# ENERGY

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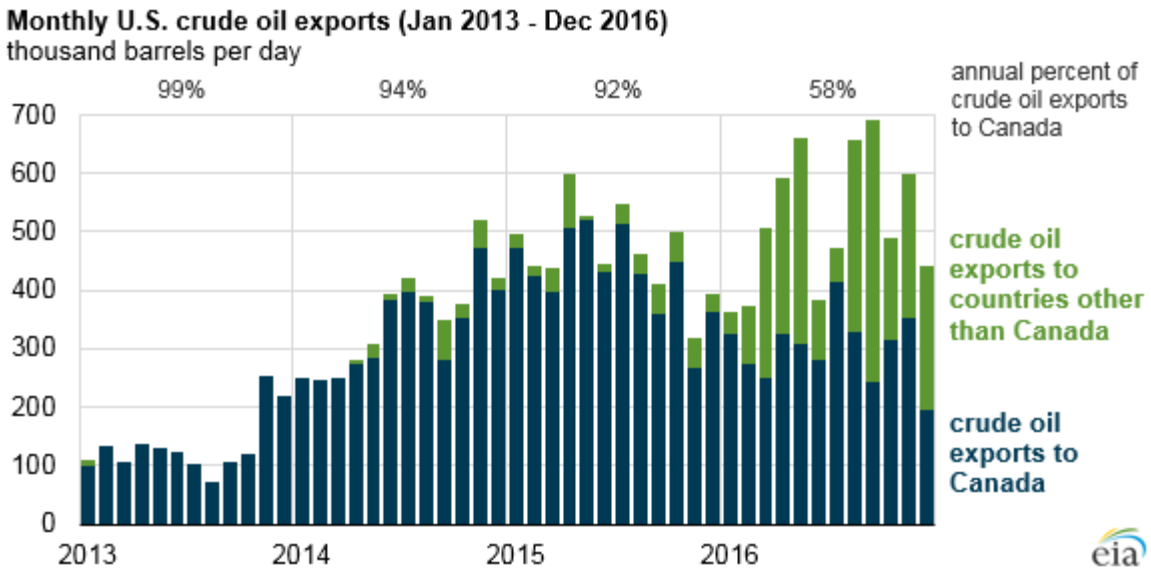
# Contents

# *Oil（石油）*

## U.S. crude oil exports went to more destinations in 2016

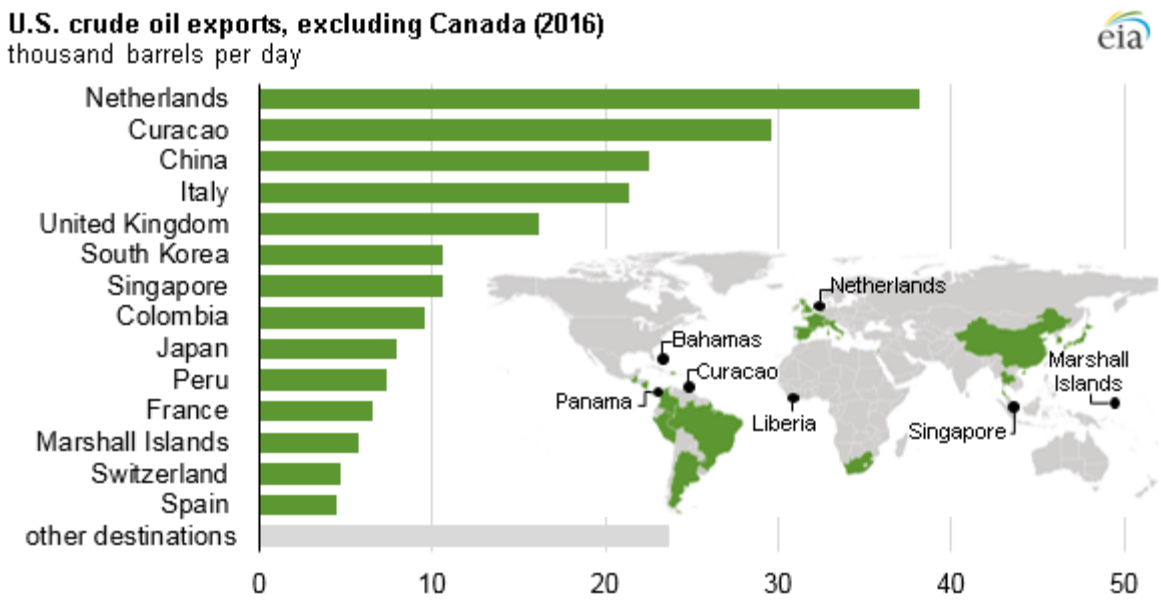



Source: U.S. Energy Information Administration, Petroleum Supply Monthly

In 2016, U.S. crude oil exports averaged 520,000 barrels per day (b/d), 55,000 b/d (12%) above the 2015 level, despite a year-over-year decline in domestic crude oil production. Even though oil exports have increased, growth in U.S. crude oil exports has slowed significantly from its pace from 2013 to 2015, when annual U.S. crude oil production grew rapidly.

Following the removal of restrictions on U.S. crude oil exports in December 2015, the United States exported crude oil to 26 different countries in 2016, compared with 10 countries the previous year. In 2015, 92% of U.S. crude oil exports went to Canada, which was exempt from U.S. crude oil export restrictions. After restrictions were lifted, Canada remained the top destination but received only 58% of U.S. crude exports in 2016.

Aside from Canada, European destinations such as the Netherlands, Italy, United Kingdom, and France rank high on the list of U.S. crude oil export destinations. The second-largest regional destination is Asia, including China, Korea, Singapore, and Japan. In 2016, the United States exported to eight different Central and South American destinations, including Curacao, Colombia, and Peru.




Source: U.S. Energy Information Administration, Petroleum Supply Monthly

Some nations listed as receiving crude oil exports from the United States in EIA export statistics, such as the Marshall Islands, Bahamas, Panama, and Liberia, are unlikely to be actual final destinations. Ports in the United States are not deep or wide enough to allow safe navigation and loading of the largest and most economic ships such as Very Large Crude Carriers to transport crude oil. Instead, U.S. crude oil is exported on smaller vessels and is then transferred to larger vessels in deeper waters outside of port.

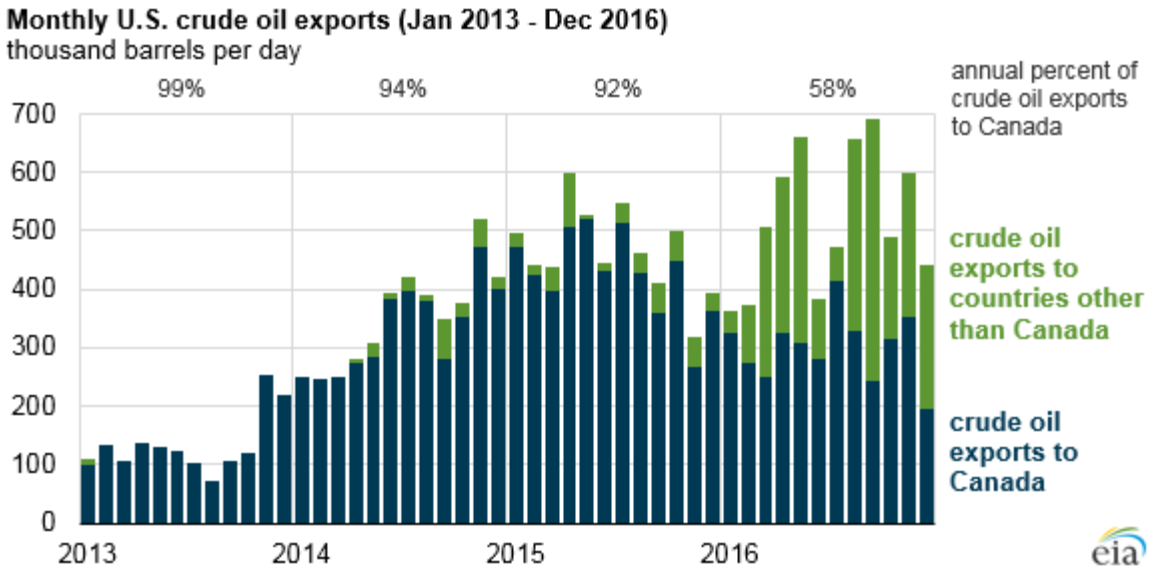
The U.S. Customs and Border Protection documentation requires the final destination of an export to be listed, if known. In some cases, cargoes that undergo ship-to-ship transfer or that do not have a buyer prior to loading will cite the jurisdiction of the transfer or the registration flag of the vessel to which the cargo is being transferred, not the cargo's actual final destination. Many vessels are registered in nations such as the Marshall Islands, Bahamas, Liberia, and Panama—meaning the exported crude oil was likely destined elsewhere.

Curacao, located in the Caribbean Sea north of Venezuela, received 30,000 b/d of U.S. crude oil in 2016, making it the third-largest destination. Petróleos de Venezuela (PDVSA), the state-owned oil company of Venezuela, operates the 330,000 b/d Isla refinery on Curacao, as well as crude and petroleum product storage facilities on the island. Trade press reports and tracking of ship movements indicate that U.S. crude exports to Curacao are likely being blended with heavy Venezuelan crude oil, either for processing at the Isla refinery or for re-export to PDVSA customers.

Several factors appear to have contributed to the rise in U.S. crude oil exports in 2016. Increased crude oil imports in 2016 substituted for some domestic crude oil at U.S. refineries, allowing higher exports despite lower U.S. production and increased refinery runs. Low tanker rates for most of 2016 helped to narrow the price spread needed to allow for an economically attractive trade between the United States and overseas markets. With the average daily volume of crude imports more than 12 times the average daily volume of crude exports, many tankers were available for back-haul voyages at rates significantly below regular tanker rates, likely further reducing the cost of reaching export markets.

More information and analysis on 2016 crude oil exports is available in This Week in Petroleum.

## 到 2016 年美国原油将出口至更多地方

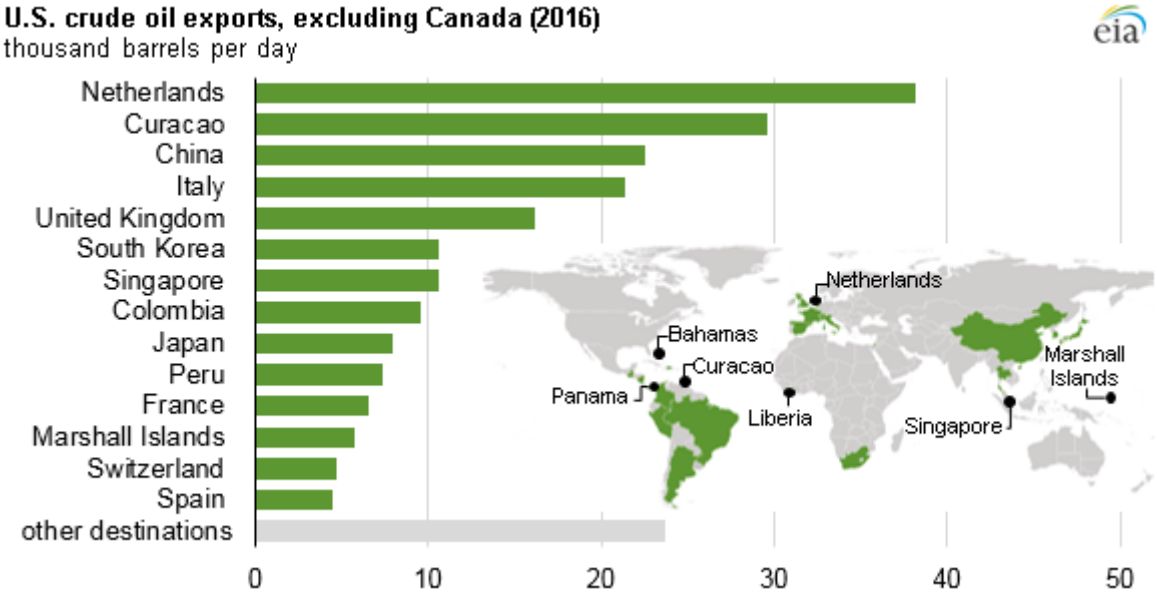



资料来源：美国能源信息管理局，石油供应月刊

2016 年，美国原油出口平均每天 52 万桶（b / d），比 2015 年水平高出 55,000 桶/日（12％），而国内原油产量同比下滑。从 2013 年至 2015 年虽然石油出口有所增长，但美国原油出口同比增长迅速，美国原油出口增速明显放缓。

在 2015 年 12 月取消对美国原油出口的限制后，美国在 2016 年向 26 个不同国家出口原油，而去年同期仅为 10 个国家。 2015 年，美国原油出口的 92％到加拿大，这是不受美国原油出口限制的国家。限制措施解除后，加拿大仍然是首要目的地，但在 2016 年仅占美国原油出口的 58％。

除了加拿大，荷兰，意大利，英国，法国等欧洲国家和地区在美国原油出口地中名列前茅。亚洲是第二大地区，包括中国，韩国，新加坡和日本。 2016 年，美国出口地包括库拉索，哥伦比亚和秘鲁在内的八个不同的中南美洲国家。




资料来源：美国能源信息管理局，石油供应月刊

列入美国原油出口的一些国家在环境影响评估出口统计，如马绍尔群岛，巴哈马，巴拿马和利比里亚，不大可能是实际的出口地。美国的港口不够深入，不足以允许安全航行，装载最大最经济的船只，例如运输原油的超大型原油运输船。相反，美国原油先放在较小的船只上，然后转移到港口以外的较深水域的较

大船舶。

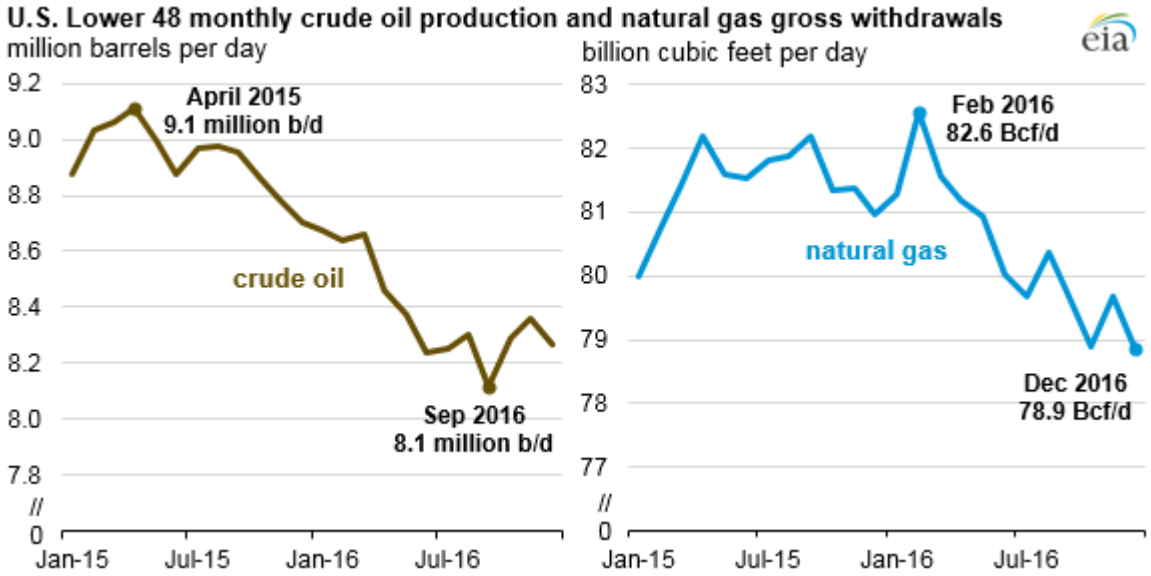
美国海关和边境保护局的文件要求出口的最终地列入名单。在某些情况下，货物转运或在装货前没有买家的货物将引用货物转运船只的转让或登记标志的管辖权，而不是货物的实际最终目的地。许多船只在诸如马绍尔群岛，巴哈马，利比里亚和巴拿马等国家注册，意味着出口的原油可能最终到达其他地方。

位于委内瑞拉北部加勒比海的库拉索岛在 2016 年进口了 30,000 桶/日的美国原油，成为第三大原油进口地。委内瑞拉国家石油公司 Petróleosde 委内瑞拉（PDVSA）在库拉索岛运营了 33 万桶/日的 Isla 炼油厂，以及岛上的原油和石油产品储存设施。贸易新闻报道和跟踪船只运动表明，美国对库拉索的原油出口可能与委内瑞拉的原油混合，要么在伊朗炼油厂加工，要么再出口到 PDVSA 的客户。

几个因素似乎对 2016 年美国原油出口的上涨做出了贡献。2016 年原油进口量的增加取代了美国炼油厂的一些国内原油，尽管美国生产量下降，但炼油厂增加，出口也增加了。 2016 年大部分时间的油轮货运量较低，有助于缩小需要的价格波动，以便在美国和海外市场之间实现经济上的有吸引力的贸易。由于原油进口平均日均产量是原油出口日均出口量的 12 倍以上，许多油轮可以以远低于正常油轮利率的差旅航行，可能进一步降低出口市场的成本。

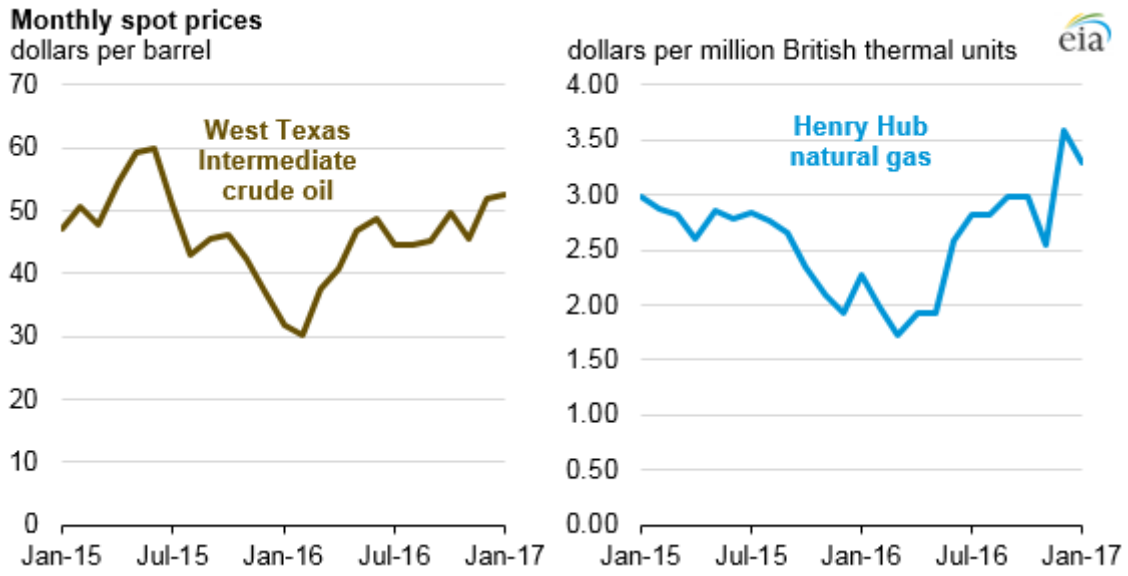
有关 2016 年原油出口的更多信息和分析见《本周石油》。

# U.S. crude oil and natural gas production both fell in 2016



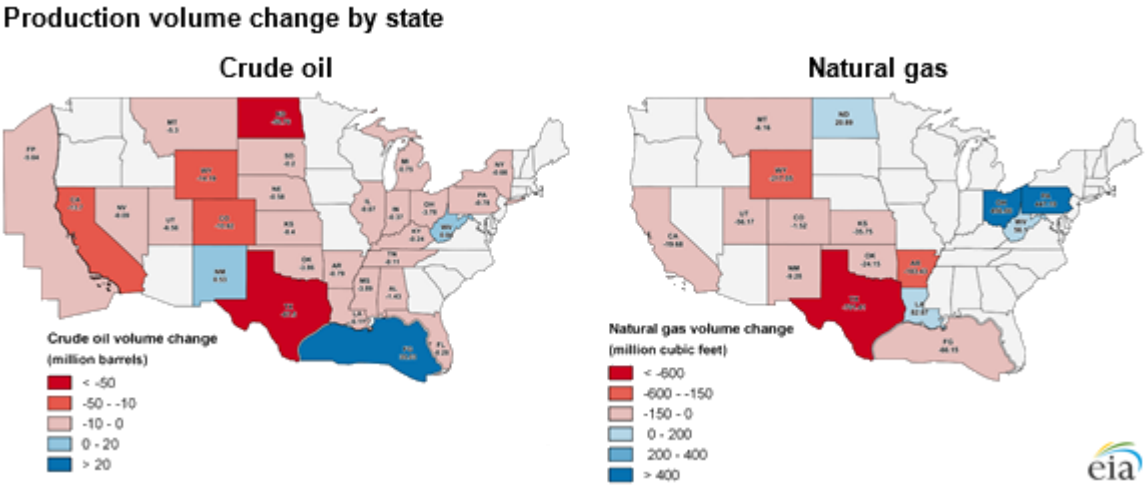

Source: U.S. Energy Information Administration, Monthly Crude Oil, Lease Condensate, and Natural Gas Production Report

Based on data in EIA's Monthly Crude Oil, Lease Condensate, and Natural Gas Production Report, average crude oil production in the Lower 48 states fell to 8.39 million barrels per day (b/d) in 2016, a decrease of approximately 0.55 million b/d, or 6.1% from the 2015 average. Natural gas gross withdrawals in the Lower 48 states also decreased in 2016, averaging 80.39 billion cubic feet per day (Bcf/d), or 1.03 Bcf/d (1.3%) lower than in 2015. EIA now has two complete years of monthly survey-based data on crude oil and natural gas production since expanding the EIA-914 survey in 2015.




Source: U.S. Energy Information Administration

After declining throughout 2015, crude oil and natural gas prices began to recover in 2016, increasing through much of the year, which drove production increases in the second half of 2016. The price for West Texas Intermediate (WTI) crude oil, after reaching a monthly low of $30 per barrel (b) in February 2016, began to increase in March and most recently averaged $53/b in January 2017. Natural gas gross withdrawals increased in August and November 2016 as Henry Hub natural gas prices rose from an average of $2.00 per million British thermal units (MMBtu) in the first quarter of 2016 to an average of $2.88/MMBtu in the third quarter of 2016. Natural gas and crude oil prices are expected to increase in 2017 and 2018.




Source: U.S. Energy Information Administration

The largest increase in crude oil production was in the Gulf of Mexico, which increased 96,000 b/d (35 million barrels) from 2015 to 2016 as new projects, which were planned in 2012–14, began to come online. Onshore crude oil production saw small increases in New Mexico and West Virginia, partially in response to higher WTI crude oil prices.

Texas oil production had the largest volumetric decrease at 239,000 b/d (87.5 million barrels). Texas crude oil production declines were partially offset by production increases in the Permian region, where producers continued operations while prices were low and increased drilling rig counts as WTI prices increased. The largest production decline on a percentage basis occurred in the Federal Offshore Pacific, where production declined 44%

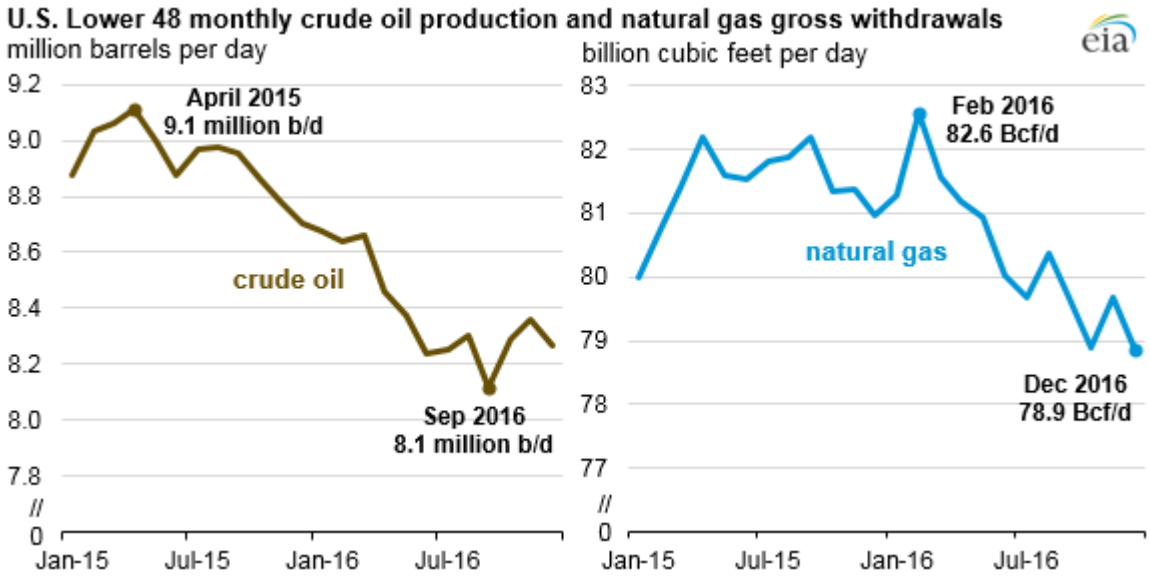
in 2015, due in part to a pipeline disruption in May 2015.

Annual natural gas production increased from 2015 to 2016 in Pennsylvania and Ohio, reflecting higher production from the Utica and Marcellus shale plays. In Ohio, natural gas production in the Utica Shale, including the Point Pleasant formation, has continued to increase since 2011 because of increases in production efficiencies and favorable geologic conditions. Efficiency improvements in horizontal drilling and hydraulic fracturing in the Marcellus Shale have also driven natural gas production increases in Pennsylvania and West Virginia. Outside of the Marcellus and Utica regions, annual natural gas production fell because of lower natural gas prices.

EIA's Monthly Crude Oil, Lease Condensate, and Natural Gas Production Report collects monthly oil and natural gas production data from a sample of operators of oil and natural gas wells in 15 states, the Federal Offshore Gulf of Mexico, and collectively from the remaining states and the Federal Offshore Pacific. EIA published the first survey-based reporting of monthly crude oil production in August 2015.

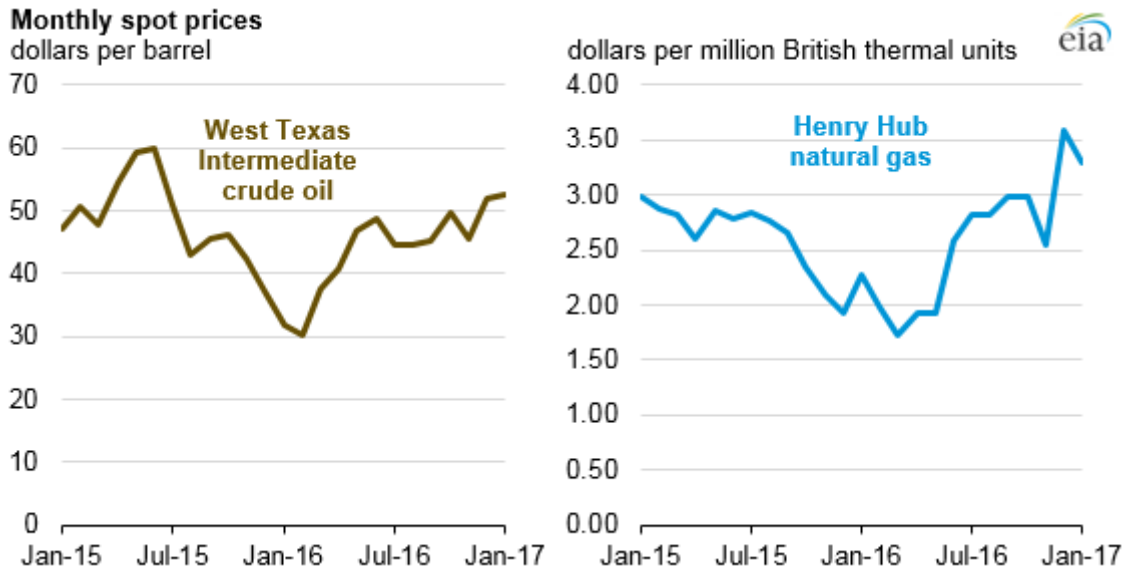
The survey covers roughly 90% of crude oil and natural gas production in the Lower 48 states, improving EIA estimates of total production. Previous estimates of U.S. crude oil production were based on tax and production data obtained directly from state agencies that may have been incomplete at the time of publication. EIA's survey-based data collection provides a more consistent, timely way to assess production trends across states.

## 2016 年美国原油和天然气产量都下降



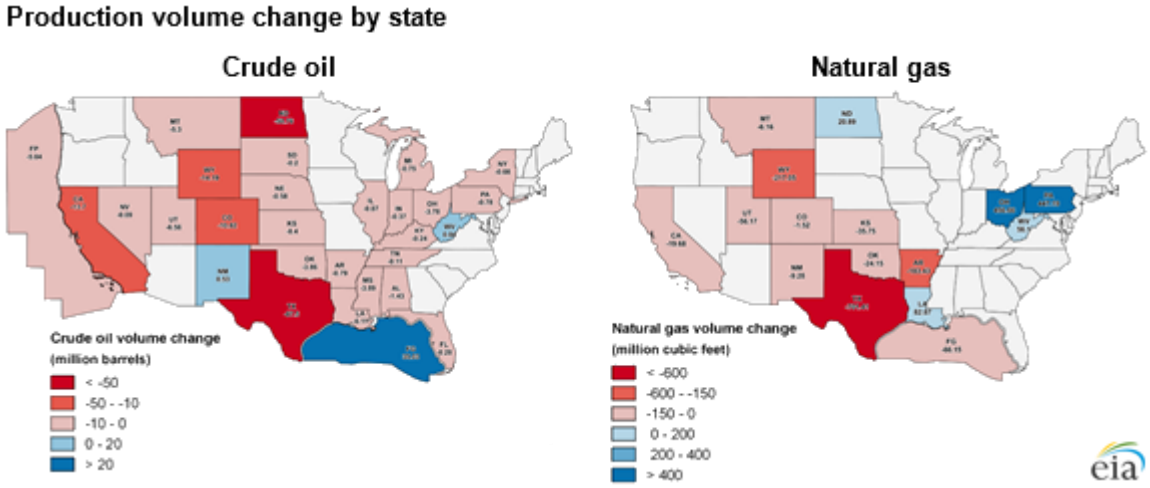

来源：美国能源信息管理局，每月原油、租赁冷凝水和天然气产量报告

根据"环境影响评估月度原油、租赁冷凝水和天然气生产报告"的数据，2016 年下半年 48 平方公里原油产量下降至每天 839 万桶（b/d），同比减少约 55 万桶 b/d，或 2015 年平均水平的 6.1%。2016 年下半年国家天然气总出口量也有所下降，平均每天为 803.9 亿立方英尺（80.39 Bcf / d），低于 2015 年的 1.03Bcf / d（1.3%）。环境影响评估现在已经有两年的月度调查基于 2015 年推出"EIA-914"调查的原油和天然气生产数据。




来源：美国能源信息管理局

在 2015 年下降之后，2016 年原油和天然气价格开始回升，其中大部分时间都是在 2016 年下半年上涨，导致西德克萨斯中质油（WTI）原油价格在 2016 年 2 月达到每月低点 30 美元每桶（b），3 月份开始上涨，最近在 2017 年 1 月平均为 53 美元/桶。随着亨利 Hub 天然气价格从 2016 年第一季度平均水平 2.00 美元/百万英热单位，到 2016 年第三季度平均为 2.88 美元/百万英热单位。预计 2017 年和 2018 年天然气和原油价格将上涨。




来源：美国能源信息管理局

原油产量增幅最大的是墨西哥湾，由 2012 - 2014 年计划的新项目开始上线，2015 年至 2016 年增加了 9.6 万桶/日（3500 万桶）。陆上原油生产在新墨西哥州和西弗吉尼亚州出现小幅增长，部分原因是 WTI 原油价格上涨。

得克萨斯州的石油产量最大，减少了 23.9 万桶/天（8750 万桶）。得克萨斯州原油生产下降部分被二叠纪地区的生产增长所抵消，生产商继续开展业务，而价格较低，随着 WTI 价格上涨，钻井平台数量增加。以百分比计的最大生产量下降发生在联邦海上太平洋地区，由于 2015 年 5 月管道中断，2015 年产量下降了 44%。

宾夕法尼亚州和俄亥俄州的年度天然气产量从 2015 年到 2016 年都有所增长，反映了 Utica 和 Marcellus 页岩气产量的增加。在俄亥俄州，由于生产效率的提高和良好的地质条件，因此，Utica 页岩的天然气生

产，包括 Point Pleasant 地层，自 2011 年以来一直在增加。Marcellus 页岩水平钻井和水力压裂的效率改善也推动了宾夕法尼亚州和西弗吉尼亚州的天然气生产增长。在马塞鲁和尤蒂卡地区之外，由于天然气价格下降，年天然气产量下降。

环境影响评估的月度原油、租赁冷凝物和天然气生产报告从 15 个州、墨西哥联邦海上并从其余州和联邦太平洋海上的石油和天然气井的经营者样本中收集了每月的石油和天然气生产数据。环境影响评估公布了 2015 年 8 月份首个基于月度原油产量的调查报告。

该调查涵盖了 48 个州的原油和天然气产量的大约 90％，提高了环境影响评估总产量的估计。以前对美国原油生产的估计是基于直接从国家机构获得的在出版时可能不完整的税收和生产数据。EIA 的基于调查的数据收集提供了更加一致、及时的方式来评估各州的生产趋势。

# *New Energy（新能源）*

## Hanergy founder Li offers personal guarantee for debt

Chinese entrepreneur Li Hejun has offered to personally guarantee payment of the HK$3.2bn ($466m) owed by his mainland group to its troubled Hong Kong-listed subsidiary, as part of efforts to end a near two-year trading suspension.

