Whitsun

Actual production



**no blackout
at Whitsun!!!**

- There was no risk of a blackout during Whitsun
- Solar plants stabilize the grid, since they deliver peak load

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform

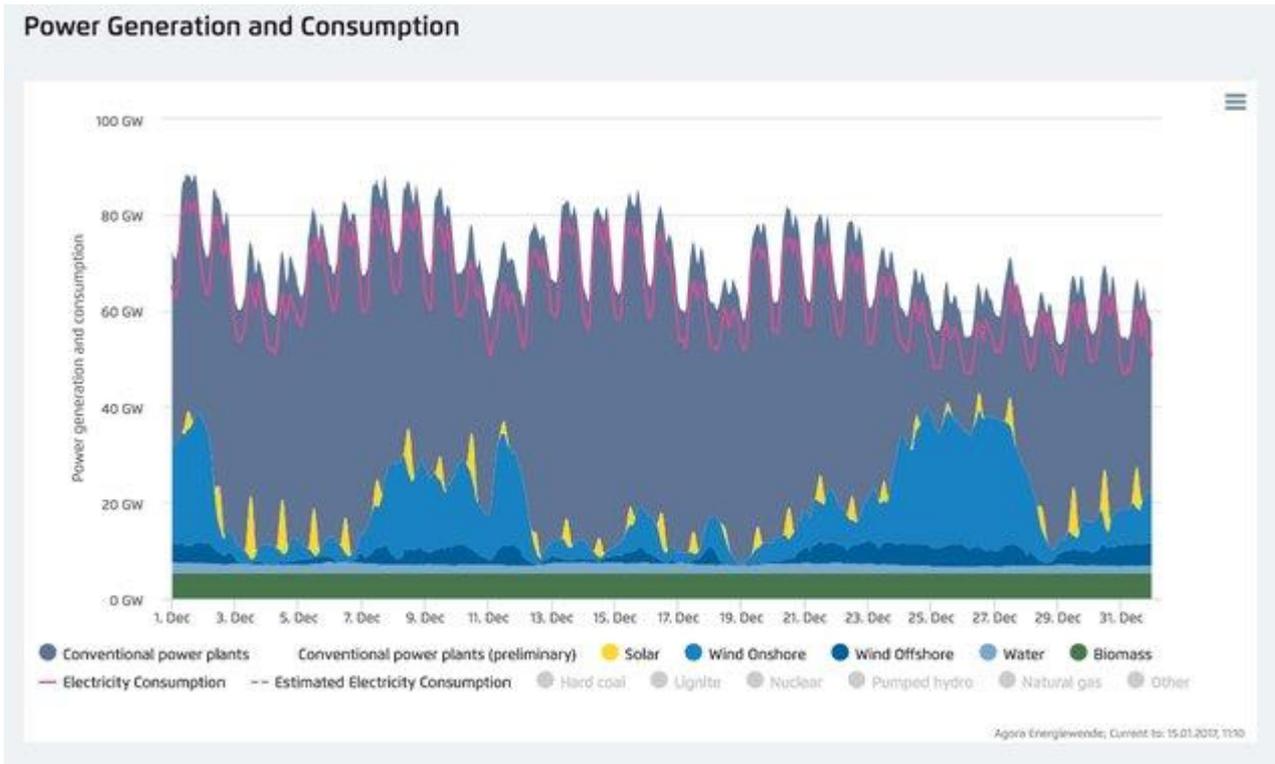
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What's the solution?

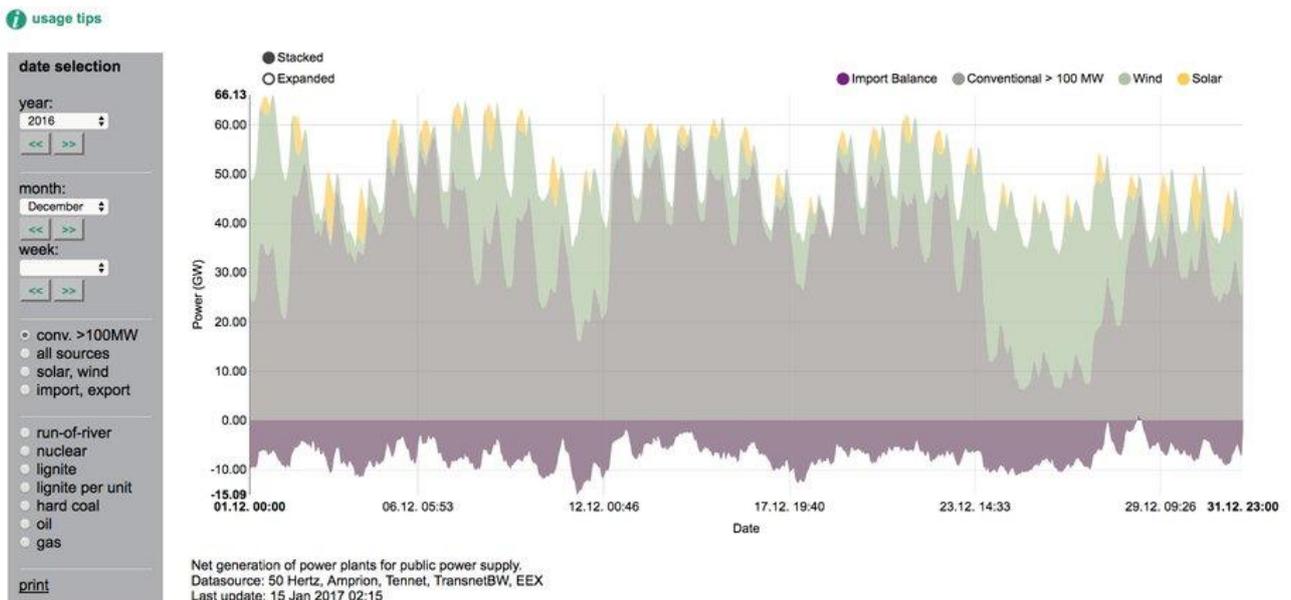
Not only have German experts coined a term and spoken about the danger of “dark doldrums” for years, they have even produced studies about what to do about them. Last year, I created two videos with the head of Fraunhofer IWES, the institute behind the Combined Power Plant study, which visualized the reliability of German power supply with 100% renewables (a goal, it should be noted, more ambitious than the German government’s actual target of 80% renewable power by 2050): see here.

The short answer to the obstacle of the dark doldrums begins when we extend the chart Flassbeck uses to cover all of December. Days of high wind & solar are never far from days of low wind & solar.



On the day Flassbeck originally published, wind power was just picking up again. It hit near record levels for five days in a row. As Fraunhofer’s chart below for the same month shows, conventional power was pushed below 10 GW as a share of domestic demand, with exports once again “rescuing” these plants.

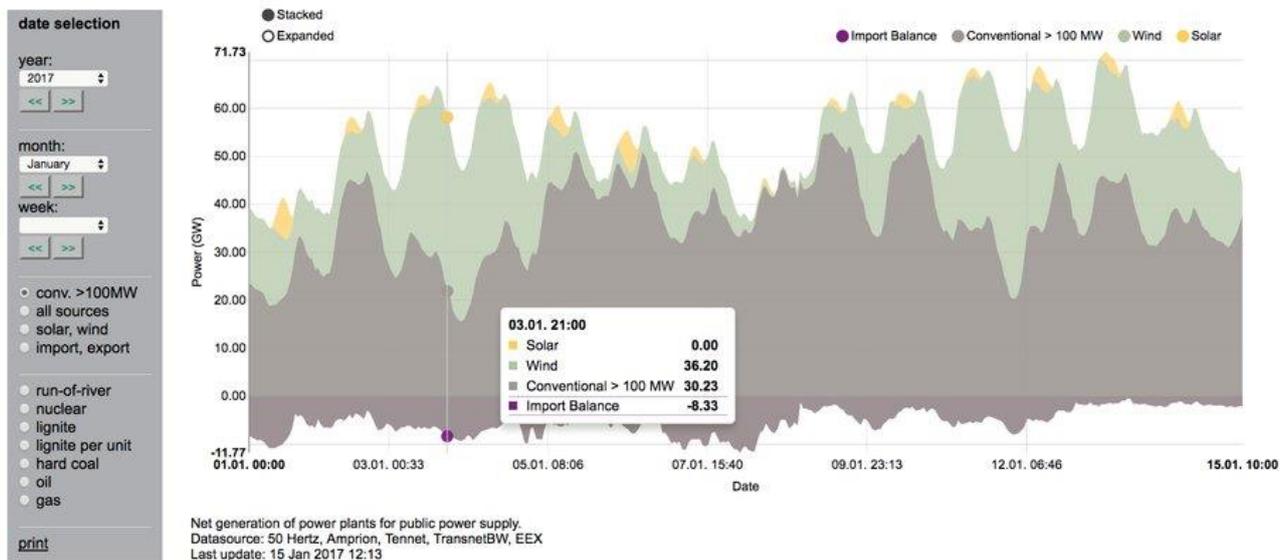
Electricity production in Germany in December 2016



Indeed, Germany posted a new record level of wind power production on January 3 of around 36 GW at 9 pm, as the chart below for the first half of January shows.

Electricity production in Germany in January 2017

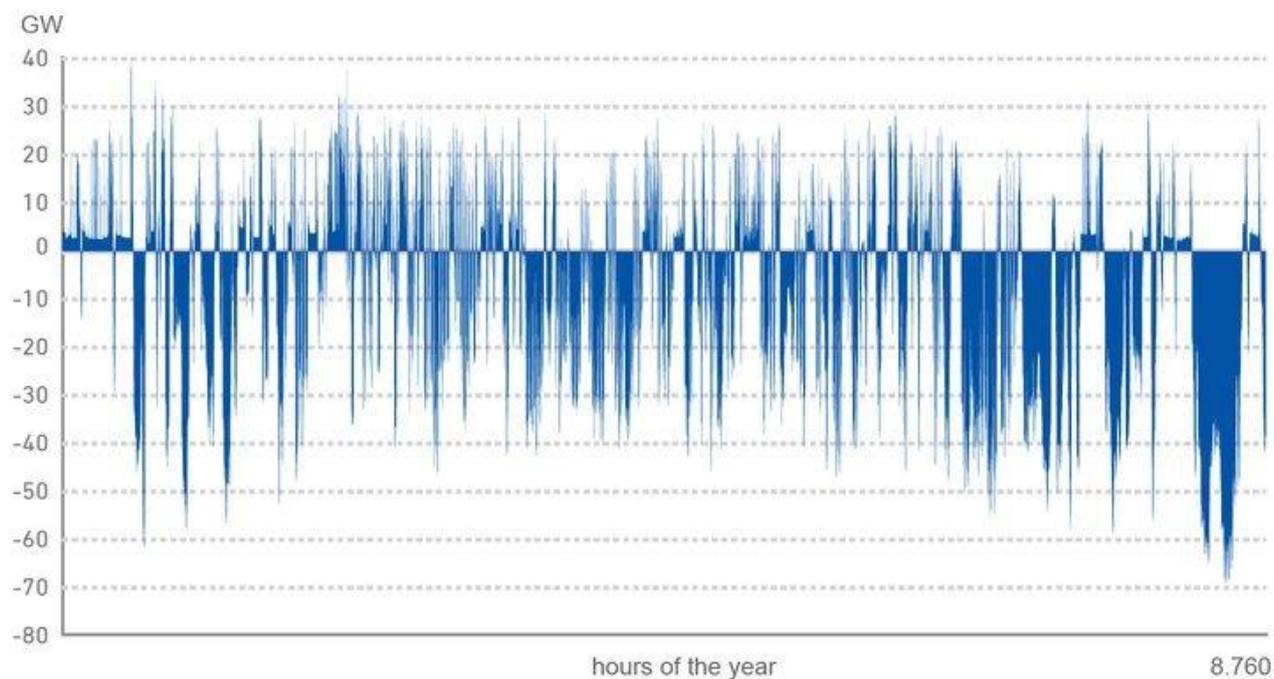
usage tips



The solution to all of this is “flexibility options”: first, all power plants that can ramp; second, demand that can react; and third, storage – in that order. Ho hum.

We are just entering the second stage, requiring more demand shifting. Right now, dispatchable power plants ramp to accommodate spikey wind and solar. As boring as the issue Flassbeck addresses currently is, it will become interesting – and the Dunkelflaute is the central technical challenge of the Energiewende in the power sector. The scariest chart I have seen shows the residual load for 2050 with 100% renewables (below).

The residual load in 2050 with 100% RE



Source: Kombikraftwerk, 2014

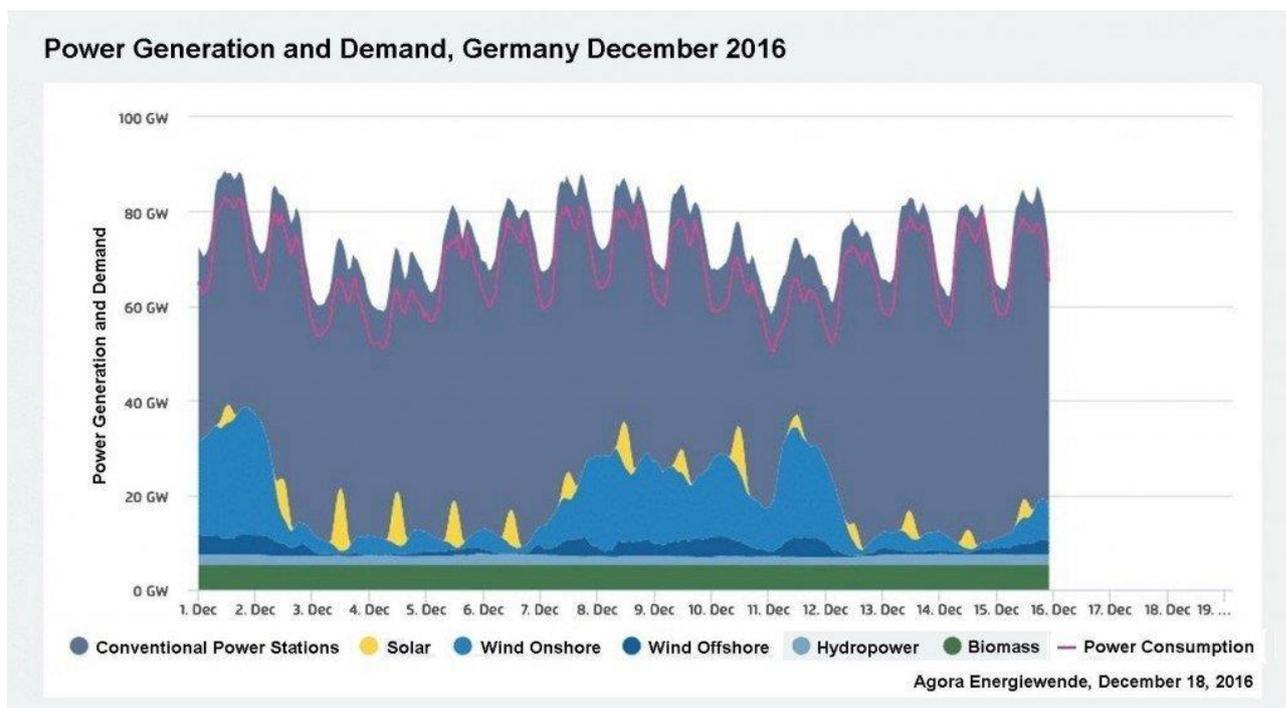
Renewables Tagged With: capacity markets, demand response, electricity market, Energiewende, energy transition, energy2030, grid, infrastructure, renewables, smart grids, solar power, wind power

Does that chart not prove that Flassbeck is right and the Energiewende is doomed to fail? He certainly puts his finger on the main challenge, yes. (But don't forget charging electric vehicles and electric heat – and the 80% target, not 100%). The problem with his analysis is that he acts as though there are no solutions – indeed, as though no one had even looked for any.

再次迎来能源转型的结束

再次，一位专家——这次是一位德国专家——宣布，德国的能源转型无法成功。他对于能源转型的倡导者提供了一个惊人的见解：太阳并不总是会闪耀光芒，风也并不总是无处不在。我们如何能够错过这个失败呢，屡获殊荣的能源作家 Craig Morris 想要知道？礼貌的能源转型/全球能源转型。

德国经济学家 Heiner Flassbeck 最近认为，德国永远都不可能依赖于可再生电力。他的中心论点是，截至 12 月，最初公布的数据（12 月 20 日）表明，德国的能源转型注定会失败。在此为支持 Flassbeck 先生言论的图表：



低水平——顺便一提，没什么不同寻常：我在 2014 年 12 月也撰写了完全一样的事情——令 Flassbeck 作出如下总结：

“随着证明德国能源转型是毫无根据的以及无法成为一个成功故事的事件的产生，这个冬季温度可能会下降。风力和太阳能发电产生的电力在几周时间内一直相当低。”

有人称 Flassbeck 是一个“外行人”，他刚刚发现自己因 *Dunkelfaute*：“黑暗低谷”或太阳能和风能发电非常低的时期而在德国辩论中众所周知。

我在去年在这里写过关于它的事情，主要是解释我惊讶于即使是最糟的时期，距（自上调至 35% 以来）2020 达到 20% 的可再生能源电力的原始目标（！）有多近。我至少在 2012 年还公布了负载时间曲线（见 PDF 中的表 1）；这些图表显示了低风和/或太阳能发电量的频繁周期。

所有这些“灵活性选项”的解决方案：首先，所有的电厂可以加价；其次，可以回应需求；再次，存储——按这个顺序。

因此在阅读 Flassbeck 的下一句话时会觉得是显而易见而不会奇怪：“我们曾试图发现愿意解释这种不一致的能源转型的倡导者，但是并未成功。很难了解他们沉默的意义。”

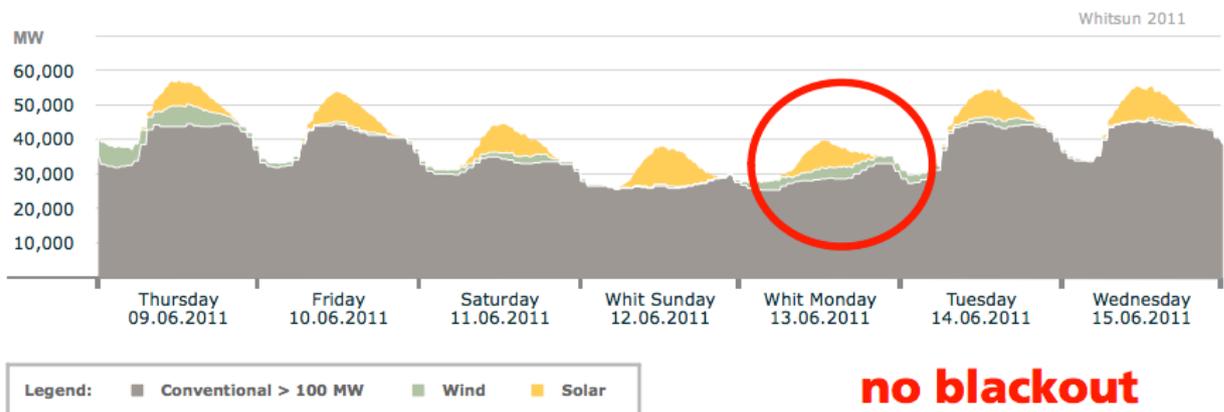
他的言论并不奇怪，因为能源转型的评论家通常会指责他们的支持者忽视了已经深入研究的事物。在此，就像 Flassbeck 认为的，最佳的德国人并不清楚有一半的时间是黑夜。（讽刺的是，能源转型的批评家使用的是能源转型的专家所制作的图表，用于展示这些专家据称没有得到解决的事物，而这对于这些批评家而言通常不起作用。）

假设 Flassbeck 在上述话语中使用了第一流的“我们”，他显然看起来没有那么努力。这个网站被那些对能源转型感兴趣的人所熟知（并且我也在《能源快报》中发表过）。同样，*Dunkelfaute* 的维基百科条目（德语）（是的，确实有一个）具体引用了 Agora Energiewende 的文本，Flassbeck 使用的图表来源。

在 Energy-Charts.de，Fraunhofer ISE 已经强调了自 2011 年以来最低年度太阳能/风能电力产量的时期。例如，下图从 2011 年，强调了有关 6 月可能停电的长期担忧。

Electricity Production in Germany at Whitsun

Actual production



**no blackout
at Whitsun!!!**

- There was no risk of a blackout during Whitsun
- Solar plants stabilize the grid, since they deliver peak load

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform

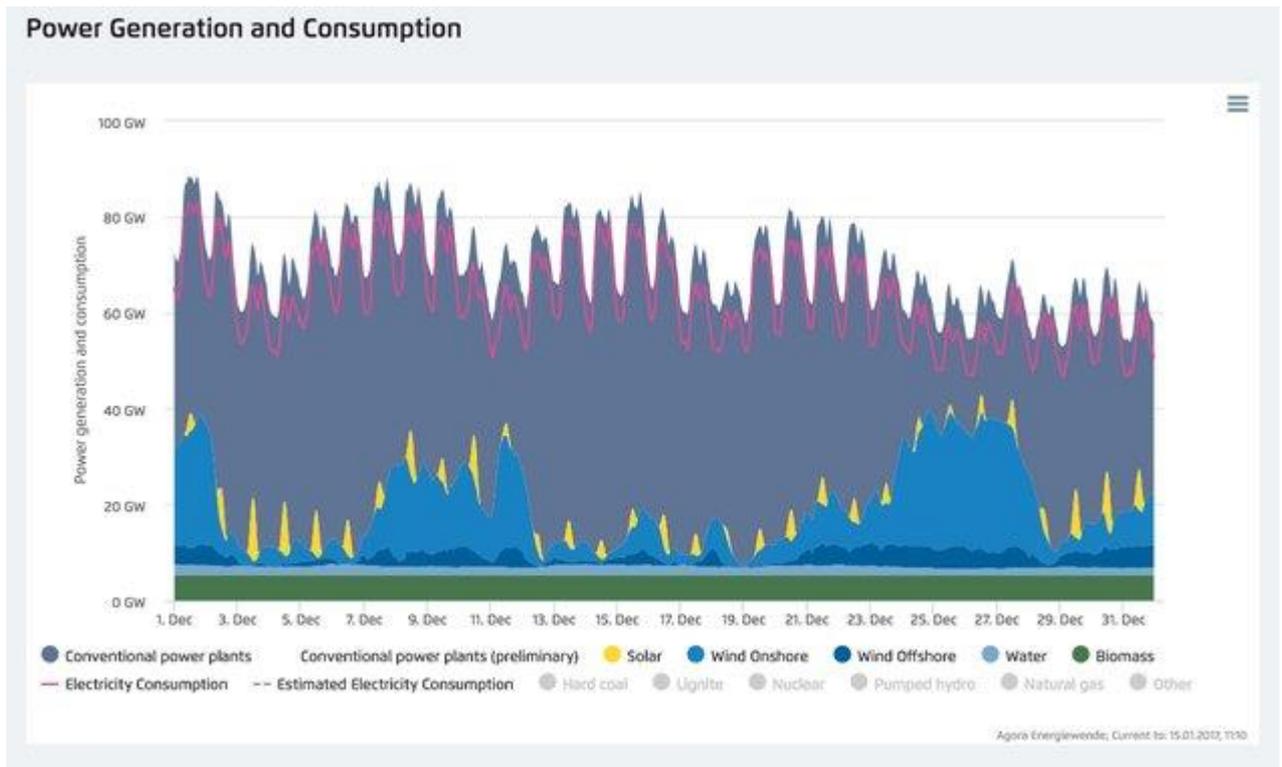
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解决方案是什么？

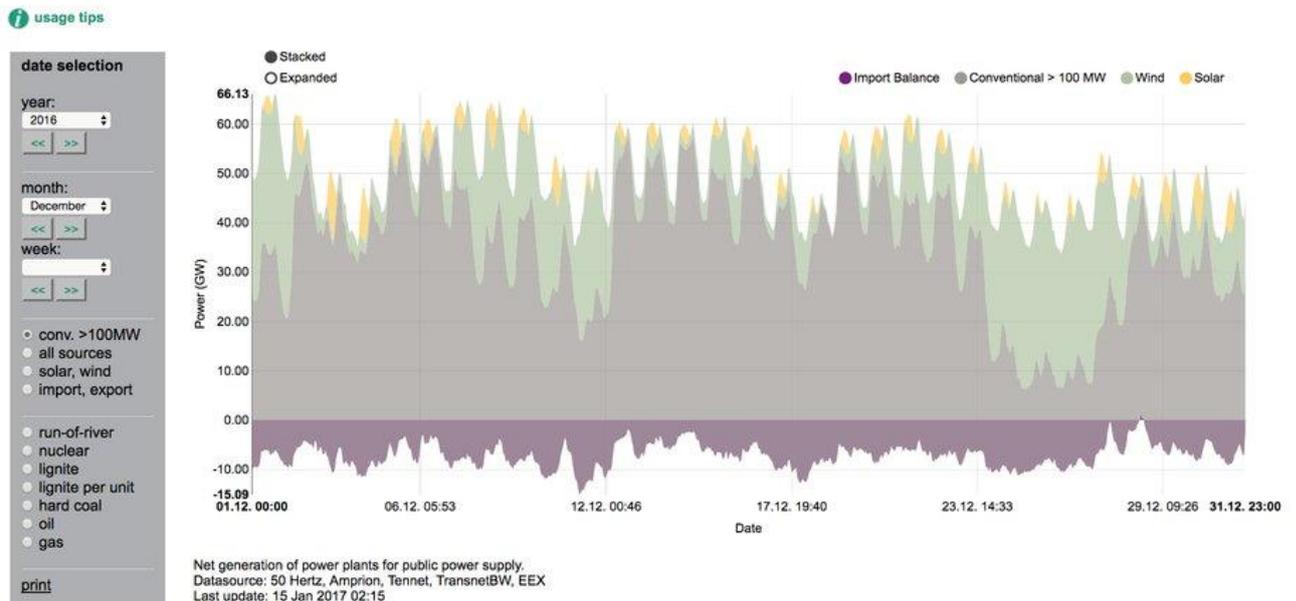
德国专家不仅多年来创造了一个关于“黑暗低谷”的危险的术语，他们甚至还研究了这些问题的解决方案。去年，我与 Fraunhofer IWES 的负责人创建了两个视频，这个支持联合发电厂研究的研究所，可视化了德国电力供应通过 100% 可再生能源供应的可靠性（这是一个目标，应该指出的是，比德国政府到 2050 年达到 80% 可再生电力的实际目标更为雄心勃勃）：见这里。

当我们扩展 Flassbeck 所用于覆盖整个 12 月时的图表时，对黑暗困境的障碍的简短回答开始了。高风力/太阳能的日子与低风力/太阳能的日子很近。



Flassbeck 最初发表的日子，风力发电才刚刚回升。其在连续五天内创下了历史记录水平。正如 Fraunhofer 有关相同月份的下表显示，传统电力作为国内需要的份额会下降到 10GW 以下，专家再一次“拯救了”这些工厂。

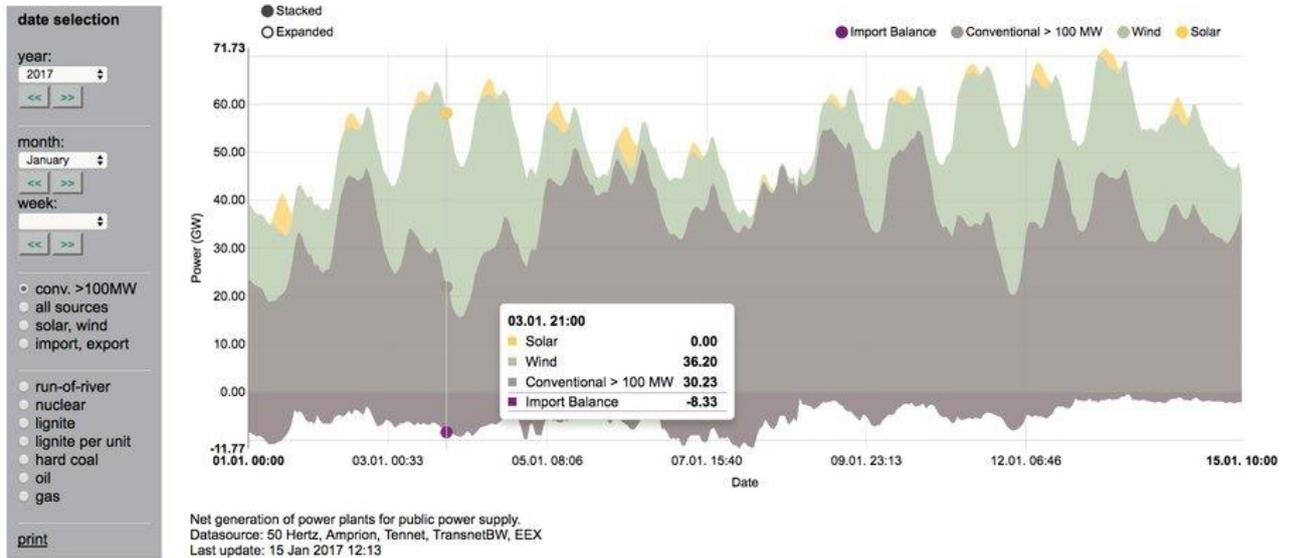
Electricity production in Germany in December 2016



