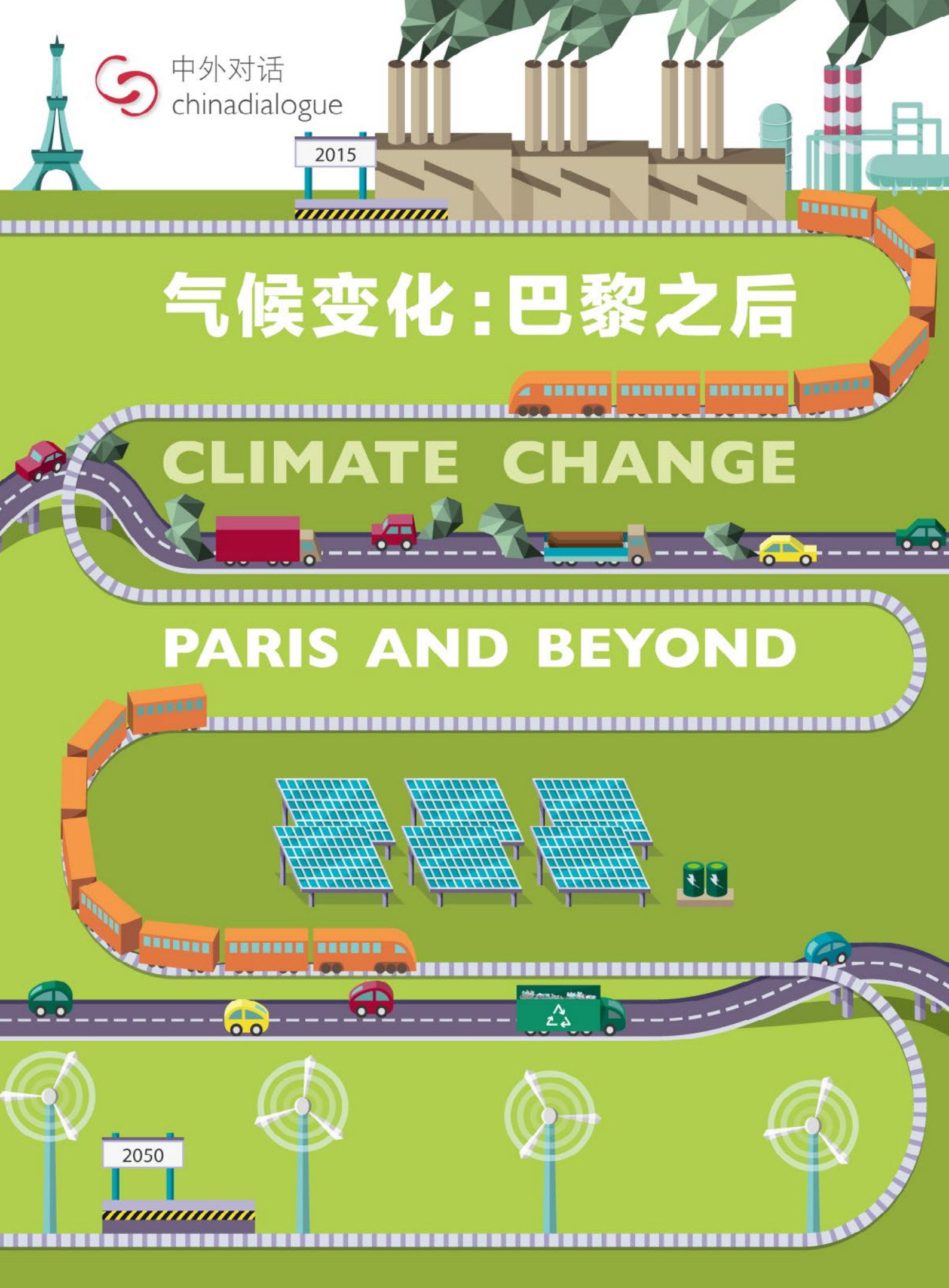
中外对话
chinadialogue



气候变化：巴黎之后

CLIMATE CHANGE
PARIS AND BEYOND

关于“中外对话”

“中外对话”是一个独立的非营利性组织，以伦敦、北京、德里和圣保罗为中心开展工作。

“中外对话”的主要业务是其独特的完全双语网站，它通过发表精辟、原创的中外文章、评论和分析，促进世界理解中国崛起带来的全球性生态环境影响，进而共同寻求公平可行的全球环境问题解决之道。

“中外对话”在很多机构的资助下运作，其中包括英国环境、食品和农业事物部、壳牌（中国）以及许多基金会。

关于“中外对话”内部交流刊物及网站

《中外对话》内部交流刊物是“中外对话”网站文章的精华。我们从网站上精心挑选了趣味盎然而极富挑战性的深度报道以及展现科技进步的新闻信息，方便与您的交流。欲阅读更多精彩的文章，请您登陆“中外对话”网站（http://www.chinadialogue.org.cn）。