Mr Li shot to prominence in 2015 when the soaring value of his listed unit Hanergy Thin Film Power, a solar panel equipment maker, briefly made him China’s richest man. However, its shares have been suspended since May 2015 after they inexplicably plunged almost 50 per cent in less than half an hour, wiping $19bn off its value in the process.

The rise and fall happened amid a growing chorus of questions over the links between HTF and its parent, both of which are controlled by Mr Li, and the growing pile of receivables owed to HTF by Hanergy Holding, the parent.

Earlier this year, Hong Kong’s Securities and Futures Commission sought the disqualification of Mr Li and five others from holding directorships and demanded a guarantee from Mr Li that HTF’s mainland parent would pay the outstanding receivables, of which HK$2.4bn are more than a year past due.

Meeting the conditions is a prerequisite to resuming trading, the regulator said at the time.

However, Mr Li’s offered guarantee would only kick in after the shares began trading, and he suggested a two-year repayment schedule, with half the funds due at the end of that.

He also pledged to HTF 1.37bn shares in itself, equivalent to 3 per cent of the company, to back the guarantee. At the shares’ last traded price of HK$3.91, the pledge is worth HK$5.3bn. Based on the amount owed to HTF, the implied share price is HK$2.31.

Hong Kong’s SFC declined to comment yesterday.

HTF reported a profit for 2016 of HK$658m following the sale of a solar power farm in Qinghai province and an energy asset in Guangdong. In 2015, it reported a HK$12bn loss.

## 李河君提出个人担保公司债务

这位前中国首富提议由其个人担保旗下内地集团对香港上市子公司的欠款，以帮助停牌近两年的汉能薄膜发电复牌。

中国企业家李河君提出由其个人担保旗下内地集团对陷入困境的香港上市子公司欠下的 32 亿港元（合 4.66 亿美元），作为结束近两年的停牌的努力的一部分。

2015 年李河君声名鹊起，旗下上市的太阳能电池板设备制造商汉能薄膜发电(Hanergy Thin Film Power)市值飙升，令他一度成为中国首富。然而 2015 年 5 月该公司股价在不到半小时莫名暴跌近 50%，抹去 190 亿美元市值，随后该公司股票一直停牌。

汉能薄膜发电的这一涨跌，伴随着该公司与其母公司——两家公司均由李河君控制——之间的关系引发越来越多的质疑，同时母公司汉能控股(Hanergy Holding)欠汉能薄膜发电的应收账款不断增加。

今年早些时候，香港证券及期货事务监察委员会(SFC)寻求取消李河君及其他五人担任董事职位的资格，并要求李河君保证汉能薄膜发电的内地母公司会支付未偿付应收款项，其中 24 亿港元已拖欠一年多。

这家监管机构当时表示，满足上述条件是复牌的前提。

不过李河君提供的保证将仅在股票复牌后才会生效，他还提议了两年的还款时间表，一半资金在两年结束时才支付。

他还承诺用汉能薄膜发电 13.7 亿股股票——相当于该公司 3%股权——向该公司作出担保。该股最后交易价为每股 3.91 港元，因此李河君所承诺价值为 53 亿港元。根据汉能薄膜发电被欠款的金额，隐含股价为每股 2.31 港元。

香港证监会昨日不予置评。

2016 年汉能薄膜发电在出售青海省一个太阳能发电场，以及广东省一笔能源资产后，报告实现利润 6.58 亿港元。2015 年，该公司报告亏损 120 亿港元。

## Sonnedix acquires 21.6MW Italian solar portfolio from First Reserve

International PV developer Sonnedix has acquired a 21.6MW solar portfolio comprising five ground-mount projects in Italy from private equity firm First Reseve.

The projects located in the Apulia and Lazio regions bring Sonnedix’s operating capacity in Italy to 102MWA Sonnedix release cited the firm’s intentions to commit long-term to the Italian market.

## Sonnedix 从 First Reserve 手中购买 21.6MW 意大利太阳能项目组合

国际光伏开发商 Sonnedix 日前从私募公司 First Reserve 手中购买 21.6MW 太阳能项目组合，包括位于意大利的五座地面支架项目。

相关项目位于阿普利亚和拉齐奥地区，此次收购使得 Sonnedix 在意大利市场的总业务规模达到 102MW。

Sonnedix 在一份公告中表示了公司在意大利市场开展长期业务的意愿。

## Astronergy completes 16.5MW PV project in South Korea

PV module Astronergy announced Monday that it has successfully completed a 16.5MW solar power station in Jeju Island, South Korea.

Jeju Island is located 82km south of the Korean peninsula and boasts the hottest temperatures — along with the best irradiation conditions — in South Korea. The installation, which is located over an area of 680,000 square metres, can generate 20,476 MWh annually and required a total investment of US$26.7 million.

As the primary investor on the project, Astronergy led the engineering, procurement and construction as well as the maintenance of the solar power station.

Dr. Lu Chuan, Astronergy CEO, noted: "Astronergy has strong presence in the Republic of Korea market and our local team made great achievements. The Jeju Island project will not only generateclean energy, but also attract many visitors in the future."

## 正泰太阳能韩国 16.5MW 光伏项目完工

光伏组件商正泰太阳能在周一宣布，公司在韩国济州岛的 16.5MW 太阳能电站已经成功建成。

济州岛位于韩国本岛南部 82 公里，拥有韩国最炎热的气候，以及最好的日照辐射条件。该项目占地 68 万平方米，可年产电力 20.476GWh，共需 2670 万美元投资。

作为该项目的主要投资商，正泰太阳能负责太阳能电站的工程、采购和建造，以及维护工作。

正泰太阳能总裁陆川博士表示："正泰太阳能在韩国市场有很扎实的基础，并且公司在 当地的团队也取得了极大的成绩。济州岛项目不仅能够产生清洁能源，同时还将在未来吸引到更多参观者。"

## GSSG Solar to acquire 350MW portfolio of solar in Japan

Solar investment firm GSSG Solar announced Monday that it will provide over US$120 million in additional commitments to the firm's investments in Japanese solar projects.

As a result of this increased capacity, GSSG will invest in the acquisition and financing of an incremental US$1 billion of Japanese mega-solar plants over a three-year investment period.

GSSG raised its first fund in 2014, which focused primarily on Japanese solar with select exposure to the US utility solar market. This new commitment is exclusively tabbed for the Japanese market and will allow the firm to acquire another 350MW of solar projects within the country.

GSSG is an investment manager that overviews the technical, financial, and execution risk of each potential solar project investment. It focuses on aligned and collaborative structures with its development partners and stakeholders.

## 日本 350MW 太阳能项目被 GSSG 投资公司收购

太阳能投资公司 GSSG 太阳能在周一宣布，公司将在日本太阳能项目领域内增加逾 1.2 亿美元投资。

GSSG 太阳能此次所增加的投资将被用来在三年的投资期限内对日本超级太阳能电站项目进行收购，融资增量为 10 亿美元。

GSSG 太阳能在 2014 年完成首只基金的融资，主要关注日本太阳能产业及部分美国公共事业规模太阳能市场。新增投资将全部为日本太阳能市场投资，可使得公司能够在该国市场内再收购 350MW 太阳能项目。

GSSG 公司是一家投资管理公司，业务范围涵盖技术、金融等，并为每个潜在太阳能项目进行风险管理。公司十分注重于开发合作伙伴和股东之间的协作与合作关系。

# India's Greenko raises US$155 million equity from GIC and Abu Dhabi investors

Indian renewable energy firm Greenko Energy Holdings has raised US$155 million in equity from an affiliate of global investment firm GIC and a wholly-owned subsidiary of the Abu Dhabi Investment Authority (ADIA).

The funds will be used to build new renewable energy projects and work on Greenko's already acquired PV projects, with further plans to expand existing wind farms. Greenko completed its acquisition of bankrupt SunEdison's 587MW Indian solar and wind portfolio for US$392 million last November, bringing to an end several months of the sector fretting over how SunEdison's demise might impact downstream progress in India.

GIC is investing US$123.9 million, while US$31.1 million is to come from the ADIA entity, which invests on behalf of the Abu Dhabi government. Greenko had already raised US$230 million in capital from ADIA and GIC last June. GIC remains the majority shareholder in Greenko having bought a stake last October for US$213 millionGreenko now has more than 2GW of operational wind, solar and small hydro projects in India.

Anil Kumar Chalamalasetty, chief executive Greenko Group, said: "We have created a strong and sustainable platform to take advantage of evolving energy market dynamics and strong sector fundamentals accelerated by new government initiatives."

# 印度 Greenko 从 GIC 和阿布扎比投资商处获得 1.55 亿美元资产

印度可再生能源公司 Greenko 日前从全球投资公司 GIC 旗下子公司和阿布扎比投资管理局(ADIA)全资子公司处共获得 1.55 亿美元资产。

这笔资金将用于建造可再生能源新项目，并发展 Greenko 已收购的光伏项目及进一步扩张的计划。Greenko 在去年十一月完成了对 破产公司 SunEdison 位于印度的 587MW 太阳能 和风能项目组合的收购，收购金额为 3.92 亿美元，从而结束了产业对 SunEdison 破产会对印度下游产业造成冲击的长达数月的烦扰。

GIC 将投资 1.239 亿美元，其中 3110 万美元来自代表阿布扎比政府进行投资的 ADIA 资产。 Greenko 在去年六月已从 ADIA 与 GIC 处融得 2.3 亿美元资金。GIC 自去年十月出资 2.13 亿 美元收购 Greenko 股票后，成为该公司的大股东之一。

Greenko 公司目前在印度共拥有超过 2GW 风能、太阳能和小型水利项目。

Greenko 集团首席执行官 Anil Kumar Chalamalasetty 表示："公司已经建立起了强劲且可持续发展的业务平台，以从新政府扶持机制刺激下不断发展的市场活力及强劲的产业基础中获益。"

# SMA inverters selected for 94MW PV project in Nevada

SMA announced Tuesday that its inverters have been selected by Amec Foster Wheeler for Sempra Renewables' 94MW Copper Mountain Solar 4 project in Boulder City, Nevada.

This stands as the fourth phase of the Copper Mountain Solar Complex — which is one of the largest PV solar facilities developed in the US. Once Copper Mountain Solar 4 is finished, it will generate enough energy to power approximately 41,000 California homes.

The installation is one of the first solar projects to use SMA's Sunny Central 2200-US inverter, which provides more efficient project design and high-power density. The Copper Mountain phase utilised 46 Sunny Central inverters.

Boris Wolff, executive vice president of SMA's Utility business unit, said: "SMA is honored to be selected for this project and to work with Amec Foster Wheeler and Sempra Renewables on this effort. The new Sunny Central 2200-US inverter is a game changer in terms of power density and feature-rich integration of advanced utility grade functionality."

Larry Myers, director of solar projects for Amec Foster Wheeler, added: "SMA inverters were the right choice for this project due to their production technology and capability, robust reliability, industry presence, and our familiarity with their organization and products from previous projects."

## SMA 为内华达州 94MW 光伏项目选择逆变器合作伙伴

SMA 公司在本周二宣布，公司逆变器已被 Amec Foster Wheeler 公司选择用于 Sempra Renewables 旗下位于内华达州博尔德城的 94MW Copper Mountain 太阳能四期项目。

SMA 公共电力业务执行副总监 Boris Wolff 表示："SMA 为自己被选为该项目逆变器供应商，并与 Amec Foster Wheeler 和 Sempra Renewables 公司在此项目上进行合作而感到 十分荣幸。此次使用的 Sunny 2200-US 中央 逆变器在功率密度和高级公共事业级别功能集成领域均具有创新性意义。"

Amec Foster Wheeler 公司太阳能项目总监 Larry Myers 补充道："SMA 逆变器凭借产品 所具有的技术与能力、牢固的可靠性、产业知名度，以及我们从此前项目合作中对该公司及其产品的了解等优势，成为了此次项目的不二之选。"

## ReneSola posts further quarterly losses as margins plummet

ReneSola reported fourth quarter revenue of US$232.1 million, which was in line with its previous guidance range of US$220 million to US$240 million and around 24% higher than the slump in demand experienced in the previous quarter, due to the slowdown in China demand.

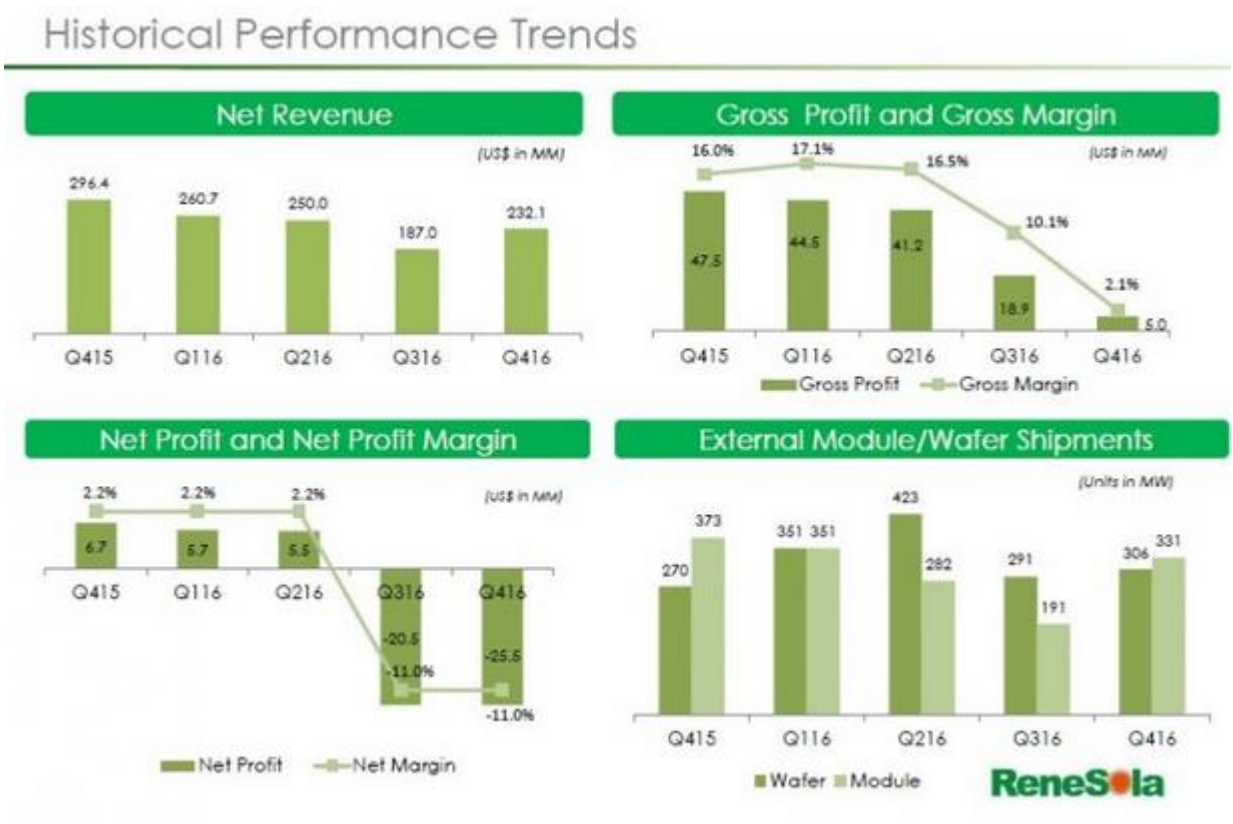
The higher revenue was primarily due to total external wafer shipments of 305.9MW, compared to 290.5MW in the previous quarter and external module shipments of 330.7MW, compared to 191.2MW in the previous quarter. Module shipments to its downstream power plant business were 12.3MW in the fourth quarter, compared to 6.1MW in the third quarter of 2016.

On a regional basis, module shipments significantly increased in China, accounting for 69% of total module shipments in the quarter, up from 56% I the previous quarter.

Module shipments to India accounted for 6% of the total, compared to 21% in the previous quarter. Module ASP in the fourth quarter was claimed to be US$0.44/W.

Gross margin slumped to only 2.1%, compared to 10.1% in the previous quarter and 16.0% in the prior year period. The company had previously guided gross margin in the high-single digits. ASP declines across the industry, due to weak second half demand and overcapacity fears were behind the margin declines.

Net loss was US$25.5 million, compared to net loss of US$20.5 million in the previous quarter and net income of US$6.7 million in the prior year period.




Net loss was US$25.5 million, compared to net loss of US$20.5 million in the previous quarter and net income of US$6.7 million in the prior year period. Image: ReneSola

Xianshou Li, ReneSola's Chief Executive Officer, commented, "Overall business conditions in the quarter were mixed, with solid execution in downstream project sales, strong top-line sequential growth in LED distribution business and in-line revenue performance, offset by lower-than-expected gross margin. While the overall market environment was challenging in 2016, we have been executing our strategy to shift our business focus from manufacturing business to downstream project development business since the second half of 2015."

ReneSola recognized revenue from six utility-scale projects (26MW) in the United Kingdom that were sold in the fourth quarter of 2016. Additionally, the company sold rooftop projects of 2MW in China's domestic distributed generation market in the quarter.

2016 financial results

ReneSola reported full-year 2016 revenue to US$929.8 million, down from US$1.28 billion in 2015 as the company changes its business model and focuses on the downstream business.

Total external solar module shipments were 1.2GW in 2016, compared to 1.6GW in 2015. The company had guided module shipments in 2016.

Gross margin decreased to 11.8% in 2016, down from 14.7% in 2015. The company reported an operating loss of US$15.1 million, compared to operating income of US$29.3 million in 2015.

Gross profit was US$109.5 million, down 41.7%, compared with the prior year. Net loss was US$34.7 million, which compares to a net loss of US$5.1 million in 2015.

ReneSola had cash and cash equivalents of US$133.2 million as of December 31, 2016, compared to US$139.4 million at the end of the previous quarter.

Guidance

ReneSola guided revenue in the first quarter of 2017 to be in the range of US$130 to US$150 million, compared to the prior year revenue of $260.7 million.

## 利润下降导致昱辉阳光出现季度亏损

昱辉阳光日前公布了去年第四季度的营收额为 2.321 亿美元，与此前公布的 2.2-2.4 亿美元预期相符，相较于由于中国市场发展放缓而导致需求下降的上一季度业绩增长了 24%。

较高的营收来组与总量为 305.9MW 的外部硅片出货量，和 330.7MW 的外部组件出货量，这两个数字在上一季度分别为 290.5MW 和 191.2MW。面向其下游电站业务的组件出货量在第四季度内为 12.3MW，而在去年第三季度内为 6.1MW。

在地区市场上，中国市场上的组件出货量涨幅显著，占到了季度内组件出货量的 69%，相比上一季度内 56%的占比有所增长。

印度市场上的组件出货量占比 6%，而上一季度内该市场出货量占比 21%。去年第四季度内组件产品平均销售价格据称为 US$0.44/W。

去年第四季度内公司的毛利润率降至 2.1%，环比上一季度的 10.1%、同比去年同期的 16%均有所下降。公司此前曾预计该季度的毛利润率接近 10%。由于去年下半年市场需求较弱，产业内的产品平均价格整体出现下降，并且产业对产能过剩的恐惧导致了利润率的下降。

公司在去年第四季度内的净损失额为 2550 万美元，前一季度净损失额为 2050 万美元，去年同期净收入额为 670 万美元。

昱辉阳光首席执行官李仙寿先生表示："季度内的整体业务状况比较复杂，下游项目销售业务进行的十分扎实，LED 业务涨势强劲并与营业额相符合，而这些被低于预期的毛利润率所抵消。尽管 2016 年的整体市场环境十分具有挑战性，我们仍旧执行着公司所制定的策略，从 2015 年下半年开始，将业务重心由制造业务转移至下游业务开发上来。"

昱辉阳光将其在去年第四季度内出售的六座英国公共事业规模电站的收益计算在收益额中。此外，公司还在季度内在中国国内分布式发电市场内出售了 2MW 的屋顶项目。

2016 年业绩

昱辉阳光公布的 2016 年全年营收额为 9.298 亿美元，由于公司将业务模式和重心转移至下游业务，因此这一数字相较于 2015 年的 12.8 亿美元有所下降。

2016 年太阳能组件产品外部总出货量为 1.2GW，同比 2015 年为 1.6GW。公司此前曾公布 2016 年组件出货量预期。

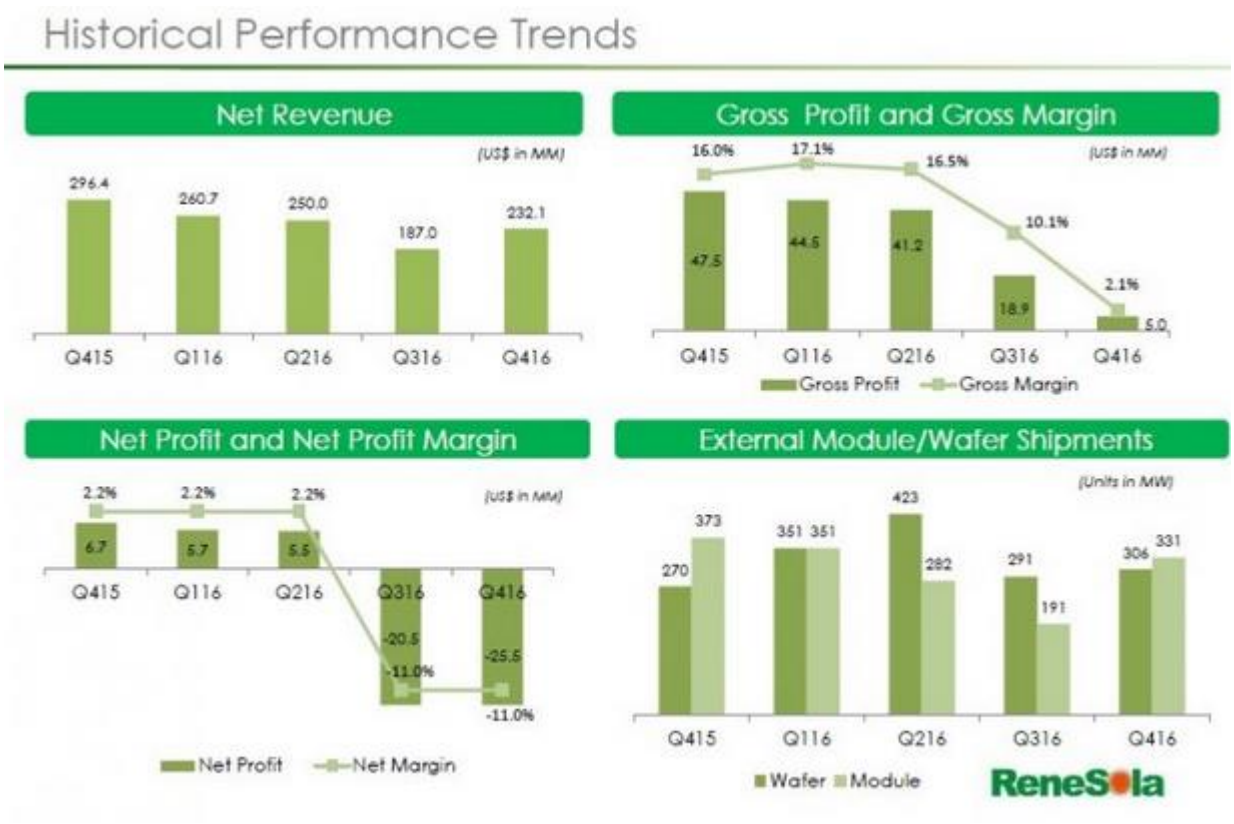
2016 年公司的毛利润率从 2015 年的 14.7%降至 11.8%。公司公布业务盈利为负 1510 万美元，而在 2015 年的业务盈利为 2930 万美元。

公司毛利润为 1.095 亿美元同比上一年度下降 41.7%。净损失额为 3470 万美元，而 2015 年的净损失额为 510 万美元。

昱辉阳光截止至 2016 年 12 月 31 日共拥有现金及现金等价物 1.332 亿美元，在去年三季度末时拥有现金及现金等价物 1.394 亿美元。

业绩预期

昱辉阳光公布 2017 年一季度营收额预期在 1.3-1.5 亿美元之间。




# Australian rooftop solar financier issues another AU$50 million climate bond

Financial services group FlexiGroup, whose subsidiary Certegy Ezi-Pay finances rooftop solar, has issued a AU$50 million (US$38 million) climate bond, which has been certified by the global Climate Bonds Initiative (CBI)

The Clean Energy Finance Corporation (CEFC) made a cornerstone commitment of AU$20 million to the bond.

This is only the second climate-certified issue of a bond backed by securitised assets in Australia, with FlexiGroup issuing a very similar bond back in April 2016.

CEFC debt markets lead Richard Lovell said: "FlexiGroup achieved tighter pricing on this climate bond, which shows investors were prepared to pay a 'green premium'. This is a strong market signal which will assist in accelerating the development of a more varied and flexible green bond market in Australia."

The bond is backed by consumer receivables originated through FlexiGroup's wholly-owned subsidiary Certegy Ezi-Pay, which has financed more than 120,000 solar PV rooftop installations.

Lovell added: "There is clearly a global trend toward investment in green bonds. Our investment support for the FlexiGroup climate bond is part of our strategy to ensure that Australia's clean energy sector can tap into this burgeoning source of capital, and that investors with a socially responsible mandate have the opportunity to participate."

## 澳大利亚屋顶太阳能融资方发行 5000 万澳元气候债券

金融服务公司 FlexiGroup 日前发行 5000 万澳元(约合 3800 万美元)气候债券，并获得国际气候债券倡议组织(CBI)认可。

清洁能源融资公司(CEFC)做出里程碑式决定，发行 2000 万澳元债券这是澳大利亚市场上发行的第二个证券化资产担保的气候债券，FlexiGroup 在 2016 年 4 月曾发行过类似债券。

CEFC 债权市场负责人 Richard Lovell 表示："FlexiGroup 的气候债券定价较为严格，从 而显示出投资者愿意为此支付'绿色溢价' 。这是一个极强的市场信号，将有助于澳大 利亚市场内更多样化、更灵活的绿色债券市场的加速发展。"

该债券由 FlexiGroup's 全资子公司 Certegy Ezi-Pay 的消费者营收账款抵押，并可为 12 余万太阳能光伏屋顶项目进行融资。

Lovell 先生还补充道："投资绿色债券是一 个全球化趋势。我们对 FlexiGroup 气候债券的支持是公司政策的一部分，以确保澳大利亚清洁能源产业能够从这一不断增长的资本来源中获益，并且使得具有社会责任感的投资商能够有机会参与进来。"

# India's Azure Power commissions 130MW solar project in Karnataka

Indian renewables developer Azure Power has commissioned a 130MW solar project in Chitradurga district, Karnataka.

The project is divided into one 50MW plant and two 40MW plants, all spread across a total of 270 hectares.

Azure has signed a 25-year power purchase agreement (PPA) with three distribution companies: Chamundeshwari Electricity Supply Company Limited, Hubli Electricity Supply Company Limited and Gulbarga Electricity Supply Company Limited. The tariff is set at INR 6.51/kWh (US$0.10).

Inderpreet Wadhwa, founder and chief executive of Azure Power, said: "With the commissioning of this plant, we now have a 150MW portfolio and proven track record of operating solar power projects in Karnataka. We have once again demonstrated our strong project development, engineering, and execution capabilities. We are delighted to make a contribution towards the realization of our Hon'ble prime minister's commitment towards clean and green energy, through solar power generation."

The company claims it is now the largest PV operator in the south Indian state, while it has a total Indian portfolio of more than 1GW of PV projects, having been one of the pioneers of large-scale Indian solar.

At the start of the year, Karnataka increased its solar target from 2GW to 6GW, to bring its goals in line with those of the central government.

# 印度 Azure 公司完成卡纳塔克邦 130MW 太阳能项目调试

印度可再生能源开发商 Azure 公司日前完成了在卡纳塔克邦 130MW 太阳能项目的调试工作。

该项目共分为一个 50MW 电站和两个 40MW 电站，总占地 270 公顷。

Azure 公司已与三家配电公司签署了 25 年购电协议：Chamundeshwari 电力供应公司、Hubli 电力供应公司和 Gulbarga 电力供应公司。售电价格为 INR 6.51/kWh (US$0.10)。

Azure 公司创始人兼首席执行官 Inderpreet Wadhwa 表示："随着此次项目的竣工调试，公司共在卡纳塔克邦拥有 150MW 项目组合和极为强劲的太阳能电站运营记录。我们再一次证明了公司在项目开发、工程设计和项目执行方面的能力。我们十分高兴能够在实现尊敬的总理所提出的清洁绿色能源目标上，通过太阳能发电项目做出自己的贡献。"

公司称其已是印度南部邦州内最大的光伏项目运营商，同时在全印度市场内拥有超过 1GW 的光伏项目，并成为印度大规模太阳能项目领域内的先锋。

在今年年初，卡纳塔克邦将自己的太阳能发展目标由此前的 2GW 提高至 6GW，从而符合中央政府提出的相关发展目标水准。

# Texas' El Paso Electric opens its first community solar programme

Texas utility El Paso Electric is now accepting subscriptions for its first ever community solar programme, in a first of its kind pilot in the state.

Customers in the El Paso Electric service territory can subscribe to solar generation in 1kW blocks at a fixed rate of US$20.96/kWh. According to the utility, this rate will not increase as long as the customer is part of the programme.

"El Paso Electric is excited to offer this new option that makes solar power more widely available to all of our Texas customers," said Mary Kipp, El Paso Electric CEO. "Community Solar really expands on our commitment to invest in renewable technology for the benefit of our community and environment."

The solar for the programme will be generated from a new 3MW solar facility located in the Montana Power station complex in east El Paso.

Construction on the plant started in November 2016 and is set to be completed this spring. Once the facility is complete, homeowners, renters and businesses will be able to subscribe for savings on their monthly electric bill via solar credits.

In related news, last month El Paso Electric filed a request with regulators to approve a 8.7% increase for electric customers and a mandatory demand charge for solar customers.

This article has been ammended to clarify that it is El Paso Electric'sfirst ever community solar programme - not the first in the state of Texas.

## 德州 El Paso 电力启动州内首个社区太阳能项目

德州电力公司 El Paso 电力正接受关于其首座社区太阳能项目的申请，该项目是州内首个同类项目。

在 El Paso 电力业务区域内的消费者能够以 US$20.96/kWh 的固定价格申请 1kW 的太阳能发电系统。据该电力公司称，只要消费者仍旧参与在项目中，这一价格将保持不变。

"El Paso 电力对于能够为德州消费者提供这一能够拓展太阳能应用服务。" El Pas 电力首席执行官 Mary Kipp 表示，"社区太阳能在我们的努力下得到了发展，公司为了整个社区和环境的利益对可再生能源进行了投资。"

项目中的太阳能电力来自位于 El Paso 东部的 Montana 电站内新建的 3MW 太阳能项目。

项目的建造于 2016 年 11 月开始，并预计于今年春天完成。项目完成后，居民业主、承租人和商业业户可申请参加项目，并通过太阳能积分抵免每个月的电费。

在其他相关新闻中，El Paso 电力在今年二月向电力监管机构上交提案，申请将电力用户的费用提高 8.7%，并针对太阳能电力客户收取强制性费用。

# ENGIE enters partnership to develop solar in Malaysia

French energy group ENGIE has signed a partnership agreement with Sime Darby, a Malaysian multinational for the co-development of solar and integrated facilities management services.