事实上，德国在 1 月 3 日下午 9 点左右达到了风力发电量新的创纪录水平，大约 36GW，正如下表一月上旬的数据显示的。

Electricity production in Germany in January 2017

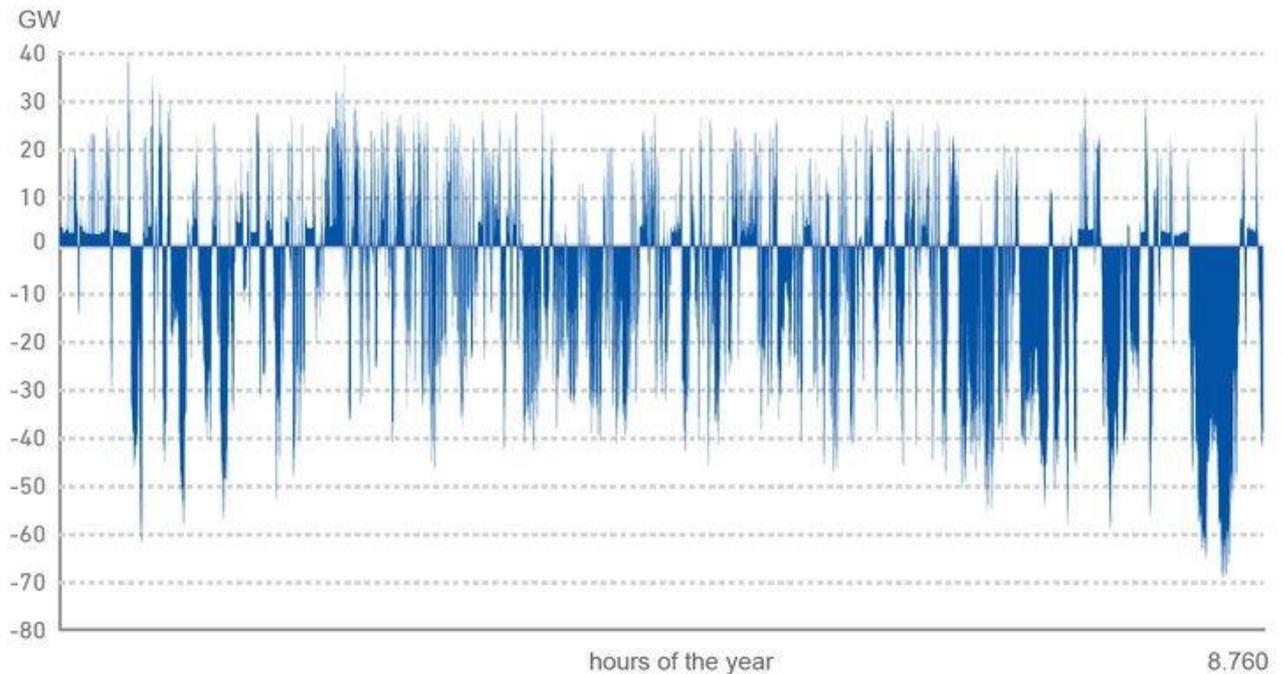
usage tips



所有这些“灵活性选项”的解决方案：首先，所有的电厂可以加价；其次，可以回应需求；再次，存储——按这个顺序。

我们才刚刚进入第二阶段，需要更多的需求转移。目前，可高度的电厂提高电价以适应 spikey 风能和太阳能。与 Flassbeck 目前解决的问题一样无聊，这将变得有趣——并且 Dunkelflaute 在电力行业是 Energiewende 的核心技术挑战。我见过的最可怕的图表显示了 2050 年以 100% 可再生能源运行的剩余负荷（下图）。

The residual load in 2050 with 100% RE



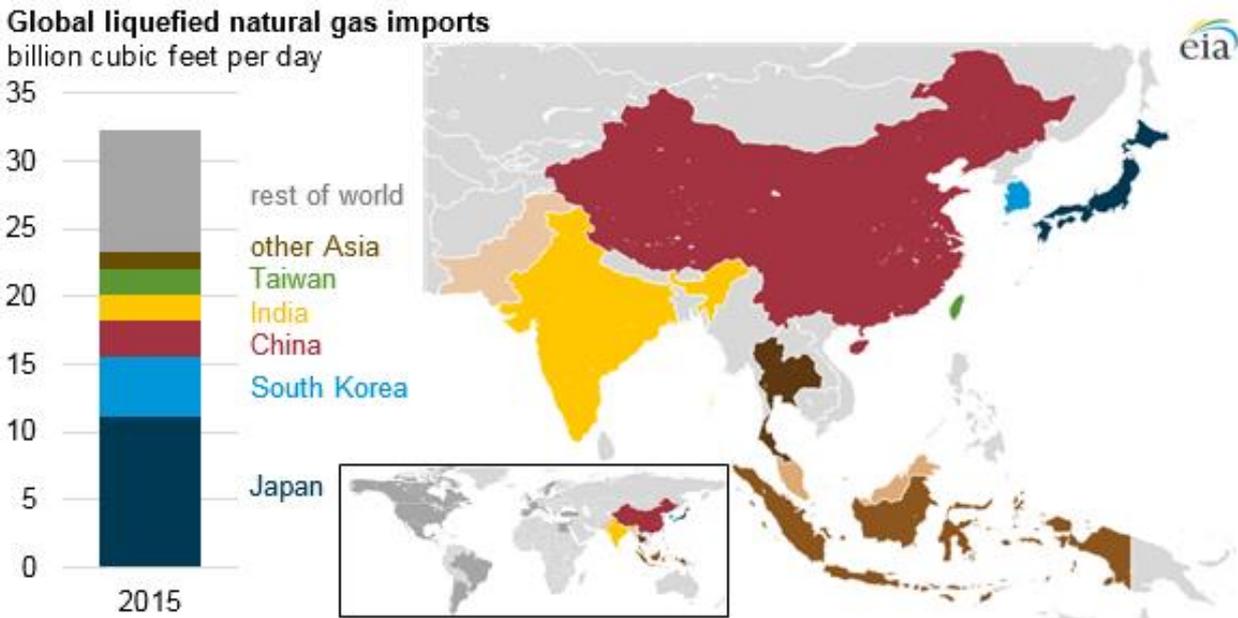
Source: Kombikraftwerk, 2014

可再生能源标签：产能市场、需求响应、电力市场、Energiewende、能源转型、2030 能源、电网、基础设施、可再生能源、智能电网、太阳能发电和风力发电

该表是否并未证明 Flassbeck 是对的以及 Energiewende 注定会失败？他肯定会把握住手中的主要挑战，是的。（但是，不要忘记给电动汽车以及电动加热器充电——并且目标为 80%，并非 100%！）他的分析产生的问题是，他表现得好像没有解决方案一样——事实上，甚至好像没有人寻找过任何解决方案。

Natural Gas (天然气)

Growing global liquefied natural gas trade could support market hub development in Asia

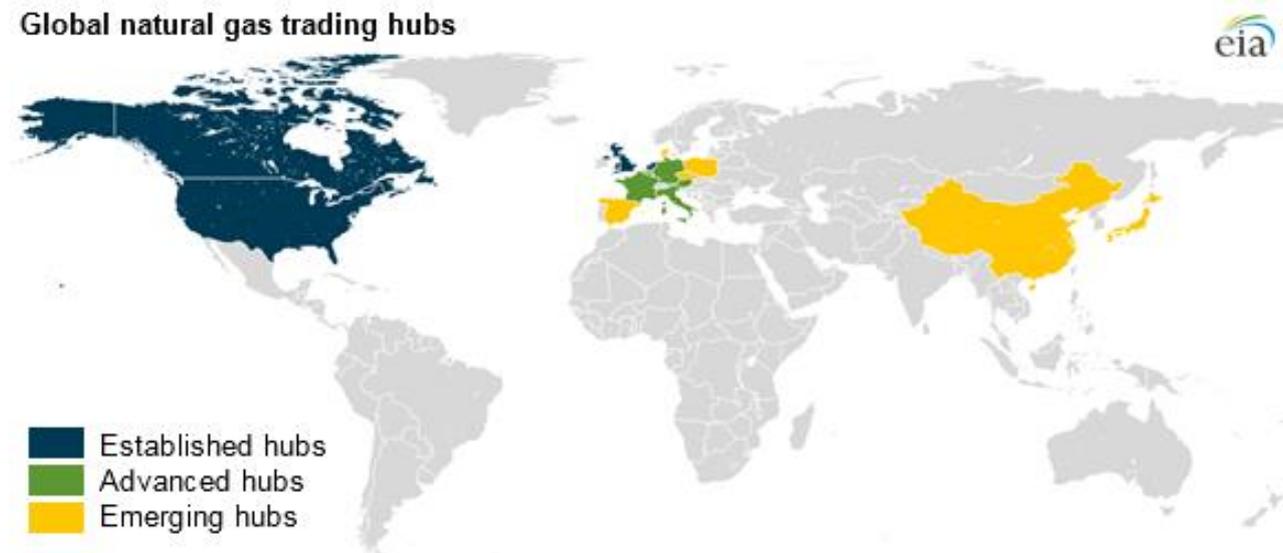


Source: U.S. Energy Information Administration, based on the International Group of Liquefied Natural Gas Importers annual report

Asia is the world’s largest consumer of liquefied natural gas (LNG), accounting for three-quarters of global LNG trade and one-third of total global natural gas trade. However, the region lacks a pricing benchmark that can reliably reflect supply and demand changes in Asia’s natural gas markets.

Natural gas market hubs, such as Louisiana’s Henry Hub or the United Kingdom’s National Balancing Point (NBP), have been a key feature of competitive gas markets in the United States and Europe. These hubs provide locations—either physical, in the case of Henry Hub, or virtual, in the case of NBP—for trading natural gas and ultimately for determining price. The most important hubs have publicly reported price indexes that are benchmarks for the value of natural gas in the larger regional market.

Currently, no location in Asia has sufficiently developed physical infrastructure or regulatory frameworks to accommodate the creation of a natural gas trading hub, but the governments of Japan, China, and Singapore are each exploring the possibility of establishing an LNG market hub. Given the emergence of the United States as a major LNG supplier and the potential impact on the structure of future LNG trade in Asia, EIA commissioned a contractor study that examines efforts to establish regional LNG trading hubs and price benchmarks in Asia and some of the inherent challenges they face.



Source: U.S. Energy Information Administration and ICF International, Inc, Perspectives on the Development of LNG Market Hubs in the Asia Pacific Region

Fully established natural gas market hubs, such as the United States' Henry Hub, have high liquidity, with a high volume of trades; open access to transport facilities; and transparent price and volume reporting, index pricing, and futures contracting. In comparison, hubs such as those in France and Italy have lower trading volumes and less liquidity in forward pricing.

While natural gas hubs in North America and Europe are pipeline-based (for example, Henry Hub is located in Louisiana, close to natural gas infrastructure on the U.S. Gulf Coast), major countries in Asia rely on LNG as the primary source of natural gas.

LNG-based hubs present a number of challenges compared to pipeline-based hubs. Pipeline hubs rely on continuous flows of natural gas, daily scheduling of receipts and deliveries, standardized natural gas specifications, uniform transportation and contracting rules, and diligent regulatory oversight. In contrast, LNG shipments can be large and difficult to store, there can be significant time between contracting and delivery, and cargoes can differ in LNG specifications. Asian LNG import terminals have limited pipeline interconnectivity and operate primarily under long-term bilateral contracts between multiple suppliers and buyers, which limits transparency, third-party access, and publically available price benchmarks.

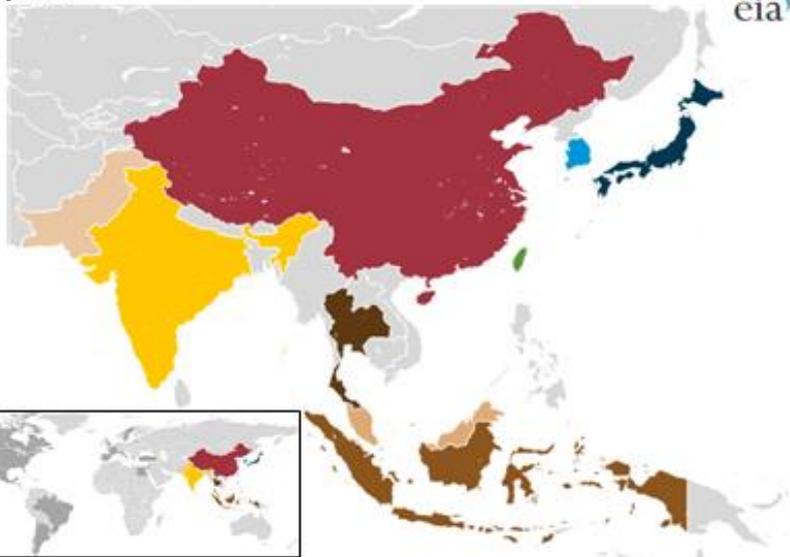
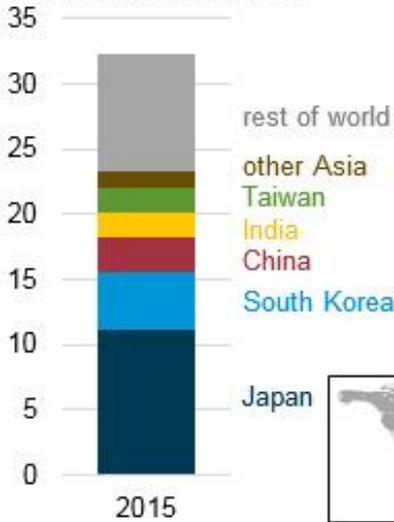
In 2016, the Japanese government developed a comprehensive strategy to liberalize its domestic natural gas market and launched major initiatives to encourage private-sector participation in the development of an LNG trading hub and a pricing index. In addition, Japan, China, and Singapore have established benchmark LNG pricing indexes.

For the next few years, LNG indexes will likely remain the most reliable indicators of natural gas market value in Asia. As existing LNG price surveys continue to improve in accuracy and increase their significance as indicators of the market price for LNG and as reliable hub-based price indexes emerge, indexes will be more reliably used to not only set the pricing for sales and purchase contracts, but also to serve as the basis for greater volumes of futures and derivatives trading.

不断增长的全球液化天然气贸易可以支持亚洲市场枢纽的发展

Global liquefied natural gas imports

billion cubic feet per day



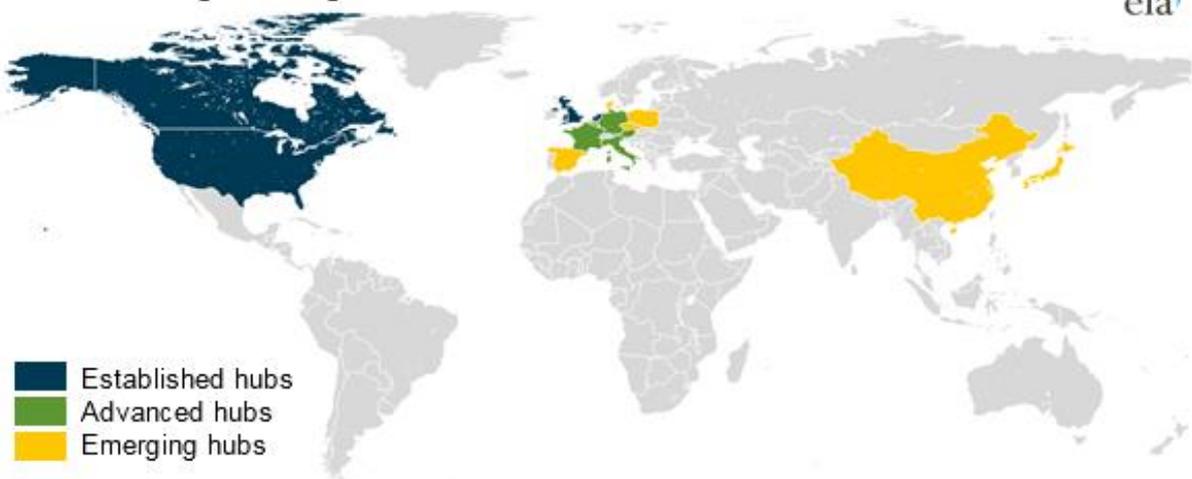
资料来源：美国能源信息管理局，根据国际液化天然气进口集团年度报告

亚洲是世界上最大的液化天然气（LNG）消费国，占全球液化天然气贸易的四分之三，占全球天然气贸易总量的三分之一。然而，该地区缺乏能够可靠反映亚洲天然气市场供需变化的定价基准。

天然气市场枢纽，如路易斯安那州的亨利枢纽或英国的国家平衡点（NBP），都是美国和欧洲竞争气体市场的一个关键要素。这些枢纽提供位置 - 在 Henry Hub 或者 NBP 的情况下是虚拟的交易天然气的最终确定价格。重要枢纽已经公开报告的价格指数是较大区域市场中天然气价值的基准。

目前，亚洲地区没有充分发展物质基础设施或监管框架来适应天然气交易中心的建设，但日本，中国和新加坡政府都在探索建立液化天然气市场枢纽的可能性。鉴于美国作为主要液化天然气供应商以及对亚洲未来液化天然气业务结构的潜在影响，EIA 委托承包商研究在亚洲建立区域液化天然气贸易中心和价格基准的努力，以及一些固有的需要面临的挑战。

Global natural gas trading hubs



资料来源：美国能源信息管理局和 ICF 国际公司，关于亚太地区液化天然气市场发展的展望

完善的天然气市场枢纽，如美国亨利中心，流动性高，交易量高；开放运输设施；透明的价格数量报告，指数定价和期货合约。相比之下，法国和意大利等中心的交易量较低，远期定价流动性也较低。

虽然北美和欧洲的天然气枢纽是以管道为基础的（例如，Henry Hub 位于路易斯安那州，靠近美国墨

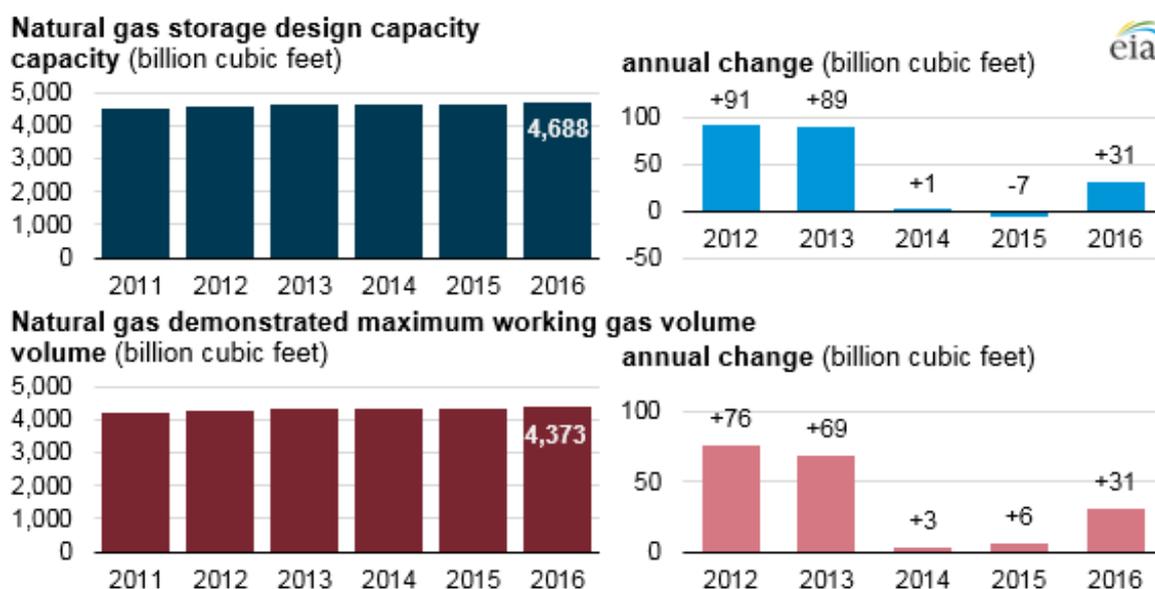
西哥湾沿岸的天然气基础设施), 亚洲主要国家依靠液化天然气作为天然气的主要来源。

与基于管道的集线器相比, 基于液化天然气的集线器面临着许多挑战。管道枢纽依靠天然气持续流动, 每天安排收货和交货, 标准化天然气规格, 统一的运输和承包规则, 以及勤勉的监管。相比之下, 液化天然气运输可能很大, 难以储存, 承包和运输之间可能有重大的时间问题, 液化天然气规格货物也会有差异。亚洲液化天然气进口码头的管道互连性有限, 主要是在多个供应商和买家之间的长期双边合同下进行, 这限制了透明度, 第三方访问和公开的价格基准。

2016年, 日本政府制定了开放国内天然气市场的综合战略, 并出台了重大举措, 鼓励私营部门参与开发液化天然气贸易中心和定价指标。此外, 日本, 中国和新加坡已经建立了基准的液化天然气定价指标。

未来几年, 液化天然气指数仍将是亚洲天然气市场价值最可靠的指标。随着现有液化天然气价格调查的准确性不断提高, 液化天然气市场价格指标的显著性提高, 以及可靠的中心价格指数出现。那么这个指数将更可靠地用于销售和采购合同定价, 也可以作为大量期货和衍生品交易的基础。

U.S. natural gas storage capacity increased slightly in 2016



Source: U.S. Energy Information Administration, Underground Natural Gas Working Storage Capacity

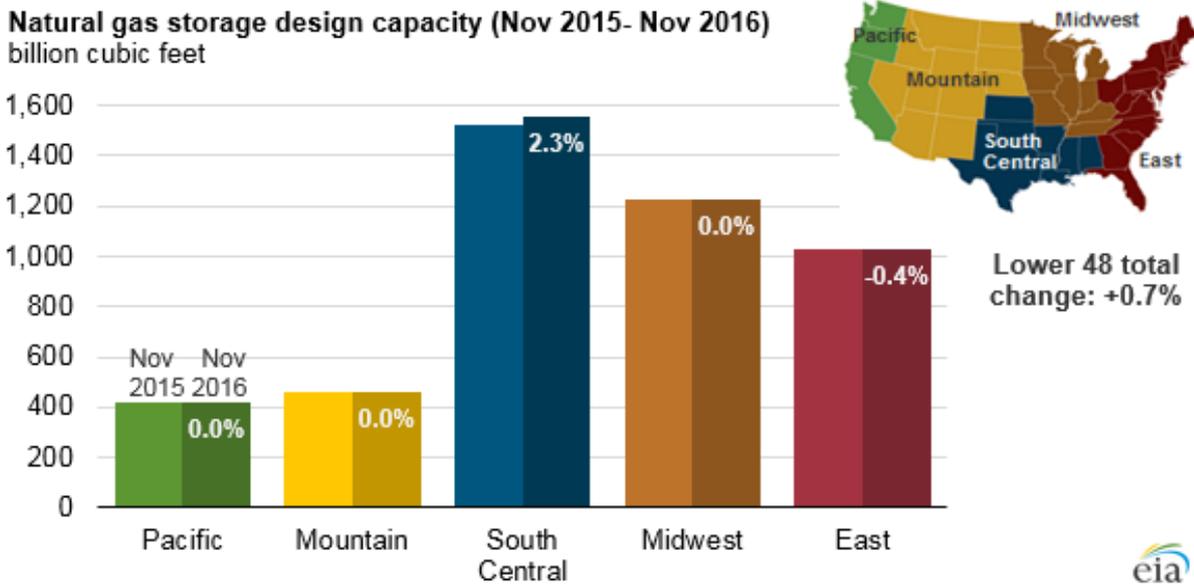
For the past three years, underground natural gas storage capacity in the Lower 48 states has changed by relatively small increments compared to the changes in 2012 and 2013. No new storage facilities have entered service since 2013, so recent annual changes in both storage design capacities and demonstrated maximum working gas volumes reflect the aggregate effect of small changes at existing facilities.

The relatively small change in natural gas storage capacity over the past three years is likely a reflection of long-term trends, such as higher levels of natural gas production, the proximity of production to consuming markets in the Northeast and Midwest, and the lower price premium for natural gas during the winter. These trends may reduce reliance on storage as a source of supply during periods of elevated demand, such as during cold winter months.

EIA has published updated estimates of storage capacity based on data for the end of November, which is approximately when storage levels have reached their highest points for the year. EIA uses two distinct measures

of natural gas storage capacity: design capacity and demonstrated working natural gas volume.

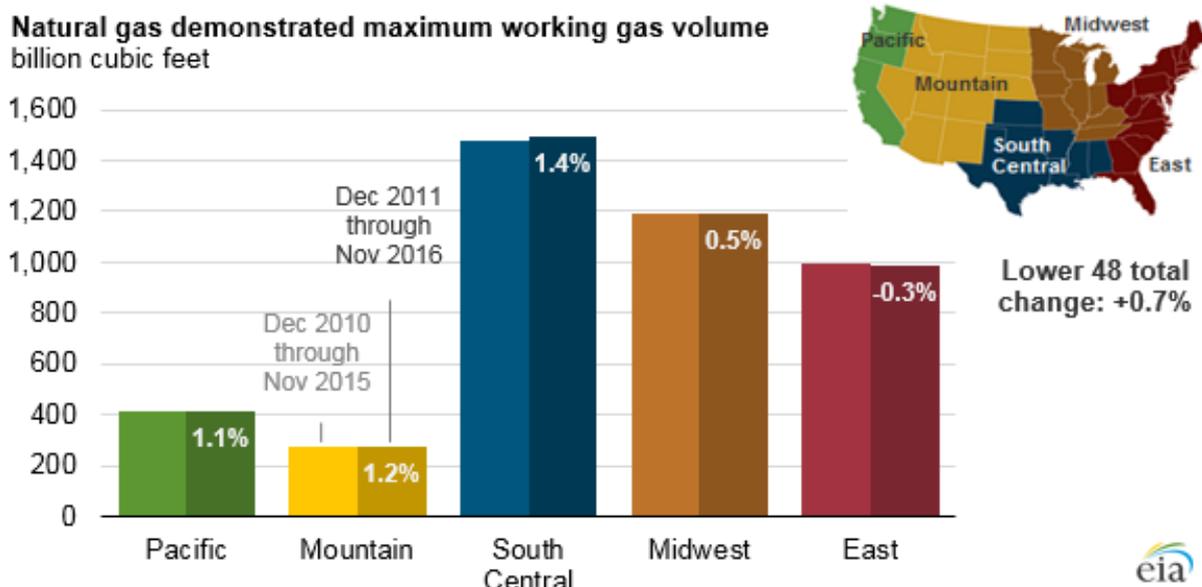
Design capacity is the sum of the 385 active storage fields' working gas design capacity, as of November 2016, as reported in EIA's Underground Natural Gas Working Storage Capacity. Design capacity is based on the physical characteristics of the reservoir, installed equipment, and operating procedures particular to the site that are often certified by federal or state regulators. Design capacity increased slightly, growing 0.7%, from 4,658 billion cubic feet (Bcf) in November 2015 to 4,688 Bcf in November 2016. This increase resulted from a combination of expansions at existing facilities, reclassifications from base gas to working gas, and the restoration of an inactive facility to service.



Source: U.S. Energy Information Administration, Underground Natural Gas Working Storage Capacity

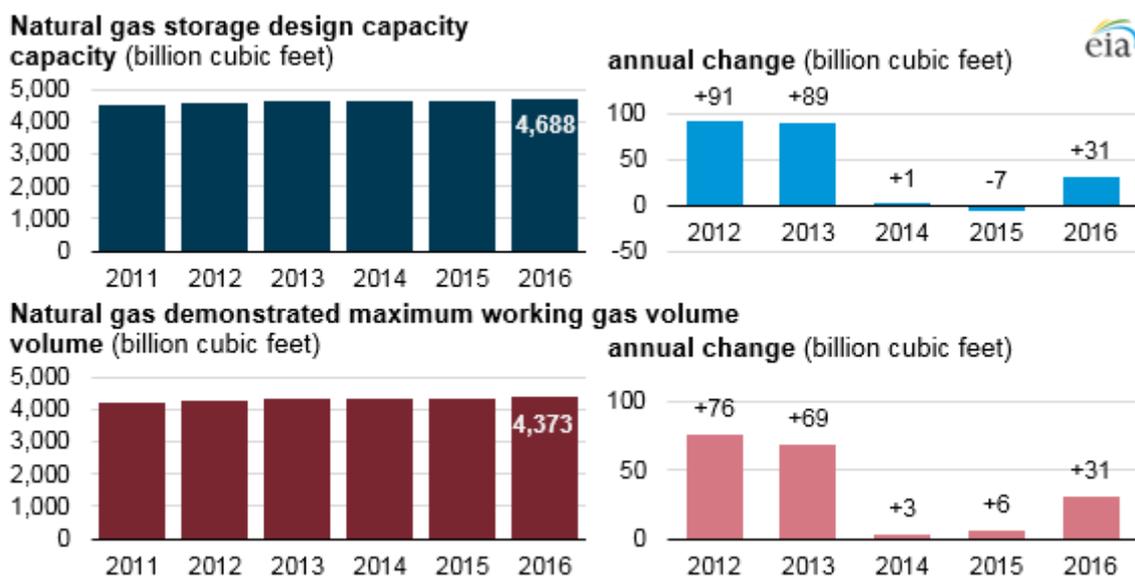
Demonstrated maximum working gas volume is the sum of peak volumes reported by the 385 active storage facilities in the Lower 48 states, regardless of when the individual field-level peaks occurred over the five-year (60-month) reporting period ending November 2016. In the graphic below, this measure is compared to the five-year period ending November 2015. In the Lower 48 states, the demonstrated maximum working gas volume grew by 0.7%, from 4,342 Bcf in 2015 to 4,373 Bcf in 2016.

Demonstrated maximum working gas volumes can be affected by short-term circumstances. For example, the 2016 injection season started with very high levels largely because of the mild winter of 2015–16. These injections led to all-time high storage levels in November, at the beginning of the most recent withdrawal season. As a result, many storage facilities reached new demonstrated maximums in 2016.