“中外对话”网站以中国前沿环境记者撰写的文章、对国际知名人士的访谈以及对全球重大问题的深入报道为主要内容，通过网站，您可参阅每日全球环境新闻、赏析高质量的文章和参与“零语言障碍”的讨论（双语发布）。

另外，通过全球双语志愿者的帮助，您还可以在线与英文读者顺畅进行跨文化交流。在那里，您可以提出疑问、挑战专家观点、贡献您的知识和了解他人独到的见解。

加入讨论您就走出了解决问题的第一步。

What is *chinadialogue*

chinadialogue is an independent, not-for-profit organisation based in London, Beijing, Delhi and Sao Paulo.

chinadialogue's primary vehicle is our website (http://www.chinadialogue.org.cn), a unique bilingual platform which promotes a global understanding of the environmental impact of China's rise by publishing informed articles, commentaries and analysis by writers from inside and outside of China. We aim to inform, educate, and contribute to building a global consensus on fair and workable solutions.

chinadialogue is now read in 208 countries and regions and in all regions of China.

About our journal

Produced on a bi-monthly basis, our journal brings you the best articles and reports from *chinadialogue*. If you want to contribute to the discussion you can visit our website (http://www.chinadialogue.org.cn) to add your comments and thoughts. Join the debate and be part of the solution.

▶ 联 系 我 们

有关供稿请联系：
ideas@chinadialogue.net(English)
ideas.cn@chinadialogue.net（中文）

有关在经济上支持中外对话请联系：
support@chinadialogue.net

有关获得与中外对话进行合作项目的信息请联系：
lushan.huang@chinadialogue.net

有关咨询中外对话实习或者工作信息请联系：
lushan.huang@chinadialogue.net

有关咨询加入中外对话志愿者翻译员请联系：
volunteer@chinadialogue.net

▶ Contact Us

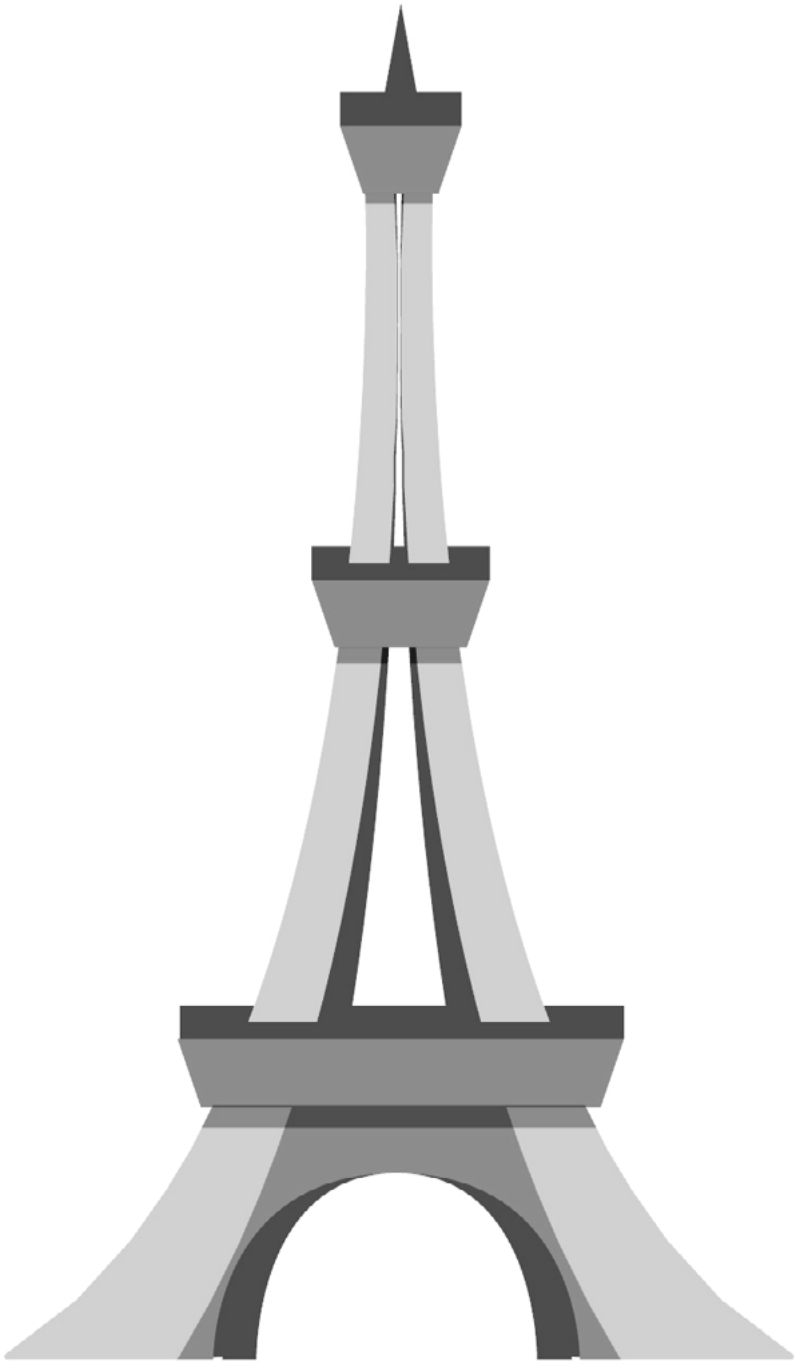
For editorial submissions, please contact:
ideas@chinadialogue.net (English)
ideas.cn@chinadialogue.net（中文）