Malaysia is one of France's major economic partners in Southeast Asia.

"We are pleased to form this strategic partnership with Sime Darby, a most respected and successful multinational corporation with a strong local foothold. Our aligned vision on sustainability and performance offers many opportunities to combine our strengths to positively impact the lives of our many stakeholders," said Didier Holleaux, executive vice president of ENGIE.

ENGIE and Sime Darby will be providing low-cost solar PV, aiding Malaysia in its renewable energy goals. The country has a target to procure 2GW of clean energy by 2020 – 10% of its overall energy mix, 3.5GW by 2030 (13%) and 11.5GW by 2050 (34%).

"Our partnership will pave the way for greater collaboration in the solar and integrated facilities management space. With a combination of technical expertise and a deep understanding of the Malaysian market, we believe this partnership will enable us to significantly expand into these sectors," said Tan Sri Data Mohd Bakke Salleh, president and group chief executive of Sime Darby.

In other ENGIE news, the company announced earlier this month that it has issued its second green bond, worth approximately US$1.6 billion

## 曾发行价值 16 亿美元绿债的 ENGIE 欲进军马来西亚太阳能市场

法国能源集团 ENGIE 日前与马来西亚跨国公司森那美集团(Sime Darby)签署合作协议，共同开发太阳能项目并发展集成设备管理服务。

马来西亚是法国在东南亚地区内主要的经济合作伙伴。

"我们十分高兴能够与森那美集团达成战略合作伙伴关系，森那美集团是一家具有极高口碑的成功跨国公司，并在当地市场占有较大的份额。我们在可持续性发展和发展业绩等方面的理念相同，从而为双方联手合作、为股东带来正面影响等带来了许多合作机会。"ENGIE 集团执行副总监 Didier Holleaux 表示。

ENGIE 与森那美将向客户提供低成本太阳能光伏电力，帮助马来西亚市场实现其可再生能源目标。该国为自己定下了在 2020 年完成 2GW 清洁能源应用量的目标——占到其总能源组成的 10%，并在 2030 年累计 3.5GW(13%)和 2050 年达到 11.5GW(34%)。

"此次合作将为双方在太阳能和集成设备管理领域的进一步合作打下良好基础。通过将专业技术与对马来西亚市场的深入理解相结合，我们相信此次合作将使双方在相关领域均取得长足发展。" Sime Darby 公司总监及集团首席执行官 Mohd Bakke Salleh 表示。

在其他与 ENGIE 相关的新闻中，该公司在三月初曾宣布 公司已发行了第二批价值约 16 亿美元的绿色债券。

## AfDB provides US$2.3 million for solar in Uganda

The African Development Bank (AfDB) has approved a project preparation grant of US$2.3 million for future solar investments in rural and urban areas in Uganda.

The grant was leveraged through the Climate Investment Funds' Scaling-Up Renewable Energy Programme.

The funds will specifically be used to target off-grid solar projects for a number of islands across Lake Victoria. It will also be used to develop feasibility studies, the required regulatory and legal frameworks needed to pilot net metering systems.

"The proposed electrification program on the islands in Lake Victoria will considerably boost economic and social development and improve the lives of the most vulnerable ones especially the women and youth," said Amadou Hott, AfDB's vice president for Power, Energy, Climate Change and Green Growth.

## 非洲开发银行为乌干达太阳能项目提供 230 万美元资金

非洲开发银行(AfDB)日前批准了一笔 230 万美元的项目准备金，用于乌干达农村及城市地区未来太阳能领域内的投资。

此笔资金将通过气候投资基金旗下的可再生能源扩大项目发放。

资金将专门用来资助维多利亚湖周围岛上的离网电力项目。相关资金还将用于进行可行性调研，以及实施净计量系统所需的监管与法律框架合规工作。

"维多利亚湖周边的岛屿上所进行的电气化规划将大幅促进当地的经济和社会发展，改善弱势群体，特别是妇女和青少年的生活质量。"AfDB 的能源、电力*气候变*化与绿色发展部门副总监 Amadou Hott 表示。

## Spain takes first step towards renewables auction but capacity still unclear

Spain has approved the first of four norms necessary to carry out a major renewable energy tender, but the size of capacity available remains in doubt.

The Council of Ministers has approved a Royal Decree calling for the tendering of up to 3GW of renewables in a technology neutral auction for projects to be located on the Spanish peninsula.

However, Daniel Perez, legal counselor at the Holaluz utility firm, told PV Tech that the regulations and requirements are still to be decided by a Ministerial Order and two resolutions must be approved by the Secretary of State for Energy.

Indeed the draft Resolution states that even though there is a maximum of 3GW, the government plans to use just 2GW.

Perez said: "It is likely they will approve the draft that they have sent with very little changes."

At the end of last year, energy minister Alvaro Nadal said that the auctions will be carried out in the first semester of 2017. The Ministry of Energy and Tourism had also directed that it would carry out a renewable energy auction for Spanish islands in the first quarter of 2017.

## 西班牙启动可再生能源拍卖规范程序，但规模未知

西班牙政府日前批准了进行重要可再生能源招标所需的四项规范中的第一项，但相关项目规模仍未被公布。

部长会议日前批准了皇家法令，号召针对位于西班牙半岛上的规模高达 3GW 的项目进行技术中立型可再生能源项目招标。

但是，Holaluz 电力公司法律顾问 Daniel Perez 向 PV-Tech 表示，相关法规和要求仍需获得部长令的批准，且其中两项决议还需获得能源部国务秘书的批准。

事实上，尽管决议草案表明，项目规模上限被设在 3GW，但政府仍计划仅使用 2GW 的规模。

Perez 先生表示："能源部很可能批准通过草案，且几乎不对其进行任何改动。"

在去年年底，该国能源部长 Alvaro Nadal 曾表示，相关项目招标将在 2017 年上半年进行。能源与旅游部还明确表示，将在 2017 年一季度内针对西班牙境内各岛进行可再生能源项目招标。

## Comtec more than doubles expected losses for 2016

Monocrystalline wafer producer Comtec Solar Systems Group has more than doubled expected losses for 2016, due to further write-downs on its Malaysia manufacturing facility with the pending sale of the facility to leading mono wafer supplier, LONGi Green Energy Technology.

Comtec had previously said that it had expected a net loss of approximately RMB434.7 million (US$63.07 million) in 2016. Updated information in a financial filing indicates the company expects losses to be over RMB1,000.0 million (US$145.09 million) in 2016, while these figures remain preliminary, according to the company.

The company said that the write-down of assets at its Malaysian manufacturing facilities would be approximately RMB339.3 million (US$49.2 million) as the company would be disposing of equipment at a loss.

A write-down of approximately RMB276.5 million (US$40.1 million) of the assets related to manufacturing facilities in China as it downsizes its mono wafer production as it shifts to a downstream business model.

However, market dynamics are also at play, due to falling ASPs. Comtec said it would take a charge of RMB152.6 million (US$22.1 million) on inventory write downs and RMB94.5 million (US$13.7 million) due to the decrease in the market prices of solar wafers and polysilicon.

Comtec cited that its upstream business deterioration in the second half of 2016 was due to weak demand and customers scaling back production of solar cells as overcapacity forced overall price declines. The company has yet to report full-year 2016 financial results.

## 卡姆丹克提高 2016 年亏损预期逾一倍

由于与领先单晶硅片供应商隆基绿能间的设备待售协议而导致的位于马来西亚制造厂区将进一步出现资产减持，单晶硅片制造商卡姆丹克(Comtec)太阳能日前将其 2016 年亏损额提高了一倍以上。

卡姆丹克此前曾预计其 2016 年业绩净亏损额为 4.347 亿人民币(约合 6307 万美元)。在公司日前更新的一份业绩公告中显示，公司预计其 2016 年亏损额将超过 10 亿人民币(约合 1.4509 亿美元)，但公司还表示，这些数字还只是初步统计数字。

公司表示，随着公司对生产设备进行折价出来，其位于马拉西亚制造厂区的资产减持规模预计约为 3.393 亿人民币(约合 4920 万美元)。

此外，随着公司将业务重心转移至下游业务模式，并缩减其单晶硅硅片生产业务，公司还对中国境内的生产设备进行了约 1.765 亿人民币(约合 4010 万美元)的资产减持。

然而，不断下跌的平均产品销售价格也同样对公司业务造成影响。卡姆丹克公司表示，库存减持导致了 1.526 亿人民币(约合 2210 万美元)的费用，同时，由于太阳能硅片和多晶硅产品的市场价格下跌，对公司营利造成了 9450 万人民币(约合 1370 万美元)的影响。

卡姆丹克公司表示，由于市场需求疲软、产能过剩导致产品价格出现整体下跌，进而引发客户缩减太阳能电池生产规模，公司的上游业务在 2016 年下半年出现恶化。公司目前仍未公布 2016 年全年财务业绩报告。

# *Natural Gas（天然气）*

# FERC certificates several new natural gas pipelines in 2017


Source: U.S. Energy Information Administration, IHS Markit

Several large natural gas interstate pipeline projects have come online in recent years to support the shifting geography of domestic natural gas production. The Marcellus and Utica shale plays in the Northeast, where production has grown and resources are abundant, are major drivers for pipeline development. In 2016, the Federal Energy Regulatory Commission (FERC) certificated 17.6 billion cubic feet per day (Bcf/d) of new natural gas pipeline capacity. So far in 2017, FERC certificated more than 7 Bcf/d of new pipeline capacity before losing its quorum following the departure of one commissioner in February, which left just two sitting commissioners and three vacant seats.

FERC oversees the interstate transmission of natural gas, which includes the regulation of interstate transportation rates and services for natural gas pipelines, natural gas pipeline construction, and related pipeline environmental matters. Pipeline certification involves reviewing applications for the construction and operation of natural gas pipelines and ensuring that applicants comply with safety standards.

Receiving a certificate is just one step in the process of building and operating a new pipeline; pipelines receiving certification in 2017 will not necessarily come online in 2017.

The seven projects certificated during the first few weeks of 2017 include more than 1,500 miles of natural gas pipeline construction and expansions, involving combined additions of more than 7 Bcf/d of capacity. The pipeline projects are concentrated in the eastern half of the United States to improve access to markets for growing eastern natural gas production, and they have projected 2017 and 2018 in-service dates.

Two large-capacity projects, the Rover Pipeline Project (and related projects) and the Atlantic Sunrise Pipeline Project, were among those that received certificates in early 2017. The Rover Pipeline will move natural gas out of the Utica shale play that spans parts of New York, Pennsylvania, West Virginia, and Ohio. According to Rover Pipeline LLC, the $4.2 billion project will have direct deliveries in Ohio; West Virginia; Michigan; and Ontario, Canada and will reach a capacity of 3.3 Bcf/d. Construction will begin in the first quarter of 2017.

The Atlantic Sunrise Pipeline will move natural gas out of the Marcellus shale play to markets in the mid-Atlantic

and southeastern states. According to the Transcontinental Gas Pipe Line Company, LLC, the $2.6 billion expansion will add 1.7 Bcf/d of pipeline capacity, and construction will begin in mid-2017.

Other recently certificated pipeline projects include the Orion Project, Transco to Charleston Project, Rayne and Leach Xpress, Northern Access, and Northern Lights 2017 Expansion. As of February 23, 33 projects had FERC applications in process, and 20 projects had submitted FERC pre-filings, according to data from PointLogic Energy. Consideration of these projects, among others, will be deferred until FERC has at least the three commissioners required to constitute a quorum.

## FERC 在 2017 年批准了几条新的天然气管道


资料来源：美国能源信息管理局 IHS Markit

近几年来，天津一些大型天然气管道工程已经上线，以促进国内天然气生产的转变。Marcellus 和 Utica 页岩在东北地区生产，资源丰富，是管道开发的主要动力。 2016 年，联邦能源管理委员会（FERC）每天验证了 176 亿立方英尺/日（17.6Bcf / d）的新天然气管道产能。到 2017 年为止，FERC 在二月份一名专员离职后，在超过 7 Bcf / d 的管道能力上证明达不到法定人数标准，只剩下两名专员和三名空缺席位。

FERC 监督天然气的州际传输，其中包括对天然气管道的州际运输率和服务的管理，天然气管道建设和相关管道环境事宜。管道认证涉及审查天然气管道建设和运行的申请，还需要确保申请人符合安全标准。

接收证书只是建立和运行新管道的过程中的一步; 2017 年获得认证的管道不一定会在 2017 年上线。

2017 年头几个月的七个项目获得认证，包括天然气管道建设和扩建超过 1500 英里，累计增加了 7 Bcf / d 的产能。管道项目集中在美国东部半岛，以改善进入东部天然气生产增长的市场，在职日期预计为 2017 年和 2018 年。

两个大容量项目，流浪者管道项目（及相关项目）和大西洋日出管道项目，都是在 2017 年初获得证书的人之一。流浪者管道将把天然气从 Utica 页岩游戏中移出纽约州、宾夕法尼亚州、西弗吉尼亚州和俄亥俄州。据 Rover Pipeline LLC 称，这笔 42 亿美元的项目将在俄亥俄州直接交付;西弗吉尼亚;密歇根州和加拿大安大略省，将达到 3.3 Bcf / d 的产能。 2017 年第一季度开工建设。

大西洋日出管道将天然气从 Marcellus 页岩播放中移到大西洋和东南部中部的市场。根据跨洲天然气管道公司有限责任公司的报告，26 亿美元的扩张将增加 1.7 Bcf/d 的管道能力，建设将于 2017 年中期开始。

其他最近认证的管道项目包括猎户座项目，Transco 到查尔斯顿扩展项目，Rayne 和 Leach Xpress，北方进出口和北极光在 2017 年开始扩张。根据 PointLogic Energy 的数据，截至 2 月 23 日，已有 33 个项目

正在进行 FERC 申请，20 个项目已提交 FERC 预申请。这些项目的审议到 FERC 接受审核时，至少需要有三名专员构成法定人数。

# LNG to be part of seasonal natural gas storage play in Europe: Snam CEO

LNG supplies to Europe can increasingly be diverted into storage in the summer, giving storage operators the ability to then release the gas in the higher-demand winter months, the head of Italian TSO Snam said Wednesday.

Speaking at FT Commodities Global Summit in Lausanne, Switzerland, Snam CEO Marco Alvera said LNG would become "hugely seasonal" and that Italy in particular could take advantage of these market dynamics.

LNG, he said, is likely to play a key role in gas supply into Europe but "will need to be tied into storage."

"Europe has a huge opportunity in storage," Alvera, who is also a director on the board of S&P Global, said.

"LNG is going to become hugely seasonal," he said, adding that the majority of LNG demand is in the northern hemisphere.

"You will have very distressed LNG available in the summer and people will capture that if they have storage," Alvera said.

Alvera said Italy in particular could play an important role in importing LNG for seasonal storage.

"Italy is in a unique position for gas storage reserves and ability to export gas," he said.

"It can really be the hub where people import LNG in the summer and export it out to the rest of Europe in the winter."

Italy has a current gas storage capacity of some 16.5 Bcm, second only to Germany in terms of size within the EU.

ITALIAN TENDER

Italy is already moving toward a joint LNG import and storage strategy.

OLT Offshore, the operator of the Toscana LNG import facility, awarded 16 unloading slots earlier this month as part of a bundled storage and regasification capacity procedure for the 2017/2018 storage year.

OLT said it would allocate three LNG unloading slots in April, four in May, three in June, two in July, two in August and two in September.

The total LNG to be imported under the tender is equivalent to about 1.3 Bcm, which will be sent to the Stogit storage system.

As a result, Platts Analytics' Eclipse Energy expects LNG send-out in Italy to be up 10 million cu m/d year-on-year this summer.

Europe as a whole is expected to import more LNG in 2017 given a boost in global LNG production capacity and relatively low prices.

According to data released this week by LNG industry group GIIGNL, European net imports of LNG totaled 38.5 million mt last year, up just 2.4% year on year.

It represented 15% of the global import total of 264 million mt, which was up 7.5% year on year.

Of that, the majority -- 160 million mt, or 61% -- was bought by countries in northeast Asia (Japan, South Korea,

China and Taiwan).

INTERCONNECTIVITY

Alvera also said Europe's gas market was becoming increasingly interconnected -- a goal of the EU Energy Union -- which would improve the efficiency of the transmission system.

"We need to interconnect France and Spain, reverse flow out of Italy, [provide] additional storage and LNG and you've achieved the Energy Union," he said.

Properly connecting Turkey to the European gas system would result in "the world's largest interconnected market," he said.

The drive to create interconnections and create harmonization would ultimately bring gas prices down to the benefit of consumers.

But, he said, the greater efficiencies of the Energy Union would "take some trading margins out of the system."

## Snam CEO 表示，LNG 成为欧洲季节性天然气储存的一部分

意大利 TSO Snam 周三表示，在夏季，向欧洲供应的液化天然气可以越来越多地转移到储存中，使仓储运营商能够在更高需求的冬季释放天然气。

斯纳姆首席执行官马可•阿尔韦拉（Marco Alvera）在瑞士洛桑金融时报全球首脑会议上说，液化天然气将变得“非常季节性”，特别是意大利可以利用这些市场动力。

他说，液化天然气可能在向欧洲供气方面发挥关键作用，但“需要与储存有关”。

“欧洲存储了巨大的机会，”Alvera 也是标准普尔全球董事会主席。

“液化天然气将会变得非常季节性。”他补充说，大部分 LNG 需求都在北半球。

阿尔韦拉说：“夏天，你们将会有非常苦恼的液化天然气，人们会抓住这些储存空间。”

阿尔韦拉说，意大利特别是在进口季节性储存液化天然气方面发挥重要作用。

他说：“意大利在储气库和出口天然气方面处于独特地位。”

“这真的可以成为夏天进口液化天然气的枢纽，冬天将其出口到欧洲其他地区。”

意大利目前的储气能力约为 165 亿立方米，仅次于德国在欧盟范围内。

意大利投标

意大利已经进入液化天然气进口和储存联合战略。

本台早些时候，托斯卡纳液化天然气进口设施的运营商 OLT Offshore 在本月初批准了 16 个卸货槽，作为 2017/2018 储存年度捆绑式储存和再气化能力程序的一部分。

OLT 表示将在四月份分配三个 LNG 卸货槽，五月四号，六月三号，七月二号，八月二号，九月二号。

根据招标进口的 LNG 总量约为 13 亿立方米，将发送到 Stogit 储存系统。

因此，Platts Analytics 的 Eclipse Energy 预计，今年夏天，意大利的液化天然气出货量将达到 1000 万立方米/年。

由于全球液化天然气生产能力和价格相对较低，预计 2017 年全球将进口更多的液化天然气。

据液化天然气行业集团 GIIGNL 本周公布的数据显示，去年欧洲液化天然气净进口量为 3850 万吨，同比增长 2.4％。

占全球进口总额的 2.45 亿吨的 15％，同比增长 7.5％。

其中，东北亚（日本，韩国，中国和台湾）的国家购买了大部分 - 1.6 亿公吨（占 61％）。

互连性

Alvera 还表示，欧洲的天然气市场正在日益相互关联 - 欧盟能源联盟的目标 - 这将提高传输系统的效率。

他说："我们需要连接法国和西班牙，反向流出意大利，提供额外的储存和液化天然气，你已经实现了能源联盟。"

他将土耳其正确连接到欧洲的天然气系统将导致"世界上最大的相互关联的市场"。

创造互连和创造协调一致的驱动力最终将使天然气价格下降到消费者的利益。

但是，他表示，能源联盟的更大的效率将"把一些交易利润从系统中除去"了。

# Russia's major natural gas producer says available reserves to suffice for over 20 years

Novatek, Russia's largest private natural gas producer, specializes in the exploration, production, processing and sale of natural gas and liquid hydrocarbons

ARKHANGELSK, March 29. /TASS/. Russia's largest independent natural gas producer Novatek boasts available reserves that will suffice for another 24 years while the relevant period for US companies is nine years, Novatek CEO Leonid Mikhelson said on Wednesday.

The company's chief executive made this statement at an international forum, Arctic - Territory of Dialogue, which opened in the northern Russian city of Arkhangelsk on March 29.

"Judging by the volume of output as of today, Novatek has reserves for 24 years. Gazprom may possibly correct me but with the volume of Gazprom's gigantic reserves, this will probably suffice for 50 years," Mikhelson said.

"Today America comes first by the volume of gas production but relative to today's date the US reserves will suffice for 9 years," the Novatek CEO said.

Russia needs to secure the support of foreign partners for full-fledged work on projects in the Arctic area, Mikhelson said.

"The Yamal-LNG project involves 15 countries and we would be glad to invite foreign partners to our future projects," the company's chief executive said.

Novatek, Russia's largest private natural gas producer, specializes in the exploration, production, processing and sale of natural gas and liquid hydrocarbons. In 2009, the company joined the Arctic Yamal-LNG project licensed to develop the gigantic South Tambey gas condensate field.

LNG projects

Novatek is interested in bringing foreign partners into liquefied natural gas (LNG) projects, particularly from countries with the market for its sales, Mikhelson said:

"We would invite our foreign partners into our new projects with pleasure. We are giving priority now to the ones with the market for our products. We must unite; it provides stability".

Yamal LNG project is an example of such cooperation, Novatek CEO said. "Fifteen countries are involved in Yamal LNG at present, leave alone Total and Chinese companies," he added.

Arctic forum

The Arctic - Territory of Dialogue forum is a key venue for discussing the problems and the prospects of the Arctic region. The forum is designed to bring together the efforts of the international community for the Arctic's effective development.

The participants in the forum that has been held since 2010 discuss raising living standards on Arctic territories, developing the transport system and dealing with environmental issues.

The fourth international Arctic - Territory of Dialog forum that has opened in Arkhangelsk on March 29 is being attended by 1,500 participants from Russia and other countries. TASS is the forum's general information partner and official photo-hosting agency.

## 俄罗斯的主要天然气生产商称现有储备够用 20 多年

俄罗斯最大的私营天然气生产商 Novatek 专门从事天然气和液体碳氢化合物的勘探，生产，加工和销售。

Novatek 首席执行官 Leonid Mikhelson 周三表示，俄罗斯最大的独立天然气生产商 Novatek 拥有足够的可用储备，足够 24 年，而美国公司的相关期限为九年。

该公司的首席执行官在三月二十九日在俄罗斯北部阿尔汉格尔斯克市开设的北极 - 对话领域国际论坛上发表了这一声明。

"根据今天的产量，Novatek 已经有 24 年的储备，俄罗斯天然气工业公司可能会纠正我，但看俄罗斯天然气工业公司巨大的储量的话，实际上可能足够 50 年用了。" Mikhelson 说。

Novatek 首席执行官说："今天美国首先是天然气生产量，但相对于今天的美国储备而言将足够 9 年。"

Mikhelson 说，俄罗斯需要确保外国合作伙伴对北极地区项目进行全面工作的支持。

该公司的首席执行官说："亚马尔液化天然气项目涉及 15 个国家，我们很乐意邀请外国合作伙伴参与我们未来的项目。"

俄罗斯最大的私营天然气生产商 Novatek 专门从事天然气和液体碳氢化合物的勘探，生产，加工和销售。 2009 年，该公司加入了北极亚马尔液化天然气项目，授权开发巨大的南坦比气田凝析油田。

液化天然气项目

Novatek 有兴趣将外国合作伙伴引进液化天然气（LNG）项目，特别是从销售市场的国家，Mikhelson 说：

"我们愿意邀请我们的外国合作伙伴快速进入我们的新项目，我们现在将重点放在与我们产品市场相关的项目上，我们必须团结一致，提供稳定性"。

亚马尔液化天然气项目是这种合作的一个例子，Novatek CEO 说。他补充说："目前，有 15 个国家正在参与亚马尔液化天然气项目。"

北极论坛

北极 - 对话领土论坛是讨论北极地区问题和前景的重要场所。论坛旨在汇集国际社会为北极有效发展所作的努力。

自 2010 年以来举办论坛的与会者讨论了提高北极地区生活水平，发展运输系统和处理环境问题。

3 月 29 日在阿尔汉格尔斯克举行的第四届国际北极 - 对话论坛领域正在出席，有来自俄罗斯等国家的 1500 人参加。 TASS 是论坛的一般信息合作伙伴和官方照片托管机构。

# *Minerals（矿产）*

## China targets false claims on steel mill closures

China is planning a new crackdown on steel production in the north-east city of Tangshan in a bid to prevent false reporting of mill closures by local governments reluctant to obey shutdown orders.

Officials in Hebei province have been sent a government notice, seen by the FT, stating that an investigative team

had been sent to Tangshan, a leading steel producer, to verify the closure of mills.

The notice, sent on Saturday, cites orders from President Xi Jinping and Zhang Gaoli, the vice-premier, for Tangshan to investigate the problem of falsely reported plant closures and rising steel output.

The Hebei government declined to comment yesterday. The authenticity of the memo was confirmed by a state-run industry group.

Last year, China's state council set out plans to eliminate 100m-150m tonnes of steel capacity in a bid to restructure the economy from one driven by government-led infrastructure investment and exports to a more consumption and services-oriented model.

The initiative was also aimed at reducing heavy smog and groundwater pollution in China. Steel is the second-biggest contributor to sulphur dioxide and other emissions, after coal-fired power.

But local authorities have dragged their feet on implementing orders to shut down steel mills because doing so would potentially eliminate hundreds of thousands of jobs.

"The local government will always want to protect its own industries because company officials get promotions based on growth," said Scott Laprise, the founder of steel research firm LTH Consulting.

"No one gets a promotion because they lost jobs and their local economy did poorly."

A study commissioned by environmental campaign group Greenpeace, published last month, showed that two-thirds of China's claimed cuts in steel capacity last year came from mills that were already idle. Production of crude steel in 2016 rose about 1 per cent from the year before to 808m tonnes, according to preliminary data from the National Bureau of Statistics.

"Local governments will report back and simply say certain companies eliminated capacity or were closed or went bankrupt," said Mr Laprise.

"No one is checking what is supposedly already closed and what is actually closed."

Beijing has moved to police steel mills more strictly and verify the closure and demolition of production sites. Last November, inspection teams were sent to steel-producing provinces to enforce anti-pollution standards by shutting down ageing mills.

Saturday's notice signals a more aggressive shift to tackle the problem of false data regarding mill closures.

Tangshan is the heartland of Chinese steel production. The city is home to the headquarters of the state-owned Tangsteel Group, which in 2006 merged with other companies to form Hebei Steel Group, the second-largest steel producer in the world.

## 中国整治虚报钢厂关闭问题

中央政府向唐山派出调查小组核查钢厂关闭情况，并要求该市调查虚报钢厂关闭、实际钢铁产量不断增长的问题。

中国正计划对华北城市唐山的钢铁生产发起新的整治行动，以防不愿遵守限产令的地方政府虚报钢厂关闭。

中央政府已向河北省官员发出通知（英国《金融时报》看到了这份通知），称一个调查小组已被派往钢铁重镇唐山，以核查钢厂关闭情况。

上周六发出的通知援引了国家主席习近平和副总理张高丽的命令，要求唐山调查虚报钢厂关闭、实际钢铁产量不断增长的问题。

河北省政府昨日拒绝置评。上述通知的真实性得到了一家国营行业组织的确认。

去年，中国国务院制定了淘汰 1 亿至 1.5 亿吨钢铁产能的计划，以求调整经济结构，从政府主导的基础设施投资和出口驱动模式，转向在更大程度上以消费和服务为导向的模式。

此项举措还旨在缓解中国的严重雾霾和地下水污染。钢铁是二氧化硫等物质排放的第二大贡献者，仅次于燃煤发电。

但是地方当局拖延执行关闭钢厂的命令，因为那么做可能意味着失去数十万个工作岗位。

“地方政府总是希望保护本地产业，因为官员们的晋升是以经济增长为依据的，”钢铁业研究公司 LTH Consulting 的创始人乐天虎(Scott Laprise)表示。

“没有人因为就业岗位减少且地方经济表现糟糕而获得晋升。”

环保活动组织绿色和平(Greenpeace)委托进行、上月发表的一项研究表明，去年中国报告的钢铁产能削减有三分之二来自本已闲置的钢厂。根据中国国家统计局(NBS)的初步数据，2016 年粗钢产量比上年增长约 1%，至 8.08 亿吨。

“地方政府在汇报工作时，只会说某些公司淘汰了产能、关闭了或者破产了，”乐天虎表示。

“没有人检查哪些钢厂理应已经关闭，哪些钢厂真的关闭了。”

北京方面已采取行动收紧对钢厂的管控，核查生产场地的关闭和拆除情况。去年 11 月，检查组被派往一些炼钢大省，通过关闭陈旧的钢厂来执行污染治理标准。

上周六的通知说明中央政府采取更加有力的行动，力求解决在钢厂关闭方面数据造假的问题。

唐山是中国钢铁生产的心脏地带。该市是国有的唐钢集团(Tangsteel Group)总部所在地，该集团在 2006 年与其他公司合并，组成世界上第二大钢铁生产企业——河北钢铁集团(Hebei Steel Group)。

# *Clean Energy（清洁能源）*

## The disruptive impact of technology

Too much of what is written about energy is negative, even despairing. Too much space is taken up by those predicting gloom, seeking subsidies or looking for incredible global agreements. There is a place for rational optimism and it is a pleasure to find that case presented so clearly and objectively in a new paper from the Grantham Institute.

The work from the independent academic body based at London’s Imperial College describes the transition of the market over the next two decades by focusing on two areas — the advance of solar power through the deployment of photovoltaics and the growth of electric vehicles.

This is not an advocacy document or wishful thinking but a well-sourced projection based on what is already happening. It deserves to be read by everyone working in the energy sector, by policy makers and perhaps most urgently by investors. Its conclusions really do qualify for inclusion in the overused category of “breaking news”.

It is tempting to think there are two “alternative truths” in the widely divergent views of the future presented on the one hand by the major energy companies and some international institutions and on the other by the Grantham Institute.

The first view suggests that the world’s energy mix will change only gradually over the next 20 to 30 years, with hydrocarbons remaining dominant and renewables growing but still providing no more than 10 to 15 per cent of total supply by the end of the period.

The analysis from the Grantham Institute, written in collaboration with the think-tank Carbon Tracker, comes to a rather different conclusion. On their projection solar will take 23 per cent of the power generation market by 2040

and 29 per cent by 2050. Electric vehicles will account for around 35 per cent of the road transport market by 2035.

These sectors, of course, are not the whole story, nor the limit of the potential for radical change — wind power could constitute another 12 per cent of the power market by 2050. But the focus is justified because these are the two technologies that have made most progress in the last decade.

Note the tense: “have made”. This is based on what has happened, not on a starry-eyed view of what progress might be made. Five years ago, the institute estimated on the basis of the best available data that utility-scale solar costs in 2016 would be around $3.7bn per GW. The latest research puts the figure at $1.4bn per GW. The fall began with module costs but now includes cabling and installation. According to 2016 research from the US Department of Energy, battery costs for use in electric vehicles have fallen from $1,000 per kW hour in 2008 to $268 per kWh in 2015 — a 73 per cent reduction.

These falls have transformed the cost competitiveness of renewables, and there is more to come as industrialisation of both activities advances rapidly, particularly in the US and China.

Nor are the projections based on dramatic shifts in public policy. The authors have taken as their baseline the national commitments made at the Paris conference in December 2015. In many cases these are modest, easily achievable and — more important — did not take much account of the advances in technology and cost reductions.

Stronger policies — an effective carbon price regime or more direct subsidies — would deliver more change, more quickly. But the analysis does not rely on that. We are moving very quickly beyond the world of subsidies and even beyond the point where regulation and global agreements are relevant. The shape of the future energy market will be dictated by open-market competition between different technologies.

The modelling exercise is careful and limited. As the authors say, there is scope for much more work on other aspects of the energy market that could also see radical disruption. Nevertheless, the conclusions are dramatic. On the basis of known working technology, solar power and electric vehicles can look forward to sustained growth worldwide. At the same time hydrocarbons will peak and the authors are bold enough to foresee peak oil and coal demand in 2020 — just three years away.