Source: U.S. Energy Information Administration, Underground Natural Gas Working Storage Capacity

美国 2016 年天然气储存量略有增加



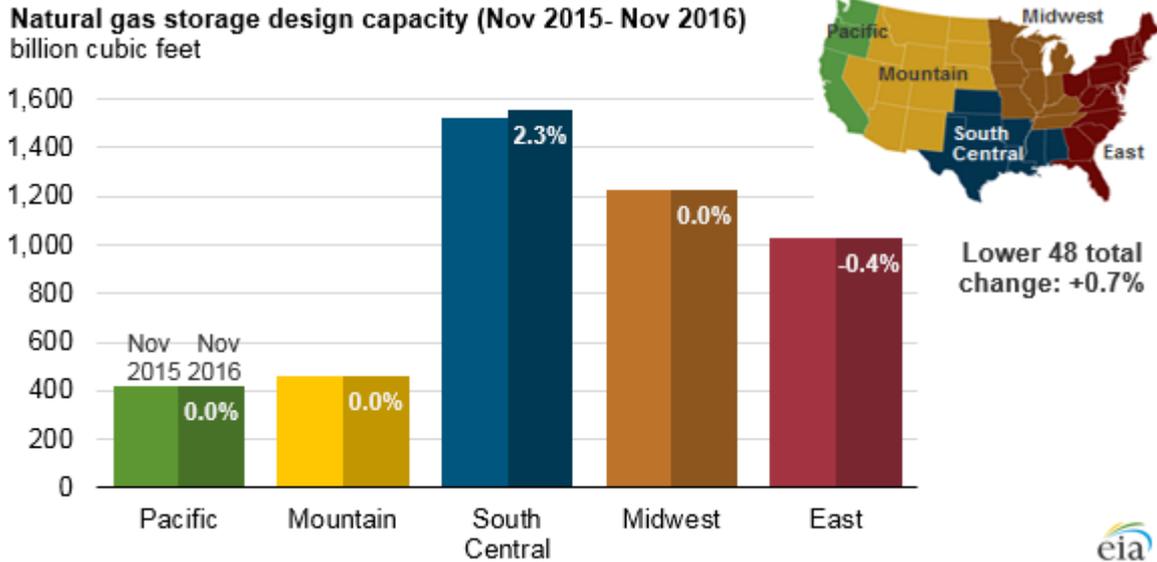
资料来源：美国能源信息管理局，地下天然气工作存储容量

过去三年来，与 2012 年和 2013 年的变化相比，48 个州下游的地下天然气储存容量发生了相对较小的增长。自 2013 年以来，没有新的储存设施投入使用，所以存储设计能力近来的年度变化并表明最大工作气体量反映了现有设施的小变化的总体影响。

过去三年天然气储存量相对较小的变化可能反映了长期趋势，如天然气产量上升，东北及中西部地区生产与消费市场的接近，以及较低的价格冬季天然气费用。这些趋势可能会降低对储存作为供应来源的依赖，例如在寒冷的冬季期间。

根据 11 月份的数据，环境影响评估已经发布了最新的存储容量估算值，这大概是当存储量达到今年的最高点时。环境影响评估采用两种不同的天然气储量测量方法：设计能力和工作天然气量。

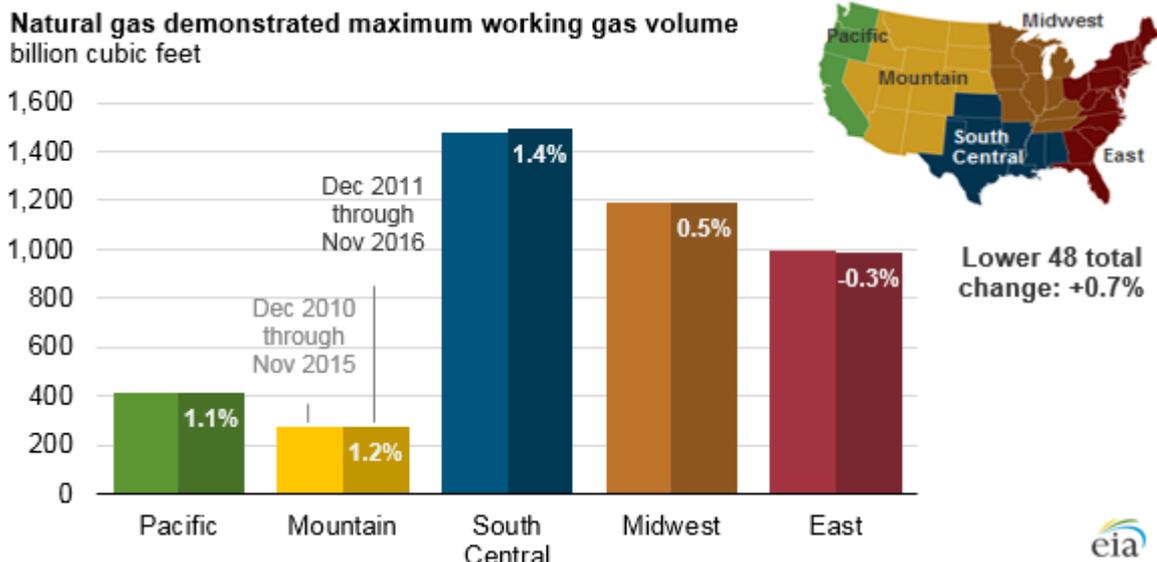
根据 EIA 的地下天然气工作存储容量报告，截至 2016 年 11 月，设计能力是 385 个主动存储领域的工作气体设计能力的总和。设计能力基于水库的物理特性，安装的设备以及通常由联邦或州监管机构认证的场地特有的操作程序。设计能力略有上升，从 2015 年 11 月的 46580 亿立方英尺,上升到 2016 年 11 月的 46880 亿立方英尺，增长了 0.7%。这一增加是由于现有设施的扩建，基础气体到工作气体的重新分类，以及恢复一个不活动的服务设施。



资料来源：美国能源信息管理局，地下天然气工作存储容量

最高工作气体量是截至 2016 年 11 月底的五年（60 个月）报告期内，48 个州的 385 个活跃仓储设施报告的峰值总量的总和。在下图中，将该措施与截至 2015 年 11 月的五年期间进行比较。在 48 个州中，最高工作气体量显示量从 2015 年的 43420 亿立方英尺，至 2016 年的 43730 亿立方英尺，增长了 0.7%。

最高工作气体量是截至 2016 年 11 月底的五年（60 个月）报告期内，48 个州的 385 个活跃仓储设施报告的峰值总量的总和。在下图中，将该措施与截至 2015 年 11 月的五年期间进行比较。在 48 个州中，最高工作气体量显示量从 2015 年的 43420 亿立方英尺，至 2016 年的 43730 亿立方英尺，增长了 0.7%。



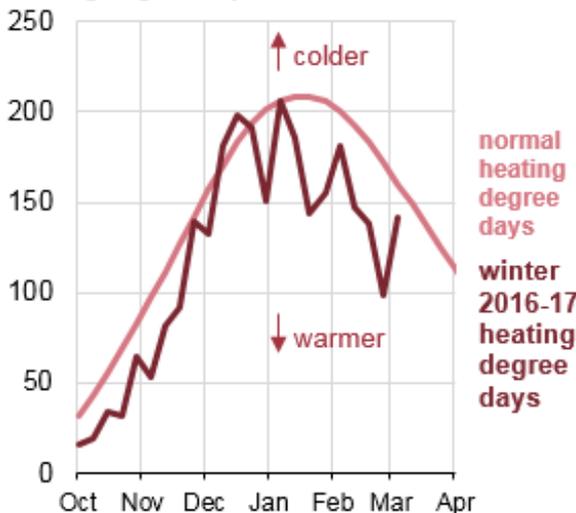
资料来源：美国能源信息管理局，地下天然气工作存储容量

Warm weather leads to first recorded natural gas

storage injection in February

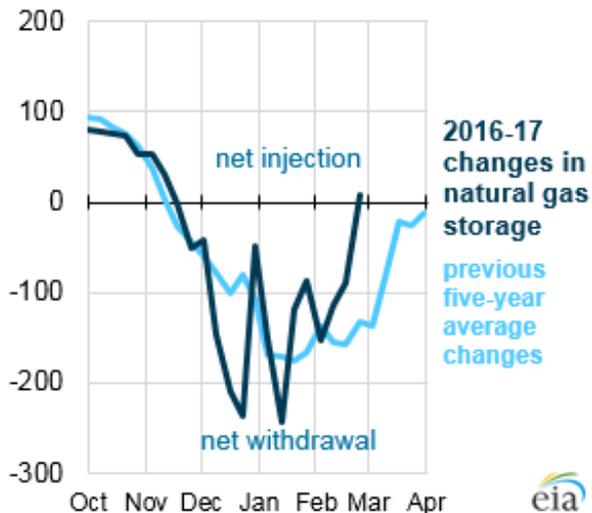
U.S. heating degree days

heating degree days



Weekly changes in natural gas storage

billion cubic feet



Source: U.S. Energy Information Administration, Weekly Natural Gas Storage Report and National Oceanic and Atmospheric Administration, Climate Prediction Center

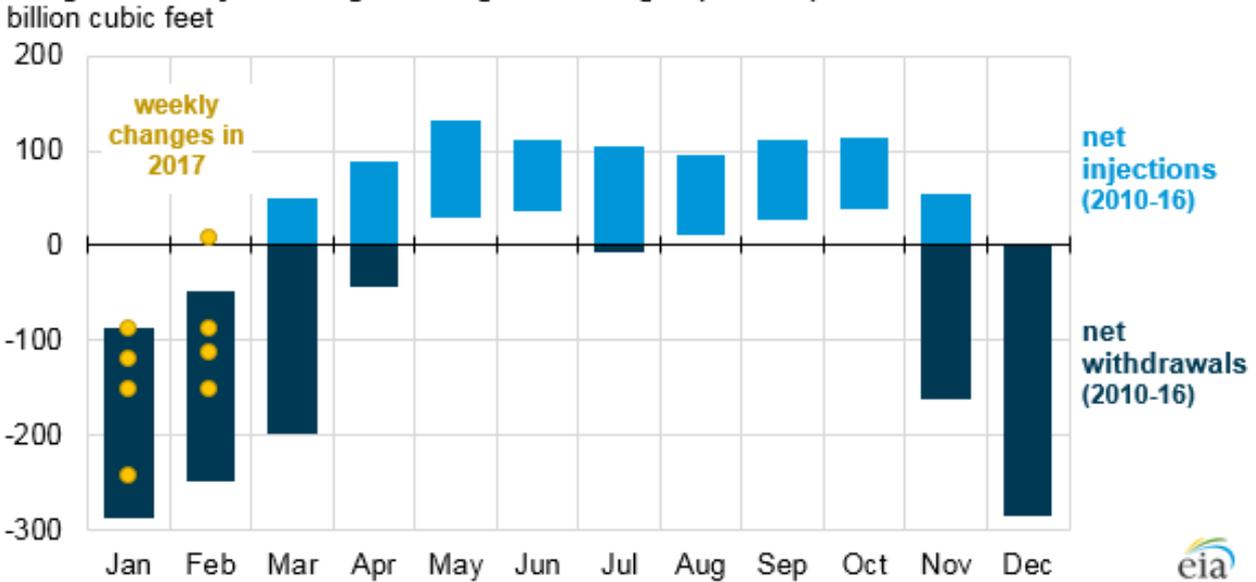
Warmer than normal weather throughout much of the United States resulted in the first recorded net natural gas injection during a week in February since weekly storage data has been collected. For the week ending February 24, the amount of natural gas in storage in the Lower 48 states increased 7 billion cubic feet (Bcf). While some weeks during March in previous years had recorded injections, net injections of natural gas into storage do not typically occur until at least April.

Weekly changes in natural gas storage reflect changes in natural gas consumption, production, and, to a lesser extent, trade. Natural gas consumption is particularly sensitive to fluctuations in weather. Not only is natural gas consumed directly by furnaces and boilers in homes and businesses for heating, but natural gas is also used to generate electricity, which then fuels electric heat pumps and radiant heaters.

Temperatures throughout much of the United States have been higher than normal for many weeks this winter. Heating degree days are a standard index of heating needs that are calculated based on deviations relative to a base temperature of 65 degrees Fahrenheit, and higher numbers of heating degree days reflect colder weather. For the week ending February 25, there were only 98 population-weighted heating degree days for the United States as a whole—a level more typical of mid-April weather. Based on normal weather data for 1971–2000, heating degree days would normally be near 172 for the week ending February 25. Temperatures were especially warm in the Northeast and Midwest, where natural gas heating is common.

The net injection of 7 Bcf during the week ending February 24, 2017, was extremely rare. Based on data from 2010–16, weekly changes during the month of February ranged from a net withdrawal of 48 Bcf to a net withdrawal of 243 Bcf. Previously, the earliest net injection of the calendar year occurred during the week ending March 16, 2012.

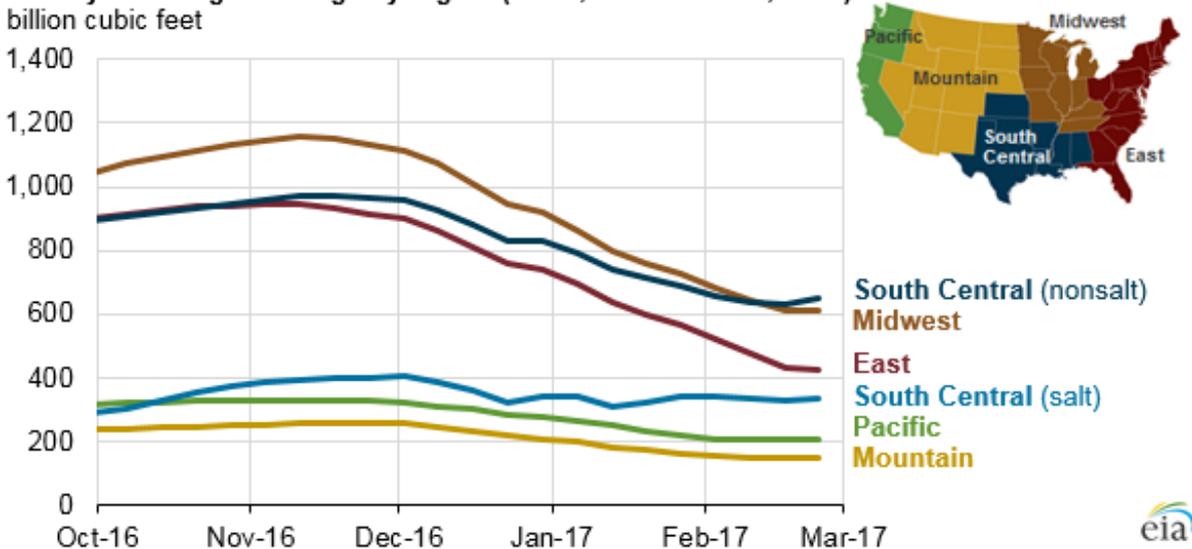
Range of weekly natural gas storage net changes (2010-17)



Source: U.S. Energy Information Administration, Weekly Natural Gas Storage Report

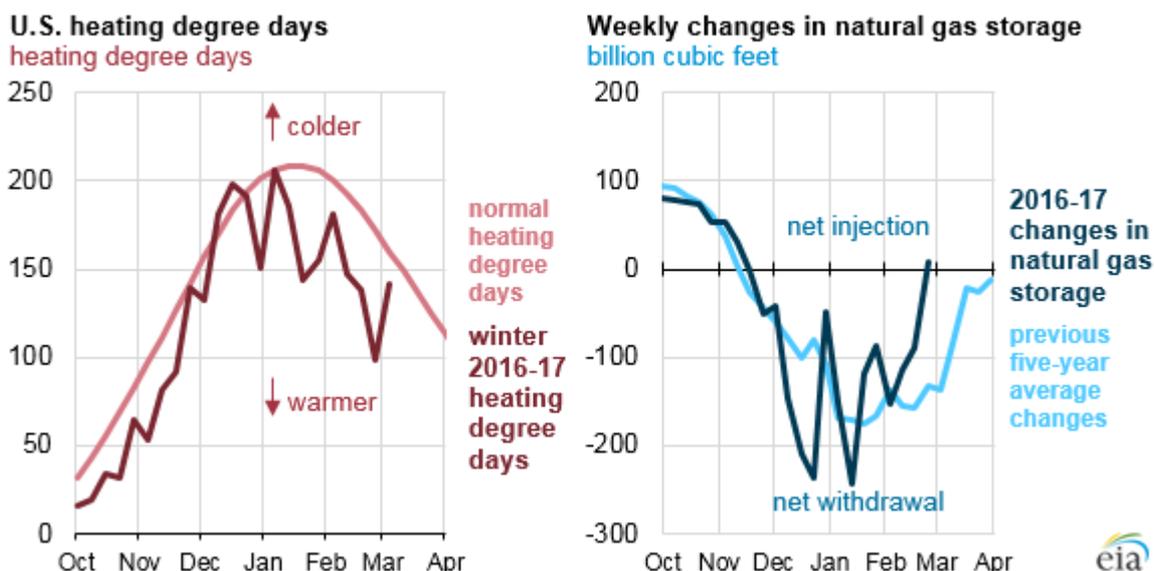
In the week ending February 24, natural gas injections in the South Central region offset unseasonably low withdrawals in other regions. In EIA’s Weekly Natural Gas Storage Report, the South Central region is split into salt and nonsalt (depleted reservoir) facilities. The amount of natural gas stored in South Central nonsalt facilities increased by 16 Bcf and in South Central salt facilities by 5 Bcf. After that injection, natural gas storage levels totaled 2,363 Bcf, or about 300 Bcf more than the previous five-year average for that week (2012–16). EIA’s latest Short-Term Energy Outlook expects natural gas storage levels to fall to 2,121 Bcf by the end of March, or about 335 Bcf higher than the previous five-year average.

Weekly natural gas storage by region (Oct 1, 2016 - Feb 24, 2017)



Source: U.S. Energy Information Administration, Weekly Natural Gas Storage Report

温暖的天气导致二月份天然气储存注入量首次创纪录



资料来源：美国能源信息管理局，每周天然气储存报告和国家海洋和大气管理局气候预测中心

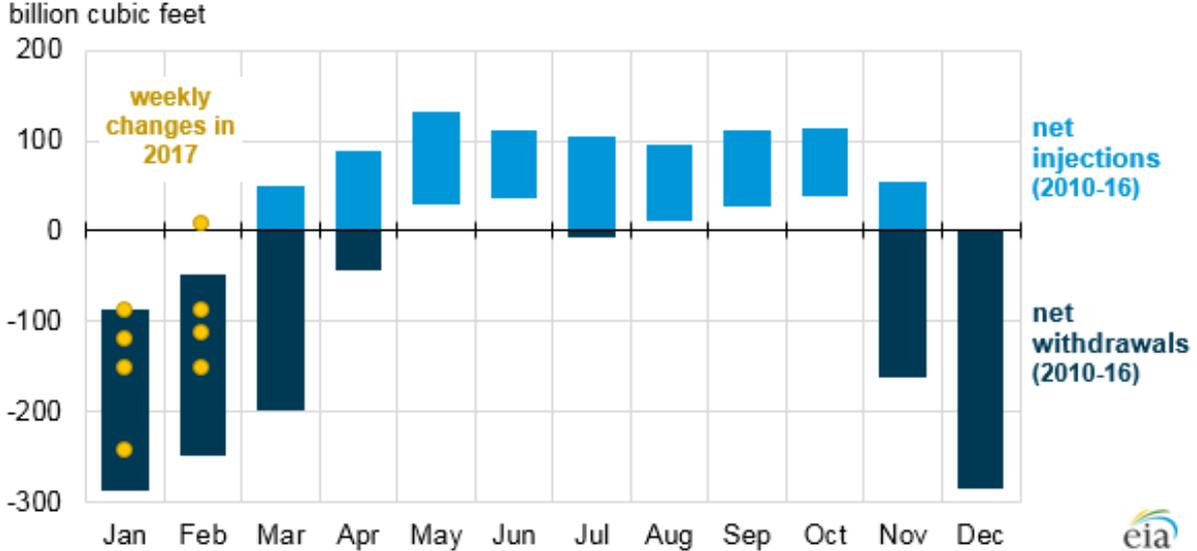
美国大部分地区的天气比正常天气暖和，因为每周的储存数据已被收集，在二月份的一个星期内，天然气净注入量首次录入。截至二月二十四日的一周，本土 48 州的天然气储量增加了 70 亿立方英尺。虽然在过去几年，是 3 月份的几个星期创注入记录，天然气进入储存的净注入量通常直到 4 月才会发生。

天然气储存的每周变化反映了天然气消费，生产以及在较小程度上的贸易变化。天然气消费对天气波动特别敏感。不仅天然气直接由家庭和企业的炉子和锅炉供暖，也会被用于发电、燃料电热泵和辐射加热器。

美国大部分地区的气温，在今年冬季已经高于正常水平。加热度天数是根据相对于基础温度为华氏 65 度的偏差计算的加热需求的标准指数，较高的加热度天数反映较冷的天气。截至 2 月 25 日的一周，美国整体人口加权加热度日数只有 98 人，比四月中旬天气更为典型。根据 1971 - 2000 年的正常天气数据，截至二月二十五日的一周，加热度天数一般会接近 172 点。东北和中西部地区的气温特别暖和，那里天然气采暖十分普遍。

在 2017 年 2 月 24 日结束的一周内，净注入量 70 亿立方英尺是非常罕见的。根据 2010 - 16 年度的数据，二月份的每周变化范围从净收益率为 480 亿立方英尺，净额为 2430 亿立方英尺。以前，日历年的最早净注入是在截至 2012 年 3 月 16 日的一周内发生的。

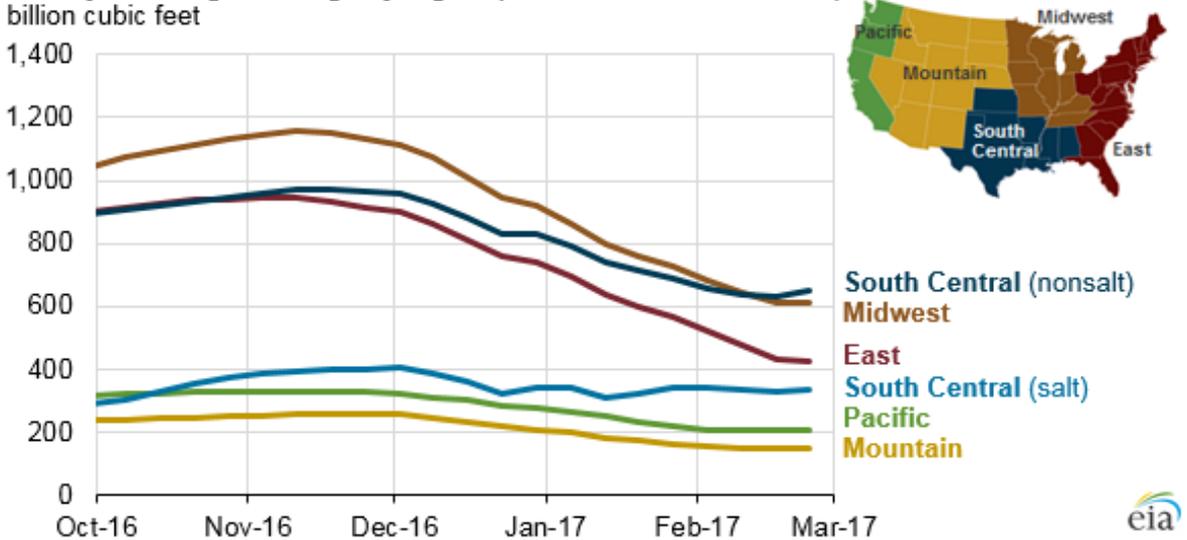
Range of weekly natural gas storage net changes (2010-17)



资料来源：美国能源信息管理局每周天然气储存报告

截至二月二十四日的一周，南中部地区的天然气注入抵消了其他地区的不合时宜的采购。在“环境影响评估周刊天气储存报告”中，南中部地区分为盐和非咸水库（耗水库）。南中非核设施储存的天然气量增加了 160 亿立方英尺，南中盐设施增加了 50 亿立方英尺。注射后，天然气储存水平为 23630 亿立方英尺，约比本周前五年平均水平上高出约 3000 亿立方英尺（2012-16）。EIA 最新的短期能源展望预计到 3 月底天然气储量将下降至 21210 亿立方英尺，比前五年平均水平高约 3350 亿立方英尺。

Weekly natural gas storage by region (Oct 1, 2016 - Feb 24, 2017)



资料来源：美国能源信息管理局每周天然气储存报告

World's 2nd Largest LNG Importer to Boost Consumption

The two leading candidates in next month's presidential election in South Korea are vowing to scale back the

country's reliance on nuclear energy and coal imports, while boosting the use of LNG and renewables in a bid to address concerns over nuclear safety and environmental pollution.

South Korea is holding a presidential election on May 9 to elect a president to replace Park Geun-hye, who was impeached by Parliament late last year and ousted from office in March when the Constitutional Court upheld the Parliament's decision.

With the presidential election in less than a month, policy advisors for the two frontrunners in the vote have outlined plans to reduce South Korea's dependence on nuclear power generation and coal imports and promote renewables and additional rise in LNG imports to support renewable energy growth.

The two main contenders in the presidential race are left-leaning front-runner Moon Jae-In and centrist Ahn Cheol-soo.

Kim Jwa-kwan, head of Moon's energy policy team, said at a forum, as quoted by Reuters:

“We should move away from coal and nuclear power, and shift to clean or renewable energy-based platforms.”

South Korea, currently the world's second-largest LNG importer after Japan, generated 39 percent of its electricity in 2015 from coal, 31 percent from nuclear power, and 19 percent from natural gas, with the remaining part coming from oil and renewables.

Moon plans LNG's share of the power supply to grow to 37 percent by 2030 to support renewables growth, while nuclear and coal-fired generation to account for 18 percent and 15 percent, respectively. The liberal candidate is also vowing to scrap plans for construction of reactors that started last year and to rethink the nuclear power expansion plans

According to the World Nuclear Association, South Korea's current plans include increasing its nuclear capacity by 70 percent to 38 GWe by 2029.

The other leading candidate in the presidential race, Ahn, is also targeting reduction of coal-fired and nuclear power generation.

Both Ahn and Moon want renewables to account for 20 percent of South Korea's power supply by 2030.

世界第二大液化天然气进口国计划促进消费

下个月在南韩举行总统选举的两位主要候选人正在誓言缩小国家对核能和煤炭进口的依赖，同时推动 LNG 和可再生能源的利用，以解决对核安全和环境污染问题的关切。

韩国 5 月 9 日正在举行总统选举，选举总统取代去年年底被议会弹劾的朴槿惠，她于 3 月当宪法法院维持议会的决定时撤职。

在总统选举不到一个月的时间里，两位执行主席的政策顾问都提出了减少南韩对核能发电和煤炭进口依赖的计划，并推动可再生能源和液化天然气进口的额外增长，以支持可再生能源的增长。

总统竞选的两个主要竞争者是左倾先锋文在寅和中立者安哲秀。

路透社引用了文在寅能源政策小组的组长金正宽在一次论坛上的说话：

“我们应该放弃煤炭和核电，并转向清洁或可再生能源平台。”目前，韩国是日本之后世界第二大液化天然气进口国，2015 年煤炭占 39%，核电占 31%，天然气占 19%，其余部分来自石油和可再生能源。

文在寅计划液化天然气在 2030 年之前的电力份额将增长到 37%，以支持可再生能源的增长，核能和燃煤发电量分别占 18% 和 15%。自由派候选人也誓言废除去年开始建设反应堆的计划，重新考虑核电扩张计划

根据世界核协会的数据，韩国目前的计划包括到 2029 年将核能容量提高 70%，达到 38 GWe。

另一位主要总统候选人安哲秀的目标也是为了减少燃煤和核能发电。

安哲秀和文在寅都希望可再生能源在 2030 年前占到韩国电力供应的 20%。

China develops LNG operating fleet

Cosco Shipping Heavy Industry Co and Wärtsilä have developed a concept for a liquefied natural gas (LNG) operating fleet comprising barges and a pusher tug. Together they have gained approval in principle certification from Lloyd's Register (LR).

The concept fleet includes a pusher tug that could be LNG-fuelled, an LNG storage barge, an LNG regasification barge, and a floating liquefaction natural gas barge. The pusher tug can be used to transport the three barges once they are all built.

The development project was conducted under the terms of a memorandum of understanding that was signed in June 2016 between the three companies. They expect the LNG fleet would be competitive in capital and operating expenditure terms. A key element of this is using the pusher tug to ensure the three barges are mobile and transportable.

The concept fleet can be used for LNG transportation in shallow waters, using the tug to push an LNG barge. Or as a mobile platform for production of LNG from offshore or remote natural gas resources. The fleet vessels could include Wärtsilä dual-fuel engines and steerable thrusters, gas storage and supply systems, liquefaction and regasification modules and an LNG cargo handling system.

The design and engineering included development of the hinge joint, mooring arrangement, plus ship-type and seakeeping analysis. Wärtsilä Marine Solutions director of business development in South East Asia Sanjay Verma said the joint venture is ready to take the concept another step forward in creating an optimal LNG supply chain. He added: "This is a new and innovative fleet concept that is designed to create better efficiencies for companies involved in any part of the natural gas supply chain."

Cosco Shipping Heavy Industry Co general manager for technical research and development, Zhao Zhijian said: "This natural gas operating fleet concept is a new and exciting development, which should bring extensive customer benefits. We will continue to focus on LNG-related business, and extend its market influence, research and development for LNG projects."

LR general manager for the Shanghai technical support office Wei Ying said the class society completed a preliminary hazard identification study for this innovative design concept. He added: "This study covered the fuel gas supply system, the transfer of LNG between the vessels, as well as the mooring arrangement of the fleet. As a result, the approval in principle certificate has been issued."

中国开发 LNG 运营舰队

中远航运重工有限公司和瓦来兰已经开发出了一种液化天然气（LNG）运营舰队的概念，包括驳船和推进拖船。他们一起获得劳氏船级社（LR）的标准认证。

概念车队包括可以使用液化天然气的推进拖船，液化天然气储存驳船，液化天然气再加注驳船和浮动液化天然气驳船。一旦推进拖船建成可用于运输三艘驳船。

发展项目是根据三家公司于 2016 年 6 月签署的谅解备忘录进行的。他们预计液化天然气车队将在资本和运营支出方面具有竞争力。其中一个关键因素是使用推进拖船来确保三艘驳船是可移动和可运输的。

该概念车队可用于浅水中的 LNG 运输，使用拖船推动液化天然气驳船。或作为从海上或远程天然气资源生产液化天然气的移动平台。舰队船只可包括 Wärtsilä 双燃料发动机和可控推进器，气体储存和供应系统，液化和再气化模块以及 LNG 货物处理系统。

设计和工程包括铰链接头的开发、系泊安排、船型和隔震分析。Wärtsilä Marine Solutions 东南亚业务

发展总监 Sanjay Verma 表示，这家合资企业已经准备好在创造最佳液化天然气供应链的同时向前迈进。他补充说：“这是一个新的和创新的车队概念，旨在为参与任何天然气供应链的公司创造更高的效率。”

中远航运重工业技术研发总经理赵志坚说：“这种天然气运营车队概念是一个新的，令人兴奋的发展，应该带来广泛的客户利益。我们将继续关注液化天然气业务，扩大市场影响力，研发 LNG 项目。”

上海技术支援办公室总经理魏莹表示，阶级社会对这一创新设计理念进行了初步的危害识别研究。他补充说：“这项研究涵盖了燃气供应系统，LNG 船舶之间的转移以及舰队的系泊安排。因此，原产地证书已经发放。”

Georgia to completely switch to gas supply from Azerbaijan

Georgia will refuse to purchase natural gas from Russia's Gazprom, the Business Georgia portal reported citing Georgian Energy Minister Kakha Kaladze.