For information on how you can support chinadialogue financially, please contact:
support@chinadialogue.net

To receive information on chinadialogue partnership programmes, please contact:
lushan.huang@chinadialogue.net

To enquire about internships or jobs at chinadialogue, please contact:
lushan.huang@chinadialogue.net

To enquire about joining chinadialogue's network of volunteer user-comment translators, please contact:
volunteer@chinadialogue.net



气候变化：巴黎之后

CLIMATE CHANGE
PARIS AND BEYOND

前言

巴黎气候峰会需加快推动世界走向低碳未来

《中外对话》总编：伊莎贝尔 • 希尔顿

“巴黎会议是起点，而非终点。”

参加 12 月巴黎气候峰会的谈判代表如是说道，他们的肩上担负着达成一项有意义的气候协议的重任。

即将召开的气候峰会能否帮助世界大力削减碳排放，从而避免灾难性的全球变暖？亦或者，各国集团是否会围绕如何使用全球剩余的“碳预算”（即在保证平均气温上升不超过科学家推荐的 2 摄氏度的前提下，全球还能够排放的二氧化碳量）展开争论，导致此次联合国大会陷入困境呢？

联合国官员表示，各国向联合国提交的气候计划（即《国家自主贡献》（INDCs））的累积效应让他们对未来的形势持乐观态度。包括全球最大排放国在内的 170 多个国家在《国家自主贡献》中提出了本国的限排计划。《联合国气候变化框架公约》秘书处执行秘书、哥斯达黎加外交官克里斯蒂娜·菲格雷斯认为，这些计划提出的限排量虽然还不足以将平均气温上升幅度控制在 2 摄氏度以内，但他们已经开始“让碳排放朝有利的方向延伸”。

2009 年的哥本哈根气候会议在混乱中结束。而对于当年国际社会开展的自上而下的气候行动，克里斯蒂娜·菲格雷斯认为“状况真的非常糟糕”。相反，在巴黎气候峰会即将召开之际，大多数主要排放国都采取了更为自愿的、自下而上的手段。克里斯蒂娜认为，虽然围绕这些复杂的谈判总是有一些令人困惑的杂音，但谈判传达的信号是明确的。

政府的承诺表明，主要排放国引领高污染化石燃料转型是符合其国家利益的。去年，中美两国签订的具有里程碑意义的气候协议则表明了这两个战略竞争对手紧密合作、携手遏制碳排放的意愿。

克里斯蒂娜·菲格雷斯指出，哥本哈根会议上激烈的辩论结束以来，许多其他因素都发生了改变。可再生能源，尤其是太阳能价格的大幅下跌；技术创新让可再生能源和电动汽车电力存储设备的价格变得更加合理；更加智能化和地区化的电网也推动了发电和电力分配方式的转型。

此外，金融业如今也更多地意识到了气候变化和能源转型给数万亿美元化石燃料投资带来的威胁。特别是，如果巴黎协议最终提出的减排方案不仅能够随着时间的推移而不断深化，而且能确保可再生能源成为未来更加安全的投资选择的话，化石燃料投资将面临着更大的风险。

尽管存在这些趋势，各国想要在巴黎气候峰会上达成有意义的气候协议，还面临着一些潜在的障碍。

发展中国家对发达国家气候融资承诺的不信任仍可能使协议达成的过程复杂化。

定期对减排目标进行“调整”和“审核”能够在何种程度上深化减排工作，这一点对于极易受到气候变化影响的国家而言至关重要。

FOREWORD

PARIS SUMMIT WILL NEED TO SPEED THE WORLD TO A LOW CARBON FUTURE

chinadialogue Editor: Isabel Hilton

" Paris will be the departure point, rather than final destination."

So goes the metaphor offered by those tasked with delivering a meaningful climate deal in Paris in December.

Will the climate summit help put the world on track to the deep emissions cuts needed to avoid catastrophic global warming? Or will the UN process bog down in argument between different blocs of countries on how to use the world ' s remaining ' carbon budget ' – the amount of CO_2 that the world can emit whilst remaining below the scientists ' recommendations of a 2C threshold?