To describe this as a wake-up call to those in the energy business is somewhat inadequate. There is no “alternative truth”. Change cannot be wished away and companies and investors should get used to it. Public policy can alter the pace of change, but is a secondary factor compared with the progress of technology. Those who don’t understand how fast such advances can spread in an age of globalisation are liable to make big mistakes. The authors cruelly, but effectively, quote the McKinsey study written in 1980 which said that by the year 2000 there might be 900,000 mobile phone subscribers. In fact, there were 109m.

In business terms, those who can ride the changes will do very well. Everything in the paper suggests energy will be plentiful, and prices low. But volumes will be high. The world will have 9bn to 10bn citizens within the next half century, all needing energy supplies. Low-cost energy could transform regional economies in Africa and South Asia, bringing into the market hundreds of millions of people who now have subsistence lives.

A transformed market will break some business models — it has already done great damage to the utilities in Europe — and force others to adapt. Value will be created and destroyed. Those who don’t want to be on the wrong side of the coming value shift should read the Grantham Institute paper.

## 技术将颠覆能源市场

巴特勒：最新研究预测，20 年后太阳能发电和电动车将占据可观市场份额，与此同时石油和煤炭需求将在 2020 年就见顶。

太多有关能源的著述是悲观的、甚至令人绝望的。太多篇幅出自那些预测前景不妙、寻求补贴或寻求

不可思议的全球协议的人笔下。应该存在理性乐观主义的空间，就此而言，格兰瑟姆研究所(Grantham Institute)在一篇新论文中呈现得如此清晰和客观的乐观论证十分可喜。

这家隶属于伦敦帝国理工学院(Imperial College)的独立学术机构发表的研究，描述了未来 20 年市场的转型，该文专注于两个领域：通过部署太阳能光电板来发电的进展，以及电动汽车的增长。

这并非一份倡议文件或一厢情愿的想法，而是一份基于正在发生事情的来源详实的预测。在能源行业工作的所有人、政策制定者以及投资者（他们或许最需要赶紧）都应该读一读这篇文章。其结论真的有资格纳入如今使用过多的“突发新闻”类别。

人们很容易认为，对于未来的差异甚大的观点代表着两种“替代真相”：一种是大型能源公司和一些国际机构陈述的观点，另一种是格兰瑟姆研究所陈述的观点。

第一种观点认为，在未来 20 至 30 年，世界能源结构只会逐渐改变，其中碳氢化合物仍占主导地位，可再生能源不断增长，但其占总供应量的比重到期末仍仅为 10%至 15%。

格兰瑟姆研究所与智囊机构“碳追踪者”(Carbon Tracker)合作撰写的分析文章，得出了一个截然不同的结论。根据他们的预测，到 2040 年，太阳能将占发电市场的 23%，到 2050 年将占 29%。到 2035 年，电动汽车将占公路运输市场的大约 35%。

注意时态：“已经取得”。这项分析基于已经发生了什么，而不是基于可能会取得何种进展的乐观看法。5 年前，格兰瑟姆研究所根据最佳可用数据估计，2016 年“公用事业级规模”太阳能发电的成本将达每吉瓦(GW)约 37 亿美元。最新研究显示，这一数字为每吉瓦 14 亿美元。成本降低始于模块成本，但现在，布线和安装成本也降低了。根据美国能源部(Department of Energy) 2016 年的研究，用于电动汽车的电池成本已从 2008 年的每千瓦时 1000 美元下降到 2015 年的每千瓦时 268 美元——降幅达 73%。

这类大幅下降已经彻底转变了可再生能源的成本竞争力，而随着两个领域活动的工业化程度迅速提升——特别是在美国和中国——成本将进一步降低。

上述预测也并非基于公共政策的重大转变。作者们把各国在 2015 年 12 月巴黎会议上做出的承诺作为基线。在很多情况下，这些预测是适度、容易实现的，而且更重要的是没有假设很多的技术进步和成本降低。

更强有力的政策——有效的碳价制度或更直接的补贴——将更快地带来更大变化。但这项分析不依赖于此。我们正在迅速超越补贴时代，甚至超越了监管和全球协议变得意义不大的临界点。未来能源市场的格局将由不同技术之间开放的市场竞争决定。

建模工作是审慎和有限度的。正如作者们所说，在也可能发生大规模扰动的能源市场其他方面，还有开展更多研究的空间。然而，结论仍是戏剧性的。在已知有效技术的基础上，我们可以期待全球范围内太阳能发电和电动汽车的持续增长。与此同时，碳氢化合物将达到峰值，作者们大胆预测，石油和煤炭需求将在 2020 年见顶——仅仅三年后。

将此形容为对能源行业从业者拉响的警钟，还有点不到位。不存在“替代真相”。变化是不以人的意志为转移的，企业和投资者应该适应变化。公共政策可以改变变化的步伐，但与技术进步相比是次要因素。那些不懂这种进步在全球化时代可能以多快速度蔓延的人，容易犯下大错误。作者们刻薄（但有效）地援引了麦肯锡(McKinsey)在 1980 年发布的研究报告——报告称，到 2000 年全球可能会有 90 万移动电话用户。事实上，移动电话用户达到了 1.09 亿。

从商业角度看，那些能够驾驭变化的人将非常成功。这篇论文通篇都暗示，能源将会很丰富，价格会很低廉。但数量将会很大。在未来半个世纪里，世界人口将达 90 亿至 100 亿，每个人都需要能源供应。低成本能源有望转变非洲和南亚的区域经济，让目前勉强谋生的数亿人进入市场。

转型后的市场将打破一些商业模式——它已经对欧洲的公用事业企业造成巨大损害，并迫使其他行业进行调整。价值将被创造和摧毁。那些不想在未来价值消长时处于不利地位的人，应当读一读格兰瑟姆研究所的这篇文章。

# Roundtable: What would a US withdrawal from the Paris Agreement mean for China?

With Obama's climate policy threatened, we asked Chinese experts about the potential impact of the US leaving the Paris Agreement

President Trump on Tuesday signed an executive order that will trigger a review of the Clean Power Plan, Obama's 2015 policy on limiting emissions from power plants. This policy is essential to helping the US meet its commitment to reduce greenhouse gas emissions under the Paris Agreement. Although the plan was blocked by the courts last year, the new effort to scrap it whilst promoting investment in heavily polluting industries such as coal, is the clearest statement yet that cutting emissions is not a priority for the US administration.

But will the attack on the Clean Power Plan make a difference elsewhere, particularly if it's the first step in an effort by the US to leave the Paris Agreement altogether? We asked Chinese policy experts to weigh in on the issue.

Trade policy rather than political commitment is the key factor - Liu Qiang1

Liu Qiang, head of the energy division at the Chinese Academy of Social Science's Institute of Quantitative and Technical Economics

China has made clear that it will not withdraw from the Paris Agreement, even if the US does, so it will continue to fulfil its commitment to cut [greenhouse gas] emissions. But changes in the US position may present obstacles for implementing a carbon pricing mechanism.

The development of clean power has reached a crucial point: advances in wind and power technology have reduced costs to the point where they can compete to an extent with fossil fuels. The carbon pricing mechanism of the Paris Agreement would make clean energy even more competitive. If the US pulls out that mechanism is at risk and China's motivation to implement a carbon trading market will be reduced.

A US withdrawal will have more of a symbolic effect, rather than a real impact on specific sectors. The US has never been deeply involved in climate change talks and, moreover, US$2 billion [the amount owed by the US to the United Nation's Green Climate Fund] is, on a global scale, not that large an amount.

The impact industry and investment will not be huge, and the peak of global investment in clean energy has already passed. Recently, exports of solar modules from China have been hit by EU anti-dumping measures, therefore, [US] trade policy rather than political commitment is the key factor.

No matter how the international situation changes, China will not stop supporting climate governance – Wang Binbin

Wang Binbin, post-doctoral research fellow at Peking University's School of International Relations

Climate governance is a joint undertaking affecting all humanity. Speaking at Davos recently China's President Xi Jinping made China's stance clear: "China will continue to take action in response to climate change and fulfil its duties 100%."

Foreign Minister Wang Yi, speaking at the G20 Foreign Ministers Meeting in February, stressed the need for cooperation and the creation of a peaceful and stable international environment:

"[We must] establish a UN-led system of cooperation based around North-South cooperation and supplemented with South-South cooperation; and create new types of global development partnerships forming joint development efforts."

No matter how the international situation changes, China will not stop supporting climate governance and

South-South climate governance.

Climate diplomacy has been a bright spot for China-US relations in recent years – Chai Qimin

Chai Qimin, director of the National Centre for Climate Change Strategy and International Cooperation's (NCSC) International Cooperation Department

If Trump does opt to pull out of the Paris Agreement, there will be a diplomatic impact not just in China, but worldwide.

In 2001 the US refused to sign the Kyoto Protocol. If it now withdraws from the Paris Agreement damage will be done to the UN's multilateral mechanism. Both the Paris and Kyoto deals were milestones under the 1992 UN Framework Convention on Climate Change; both were programmes for real action; and both made compromises because of US domestic politics.

The Paris Agreement involved intended nationally determined contributions and was specifically designed to facilitate implementation rather than punish failure, and had no legal binding force to a certain extent – all because of the circumstances in the US at the time (i.e. the difficulty in having the treaty ratified by congress).

If the US pulls out it will once more be a case of US internal disputes playing out overseas. This first sets a bad example for other Umbrella Group nations, as when Japan, Australia and Canada withdrew from the Kyoto Protocol; and second, deals a huge blow to the confidence of other countries [in the US as a trustworthy international partner].

China's energy and climate policy, and its nationally determined contributions, are set according to its own circumstances. Chinese leaders and officials have repeatedly indicated that China is confident in its policies and that the country has its own reasons for a low-carbon transition, which will shore up confidence in multilateral mechanisms. But it is undeniable that more questions are being raised in Chinese government and industry, and that an ambitious green plan will be more difficult to implement than previously – and may even meet scepticism and opposition.

The negative attitude of the US has already affected industry, with clean energy investment sliding last year and low-carbon innovation affected worldwide. Many Chinese new energy firms have seen valuations and borrowing ability fall, and these negative impacts are still emerging. If the remaining US$2 billion promised by the US is not forthcoming the outlook for the Green Climate Fund is bleak.

Climate diplomacy has been a bright spot for China-US relations in recent years, but with the Trump administration coming to power it may be inevitable that such activities become less frequent.

However, there may be a more pragmatic attitude towards energy sector cooperation – for example in shale gas there's the scope to develop trade, with many benefits for both parties. A lot of work will continue, just not under the banner of climate diplomacy.

Links between China and the US are becoming more diverse, and local governments, businesses and Non-Governmental Organisations will remain active. We refer to these parties as non-governmental stakeholders, and they have a huge role to play. China's current diplomatic thinking is to expand cooperation as much as possible, rather than oppose it. The Chinese have a saying, that friendliness creates riches. Our new approach is to create new routes to growth and share the benefits of a green transition.

China is also willing to address the concerns of other nations arising from misunderstandings over, for example, transparency; and willing to look for more opportunities for cooperation.

Alongside China-US climate cooperation there are other platforms: China-EU cooperation, the BRICs countries, South-South cooperation. In the past the media preferred to focus on China and the US – the G2. China is currently implementing its 10-100-100 Project [to support adaption and mitigation efforts] and has set up the South-South Cooperation Fund on climate change, both of which are new experiments.

US political changes are irrelevant as China's existing climate change strategies, targets and actions will not see

major changes – Wang Ke

Dr Wang Ke, research fellow at the National Academy of Development and Strategy at Renmin University

China needs to respond to climate change both as part of its own sustainable development, and as a responsible nation. It is not something others are telling us to do, it is something we have to do. In economic terms we are currently faced with a historic task: making our economy yet bigger and better.

This means we need new development pathways for the next 35 years and to carefully avoid creating carbon emissions. China intends to use low-carbon development and its response to climate change to drive increases in total-factor productivity and economic growth; achieve greater energy efficiency; a change in the energy structure; an improved industrial structure; optimisation of income structure and a better-trained workforce, thus fully reinventing our development pathway.

In this sense US political changes are irrelevant as China's existing climate change strategies, targets and actions will not see major changes, but will be continued. Nor, though, will China be over-ambitious, our actions will align with our abilities and our stage of development.

China and the US are facing very similar challenges with energy efficiency, renewables and the construction or upgrading of infrastructure, and can complement each other in the process of meeting these challenges.

China's transition to a low-carbon economy will create a huge domestic market for clean energy technologies and products, with large scale demand for the advanced systems, technologies, standards and management practices of the US. By boosting low carbon technology cooperation with China, US firms will be able to able to combine their innovations in technology and business models with China's world-leading manufacturing ability and huge domestic market.

This will increase the global division of labour, decrease the cost of using low carbon technology, and increase markets for low-carbon technology and products globally. This in turn will reduce greenhouse gas emissions, boost economic prosperity and create jobs in manufacturing. This will encourage the upgrading of infrastructure in the US and make it easier for the US to transition to a low carbon economy and society. Therefore, the Trump administration's plans for new infrastructure and jobs require more clean energy cooperation with China – this is in the US's own best interests.

## 圆桌讨论：美国若“毁约”，中国会恪守《巴黎协定》吗？

特朗普下令重审奥巴马《清洁能源计划》，这是否意味着白宫离退出《巴黎协定》又近一步？中国又将如何应对？

美国总统特朗普本周二宣布将重新审核奥巴马留下的《清洁能源计划》。作为中美气候双边合作的基石之一，《清洁能源计划》是美国碳减排的重要政策依据，也是保证美国遵守《巴黎协定》的关键。关于白宫着手退出《巴黎协定》的推测早已甚嚣尘上，特朗普此番下令，除了将美国气候行动置于悬崖边缘，对中国气候政策又会有何冲击？为此，中外对话采访了几位重要的国内气候政策专家。

贸易政策而非政治承诺这才是更为关键的因素。 —— 刘强

刘强,中国社会科学院数量经济与技术经济研究所的秘书长

即使美国退出《巴黎协定》，中国也明确表态不会退出，所以仍然会履约相应的减排目标。但是由于美国态度的变化，碳定价机制的推行可能面临阻碍。

清洁能源的发展现在到达了一个比较关键的时期，风能、光能技术进步导致的成本降低，使其一定程度上可以和化石能源竞争，《巴黎协定》确定的碳定价机制更有利于清洁能源的竞争优势，但是随着美国的退出，相应的定价机制存在变化的风险，中国碳交易市场推进的动力也会相应降低。

但是，美国退出《巴黎协定》对于具体产业的影响小于象征性的影响。一方面，美国原来的参与程度就不高；另一方面，从全球的角度，20 亿美元并不是很大的数字。

从产业及投资的角度影响也不会很大。全球清洁能源的投资高峰已经过去。近来，中国光伏组件的出口不断受到欧盟双反政策的影响，贸易政策而非政治承诺这才是更为关键的因素。

不管国际局势怎样变幻,中国坚持气候治理、坚持南南气候合作的方向不会改变。 —— 王彬彬

王彬彬，北京大学国际关系学院博士后研究员

气候治理是全人类的共同担当，中国国家主席习近平在达沃斯论坛上明确表达了中国的态度，“中国将继续采取行动应对气候变化，百分之百承担自己的义务。”中国外长王毅在今年 2 月的二十国集团外长会上也强调应携手合作，全力打造和平稳定的国际环境，“建设以联合国为主导、南北合作为主渠道、南南合作为补充的国际合作格局，建立新型全球发展伙伴关系，形成发展合力。”可见，不管国际局势怎样变幻,中国坚持气候治理、坚持南南气候合作的方向不会改变。

气候外交在过去几年中确实成为了中美关系中的亮点。 —— 柴麒敏

柴麒敏，国家发展和改革委员会国家应对气候变化战略中心国际部主任

如果特朗普决意退出《巴黎协定》，外交上，不仅对中国，对全球都会有影响。美国 2001 年拒绝签署《京都议定书》，现在如果又退出《巴黎协定》，那对联合国这项多边机制的伤害显而易见。这两个协议都是 1992 年通过的《联合国气候变化框架公约》下的最为重要的里程碑，是具体实施的方案，而且都是迁就美国国内政治后妥协的产物。特别是《巴黎协定》，各国自主贡献、促进性的而非惩罚性的、没有实际法律约束力的“牙齿”，也是为了照顾美国当时的国情。如果退出，那就意味着美国国内矛盾的再次外化，这首先会对伞形集团国家做出不好的示范，比如之前日本、加拿大、澳大利亚也陆续跟随退出《京都议定书》，也会对其他缔约方的信心产生极大影响。

中国的气候/能源政策、国家自主贡献虽然是基于自身国情制定出来的，领导人和官方也已经多次表示中国有自己的政策自信，低碳转型也是国情的内在需求，会坚定多边机制的信心。但不可否认地说，中国国内政府、产业界怀疑的声音会增多，推动有雄心的绿色计划会比以前更难，甚至可能受到更多地质疑和阻碍。美国说不的消极影响已经蔓延到了产业界，去年清洁能源的投资就已经开始下滑，低碳技术创新在全球范围也会受到影响，很多国内新能源企业的估值和融资能力也出现了下降，这些负面影响都已经逐渐在显现了。美国剩余的 20 亿美元资金不注入的话，绿色气候基金（GCF）的前景也不乐观。

气候外交在过去几年中确实成为了中美关系中的亮点，从特朗普政府上台后，官方层面的此类活动可能会不可避免地大幅减少，但能源领域的合作可能会更务实，比如说在页岩气等新领域，存在贸易开拓的可能性，两国双赢的方面并不少。没有了气候外交的名头，但很多实际工作是一样的。而且中美的交往也越来越趋向于多元化，地方、企业、NGO 等仍然会很活跃，我们把这些称之为“非政府利益相关者”，会起到很大的作用。中国现阶段外交的逻辑还是希望尽可能扩大合作，而非对抗。中国人经常讲，“和气生财”。创新增长路径，分享绿色转型的效益，这是我们的新主张。

因为透明度等惯常误解和质疑，中国也很愿意主动和其他国家释疑解惑，并寻求更多的合作，除了中美气候合作外，中欧、基础四国、南南合作等平台机制的建设也很多，可能以前媒体更愿意把聚光灯放在“中美共治”（所谓“G2”）的身上。中国正在实施“十百千”项目，并成立了气候变化南南合作基金，都是新的尝试。

无论美国的政局如何变动，中国应对气候变化的既定战略、目标和行动都不会发生大的变化。 —— 王克

王克，中国人民大学国家发展与战略研究院研究员

应对气候变化是中国可持续发展的内在要求，也是负责任大国应尽的国际义务，这不是别人要我们做，而是我们自己要做。中国经济面临着向更高水平、更高质量升级的历史任务，这要求中国在未来的 35 年里创新发展路径，严格管控碳排放轨迹。中国将应对气候变化和低碳发展作为提高要素生产率和驱动经济增长与转型的重要推动力，实现能源效率提高、能源结构转变、产业结构升级、收入结构优化、人力资本提升，从而全面实现发展路径的创新。从这个意义上说，无论美国的政局如何变动，中国应对气候变化的既定战略、目标和行动都不会发生大的变化，即坚持积极行动，又不盲目冒进，和自身发展阶段和能力相

匹配。

中美两国在能源效率、可再生能源、基础设施新建或更新等方面面临很多本质上十分相似的挑战。而在寻求解决方案的过程中，中美两国又具有高度的互补性。中国经济向低碳发展方向转型将创造一个巨大的清洁能源技术和产品的国内市场，并形成对美国先进的制度、技术、标准和管理经验的大规模需求。美国企业通过在低碳技术产业链中加强与中国协作，将自身在低碳技术研发和商业模式方面的创新能力与中国所拥有的全球领先的制造能力和庞大的国内市场潜力有效结合，将深化全球供应链布局和专业化分工，有力的推动低碳技术应用成本的降低，扩大全球范围内低碳技术和产品的市场空间，从而减少温室气体排放，并促进经济繁荣和创造就业机会。这也将反过来促进美国国内基础设施的翻新，降低美国社会经济低碳转型的难度。因此，特朗普政府打算推行的翻新美国基础设施，扩大就业等方面，需要在清洁能源领域加强与中国的合作，这符合美国自身的利益。

# China’s climate aid flows into Myanmar

A Chinese NGO is bringing solar power and clean cook stoves to villages in Myanmar, writes Beth Walker

Than Bayar Khon village sits nested in the foothills of the Bago Yoma forest in central Myanmar. The low mountains, once heavily forested with teak and valuable tropical timbers, are now rapidly balding.

Despite being only a few kilometres from the major highway connecting the port city of Yangon with the capital Naypyidaw, the three hundred fifty families living in the village had no access to electricity until recently and relied on gathering charcoal and firewood from the forest for cooking.

Now this is changing. In 2015 the Chinese NGO Global Environment Institute teamed up with an alliance of Myanmar NGOs and the Blue Moon Foundation to provide small household solar panels and clean cook stoves to families in the village. This initiative aims to protect the teak forests, provide clean electricity and support local livelihoods.

“Most villagers live on the margins,” said Thet Paing Phyo project manager at Spring Foundation, GEI’s local partner. “Only 10-20% of people own land and others go to work in mines in Kokang [near China], to Thailand, or in the plantations.”

The A4 size solar panels and battery packs can power a light bulb or charge a phone. “Now people can use lights to work at night. Children are happy they can charge their mobile phones and be connected to the outside world,” said the head monk over tea on the floor of the monastery.

GEI and Spring Foundation have also provided training to villages in agroforestry, homestead planting, how to produce products for local markets and accounting, Phyo explained, as we walked through bamboo woven houses and past neat gardens of medicinal plants, passion fruit vines and betel trees.

The struggles of Than Bayar Khon village encapsulate Myanmar’s profound energy crisis, where only 34% of people have access to electricity through the grid, falling to 16% in rural areas. Almost all the rural population rely on firewood for cooking, a major driver of deforestation in Myanmar, the government claims, which has the third highest rate in the world.

GEI’s involvement in rural Myanmar is unique in a country where officials and citizens alike are increasingly vocal about concerns over Chinese-funded infrastructure projects and the extraction of natural resources, including timber, by Chinese companies that have signed deals with the military and its cronies.

Since the suspension of the controversial Myitsone dam on the Irrawaddy River in the face of nationwide opposition, the Chinese embassy in Yangon has been trying to encourage companies to pay more attention to their image and reach out to local communities. But tokenistic efforts, such as tree planting, have done little to soothe deep wounds. A scathing Amnesty report published in February revealed the failure of Chinese mining company

Wanbao to address ongoing human rights abuses at the Letpadaung copper mine in central Myanmar. The recent destruction of a Chinese owned textiles factory by striking workers in Yangon is just the latest manifestation of simmering anger over China's influence in the country.

China’s climate aid model

Against this difficult political backdrop, GEI’s work in Myanmar has caught the attention of the Chinese government, which is now partnering with the NGO to deliver one of China’s first climate aid initiatives.

China has pledged to provide 20 million yuan (US$2.9 million) worth of solar panels and clean cook stoves to Myanmar through its South-South Cooperation Fund for Climate Change. The fund was set up in 2014 in the run up to the UN climate conference in Paris as a sign of China’s commitment to supporting developing countries to adapt to climate change and lead the global transition to a low carbon future.

“Myanmar is one of the most vulnerable countries to climate change,” said Xie Zhenhua, China's chief climate negotiator, at a ceremony in Myanmar’s capital of Naypyidaw in March. “China got help from the international community, now we are relatively developed we’re willing to share technology, best practices and provide climate finance,” he said.

At the event, China’s National Development and Reform Commission, its top planning body, handed over 10,000 cook stoves and 5,000 solar panels to Myanmar’s Ministry of Natural Resources and Environmental Protection to be dispersed among remote communities.

“Our cooperation with Myanmar demonstrates the kind of cooperation needed after the Paris Agreement that can make a difference and mobilise common people to adapt,” said Xie Zhenhua.

Since 2011, China has provided 700 million yuan (US$100 million) for South-South cooperation and signed agreements with 27 countries to provide energy efficient lamps, remote sensing satellite systems, develop low carbon zones, mitigation and adaptation projects, and train officials.

Chinese officials gathered at the event expressed the hope that China’s cooperation with Myanmar would create a model for the fund’s future work and expand to multilateral cooperation in the long run. “This is the way to meet the Paris Agreement with or without US and developing countries,” said Zhang Jiqiang, chairman of GEI’s executive board.

Grassroots adaptation

While the fund is a top down approach to China’s climate diplomacy, the government is reaching out to Chinese civil society and entrepreneurs to ensure its success.

“GEI have played an important coordination role in promoting climate adaptation in Myanmar and building relations with local NGOs. We hope for more civil society and business involvement in the future – building a bridge for South-South cooperation,” Xie said.

GEI was one of the first Chinese NGOs to operate abroad and takes an interesting approach to climate adaption. The Beijing based NGO is working with five local NGOs in four different sites in Myanmar using a community conservation model developed through their own experiences working with poor communities in northwest China, inspired in turn by a Peruvian initiative. They aim to stimulate rural economic development at the same time as reducing vulnerability to climate change – such as drought and floods – and supporting conservation.

“When we went to work in rural villages in Myanmar we found they were in the same conditions as China 20 years ago,” said Zhang. While solutions can’t be transplanted, China’s experience developing rural enterprises and energy solutions, such as biogas, cook stoves and heating solutions, offer useful lessons for countries like Myanmar. GEI have helped communities in Tibet bring environmental friendly products to high-end consumers, and farmers in Nepal export organic rice to international markets.

“In the future we can use e-commerce and market tools to help people sell their goods – like we have in China. This project is just the beginning of the story to help create a green economy in this country,” Zhang said.

In Myanmar's Than Bayar Khon village this has involved setting up a solar powered water pump for irrigation and a community development fund, which villagers all contribute to depending on how much they can afford. So far the money has been used to maintain the solar pump and there are plans to use it to extend irrigation to neighbouring fields and boost the number of annual crops. But when I visited at the tail end of the rainy season, the pump lay abandoned.

The challenge now is to find ways to support and encourage village enterprise said U Zaw Win, director of the Spring Foundation: "The best way to increase access to energy is to build village solar systems not just household – so there is enough to power small industry". Wandering around the village, I notice some disconnected panels. "60% of households have bought their own solar panels now," explained Thet Paing Phyo. The GEI panels can only provide power for two hours a day and many families now want more powerful equipment.

In neighbouring Ye Aye village, the NGOs are supporting the village committee to apply for community land ownership – a difficult and daunting process – so they can move beyond subsistence farming and start plantations for firewood without having to use protected forest.

Illegal logging – the bigger threat

Foraging for firewood is not the only threat to Myanmar's forests. Illegal logging to feed demand across the border in India and China is the biggest culprit, admits U Zaw Win. He worked for decades with the Ministry of Forestry and the Myanmar Timber Enterprise, the state company blamed for the worst forest looting in the past and now says he wants to give something back to support the local communities.

It was China's excessive logging activities overseas that first brought Jin Jiaman, director of GEI, to work in Myanmar. Since 2005 she has worked closely with the Chinese government to develop guidelines for companies and held workshops and study trips for forestry officials in Myanmar and China. In 2015 the Myanmar government announced a one-year nationwide logging ban and a ten year ban in the Bago mountains, one of the worst affected areas. However, sources within the timber industry say that extraction continues, exacerbated by conflict between the military and armed ethnic groups in the forested borderlands.

Harnessing Chinese entrepreneurs

Many in Myanmar believe Chinese companies could also play a more positive role in the country's development. For example, rather than funding large hydropower and coal projects, China's clean tech companies could support Myanmar's green energy transition, argues Aung Myint, director of the Renewable Energy Association of Myanmar (REAM).

Hundreds and thousands of small household solar systems are bought every year to power homes, monasteries and village businesses – mostly from China. However, the equipment is poor quality and soon breaks, Aung Myint explained.

China could help Myanmar leapfrog traditional energy infrastructure and support the decentralised wind, solar and micro grid solutions being sidelined by the government and traditional donors such as the World Bank, said Aung Myint. "We want to work with qualified Chinese companies, but they need policies from the government. The government has to specify standards and materials to restrict bad materials and incentivise good installation systems," he said.