He said that no deals will be concluded to purchase Russian gas until late 2017.

“Since April 2017, Georgia will completely switch to supplying the population and enterprises with gas from Azerbaijan,” the report said. “Azerbaijan's state oil company SOCAR and the consortium for the development of the Shah Deniz gas condensate field are the suppliers of gas to Georgia. Thus, the share of Russian gas in the total volume of imports will amount to four percent.”

In January-March 2017, the volume of Georgia's purchases of natural gas from Russia amounted to 100 million cubic meters, according to the Georgian Energy Ministry.

The Ministry also estimated the projected volumes of gas supplies to Georgia.

This year, Georgia will receive 2.457 billion cubic meters of gas, of which deliveries from Azerbaijan will amount to 2.347 billion cubic meters of gas (95.5 percent).

In 2017, the volume of gas produced in Georgia will amount to 10 million cubic meters.

Georgia stopped importing gas from Russia in 2007. Since then, Azerbaijan has become the key supplier of gas to Georgia, thus decreasing Georgia's dependence on Russian gas. Azerbaijan supplies Georgia with natural gas from the Shah Deniz field via the Hajigabul-Gardabani pipeline. The second way carrying gas to Georgian consumers is the Baku-Tbilisi-Erzurum (South Caucasus) Pipeline, through which the gas from the first stage of the Shah Deniz field is supplied to Georgia and a large proportion goes through its territory to Turkey.

Georgia receives 10 percent of the Russian gas transited to Armenia as payment for transiting via its territory. In 2016, the extension of the contract was delayed until April, since Gazprom insisted on monetary payment for transit.

Under the agreement reached between the Georgian Energy Minister and Gazprom company at the end of 2016, starting from 2017, Georgia will be paid for gas transit to Armenia in cash. Besides, Georgia will be receiving gas from Russia for \$185 per 1,000 cubic meters instead of \$215.

格鲁吉亚完全转向阿塞拜疆寻求天然气供应

乔治亚州格鲁吉亚企业门户网站报道援引格鲁吉亚能源部长卡卡拉泽（Kakha Kaladze）说，格鲁吉亚将拒绝从俄罗斯天然气工业公司购买天然气。

他表示，到 2017 年底才能完成购买俄罗斯天然气的交易。

报告说：“自 2017 年 4 月以来，格鲁吉亚将全面转向向人口和企业提供阿塞拜疆天然气。阿塞拜疆的国有石油公司 SOCAR 和 Shah Deniz 气体凝析油田开发的联盟是向格鲁吉亚提供天然气的供应商。因此，俄罗斯天然气在进口总额中的份额将达到 4%。”

根据格鲁吉亚能源部的数据，2017 年 1 月至 3 月，格鲁吉亚从俄罗斯采购天然气的数量达到 1 亿立方米。

该部还估计预计向格鲁吉亚提供的天然气供应量。

今年格鲁吉亚将接收 24.57 亿立方米的天然气，其中阿塞拜疆的交付量为 23.47 亿立方米（95.5%）。

2017 年，格鲁吉亚生产的天然气达 1000 万立方米。

格鲁吉亚于 2007 年停止从俄罗斯进口天然气。此后，阿塞拜疆已成为格鲁吉亚天然气的主要供应国，从而减少了格鲁吉亚对俄罗斯天然气的依赖。阿塞拜疆通过哈吉格 - 加拉巴尼管道向沙阿尼兹地区向格鲁吉亚提供天然气。向格鲁吉亚消费者运送气体的第二种方式是巴库 - 第比利斯 - 埃尔祖鲁姆（南高加索）管道，沙阿尼兹地区第一阶段的天然气供应给格鲁吉亚，大部分地区通过其领土到土耳其。

格鲁吉亚得到俄罗斯天然气的 10% 转运到亚美尼亚，作为通过其领土过境的付款。由于俄罗斯天然气工业股份公司坚持过境货币支付，2016 年合约延期延迟至四月。

根据格鲁吉亚能源部长和俄罗斯天然气工业公司在 2016 年底达成的协议，从 2017 年开始，格鲁吉亚将以现金支付向亚美尼亚的天然气转运。此外，格鲁吉亚将以每 1000 立方米 185 美元收取俄罗斯天然气，而不是 215 美元。

Minerals (矿产)

Shandong Gold seals \$960m deal for 50% stake in Argentina mine

Shanghai-listed Shandong Gold Mining has sealed a \$960m deal for a 50 per cent stake in Barrick Gold's Valedero gold mine in Argentina.

Barrick also said in a statement that the two companies would form a working group to explore the Pascua-Lama deposit in Argentina.

Reuters reported earlier that a deal between Shandong Gold and New York-listed Barrick was near completion, and that previous discussions between Barrick and another Chinese company, Zijin Mining Group, had fallen apart.

The deal adds to the list of mining-related transactions leading China's outbound investment drive this year. Industry insiders have noted that mining and material acquisitions have been deemed safer bets during a time when China's regulators are scrutinising cross-border transactions.

The largest Chinese buyouts in 2017 have been in the materials industry. In the first three months of the year, Wang Tai Holdings purchased two iron mine interests in Mongolia for a combined \$5.5bn, including debt. Yan Kuang Group bought a coal mine from Rio Tinto for about \$2.5bn.

Citi was the sole advisor for Shandong Gold. Barrick was advised by CIBC World Markets.

山东黄金 9.6 亿美元收购巴理克旗下金矿 50% 股权

沪市上市公司山东黄金矿业股份有限公司(Shandong Gold Mining)与巴里克黄金公司(Barrick Gold)完成了一项规模达 9.6 亿美元的交易，买入了后者持有的阿根廷贝拉德罗(Valeadero)金矿 50%的股权。

巴里克还在一份声明中表示，两家公司将组成一个工作组，共同勘探阿根廷的 Pascua-Lama 矿床。

路透社(Reuters)早些时候报道称，山东黄金与在纽约上市的巴里克之间的交易已接近完成，此前巴里克和另一家中国公司紫金矿业(Zijin Mining Group)之间的谈判已破裂。

这是又一笔引领中资企业对外投资的、发生在矿业领域的交易。业内人士指出，在中国监管机构审查跨境交易之际，矿业与材料行业的收购被视为更安全的押注。

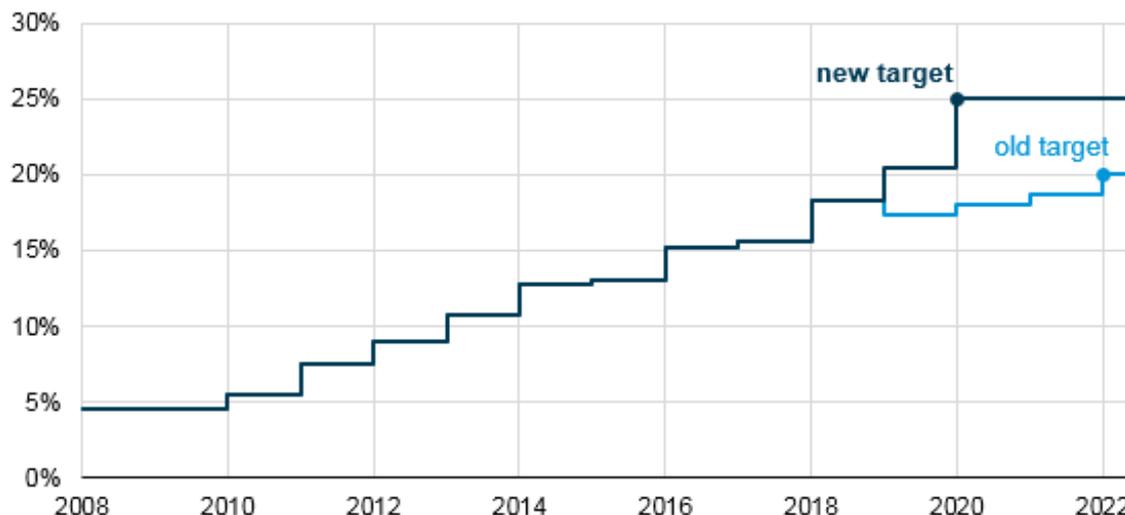
2017 年最大的中资企业收购案发生在材料行业。今年第一季度，宏太控股有限公司(Wang Tai Holdings)总共斥资 55 亿美元，收购了蒙古国两处铁矿的权益，并承担后者的债务。兖矿集团(Yan Kuang Group)以约 25 亿美元向力拓(Rio Tinto)收购了一处煤矿。

在此次交易中，花旗(Citi)是山东黄金的独家顾问，CIBC World Markets 为巴里克提供咨询服务。

Clean Energy (清洁能源)

Maryland increases renewable portfolio standard target to 25% by 2020

Maryland renewable portfolio standards targets
percent of retail electricity sales



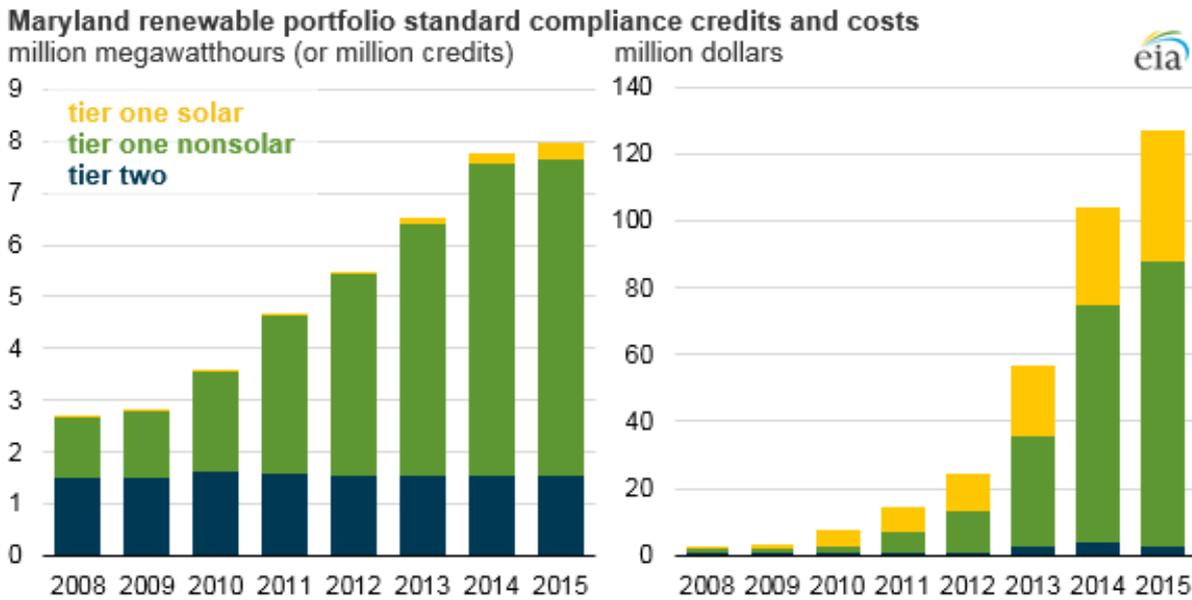
Source: U.S. Energy Information Administration, based on Maryland's Clean Energy Jobs Act (House Bill 1106)

This February, Maryland increased the renewables generation target in its renewable portfolio standard (RPS) to 25% of retail electricity sales by 2020, replacing the earlier target of 20% by 2022. The change occurred as legislators in both houses of the state's General Assembly voted to override the governor's veto of legislation they had first passed in 2016.

The Maryland RPS is divided into two tiers. Tier one includes electricity generated from solar, wind, biomass, geothermal, fuel cells, ocean, small hydro, as well as some qualified waste technologies. Tier one also includes

two technology specific targets (or set-asides). The solar generation set-aside, which was included in the state’s previous RPS, now ramps up to 2.5% of sales by 2020. The set-aside for offshore wind has not been determined yet, but will be set by the Maryland Public Service Commission starting in 2017 and will be no more than 2.5% of sales. Hydroelectric generation can be used to meet tier two requirements, which are currently set at 2.5% of sales, but this tier expires in 2018.

In 2015, Maryland’s RPS target was 10.5% of electricity sales, which equaled 8.0 million renewable energy credits (RECs). RECs are tradeable certificates representing generation of one megawatthour from eligible renewable electricity sources, which for Maryland includes generation within the PJM region, which covers several areas across Mid-Atlantic, Southern, and Midwestern states. From 2008 to 2015, Maryland’s renewable generation requirements have grown from 2.7 million RECs to 8.0 million RECs. Over that same time period, the compliance cost for the RPS has increased from a total of \$3.26 million to \$127 million.

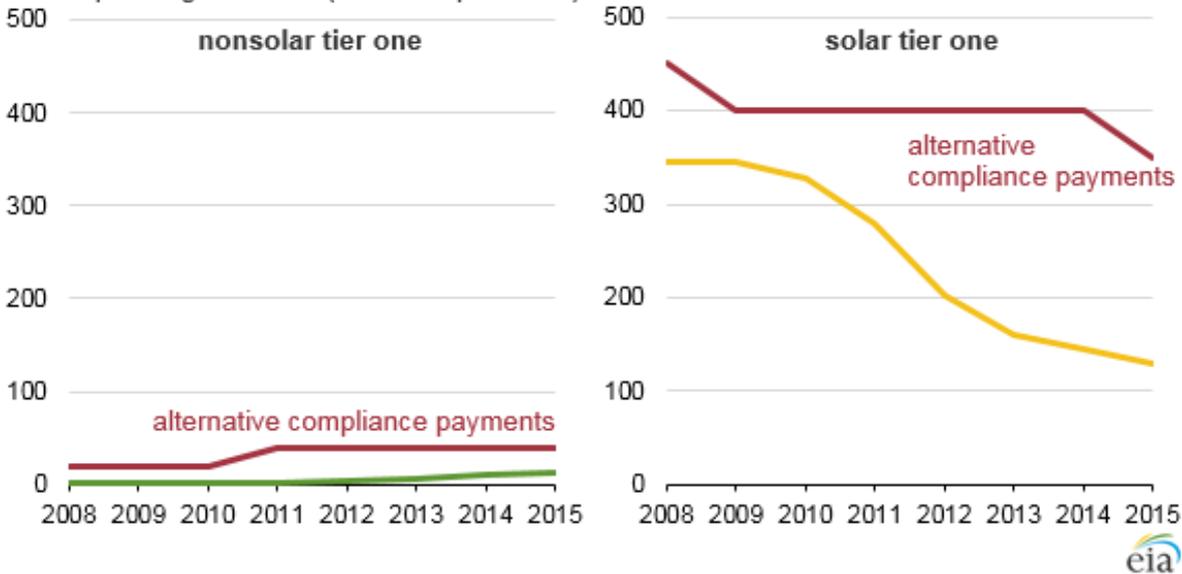


Source: U.S. energy Information Administration, based on Public Service Commission of Maryland Renewable Portfolio Standards Report, 2008-2015

Solar technologies have made up a small part of the RECs used for compliance, but a relatively larger share of the cost of compliance. Of the RECs used for compliance in 2015, only 4% were from solar. In comparison, solar made up 31% of the cost of compliance. During 2015, the average cost for solar RECs in Maryland was \$130 per REC, nearly 10 times the cost of tier one, nonsolar RECs. However, with an increase in the number of solar facilities in the state, solar REC costs have declined from as high as \$345 per REC in 2008. Conversely, tier one, nonsolar REC prices have increased from just under \$1 per REC in 2008 to almost \$14 per REC in 2015.

Mcanxixun Information

Maryland average cost of renewable energy credits and alternative compliance payments
dollars per megawatthour (or dollars per credit)

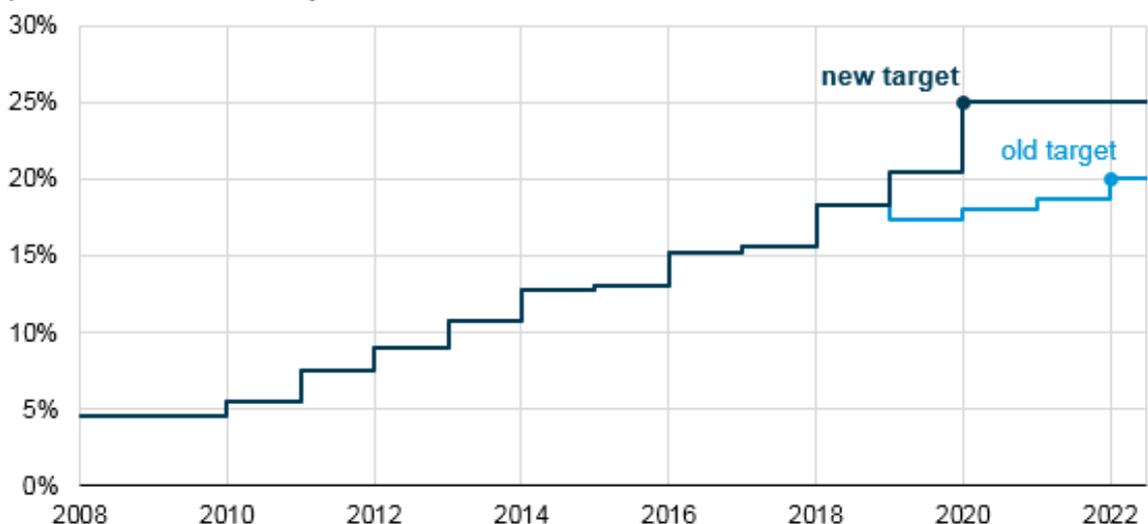


Source: U.S. energy Information Administration, based on Public Service Commission of Maryland Renewable Portfolio Standards Report, 2014-2015

Under Maryland’s RPS , electric service providers can choose to make alternative compliance payments (ACPs) in lieu of purchasing RECs. ACPs, which are set by Maryland’s Public Service Commission, are often viewed as a ceiling for REC prices. If a market lacks sufficient supply to meet RPS requirements, the average price of a REC would be at or near its ACP. In 2015, the ACP was \$40 for tier one nonsolar RECs and \$350 for solar RECs. ACPs made up only 0.02% of the total cost of compliance in 2015.

马里兰州将 2020 年可再生能源组合标准目标提高到 25%

Maryland renewable portfolio standards targets
percent of retail electricity sales



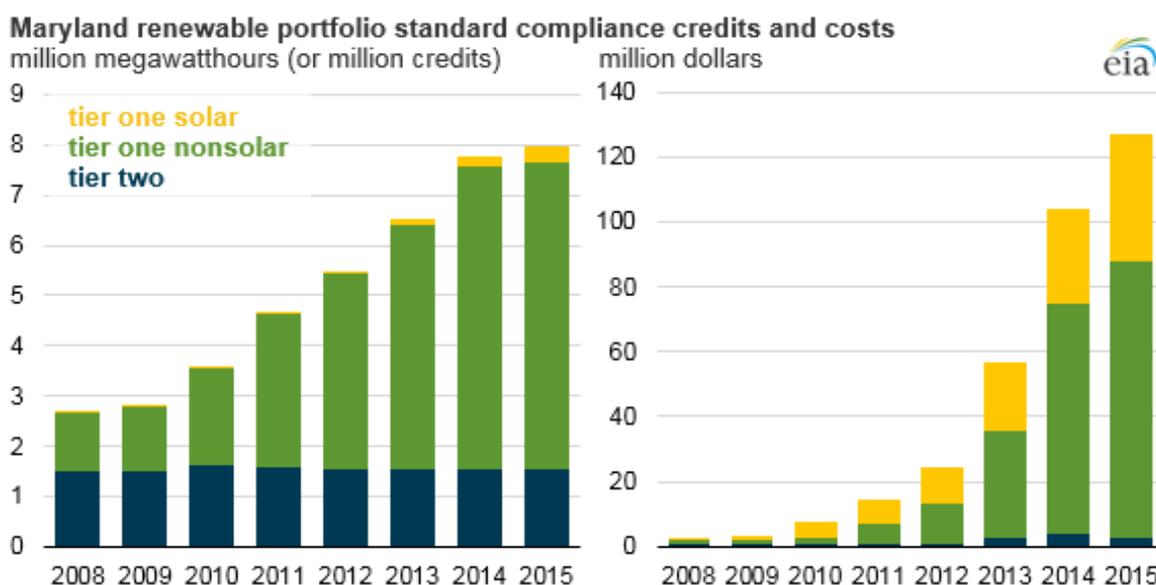
资料来源：美国能源信息管理局，根据马里兰州的清洁能源工作法案（1106 号议案）

今年二月，马里兰州将可再生能源组合标准（RPS）的可再生能源发电目标提高到 2020 年零售电力销

销售额的 25%，取代了早期的到 2022 年 20% 目标。这一变化发生在国家大会两院的立法委员投票否决了他们在 2016 年首次通过的州长的否决权。

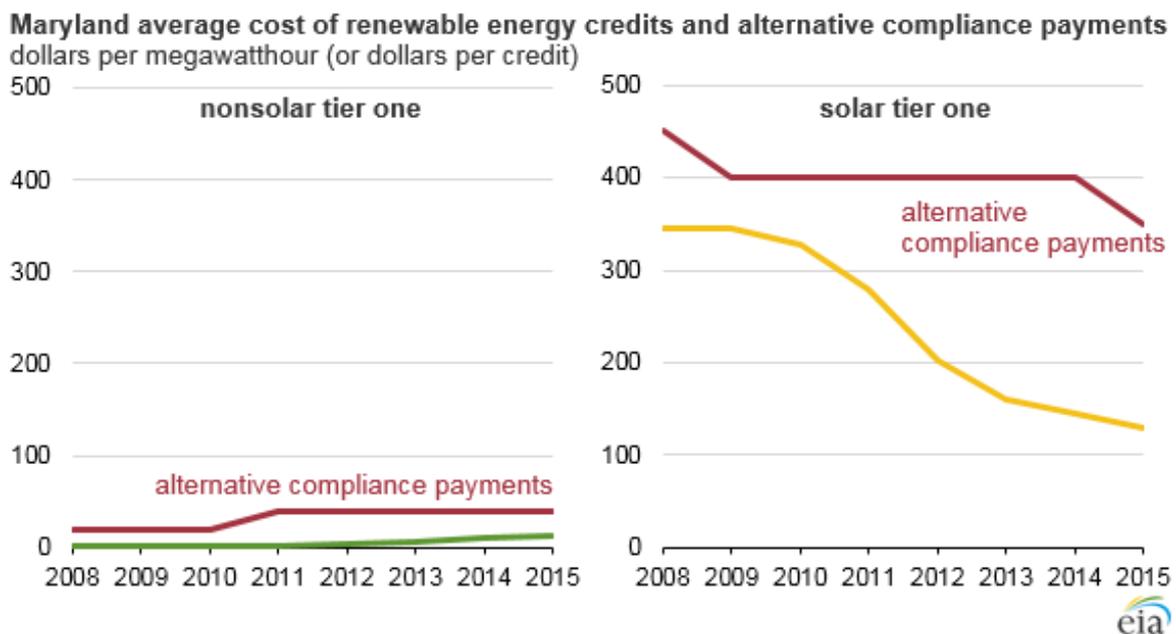
马里兰州可再生能源组合标准分为两层。第一层包括太阳能，风能，生物质能，地热能，燃料电池，海洋，小型水电以及一些合格的废物技术产生的电力。第一层还包括两个技术特定目标（或设置）。纳入该州以前的可再生能源组合标准的太阳能发电设备现在在 2020 年之前上升到 2.5% 的销售额。海上风电的设定尚未确定，但将由马里兰州公共服务委员会从 2017 年开始，销售额将不超过 2.5%。水力发电可用于满足二级要求，目前为 2.5% 的销售额，但该级别于 2018 年到期。

2015 年，马里兰州的可再生能源组合标准目标是电力销售的 10.5%，相当于 800 万可再生能源信贷（RECs）。RECs 是可交易证书，代表合格可再生能源的一兆瓦，其中马里兰州包括 PJM 地区内的一代，涵盖中大西洋，南部和中西部各州的几个地区。从 2008 年到 2015 年，马里兰州的可再生能源发电量已经从 270 万 RECs 增长到了 800 万 RECs。在同一时期，可再生能源组合标准的合规成本从总计 326 万美元增加到了 1.27 亿美元。



资料来源：美国能源信息管理局，基于 2008 - 2015 年马里兰州可再生能源组合标准报告公共服务委员会

太阳能技术已经占据了用于遵守的 REC 的一小部分，但是遵守成本的份额相对较大。在 2015 年用于遵守的 REC 中，只有 4% 来自太阳能。相比之下，太阳能占合规成本的 31%。在 2015 年期间，马里兰州太阳能发电的平均成本为每 REC 为 130 美元，是第一级非极性 REC 的成本的近 10 倍。然而，随着太阳能设施数量的增加，太阳能 REC 成本从 2008 年的每 REC 高达 345 美元开始下降。相反，第一级非极性 REC 价格从 2008 年的每 REC 低于 1 美元增加到几乎 2015 年每 REC 14 美元。



资料来源：美国能源信息管理局，基于 2010 - 2015 年马里兰州可再生能源组合标准报告公共服务委员会

在马里兰州的可再生能源组合标准下，电力服务提供商可以选择替代合规支付(ACP)代替购买 REC。ACP 由马里兰州公共服务委员会制定，经常被视为 REC 价格的上限。如果市场缺乏足够的供应以满足可再生能源组合标准要求，REC 的平均价格将处于或接近 ACP。在 2015 年，ACP 一级非极性 RECs 为 40 美元，太阳能可再生能源组合标准为 350 美元。 ACP 仅占 2015 年合规总成本的 0.02%。

U.S.' eye stays on state nuclear plant

Entergy continues to face challenges in the operation of its Arkansas Nuclear One generating plant almost four years after a worker was killed and eight others were injured in an accident.

On March 31, 2013, the mishandling of a 1 million-pound generator stator caused it to fall 30 feet while it was being moved, which dislodged beams, and one struck and killed worker Wade Walters, 24.

In 2015, the federal Nuclear Regulatory Commission moved the Arkansas nuclear plant to the column four category of the commission's rating of overall plant performance. Plants in column five aren't permitted to operate.

The plant has had problems with equipment and preventable human errors, representatives of the commission said at a public hearing Thursday night to address the plant's 2016 performance.

About 60 people attended the meeting at a conference room on the plant's campus near Russellville. No one from the audience asked questions after the 75-minute meeting.

In September, there was a failure to ensure that a bearing for an emergency diesel generator had adequate lubrication. In a 24-hour endurance test the bearing overheated and caused the generator to fail.

The reason for the failure was that the bearing had been installed upside down, said Brian Tindell, the commission's senior resident inspector at the plant.

"The extent of damage from the failure led to the decision to shut down [nuclear reactor] Unit 2 to comply with technical specifications," Kriss Kennedy, the commission's regional administrator, said in a letter last month to

Rich Anderson, site vice president at Arkansas Nuclear One.

The incident was characterized by the commission as a low to moderate safety significance, Kennedy said in the letter.

The plant, though, continues to be operated safely, Tindell said.

"[Entergy] is taking substantial actions to restore safety margins," Tindell said. "However, there is still a lot of work to be done."

The regulatory commission has seen improvements at the plant, Victor Dricks, spokesman for the commission, said in an interview before the meeting.

"We've seen some improvements in accountability," Dricks said. "Decision-making is better than we had seen previously. We've seen improvements in corrective action programs."

But progress has been slow, Dricks admitted.

"And there are areas where they are going to need to improve further, like reduce the backlogs of work, maintenance issues and engineering documentation and corrective actions," Dricks said.

Arkansas Nuclear One is subject to the commission's highest level of scrutiny. Last year, the commission conducted more than 10,000 hours of inspections, Tindell said. That's compared to about 3,500 hours of inspection at a nuclear plant in column one, the commission's highest safety level, Tindell said.

Entergy hired Anderson, 59, in September as site vice president. He has worked at a handful of nuclear plants in his career, including being site vice president at several.

Entergy is making improvements, but "we're still not where we want to be," Anderson said.

"We also understand that the culture and the behaviors are key to establishing and sustaining the desired performance," Anderson said. "We do get the message. We understand [the commission's] message tonight on the need for continued improvement."

Entergy has realized that the plant is understaffed, and 44 additional employees have been hired, Anderson said.

Dricks said that the commission will continue to maintain enhanced oversight of the facility.

"We'll be conducting a supplemental inspection later this year after [Entergy] identifies that they are ready for us to come and look at the corrective actions they've taken in connection with this specific event," Dricks said, referring to the 2013 accident. "But overall our view is that the plant is being operated safely. We feel they are on the right track."

If all requirements are followed and no other violations are discovered, Entergy could be out of column four by early 2019, Kennedy said.

"It's not easy to operate one of these plants," Kennedy said at the meeting. "It's a long process [to work out of column four]."