The cumulative effect of climate plans submitted to the UN, known as Intended Nationally Determined Contributions (INDCs), its officials say, give grounds for optimism.

The INDCs lay out how more than 170 countries, including the world ' s biggest emitters, intend to limit their emissions. Although the plans will need to go much further to meet the 2C target, the UN climate chief, the Costa Rican diplomat Christiana Figueres, points out that they have already begun to " bend the curve."

Top-down international action in 2009, the year of the Copenhagen climate conference that ended in disarray, " was in a really bad place," said Figueres. In the run up to Paris, on the other hand, most major emitters have adopted a more consensual, bottom-up approach. And, despite the confusing noise that surrounds these complex negotiations, the signals, she said, are clear.

Government pledges reflect the national interest of major emitters leading moves to shift from highly-polluting fossil fuels, while a landmark climate agreement between the US and China, signed last year, testifies to the willingness of strategic rivals to co-operate closely on curbing emissions.

Figueres points out that much else has changed since the acrimonious climate summit in Copenhagen. The cost of renewables, particularly solar energy, has fallen sharply; technological innovation promises affordable storage for renewable energy and electric vehicles; and power generation and distribution is being transformed by increasingly localised, smarter power grids.

Moreover, the financial sector is now much more aware of the risks that climate change and the energy transformation could pose to the trillions of dollars invested in fossil fuels. Particularly if a Paris agreement anchors emissions cuts that can be deepened over time and ensure that renewables are a safer investment in the future.

But, despite these trends, there are still some potential obstacles to success in Paris.

The mistrust that poor countries show towards rich world promises on climate finance could still complicate progress towards a deal.

And the extent to which emissions cuts can be deepened through regular " ratchet" and " review" will be critical for the vulnerable countries most at risk from the damage done by the major emitters.