## 中国气候援助落地缅甸

中国的南南气候援助已在缅甸落地开花，政府与非政府组织正在合力为缅甸农村提供太阳能和清洁炉灶。

坦巴亚坤村坐落在缅甸中部勃固山山麓之间，那里的山丘曾一度长满郁郁葱葱的柚木和珍贵的热带木材，如今却正在迅速变成秃山。

村庄距连接首都内比都和港口城市仰光的主要公路仅数千米，但居住在那里的 350 户家庭却一直没有

通上电，只能靠从森林中捡拾木柴生火做饭。

现在这一情况正在改善。2015 年，中国非政府组织全球环境研究所（GEI）与布莱蒙基金会及多家缅甸非政府组织合作，联手为村里的家庭提供小型家用太阳能电池板和清洁炉灶。这一活动旨在保护柚木林免受砍伐，为村民提供清洁电力，支持他们的生计。

“大多数村民生活在贫困之中，”全球环境研究所在当地的合作伙伴春天基金会的项目经理德柏朴说，“他们中仅 10%-20%的人拥有土地，其他人要么去（靠近中国的）果敢的矿上工作，要么去泰国，或者在种植园干活。”

A4 纸大小的太阳能电池板和电池组足够点亮一盏灯泡，或给一部手机充电。“现在大家晚上工作可以开灯，孩子们都很高兴能用手机与外界联系，”寺院住持喝着茶说。

我和德柏朴穿行在一座座竹屋之间，时不时会经过一个个整洁的园子，里面种着药用植物、百香果和槟榔树。德柏朴解释说，全球环境研究所和春天基金会还为村庄提供农林业和家庭种植方面的培训，教村民怎么把自己种的东西拿到集市上出售，怎么算账。

这座村子的艰难现状是缅甸深重的能源危机的缩影。目前缅甸的电网覆盖率仅为 34%，而农村地区则仅为 16%。几乎所有农村人口都靠木柴生火做饭，缅甸政府声称这是导致该国森林砍伐的主要原因。目前该国的森林砍伐率位列全球第三。

与中国政府以往资助的基础设施项目以及中国企业的木材等自然资源开采项目相比，全球环境研究所此次在缅甸农村开展的活动展示了另一种合作模式。

自从伊洛瓦底江上的密松水电站遭反对被迫搁置后，中国驻仰光大使馆开始鼓励本国企业注意维护企业形象，多与当地社区接触，但植树等活动的收效不大。 一份国际组织的报告显示一家中国矿业公司在缅甸中部经营的莱比塘铜矿存在环境和程序问题，而近来仰光的一家中资纺织厂还因劳工纠纷遭罢工工人打砸。

帮助老百姓适应气候变化

在此背景之下，全球环境研究所在缅甸开展的工作得到了中国政府的关注。目前，研究所已经与中国政府合作，发起中国第一个气候援助倡议。

中国承诺通过气候变化南南合作基金向缅甸提供价值 2000 万元人民币的太阳能电池板和清洁炉灶。该基金成立于 2014 年巴黎气候大会召开之前，是中国致力于帮助发展中国家适应气候变化，引领全球低碳转型的一大标志。

“缅甸是全球最易受气候变化影响的国家之一，”中国首席气候谈判代表解振华 3 月在缅甸首都内比都参加一场物资交接仪式时说。“中国曾经得到了国际社会的帮助，现在相对发展起来了，我们愿意分享技术和最佳实践，提供气候融资，”他说。

仪式上，中国国家发展和改革委员会向缅甸自然资源和环境保护部赠送了 10000 台清洁炉灶和 5000 套太阳能光伏发电系统，这些物资将分发到偏远社区。

“我们和缅甸进行的正是巴黎协议之后最需要的合作，也就是帮助普通老百姓有效适应气候变化，”解振华说。

2011 年以来，中国已经为南南合作提供了 7 亿人民币，并与 27 个国家签署协议为其提供节能灯具和遥感卫星系统，帮助他们开发低碳经济区以及气候变化缓解和适应项目，并为官员提供培训。

参加此次交接仪式的中国官员表示，希望中缅此次合作能够为南南合作基金未来的工作创建一个模型，进而发展为多边合作。“这就是达成《巴黎协定》的办法，即便没有美国和发达国家的支持，”全球环境研究所执行委员会主席张冀强说。

气候援助中的民间力量

除了南南合作基金这样自上而下的气候外交，政府同时也在接触中国民间社会团体及企业家。

“在缅甸当地推广气候适应项目，并与当地非政府组织建立联系的过程中，全球环境研究所发挥了重要的协调作用。我们希望未来更多的民间社会团体和企业能够参与进来，为南南合作铺路搭桥，”解振华

说。

全球环境研究所是首批在境外活动的中国非政府组织之一，其推广气候适应的方法颇为特别。该研究所总部位于北京，目前已与缅甸 4 个不同地方的 5 个非政府组织建立合作。他们受秘鲁一个倡议项目的启发，并结合自己在中国西北地区贫困社区的工作经验，建立了自己的一套社区保护模式。他们的目标是在刺激农村经济发展的同时提升当地抵御气候变化（干旱洪水等）的能力，并支持自然保护工作。

“刚到缅甸农村的时候，我们发现那里的条件就跟 20 年前的中国一样，”张冀强说。尽管他们不能照搬中国的模式，但中国发展乡镇企业和解决乡村能源问题的经验，如开发沼气、炉灶和制热方面的经验能够为缅甸这样的国家提供有用的借鉴。全球环境研究所曾帮助西藏社区把他们的环保产品卖给高端客户，也曾帮助尼泊尔农民把有机稻米出口到国际市场。

“未来我们可以利用电子商务和市场工具帮助人们出售自己的产品，就跟中国一样。这个项目只是我们帮助这个国家创建绿色经济的一个开始。”张冀强说。

在缅甸坦巴亚坤村开展的工作包括建立太阳能水泵灌溉系统以及社区发展基金，村民可以根据自身情况给基金捐款。截至目前，基金已用于维护太阳能水泵，村民们还计划用这笔钱把灌溉系统扩大到周边区域，提高每年生产的作物量。

现在的挑战是想办法支持和鼓励乡镇企业的发展，春天基金会主任吴佐温说：“电力普及最好的办法就是建立村一级的太阳能系统，不要局限在家庭，这样就有足够的电力支持小型工业。”在村子里寻访时我发现了一些闲置的电池板。“现在 60%的家庭都用自己买的太阳能电池板了，”德柏朴解释说。全球环境研究所提供的电池板每天只能供电两小时，现在许多家庭都想要更强大的设备。

在邻村耶埃，非政府组织正在协助村委会申请社区土地所有权，这一过程极为复杂繁琐，但一旦成功，村子的农业就不仅能够自给自足，还能种植供应柴火所需的林木，以避免砍伐受保护的森林。

非法采伐——更大的威胁

村民对木柴的需求并不是缅甸森林面临的唯一威胁。吴佐温承认，为满足邻国的需求而进行的非法采伐才是最大的元凶。他曾在林业部和国营的缅甸木材公司工作过数十年，后者是造成缅甸严重毁林的罪魁祸首；现在，吴佐温说自己想为当地社区做点事情。

最初促使全球环境研究所执行主任金嘉满来缅甸工作的原因是中国在海外的过度采伐活动。她从 2005 年开始就和中国政府合作制订针对企业的指导方针，并多次主持中缅两国林业官员召开研讨会和学术访问。2015 年，缅甸政府颁布了为期一年的全国砍伐禁令，并在受影响最为严重的勃固山脉施行为期十年的采伐禁令。但据业内消息称，砍伐仍在继续，军队和少数民族武装组织在边境森林地区的冲突更是加剧了这一情况。

让中国企业发挥更大作用

许多缅甸人相信中国企业能够在自己国家的发展中扮演更加积极的角色，例如，缅甸可再生能源协会主任昂敏就认为，中国的清洁技术企业可以支持缅甸的绿色能源转型，而不是资助大型的水电和煤炭项目。

每年都有成千上万套小型家用太阳能供电系统为家庭、寺院和乡镇企业带去电力。这些系统大多来自中国，但也有一些出现过质量问题，昂敏解释说。

中国有能力帮助缅甸超越传统的能源基础设施，支持不被政府和世界银行等传统资助方重视的分布式风能、太阳能和微电网解决方案，昂敏说。“我们想和有资质的中国企业合作，但他们需要政府政策的引导。政府必须出台具体的标准和材料要求，保证材料质量，鼓励建立优质的安装体系，”他说。

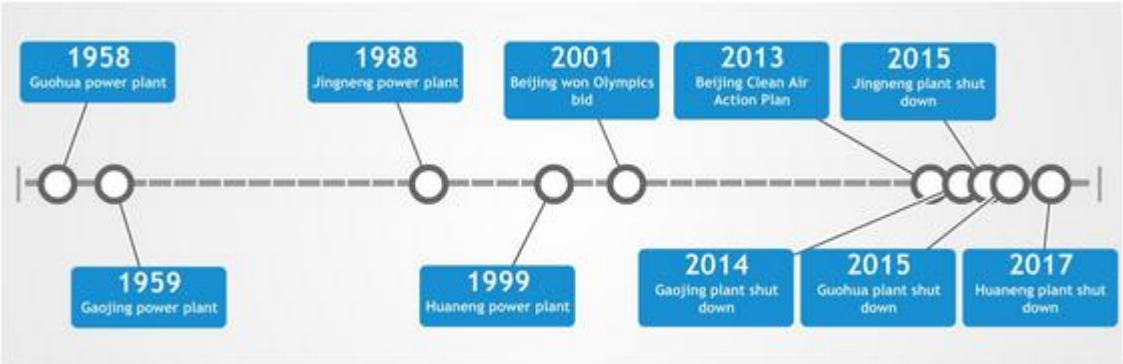
# Goodbye to six decades of coal power in Beijing

As Beijing closes its last coal power plant Feng Hao looks back at the history of the capital’s coal dependency

On the morning of March 18, shift manager Liu Yong pressed the button to halt Generator 4, bringing operations at Beijing’s last coal-fired power plant, Huaneng Beijing, to a halt.

Huaneng was one of four such plants in the city. Beijing's history of industrialisation began in the 1950s and was followed by the market reforms of the 1990s, the legacy of which was four major coal-fired plants supplying power and heat. After half a century of development, environmental pressures have forced their closure.

Timeline of Beijing's major coal power plant construction




Source: chinadialogue.net

The 156 Project

On coming to power in 1949, China's Communist Party had a plan to modernise industry, agriculture, national defence, and science and technology, which it implemented throughout the '50s. The "Four Modernisations" became, in a very Socialist way, part of the official rhetoric; printed on factory walls, dormitory corridors and on the pages of schoolbooks.

Today, China's youth might not know much of that era. At the time, the country's leaders set out to: "Build an independent, largely complete industrial system and civil economy approaching advanced international standards". China was still an agricultural nation with no industrial base to speak of when the ambitious goal was set.

To build this industrial base, China implemented its first Five-Year Plan between 1953 and 1957, which hinged upon the "156 Project"; a plan to build 156 heavy industrial projects with aid from the Soviet Union and other nations that would form the foundation of "New China".

Only one of those 156 projects was in Beijing; the Beijing Coal Power Plant, later to become the Guohua Beijing Coal Power Plant. This was New China's first high-temperature, high-pressure combined heat and power plant and once an important supplier of energy services to the capital. The Guohua plant had an installed capacity of 400 megawatts and could heat 21 million square metres of building area, enough energy to heat the homes of four million people.

Electricity leads the way

A prerequisite of economic growth is access to electricity. An important symbol of modernisation, electricity is also the basis of industrialisation and closely linked with urbanisation.

Under the slogan of "Overtake the UK, chase the US", China's industry developed rapidly and demand for electricity in Beijing increased year-after-year, meaning power cuts grew more frequent. Figures from the national statistics authorities show that demand increased tenfold between 1949 and 1958 in the capital (from 82.45 million kWh to 787 million kWh).

In 1959 work started on the Gaojing Power Plant in Shijingshan in the Western Hills area of Beijing. This was only completed fifteen years later, towards the end of the Cultural Revolution, with power generation capacity of 600 megawatts and heat for 12 million square metres. Add in the Beijing Energy plant (Jingneng) also in Shijingshan and completed in time for the 1990 Asian Games, and the Guohua and Huaneng plants already mentioned, and these composed the four main coal-fired power plants.

Receding from history

By 2016 the city was using 102 billion kWh a year, 130 times the 790 million kWh of 1958. But behind those rising consumption figures lay large-scale coal burning and the release of pollutants.

For a long time the lion's share of Beijing's, indeed all of China's, electricity was generated from coal burning. From 1952 to 2012 thermal power provided over 80% of all electricity (95% of thermal power came from coal). But for years now China has been trying to improve that structure and control investment in new coal-fired plants. By 2015 thermal power accounted for 59% of total generating capacity – down from 90% in 1952.

In 2001 Beijing was awarded the 2008 Olympic Games, and one of its aims was to hold a "Green Olympics". The government sought to shed the image of Beijing as a city shrouded in noxious smoke. The authorities ordered reductions in coal burning and tightened emissions standards for coal-fired generators. The four coal-fired power stations underwent major upgrades to remove sulphur, nitrates and ash from their emissions. The results were noticeable.

Better environmental awareness was therefore part of the Olympic legacy. The year after the games Zhang Guobao, then deputy chair of the National Development and Reform Commission and head of the National Energy Administration, made clear that the coal power plant situated in the city centre was affecting development and emissions reduction efforts, and suggested they be converted to burn natural gas.

A plan which at the time seemed unrealistic was gradually implemented. Coal was replaced with natural gas for power and heat generation in Beijing.

Concerns and opposition came from both the business community and from within government. But as smog worsened environmental needs won out. From 2010 Beijing started to suffer more frequent and severe smog events. After the severe pollution of the winter of 2012, national efforts to deal with air pollution were accelerated.

In the run up to the winter of 2013 the Beijing government published its Clean Air Action Plan: within five years coal would account for only 10% of all energy consumption in the city, with power and heat to come from natural gas, a cleaner source of energy. The four coal power plants were ordered to close and four gas-fired power hubs were constructed instead, one in each quarter of the city.

The result of this is that Beijing has become less energy self-sufficient. By 2017, 70% of Beijing's power is expected to come from outside of the city. The extent to which Beijing has really bid farewell to coal depends then on how fast the surrounding provinces, upon which the capital now relies, can replace their power infrastructure and curb coal use.

# 谢谢你，再见——北京煤电小史

随着北京最后一台煤电机组的停机，也许需要追问的是，北京煤电的迅速淘汰到底是中国能源发展历程的缩影还是孤例？

2017 年 3 月 18 日上午 9：42，随着 4 号机值长刘勇按下停止键，北京市最后一座燃煤电厂——华能北京热电厂的所有燃煤机组实现停机。至此，北京市原有的四座燃煤电厂已全部关停，和几代北京人成长记忆密切相关的大型燃煤电厂将成为历史，彻底告别这个国家的首都。

自上世纪 50 年代随工业化起步，90 年代在市场经济改革中不断改建重组，最终确立为四大煤电厂的供电供暖体系，到 2010 年代在环境压力下全部关停，北京的燃煤电厂见证了半个多世纪中国社会的沧桑巨变。

唯一一座坐标北京的“156 项工程”

从 1949 年中华人民共和国成立到 1950 年代，刚刚执掌政权的中国共产党逐步提出了“工业现代化、农业现代化、国防现代化、科学技术现代化”的国家战略目标，“建设四个现代化”被写在工厂的车间、贴在宿舍的走廊、印在作业本的封面，以社会主义特有的宣传方式进入中国人的语言体系。

中国的年轻人或许对于提出这个目标的年代没有概念。在提出“建立一个独立的、比较完整的工业体系和国民经济体系，使工业大体接近世界先进水平”这样雄心勃勃的“初步”目标的时候，中国还是一个传统的农业国家，工业体系全无基础可言。

为建立工业化的初步基础，中国由 1953 年至 1957 年开始执行国民经济和社会发展第一个五年计划，其中，苏联等国援建的 156 项重工业项目是重点中的重点，“156 项工程”被誉为新中国工业的奠基石。

这 156 项重点工程中唯一一个位于首都的，就是北京热电厂，后改制为国华北京热电厂。这是新中国成立后在北京建设的第一家高温高压热电联产企业，曾是北京市重要的集中供热热源和电力支撑点。国华热电厂总装机容量 40 万千瓦，供热能力 2100 万平方米，按照当时全国人均 5 平米左右的城市居民住房面积计算，相当于可以为 400 万人的住宅供暖。

经济发展 电力先行

经济发展的基本规律是电力先行。作为现代化的重要标志，电力供应是工业生产的基础，和城市化直接联系。

工业在“赶英超美”的口号下快速发展，北京城区的用电需求也连续多年持续增长，电力缺口日趋加大。根据后来北京市统计局和国家统计局公布的数据，北京地区 1958 年的年用电量为 7.87 亿千瓦时，而在 1949 年，这一数字仅为 8245 万千瓦时，10 年的时间翻了近 10 倍。

在此背景下，石景山发电厂高井电站工程于 1959 年破土动工。15 年后这座燃煤电站才在文革末期建成，总装机容量 60 万千瓦，供热面积 1200 万平方米，用于满足北京西部的用电和供热需求。

加上赶在 1990 年北京亚运会前改建完成的京能石景山热电厂，和文首提到的华能北京热电厂，最多有四座煤电厂同时在北京运行，为首都提供制暖和能源。

退出历史舞台

北京作为大都市的进化在 80 年代后愈发迅猛，到 2016 年，北京的用电量已经达到 1020 亿千瓦时，比起 1958 年的 7.9 亿多万千瓦时又翻了近 130 倍。高速增长的电力需求的背后，是大规模的煤炭燃烧及污染物排放。

长期以来，在北京乃至整个国家的电力供应结构中，煤电都占据了极其重要的地位，梳理 1952-2012 年的发电量构成，火电占比一直在 80%左右，而在火电中，绝大部分是燃煤电厂，占比在 95%左右。多年来，中国一直积极优化电源结构，控制燃煤电厂的投资新增，火电在发电装机容量中的比例也由 1952 年的 90%降低到了 2015 年的 59%。

2001 年，北京获得奥运会举办权之后，提出“绿色奥运”作为理念之一，摆脱煤烟污染的城市形象被提上政府的工作议程，北京市政府提出了全市压减燃煤的要求，燃煤机组的排放限值也不断收紧。四大燃煤电厂在此期间均进行了大规模的环保升级改造，脱硫、脱销、除尘，减排效果明显。

环保也成为了北京奥运会的重要遗产。奥运后的次年，时任国家发改委副主任、国家能源局局长张国宝明确表示，四大燃煤电厂位于市中心，影响城市减排和发展，并提出全部改建燃气机组的构想。一个在当时看来不切实际的能源结构调整计划在国家的直接推动下逐渐酝酿成形——在北京全面用天然气替代燃煤发电供热。

反对和质疑之声不仅来自于企业，政府内部也有不少担忧，但环保的诉求终究随着雾霾占了上风。

2010 年代以来，雾霾以越来越频繁的次数、越来越严重的程度侵袭北京。经历了 2012 年严重污染的冬季之后，中国开始全面治理大气污染。

2013 年的冬天到来前，北京市政府公布了自己的《清洁空气行动计划》：5 年内，煤炭被要求在能源消费比重中降至 10%以下，大量补充燃气发电供热设施，四大燃煤电厂也被下令逐个关闭。取而代之的，是城区东南西北四个方位的燃气热电中心，它们将使用更为清洁的天然气作为动力来源。

但值得注意的是，北京的煤电淘汰和能源自给度的降低是同时发生的。同一份《清洁空气行动计划》提出，到 2017 年北京 70%的电力将从其他地区调入。因此，中国首都告别煤电厂的意义有多大程度上是象征性的，还取决于北京周边地区乃至更大范围的能源结构转型速度。

# Iran, Russia agree to build 2 nuclear power plants

Iran and Russia have signed an agreement to build two new nuclear power plants in Iran's southern city of Bushehr, President Hassan Rouhani announced yesterday.

The deal was made during Rouhani's official two-day visit to Russia to meet his counterpart Vladimir Putin in Moscow.

"We have signed an agreement with Moscow to build two new units at the Bushehr nuclear plant," Rouhani was quoted as saying by Russian state media.

Iranian vice president and head of the country's Atomic Energy Organisation, Ali Akbar Salehi, announced last year that his country plans to build two new nuclear units at the Bushehr nuclear plant, south of the country, in cooperation with Russia.

At the time, Salehi pointed out that the construction process would take 10 years, at a cost of $10 billion.

## 伊朗和俄罗斯同意建设 2 座核电站

哈桑•鲁瓦尼总统昨天宣布，伊朗和俄罗斯已签署协议，在伊朗南部城市布什尔建造两座新的核电站。这项交涉是在鲁瓦尼进行为期两天的俄罗斯访问期间与莫斯科的对手弗拉基米尔•普京达成的。

"我们已经和莫斯科签署了在布什尔核电厂建造两个新的部队的协议，"俄罗斯国家媒体引用了鲁瓦尼的话。

伊朗副总统兼国家原子能组织负责人阿里•阿克巴尔•萨利赫去年宣布，他的国家计划与俄罗斯合作，在该国南部布什尔核电厂建造两座新的核电站。

当时，Salehi 指出，建设过程需要 10 年时间，花费 100 亿美元。

# Westinghouse files for bankruptcy, with 4 U.S. nuclear reactors unfinished

Westinghouse Electric Co., a major player in global nuclear construction, filed for bankruptcy protection on Wednesday, its Japanese parent Toshiba Corp. said, raising questions about the fate of four half-finished reactors in the U.S.

A storied name in nuclear power, Westinghouse incurred billions of dollars of cost overruns building the nuclear reactors in Georgia and South Carolina, a financial disaster that threatens Toshiba's viability.

Toshiba said last month it would take a write-down of more than $6 billion due to the U.S. cost overruns. To contain the financial damage, it allowed its subsidiary to seek bankruptcy protection and says it plans to exit from the nuclear-construction business.

The filing is likely to start extensive negotiations between Toshiba and the utilities for which it was building the reactors, Southern Co. and Scana Corp. The utilities have said Toshiba is responsible for any Westinghouse debts related to the nuclear plants. But Toshiba could contest that.

## Westinghouse 申请破产，留下 4 个未完成的核反应堆

日本东芝公司表示，西屋电器有限公司是全球核能建设的主要参与者，周三申请破产保护，并对美国四台半成品反应堆的命运提出疑问。

核电厂的传言，西屋公司造成数十亿美元的成本超过在格鲁吉亚和南卡罗来纳州建造核反应堆，这是一场威胁东芝可行性的财政灾难。

东芝上个月表示，由于美国的成本超支，这笔交易将减少 60 亿美元。为了遏制财务损失，它允许其子公司寻求破产保护，并表示计划退出核建企业。

东芝可能会与正在建设反应堆的公用事业公司 Southern Co.和 Scana Corp.开始广泛的谈判。公用事业公司表示，东芝负责与核电厂有关的任何 Westinghouse 债务。但东芝可以不这样做。

# U.S. study maps out clear strategy for renewable energy development in Africa

Renewable energy currently accounts for less than 1 percent of the energy consumed on the African continent. However, a recent study conducted by the US Department of Energy's Lawrence Berkeley National Laboratory maps out a viable strategy for developing wind and solar power while reducing the continent's reliance on fossil fuels.

The research team assessed the potential for large solar and wind farms in 21 countries. They concluded the project sites should be close to transmission infrastructure or to cities, slashing the risk and cost involved in installing huge lengths of power lines and also improving efficiency.

Their analysis also showed choosing wind sites to match the timing of wind generation with electricity demand is less costly overall than choosing sites with the greatest wind energy production. Assuming adequate transmission lines, strategies that take into account the timing of wind generation result in a more even distribution of wind capacity across countries than those that maximize energy production.

The report goes on to state strategic siting of renewable power in this way could reduce the need for conventional generation capacity by 9.5 percent, resulting in cost savings of up to 20 percent, depending on the technology being replaced.

"The surprising find is that the wind and solar resources in Africa are absolutely gigantic, and something you could tap into for relatively low cost," said senior author Duncan Callaway, a UC Berkeley associate professor of energy and resources and a faculty scientist at Berkeley Lab. "But we need to be thinking now about strategies for fostering international collaboration to tap into the resource in a way that is going to maximize its potential while minimizing its impact."

The study will appear online this week in the journal Proceedings of the National Academy of Sciences.

# 美国制定出非洲可再生能源发展的明确战略

目前，可再生能源占非洲大陆能源消耗的不到 1%。然而，美国能源部劳伦斯伯克利国家实验室最近进行的一项研究，绘制了一个可行的发展风力和太阳能发电战略，同时减少了大陆对化石燃料的依赖。

研究团队评估了 21 个国家大型太阳能和风力发电场的潜力。他们认为项目现场应该靠近传输基础设施或城市，减少安装大量电力线路的风险和成本，并提高效率。

他们的分析还表明，选择风场以匹配风力发电的时间与电力需求相比，选择风力发电最多的地区总体成本较低。假设有足够的输电线路，风力发电的时机的策略会导致各国的风力发电能力分配比能源生产最大化的更为均匀。

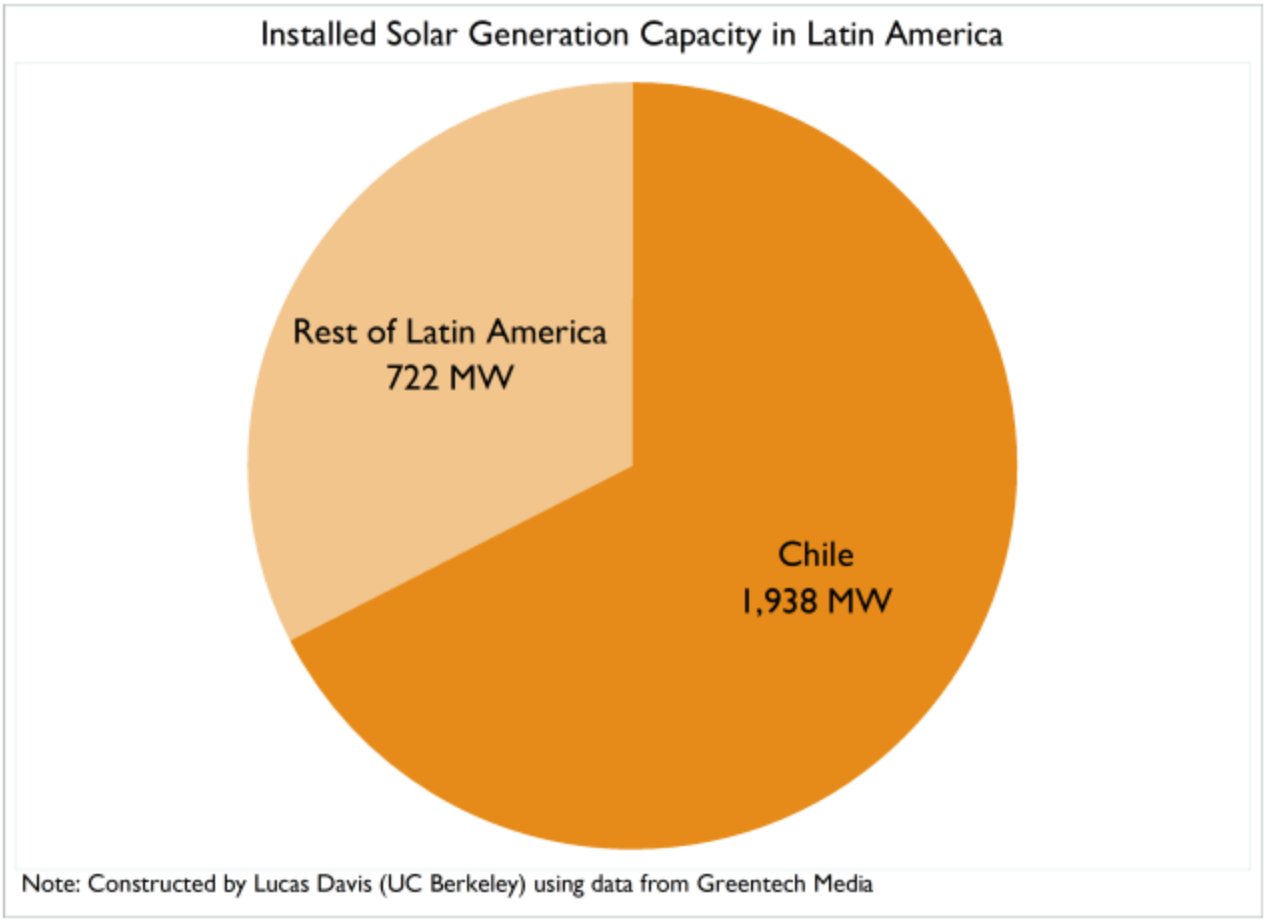
报告继续说明可再生能源的战略选址，可以将传统发电能力的需求降低 9.5%，从而可以节省高达 20%的成本，这取决于被替换的技术。

“令人惊讶的发现是，非洲的风能和太阳能资源绝对是巨大的，而且您可以利用相对较低的成本进行开采，但是，我们现在需要考虑促进国际合作的战略，以最大限度发挥其潜力并最大限度地发挥其影响的方式利用资源。”资深作者邓肯•卡拉威（Bercanley）说。他是加州大学伯克利分校能源和资源副教授，伯克利分校教授，在科学家实验室工作。

这项研究本周将在《美国国家科学院学报》期刊上刊登。

# Four Reasons Why Chile Is the Biggest Solar Market in Latin America

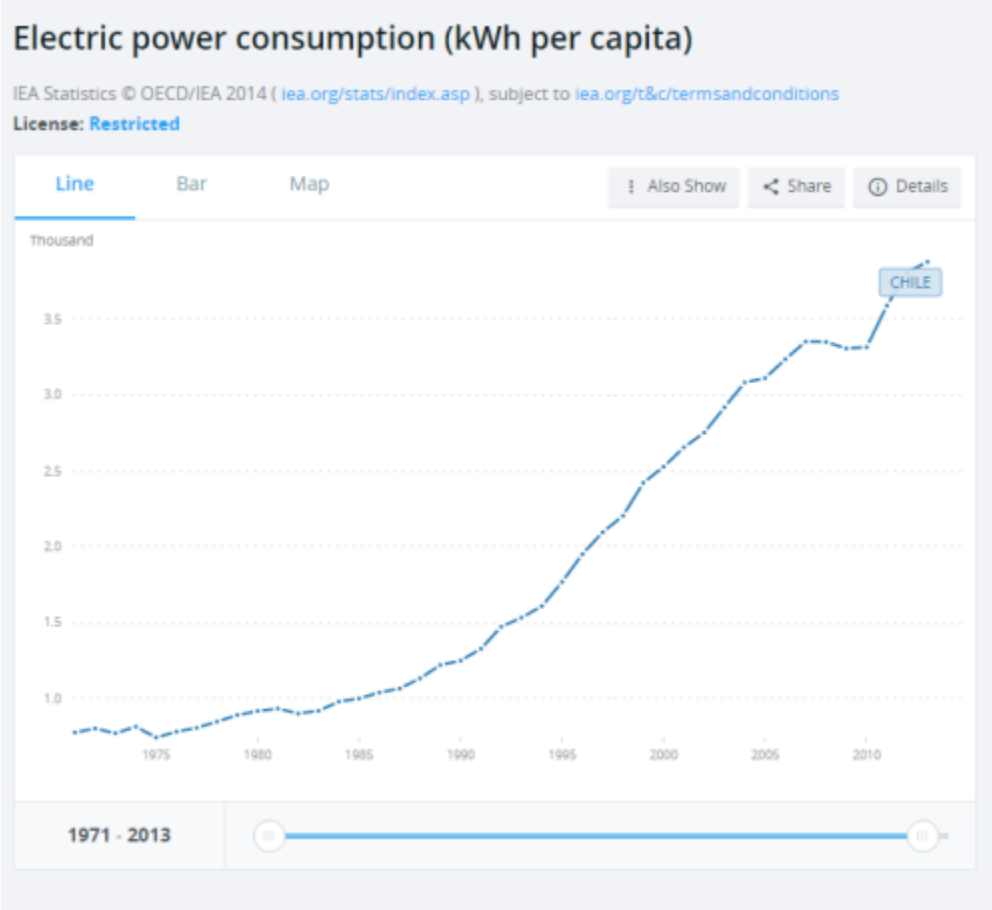
With the U.S. Federal government pulling back sharply from efforts to address global warming, I’ve found myself looking outside the United States for good news on climate.  One of the most compelling recent trends comes from Chile, the little-engine-that-could when it comes to solar power. Despite having only 3% of the population of Latin America, Chile has almost three-quarters of the installed solar generating capacity.




Some have pointed to the near-zero electricity prices, inadequate transmission, and other challenges in the Chilean market to suggest that these investments were somehow a mistake, or unsustainable. But I don’t buy it. Here are four reasons why Chile is, and will continue to be, a very attractive market for grid-scale solar.

#1: Electricity Demand Growth

Electricity demand in Chile is forecast to increase 2.6% annually over the next two decades. Not impressed? The same number for the United States is 0.7%. Now it's true that the last couple of years have seen slow growth, with the Chilean copper industry hurt by low copper prices in 2015 and 2016. But copper prices have been increasing since November and, moving forward, electric vehicles and batteries are expected to significantly increase global demand for copper. Historically, with the exception of a few hiccups, Chilean electricity demand has grown steadily for three decades.




Source: World Bank Development Indicators.

Most of the future growth is expected to come, not from mining, but from Chile's residential and commercial sectors. This is consistent with recent work by Catherine Wolfram and co-authors who find large scope for energy-demand growth in middle-income countries like Chile. In the coming years, Chile will continue to close the development gap between itself and high-income countries like the United States, and this means widespread adoption of lots of energy-using devices.

#2 The Atacama Desert

At-a-ca-ma! Dry? The Atacama Desert in Northern Chile is the driest place on the planet. Some parts of the desert have never seen a drop of rain since recordkeeping began. The Atacama is high, flat, and bone dry — the ideal location for solar. The sun beats down day after day with rarely a cloud in sight with some of the highest levels of solar radiation anywhere in the world.

Also important is that the Chilean government is expanding transmission, with an aim to connect Chile's "Northern" and "Southern" grids by 2018. This is key for solar producers in the Atacama because the bulk of electricity demand is in the South, and the new transmission link will allow them to access Southern customers.

#3 Limited Natural Gas and Coal

Another key factor for Chile is that it does not have significant reserves of natural gas. Chile has two LNG

import terminals, but LNG is expensive, averaging two- to three- times typical prices for natural gas in North America. This is expensive enough that natural-gas fired plants struggle to compete with unsubsidized grid-scale solar.

Moreover, although Chile has rich copper and other mineral resources, it has very little coal. Coal can be imported, of course, but there is political opposition in Chile to coal based on environmental concerns.

#4 Commitment to a Free Market

It doesn't get mentioned as frequently, but another important factor is Chile's commitment to the free market. Chile has been viewed as a bastion for free market economics since Milton Friedman and the "Chicago Boys" wielded great influence during the 1970s and 1980s. Deregulation and privatization have not always been good for Chile's environment, but in this case the transparency of the market and lack of government interference has helped give private investors the confidence to enter the market aggressively. All electricity generation in Chile is privately owned, and there are over one dozen international firms operating in Chile's solar sector.

The Chilean solar boom has occurred without any explicit tax on carbon or subsidy for renewables. The favorable conditions in Chile have nonetheless led to eye-poppingly low prices for solar. During auctions in August 2016, for example, the winning bid was $29.10/MWh, the lowest price ever for solar. Companies have had some trouble financing projects at these low prices, but the economic viability of these projects hinges on energy demand and supply forecasts, not about regulatory or political risk, which Chile has effectively minimized through its long-time laissez faire approach to markets.

Comparison to Mexico

The next big solar boom in Latin America is expected to happen in Mexico. Nearly half of projected solar installations for 2017 are in Mexico, and large contracts have been signed for 2018 and 2019. These investments may all go according to plan, but Mexico's electricity market is less open than the market in Chile, so it makes these investments more risky for investors.

Perhaps the more important difference, however, is that Mexico has access to low-price North American natural gas. Natural gas is already the biggest source of electricity generation in Mexico, and 60% of new capacity between now and 2020 is expected to come from natural gas. Low-price natural gas doesn't make it impossible to invest in renewables, but it does make it harder.