美国仍关注国家核工厂

在一名工人遇害四年后，另外八人在事故中受伤，安特吉公司继续在阿肯色州一号发电厂运营中面临挑战。

在 2013 年 3 月 31 日，一个 100 万磅重的发电机定子处理不当，导致它在被移动时下降了 30 英尺，移动了横梁，导致一名 24 岁的工人 Wade Walters 死亡。

在 2015 年，联邦核管理委员会将阿肯色核电站移至委员会整体工厂业绩评级的第四类。第五栏中的植物不得使用。

Mcanxixun Information

该工厂的设备出现问题，可以防止人为错误，委员会的代表周四晚在公开听证会上表示，要解决工厂的 2016 年业绩。

约有六十人在 Russellville 附近工厂校园的会议室出席了会议。75 分钟的会议后，观众中没有人问过问题。

9 月份，无法确保紧急柴油发电机的轴承有足够的润滑。在 24 小时耐力测试中，轴承过热并导致发电机故障。

委员会工厂的高级驻地检查员布莱恩·廷德尔（Brian Tindell）说，失败的原因是轴承安装倒置。

“失败的程度导致决定关闭[核反应堆]第 2 单元以符合技术规格，”委员会区域主管 Kriss Kennedy 在上个月的一封信中对阿肯色核一现场副总裁 Rich Anderson 说。

肯尼迪在信中说，事件的特点是委员会的安全意义低至中等。

该工厂虽然继续安全运行，Tindell 说。

“[Entergy]正在采取实质性行动来恢复安全利益，”Tindell 说，“但是，还有很多工作要做。”

委员会发言人维克多·里克斯（Victor Dricks）在会议前接受采访时表示，监管委员会在工厂进行了改进。

“我们已经看到了一些问责制改善，”Dricks 说，“决策比以前更好，我们已经看到了纠正措施方案的改进。”

但进展一直很慢，Dricks 承认。

“有些地方需要进一步改进，例如减少工作积压，维护问题和工程文件以及纠正措施。”Dricks 说。

阿肯色州核能公司受委员会审查的最高级别。廷德尔说，去年，委员会进行了超过 10,000 小时的视察。相比之下，这个委员会最高的安全级别是第一列核电厂的大约 3,500 小时的检查，廷德尔说。

Entergy 雇用安德森，59 岁，9 月份担任网站副总裁。他在职业生涯中曾在少数几家核电厂工作，其中包括几家核电厂的副总裁。

Entergy 正在改进，但“我们还不是在我们想要的地方，”安德森说。

安德森说：“我们也明白，文化和行为是建立和维持理想表现的关键。我们确实得到了消息，我们了解[委员会]今天晚上的消息，需要继续改进。”

Entergy 已经意识到这个工厂人手不足，还有 44 名员工被雇用，Anderson 说。

Dricks 表示，该委员会将继续加强对设施的监督。

“我们将在今年晚些时候进行补充检查后，[Entergy]确定他们准备好我们来看看他们为与这个具体事件有关的纠正措施，”Dricks 说，参考 2013 事故。“但总体而言，我们认为工厂正在安全运行，我们觉得他们正处于正轨。”

如果遵循所有要求，没有发现其他违规行为，那么 Entergy 可能在 2019 年初可能超出第四栏，肯尼迪说。

肯尼迪在会上说：“运转这些工厂不容易。“这是一个漫长的过程。”

Russia seeks closer nuclear ties with Japan

Russia is ready to build "effective and full-scale" cooperation with Japan in the peaceful uses of nuclear energy to harness the innovations of Russian scientists, Alexey Likhachov, director-general of state nuclear corporation Rosatom said this week. Likhachov began a working visit to Japan on 4 April, where he said in an interview with the Japan Times that cooperation between the two countries was "becoming an urgent necessity".

Likhachov's visit follows his signing in December of a memorandum of cooperation in peaceful uses of atomic energy with two Japanese ministries. One key area of cooperation under the agreement is post-accident recovery at the damaged Fukushima Daiichi plant. Likhachov told the Japanese newspaper that Russia is interested in

creating a framework for cooperation - scientifically, technologically and financially.

On Russian assistance in Japan's recovery from the consequences of the 2011 accident, Likhachov noted that the Mitsubishi Research Institute had last month selected two Rosatom subsidiaries, RosRAO and Tenex, to conduct a feasibility study on the creation of a an integrated high-sensitivity neutron detector. This technology will be necessary, he said, for the most accurate "search and identification" of nuclear fuel fragments at the Fukushima Daiichi plant.

Likhachov also noted that the memorandum signed on 16 December enables the two countries to consider the creation of a "unified Russian-Japanese platform" to explore the promotion of innovative nuclear technologies based on the knowledge and experience of nuclear power engineers in both countries. Among such technologies, Likhachov referred to developments in fast neutron reactors, in which he said independent experts rank Rosatom as the world leader. Only in Russia - at the Beloyarsk nuclear power plant - are industrial scale fast neutron reactors in operation, he said.

Beloyarsk 4 - the BN-800 fast neutron reactor - started operating at 100% power for the first time in August last year and officially started commercial operation in November. The 789 MWe reactor is fuelled by a mix of uranium and plutonium oxides (MOX) arranged to produce new fuel material as it burns. Its capacity exceeds that of the world's second most powerful fast reactor - the 560 MWe BN-600 Beloyarsk 3.

Likhachov said that, owing to the fact Japan's geography means it has no indigenous reserves of uranium, "the raw material base for supplying fuel to its own nuclear power plants is therefore a topical issue for Tokyo".

Fast neutron reactors operate within a closed nuclear fuel cycle, requiring less uranium and leading to significantly less radioactive waste, he said, adding that Japanese specialists may one day participate in the work of MBIR - the multipurpose sodium-cooled fast neutron research reactor that is under construction at the site of the Research Institute of Atomic Reactors at Dmitrovgrad, which is in Russia's Ulyanovsk region. AEM-Technology announced last month it had started the manufacture of the reactor pressure vessel for MBIR.

This is a 150 MWt, sodium-cooled fast reactor that will have a design life of up to 50 years. It will be a multi-loop research reactor capable of testing lead, lead-bismuth and gas coolants, and running on MOX fuel. NIIAR intends to set up on-site closed fuel cycle facilities for the MBIR, using pyrochemical reprocessing it has developed at pilot scale.

Rosatom has said the MBIR project will be open to foreign collaboration, in connection with the International Atomic Energy Agency's International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO).

俄罗斯希望与日本建立更密切的核关系

国家核能公司 Rosatom 的总经理 Alexey Likhachov 于本周表示，俄罗斯准备好与日本在和平使用核能方面建立“有效且全面”的合作，利用俄罗斯科学家们的创新。Likhachov 在 4 月 4 日对日本进行了一次工作访问，在日本他在一些《日本时报》的采访时表示，两国之间的合作“是迫切需要”。

在 12 月，Likhachov 与两位日本部委签署了和平使用原子能的合作备忘录，在此之前他进行了此次访问。根据协议，一个关键的合作领域是受损的福岛第一工厂在事故后的恢复。Likhachov 在接受日本报纸采访时表示，俄罗斯对于为合作创建一个框架非常感兴趣——科学化的，技术上的，以及财政上的。

对于俄罗斯对日本从 2011 年的事故后果中的恢复所做出的援助，Likhachov 指出，三菱研究所在上个月选择了两家 Rosatom 的子公司，RosRAO 和 Tenex，对集成的高灵敏度中子探测器的创建进行一项可行性研究，他表示，以便对福岛第一工厂核燃料碎片进行最准确的“研究和鉴定”。

Likhachov 还指出，在 12 月 16 日签署的备忘录使得两国能够考虑创造“统一的俄罗斯-日本平台”，根据两国核能工程师的知识和经验探索促进创新型核能技术。在这些技术中，Likhachov 提到了快速中子反应堆的发展，其中他表示独立专家将 Rosatom 评为世界领先企业。只有在俄罗斯——贝加尔斯克核电厂——运行着工业规模的快速中子反应堆，他表示。

Beloyarsk 4——BN-800 快速中子反应堆——去年八月首次以 100%的动力进行运营，并且在 11 月正式开始商业运行。789 MWe 反应堆是通过铀和钚氧化物（MOX）的混合物在其燃烧时产生新的燃料材料来供应燃料的。其产能超过了世界上第二大功率快速中子反应堆——560MWe BN-600 Beloyarsk 3。

Likhachov 表示，由于日本地球学的事实意味着其没有本土储备的铀，“从而对其自己的核电站供应燃料的原材料基础就成为了东京的一个时事问题。”

他说，快速中子反应堆是在一个封闭的核燃料循环中运行的，需要较少的铀，并且会造成更少的放射性废弃物，并且他补充称，日本专家可能有一天会参与的 MBIR 的工作中——俄罗斯乌里扬诺夫斯克地区的德米特罗夫格拉格原子反应堆研究所现场正在建设的多功能钠冷却快速中子研究反应堆。AEM-技术在上周宣布，其已经开始了 MBIR 的反应堆压力容器的制造。

这是一个 150 MWt 的钠冷却快速反应堆，其将拥有长达 50 年的设计寿命。其将成为能够测试铅、铅铋和气体冷却剂并且以 MOX 燃料提供动力的多回路研究反应堆。NIAR 希望为 MBIR 创建一个现场关闭燃料循环设施，利用其在试验性的规模下开发的化学再加工。

Rosatom 表示，MBIR 项目对外国合作开放，在创新核反应堆和燃料循环（INPRO）方面与国际原子能机构的国际项目有关。

Signatories to climate change agreement in dispute over financing

A gap of at least \$40bn in financing commitments is hampering efforts to combat climate change, signatories to the Paris agreement have warned, as they try to keep the agreement going in the face of doubts over US support under President Donald Trump.

Disputes over who will foot the bill comes as the Trump administration's energy secretary, Rick Perry, scuppered a joint statement about climate change at a G7 energy meeting in Rome this week.

The Paris agreement to limit global temperature rises to under 2 degrees Celsius includes financial commitments from developed countries to help developing nations deal with climate change. Before its adoption it was agreed this amount should reach \$100bn a year. However, it has been estimated that only \$60bn has been committed so far.

Climate ministers from Europe, India, Brazil and South Africa have gone to Beijing in recent weeks, hoping to sustain momentum from the Paris talks despite the Trump administration's dismantling of US regulations meant to limit American emissions. But discussions have quickly run up against the issue of financing.

“Developed countries have not met their commitments. In their reports a lot of their commitment is in the form of development aid. That doesn't meet the commitment to contribute to new funds,” China's top climate change negotiator, Xie Zhenhua, told a briefing on Tuesday. “A lot of countries don't want to chip in. I said to the European minister: that's your problem as developed countries. It's your responsibility to work together and sort it out.”

Mr Xie's meeting with Miguel Arias Cañete, the European commissioner for climate action and energy, in Beijing two weeks ago involved “uncharted waters” regarding “differences in approaches to climate financing”, Mr Cañete told the FT in an interview after their meeting.

“We are seeing there is a country, the largest in the world, that has announced policies that means they will never reach their targets,” he said, referring to the US. “Now that the US will not play the role [of a major partner] we are obliged to intensify our efforts to develop the Paris agreement.”

Beijing has aligned itself with developing countries and does not count among contributors to the intended \$100bn,

although it has established a separate, \$3.1bn “south-south co-operation fund”.

It views spending on infrastructure in developing countries as benefiting its own prowess in dam construction or wind turbine and solar panel manufacturing. Mr Xie said the scale of investment in equipment and infrastructure investment needed by 2030 would translate into “job opportunities”.

Meanwhile, red tape prevents funds that have been committed from flowing to developing countries, said Ravi Prasad, India’s minister for environment, forest and climate change, calling the \$60bn in commitments “highly suspicious” since the sum included previously allocated funds including aid. “When we go behind the numbers we find there has been a reclassification of the bilateral flows,” Mr Prasad said.

Mr Xie said: “Enthusiasm isn’t the problem but there are some doubts. I believe other countries feel the same.”
Signatories to climate change agreement in dispute over financing

中国气候谈判代表：发达国家未兑现援助承诺

巴黎协定签约方警告称，融资承诺方面至少达 400 亿美元的缺口正在破坏应对气候变化的努力。在外界对唐纳德·特朗普(Donald Trump)治下的美国是否支持巴黎协定感到疑虑的背景下，各签约方继续努力推进该协定。

在出现围绕谁将埋单的争议之际，特朗普政府的能源部长里克·佩里(Rick Perry)本周在七国集团(G7)罗马能源会议上让关于气候变化的联合声明流产。

力争将全球升温幅度限制在 2 摄氏度以下的巴黎协定中包括发达国家帮助发展中国家应对气候变化的财务承诺。在协定通过前，各方一致同意这一援助金额应达到每年 1000 亿美元。然而，据估计迄今援助承诺只达到了 600 亿美元。

欧洲、印度、巴西和南非的气候部长们最近几周前往北京，希望维持巴黎谈判的势头，尽管特朗普政府废除了旨在限制美国排放的法规。但谈判很快遇到资金问题。

中国首席气候谈判代表解振华周二在记者招待会上表示：“发达国家没有兑现承诺。在他们所报告的资金总量中有很多是发展援助资金，不符合《(联合国气候变化框架)公约》新的额外资金的原则要求。有些国家可能不愿意出这个钱了。这件事我和欧盟气候专员交换意见时讲了，这件任务是发达国家的。发达国家内部要很好地协调，要兑现这个承诺。”

两周前，欧盟气候行动与能源专员米格尔·阿里亚斯·卡涅特(Miguel Arias Cañete)在北京与解振华举行了会晤。卡涅特会后在接受英国《金融时报》采访时表示，会晤谈到了关于“气候融资方式差异”的“未知水域”。

他说：“我们看到，世界上最大的国家宣布了意味着他们将永远不会实现目标的政策。”他这里指的是美国。“既然美国不扮演（主要合作伙伴的）角色，那我们不得不加大努力落实巴黎协定。”

中国自认属于发展中国家，因此不用为 1000 亿美元援助承诺出资，尽管它另外设立了 31 亿美元的“南南合作基金”。

中国认为，投资发展中国家的基础设施会让中国在大坝建设或风力涡轮机和太阳能面板制造方面的技能受益。解振华表示，到 2030 年所需的设备投资规模和基础设施投资将带来“就业机会”。

与此同时，印度环境、森林和气候变化部长拉维·普拉萨德(Ravi Prasad)表示，手续繁琐让承诺的资金很难流向发展中国家，他认为已承诺的 600 亿美元“极为可疑”，因为该数字包括早先已拨的资金，包括援助资金。普拉萨德表示：“当我们研究这些数字时，我们发现其中包括被重新分类的双边流动资金。”

解振华表示：“大家现在对气候变化进程的热情并没有减，但是都有一些疑虑。”

Trump administration seeks non-Chinese owner for

Westinghouse

The Trump administration is working to find a new owner for Westinghouse, the bankrupt US nuclear engineering group, to ensure that it does not fall under Chinese control.

One US official said the White House would move to stop Chinese companies playing central roles in any consortium that might buy Westinghouse from its parent Toshiba, but did not rule out the possibility that they could make a “passive investment”.

The official said the administration was “keenly aware” of the national security implications attached to the sale of the company, and was trying to pre-empt any possible blocking of a deal by making clear at an early stage that the US government would take a tough stance on any significant Chinese role.

Westinghouse said it had been in contact with the administration and elected officials, but declined to comment on possible future owners.

The company entered Chapter 11 bankruptcy protection at the end of last month, brought down by huge cost overruns on four new reactors that it is building in the US.

The only US company with substantial nuclear engineering operations is General Electric, through its joint venture with Hitachi, but its technology is different from Westinghouse’s.

Any foreign company attempting to buy all or part of Westinghouse would be scrutinised by the US Treasury’s Committee on Foreign Investment in the US for the deal’s potential impact on national security. The secretaries of state, commerce, homeland security, defence and the Treasury are among the members of that committee. The Treasury declined to comment.

Acquisitions by investors from China have accounted for the largest share of notices to Cfius over 2012-14, with 68 out of the 358 received by the committee over that period.

Westinghouse has close links to China, where it has four of its AP1000 reactors under construction. As part of the deal for those projects, Westinghouse agreed to transfer intellectual property relating to the plants. More than 75,000 documents were handed over to its Chinese customers in 2010 in the first stage of implementing that agreement.

However, there were also accusations of a covert campaign by China to acquire more of Westinghouse’s technology. In 2014 the US Department of Justice charged five Chinese military hackers with cyber espionage against five US companies including Westinghouse over the period 2006-14.

In January Allen Ho, a US citizen born in Taiwan, pleaded guilty to taking part in “unauthorised development or production of special nuclear material” outside the US, although without “the intent to injure the US or to secure an advantage to a foreign nation”.

He was alleged to have sought assistance from US experts on technologies including small modular reactors, advanced fuel assembly and nuclear reactor-related computer codes, on behalf of the China General Nuclear Power Company.

美寻求阻止中资企业收购西屋

特朗普政府正努力为破产的美国核工程集团西屋物色一个新业主，以确保其不会落入中国企业手中。

特朗普(Trump)政府正努力为破产的美国核工程集团西屋(Westinghouse)物色一个新业主，以确保其不会落入中国企业手中。

一位美国官员表示，白宫将阻止中国企业在可能从母公司东芝(Toshiba)购买西屋的任何财团中发挥核

心作用，但并不排除中国企业进行“被动投资”的可能性。

该官员表示，美国政府“敏锐地意识到”出售该公司所涉及的国家安全隐患，并试图预先阻止任何可能的交易——在早期便明确表明，美国政府将对中国企业扮演重要角色采取强硬立场。

西屋表示，一直在与政府和民选官员接触，但拒绝对未来可能的业主发表评论。

上月底，西屋进入了《破产法》第 11 章规定的破产保护状态。破产原因在于，其在美国兴建的四座新反应堆的成本严重超标。

唯一拥有大量核工程业务的美国公司是通用电气(General Electric)——这些业务是由一家与日立(Hitachi)组建的合资企业完成的——但其技术与西屋的技术不同。

任何试图购买西屋全部或部分股份的外国公司，都将受到美国财政部下属的美国外国投资委员会(Cfius)的审查，审查内容在于交易对国家安全的潜在影响。国务卿、商务部部长、国土安全部部长和财政部部长都是该委员会的成员。财政部拒绝就此发表评论。

在 2012 年至 2014 年，中国投资者发起的收购案在所有报告给 Cfius 的收购案中占有最高比例。这几年来，Cfius 收到报告的收购案为 358 起，其中收购方为中资企业的有 68 起。

西屋与中国有密切联系，正在中国兴建四座 AP1000 反应堆。在签署涉及这些项目的协议时，西屋公司同意转让有关工厂的知识产权。在执行该协议的第一阶段，逾 7.5 万份文件在 2010 年被交付给了中国客户。

然而，也有人指责中国在悄悄地获取西屋更多的技术。2014 年，美国司法部对 5 名中国军方黑客提出指控，罪名是他们在 2006 年至 2014 年针对包括西屋在内的五家美国公司实施了网络间谍活动。

Wasting less renewable energy could boost China's air quality

Better use of renewables could reduce air pollutants. And with technology that's already been paid for, writes Sara Shapiro-Bengtson

Presenting his 2017 government work report to the National People's Congress in March, Premier Li Keqiang stressed the importance of making China's skies blue again by integrating renewables more effectively into the power grid.

Despite its enormous investment in renewable energy and owning the most installed capacity globally, China is yet to reap the full benefits from its renewable sectors. Record high curtailment of renewable energy prevents these resources from effectively contributing to clearer skies. Addressing the problem won't be easy but would be a major boon for air quality.

Record energy losses

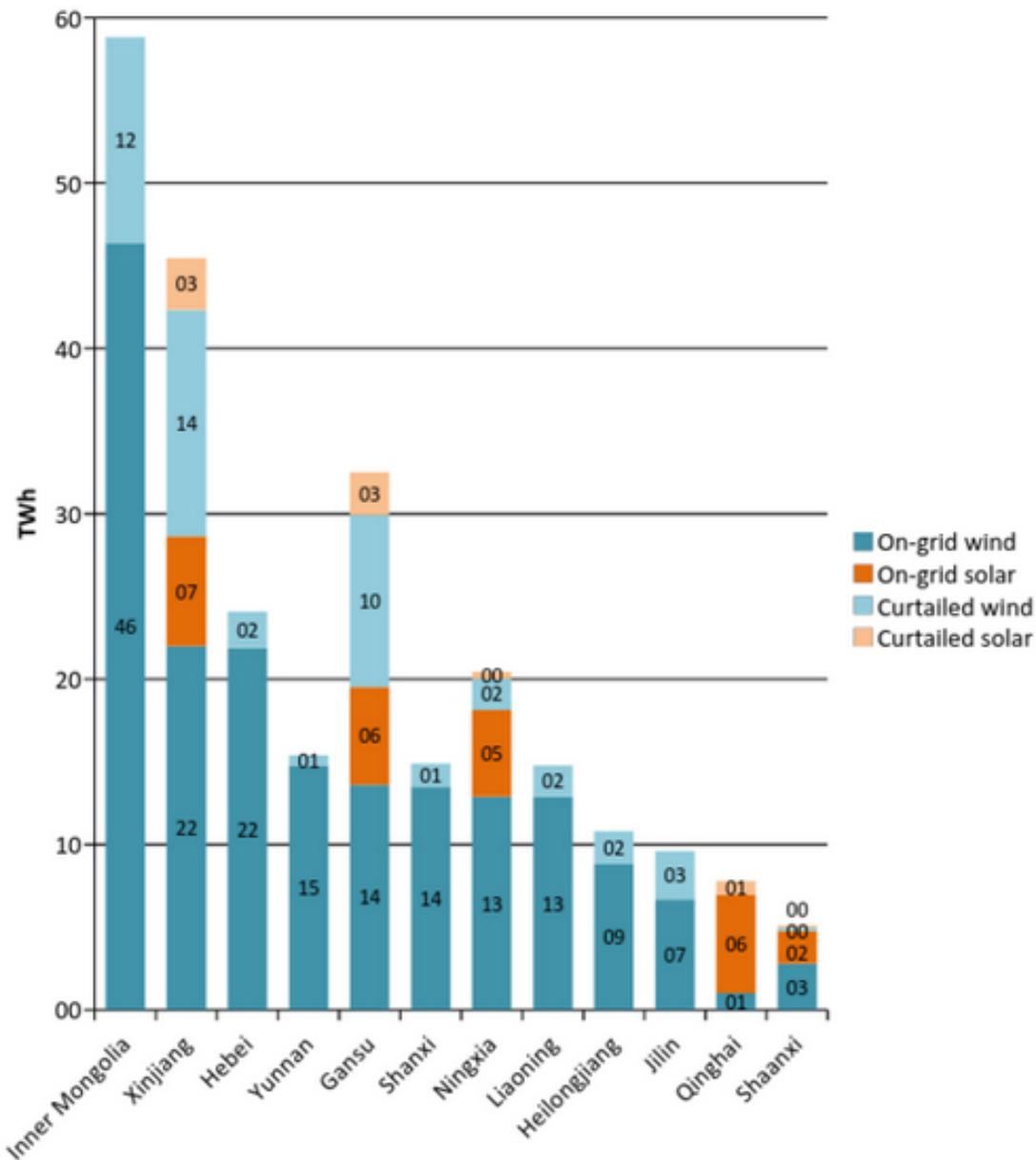
Curtailment occurs when the grid can't handle all the resources feeding into it. According to China's National Energy Agency (NEA), the national average wind curtailment rate in 2015 was 15%. Using the same method of calculation, it rose to 17% for 2016.

The 11 provinces with three-quarters of the country's installed wind power capacity curtailed 49.7 terawatt hours (TWh) of wind power last year, enough to power Beijing for six months.

The average photovoltaic (PV) curtailment rate in northwestern China in 2016 was 20% – a total of 7 TWh of PV curtailed. Together, this represents 56.7 TWh of clean power not delivered to the grid. For comparison, that's about one sixth of the UK's entire electricity generation.

Energy production and curtailment of wind and solar in 2016

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Solar energy production and curtailment data is only shown for provinces in the northwest. Source: NEA

But overall rates do not tell the whole story because curtailment in some provinces is well above average.

Losses are worst in the bright and windy northwest. Gansu province curtailed 40% of its wind and solar energy in 2016, and Xinjiang had to dump 37%. Gansu, Xinjiang and Inner Mongolia have China's greatest installed capacity of wind and solar and so a large share of energy production.

Installed wind and solar capacity and curtailment rates in 2016

Province	Curtailment rate		Installed capacity (GW)		Share of production	
	Wind	Solar	Wind	Solar	Wind	Solar
Gansu	43%	30%	12.8	6.8	11%	5%
Xinjiang	38%	32%	17.8	8.6	10%	3%
Inner Mongolia	21%	N/A	25.6	6.4	11%	1%

To put China’s levels of curtailment in perspective, it’s worth contrasting them with the situation in the US and Europe where rates are typically between 0-5%, even in countries that have a higher proportion of renewables in the overall energy mix. Some curtailment can be economically justified to ensure the stability of supplies to the grid and enable high shares of renewables.

Tackling the problem

The government recognises that curtailment is an obstacle to a greener, more sustainable energy system.

A document published in 2015 set the direction for reforms in the power sector, highlighting measures that can reduce energy waste by improving dispatch to the grid and increasing cross-provincial energy trading.

A subsequent set of policies issued last year aimed to further reduce curtailment by prioritising renewable energy in dispatch, and compensating generators for curtailment. These policies have yet to be fleshed out and implemented though.

When the NEA published the 13th Five-Year Plan for the power sector in November 2016, it said it wanted to reduce curtailment to a reasonable level within five percent, but provided no details of specific short-term measures.

Benefits for air quality

Tackling the curtailment problem is crucial not just for the efficient functioning of the electricity system but because renewables can displace dirtier forms of energy such as coal. Air pollution is a serious problem in all of China’s provinces, including ones with high curtailment rates.

In 2015, no province met the World Health Organization’s air pollution guidelines for PM2.5 concentrations, and most fell short of China’s less stringent national guidelines.

So ensuring the full utilisation of renewables already installed could yield significant air quality benefits.

A rough calculation of renewable energy lost in Gansu, Xinjiang, and Inner Mongolia – the three provinces curtailing most renewables – suggests that China needlessly mined, transported and burned 13.2 million tonnes of coal in 2016.

Getting curtailment down to five percent or below would cut tonnes of pollutants caused by coal burning. The Health Effects Institute find that coal power contributed to 87,000 premature deaths in China in 2013 so even a small reduction in total emitted pollutants could save hundreds of lives every year, using technology that is already installed.

Emissions reductions are estimated by applying provincial power production to region-specific emission factors. These take account of extensive efforts made during the 10th and 11th Five-Year Plan periods to reduce particulate and sulphur dioxide (SO2) emissions from power plants, but not the control measures for nitrogen oxides (NOX) such as smog-inducing nitric oxide and nitrogen dioxide introduced in the 12th Five-Year Plan (2011-2015).

Tonnes of PM2.5, NOx and SO2 emissions avoided each year if curtailment was 5%

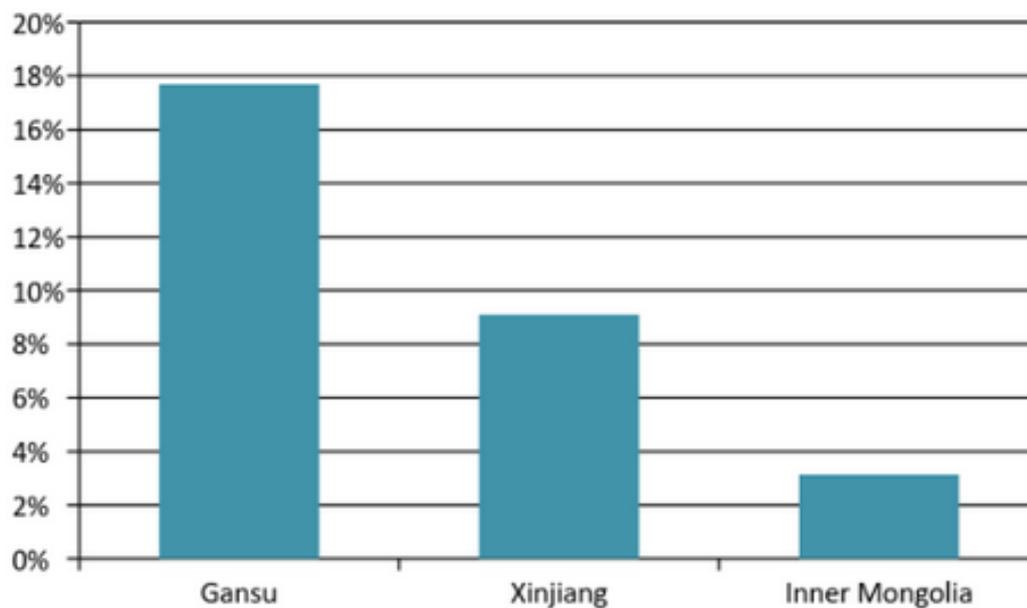
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	PM2.5	NO _x	SO ₂
Gansu	2,900	31,200	26,000
Xinjiang	3,800	39,900	33,300
Inner Mongolia	2,300	27,500	18,100

Getting to a 5% curtailment rate in Gansu would mean saving emissions corresponding to 18% of the emissions from coal power plants in the province in 2016.

For Xinjiang, it would represent a 9% saving, and in Inner Mongolia 3%. The avoided NOX emissions combined correspond to taking about 50 million cars off the streets.

Avoided emissions if renewables curtailment was 5%, expressed as a share of coal power plant emissions



Renewables will play a more prominent role in Chinese energy production, making the ability to integrate this production into the grid increasingly important.

In just a few years, China plans to double its share of wind power to six percent of total generation capacity. Wind and solar combined will make up eight percent of total generation capacity in 2020.

But the impact of renewable energy on air quality will depend on policymakers' plans and actions to reach the 2020 target of five percent curtailment.

China has made progress improving its air quality, with pollutant concentrations in cities on a downward trend.

Nonetheless, at the current rate of improvement, it will take 23 years for Lanzhou, the capital of Gansu province, to meet the WHO's standards for PM2.5 concentration. Xinjiang's capital city Urumqi would need to wait 30 years, and the Inner Mongolian capital, Hohhot, 12 years.

Reducing renewable energy curtailment would help accelerate progress. Making sure that variable renewables such as wind and solar are efficiently integrated into the grid is a crucial step if China is to realise its air pollution targets and make the skies blue again.