目 录

CONTENTS

气候谈判 Climate talks

中国能源和气候 China energy and climate

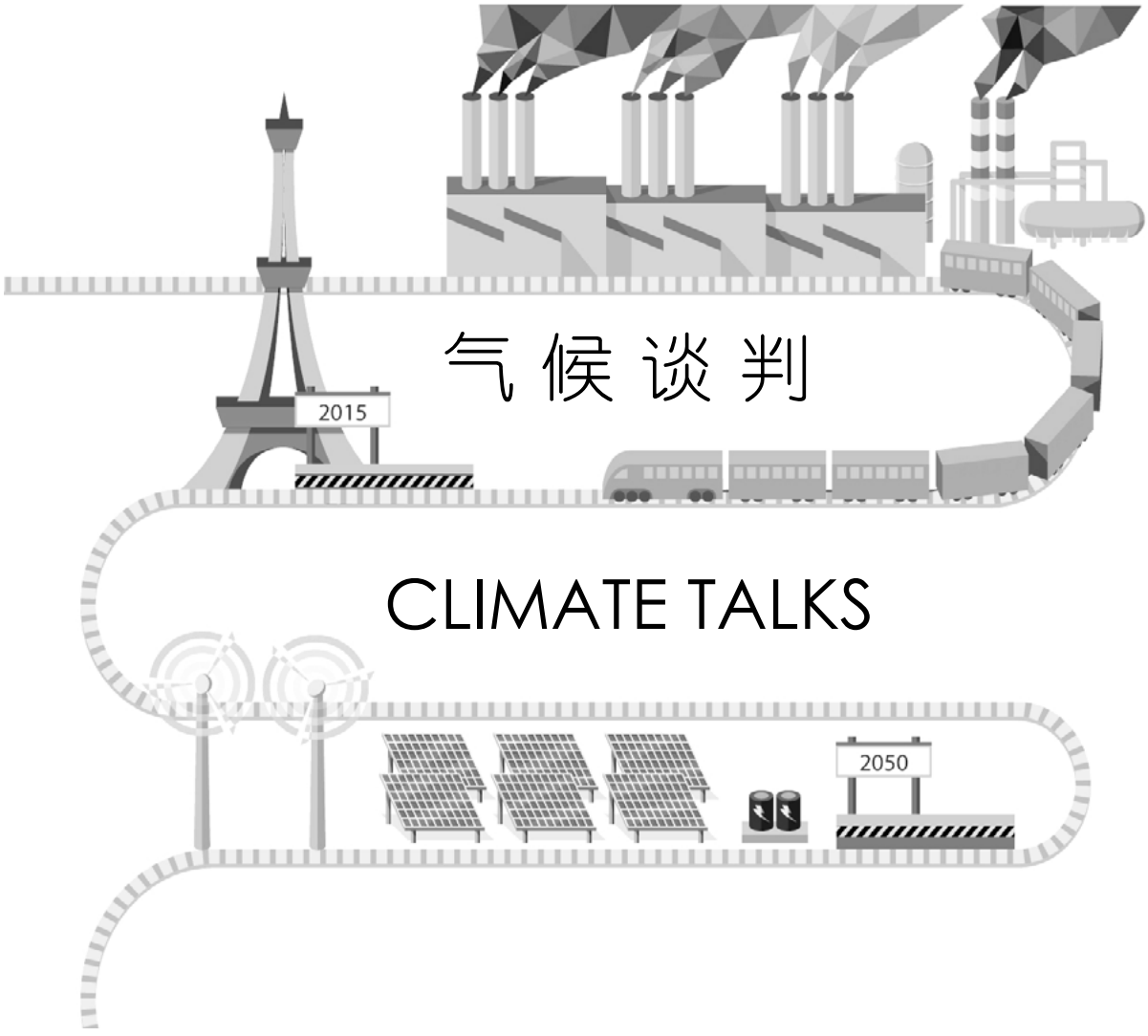
中国与世界，环境危机大家谈

China and the world discuss the environment

气候移民 Mitigation

气候金融和法律 Finance and law

气候影响 Impacts



气候谈判

CLIMATE TALKS

巴黎气候协议究竟需要解决什么问题?

周一在巴黎举行的联合国气候大会聚集了全球200多位领导人和各界高层，是时候协商解决各种遗留已久的棘手问题了。

约翰·麦克加里蒂

时间紧迫，参与各方必须在不到两周的时间内就如何避免全球变暖继续恶化达成一致。2009 年的哥本哈根气候峰会在一片批评声中落幕。与哥本哈根不同，巴黎大会的关键不在于是否签订协议，而是要看协议各方最终的行动决心有多大。法国在过去一年在外交上进行了不懈的努力，加之最近的恐怖袭击，巴黎大会若最终无法达成任何协议，后果无疑是十分严峻的。

大会的关键在于，最终协议是否可以给出清晰的步骤图，确保全球变暖不超过 2 摄氏度。要想实现这一目标，必须进行低碳能源转型，远离化石燃料，削减温室气体排放。今年的温室气体排放浓度水平已经超过了百万分之 400，达到了近百万年来的最高点。一旦超过了这个临界点，全球生态气候将面临巨大的劫难，洪水、干旱和极端温度天气都将给地球带来严峻考验。

以下是巴黎会谈此次亟需解决的几大问题：

2020年后的及长期减排目标

据测算，如果能将与会的 180 个国家提交的“国家自主贡献预案(INDCs)”全部落实，那么全球温升平均将不超过 2.7 摄氏度。

即便将全球变暖程度控制在 2 摄氏度范围内，极端天气事件出现的频率也会居高不下。所以，必须快速推出更有魄力的“国家自主贡献预案”。那些最易受到气候变化影响的国家，比如有些小岛国家认为，如果全球温升超过 1.5 摄氏度，他们的国土就将永远从地图上消失。

中国、欧盟和美国这样的排放大国都已经开始践行减排措施了。例如，限制煤电发电厂数量，扩大可再生能源利用比例，提高能效和智能电网覆盖率以推广电动汽车使用等等。

“碳预算”是指在保证全球变暖不超过 2 摄氏度的情况下可以“安全”使用的化石燃料总量。要想保证全球碳使用量符合这一预算，全球最大的几个经济体和发展中国家就必须放弃煤炭和石油，帮助遏制温室气体排放迅猛增长的势头。

比如，作为全球最大的两个温室气体排放源，中美两国需要逐步淘汰多年来的能源结构，同时保证低碳替代品可以满足人口和经济增长带来的巨大能源需求。煤炭能源曾经帮助西方国家快速实现工业化和财富积累。然而，否能够说服全球第三大温室气体排放国印度放弃上述这种传统的能源方式还是个未知数。

截至目前，种种迹象显示，印度尚无计划放弃自己在全球剩余碳预算中的可使用量。巴黎大会的主要目标应该是如何树立长期目标，在 2050 年前大幅削减温室气体排放量，并在本世纪末彻底完成无碳化进程，即便这一过程中没有任何法律性的强制要求。与大型发展中国家达成协议就意味着可能在资金和技术转让方面也会出现重大突破。

强制和审查措施

无论是受气候变化威胁的国家，还是像美国和欧盟这样希望各主要排放国都负起责任的国家，如果想在本世纪中完成深度去碳化目标，就需要从2020年起每五年进行一次常规审查或削减温室气体排放。

为了向能源、工业以及城市规划方面表明立场，常规审查机制的支持者认为各国都应在谈判过程中详细说明低碳能源转型的进展程度，以及各国是如何深化去碳化目标的。常规审查制度——以及长期目标——都向私有资本领域传达了一个重要信号，化石燃料结构转型已经开始了。