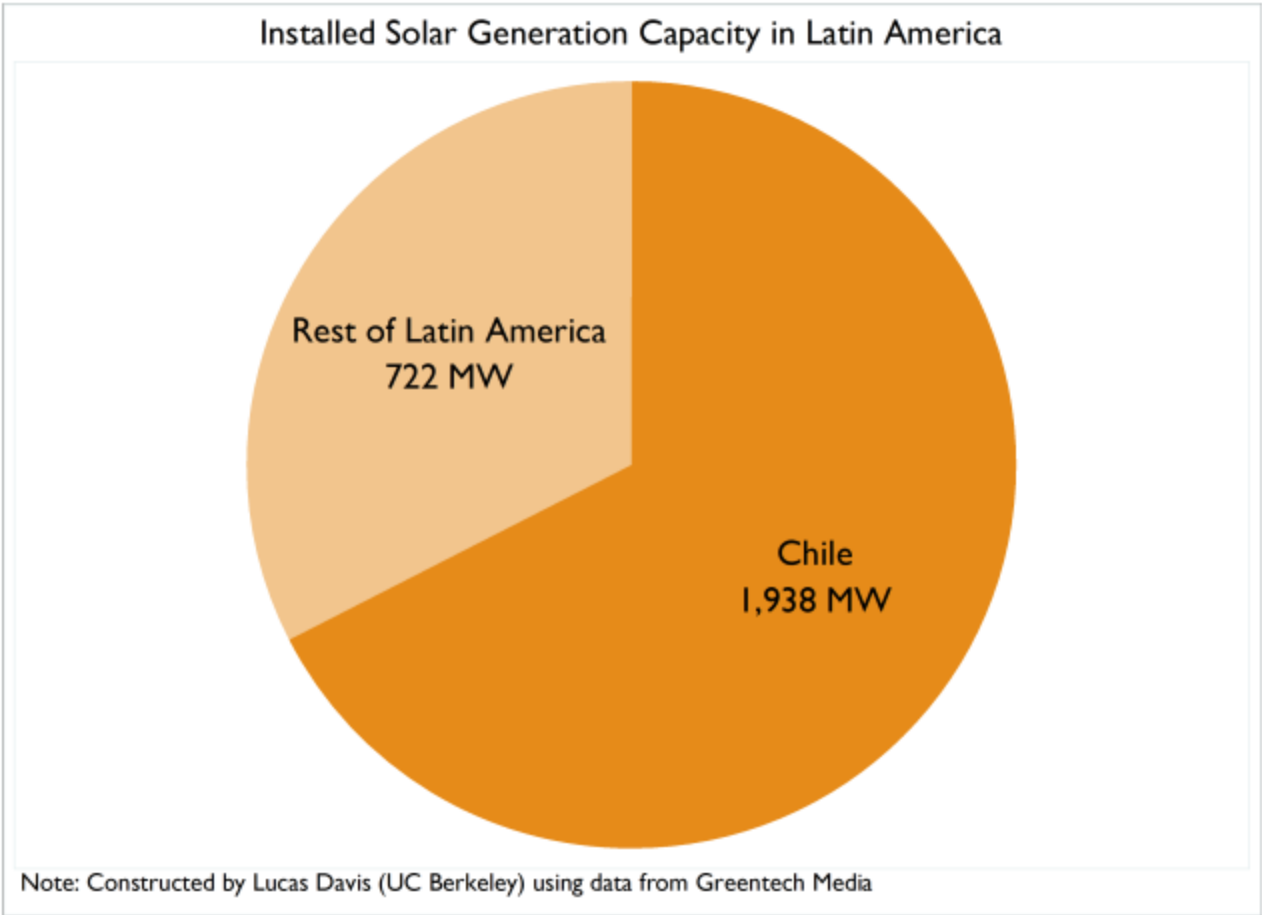
Conclusion

I'd be very interested if readers can come up with other potential explanations. But I'm pretty sure that these four explanations all play an important role. With good reason, Chile is the biggest solar market in Latin America. And, looking forward, none of these factors is likely to change overnight. After all, the Atacama has been dry for over 3 million years.

Chile is a fascinating case study that illuminates some of the broader underlying economics behind electricity markets. Some of these factors, like robust electricity demand growth, are present in a large number of other countries. Other factors, like the lack of natural gas reserves, are more unusual, though not unique to Chile.

# 智利是拉美最大太阳能市场的四大原因

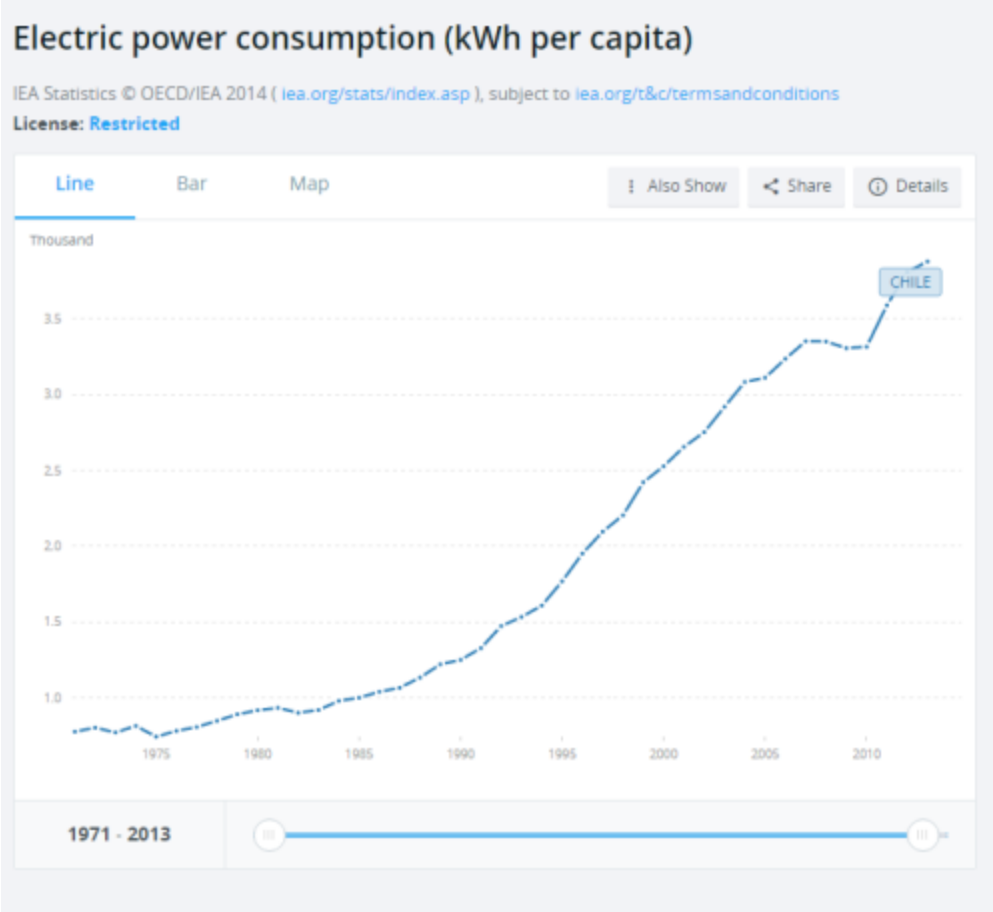
随着美国联邦政府对解决全球变暖的努力，我发现自己在美国以外也得到了气候变好的消息。最引人注目的近期趋势之一就是智利，这是太阳能发电的小巧引擎。尽管拉丁美洲只有 3%的人口，智利的太阳能发电量已经达到了近四分之三。




有些人指出，智利市场接近零电价，传播不足以及其他挑战，表明这些投资以某种方式是错误的，或不可持续的，然而我并不这么认为，以下是智利将继续成为电网规模太阳能市场的四大原因。

＃1：电力需求增长

智利的电力需求预计在未来二十年将每年增长 2.6％。没有留下深刻印象？美国的这个数字是 0.7％。最近几年来，智利铜行业在 2015 年和 2016 年受到铜价下跌的阻碍，但最近几年的增长情况确实如此。但自 11 月份以来铜价一直在上涨，电动汽车和电池预计将大幅上涨并增加全球铜需求。历史上，除了几次特殊情况以外，智利的电力需求已经稳步增长了三十年。




资料来源：世行发展指标。

未来大部分增长预计来自矿业，而不是来自智利的住宅和商业部门。这与近期在智利等中等收入国家能源需求增长幅度较大的合作者凯瑟琳•沃尔夫兰克（Catherine Wolfram）的工作相一致。未来几年，智利将继续缩小与美国等高收入国家之间的发展差距，这意味着他们会广泛采用大量的能源使用装置。

＃2 阿塔卡马沙漠

智利北部的阿塔卡马沙漠是地球上最干旱的地方。自记录开始以来，沙漠的一些地方从未见过一阵雨。阿塔卡马山高度平整，怪石嶙峋，是太阳能的理想地点。太阳照射日复一日，几乎没有一片云彩，在世界上任何地方都有一些最高水平的太阳辐射区。

同样重要的是，智利政府正在扩大传播，目的是到 2018 年之前连接智利的“北方”和“南方”电网。这是阿塔卡马的太阳能生产商的关键，因为大部分电力需求在南部，新的传输链接将允许他们访问南方客户。

＃3 有限天然气和煤炭

智利的另一个关键因素是天然气储量不大。智利拥有两个液化天然气进口码头，但液化天然气价格昂贵，平均北美天然气价格为二至三倍。这是很贵的，所以天然气燃料发电厂难以与未上市的电网规模的太阳能竞争。

此外，虽然智利铜矿等矿产资源丰富，但几乎没有煤炭。煤炭当然可以进口，但由于环境问题，智利政治上反对煤炭。

＃4 承诺自由市场

它不被频繁地提及，但这一个重要因素是智利对自由市场的承诺。自从米尔顿•弗里德曼（Milton Friedman）和“芝加哥男孩”（Chicago Boys）在 20 世纪 70 年代和 80 年代出现了巨大的影响之后，智利被视为自由市场经济的堡垒。放松管制和私有化并不总是对智利的环境有利，但在这种情况下，市场的透

明度和政府的干预不利于私人投资者进入市场的信心。智利的所有发电都是私有的，智利太阳能行业有十几家国际公司。

智利太阳能热潮没有明确征收碳或补贴可再生能源。智利的有利条件仍然导致太阳能价格惊人的低价位。例如，在 2016 年 8 月的拍卖中，中标价为 29.10 美元/兆瓦，这是太阳能价格最低的一次。公司在这些低价格的融资项目上遇到困难，但这些项目的经济可行性取决于能源需求和供应预测，而不是监管或政治风险，智利通过长期的自由放任市场手段有效地减少了些危害。

与墨西哥比较

预计拉丁美洲的下一个大型太阳能热潮将在墨西哥发生。 2017 年预计太阳能装置的近一半都在墨西哥。墨西哥还在 2018 年和 2019 年分别签署了大量合同。这些投资可能都按照计划进行，但是墨西哥的电力市场比智利市场的开放程度较低，因此进行这些投资的投资者会担更大的风险。

可能更重要的区别是墨西哥可以以更低的价格获得北美天然气。天然气已经是墨西哥最大的发电源了，现在到 2020 年的新能源产量预计将来自天然气。低价格的天然气并不能使可再生能源投资成为可能，但是它确实会变得更加困难。

结论

如果读者可以提出其他潜在的解释，我会非常感兴趣的。但我确信这四个解释都起着重要的作用。有理由相信，智利是拉丁美洲最大的太阳能市场。而且，展望未来，这些因素都不可能在一夜之间改变。毕竟，阿塔卡马已经干了 300 多万年了。

智利是一个引人入胜的案例研究，阐明了电力市场背后的一些更广泛的基础经济学。其中一些因素，如强劲的电力需求增长，都存在于很多其他的国家内。另外的因素，如缺乏天然气储备，更是不寻常的，虽然这都不是智利独有的。

# *Coal（煤炭）*

## Ageing coal generators may be unable to cope with energy transition

The Australian Energy Market Operator has highlighted one of the biggest problems in Australia’s electricity grid – namely that some legacy coal and gas generators have no performance standards, and it may not even know what their control settings are.

The admission comes in AEMO’s submission to the Finkel Review, in which it also pleads for much faster decision making on critical rule changes – such as the 5-minute rule – and for such decisions to be “forward looking” and “proactive,” rather than “reactive”.

Its frustrations with the glacial pace of rule-changes – the province of the Australian Energy Market Commission – have been reflected in the broader market and at ministerial level.

AEMO notes that some rule changes can take years to be finalised, and even then may not result in “forward looking” decisions, or take into account new technology developments.

It wants to be able to do some of that rule-making itself, in recognition of the importance of its role in dealing with the actuality of technology changes and grid challenges, and of keeping the lights on.

“The current arrangement is therefore not sufficiently responsive or forward-looking to meet the needs of the paradigm shifts the NEM and its participants need to embrace,” AEMO writes.

It says processes and settings within a broad policy space could be managed by agencies such as itself and the Australian Energy regulator.

“One example is the critical need to continually adapt the technical standards applied to generators seeking connection to the grid. These standards are currently embedded in the Rules and have not been updated in some time.”

It made special mention of the 5-minute rule proposal, which proposes to change the time period for settlement on the wholesale electricity market from 30 minutes to 5 minutes to stop market gaming.

The proposal has come from zinc refiner Sun Metals, which says the obvious distortions in the market often force the company to slow down production so it doesn’t have to pay inflated prices. It has since commissioned a 116MW solar plant to reduce its dependence on expensive coal power.

“It is well known to distort bidding behaviour and create unintended risks, issues which may become more severe over time given the technological changes underway,” AEMO wrote in its submission.

AEMO says it wants a quick resolution to this rule, but consideration has been repeatedly delayed by the AEMC, in the face of intense pressure from the fossil fuel generators, those accused of that distorting bidding behaviour, who want to protect their hold on the market and not allow in new competitors such as battery storage.

On the issue of standards, the AEMO, while welcoming new technologies, which it says offer a multiple of options to deal with upcoming grid issues in the energy transition, is concerned about the status of “legacy” coal and gas generators.

It says those connected before 2007 – which is nearly all of them –“do not have standards to which they have to adhere in respect to some aspects of their performance.”

On top of that, AEMO admits to having only “limited knowledge” of the settings for these generators. So much so, that is has no idea how they might perform in system faults, because data “can often only be obtained through testing or by observing extreme disturbances on the power system.”

It went on: “This means that as the power system evolves, AEMO will face challenges in determining how existing technologies will behave under the changing system dynamics.”

This is a critical element and one that has been raised by other energy engineering specialists.

Earlier this week we wrote of a new paper that questions the settings on major generators, and their impact on grid stability, The authors are concerned that the settings have been relaxed to the point where they are useless, and could cause immense damage to the generators themselves, and to the system as a whole.

AEMO now says the lack of knowledge about the settings on legacy plants could cause it to act more conservatively in running the grid, or impose added costs to ensure they are protected.

But it questions whether others should pay these costs, or the generator owners should cough up to bring their generators up to date.

“The NEM has generally maintained a principle of grandfathering, i.e. if the equipment was approved for connection at some historical time, then it should not be obliged to meet standards that might apply now,” it writes.

“This approach has obvious benefits in lowering investor risk, however its retention presents challenges during the dramatic technical changes occurring in the power system currently, meaning that either:

·The network must be operated more conservatively in order to protect sensitive legacy equipment.

·Investments in expensive new regulated network equipment must occur, which may be more costly than retrofitting or retiring the legacy equipment.

· More burdensome obligations must be placed upon new entrants in order to protect the legacy equipment.”

It is yet another highlight that the principal issues surrounding Australia’s electricity network are not new technologies, which can be combined with incredibly fast response and smart software, but in the clunky old generators that are falling out of date.

## 老化煤发电机可能无法应付能源转型

澳大利亚能源市场运营商突出了澳大利亚电网中最大的问题之一，即一些传统的煤炭和天然气发电机没有性能标准，甚至可能不知道它们的控制设置是什么。

AEMO 提交给 Finkel 评审的入场许可，它也要求对关键的规则改变（例如 5 分钟的规则）做出更快的决策，而且这些决定是“前瞻性”和“主动性”，而不是“反应性”。

澳大利亚能源市场委员会的省对规则变革的缓慢节奏的沮丧，已经反映在更广泛的市场和部长级别方面了。

AEMO 指出，一些规则更改可能需要几年才能完成，甚至可能不会导致“前瞻性”决策，或考虑新的技术发展。

它希望本身能够制定一些规则，认识到其作用在处理技术变革和电网挑战的现实性时对保持亮灯的重要性。

“因此，目前的安排没有足够的反馈性和前瞻性，以满足 NEM 及其参与者需要接受的范式转换的需要，” AEMO 写道。

它说，在广泛的政策空间内的流程和设置，可以由澳大利亚能源监管机构等机构管理。

“一个例子是，迫切需要不断地适应应用于寻求连接到电网的发电机的技术标准。这些标准目前嵌入在规则中，并且在一段时间内没有更新。”

它特别提到了 5 分钟规则建议，建议将批发电力市场的结算时间从 30 分钟改为 5 分钟，以停止市场博弈。

该建议来自锌冶炼公司 Sun Metals，该公司称，市场的明显扭曲经常迫使公司减缓生产，因此它不必支付高昂的价格。它已经委托一个 116MW 的太阳能发电厂，以减少对昂贵的煤电的依赖。

AEMO 在其提交的文件中写道：“众所周知，扭曲竞价行为和产生意外风险，随着技术变革，这些问题可能会随着时间而变得更加严重。

AEMO 说，它想要一个快速解决这个规则，但考虑已被 AEMC 一再推迟，面对来自化石燃料发电机，那些被指控扭曲的投标行为，谁想要在标准问题上不允许新的竞争对手，如电池存储方面，的加入，以此来保护他们的市场呢。AEMO 欢迎新技术，它提供了多种选择来应对能源转型中的即将到来的电网问题，更关注“传统”煤和气发电机的状态。

它说，在 2007 年之前连网的几乎所有发电厂，“在其性能的一些方面，都没有可遵循的标准”。

最重要的是，AEMO 承认，对这些发电机的设置，只有“有限的知识”。所以，这是不知道他们如何可能在系统故障中执行的原因，因为数据“通常只能通过测试或观察电力系统的极端干扰获得。”

它继续说：“这意味着随着电力系统的发展，AEMO 将面临挑战，以确定现有技术将在不断变化的系统动态下的行为。”

这是一个关键因素，也是其他能源工程专家提出的。

本周早些时候，我们编写了一篇新文章，对主要发电机的设置及其对电网稳定性的影响提出了疑问。作者担心这些设置已被放宽到无用的程度，并可能对发电机造成巨大损害，甚至危及整个系统。

AEMO 现在表示，对传统工厂的设置缺乏了解可能会导致它在运行电网时更保守地采取行动，或者施加额外的成本以确保它们得到保护。

但它质疑其他人是否应该支付这些成本，或者发电机所有者应该时刻使发电机保持更新状态。

“NEM 通常会保持原始的原则，即如果设备在某个历史时间被批准连接，那么它不应该被迫满足现在可能适用的标准。”

“这种方法在降低投资者风险方面具有明显的好处，但是其保留在当前电力系统中发生的剧烈技术变化时提出了挑战，意味着：

•网络必须更保守地操作，以保护敏感的传统设备。

•必须对昂贵的新监管网络设备进行投资，这可能比改造或退役传统设备更昂贵。

•为了保护传统设备，必须对新进入者承担更多的繁重义务。

这是另一个亮点，澳大利亚电力网络周围的主要问题不是新技术，可以结合令人难以置信的快速反应和智能软件解决，但笨重的旧发电机的确已经过时了。

# India to release discussion paper on rules for commercial coal mining this month

Commercial mines are alloted without specifying the end use and allow private entities to sell the fuel to buyers across sectors such as power, cement and steel.

The government will release a discussion paper this month for framing rules and regulations to auction coal blocks for commercial mining by private players, a top official said today.

Commercial mines are alloted without specifying the end use and allow private entities to sell the fuel to buyers across sectors such as power, cement and steel.

The government has identified four coal blocks which would be put up for auction in the next fiscal.

The Coal Ministry will come out with the discussion paper this month and it will contain the procedure of auction of coal blocks, eligibility criteria and other issues, Coal Secretary Susheel Kumar told PTI.

It will be put up on the ministry's website seeking comments from stakeholders, he said. "After that we will issue the tender."

Kumar said: "In the discussion paper we will mention as to how many mines would be auctioned, what would be the procedure of auction, what would be the eligibility criteria... All these things would be there."

As per the the Coal Mines Special Provision Act of 2015, government can open up commercial coal mining for private players. The government had earlier allowed state utilities to commercially mine coal and sell to private companies.

## 印度本月发布商业采煤规则的讨论文件

商业矿山被分配，没有明确最终用途，允许私人实体向电力、水泥和钢铁等行业的买家销售燃料。

一位高级官员今天表示，政府将在本月发布一份讨论文件，制定规则和条例，允许私营企业采购煤矿商业化。

商业矿山被分配，没有明确的最终用途，允许私人实体向电力，水泥和钢铁等行业的买家销售燃料。

政府已经确定了四个将在下一财政年度拍卖的煤矿。

煤炭部门将在本月出版讨论稿，并将包含煤层块拍卖程序，资格标准等问题，煤炭部长苏西尔•库马尔告诉 PTI。

他说，这个网站将在部门的网站上提出，征求利益相关方的意见。“之后，我们将发出招标。”

库马尔说：“在讨论文件中，我们将提及拍卖多少矿场，拍卖程序是什么，资格标准是什么？所有这

些都将在那里。”

按照 2015 年的“煤矿特别规定法”，政府可以为私营企业开采商业采煤。政府早些时候允许国营公用事业商业化开采煤炭，并向私人公司出售。

# No large-scale cuts from Chinese coal mines in 2017: NDRC

China’s National Development and Reform Commission (NDRC) said Tuesday that it will not seek to lower coal output in large scale, even as it continues to rationalize supply. This is provided that prices remain in a reasonable boundary.

“Although the task of cutting [coal] overcapacity task is tough but it is achievable and the fundamentals of supply and demand will improve further,” NDRC said on its website.

Premier Li indicated that China plans to cut 150 million mt of coal capacity in 2017 earlier in the week.

The announcement comes in response to significant market anticipation as to whether NDRC would revert back to 276 work day policy in mid-March after they temporarily loosened the work day policy in November in attempts to curb increasing thermal and met coal prices.

Domestic coal prices jumped last year after the Chinese government reduced the number of working days for mines to 276 days from 330.

The price of FOB Qinhuangdao 5,500 NAR prices has surged 66% in the past one year to be assessed at Yuan 630/mt on Monday, according to S&P Global Platts data. The price had touched a high of Yuan 760/mt in November, when the Chinese government intervened to ease production and rein in the upward price trend.

NDRC said early January this year that the reasonable price range for the domestic coal should be within 6% basis on Yuan535/mt FOB for 5,500 kcal/kg NAR coal.

Imported metallurgical coal prices delivered into China also surged last year, reaching its highest point in November at $306.50/mt CFR China, more than tripled its sub-$100/mt value in April, according to S&P Global Platts data.

However it is important to note that NDRC did not make any distinction between thermal and coking coal mines in its recent statement.

NDRC also said that for those provinces which require more coal or which face supply pressure, the provincial governments could “make their own decisions” and the central government would not intervene in such instances.

As far as the coal prices are within in a reasonable range the government will not tweak its production policy, NDRC said.

NDRC’S IMPACT MIXED ON MET AND THERMAL COAL

NDRC’s statement which seemingly alludes to maintaining the existing 330 work day policy for met coal might have limited impact on the physical market as Chinese supply of low ash, sulfur and high CSR coals are tight, a sell-side source said.

The source said that even from November to March where work day policy loosened to 330 days, China was still short of such good quality coals and imported significant volumes of it.

However from a confidence level point of view, such news might impact mills’ desire to buy imports as it might encourage them to adopt a wait-and-see attitude, and wait for the impact to come in before making any

procurement move, the source added.

The source said that NDRC's impact on thermal and coking coal has to be evaluated separately as thermal prices have been high in recent weeks.

A trader said that NDRC's move might have less impact on met coal as previously circulated rumors already suggested that coking coal would not see a return of the 276 work day policy.

Another trader suggested that this might have downward pressure on prices if implemented, but said that impact might not be as much as last year's policy did on met coal prices.

## 国家发改委：2017 年中国煤矿无大规模削减

中国国家发展和改革委员会周二表示，即使继续使供应合理化，也不会大幅降低煤炭产量。这都是因为价格保持在了合理的边界。

国家发改委在网站上表示："虽然削减煤炭产能过剩的任务艰巨，但可以实现，供需基础也将进一步改善。"

李总理表示，中国计划在本周早些时候在 2017 年削减 1.5 亿吨煤炭产能。

该公告是为了响应市场预期，即在 11 月中旬暂缓放宽工作日政策以试图遏制热涨和煤价上涨，之后，国家发改委将恢复到 276 个工作日政策。

去年中国政府将矿山工作天数从 330 天减少到了 276 天后，国内煤炭价格大涨。

根据标准普尔全球普氏资料显示，侨乡侨兴 5,500 NAR 的价格在过去一年飙升 66%，周一评估为 630 元/吨。 11 月份，中国政府干预了生产和控制价格上涨的态势，价格甚至一度高达 760 元/吨。

国家发改委今年 1 月初表示，国内煤炭合理价格区间应在 5,500 千卡/公斤 NAR 煤的 535 元/吨离岸价格的 6%以内。

根据 S＆P Global Platts 数据，进口中国的冶金煤价格去年也激增了，达到 11 月份的最高点，CFR 中国的价格为 306.50 美元/吨，比 4 月份的价格高了 100 美元/吨。

但重要的是要注意，国家发改委在最近的声明中并没有对热煤和焦煤进行区分。

发改委还表示，对于那些需要更多煤炭或面临供应压力的省份，省级政府可以"做出自己的决定"，中央政府不会干预这种情况。

就煤炭价格处于合理范围而言，政府不会调整生产政策，发改委表示。

国家发改委对金属和热煤混合的影响

卖方声称，国家发改委表示，由于中国低灰，硫磺和高企业煤炭供应紧张，所以似乎暗示维持现有的 330 工作日煤炭政策对实体市场的影响可能有限。

消息人士说，即使从 11 月到 3 月，工作日的政策放松到 330 天，中国仍然缺乏这样优质的煤炭，进口量很大。

然而从信心层面来看，这样的消息可能会影响到工厂购买进口货物的愿望，因为它可能会鼓励他们采取观望态度，等待的影响力会在进行采购之前产生。

消息人士说，国家发改委对热炼焦煤的影响必须单独进行评估，因为热价格在近几周来一直很高。

一位贸易商表示，国家发改委的举措对会议煤炭的影响可能较小，以前流传的传言已经表明，炼焦煤不会回收 276 个工作日的政策。

另一位贸易商表示，如果实施这种做法可能会对价格造成下行压力，但也表示，影响可能不如去年的政策那样，那么影响煤炭的价格。

## 'Clean' coal won't be commercially viable before 2030,

# energy analysis says

Renewables now the cheapest source of reliable power generation in Australia, RepuTex says

“Clean” coal technologies won’t be commercially viable before 2030 without government subsidy and are fundamentally out of sync with the move towards more flexible power generation, according to the energy market analysis firm RepuTex.

In a new analysis released on Thursday, RepuTex argues that the rising price of gas, coupled with the falling cost of energy storage, has now made renewable energy the cheapest source of reliable power generation in Australia.

The long lead time before technologies such as carbon capture and storage reach commercial maturity means “clean” coal won’t help Australia meet its 2030 emissions reduction target under the Paris agreement.

RepuTex used its submission to the Finkel review to argue that a market signal was required to determine the value of abatement and to allow an orderly retirement of ageing coal-fired generators.

The firm said the market signal could take the form of an emissions intensity scheme, a legislated emissions benchmark, cap, or target that “better links emissions reduction objectives to the operation of the Australian electricity system”.

While the debate accompanying the Finkel review has centred on the electricity industry, RepuTex pointed out energy was not the only source of low-cost emissions reduction potential in the Australian economy.

“Outside of the generation sector, the effort to reduce emissions could therefore be spread across the economy,” the firm said. “This may be achieved via the design of sectoral targets for industrial emitters via the safeguard mechanism, supported by emissions offsets, which would enable companies to reduce emissions at lower cost, while incentivising investment in cleaner, more efficiency energy technology.”

The call by RepuTex for a clear market signal follows similar arguments mounted by the National Farmers’ Federation, which this week reversed its once-vociferous opposition to carbon pricing.

Other major organisation to champion a market mechanism include Energy Networks Australia, the retailer EnergyAustralia, the electricity provider AGL, the Climate Change Authority, the Investor Group on Climate Change, the Business Council of Australia and the CSIRO.

The official conducting the energy review, the chief scientist, Alan Finkel, gave implicit support for an emissions intensity scheme in his preliminary report, saying it would integrate best “with the electricity market’s pricing and risk management framework” and “had the lowest economic costs and the lowest impact on electricity prices”.

The energy and environment minister, Josh Frydenberg, initially signalled the government would look at the desirability of an emissions intensity trading scheme for the electricity sector as part of its scheduled review of its Direct Action climate policy – but he reversed his position after an internal Coalition revolt.

A major stakeholder in Australia’s politically toxic carbon pricing debate, the Minerals Council of Australia, has used its submission to rebuke Finkel for floating an intensity scheme in his preliminary report without detailed analysis of the costs.

While the MCA doesn’t rule out supporting such a scheme, noting it is appropriate to consider all policy options, it says Finkel conducted “virtually no serious analysis of the economic costs”.

The council, which represents Australia’s mining giants, says modelling “relied upon by the independent review shows the costs of an EIS are very high”.

“For example, close analysis of one of the cited reports … shows the total additional cost to household and industry of an EIS configured around Australia’s contribution to a 2 degrees limit on global warming would reach $128bn over the period 2020 to 2030,” the submission says.

“That is a fact germane to the broader national policy debate. At the very least, the independent review should be more transparent about these costs in its final report.”

The MCA blasts Finkel’s preliminary report on a range of fronts, declaring it “conspicuously fails to examine the comparable costs of available energy sources” – declaring this “an extraordinary omission for a report of this kind”.

The council uses figures dating from 2015 to argue that coal and gas technologies remain the lowest cost to build and operate. It asserts the review ignored the potential contribution of high-efficiency, low-emissions (HELE) coal technologies and ignored the potential of nuclear power.

The MCA submission contains new research arguing that electricity networks face significant integration costs as the relative share of wind and solar energy rises – including the requirement to keep backup generation power on standby.

The research says the direct subsidies paid by electricity consumers to achieve the large-scale component of the renewable energy target “are estimated at more than $1.8bn in 2016 alone but these subsidies only represent a fraction of the costs of this policy”.

The research by the consultancy BAEconomics says integration costs increase significantly as the share of intermittent generation capacity in a power system rises. The MCA argues the costs associated with intermittent capacity should be borne by renewable generators.

It also argues the government should provide support “to all energy sources or to none”.

It declares that the final Finkel report must make a “clear and unambiguous statement in favour” of a technology-neutral approach to policy support for both CCS and HELE coal technologies – meaning the rules should be changed to allow the Clean Energy Finance Corporation to invest in “clean” coal.

The CEFC has said clean coal plants are not financeable in Australia unless the government agrees to indemnify projects against the future risk of a carbon price being introduced, and against the cost of delays prompted by likely community protest action.

In its submission to the Finkel review, the CEFC noted there was no new coal-fired capacity among current proposals registered with the Australian Energy Market Operator.

“Coal-fired generation tends to be relatively inflexible and not suited to a market with higher levels of renewable energy penetration and declines in daytime demand as a result of rooftop solar generation,” the CEFC said.

“While the range of cost estimates for new coal-fired generation capacity are broadly comparable with new renewable energy capacity (excluding any cost for carbon emissions), negative investor perceptions mean that new investment in coal-fired capacity would be unlikely to be financed by Australian or international capital markets.

“Investors perceive that new fossil-fuel generation capacity has carbon risk, which is the risk that a new asset would be stranded if a future government were to adopt tighter emissions constraints.

“Further, there is arguably no longer a social licence for new coal-fired power stations in Australia.”