减少能源浪费可以提高中国的空气质量

提高可再生能源的入网效率不仅能够降低空气污染物的排放，还能够让那些已经投入了资金的技术发

挥作用，莎拉·夏皮罗·本岑写道。

2017年3月，国务院总理李克强在全国人大发布了本年度政府工作报告。报告强调，提高可再生能源入网效率对重塑中国蓝天有着非常重要的意义。

尽管中国斥巨资发展可再生能源，总装机居世界首位，但是目前却仍在努力充分享受可再生能源带来的益处。可再生能源本来可以帮助中国减少排放，重现蓝天，但创纪录的弃风弃光率却使得这些资源无法发挥作用，解决这个问题并不容易，但对于改善空气质量非常重要。

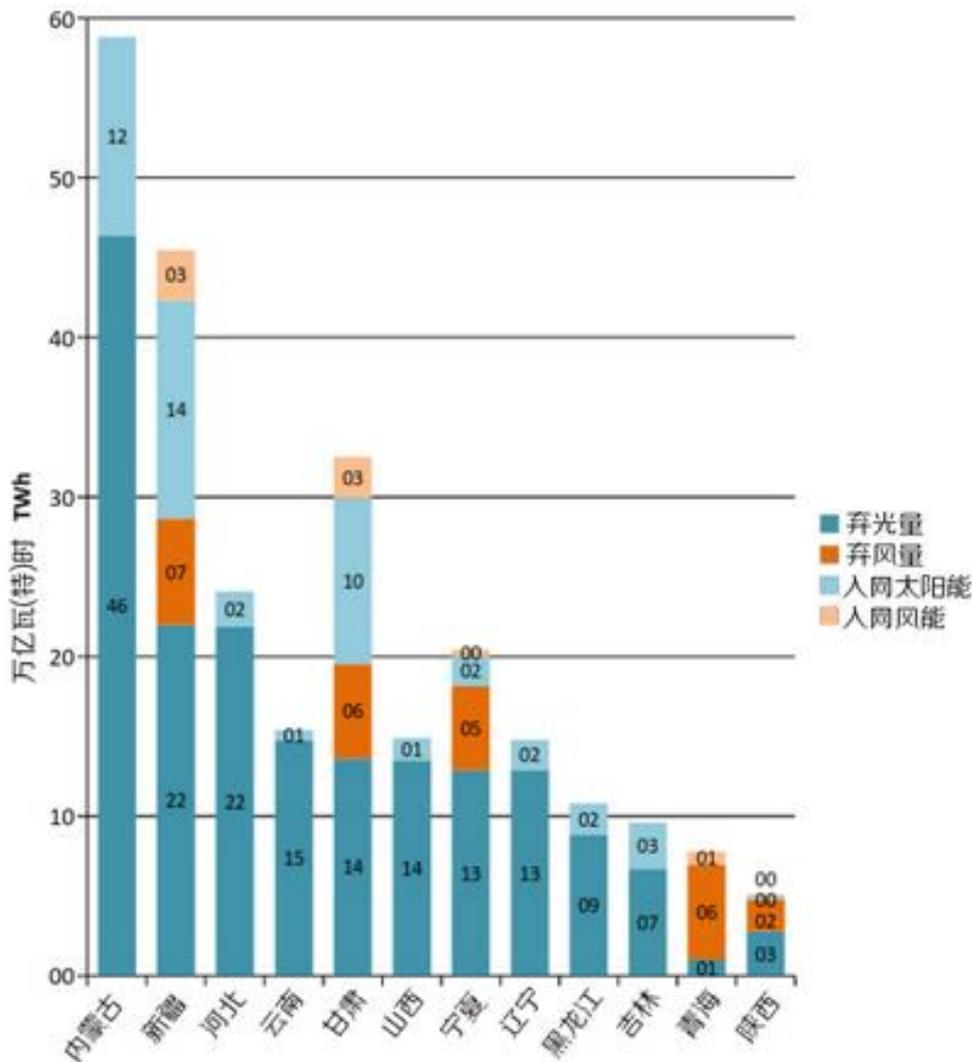
弃电不是小问题

之所以出现弃风弃光现象是因为电网无法消纳入网的所有电力。据中国国家能源局统计，2015年全国平均弃风率为15%。按照同样方法测算，2016年的平均弃风率增长到了17%。

风电装机占全国总装机四分之三的11个省份过去一年的弃风总量高达497亿千瓦时，足以满足整个北京地区半年的用电需求。

2016年，中国西北地区平均弃光率为20%——也就是说，弃光总量高达70亿千瓦时。总体来看，有567亿千瓦时的清洁电力无法并入国家电网，这相当于英国全年发电总量的六分之一。

2016年风能、太阳能产量及弃风弃光量



上述省份均拥有太阳能资源，但是只有西北部几个省份有太阳能光伏生产和弃光率数据。数据来源：国家能源局

但是，整体弃风弃光率并不能说明全部问题，因为有些省份的弃风弃光率显然要比整体水平高得多。

弃风弃光现象在光照充足、风力充沛的中国西北部地区最为明显。2016年，甘肃弃风弃光率为40%，而新疆则为37%。甘肃、新疆和内蒙古是中国风能与太阳能装机容量最高的地区，新能源在能源生产中所占的比重也较大。

2016年风能、太阳能装机与弃风弃光率

省份	弃风弃光率		装机容量 (百万千瓦)		发电总量占比	
	风能	太阳能	风能	太阳能	风能	太阳能
甘肃	43%	30%	12.8	6.8	11%	5%
新疆	38%	32%	17.8	8.6	10%	3%
内蒙古	21%	未知	25.6	6.4	11%	1%

为了正确客观看待中国的弃风弃光问题，我们可以将其与美国、欧洲地区的情况进行比较。欧美地区的弃风弃光率一般在0-5%之间，即便在可再生能源占比较高的国家也是如此。从经济的角度来说，一定程度的弃风弃光可以保证整个电网的稳定，同时也可使可再生能源在电力生产中占有较高比例。

攻克弃风弃光提上日程

中国政府意识到，弃风弃光是实现绿色、可持续能源系统转型的一大阻碍。

2015年发布的一份文件为电力产业的改革指明了方向，其中突出强调了要采取措施，提高国家电网调度能力和扩大跨省电力交易，减少能源浪费。

去年发布的一系列政策文件希望通过可再生能源发电优先上网，限发电量补偿机制等措施进一步减少弃风弃光现象。然而，目前上述措施的细节尚未出台，落实也仍需时日。

2016年11月，国家能源局发布了国家能源“十三五”规划。规划指出，要将弃风弃光率控制在合理水平，也就是5%以内，但是并未明确短期内采取的具体措施。

弃风弃光与空气治理

解决弃风弃光问题之所以重要，不仅仅是因为能提高整个电网的运行效率，同时也有助于可再生能源替代煤炭等高污染的能源形式。如今，空气污染已经成为困扰全中国的严重问题，弃风弃光率较高的地区也是如此。

2015年，中国所有省份均未达到世界卫生组织《环境（室内）空气质量与健康》中设定的PM2.5浓度标准，而其中大多数省份甚至距离中国相对宽松的本土环保要求都有着不小的差距。

所以说，全面提高现有可再生能源的利用率对提高空气质量的作用不容小视。

甘肃、新疆和内蒙古是中国弃风弃光率最高的三个地区。粗略统计显示，上述省份未能消纳的可再生能源相当于2016年中国额外挖掘、运输和燃烧了1320万吨的煤炭。

将弃风弃光率控制在5%甚至更低水平将大幅削减煤炭燃烧带来的环境污染。据健康效益研究所调查，2013年中国有8.7万人因为煤电导致的污染而过早死亡。所以，采用已有的技术设备，即便所减少的污染只占整体污染物总量的一小部分，每年也可以避免数百例过早死亡。

各省电力产量乘以相应地区的排放因子就得出大体的减排量。这一估算方法考虑了“十五”和“十一五”规划时期为了降低电厂颗粒物污染和二氧化硫排放所采取的一系列措施，但并未考虑“十二五”规划（2011-2015年）期间针对一氧化氮和二氧化氮等致霾氮氧化物采取的管控措施。

5%的弃风弃光率带来的年度减排效果（单位：公吨）

	PM2.5	氮氧化物	二氧化硫
甘肃	2,900	31,200	26,000
新疆	3,800	39,900	33,300
内蒙古	2,300	27,500	18,100

弃风弃光率降低到 5%对甘肃来说，相当于将该省燃煤电厂 2016 年的污染物排放量降低 18%。

而对于新疆和内蒙古来说，则相当于将燃煤电厂的排放分别降低了 9%和 3%。而以上三省区的氮氧化物减排量合计相当于减少了 5000 万汽车的排放。

可再生能源在中国能源结构中所占的比重将日益突出。因此，电网能否更好地消纳这些能源将变得愈加重要。

未来几年，中国计划实现风电发电量占比翻番，达到 6%。到 2020 年，风能和太阳能发电总量占比将达到 8%。

但是可再生能源对空气质量的影响取决于决策机构为了实现到 2020 年将弃风弃光率降低到 5%以下的目标所采取的计划 and 行动。

中国 in 提高空气质量方面已经取得了一些进步，城市空气污染物浓度也已经呈现了下降态势。

按照现有的改善速度来看，要想达到世界卫生组织的空气 PM2.5 浓度标准，甘肃省省会兰州可能需要 23 年，新疆维吾尔自治区首府乌鲁木齐需要 30 年，而内蒙古自治区首府呼和浩特需要 12 年。

降低弃风弃光率将有助于加快上述进程。如果想要实现空气污染治理目标，重塑昔日蓝天白云的美好景象，确保风能和太阳能等可再生能源能够有效并网才是关键。

As the US steps back, China must step up on climate leadership

Where has the Trump administration left the US-China bilateral cooperation agenda?

Presidents Trump and Xi are scheduled to meet today at Mar-a Lago, Florida, and given the tense state of US-China relations and the political leanings of the Trump administration there is much at stake for cooperation between the countries on the climate agenda – the most important bilateral relationship in the world. To maintain it, both a high-level paradigm shift of China’s diplomatic approach and a considered assessment of feasible areas of cooperation are needed.

Eight years of cooperation

In assessing the potential for climate and energy engagement during the Trump-Xi era, it’s worth reflecting on a few lessons from the past.

First, there is no real solution to climate change without the US and China travelling in the same direction. Together the world’s two largest emitters have leveraged their size and political significance to mobilise action from other countries.

Bilateral cooperation has led to political alignment on several multilateral outcomes in which both countries had a stake. This includes a successful global climate deal in Paris, a new amendment to the Montreal Protocol in Kigali to control HFC emissions, and a new agreement to address aviation emissions through ICAO.

Second, it has taken great political efforts and time to achieve the breadth and depth of the current energy and climate relationship. Washington and Beijing have been cooperating on climate change and clean energy for several decades.

Since 2009, this cooperation has been greatly enhanced and expanded, resulting in thousands of people from both countries working together to do collaborative research, to share experiences and information, and to develop commercial ventures to deploy clean energy technology. By the end of President Obama’s second term, clean energy cooperation had become the cornerstone of the bilateral relationship, and a key part of the Obama administration’s environmental legacy.

As a result, walking away from climate and energy cooperation could be destabilising for the broader US-China

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relationship. During the eight years of the Obama administration, there was no other issue on which the countries had greater common interest, ranging from their shared concerns about mitigating the economic impacts facing domestic coal communities, to their desire to be global leaders in the development of new energy industries.

This alignment of interests helped facilitate dialogue on a broader set of issues, including more contentious economic and security topics. One vehicle for such exchanges, the Strategic and Economic Dialogue, established a new model for engagement that reflected the growing importance of the relationship, providing “more senior, more direct, and more comprehensive communication,” and providing a diplomatic channel for diffusing potential conflict.

Stepping back

As we approach the end of the first 100 days of the Trump administration, it is becoming increasingly clear that the president is sceptical of the value of international climate engagement. UNFCCC executive secretary Patricia Espinosa, the UN’s top climate diplomat, was not received by Trump administration officials during her late February visit to Washington.

The US State Department now lacks a high-level climate official to engage with international counterparts, including from China. President Trump’s meeting with German Chancellor Merkel reportedly turned sour when she emphasised climate change, which is likely to be a key issue when Germany hosts the G20 summit in Hamburg this summer.

Perhaps this is unsurprising. Trump’s March 16 “America First” budget blueprint would eliminate funding for international climate change programmes, including climate change research and partnership programmes, the Global Climate Change Initiative, and payments to the UN climate change programmes.

In addition, the March 28 Executive Order “Promoting Energy Independence and Economic Growth” revokes key Obama administration executive orders including the Climate Action Plan and calls upon the EPA to “suspend, revise or rescind” the Clean Power Plan, the cornerstones of the US greenhouse gas reduction pledge under the Paris Agreement.

Role reversal

The US political situation certainly makes bilateral engagement much harder. That said, both a high-level paradigm shift of the respective roles that China and the United States play in international climate diplomacy, and a considered assessment of energy technology cooperation priorities, may be needed to maintain the broad and deep partnerships at the heart of the most important bilateral relationship in the world.

It is worth examining areas of joint work that may be feasible given the current political climate in Washington. Energy technology cooperation is one potential area. Ronald Reagan was president when the first protocol for fossil energy cooperation between the two countries was launched. While the George W. Bush administration took the US out of the Kyoto Protocol, it launched several initiatives focusing on international clean energy cooperation, including the Asia Pacific Partnership on Clean Development and Climate, and the Major Economies Meeting. These partnerships laid a foundation for international clean energy cooperation that was continued under the Obama administration, including the Major Economies Forum, the Clean Energy Ministerial, and most recently Mission Innovation.

US-China initiatives like the US-China Clean Energy Research Center (CERC) and the Climate Change Working Group (CCWG) are highly technical and have expanded collaborative research among our universities and national laboratories. These initiatives are bilateral but leverage national goals and priorities. For example in the case of the CERC, costs are split 50-50 between the United States and China, with all US government resources flowing to US-based partners and all Chinese government resources flowing to Chinese-based partners.

Ultimately, a high-level paradigm shift will be required to maintain international momentum on climate diplomacy, with China stepping into the leadership role. In much of the history of bilateral energy and climate engagement with the United States, China has primarily been reacting to a US-driven agenda, rather than being the primary

driver of the agenda. The time has come for China to shift its own diplomatic approach from sitting in the backseat to holding the wheel.

China also holds a special stake in keeping the US accountable with its commitments. With its slowing coal consumption and a booming renewable energy industry, China increasingly has the right domestic conditions to take a more active role.

A first step has already been made. In a high level UN climate event in New York in late March, China's UN ambassador reaffirmed the country's position to remain "steadfast in its determination to advance global climate governance" and to continue to "engage in pragmatic cooperation in such areas as energy efficiency, renewable energy, low-carbon cities and carbon markets."

China is also hosting two key international clean energy meetings that were originally conceived by the US government. The 8th Clean Energy Ministerial and 2nd Mission Innovation Ministerial will be held in Beijing in early June. These events are a great opportunity for China to demonstrate continued leadership on these issues and for the US to show that it will continue to engage with China and the international community on energy technology cooperation.

当美国后退时，中国应担起气候领导大任

特朗普政府会将中美双边合作议程推向何方？

美国总统特朗普与中国国家主席习近平预计将于今天在美国佛罗里达州的海湖庄园举行会晤。鉴于两国之间的紧张态势和特朗普政府的政治倾向，中美两国—这个全世界最重要的双边关系—在气候议程方面的合作正岌岌可危。为了维持合作，中国必须进行高级别外交策略的调整，并就可能的合作领域进行思考和评估。

八年合作

在评估习-特时代两国气候和能源合作的潜在可能时，我们有必要以史为鉴，吸取过去的几个经验。

首先，中美若不能携手前行，气候变化就无法真正解决。作为全球最大的两个碳排放国，中美两国曾展开合作，凭借自身的国家规模和政治地位动员其他国家采取行动。

双边合作已经促进了多个多边政治协议的达成，这些协议跟中美两国都息息相关，包括巴黎大会上成功达成的全球气候协议，基加利会议上通过的《蒙特利尔议定书》氢氟烃减排修正案，以及国际民航组织（ICAO）通过的航空业减排新协议。

其次，中美两国当前在能源和气候方面合作的深度和广度，是投入了大量政治努力和时间才得来的。两国政府就气候变化和清洁能源开展合作已有数十年。

2009年以来中美两国的合作有了大大的加强和扩大，两国有数千人在携手开展研究，分享经验和信息，并在清洁能源技术领域展开商业合作。截至奥巴马总统第二任期末，清洁能源合作已经成为两国双边关系的重要基石，是奥巴马政府环境遗产的关键部分。

因此，放弃当前的气候和能源合作将不利于中美两国关系的稳定发展。气候能源合作是奥巴马执政 8 年间中美两国最大的利益交汇点，两国都致力于减轻国内煤炭产业相关群体面临的经济影响，也都希望成为全球新能源产业发展的领袖。

共同利益促使两国就一系列更为广泛的问题展开对话，其中包括更具争议性的经济和安全话题。中美战略与经济对话作为此类交流渠道之一，不仅建立了新的参与模式，反映出双边关系日益增长的重要性，而且促进了“更高层、更直接、更全面的交流”，成为两国消除潜在冲突的外交渠道。

美国开倒车

特朗普执政即将接近百日，外界也愈发清晰地看到他对国际气候行动价值的怀疑。《联合国气候变化框架公约》秘书处执行秘书、联合国最高气候外交官帕特里夏·埃斯皮诺萨 2 月下旬访问华盛顿时没有得到特朗普政府官员的接待。

目前，美国国务院缺乏与中国等国际伙伴接洽的高级别气候官员。有传闻称，特朗普与德国总理默克尔会晤时因后者强调气候变化，而使两人不欢而散。而气候变化可能会是今年夏天在德国汉堡举行的 G20 峰会的重要议题。

这也许并不令人吃惊。特朗普 3 月 16 日发布的“美国优先”预算蓝图将取消对国际气候变化项目的资助，包括气候变化研究及伙伴项目、全球气候变化计划、以及支持联合国气候变化项目的资金。

此外，特朗普 3 月 28 日还签署名为“促进能源独立和经济增长”的行政命令，推翻了奥巴马政府包括《气候行动计划》在内的多条关键行政命令，并呼吁美国环保署（EPA）“暂缓、修改或废除”《清洁电力计划》这一美国达成《巴黎协定》中温室气体减排承诺的关键基石。

角色互换

美国的政治形势确实加大了双边合作的难度，但为了维持这种伙伴关系的深度和广度，中美两国既需要转变各自在国际气候外交中扮演的角色，也需要思考和评估双方在能源技术领域合作的首要任务。

鉴于华盛顿当前的政治气候，两国有必要研究确定可行的合作领域。能源技术合作就是潜在的合作领域之一。里根总统在任期间，两国签署了首个化石能源合作协议；小布什政府虽未签署《京都议定书》，但发起了包括亚太清洁发展和气候伙伴关系以及主要经济体会议等多个以国际清洁能源合作为核心的活动。这些伙伴关系为后来奥巴马政府继续推进国际清洁能源合作奠定了基础，催生了主要经济体论坛、清洁能源部长级会议以及近来的创新使命等大批合作。

类似中美清洁能源研究中心（CERC）和中美气候变化工作组（CCWG）这类技术层面的项目扩大了两国高校和国家实验室之间在研究领域的合作。这些项目虽然是双边的，但却推动了本国目标和优先项目的发展和落实。以中美清洁能源研究中心为例，成本由双方平摊，各国政府的资源都流向了本国的合作伙伴。

最后，为了保持国际气候外交的势头，中国必须调整其高级别外交策略，担起领导者的重任。纵观两国能源气候领域的合作史，大多数情况下，中国都是在响应美国制定的议程，而不是居于主导地位来推动议程。今时今日，中国是时候转变外交策略，反客为主了。

美国能否信守承诺对中国而言尤为重要。随着煤炭消耗的下降以及可再生能源产业的蓬勃发展，中国的国内环境正愈发有利于其采取更加积极的行动。

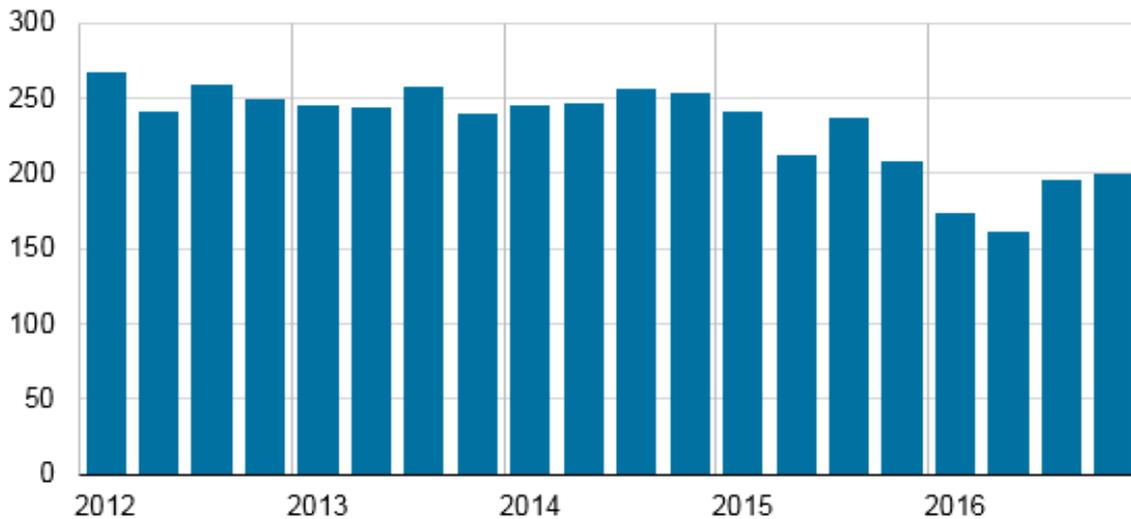
第一步已经完成。3 月下旬在纽约举行的一场联合国高级别气候会议上，中国驻联合国大使重申了本国立场，承诺将“坚决推进全球气候治理”，继续“参与能源效率、可再生能源、低碳城市以及碳交易市场等方面的务实合作。”

中国还将主办最初由美国政府发起的两场重要的国际清洁能源会议，第八届清洁能源部长级会议和第二届创新使命部长级会议都将于 6 月初在北京召开。这两次会议将是中国证明其在这些问题上继续发挥领导作用的绝佳机会，也是美国展示自己将继续与中国和国际社会开展能源技术合作的最佳场合。

Coal (煤炭)

Coal production increases during second half of 2016, but still below 2015 levels

U.S. quarterly coal production (Q1 2012 - Q4 2016)
million short tons



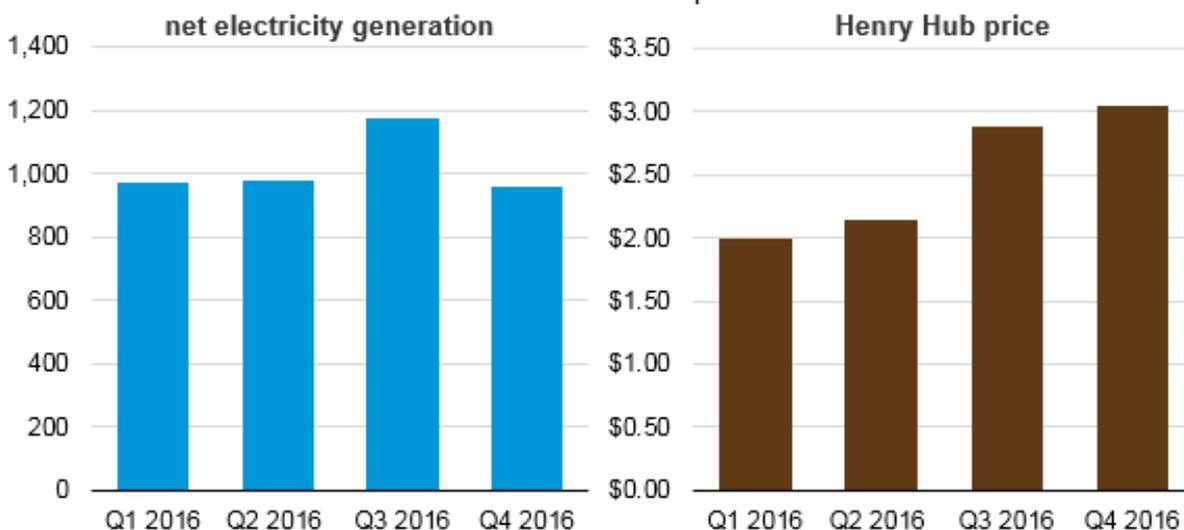
Source: U.S. Energy Information Administration, Weekly Coal Report and Quarterly Coal Report and U.S. Mine Safety and Health Administration

After falling in six out of seven quarters from mid-2014 to mid-2016, coal production rose in the third and fourth quarters of 2016. Among the coal supply regions, the Powder River Basin in Montana and Wyoming saw the largest increases in the second half of 2016. The increases in coal production were driven by an increase in coal-fired electricity generation, which occurred as natural gas prices increased.

Net electricity generation and average Henry Hub natural gas spot price

billion kilowatthours

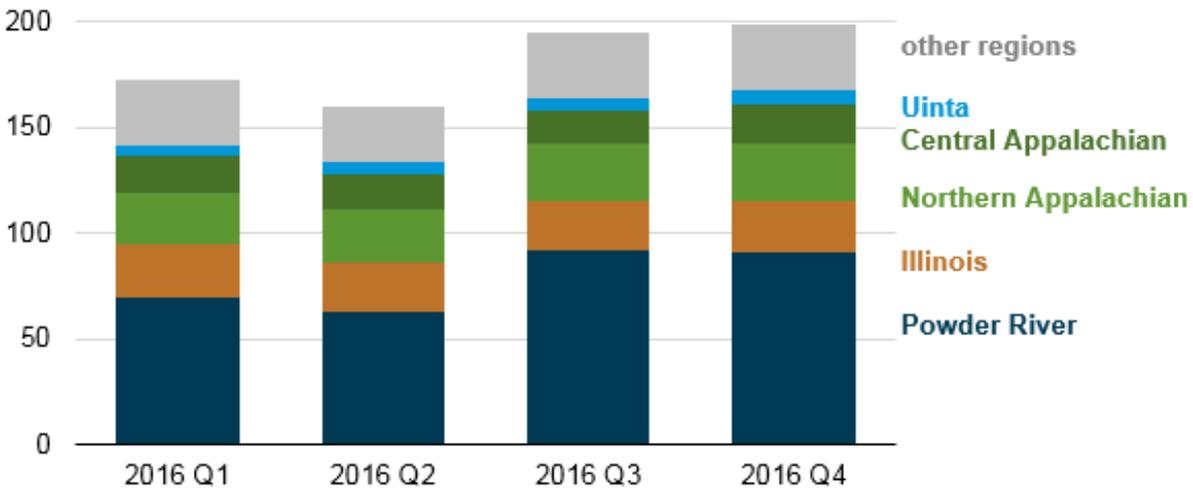
dollars per million British thermal units



Source: U.S. Energy Information Administration, Electric Power Monthly, and New York Mercantile Exchange

Electricity generation accounts for more than 90% of domestic coal use. During the third quarter of 2016, warmer-than-normal temperatures led to increased electricity generation—the highest on record for those three months combined—which resulted in higher consumption of coal compared to the first half of 2016. In the fourth quarter, even as electricity generation declined, because natural gas prices remained higher than in previous quarters, the natural gas share of electricity generation fell and coal consumption increased slightly. During December, the coal share of monthly electricity generation surpassed that of natural gas for the first time since January 2016.

U.S. quarterly coal production by basin (Q1 2016 - Q4 2016)
million short tons

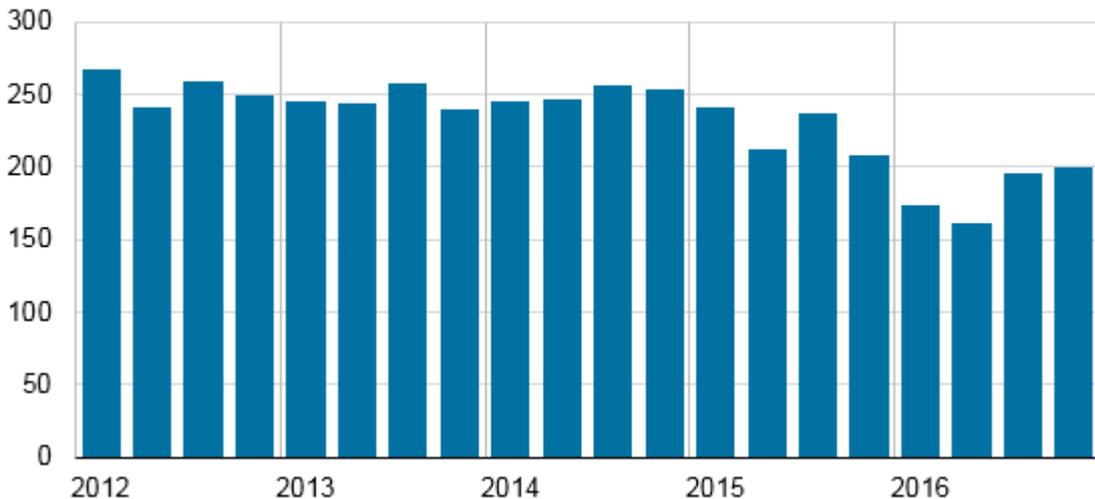


Source: U.S. Energy Information Administration, Quarterly Coal Report, and U.S. Mine Safety and Health Administration

Regionally, production from the Powder River Basin (PRB) increased the most from the first half of 2016 to the second half of 2016. Coal production from other regions, including the Appalachian and Illinois basins, remained relatively flat. Increased demand for Powder River Basin coal was not limited to any geographic region. Almost all of the 29 states that received PRB coal previously increased their consumption during the second half of 2016. Among those states, Texas, Illinois, Missouri, and Wisconsin collectively accounted for approximately half of the total increase in PRB coal demand.