尽管中国对于“五年审查机制”的态度有所缓和，但是印度等其他几个大型排放国却仍然不肯松口。至少对于最不发达国家来说，这种强制和审查机制的作用是积极的，因为我们还可以把这种机制用于发达国家的财政援助承诺上。到下周末，巴黎峰会各方必须就如何保证承诺审查机制拥有足够的合法性给予清晰的解释。就像美国首席谈判代表托德·斯特恩说的那样，与上述机制共存的，应该还有一个强力辅助机制，以便了解每个国家的所言所行：“这个看起来不错，你已经走上正轨了”或者“这看起来不怎么样。你需要什么帮助才能改善这种状况？”

一个有约束力的条约

气候协议是否应该具有“法律约束力”一直是联合国气候谈判的热点议题。哥本哈根峰会之所以失败，就是因为在厘清各方减排责任之外，很少有哪个大型排放国可以接受这样一个具有法律约束力的目标限定。

> 法国总统弗朗索瓦·奥朗德在大会开幕当天表示，融资很可能成为巴黎大会取得最终进展的潜在阻碍。

美国，以及印度等几个大型排放国已经明确表示，反对《京都议定书》中强制性的减排要求。世界资源研究所全球总监詹妮弗·摩根表示，巴黎大会各方可能会最终达成一个条款，要求协议各方就自己的“国家自主贡献预案”的承诺和政策进展情况进行实时维持和汇报。

监测、报告和验证

一个国家如何能够确认其他国家也在认真履行承诺？欧盟和美国一直坚持，应该在最终协议中添加一项对于排放和政策落实的全面“监测、报告和验证”（MRV）机制。中国之前一直对此立场强硬，但最近可能主要出于防止国家主权受到侵犯的考虑，态度也开始有所缓和。

然而一些观察家认为，这种担心西方国家侵犯主权的想法有些过虑了。哈佛大学的约瑟夫·奥利表示，这些国家都是自愿接受国际货币基金组织（IMF）咨询意见第四条和世界贸易组织（WTO）贸易政策审议机制审查的。他还说道，除了国际货币基金组织和国际贸易组织的专家通过一系列数据和公共政策进行的审议，这其中还会包括平级审议，比起现有的MRV机制来说，整个过程将更加严密、全面、可信。

对于许多发展中国家来说，一个完善的MRV体系是有益的，因为它同样会帮助落实发达国家的各种气候金融政策，同时提高公共融资来源的透明度。

融资

一法国总统弗朗索瓦·奥朗德在大会开幕当天表示，融资很可能成为巴黎大会取得最终进展的潜在阻碍。

发展中国家认为，富裕国家在哥本哈根峰会上提出的2020年起每年提供1000亿美元气候资金援助的说法是模糊的，且可能将从现有的海外援助预算中转移抽取。而富裕国家则表示，目前已经筹得了60亿美元，而今后四年随着私有资本的加入，剩余的资金将很快筹措完毕。

要完成低碳基础设施建设，适应气候变化新环境，全球所需资金量就要从目前的几十亿美元上升到万亿美元级别。而相对贫穷的国家对于如何落实这一过程更加关注。绿色债券计划的肖恩·肯德尼认为，除了现有金融机构要投入更多资金外，政府的支持对于吸引私有资本投资来说也极为重要。

虽然巴黎大会不大可能达成一个包括碳交易和碳税率的最终协议。但是包括中国在内的多国政府都在自己的“国家自主贡献预案”中提出，应当推出一个有力的价格工具，帮助社会投资远离化石燃料。与此同时，有人预计未来世界范围内碳使

巴黎气候大会能否给出清晰的步骤图，保证全球气候变暖不超过2摄氏度？

用量将逐渐缩减，这直接导致法国安盛和德国安联集团等多家金融机构缩减碳投资，因为他们担心会“碳泡沫”会导致搁置资产。

石油被认为是引发气候变化的第二大诱因，仅次于煤炭。虽然很多投资者目前还不愿意放弃石油，但是市场石油供给过度信号愈加明显，电动汽车走向市场主流也是趋势明显，这些都会促使金融机构缩减这种化石燃料的使用量。

此外，许多世界上最富裕的企业（大多都来自科技领域）都在风能、太阳能和电动汽车领域加大了投资。比如微软集团创始人、慈善家比尔·盖茨就在周一许诺，将建立总值为10亿美元的基金，帮助加快低碳电力和新能源科技的发展。

损失和破坏

气候变化引发或加重了各种自然灾害。过去几十年里，发展中国家一直都在要求富裕国家提供资金，帮助他们实现灾后重建。近几年来这种呼声更是越来越高，因为气候变化的影响已经越来越明显了。不过发达国家也在想方设法避免这些巨额的赔偿要求。有些气候变化事件是无法适应的，例如海平面上升。面临类似这样气候危险的国家一定会坚持将这种赔偿机制写入巴黎协议的核心条款中，而富裕国家则很可能会阻碍这一条款的通过。

约翰·麦克加里蒂，《中外对话》伦敦副总编

What will a Paris climate deal need to agree?