## 能源分析表示，在 2030 年之前，“清洁”煤炭无商业可行性

RepuTex 说，可再生能源现在是澳大利亚可靠发电量最便宜的来源

能源市场分析公司 RepuTex 表示：“清洁”的煤炭技术在 2030 年之前将无法在没有政府补贴的情况下在商业上推行，并且与更灵活的发电方式基本一致。

RepuTex 在星期四发布的一项新分析中认为，天然气价格上涨以及能源储存成本下降，现在使可再生

能源成为澳大利亚可靠发电的最便宜的来源。

碳捕获和封存等技术达到商业成熟的长时间前提意味着“清洁”的煤炭不会帮助澳大利亚根据巴黎协议实现其 2030 年的减排目标。

RepuTex 使用了其提交的 Finkel 审查，认为需要市场信号来确定减排的价值，并允许老化的燃煤发电机有序退休。

该公司表示，市场信号可以采取排放强度计划，立法排放标准，上限或目标，“更好地将减排目标与澳大利亚电力系统的运行联系起来”。

尽管芬克尔评论的辩论集中在电力行业，但 RepuTex 指出，能源并不是澳大利亚经济中低成本减排潜力的唯一来源。

该公司表示：“在发电行业之外，减排的努力可能会蔓延到整个经济体系。” “这可以通过设计工业排放者的部门目标来实现，这些目标是通过排放抵消支持的保障机制来实现的，这将使公司以更低的成本降低排放，同时激励投资更清洁，更有效率的能源技术。”

RepuTex 对于明确的市场信号的呼吁遵循了国家农民联合会的类似观点，国家农民联合会本周扭转了一度反对碳定价的声音。

支持市场机制的其他主要机构包括澳大利亚能源网络，澳大利亚零售商，电力供应商 AGL，气候变化管理局，气候变化投资集团，澳大利亚商业理事会和 CSIRO。

负责能源审查的官员，首席科学家艾伦•芬克尔（Alan Finkel）在其初步报告中暗示支持排放强度计划，表示将把“最佳”与电力市场的定价和风险管理框架相结合，因为这样“经济成本最低”对电价影响最小”。

能源与环境部长 Josh Frydenberg 最初表示，政府将会考虑电力部门排放强度交易计划的可取性，将其作为对“直接行动”气候政策的定期审查的一部分 - 但是他在内部联盟之后扭转了立场。

澳大利亚矿业委员会声称，澳大利亚政治毒性碳定价辩论的一个主要利益相关者已经使用其提交来驳斥了芬克尔在其初步报告中浮动强度计划，所以无需详细分析费用。

虽然 MCA 不排除支持这样的计划，但所有政策的选择应该是适当的，它说 Finkel 几乎没有对经济成本进行严格的分析。

代表澳大利亚矿业巨头的理事会表示，“独立审查所依赖的模型显示，EIS 的成本非常高”。

“例如，对所引用的报告之一的仔细分析显示，澳大利亚对全球变暖 2 度限制的贡献的 EIS 家庭和行业的额外成本总额将在 2020 年至 2030 年期间达到 1,280 亿美元。”提交的报告中这样讲道。

“这是与更广泛的国家政策辩论密切相关的事实。至少在最终报告中，这些费用的独立审查应该更加透明。”

MCA 对 Finkel 关于一系列战线的初步报告进行了炮轰，声明“显然未能检查可用能源的可比成本” - 宣布“这种报告是漏洞百出的”。

该委员会使用从 2015 年开始记录的数字，认为煤和天然气技术仍然是建设和运营的最低成本。它断言审查忽视了高效，低排放（HELE）煤技术的潜在贡献，忽视了核电的潜力。

MCA 提交的报告包含新的研究，认为随着风力和太阳能的相对份额上升，电力网络面临重大的整合成本，包括保持备用发电电力待机的要求。

研究表明，电力消费者为实现可再生能源目标的大规模部署所支付的直接补贴“估计仅在 2016 年就会超过 18 亿美元”，但这些补贴仅占该政策成本的一小部分。

咨询公司 BAEconomics 的研究表明，随着电力系统间歇发电能力的份额上升，集成成本显着增加。MCA 认为与间歇性能力相关的成本应由可再生能源发电机承担。

它还认为政府应该为所有能源提供支持。

它宣布，芬克尔最终的报告必须对 CCS 和 HELE 煤炭技术的政策支持采取技术中立的方式，作出“明确和明确的声明”，这意味着应该改变规则，使清洁能源金融公司在“干净”的煤炭领域投资。

CEFC 表示，清洁的煤电厂在澳大利亚不能获得资金，除非政府同意赔偿项目对未来碳价未来的风险，

以及可能的社区抗议活动引发的延误造成的成本。

CEFC 在提交给 Finkel 的评论中指出，目前在澳大利亚能源市场运营商注册的建议中没有新的燃煤能力。

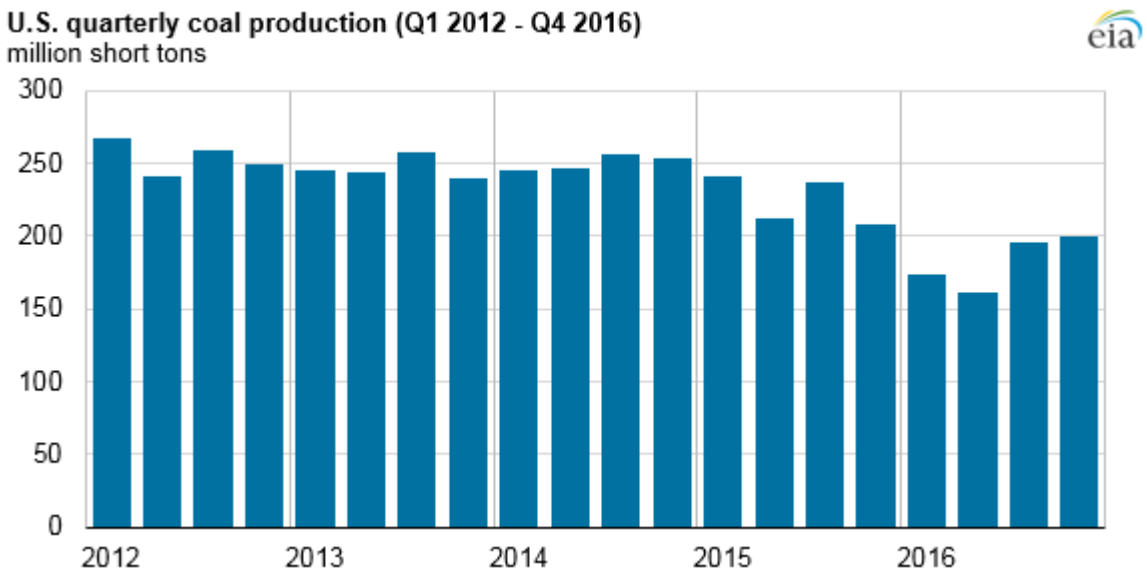
CEFC 说："燃煤发电往往相对不灵活，不适合可再生能源渗透率较高水平的市场，而且由于屋顶太阳能发电，白天的需求会因此下降。"

"虽然新燃煤发电能力的成本估算范围与新的可再生能源容量（不包括任何碳排放成本）大致相当，但负面投资者的看法意味着对燃煤能力的新投资将不太可能由澳大利亚或国际资本市场决定。

"投资者认为，新的化石燃料发电能力具有碳危机，如果未来政府采取更严格的排放限制，新资产将有被搁置的风险。

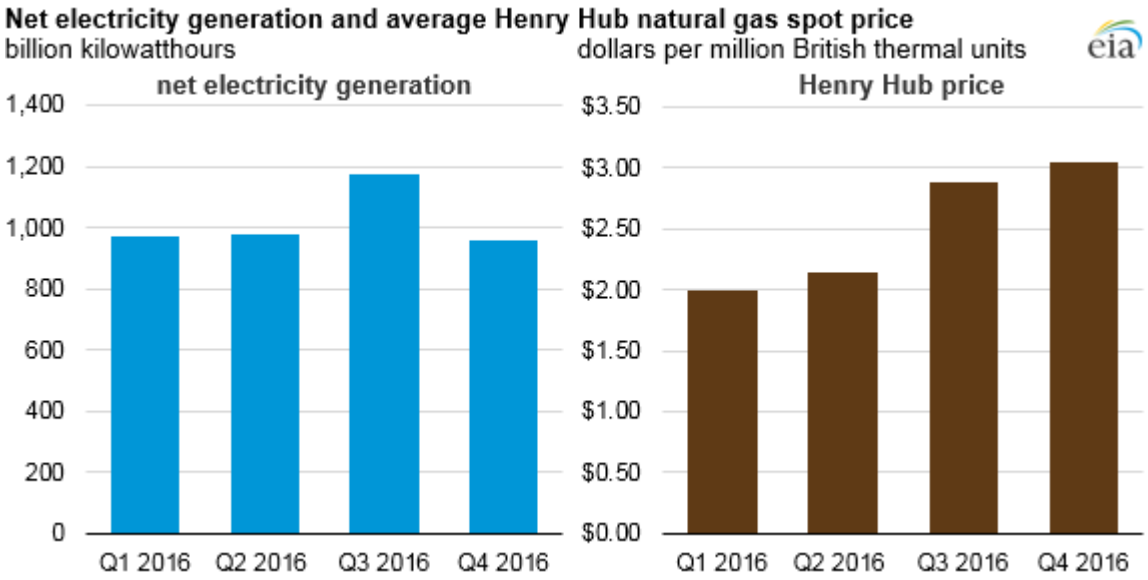
"此外，澳大利亚的新燃煤电站可能已经不再有社会执照了。"

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



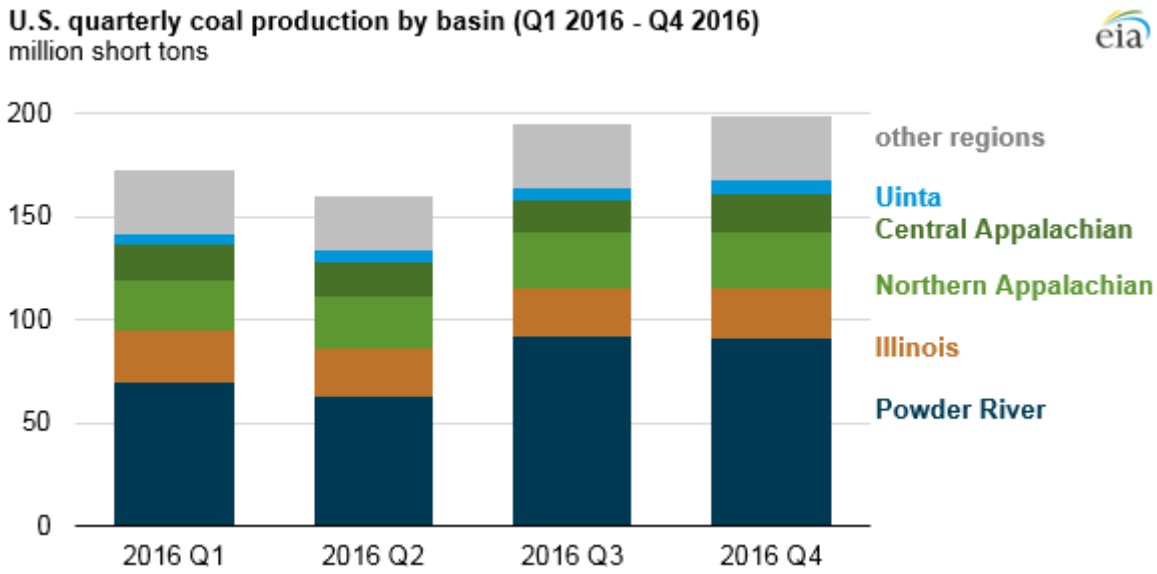

Source: U.S. Energy Information Administration, Weekly Coal Report and Quarterly Coal Report and U.S. Mine Safety and Health Administration

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.




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

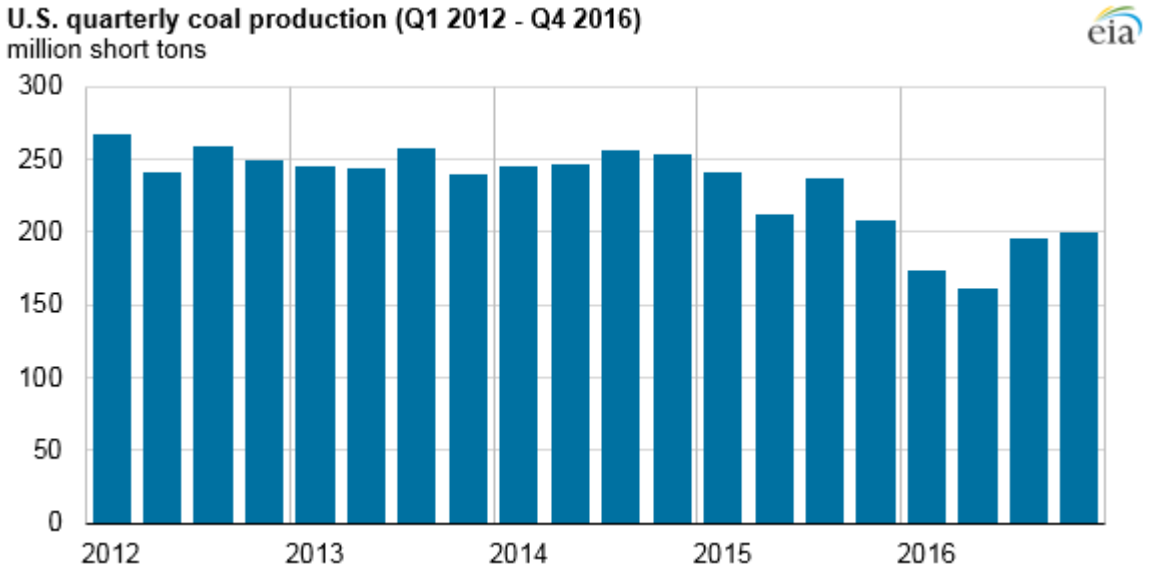
Electricity generation accounts for more than 90% of domestic coal use. During the third quarter of 2016, warmer-than-normal temperatures led to increased electricity generation—the highest on record for those three months combined—which resulted in higher consumption of coal compared to the first half 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.




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

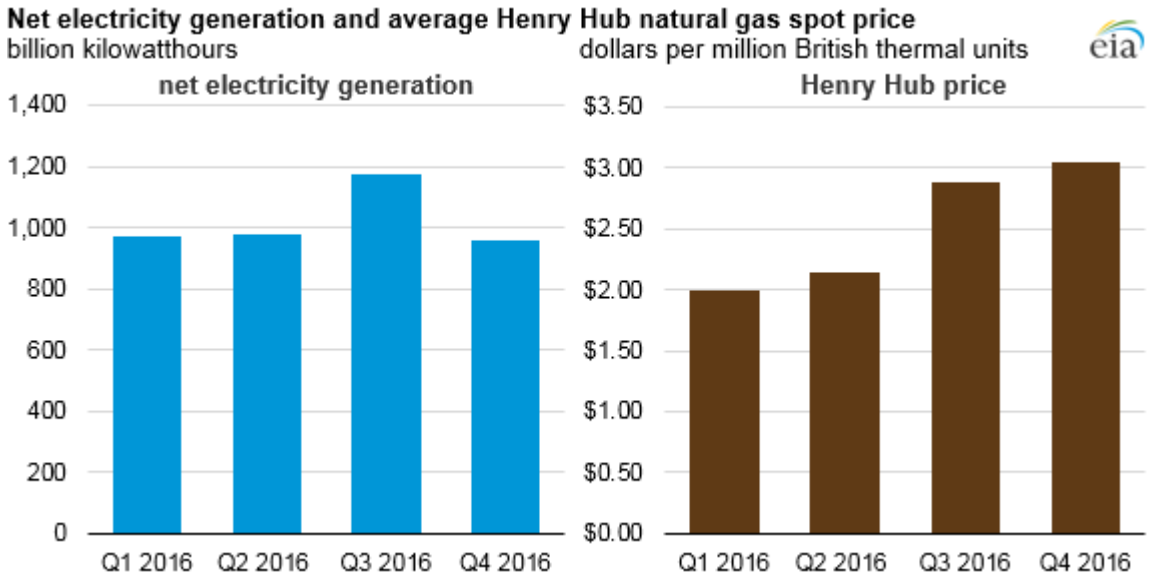
Regionally, production from the Powder River Basin (PRB) increased the most from the first half of 2016 to the second half of 2016. Coal production from other regions, including the Appalachian and Illinois basins, remained relatively flat. Increased demand for Power River Basin coal was not limited 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



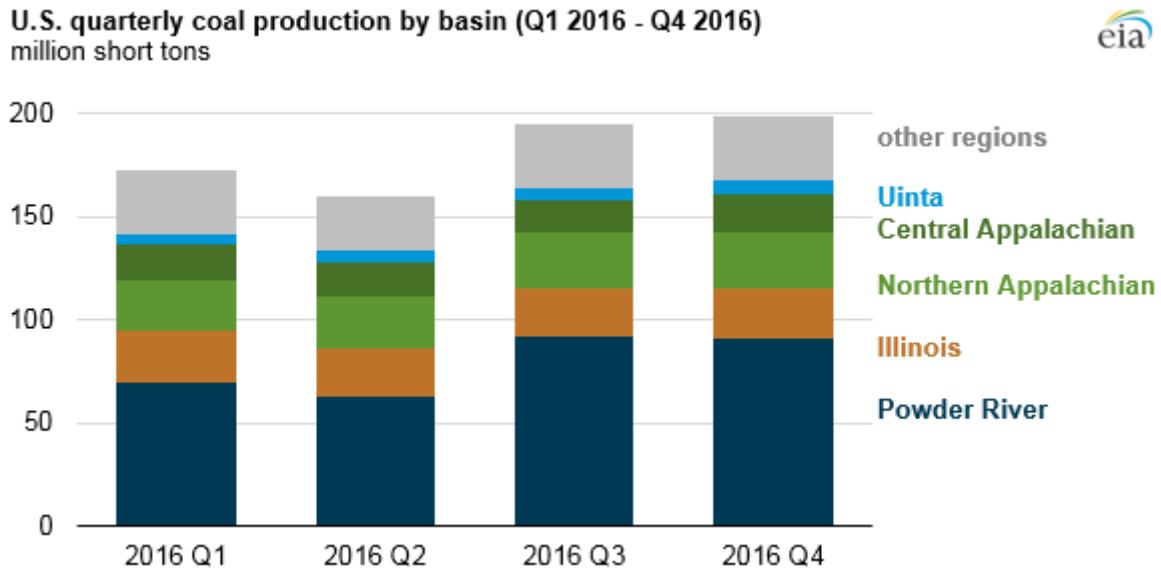

资料来源：美国能源信息管理局，每周煤炭报告和季度煤炭报告以及美国矿业安全卫生管理局

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，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，蒙大拿州和怀俄明州的粉河流域发生了第二大增长。




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。在二零一六年第三季度，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。

# ‘Coal is in decline’ and it looks like not even Donald Trump can pull the industry’s long-term future out of the fire

At their most generous, Las Vegas oddsmakers put the chances of Donald Trump winning the U.S. presidency at 25 to one. In other words, a long shot and one that likely mirrored any potential rebound by the country’s thermal coal miner stocks.

Coal mining companies have faced a constant “onslaught” of new regulations in the months and years leading up to the most recent U.S. election, said Cloud Peak Energy Inc. chief financial officer Heath Hill, including Barack Obama’s Clean Power Plan, which was designed to encourage cleaner burning natural gas and renewable power at the expense of coal-fired electricity.

“It was effectively a ‘keep coal in the ground’ campaign, where the NGOs were really well supported by the administration’s coordinated regulation and implemented rules in a way that were very disadvantageous to the coal industry,” Hill said.

But as we all know, Trump did overcome the odds and the effect on coal stocks became quickly apparent. Despite a recent pullback, Cloud Peak shares have risen 112 per cent in the past 12 months and the company is one of several thermal coal miners to post massive stock price rebounds.

TSX Venture-listed Corsa Coal Corp.’s share price rocketed 120 per cent over the same period. Similarly, Westmoreland Coal Co. is up 91 per cent and CNX Coal Resources has gained 122 per cent.

The thermal coal rebound following years of low coal prices, increasingly stringent regulations and big-name bankruptcies has been dramatic, but analysts don’t believe it will last. They warn the industry is likely to continue

losing market share to natural gas and renewable energy sources in the long term even with Trump in the White House.

The biggest factor driving coal out of the power market is the cost competitiveness of natural gas, not new regulations, said Jone-Lin Wang, vice-president of power and renewables at researcher IHS Markit.

“You’re going to have a near-term tug of war (between coal and gas for market share), but, generally speaking, coal is in decline and that, even for Trump, is hard to reverse,” she said.

U.S. Energy Information Administration (EIA) data show that electricity production from natural-gas-fired power plants surpassed coal-fired generation in the U.S. for the first time in late 2015.

Nevertheless, coal miners believe things are changing and big investment players are buying their story. For example, Toronto-based Connor, Clark & Lunn Financial Group Ltd. recently doubled its investment in Cloud Peak, to 1.8 million shares, and boosted its holdings in Westmoreland by 175,888 shares to bring the firm’s position up to 251,991 shares, according to Bloomberg data.

Hill said Cloud Peak, which operates three mines in a coal-bearing formation underlying Wyoming and Montana, can compete directly with natural gas in the power market when gas prices range between $2.50 and $3 per gigajoule. He also said the coal business has fundamentally changed to supply power plants on shorter-term contracts.

“We need to have the cost structure so we slow the mine down when the demand isn’t there and ramp it up when it is, so it’s not a five-year, stable sellout of the coal business that it used to be; it’s much shorter term and more nimble,” he said.

The EIA’s most recent forecast projects coal-fired power will claw back some its market share from natural gas even beyond 2020, and potentially as late as 2030, given that Obama’s Clean Power Plan was blocked Feb. 9.

But Wang said IHS Markit expects coal fired-power production to drop as early as 2018, “because we are likely to see continual retirements of coal plants.”

The problem for thermal coal miners is that their domestic market is disappearing. For years, coal-fired power accounted for 50 per cent of the total electricity output in the U.S., but it has since fallen to 30 per cent.

“We expect coal’s share to further decline to below 30 per cent in 2020 and barely over 20 per cent in 2030,” Wang said.

Coal-fired power plants across the U.S. have been retiring and new plants have not been built to replace the lost coal-fired generation capacity.

“Since Trump’s election, we have seen coal retirement announcements actually accelerate rather than slow down,” said Wade Schauer, Wood Mackenzie research director of power and renewables, in an email. “This trend is being driven by state policies and utilities looking beyond the next four to eight years.”

A shrinking market in North America will force companies such as Cloud Peak to increasingly look toward export markets. Hill said Cloud Peak already has customers in South Korea, but is also eyeing growing markets in Japan and China.

Looking beyond Trump’s initial four-year term in office, Hill said that investments in carbon capture and storage technology can help his industry be cleaner and stay competitive. The company is asking the new administration to consider a subsidy for carbon-capture technology in the same way the U.S. government currently subsidizes renewable power projects.

Hill said he’s hopeful that new technology can lead to either retrofits of existing coal-fired power plants or, potentially, the construction of more efficient plants.

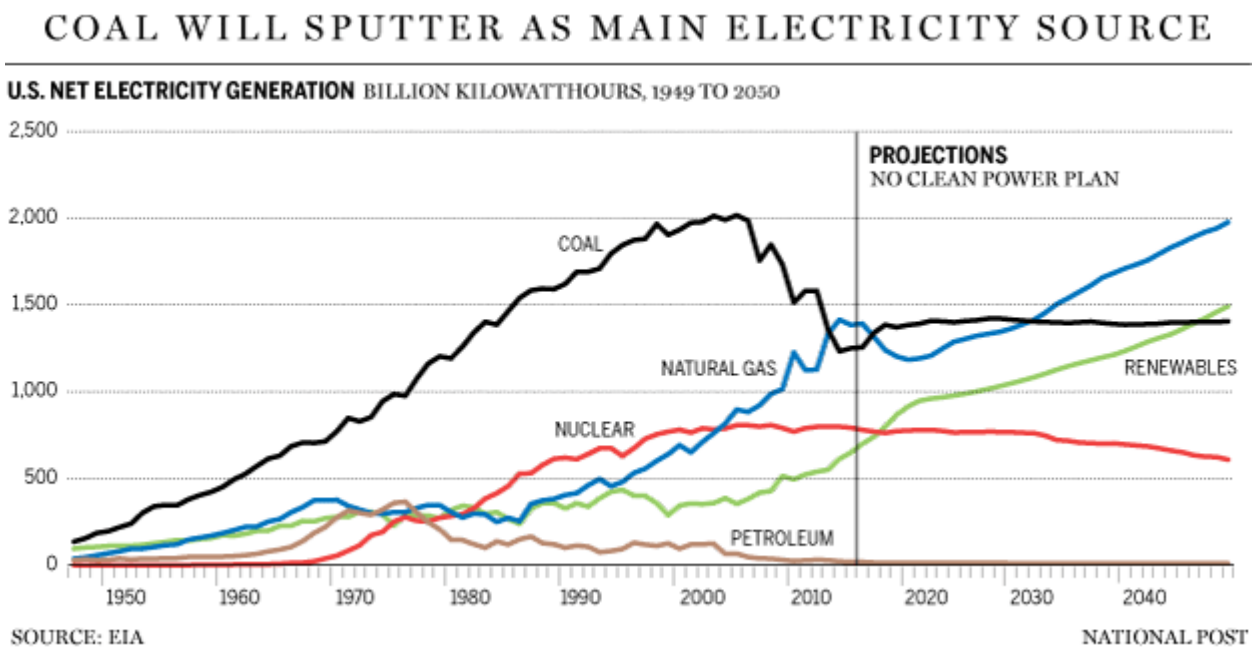
But Wang said it’s unlikely new coal plants will be able to compete with gas unless capital costs sharply decline.

"When it comes to dispatch, day in, day out, who gets to run based on short-run dispatch costs, then it's a tug of war between coal and gas based on current prices," she said. "When it comes to new builds, gas wins. Period."

The capital cost of a new gas-fired power plant is roughly US$1,400 per kilowatt of installed capacity, compared to US$3,500 per KW for coal-fired generation capacity.

"They're not close," Wang said, adding that gas plants can also be built faster than coal-fired power plants.

Wang expects natural gas prices to average between US$2.50 per GJ to US$3 per GJ between now and 2020 before increasing thereafter as coal-fired power plants are decommissioned and gas power emerges as the largest source of electricity in the U.S.




In the EIA's most bullish case, natural gas prices will average US$4 per GJ in 2020, US$8 per GJ by 2030 and close to US$10 per GJ by 2040.

"Having the coal plants there does put a bit of a constraint on the gas price," Wood Mackenzie's principal natural gas analyst Gabe Harris said. The retirement of coal plants, he said, could lead to a "longer, more intense" increase for natural gas prices.

"I think that's one of the dangers that people are seeing in retiring coal plants: there's going to be a spike," he said.

In the near term, however, the outlook for natural gas has recently deteriorated in North America. After a strong start to the critical winter heating season, NYMEX gas prices have tumbled from more than US$3.60 per GJ in January to US$2.82 this week as a result of warm weather in important markets such as Chicago and the U.S. northeast.

"It's been the warmest winter in my 20-year database," Harris said. "Between October and now, I estimate we've lost 4 [billion cubic feet] per day of gas demand."

The winter heating season has been weak, but GMP FirstEnergy analyst Martin King said in a March 6 research note that gas prices may have bottomed and he expects a "choppy" recovery over the course the year.

"At this stage, we do not rule out a US$3-plus per mmBtu handle in the near term, even with warmer than average weather," he said.

Some natural gas producers, including Calgary-based Painted Pony Petroleum Ltd., have scaled back spending plans as a result of the weaker gas outlook this year.

Such news gives thermal coal mining executives some reason to be bullish on their industry. In its fourth-quarter update, CNX Coal cited EIA forecasts that show coal-fired power plants will burn 41 million more tonnes of coal in 2017 than they burned in 2016.

“We believe this stronger coal burn and continued destocking should sustain improvements in coal supply-demand fundamentals for the upcoming periods,” the company said.

Hill said the Powder River Basin, where Cloud Peak operates, once produced 400 million tonnes of coal per year, but it produced just 320 million tonnes last year.

“We think there’s a case for it to produce between 325 million to 350 million tonnes, but not go back up to historical highs,” he said.

Hill said Cloud Peak’s goal is to be the lowest-cost coal supplier in North America, and maintain its own market share with utility companies even as natural gas and renewables create wider competition among power producers.

“This is a very competitive fuel source that utilities have an economic decision to burn,” he said.