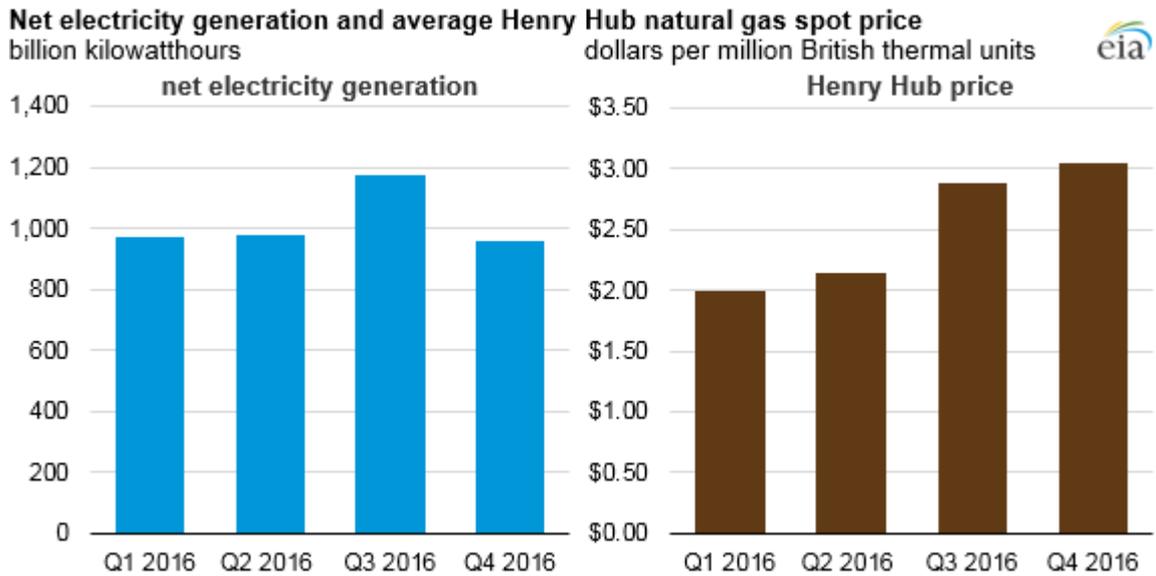
2016 年下半年煤炭产量增加，但仍低于 2015 年的水平

U.S. quarterly coal production (Q1 2012 - Q4 2016)
million short tons



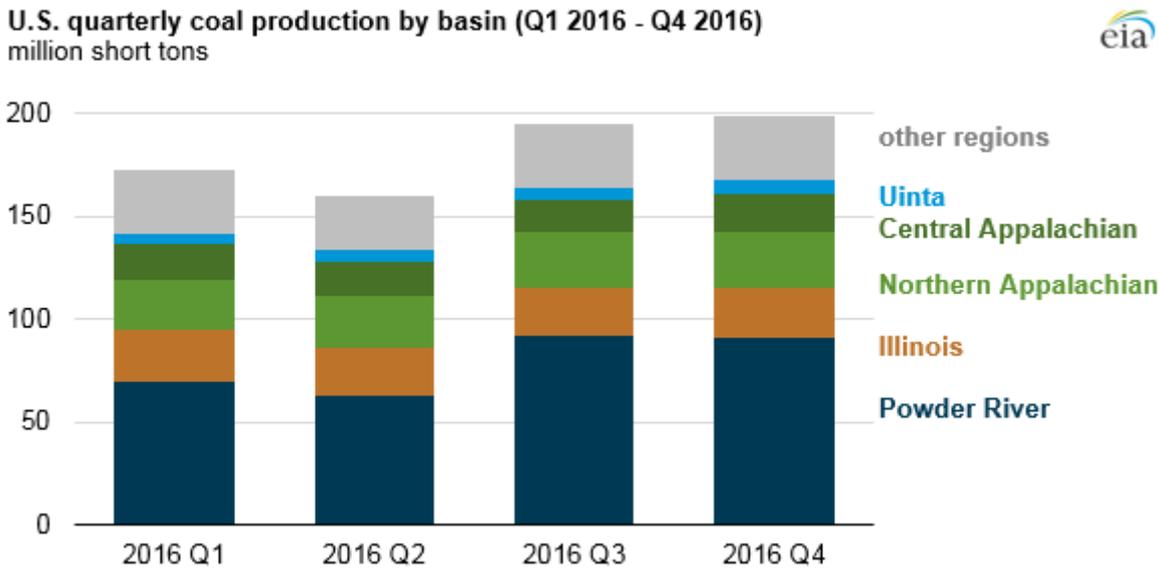
资料来源：美国能源信息管理局，每周煤炭报告和季度煤炭报告以及美国矿业安全卫生管理局
在 2014 年中期至 2016 年中期的七个季度中，六个季度下降，2016 年第三季度和第四季度的煤炭产量上涨。在煤炭供应地区，蒙大拿州和怀俄明州的粉河流域发生了第二大增长随着天然气价格的上涨，燃煤

发电量的增加推动了煤炭产量的增长。



资料来源：美国能源信息管理局，电力月刊和纽约商品交易所

发电量占国内煤炭使用量的 90% 以上。在 2016 年第三季度，温度高于正常温度导致发电量增加，是三个月合并纪录的最高水平，导致煤炭消费量高于 2016 年上半年。第四季度甚至随着电力下降，由于天然气价格依然高于前几季度，发电天然气份额下降，煤炭消费量略有上涨。12 月份，自 2006 年 1 月以来，月度发电煤炭份额首次超过天然气。



资料来源：美国能源信息管理局，“季度煤炭报告”和美国矿业安全卫生管理局

来自粉河流域（PRB）的产量在 2016 年上半年至 2016 年下半年增长最多。其他地区，包括阿巴拉契亚和伊利诺斯盆地的煤炭生产依然较为平坦。对电力河流域煤炭的需求增加并不局限于任何地理区域。接受 PRB 煤矿的 29 个州中几乎所有国家以前在 2016 年下半年增加了消费。其中德克萨斯州，伊利诺伊州，密苏里州和威斯康星州共占据了 PRB 煤炭需求总量的一半。

India to soon start auction process for commercial coal mines

The government may soon start the process of commercial coal mine auction as it waits for feedback on the discussion paper floated by the coal ministry.

These mines will not have any restriction on the end use of the dry fuel. Besides, the private miners will have freedom to manage production, pricing and marketing strategy.

“We have recently put out a draft on commercial mining of coal on the website and invited public comments. Once we receive public comments (we will auction these coal blocks for commercial mining). We have also almost identified the coal blocks for the purpose,” Power, Coal, Mines and New and Renewable Energy Minister Piyush Goyal told reporters at a conference of coal quality.

Goyal further said, “There will be big as well as small blocks for commercial mining of coal. There will be a mixture because every block has its own utility.”

The public and other stakeholders have been asked to submit their comments and suggestions on the draft discussion paper by April 26.

Asked whether the auction could be done in the next six months, he said, “Sure. We can do it. It will depend on the public comments received on the discussion paper. However, we have planned to do it this financial year only.”

Earlier, Coal Secretary Susheel Kumar had said the coal ministry does not require Cabinet approval for auction of commercial coal mines as only the minister’s nod would suffice.

A group of secretaries has also suggested that the government should create competition for the state-owned Coal India Ltd (CIL) by opening up commercial coal mining.

According to the discussion paper, there will be no restriction on the end use of coal mined from these blocks and commercial miners will have a certain degree of flexibility to manage their production depending on the market scenario.

These miners will also have full flexibility to decide its pricing and selling strategy.

It said that as a first step, there should be auction of 2-3 large mines with peak rated capacity of around 30 million tonnes per annum.

Outlining the technical qualifications for bidders, it said their tangible net worth should not be less than Rs 1,500 crore and should have experience of excavating or handling at least 25 million cubic metre per annum in the last three years.

It also provides for formation of joint ventures by private players to aggregate their credential to meet the eligibility criteria.

According to Kumar, as far as public power generators are concerned, the coal imports will be zero by 2017-18.

The coal imports have already come down by 60 per cent for central power generators and by 37 per cent in the case of state generation companies.

Kumar added that Cheyyur ultra mega power project, which was earlier planned on imported coal, will now be based on domestic coal.

Of late, the coal stock situation has improved in the country, which was about 69 million tonnes as on March 31, 2017, up from nearly 58 mt last year.

印度即将开始对商业煤矿进行拍卖

政府可能很快就会开始商业煤矿拍卖的过程，因为它等待煤矿部门讨论的论文的反馈意见。

这些煤矿对于燃料的最终用途不会有任何限制。此外，私人矿工将有自由管理生产，定价和营销策略。

“我们最近在网站上提出了煤炭商业采矿草案，并征求公众意见。一旦我们收到公众意见（我们将拍卖这些煤块进行商业采矿）。我们也几乎确定了煤块。”煤炭，煤矿，矿山，新能源和可再生能源部长 Piyush Goyal 在煤炭会议上告诉记者，

Goyal 进一步表示：“煤炭的商业采矿将会有大块和小块。将会有混合物，因为每个块都有自己的实用程序。”

公众和其他利益攸关方已被要求在 4 月 26 日之前就讨论稿草稿提出意见和建议。

被问及拍卖是否可以在未来六个月内完成，他说：“当然可以。我们可以做到这一点。这将取决于在讨论文件上收到的公众意见。不过，我们只计划在本财政年度这样做。”

此前，煤炭部长库马尔（Susheel Kumar）表示，煤矿部门不要求内阁批准商业煤矿拍卖，只有部长的点头就足够了。

一些秘书还建议，政府应通过开放商业采煤，为国有煤炭印度有限公司（CIL）创造竞争。

根据讨论文件，对这些区块开采的煤炭的最终用途不会有任何限制，根据市场情况，商业矿工将有一定的灵活性来管理生产。

这些矿工也将有充分的灵活性来决定其定价和销售策略。

策略上称作为第一步，应该拍卖 2-3 个大型矿山，年产能达 3000 万吨。

介绍投标人的技术资质，说明其实际净值不得少于 1,500 亿卢比，而且在过去三年应具有每年挖掘或处理至少 2500 万立方米的经验。

它还规定由私营企业组建合资企业以合并其资格以符合资格标准。

根据库马尔的说法，就公共发电机而言，2017-18 年度煤炭进口量将为零。

中央发电机的煤炭进口已经下降了 60%，在国有企业的情况下已经下降了 37%。

库马尔补充说，以前计划在进口煤炭方面的切尤尔超大型电力项目现在将以国内煤炭为基础。

此后，全国煤炭库存状况有所改善，截至 2017 年 3 月 31 日，煤炭库存情况已有 6900 万吨，相较而言，去年近 5800 万吨。

Ukraine's coal production in March down 12.6% on year

Ukraine's production of coal decreased by 12.6% year-on-year to 2.98 million mt in March from 3.41 million mt produced in March 2016, the energy and coal industry ministry reported Thursday, citing preliminary data.

Output also dropped by 19.7% in comparison with February, when 3.71 million mt of coal was extracted.

In the first quarter, Ukraine produced 10.34 million mt of coal, up 3.4% year-on-year, or by 340,000 mt, from 10 million mt produced in January-March 2016, the ministry reported.

The country's state-owned mines extracted 1.32 million mt of coal in January-March, down from 1.58 million mt in the same period of 2016.

Ukraine's coal production has been disrupted since June 2014 due to the armed conflict in Donetsk and Luhansk, the country's two key coal production regions. Parts of Donetsk and Luhansk regions are currently under control of pro-Russian separatists.

Coal output in the government-controlled parts of the Donetsk region decreased by 12.8% year-on-year to 3.53

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million mt in January-March, down from 4.05 million mt a year ago. Production of coal in the government-controlled parts of the Luhansk region soared by 31.8% to 1.41 million mt from 1.07 million mt a year ago, the ministry said.

At the same time, coal output in the Dnipropetrovsk region increased by 12.7% to 4.98 million mt from 4.42 million mt. Coal extraction in the Lviv region fell 2% to 383,600 mt from 391,500 mt, and coal production in the Volyn region dropped by 41.8% to 31,800 mt from 54,600 mt.

Ukraine produced 40.86 million mt of coal in 2016, compared with 39.74 million mt in 2015, 65.0 million mt in 2014 and from 83.7 million mt in 2013, according to the ministry.

乌克兰 3 月份的煤炭产量同比下降 12.6%

据能源及煤炭工业部周四报道，乌克兰的 3 月份煤炭产量同比下降 12.6%，至 298 万吨，比去年 3 月份的 341 万吨大幅增长。

二月份产量也下降了 19.7%，提炼煤炭量 371 万吨。

在第一季度，乌克兰没产量为 1034 万吨，同比上涨 3.4%，增加 34 万吨；相比之下，2016 年一季度产煤量为 1000 万吨，能源及煤炭工业部报告称。

该国的国有煤矿在 1 - 3 月份提炼了 132 万吨煤，低于 2016 年同期的 158 万吨。

由于顿涅茨克和该国两个主要煤炭生产地区的卢汉斯克武装冲突，乌克兰的煤炭生产自 2014 年 6 月以来一直处于中断状态。顿涅茨克州和卢曼西斯地区的部分地区目前受到亲俄罗斯分裂主义者的控制。

顿涅茨克地区政府控制的煤炭产量同比下降 12.8%，达到 353 万吨，一年前为 405 万吨。该部门表示，卢安斯克地区政府控制煤炭产量同比增长 31.8% 至 141 万吨。

同时，第聂伯罗彼得罗夫斯克地区的煤炭产量从 442 万吨增加了 12.7%，达到 498 万公吨。利沃夫地区的煤炭开采量从 391.5 万吨下降 2%，至 38.36 万吨，沃因地区的煤炭产量从 54,600 吨下降了 41.8%，至 31,800 吨。

乌克兰 2016 年产量为 40886 万吨，2015 年为 3974 万吨，2014 年为 6500 万吨，2013 年为 8,370 万吨。

Asian met coal prices skyrocket 32% overnight

Spot met coal prices in the Asia-Pacific region soared Wednesday as mills jostled for cargoes amid news that BHP Billiton, the world's largest met coal producer, declared force majeure due to logistical problems caused by Cyclone Debbie.

S&P Global Platts assessed Premium Low Vol FOB Australia up \$58.50/mt, or 32%, to \$241/mt FOB Australia Wednesday, the largest daily rise since the assessment began in 2010, and greater than the \$35/mt hike on January 14, 2011, caused by Cyclone Yasi.

“The [premium coking coal] market is going berserk,” one source said, with “all traditional market players hunting for cargoes.”

The source said Wednesday evoked memories of Cyclone Yasi in 2011.

The source indicated BHP's declaration of force majeure was an important signal and trigger that sent global steelmakers scrambling for non-Queensland met coal supply.

This followed force majeure declared by Yancoal, Qcoal and Jellinbah Group. One steelmaker said that while other miners had not publicly declared force majeure, they had already declared it on a “cargo-by-cargo basis.”

Firm market demand was reflected by the flurry of spot trades for met coal from several swing suppliers —

Canada, the US, Russia and China — for a wide spectrum of products.

The buyer pool also appeared to be diverse, with Northeast Asia, India and Europe all understood to have purchased cargoes.

Related blog: Situation room: Cyclone Debbie hits world's metallurgical coal capital

GLOBAL SUPPLY SHORTAGE

The wide geographical range of trades points to the global magnitude of the supply shortage faced by the market.

This was reflected in bid indications from end-users Wednesday. The highest indicative bid was \$240/mt FOB Australia for premium HCCs by a large international steelmaker.

Another international steelmaker saw a price range of \$200-\$250/mt FOB Australia as a bid indication due to a scarcity of resources.

Mirroring these bid indications were trades done, or very close to being done.

One was for a premium coal of Australian origin re-exported from Chinese ports at \$240/mt FOB China. The volume was said to be 60,000 mt.

Another was Chinese premium HCC with CSR over 70% at above \$260/mt FOB China, for 60,000 mt for an April laycan.

“The price is high because there are no coals,” a market source said.

A steelmaker said: “Some of our shipments have been canceled. The problem [shortage] is real.”

Other premium HCCs were also traded, with more than two trades of Canadian coal, though all on a floating price basis.

In the second-tier segment, there were no trades being done, but a sell-side source indicated he would increase his offer price by \$13/mt day on day for non-Australian HCC with 55-60% CSR.

There was a spot offer for US coal with 62-63% CSR, 29-30% VM and 0.9% sulfur at \$205/mt CFR India. This was for a Panamax cargo for an April 10-20 laycan.

In the semi-soft market, a supplier raised his offer by \$35/mt day on day to \$130/mt for 39-40% VM, 5-6% ash coal, saying inquiries had now risen.

“We're expecting some inquiries from China, and there have been ones from India and Japan. There just isn't much coal available,” he said.

One major Asian steelmaker said he would bid \$130/mt for 36-39% CSR, 34-36% VM semisoft coal.

The PCI market, in contrast, saw the smallest uptick.

A spot trade was done for Russian material with 19-21% VM, below 10% ash, 0.3-0.5% sulfur and around 65-75 HGI at around \$125/mt CFR India, for an April 5-15 laycan.

MILLS ACQUIESCE TO LARGE COKE RISE

In the metallurgical coke segment, a major North China-based coke maker was heard to have raised its prices by Yuan 80/mt, with no pushback from steelmakers.

The met coke export market also saw stronger inquiries, in particular from the international market because of the impact of Cyclone Debbie, participants said.

This was because some steelmakers were turning attention to importing met coke, rather than coking coal, should supply be tight.

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One coke supplier indicated he had received very strong inquiries Wednesday morning from multiple sources seeking cargoes.

The most competitive offer heard Wednesday was \$303-\$305/mt FOB China for 64/62% CSR material.

MILLS TRY TO COPE WITH SURGING COSTS

Steelmakers surveyed Wednesday indicated there could be several ways in which they could try to cope with surging met coal costs.

In the short term, the easiest option would be to seek alternative supplies of met coal, two steelmakers said.

Should they fail, options could include temporarily downgrading met coke quality due to the scarcity of premium HCCs.

Slowing the coking time in the coke ovens could also help to reduce met coal usage. Some steelmakers indicated increasing PCI injection rates could also help to reduce met coke consumption.

The least favored option, in the short run, could be steel production cuts or importing Chinese met coke, several steelmakers said.

Source: Platts

亚洲煤炭价格一夜之间飞涨 32%

现场直击周三亚太地区煤炭价格飙升，与此同时工厂在争抢货物，新闻是关于世界最大的煤炭生产商 BHP Billiton，宣布了由于不可抗力飓风戴比所造成的后勤问题。

标准普尔全球普氏评估的 Premium Low Vol FOB 澳大利亚是每吨 58.50 美元，或者说是周三 241 美元的 32%，这是从该评估自 2010 年开始以来的最大单日涨幅，超过 35 美元/吨上涨幅度的情况出现在 2011 年 1 月 14 日，是飓风“雅斯”引起的。

“优质焦炭”的市场会变得疯狂，知情人士表示，这种焦炭是所有的货运市场参与者都在争取的。他说，周三的情况使他回想起 2011 年的雅斯。

该知情人士表示，BHP 关于不可抗力的声明，是一个重要的信号，触发了全球钢铁制造商争夺非昆士兰煤炭供应。

这紧接着 Yancoal, Qcoal 和 Jellinbah 宣布不可抗力之后。一个钢铁制造商表示，尽管其他矿业公司没有公开宣布不可抗力，他们已经在货对货的基础上表明了这一点。

公司的市场需求被现货交易所左右，为了满足几个摇摆不定的供应商，比如加拿大、美国，俄罗斯和中国，为了更广泛的产品。

买家群体也似乎是多样化的，东北亚，欧洲和欧洲都被理解为已购买货物。

相关博客：情况讨论室：旋风戴比给世界的冶金煤资本以冲击

全球供应短缺

广泛的地理范围表明全球市场供应短缺的严重程度。

这反映在周三终端用户的投标迹象中，最高指示的 FOB 澳大利亚优质煤炭出价为 240 美元/吨，来自一家国际大型钢铁企业。

另一个国际钢铁制造商的 FOB 澳大利亚价格范围是 200 美元至 250 美元/吨，是稀缺资源而引起的。

这些投标迹象交易大约已经达成，或非常接近达成。

还有一个是澳大利亚的优质煤，重新出口到中国港口，FOB 中国的价格是 240 美元/公吨。体积据说是 60000 吨。

另一个是伴随 CER 的优质 HCC，超过 70%，FOB 中国是 260 美元/吨，四月卸货 60000 吨。

“价格高是因为没有煤。”市场人士说。

钢铁制造商表示：我们的出货量有些已被取消。[短缺]的问题是真实的。”

也有其他交易的优质 HCC，尽管价格在浮动，也有多个行业的加拿大煤交易。

在二线市场，没有正在进行的交易，但出售方表示他会将伴随 55-60%CSR 的非澳大利亚 HCC 逐日增加 13 美元/吨。

带有 CSR, 62-63 % CSR, 29-30% VM 和 0.9%硫的美国煤现货报价是 205 美元/公吨 CFR 印度。四月 10-20 日巴拿马货物卸货。

在半软市场，供应商把出价逐日提高 35 美元/吨，39-40% VM，5-6%的粉煤灰的报价是 130 美元/公吨，说明调查已经上升。

“我们正期待来自中国的一些查询，已经有来自印度和日本的。只是可用煤还不太多，他说。

一个主要的亚洲钢铁生产商说他将为出价 36-39 % CSR，34-36 % VM 半干煤出价 130 美元/公吨。

相比之下，PCI 市场的涨幅最小。

四月 5-15 日卸货的一笔与俄罗斯的现货交易已经达成，是 19-21 % VM，低于 10%的煤灰，0.3-0.5% 的硫，65-75 HGI，CFR 印度大约 125 美元/吨。

工厂默许了大的焦炭涨幅

在冶金焦段，主要基于中国北方的焦炭制造者将价格提高了 80 元/吨，钢铁企业没有反对。

有关者称，由于飓风戴比的影响，焦炭出口市场也出现了更强的询盘，特别是来自国际市场。

这是因为一些钢铁制造商将注意力转向进口焦炭，而不是炼焦煤。

一名焦炭供应商表示，他星期三早上收到来自多个货源的询盘。

周三最有竞争力的是 303 美元- 305 美元/吨 FOB 中国，64 / 62% CSR 的材料。

工厂试图应对飙升的成本

星期三接受调查的钢铁制造商表示，他们可能有几种方法可以应对飙升的煤炭成本。

两家钢铁制造商表示，从短期来看，最简单的选择就是寻求可供选择的煤炭供应。

如果他们失败，选择可能包括由于 HCC 的稀缺和疯涨，暂时降级焦炭质量。

降低焦炉结焦时间也有助于降低煤的使用率。一些钢铁制造商表示增加喷煤量也有助于降低焦炭消费量。

几家钢铁制造商表示，从短期来看，最不受欢迎的选择可能是钢铁减产或进口中国焦炭。

来源：普氏能源资讯

China's coal-conversion projects surge back to life

Water-guzzling coal-conversion projects are springing to life in arid western China, setting the stage for the large-scale deployment of what was previously a niche industry.

A three-year downturn in coal prices has revived projects that convert coal to motor fuel, petrochemical feedstock or gas, after many were shelved in 2008 because of concerns about water supply and pollution.

Successful development in China opens the door to the export of coal-intensive technologies, undercutting international efforts to limit emissions of carbon and other greenhouse gases. Coal conversion is not only highly polluting, it also consumes large amounts of water.

“It’s certainly something China is focusing on,” said Benjamin Sporton, chief executive of the World Coal Association. “As the energy mix diversifies, coal producers are coming under pressure and they are looking at other ways to use coal.”

Chinese coal-conversion projects have been stop-start for years. They are plagued by technical difficulties, billions of dollars in losses and bureaucratic reversals. New coal conversion targets were set in January after Chinese

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president Xi Jinping endorsed a mammoth coal-to-oil plant in Ningxia, a desert region with some of the world's richest coal reserves.

The expansion strains the scarce water resources of China's coal heartlands. Coal-to-liquids plants traditionally use 13 tonnes of water per tonne of fuel produced.

The first phase of state-owned coal group Shenhua's pilot project in Ordos, Inner Mongolia, caused the local aquifer to drop by up to four metres in its first year of operation. Phase two begins this year and will rely on mining and urban wastewater, Zhang Chuanjiang, Shenhua's head of coal to liquids, told a recent conference. Shenhua plans to cap water use at six tonnes per tonne of output, he said.

Complicated schemes to transfer rights to water from the Yellow River are enabling coal-conversion projects in areas short of water resources. Water rights transfers are being eyed for Zhundong, Xinjiang, where a planned \$28.5bn cluster of coal conversion projects has encroached on a nature reserve.

Shenhua's Ningdong plant has secured Yellow River water rights previously allocated to Ningxia's 2,000-year-old rice paddies, said Yao Min, vice-general manager of the project.

China's coal giants want to promote coal conversion overseas, especially as part of China's "Belt and Road" initiative. "We are pushing overseas projects where there are low-cost coal resources," Mr Zhang said.

Projects that work in China's state-dominated economy may not be practical elsewhere. Coal conversion has become profitable in China because of an unusual combination of low coal prices relative to state-set gas or petrol prices.

Coal-to-liquids projects normally make economic sense only when oil prices are high or supply is limited. The technology was first developed in Nazi Germany and commercialised in apartheid-era South Africa.

Natural gas prices are set relatively high in China to justify pipelines running thousands of miles from central Asia to population centres in the east. That gives an opening to gas derived from coal, which is projected to supply 12 per cent of China's gas consumption by 2020.

The switch to gas forms part of Beijing's Paris agreement pledge for emissions to peak around 2030.

Meanwhile, a state-set price band designed to protect state-owned refiners from oil price downturns has also allowed coal to be profitably transformed into motor fuels.

Coal-conversion plants' cost basis is about Rmb3,000 (\$435) per tonne, compared with about Rmb5,000 at China's most efficient refineries.

Chinese coal conversion plans add to water stress



Sources: World Resources Institute; Greenpeace; NDRC; company filings

FT

中国西部重新上马煤转化项目

2008年出于供水和污染方面的担忧，中国许多煤转化项目被搁置。如今这类项目正在干旱的中国西部重新焕发生机。

耗水量极大的煤转化项目正在干旱的中国西部焕发生机，为这个昔日小产业的大规模布局奠定了基础。

3年来煤价的持续低迷，让许多煤转化项目得以重新启动，包括将煤转化为发动机燃料、石化原料或天然气。2008年出于供水和污染方面的担忧，许多这类项目被搁置。

中国煤转化项目的成功发展打开了煤炭密集型技术出口的大门，将削弱国际社会为限制碳排放和其他温室气体排放而付出的努力。煤转化不仅污染大，还消耗大量水资源。

世界煤炭协会(World Coal Association)首席执行官本杰明·斯波顿(Benjamin Sporton)表示：“这肯定是中国

国正关注的焦点。随着能源结构多样化，煤炭生产商面临着压力，他们正寻找煤的其他用途。”

中国的煤转化项目多年来一直时断时续，困扰它们的包括技术难题、数十亿美元的损失以及政府态度的突然转变。在中国国家主席习近平批准了宁夏的一个超大型煤制油项目后，中国政府于今年 1 月制定了新的煤转化目标。宁夏为沙漠地区，也是世界上煤炭储量最丰富的地区之一。

这一扩张给中国煤炭主产地稀缺的水资源造成压力。煤制油工厂生产每吨燃料通常要使用 13 吨水。

Chinese coal conversion plans add to water stress



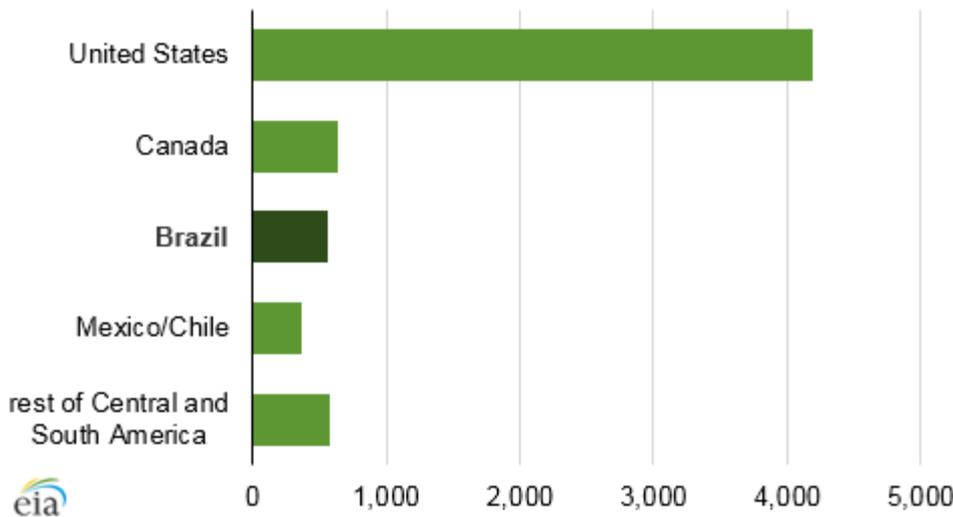
Sources: World Resources Institute; Greenpeace; NDRC; company filings

FT

Electricity (电力)

Brazil has the third-largest electricity sector in the Americas

Electricity generation in the Americas
billion kilowatthours

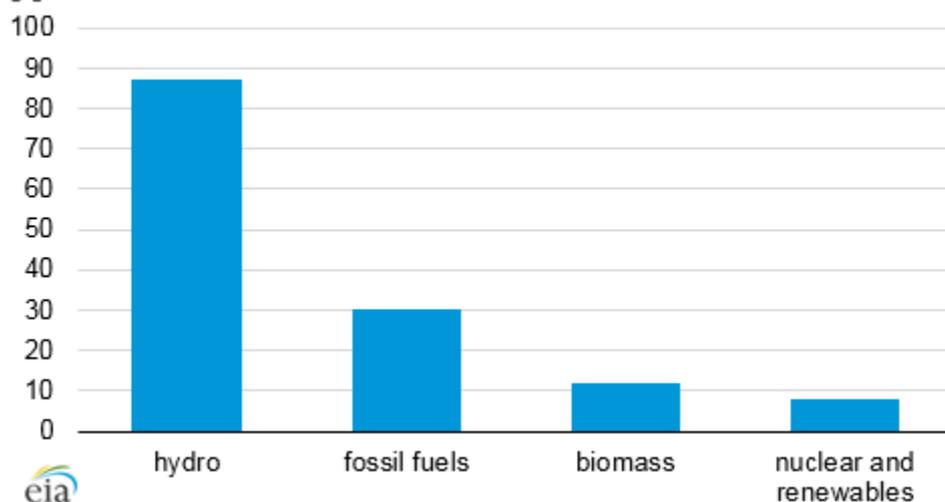


Source: U.S. Energy Information Administration, International Energy Outlook 2016

Brazil generates the third-highest amount of electricity in the Americas, behind only the United States and Canada. In 2016, Brazil had an installed generating capacity of 137 gigawatts (GW) and generated 560 billion kilowatt hours of electricity. Most of Brazil’s generation capacity is located in the Amazon basin, north of most urban load centers, which are located in the southeast, contributing to the complexity of Brazil’s transmission and distribution system.

Hydroelectricity makes up the bulk of Brazil’s generating capacity (87 GW), with the remainder provided by fossil fuel sources (30 GW), biomass (12 GW), and small amounts of wind and nuclear. Brazil is the second-largest producer of hydroelectric power in the world, behind only China, and hydropower currently accounts for more than 70% of electricity generation in the country.