After a gathering of world leaders attempted to give impetus to UN climate talks, negotiators will have to find breakthroughs on issues that have so far been tough to crack

John McGarrity

Negotiators have got just under two weeks to agree a deal that sets the world on a path to avoid the worst effects of global warming. In contrast to the last major climate summit in Copenhagen in 2009, which ended in acrimony, the question isn't so much whether an agreement will be signed, but if it will be ambitious enough. After a year of tireless diplomacy and the trauma of recent jihadist attacks in Paris, there is too much at stake for the French hosts for no deal to emerge.

But huge uncertainty remains over whether the talks will decide on clear decisive steps that will help the world limit a rise in average global temperatures to 2C or below. This outcome can only be reached through a decisive shift to low carbon energy, and away from fossil fuels and other sources of greenhouse gases (GHGs). Concentrations of greenhouse emissions this year broke through the 400 through parts per million (ppm) level, the highest for a million years, and the world is now dangerously close to a tipping point beyond which climate change will wreak increasing havoc with the world's ecology and weather, putting many in the planet at risk from flooding, droughts and extreme temperatures.

Here are the main issues that are at stake in Paris:

Emission cuts by 2030 and a long-term goal

Over 180 national climate plans submitted to the UN in the run-up to Paris, known as Intended Nationally Determined Contributions (INDCs) if enacted fully, would put the world on a path to a rise in average temperatures to 2.7C, according to estimates.

These INDCs, will need to made much more ambitious, and very quickly, if the world is to cap temperature rises at 2C, and even that level of global warming would spark a much greater incidence of extreme weather events. The most vulnerable countries, such as the small island states, say a temperature rise above 1.5C will wipe them off the map.

Most of the big emitters, such as China, the EU, and the US, have set many of their carbon-cutting policies in motion already. These include curbs on coal-fired power plants and the fixing of targets to increase the share of renewables and electric vehicles that would be combined with efficiency measures and smarter power grids.

These policies are intended to deliver on overall targets included in INDCs. For example the US has committed to cut its GHG emissions 26% to 28% by 2025 relative to a 2005 baseline, while China has undertaken to peak its emissions by 2030 or before.

But for the world to remain within its carbon budget – the amount of fossil fuels that the world can 'safely' burn and remain under a 2C warming threshold – the world's biggest economies and fast-growing developing countries will need to deepen these targets. This will require a decisive shift away from coal and oil, so that the emissions curve can be bent sharply lower.

This will involve countries such as China and the US – the world's two largest emitters – retiring decades-old energy infrastructure and ensuring that their low-carbon replacements can deal with high levels of energy demand spurred by population rises and economic growth. There's

“Getting agreement from big developing countries will likely involve major breakthroughs on finance and technology transfer.”

also the crucial question of whether India, the world's third-largest emitter, can be persuaded to forego the massive use of coal that enabled western countries to industrialise and achieve their economic wealth.

So far, India has shown few signs of relinquishing what it sees as its right to use much of the world's remaining carbon budget. Enshrining a 'long-term goal' to slash emissions from current levels by 2050, and an undertaking to completely decarbonise by 2100, even if there is no legal compulsion to do so, would be a major achievement for a Paris deal. But getting agreement from big developing countries will likely involve major breakthroughs on finance and technology transfer.

Ratchet and review

If the world is to achieve deep decarbonisation by mid-century, regularreviews every five years or emissions cuts from 2020 will be essential, say countries most at risk of climate change, and those developed countries such as the US and EU member states who want to see all major emitters pull their weight.

To send out strong messages to the energy sector, industry and urban planners, supporters of regular reviews want countries to come back to the table with detailed updates on how shifts to low carbon energy have progressed, and how carbon cuts are being deepened. Regular reviews – and a long-term goal – would also send a strong signal to the private sector that a strong shift away from fossil fuels is a reality.

But although China has dropped its previous opposition to five year reviews, other large emitters, such as India, remain hostile. For least developed countries, ratchet and review is a positive as it could also apply to commitments on finance from richer countries. By the end of next week in Paris, much greater clarity will be required on how a review of countries' commitments would work for deal to have widespread legitimacy. But it is likely to be non-punitive. As US lead negotiator Todd Stern has put it, such a mechanism is likely to be along the lines of a strong facilitative review that looks at what a country has done and says: "That looks good, you're on track," or: "That doesn't look so good. How can you be helped to do better?"

A binding treaty?

The question of whether a climate agreement should be 'legally binding' has long been a major point of contention at UN climate talks. The Copenhagen summit failed mainly because very few large emitters were prepared to accept binding targets amid clear divisions on who should shoulder the burden of emissions cuts.