## “煤炭行业正在下滑”，看起来唐纳德•特朗普（Donald Trump）也不可能会把该行业拉出火坑

在他们最慷慨的拉斯维加斯奇怪的人中，唐纳德•特朗普赢得美国总统的机会是 25 比 1。换句话说，长枪一击可能反映了该国动力煤矿股的任何潜在反弹。

云顶能源公司首席财务官 Heath Hill 说，煤矿公司在美国最近选举的几个月里面临着新的法规的“猛攻”，包括奥巴马的“清洁能源计划”，该计划旨在鼓励在牺牲燃煤电力的情况下，更清洁的燃烧天然气和可再生能源。

“这实际上是一个‘保持煤炭在地面’的运动，非政府组织真正得到政府协调监管的良好支持，并以对煤炭行业非常不利的方式实施了规则。”Hill 说。

但是大家都知道，特朗普确实克服了这个可能性，对煤炭股的影响变得很明显。尽管最近出现回调，Cloud Peak 股价在过去 12 个月中上涨了 112%，而该公司也是数个发布大规模的股票价格反弹的热量煤炭矿厂之一。

多伦多证券交易所风险投资公司 Corsa Coal Corp.的股价在同一时期上涨了 120％。同样，Westmoreland 煤炭公司上涨 91%，CNX 煤炭资源增加 122%。

随着煤炭价格低落，越来越严格的法规和大规模的破产，煤炭的反弹一直很戏剧化，但是分析师认为不会持续。他们警告说，尽管川普在位，长期来看，该行业有可能继续损失市场份额给天然气和可再生能源。

研究员 IHS Markit 的电力和可再生能源副总裁王永林表示，推动电力市场淘汰电力的最大因素是天然气的成本竞争力，而不是新的规定。

她说：“你将要进行短期的拔河（煤炭和天然气之间的市场份额），但一般而言，煤炭正在下滑，即使是特朗普，也很难逆转。”

美国能源信息管理局（EIA）的数据显示，在 2015 年下半年，在美国天然气发电厂的电力生产首次超过了燃煤发电量。

然而，煤矿工人认为事情正在发生变化，大的投资者正相信他们的话。彭博伦敦金融集团有限公司（Clark＆Lunn Financial Group Ltd.）近期将其在云顶的投资增加了一倍，达到 180 万股，并将其持有的

Westmoreland 股份增加 175,888 股，使该公司的股票达到 251,991 股，根据 Bloomberg 数据。

希尔表示，云顶公司在怀俄明州和蒙大拿州的含煤地层运营三个矿井，可以在天然气价格在每千兆焦耳价格介于 2.50 美元到 3 美元之间的同时，直接与电力市场的天然气竞争。他还表示，煤炭业务从根本上改变为短期合同供电。

“我们需要有成本结构，所以当需求不在那里时，我们会减缓矿井的下降，而且当有需求时，增加矿井，所以这不是与过去一样的五年稳定的煤炭业务，这要短得多，更灵活。”他说。

环境影响评估最近的预测项目燃煤电力将从 2020 年以后的天然气市场份额中弥补一部分，甚至可能在 2030 年末，因为奥巴马的“清洁能源计划”在 2 月 9 日被禁止。

但王先生表示，IHS Markit 预计，到 2018 年，燃煤发电量将下降，“因为我们可能会看到煤电厂不断退休。”

热量煤矿矿厂的问题在于国内市场正在消失。多年来，燃煤发电占美国总发电量的 50％，但已下降到 30％。

王先生说：“我们预计到 2020 年，煤炭的份额将进一步下降到 30％以下，2030 年将略有超过 20％。”

美国的燃煤发电厂已经退役，并没有建造新的工厂来替代燃煤发电量不足。

电力和可再生能源的 Wood Mackenzie 研究总监 Wade Schauer 在一封电子邮件中说：“自从特朗普当选以来，我们看到煤炭衰退公告实际上是加速而不是减缓。这个趋势正在受到国家政策和公用事业的驱动，超出未来四到八年。”

北美市场萎缩将迫使像云顶这样的公司越来越多地关注出口市场。Hill 表示，Cloud Peak 已经在韩国拥有客户，但也着眼于日益增长的日本和中国市场。

希尔表示，除了特朗普最初的四年任期外，碳捕获和封存技术的投资可以帮助他的行业更加清洁并保持竞争力。该公司正在要求新政府考虑对碳捕获技术的补贴，就像美国政府目前资助可再生能源项目一样。

希尔表示，他希望新技术可以导致现有燃煤电厂的改造，或者潜在的建设更有效的工厂。

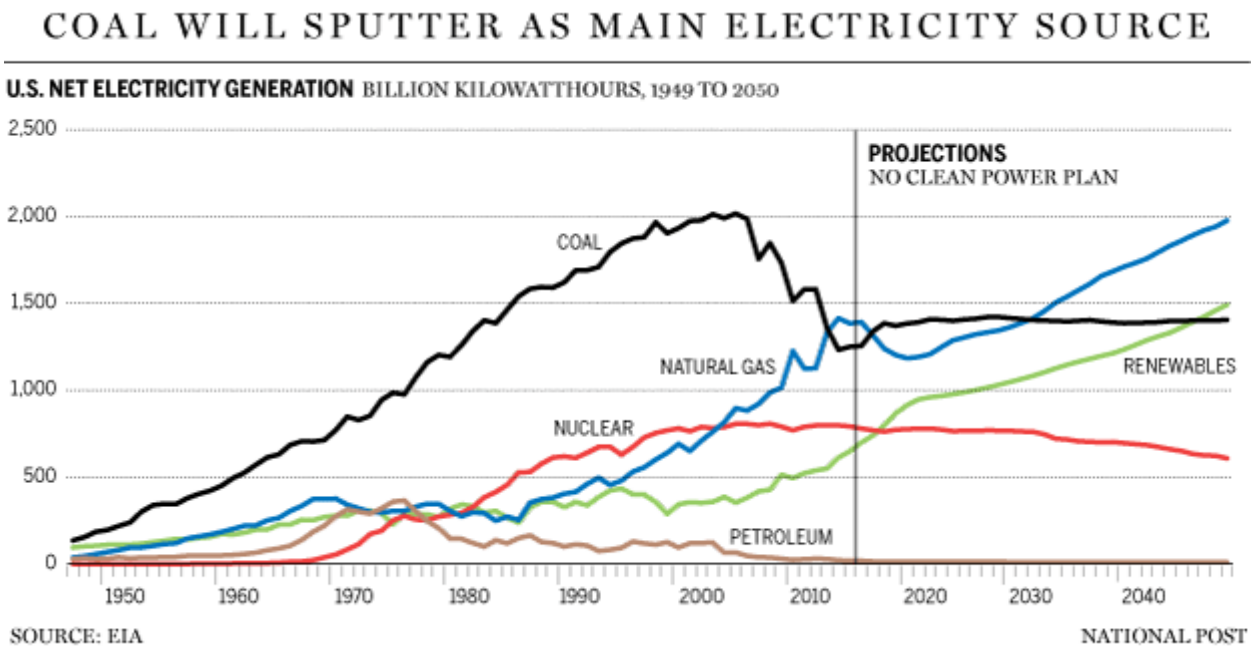
但王先生表示，除非资本成本急剧下滑，否则新的煤电厂不可能与天然气竞争。

“谈到日复一日地调度，承担短期调度成本运行的时候，那么根据目前的价格，这是煤和天然气之间的一场拔河。”她说，“当涉及到新的建造，天然气胜利。阶段性的。”

新燃气发电厂的资本成本约为每千瓦装机容量 1,400 美元，而燃煤发电装机容量为每千瓦 3,500 美元。

“他们并不紧密，”王先生说，并补充说，天然气厂也可以比燃煤发电厂建成得更快。

王先生预计，在上涨之前，从现在至 2020 年，天然气价格平均每千兆焦耳为 2.50 美元至 3 美元，此后随着燃煤电厂退役，天然气电力成为美国最大的电力来源。




在环境影响评估最乐观的情况下，2020 年天然气价格将平均为每千兆焦耳 4 美元，到 2030 年将达到每千兆焦耳 8 美元，到 2040 年将达到每千兆焦耳 10 美元。

“在那里的煤电厂确实对天然气价格造成了一些限制。”Wood Mackenzie 的主要天然气分析师 Gabe Harris 说。他说，煤电厂的退休可能会导致天然气价格上涨“更长，更强烈”。

他说：“我认为这是人们在退役煤矿中看到的危险之一：将会有一个尖峰。”

不过，近期天然气的前景在北美恶化。经过严峻的冬季采暖季开始之后，芝加哥和美国东北部等重要市场的暖气，NYMEX 天然气价格在 1 月份的每千兆焦耳上涨了 3.60 美元多，至本周为 2.82 美元。

“这是我 20 年来最热的冬天数据库。”哈里斯说，“从 10 月到现在，我估计我们每天需要耗费 40 亿立方英尺的天然气。”

冬季取暖季节疲弱，但 GMP FirstEnergy 分析师 Martin King 在 3 月 6 日的一份研究报告中指出，天然气价格可能已经触底，他预计今年将会出现“波涛汹汹”的复苏。

他说：“在这个阶段，即使气温比平均水平高，我们也不排除在短期内每每英热单位处理为 3 美元。”

一些天然气生产商，包括卡尔加里的彩石小石油有限公司，由于今年天然气前景疲软，已经缩减了支出计划。

这样的消息使得煤炭开采行业的高管有些看好他们的行业。CNX Coal 在第四季度的更新中指出，环境影响评估预测，2017 年燃煤电厂将燃烧 4100 万吨煤，比 2016 年燃烧的煤更多。

该公司表示：“我们认为，这种更强大的煤炭燃烧和持续的库存消耗将持续改善煤炭供需基本面。”

Hill 表示，Cloud Peak 运营的粉河流域每年生产 4 亿吨煤，但去年产量仅为 3.2 亿吨。

他说：“我们认为有一例可供出售 3.25 亿至 3.5 亿吨之间，但不能回升至历史新高。”

Hill 表示，Cloud Peak 的目标是成为北美地区成本最低的煤炭供应商，即使在天然气和可再生能源在电力生产商之间的竞争日益激烈，也在与公用事业公司的竞争中保持自己的市场份额。

“这是一个非常有竞争力的燃料来源，公用事业有经济的选择来燃烧。”他说。

# *Electricity（电力）*

# Wind farms could be “core providers” of grid stability, says AEMO

Australia’s wind farms could soon become “core providers” of crucial grid stability services, assuming a role currently dominated by the nation’s fossil fuel generators, a wind energy conference in Melbourne has been told.

Speaking at the 2017 Wind Industry Forum in Melbourne on Thursday, Australian Energy Market Operator principal Jenny Riesz said the growing need for frequency control and ancillary services (FCAS) on the NEM, as Australia’s thermal power generation was retired, presented an emerging opportunity for wind power.

Riesz, who outlined the findings so far of AEMO’s Future Power System Security Program, said the changing generation profile – and in particular, the addition of large amounts of large-scale solar to the grid – pointed to an important opportunity for wind; even as it continues to be singled out by detractors as an unreliable and grid destabilising energy source.

Indeed, Riesz told the conference that wind power could actually be better suited to the FCAS market, due to its ability to “ramp up more quickly” than thermal generators.

“They can really take advantage here,” she said.

The ability for wind power generators to provide contingency and regulation FCAS is about to be tested in Australia at the yet to be completed Hornsdale 2 wind farm in South Australia.

As we reported last month, the intention is to show that wind farms can provide a relatively reliable source of FCAS, in the face of unexpected voltage swings and other faults.

AEMO believes that encouraging wind farms to provide FCAS will also add more fuel choice to the narrow FCAS market, and lower prices. Currently, only a few gas generators provide FCAS in South Australia, leading to massive price spikes when the service is called upon.

But as John Dyson, from global consultancy Greenview, points out, much of the above has already been proven in other markets around the world, with considerable success.

“This is not a technical question,” Dyson told the conference on Thursday. “It’s a question of value, just like it is with gas.

“If wind … developers can get their heads around it, it could be really valuable for (them),” he said.

Dyson also urged market regulators and policy makers to work harder at getting their mind around wind as an FCAS provider, starting with a change in language and working from there.

“When should move away from terms like “spinning reserve”, he told the conference. Especially considering we could soon reach a point in the energy market “where nothing is spinning at all.” (Except, maybe, wind turbine blades.)

Kate Summers, a senior electrical engineer at Pacific Hydro and an authority on the subject of the peculiarities – and inadequacies – of Australia’s energy market, argues a complete rethink of the FCAS market is needed.

For one thing, Summers noted, our reliance on “synchronous” fossil fuel generators for NEM frequency control is not entirely logical; nor is it working.

“The traditional generators, which are synchronous, they depend on the frequency control to be synchronous,” she told the conference.

“The synchronous units, or the baseload synchronous units are at risk, right now, with the way that the power system is being managed.

“We were one contingency away from collapsing New South Wales,” Summers told the conference, referring to the near miss the majority coal-powered state experienced during a February heat wave.

“What is going on in the controls here is a lack of good power system control coordination of the settings on the generators themselves…

“This is a significant problem. And the reason I am pointing this out is because it is not the wind farms or the solar farms that will get harmed by this behaviour. It is 94 per cent of the generation fleet of the power system that is at risk of doing damage when this stuff goes wrong.”

## AEMO 说，风电场可能是电网稳定的“核心供应商”

在墨尔本风能会议上据悉，澳大利亚的风电场很快将成为关键电网稳定服务的“核心供应商”，承担了目前由国家化石燃料发电机主导的一个角色。

澳大利亚能源市场运营商负责人 Jenny Riesz 星期四在墨尔本举行的风能论坛上表示，随着澳大利亚火力发电的退出，新兴电力公司对频率控制和配套服务（FCAS）的需求不断增长，为风电提供了新机遇。

Riesz 概述了 AEMO 未来电力系统安全计划迄今为止的调查结果，他表示，不断变化的发电概况 - 特别是向电网添加大量大型太阳能 - 指出了风力发电的重要机遇；即使它被诋毁者认为是不可靠和电网不稳定能源。

事实上，Riesz 在会议上说，由于风力发电机比起热能发电机能够“快速上升”，因此风电实际上可能更适合于 FCAS 市场。

“他们真的可以好好利用这一点。”她说。

风力发电机提供应急和监管 FCAS 的能力将在还未完工的南澳大利亚州的 Hornsdale 2 风力发电场完成测试。

正如我们上个月报道的，目的是表明风电场可以提供相对可靠的 FCAS 来源，面对意外的电压摆动和其他故障。

AEMO 认为，鼓励风电场提供 FCAS 也将为狭窄的 FCAS 市场增加更多的燃料选择，降低价格。目前，只有少数燃气发电机在南澳大利亚提供 FCAS，导致在需要服务时大量价格上涨。

但是，来自全球咨询公司 Greenview 的约翰•戴森指出，上述大部分已经在世界其他市场得到证实，取得了相当大的成功。

“这不是一个技术问题。”戴森星期四在会议上说，“这是一个有价值的问题，就像气体一样。”

“如果风...开发商可以围绕它，这对他们来说可能是非常有价值的，”他说。

Dyson 还敦促市场监管机构和决策者更加努力地将风作为 FCAS 提供商，从语言和工作的变化开始。

他说：“什么时候应该摆脱像“旋转储备”这样的术语。”他在会议上说。特别是考虑到我们可以很快达到能源市场的一个要点，“没有什么是旋转的”（除了风力涡轮机叶片）。

澳大利亚能源市场的特点和不足之处，太平洋水电的高级电气工程师凯特•萨默斯（Kate Summers）认为需要对 FCAS 市场进行彻底的反思。

一方面，Summers 指出，我们依赖“同步”化石燃料发电机进行 NEM 频率控制并不完全符合逻辑; 其也没有效果。

她在会议上说：“传统的发电机是同步的，它们依赖频率控制来实现同步。”

“同步单元或基本负载同步单元现在有风险，正如电力系统的管理方式一样。

萨姆斯在会议中说：“我们是一个远离崩溃的新南威尔士州的一个突发事件。”指的是在二月份的热浪中，绝大多数煤电国家经历的错误。

“这里的控制措施是，缺少良好的电力系统控制协调发电机本身的设置...

“这是一个重大问题。而我指出的原因是，风电场或太阳能电厂不会受到这种行为的伤害。当这个事

情出错的时候，电力系统发电舰队的 94%有可能会造成损害。”

# S.A. blackout underlines need for smarter, quicker grid, says AEMO

The Australian Energy Market Operator says its investigations into the dramatic “system black” event last September in South Australia underline the need to for an overhaul of the energy market, and to embrace new fast response technologies, rather than relying on old “synchronous” coal and gas plant.

The fourth and final report into the state-wide blackout – which has sparked a huge political fight over the future of wind and solar generation in Australia, and scare campaigns about the impacts of more coal plant closures – was released on Tuesday.

It sheds little new light on the events that had not already been reported in the three previous reports, but rather than calling for a halt in what many describe as the inevitable energy transition, it underlines the need to embrace it.

This will be surely be one of the major initiatives from the newly installed CEO Audrey Zibelman, who was most recently the head of New York state’s ambitious “Reform the Energy Vision” program and its target of reaching 50 per cent renewables by 2030.

Indeed Zibelman, in her first public comments since taking her new role on March 20, underlined the urgency of change, and talked of the need of a “flexible network” that can respond in “real time and truly real time.”

“That is going to need a different approach,” she said. “Australia is leading the world …. ” She said the focus would be on better data and working on the “demand” side of the load. But because of the rapid pace of technological change “we don’t have multiple years any more” to get systems right.

The AEMO report into the system black acknowledged that there is now a need to source additional security from new technologies – such as storage and demand response, along with large-scale solar, wind farms, and household solar and storage – rather than relying on traditional coal and gas plants.

“As the generation mix continues to change across the NEM, it is no longer appropriate to rely solely on synchronous generators to provide essential non-energy system services (such as voltage control, frequency control, inertia, and system strength),” the report says.

“Instead, additional means of procuring these services must be considered, from non-synchronous generators (where it is technically feasible), or from network or non-network services (such as demand response and synchronous condensers). “

One of the big lessons of the event and subsequent reports is the need for a grid that is “smarter” and responds quicker to unforeseen events, and also for AEMO to better understand the performance characteristics of the plant at its disposal.

“While the NEM has successfully dispatched and co-optimised markets for energy and ancillary services for many years, the current mechanisms may not deliver the services required for the future as traditional providers of synchronous generation retire,” it says.

Instead, it will need to turn to new sources such as utility-scale solar PV, wind farms, batteries, “and importantly” distributed generation such as rooftop solar and battery storage installed “behind the meter” in customer premises.

This refers to the development not just of large-scale storage linked with wind and solar farms, but also to the development of “virtual power plants” of residential solar and battery storage, the likes of which are being tested by AGL, SA Power Networks and others.

“Like all technology development, there is a need to support early deployment to ensure potentially attractive solutions can be both technically and commercially deployed in the NEM.”

Because of this, AEMO is looking to work with ARENA for more “proof of concepts” projects, although it has also argued in its submission to the Finkel Review for greater power over minor rule changes to be able to accommodate new technologies.

Already, the South Australian and Victorian governments have taken the initiative by announcing two of the biggest battery storage tenders in the world, both of around 100MW, in coming weeks and months.

AEMO also wants to look at fast frequency response from batteries and other storage technologies, inverter connected generators (wind and solar farms), DC interconnectors, supercapacitors and “improved”traditional sources such as flyweels and synchronous condensors.

Most mainstream media – and particularly the ABC and Murdoch media – used the report to once again blame wind energy for the blackout, and pursued that line in a later press conference.

But AEMO chairman Tony Marxsen said it was not about wind or any other technologies. Blackouts had been caused by settings on coal plants more than a decade ago, by gas plants (including one big near miss on March 3, and by wind farms.”

“All caused massive disruption. They had very little to do with type of generation. It is not about renewables,” he said.

Pressed on whether having a coal generator in the system would have made a different, he said, no “there are too many variables” and pointed to past blackouts caused by the failure of the ageing Northern generator that is no longer in service.

AEMO’s hunger for “good data” is not just limited to new wind and solar farms and behind the meter solar and battery storage. It has admitted – although it doesn’t make much of the issue in this 260-page report – that some legacy coal and gas generators have no performance standards, and that it may not even know what their control settings are.

AEMO also didn’t know about the software settings on fault ride through mechanisms on wind farms. While the nature of wind farms (their variability) was not an issue and the wind turbines “successfully rode through grid disturbances”, it was the control settings that its says were found to have led to the system black.

Those settings have since been adjusted, and the problem fixed, and means such an event will not be repeated, as was highlighted when the state’s two biggest gas generators unexpectedly tripped in early February. Despite the immediate loss of 600MW of generation, the grid held stable.

But the report also highlights that the big gas generators were not able to react quickly enough to the dramatic events that followed the collapse of three main transmission lines, because they needed up to six seconds to respond to changes in system frequency. By that time, it was too late

“The rapid decline in system frequency following loss of the Heywood Interconnector did not allow time for more substantial governor response from these units, as it can take up to six seconds for these generating units to increase their active power output when they participate in the contingency FCAS market.”

The issue around governor responses has been highlighted by several new reports submitted to the Finkel Review. Battery storage can provide a response in milliseconds and some say that installations of sufficient size may have helped avert the disastrous events of last September.

The issue goes further than that, though. In its own submission to Finkel, AEMO admits that many of the legacy coal and gas generators have no performance standards, and it may not even know what their control settings are.

This is underlining a push for a fact-finding mission, in the form of updating generation plant requirements, and also a push for more controls and measures across a range of issues.

AEMO has released a total of 19 recommendations, including eight that are new. Three key recommendations, including the change of the ride-through settings on wind farms, have already been implemented.

AEMO is also reviewing its own response to weather forecasts, admitting that a weather update provided on September 28 did not trigger a reassessment of power system contingencies.

It admits this is a “weakness” although it insists it still would not have prompted any further precautionary action – such as reducing flows on the interconnector or calling for more local back-up.

This was also a weakness highlighted in the recent heat-wave in South Australia, when it failed to anticipate high temperatures that led to a surge in demand and a shortfall in supply, leading to yet more rolling blackouts, more political controversy, and the push by the state government to announce its own energy plan, including its own measures to ensure system security by ensuring new technologies such as storage were introduced, and its own back up generation installed.

Indeed, AGL – the owner of the state’s biggest gas generator and many wind farms – said that its wind assets performed as expected and to their “generator performance standards and their licensing requirements.”

But it also questioned the way that AEMO had set up the network on the day – when it chose not to ramp down the flow of the inter-connector or commission additional back-up within the state.

“For example, why was there full reliance on the inter-connector and wind?” AGL said, before noting recommendations that had since been made that are directed at ensuring system strength and stability in circumstances where the interconnect may trip or fail.

## AEMO 表示，S.A.停电突出对更智能更快捷电网的需求

澳大利亚能源市场运营商表示，去年 9 月在南澳大区对“系统黑”事件进行的调查显示，需要对能源市场进行大修，并采用新的快速响应技术，而不是依靠旧的“同步”煤和天然气厂。

周四公布了全国停电的第四次也是最后一次报告 - 这引发了澳大利亚风能和太阳能发电未来的巨大政治斗争，以及关于更多煤矿工厂关闭影响的恐慌活动。

在以前的三份报告中，还没有报道过的事件，这些事情没有什么新的光彩，而是要求停止许多人将其描述为不可避免的能源转型，报告强调需要接受它。

这肯定是新上任的首席执行官奥黛丽•齐贝尔曼（Audrey Zibelman）的主要举措之一，他最近是纽约州雄心勃勃的“改革能源愿景”计划的主管，其目标是到 2030 年达到 50％可再生能源。

事实上，Zibelman 在 3 月 20 日担任新任职以来首次公开征询意见，强调了变革的紧迫性，并提到需要“灵活的网络”，以“实时、真的实时”回应。

“那将需要一种不同的方法。”她说，“澳大利亚领先世界... ”她说，重点将在于更好的数据，并在负载的“需求”方面开展工作。但是由于技术变革的快速发展，“我们没有很多年”去使系统正确。

AEMO 报告系统黑色承认，现在需要从新技术（如存储和需求响应）以及大型太阳能、风力发电场和家用太阳能和存储等方面提供额外的安全性，而不是依靠传统的煤矿瓦斯厂。

“随着新一代的发电组合不断发生变化，仅依靠同步发电机提供基本的非能源系统服务（如电压控制、频率控制、惯量和系统实力）已不再适合。”报告说。

“相反，必须考虑采用这些服务的其他手段，从非同步发电机（在技术上可行），或者来自网络或非网络服务（如需求响应和同步电容器）。”

事件和后续报告的主要教训之一是需要一个“更智能”的电网，并更快地响应不可预见的事件，并为 AEMO 更好地了解其所在工厂的性能特征。

“虽然 NEM 已经成功地发送和共同优化了能源和辅助服务市场多年，但目前的机制可能不会为传统的同步发电退出提供商提供未来所需的服务。”它说。

相反，它将需要转向新的来源，如公用事业规模的太阳能光伏、风力发电场、电池，“并且重要的是”客户端后面安装“屋顶太阳能和电池存储器”的分布式发电。

这意味着不仅仅是与风电和太阳能电厂相关的大规模存储的发展，而且是开发住宅太阳能和电池存储的“虚拟发电厂”，其中正在由 AGL、SA 电力公司和其他公司测试的。

“像所有技术开发一样，需要支持早期部署，以确保潜在的有吸引力的解决方案可以在技术上和商业上部署在 NEM 中。

因此，AEMO 正在寻求与 ARENA 合作，提供更多的“概念证明”项目，尽管在提交给 Finkel Review 的论文中也提出了更大的权力，以便能够适应新技术。

南澳大利亚州和维多利亚州政府已经主动宣布在接下来的几个星期和几个月内，世界上最大的电池存储投标量都在 100MW 左右。

AEMO 还希望看到电池和其他存储技术的快速响应，逆变器连接的发电机（风力和太阳能发电机）、直流互连器件、超级电容器和“改进的”传统电源，如飞行器和同步电容器。

大多数主流媒体 - 特别是 ABC 和默多克媒体都用这份报告再一次将风能归因于停电，并在以后的新闻发布会上追求这一点。

但是，AEMO 董事长马克思森（Tony Marxsen）表示，这不是关于风力或其他技术。十多年前，由于燃煤电厂（包括 3 月 3 日风力发电场的一个大错误）造成了停电。

“所有这些都造成了巨大的破坏。他们与一代人的关系很小。它不是关于可再生能源。”他说。

按照系统中的发电机是否有所不同，他说，没有“太多变数”，并指出由于不再使用的北方发电机故障而导致的过去停电。

AEMO 对“好数据”的渴望不仅限于新的风力和太阳能发电场以及超出太阳能和电池存储。它已经承认，尽管在这 260 页的报告中没有太多的问题 - 一些传统的煤气和天然气发电机没有性能标准，甚至不可能知道他们的控制设置。

AEMO 也不知道有关风力发电机组故障的软件设置。虽然风电场的性质（它们的变异性）不是一个问题，而风力发电机“成功地绕过电网干扰”，但是它被认为是导致系统变黑的控制设置。

这些情况已经被调整了，问题得到解决，意味着这样一个事件不会重复，正如当时两个最大的气体发生器在二月初意外地绊倒时所强调的那样。尽管发电即将损失 600MW，但电网保持稳定。

但报告还强调，大型天然气发电机不能对三条主要输电线路崩溃后发生的剧烈事件做出足够的反应，因为需要长达 6 秒的时间来应对系统频率的变化。那时候就太晚了。

“由于 Heywood Interconnector 的损失后系统频率的迅速下降并没有给这些单位更多实时的州长作出响应的时间，因为这些发电机组在参与应急时可能需要 6 秒的时间才能提高其有功功率，当他们参加 FCAS 应急市场。”

关于总督回应的问题已被提交给芬克尔评论的几份新报告强调。电池存储可以以毫秒为单位提供响应，有人说安装足够的尺寸可能有助于避免去年 9 月的灾难性事件。

然而，这个问题比这更进一步。AEMO 在向芬克尔提交的文件中承认，许多传统的煤气和天然气发电机没有性能标准，甚至可能不知道它们的控制设置。

这突出了推动实况调查任务的一个推动力，更新了发电厂的要求，同时也推动了一系列更多的控制措施。

AEMO 总共发布了 19 项建议，其中 8 项是新的。三项关键建议，包括改变风电场穿越环境，已经实施。

AEMO 正在审查自己对天气预报的回应，承认 9 月 28 日提供的天气更新没有引发对电力系统突发事件的重新评估。

它承认这是一个“弱点”，尽管它坚持认为仍然不会提出进一步的预防措施，例如减少互连器上的流量或呼叫更多的本地备份。

这也是南澳最近热潮强调的一个弱点，当时没有预料到高温会导致需求激增和供应短缺，导致更多的停电，更多的政治争议和由国家政府公布其自身的能源计划的推动，包括采取措施确保系统安全，确保存储等新技术的出台，并安装了自己的备份。

事实上，国家最大的天然气发电机和许多风力发电场的拥有者 AGL 表示，其风力发电项目按照预期和“发电机性能标准及其许可要求”执行。

但它也质疑了 AEMO 在当天建立网络的方式 - 当时它选择不降低连接器的流量或者在该州内进行额外的备份。

“例如，为什么完全依赖连接器和风力发电？”AGL 说，在注意到这样一些建议之前，这些建议旨在确保互连可能跳闸或失败的情况下的系统强度和稳定性。

# Beijing’s green electricity credentials questioned

When Beijing shut its last coal-fired power station this month, state media trumpeted the smog-plagued city as China’s first to have all its power plants fuelled by clean energy. But the claim, energy experts suggest, is largely “greenwashing” because most of Beijing’s electricity is imported from equally dirty plants outside the capital.

The closure of the Huaneng Beijing Thermal Power Plant, which overlooks a swath of rusting warehouses, vehicle repair shops and a tangle of brick houses rented by migrant workers, was the final step in a multiyear plan for Beijing to shut its four remaining coal-fired plants and replace them with ones using natural gas, which produce about half the emissions.

“As an ordinary labourer, I do not pay much attention to things like air and the environment,” says Feng Huawei, a construction worker who has lived near the base of the plant for four years. “But I think overall closing the plant is quite a good thing. It means less obvious pollution.”

Huaneng burnt 1.76m tonnes of coal a year, according to state media agency Xinhua, and taking it off the grid would help lower the city’s noxious sulphur dioxide and nitrogen oxide emissions.

But 70 per cent of Beijing’s electricity is generated outside of the city, with the bulk coming from Shanxi province and Inner Mongolia via transmission lines running through neighbouring Hebei province. All three provinces have enormous coal-fired power generation capacity, and more than 60 per cent of Beijing’s electricity consumption still comes from coal, according to China’s National Energy Administration.

That means closing Huaneng is only a partial solution, says Yang Fuqiang, a senior adviser on climate and energy at campaign group the Natural Resources Defense Council in Beijing. “Beijing still consumes about 10m tonnes of coal [a year]. We would like to see coal consumption cut more quickly and deeply.”

Liansai Dong, a climate and energy campaigner at Greenpeace acknowledges that the fall in local emissions of harmful pollutants, including dust, sulphur dioxide and heavy metals could benefit Beijing’s residents. “However, it is quite a simplification of the problem to say Beijing is entirely relying on natural gas-fired power plants.”

Beijing faces a critical gap between energy supply and demand; the city’s 27 power plants have a total installed capacity of just over 11,000 megawatts, roughly half of what is required to meet its energy demands.

As a result, Beijing imported 57bn kWh of energy from China’s coal-heavy north-east provinces in 2014, the last year for which numbers are available.

That has experts worried that Beijing’s coal shutdowns are not reducing overall emissions.

“What we are most concerned with is this does not cut carbon dioxide emissions, because increased coal electricity production in other provinces also increases carbon dioxide emissions as a result,” says Mr Yang.

Still, most environmentalists and energy policy experts praise the plant closure as a move in the right direction.

"The closure of the city's last coal-fired plant is significant because it is likely a harbinger of things to come for a far larger region that currently faces air quality issues, of which Beijing is only a part," says Anders Hove, an associate research director at the at the University of Chicago's Paulson Institute.

Beijing has made significant efforts to increase the presence of renewable energy sources — wind, solar and hydropower — in its electricity generation mix. It has set a national target for the share of non-fossil fuel electricity to reach 30 per cent by 2020. Last April, energy regulators announced that China had suspended plans for about 200 coal-fired power generators, contributing to a global slump in coal demand.

# 北京：一座全部实现清洁能源发电的城市？

官媒称北京已成为中国首个清洁能源发电城市，但实际上北京市 70%电力由外埠供应，其用电量的逾 60%仍来自燃煤发电

当本月北京关停最后一座燃煤电厂时，官方媒体宣称，饱受雾霾困扰的北京由此成为中国首个全部实现清洁能源发电的城市。但能源专家表示，这种断言大体上是在"漂绿"(greenwash)，因为北京大部分电力都输自京外污染同样严重的电厂。

华能北京热电厂(Huaneng Beijing Thermal Power Plant)周围是一片外观锈迹斑斑的仓库、各种修车店以及农民工租住的杂乱的砖房。按照前几年公布的一项计划，北京要陆续关停本市最后 4 座燃煤电厂，代之以排放约少一半的燃气热电厂，而关停华能燃煤热电厂就是这项计划的最后一步。

"咱就是一个普通的干活的，不太关心空气、环境啥的，"在该电厂附近住了 4 年的建筑工人冯华伟（音）说，"但我觉得全关了是好事，污染就不会那么重了。"

中国官方通讯社新华社报道称，华能一年需要燃煤 176 万吨，将其关停将有助于降低北京市的有害二氧化硫、氮氧化物排放。

但北京市 70%的电力来自外埠，其中大部分来自山西和内蒙古，通过经由河北的输电线输入北京。这 3 个省（自治区）都拥有庞大的煤电装机容量，而根据中国国家能源局的数据，北京用电量的逾 60%仍来自燃煤发电。

自然资源保护协会(NRDC)北京代表处的气候与能源问题高级顾问杨富强表示，这意味着关停华能只能解决部分问题。"北京（一年）仍要消耗约 1000 万吨煤。我们希望看到煤炭消耗量更快、更大幅的下降。"

绿色和平(Greenpeace)的气候与能源活动人士董连赛承认，本地有害污染物排放减少，包括粉尘、二氧化硫、重金属，对北京居民有好处。"但是，说北京全部依赖燃气热电厂，未免把问题太简单化了。"

北京市的能源供给与需求之间存在着巨大缺口；全市 27 座电厂的总装机容量刚超过 1.1 万兆瓦，仅能满足本市约一半的能源需求。

因此，根据可获得的最新数据，2014 年，北京市从中国北方产煤大省输入的电量为 570 亿千瓦时。

令专家们担心的是，北京市关停燃煤电厂并不意味着排放总量下降。

"我们最关注的是，这样做不能减少二氧化碳排放，因为其他省燃煤发电增加也会导致二氧化碳排放增加，"杨富强说。

尽管如此，大多数环保主义者、能源政策专家都称赞北京市关停燃煤电厂是朝着正确方向迈出的一步。

芝加哥大学(University of Chicago)保尔森研究所(Paulson Institute)副研究主管安德斯•霍夫(Anders Hove)表示："北京市关停最后一座燃煤电厂意义重大，因为对目前面临空气质量问题的更广大地区——北京只是其中一部分——而言，这很可能是一个预示未来形势变化的先兆。"

中国已经采取了重大举措，力求提升风能、太阳能和水力等可再生能源在电力结构中所占的比重，其目标是到 2020 年非化石能源发电量的占比达到 30%。去年 4 月，能源监管部门宣布，中国暂停了约 200 座燃煤电厂的建设计划，导致全球煤炭需求暴跌。

然而，中国的电网一直难以消纳新型可再生能源发电。根据中国国家电网(State Grid Corp)的数据，由于输电线路缺乏、电网容量不足导致无法并入电网而造成弃风和弃光，2016 年，中国浪费了 497 亿千瓦时

的太阳能和风能发电量。

北京严重依赖从山西和内蒙古输入电力，而根据绿色和平的数据，这两个省（自治区）因弃风限电每年浪费的电量相当于它们输至北京的电量的 30%。

今年 2 月，在发现大量风电场完全没有并入国家电网、所发电力无处可送之后，中国能源监管部门暂停了对 6 个省所有新风电项目的审批。

华能北京热电厂周边的居民对这种政策困境泰然处之。“那个厂似乎确实不冒烟了，”在电厂附近一处仓储设施工作的金勒（音）说，“我到现在才注意到，因为北京市政府在重大（政府）会议期间就让电厂停工。但是他们没把电厂拆掉。他们可以随时让它复工。”