Brazil electric generating capacity by fuel (2016)
gigawatts



Source: U.S. Energy Information Administration, International Energy Outlook 2016

Fossil fuels are Brazil’s second largest source of electricity. Natural gas is the primary fossil fuel used in Brazil and makes up more than half of Brazil’s fossil fuel capacity. Coal makes up much of the rest. The planned Porto de Sergipe combined-cycle natural gas power plant, scheduled to come online in late 2019 with a generating

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capacity of 1.5 GW, will be the largest natural gas power plant in Latin America.

Brazil has two nuclear power plants, the 640 megawatt (MW) Angra 1 and the 1,350 MW Angra 2. Eletronuclear, a subsidiary of state-owned Eletrobras, operates both plants. The Angra 1 nuclear power plant began commercial operations in December 1984, and Angra 2 began commercial operations in December 2000. Construction of a third plant, the 1,405 MW Admiral Alvaro Alberto Nuclear Power Station (CNAEA), began in 1984 but has not yet been completed. Eletronuclear anticipates that it will begin commercial operations by May 2018.

Brazil plans to increase the share of non-hydro renewables in its generation mix and in December 2015, announced the Distributed Generation Development Program for Energy (ProGD) to expand consumer investment in renewable resources, particularly solar photovoltaic. The ProGD projects that 2.7 million consumer units could provide 23.5 GW of electric generation capacity by 2030.

The government plays a substantial role in the Brazilian electricity sector—Eletrobrás owns about one-third of total installed capacity. Transmission lines in Brazil are also largely state owned, with Operador Nacional do Sistema Elétrico (ONS) being a nationwide operator.

Most of Brazil's generation capacity is located far from urban demand centers, which requires significant investment in transmission and distribution systems. The Madeira transmission line, completed in 2014, is the longest high-voltage, direct-current line in the world and spans 1,476 miles to link new hydropower plants in the Amazon Basin to major load centers in the southeast. Increased emphasis on distributed generation will help reduce the need for additional transmission infrastructure in the future.

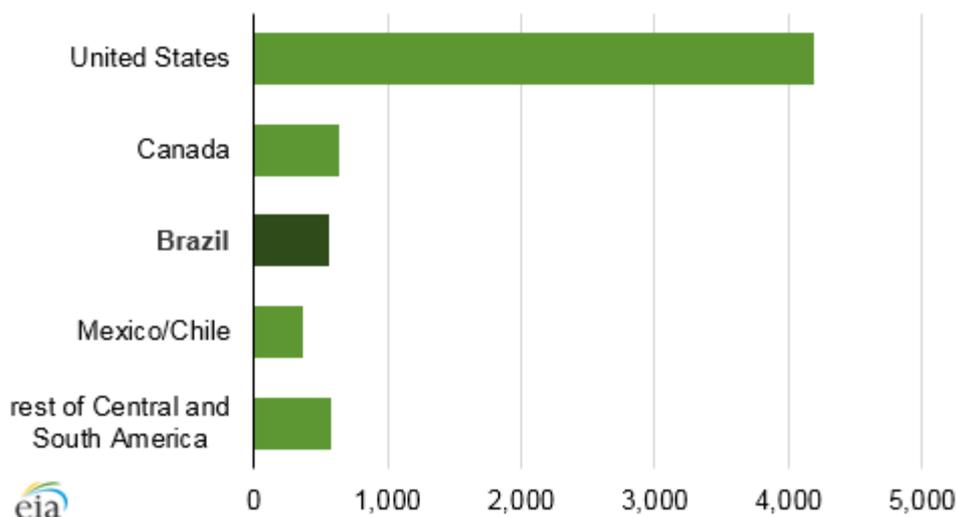
Brazil's Madeira transmission line



Source: U.S. Energy Information Administration

巴西拥有美洲第三大电力行业

Electricity generation in the Americas
billion kilowatthours

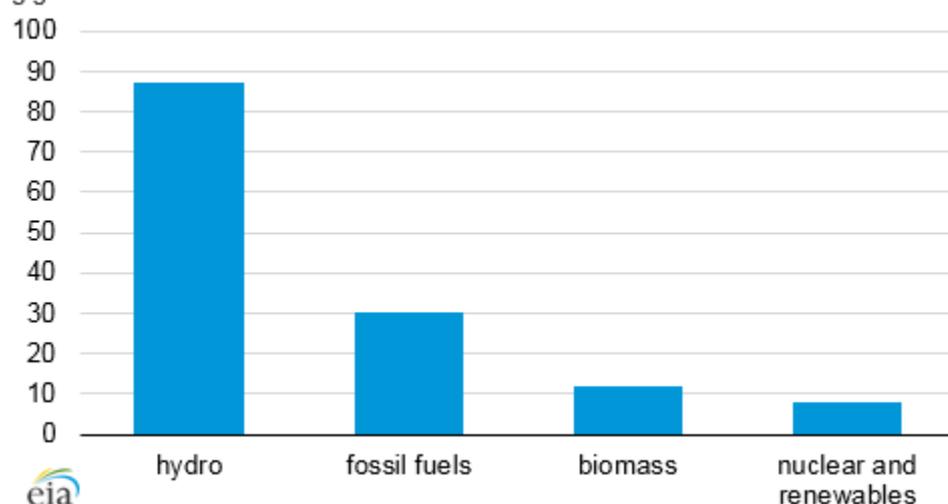


资料来源：美国能源信息署，2016年国际能源展望

在美洲，巴西发电量仅次于美国和加拿大。2016年，巴西的发电量达到了137吉瓦和5600亿千瓦时的电力。巴西的大部分发电能力位于亚马孙河流域，位于东南部的大多数城市负荷中心北部，对巴西输配电系统的复杂性造成了影响。

水电占巴西发电量（87吉瓦）的大部分，其余由化石燃料（30吉瓦）、生物质能（12吉瓦）和少量的风能和核能提供。巴西是世界第二大水电生产国，仅次于中国，水电目前占该国发电量的70%以上。

Brazil electric generating capacity by fuel (2016)
gigawatts



资料来源：美国能源信息署，2016年国际能源展望

化石燃料是巴西第二大电力来源。天然气是巴西使用的主要化石燃料，占巴西化石燃料的一半以上。煤占其余部分。计划的Porto de Sergipe联合循环天然气发电厂计划于2019年底上线，发电量为1.5吉瓦，将成为拉丁美洲最大的天然气发电厂。

巴西拥有两座核电站，产能640兆瓦（MW）的安格拉1号电站和产能1350兆瓦的安格拉2号电站。国际电力公司的子公司Eletronuclear运营两家工厂。安格拉1号核电站于1984年12月开始商业运行，安

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格拉 2 号于 2000 年 12 月开始商业运营。第三座工厂，即 1 4505 千瓦的阿尔瓦罗·阿尔贝托核电站（CNAA）建于 1984 年，始于 1984 年完成伊朗核能预计会到 2018 年 5 月开始商业运作。

巴西计划在其发电组合中增加非水电可再生能源的份额，并于 2015 年 12 月宣布分布式发电发展计划（ProGD），扩大消费者对可再生资源的投资，特别是太阳能光伏。ProGD 项目预计，到 2030 年，270 万个消费单位可以提供 23.5GW 的发电量。

政府在巴西电力行业发挥着重要作用 - Eletrobrás 拥有总装机容量的三分之一。巴西的传输线也在很大程度上是国有的，其中西班牙国家公民组织（SistemaEléctrico，ONS）是全国运营商。

巴西的大部分发电能力远离城市需求中心，这需要对输配电系统进行大量投资。马德拉斯输电线路于 2014 年完成，是世界上最长的高压直流线，跨越 1,476 英里，将亚马孙河流域的新水电站连接到东南亚的主要负荷中心。越来越强调分布式发电将有助于减少未来对额外传输基础设施的需求。

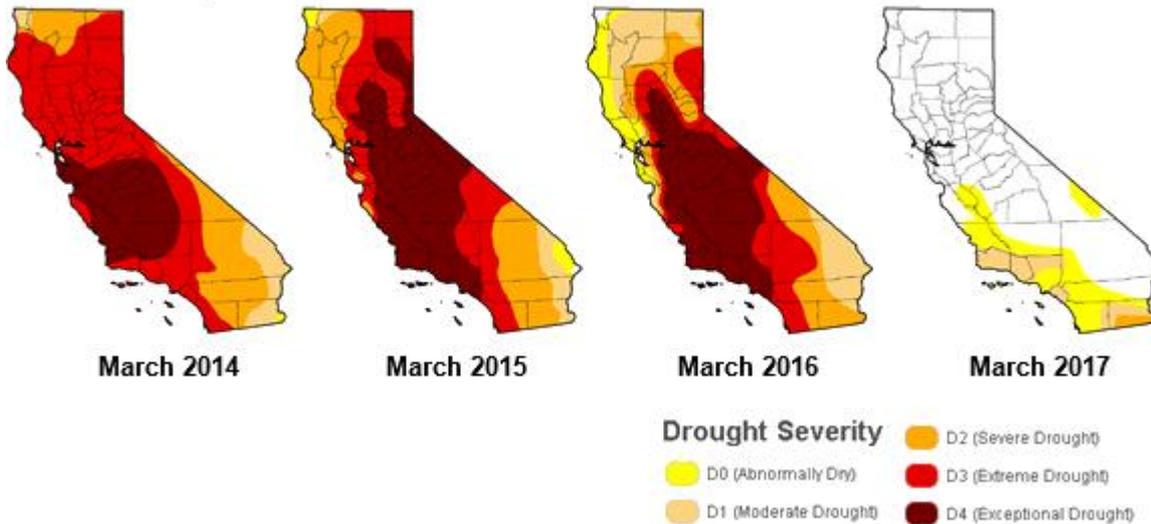
Brazil's Madeira transmission line



资料来源：美国能源信息管理局

Record precipitation, snowpack in California expected to increase hydro generation in 2017

California drought status



Source: U.S. Department of Agriculture Drought Monitor

Republished March 23, 2017, 11:30 a.m. to correct the percentage of California still in D1 status.

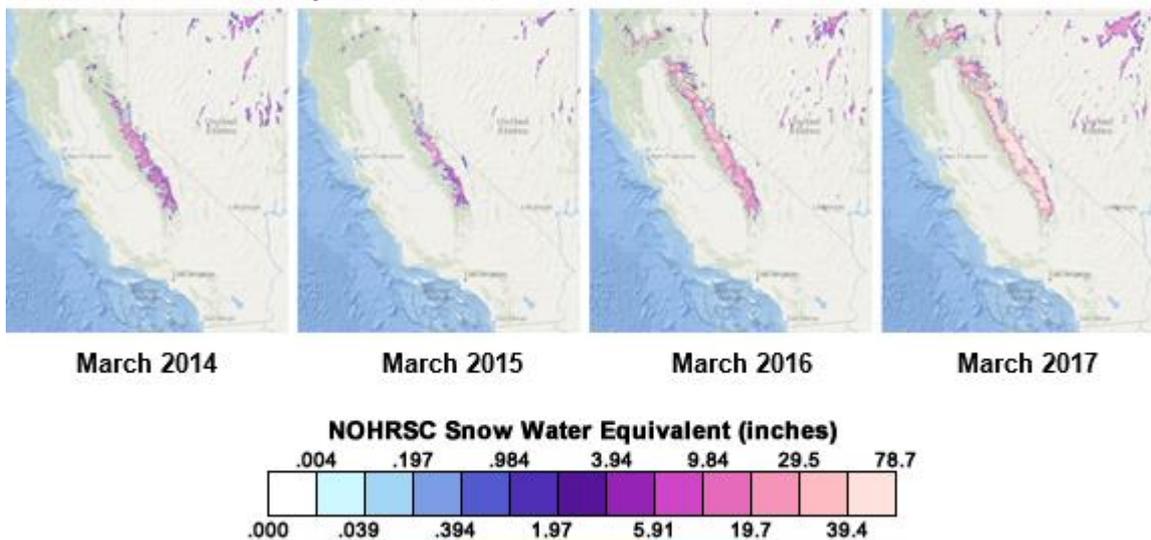
For the first time since 2011, California’s drought is significantly weakening—a result of one of the wettest winters on record. California has experienced record levels of precipitation this winter, and unlike last winter, cooler temperatures over the 2016–2017 winter season have enabled the precipitation to build up snowpack (the total accumulated snow and ice on the ground). High precipitation and snowpack levels, both of which supply hydroelectric generators throughout the year, suggest that hydroelectric generation in California in 2017 will significantly exceed 2016 levels.

Although the drought state of emergency declared by California authorities in January 2014 is still in place, drought conditions have noticeably improved, and the northern half of the state is no longer classified in any stage of drought severity. The area of the state classified as being in exceptional drought (D4), the most extreme category, has dropped to zero, a significant improvement over the 40% and 35% of the state’s land area classified as being in exceptional drought in March 2015 and 2016, respectively. However, 8% of the state—mostly regions in the south—is still in a moderate drought (category D1) status or worse. Mandatory water restrictions, enacted for the first time in the state’s history in April 2015, remain in effect in California. State officials are expected to wait until the full winter season ends in April to amend or rescind the state’s emergency drought declaration.

Snowpack levels have increased significantly from the near-zero levels measured in the Sierra Nevada Mountains in April 2015. As of March 21, 2017, the California Department of Water Resources reported that statewide snowpack was 158% of normal for that date. A more important metric when considering snowpack is the snow water equivalent (SWE)—the total amount of water contained within the snowpack. California’s SWE levels have noticeably increased this year, and as of March 21, the California Department of Water Resources reported that the statewide snow water equivalent was also 158% of average for that date.

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California snow water equivalent levels

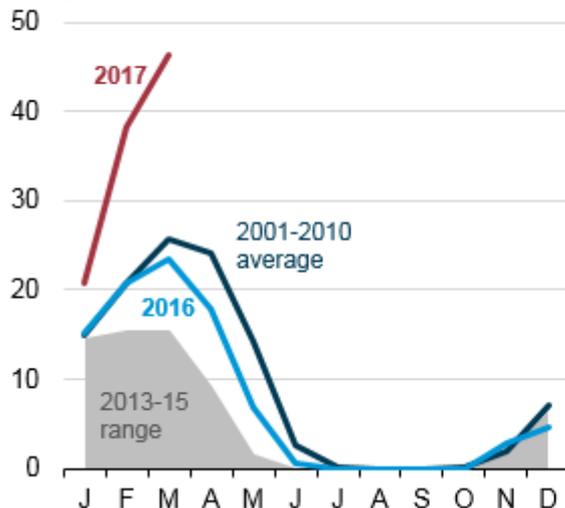


Source: California Nevada River Forecast Center

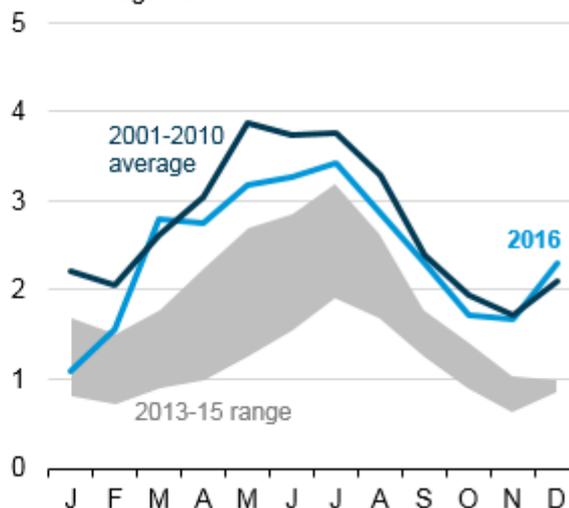
Note: Click to enlarge.

Snowpack and SWE are strong drivers of hydroelectric generation because runoff from melting snowpack feeds hydroelectric plants in the spring and summer months. California's hydroelectric generation increased through most of 2016, especially toward the end of the year. Total 2016 hydroelectric generation in California was well above the 2013–2015 range and was nearly as high as the longer-term, pre-drought generation average over 2001–2010. High levels of SWE from the 2016–2017 winter suggest increases in hydroelectric generation in California later in 2017.

California snow water equivalent inches



California net hydroelectric generation million megawatthours

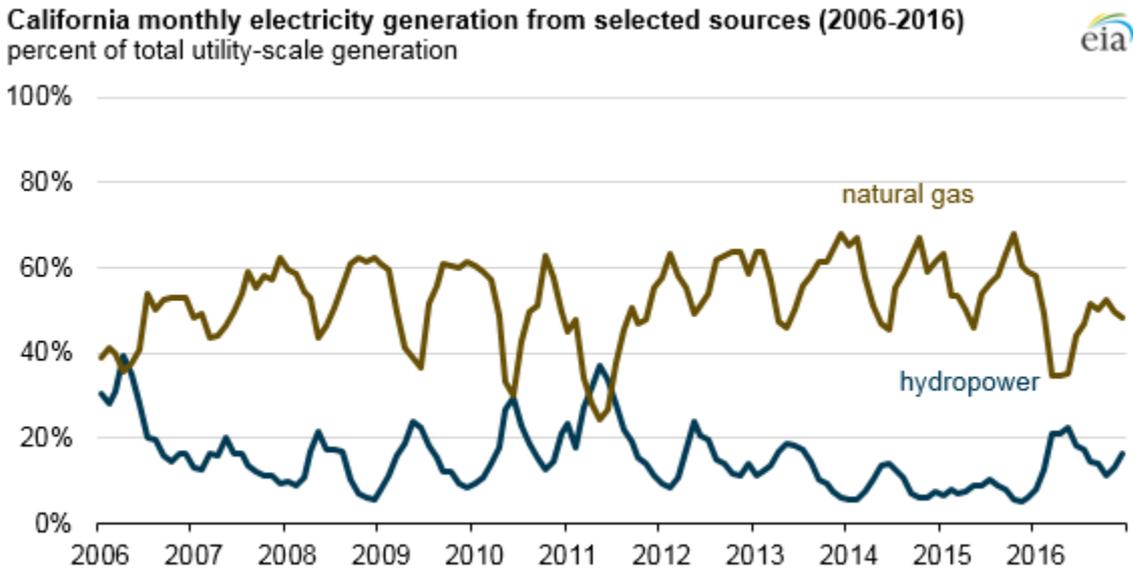


Source: U.S. Energy Information Administration, Electric Power Monthly, and California Department of Water Resources

Note: California snow water equivalent data for March 2017 is based on a partial set of monthly data.

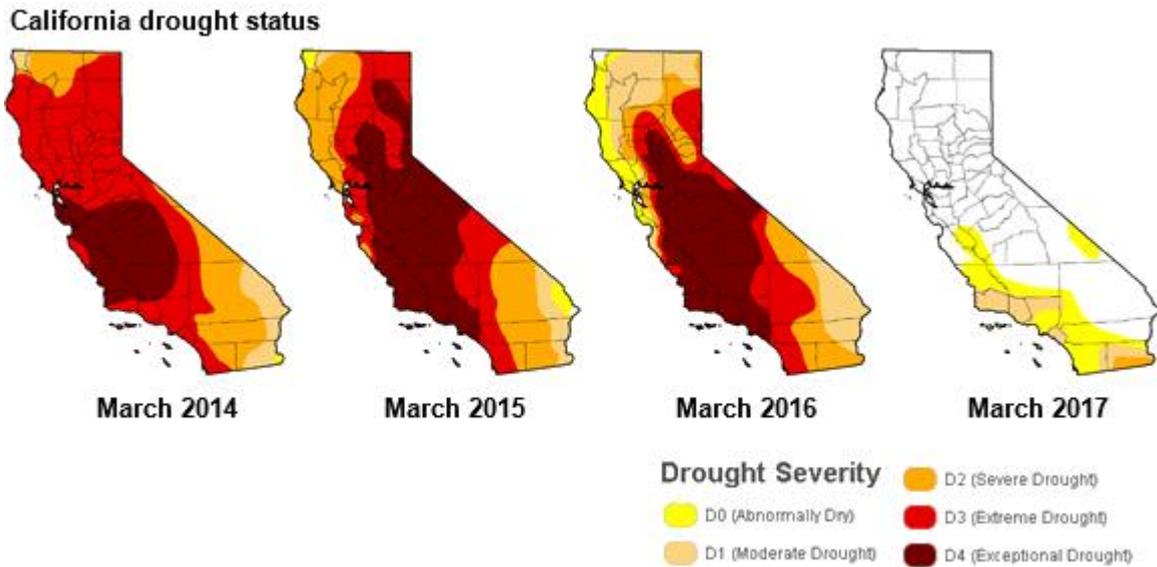
Decreasing hydroelectric generation in California in recent years has been offset by increasing natural gas, wind, and solar generation. An increase in hydroelectric generation could decrease reliance on generation from other sources, particularly natural gas-fired generation, potentially helping to mitigate the ongoing limitations at the Aliso Canyon natural gas storage facility in Southern California. According to data from the California

Independent System Operator (CAISO), the grid operator for much of the state, hydro generation in the CAISO service area so far in 2017 has been double that over the same period of 2016. Over the same time, natural gas generation has been down nearly 20%.



Source: U.S. Energy Information Administration, Electric Power Monthly

加利福尼亚降水降雪增加，预计会使 2017 年水电量增加



资料来源：美国农业部旱灾监测

于 2017 年 3 月 23 日上午 11 点 30 分重新发布，以纠正加州仍处于 D1 状态的百分比。

自 2011 年以来，加州的干旱明显减弱，这是最炎热的冬季之一。今年冬天，加利福尼亚的降水量达到创纪录水平，与去年冬天不同，2016 - 2017 年冬季的气温较低，使得降水量增加了积雪（地面积雪和积冰）。两年来这些供水水电站的高降水和积雪水平表明，2017 年加州的水力发电将大大超过 2016 年水平。

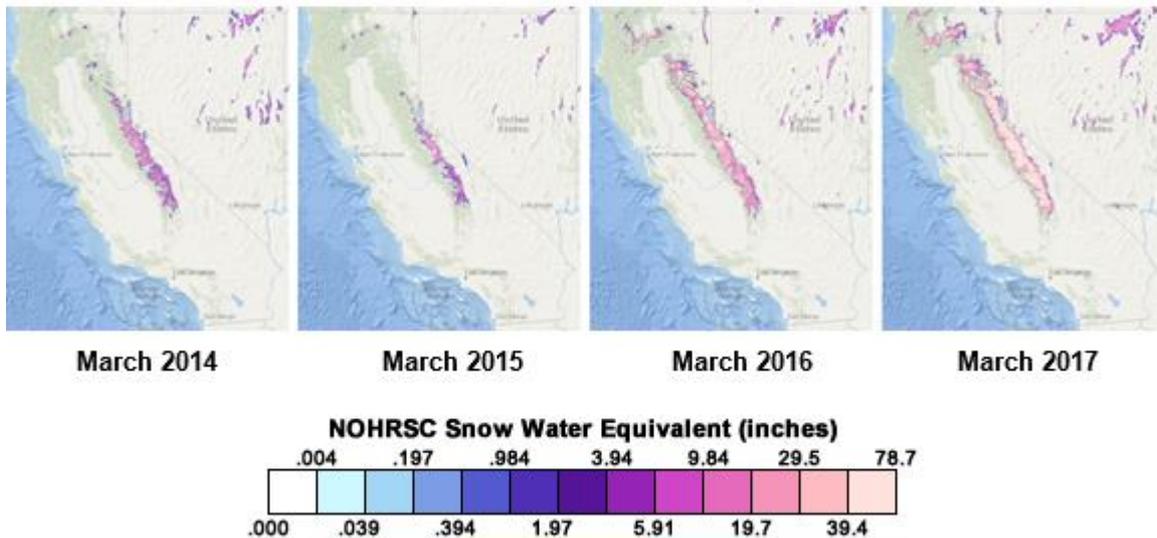
虽然加州当局 2014 年 1 月宣布的紧急干旱状况仍然存在，但干旱状况明显改善，北半部分不再属于严重的干旱程度了。被列为异常干旱的国家（D4）的最差范围已经下降到零，这一比例在 2015 年 3 月被

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分类为特殊干旱的国家土地面积的 40% 和 35% 在 2016 年有显著改善。然而，南部国家大多数地区的 8% 仍然处于中度干旱 (D1 类) 状况或更差。2015 年 4 月份国家历史上第一次颁布的强制性水资源限制在加利福尼亚州仍然有效。国家官员预计将等到四月份的整个冬季结束后才会修改或撤销国家的紧急干旱声明。

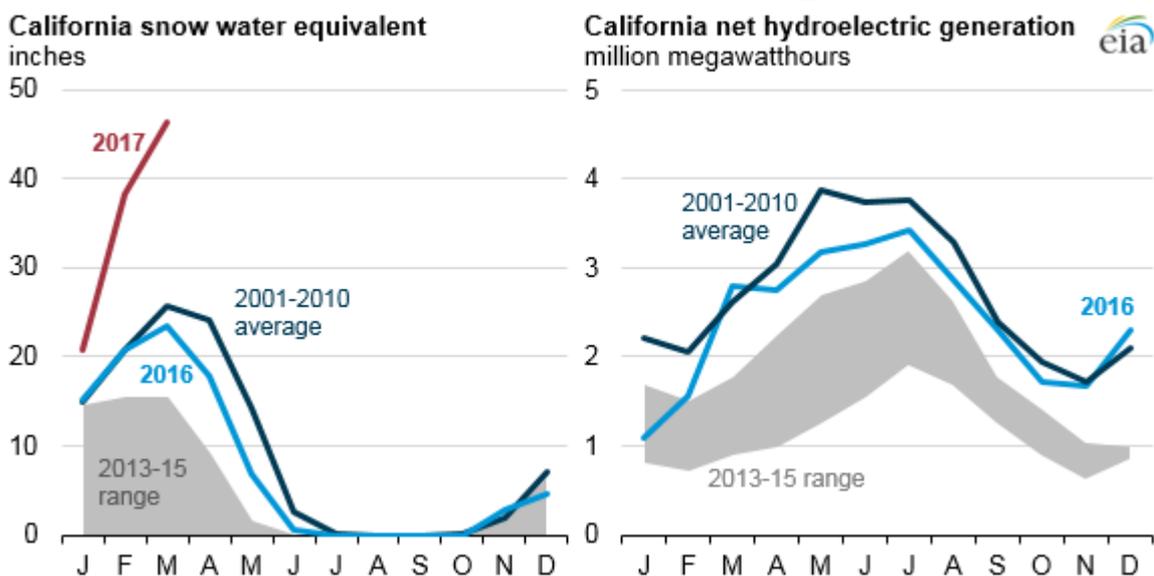
Snowpack 水平以前在 2015 年 4 月在内华达山脉山脉是接近零的水平，现在有显著的增加。截至 2017 年 3 月 21 日，加州水资源部报告说，当时全州积雪覆盖率为正常水平的 158%。考虑积雪时更重要的指标是积雪量 (SWE) - 积雪中所含的水量。加利福尼亚州的 SWE 水平今年明显增加，截至 3 月 21 日，加州水资源部报告说，全州的雪水当量也是该日平均水平的 158%。

California snow water equivalent levels



资料来源：加州内华达河预报中心

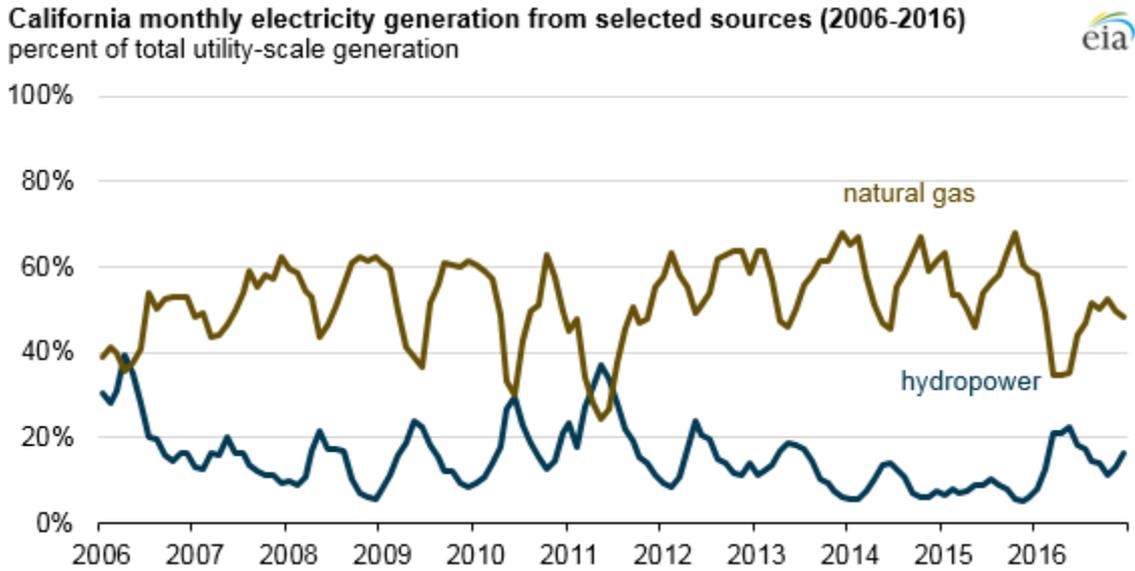
Snowpack 和 SWE 是水力发电的强大驱动力，因为在春季和夏季，来自融化积雪的径流都给水力发电厂带来了动力。加州的水电发电量在 2016 年大部分时间内都有所增长，特别是到年底。加利福尼亚州的 2016 年水电发电量远高于 2013-2015 年的水平，几乎与 2001-2010 年的长期干旱前一代平均水平一样高。2017 - 2017 年冬季高水平的 SWE 表明，2017 年后期加州的水力发电量将有所增加。



资料来源：美国能源信息管理局，电力月刊和加州水资源部

注释：2017 年 3 月的加州雪水当量数据基于部分月度数据。

近年来加利福尼亚水力发电量的下降已被天然气，风力发电和太阳能发电抵消了。水力发电的增加可能会降低对其他来源的发电的依赖，特别是天然气发电，这有可能有助于缓解南加利福尼亚州的 Aliso 峡谷天然气储存设施的持续局限性。根据加利福尼亚独立系统运营商（CAISO）的数据，从 2017 年开始到现在为止，大部分州的电力运营商 CAISO 服务区的水电发电量已经比 2016 年同期增长了一倍。与此同时，天然气天然气发电量下降近 20%。



资料来源：美国能源信息管理局，电力月刊