The US, and other large emitters such as India, have made clear their opposition to a Kyoto-style component enforcing carbon cuts. Jennifer Morgan, global director at the World Resources Institute, said the Paris talks may instead attempt to agree a clause that countries shall report and maintain their commitments or implement policies to achieve targets proposed through INDCs.

Monitoring, reporting and verification

How can countries be sure that others are delivering on their commitments? The EU and US have long insisted that robust systems of monitoring, reporting and verification (MRV) of emissions and policies are implemented in an agreement. China has recently softened its previously trenchant opposition, which was based on concerns about impingement of national sovereignty.

However in the views of some observers, fears about encroachment by western countries are overblown. Countries willingly participate in regular policy surveillance conducted through the International Monetary Fund (IMF) Article 4 consultations and the World Trade Organisation (WTO) Trade Policy Review Mechanism, points out Havard University's Joseph Aldy. Expert review by the IMF and WTO – through the collection and analysis of data and public policies – feeds into a peer-review process that is substantially more rigorous, informative and credible than the status quo climate policy MRV, he adds.

For many developing countries, a robust MRV system could be a benefit because it would likely also apply to the delivery and type of climate financepromised by rich countries, and provide greater transparency on the sources of public funding.

Finance

Finance is a strand of the talks that is most likely to prompt a crisis in Paris and block progress towards a meaningful agreement, a prospect acknowledged by French President Francois Hollande at the opening day of the summit.

Developing countries say that commitments by rich nations towards the US$100 billion a year in climate finance from 2020 made in Copenhagen are opaque and to some extent have been diverted from existing overseas aid budgets. Rich nations say over US$60 billion has been raised and that over the next four years the remainder of the US$100 billion is likely to be found through the increasing involvement of the private sector.

Poorer countries will also want to see greater clarity on how international finance can be scaled up from billions to the trillions of finance that will be needed for low carbon infrastructure and adaptation to climate change. But for financial institutions to put much more money on the table, government support will be crucial so that the private sector will have increased incentives to free up cash, points out Sean Kidney of the Green Bonds initiative.

While a Paris agreement is thought unlikely to include a clause on carbon trading and carbon taxes, at a national level various INDCs, including China's, propose the use of price signals (such as the use of carbon trading) to shift investment away from fossil fuels. Meanwhile, the prospect of an increasingly carbon-constrained world has prompted an increasing number of financial institutions, such as France's Axa and Germany'sAllianz, to ditch investments in coal amid fears of 'carbon bubble' and being saddled with 'stranded assets'.

While many investors have so far been less willing to abandon oil, signs of oversupply and the prospects of a roll-out of electric vehicles may also prompt finance house to curb exposure to the fuel that is the second-biggest contributor to climate change after coal.

In addition, some of the world's richest companies, many of which are in the tech sector, are ramping up investments in wind, solar, and electric vehicles, while Microsoft founder and philanthropist Bill Gates on Monday pledged US$1 billion to a proposed fund that aims to speed up development of low carbon electricity and new sources of energy.

Loss and damage

For decades, developing countries have been demanding 'loss and damage' funding from rich nations that would help them recover from natural disasters that were triggered or worsened by climate change. The calls have grown increasingly shrill in recent years as the impacts of climate change have become increasingly apparent, but developed countries are at pains to avoid a system that would expose them to huge compensation claims. Countries most at risk from climate change-related events that they can't adapt to – such as rising seas – will insist that this clause is included in the core text of a Paris agreement. Rich countries will likely try to block them.

John McGarrity is deputy editor of chinadialogue based in London.

气候谈判之路：从二元分化到多极混乱

过去二十年的气候谈判一直在试图调解主要排放国之间的分歧，巴黎峰会若想取得成功也必须得解决这一问题。

乔伊迪普·格普塔　德舍卡·曼达尔

1896 年，斯凡特·阿伦尼乌斯公开发表其研究成果，揭示了化石燃料燃烧对全球气温造成的影响。那时，科学家就已经知道了气候变化这一问题的存在。但直至 1972 年，决策者才真正开始在联合国人类环境会议（俗称斯德哥尔摩峰会）上讨论这一问题。

除主办国瑞典的总理以外，印度总理英迪拉·甘地是唯一参加当年那次峰会的国家总理。与当年不同的是，据估计，至少有 37 位国家和政府首脑将出席即将召开的《联合国气候变化框架公约》（UNFCCC）巴黎气候峰会。

《联合国气候变化框架公约》于 1992 年达成，距离斯德哥尔摩峰会召开整整 20 年。在这 20 年间，各国之间的协商、各种企图抹黑气候科学的行为都足以让世界意识到，要想达成应对气候变化的国际协议绝非易事。

断层

气候谈判开始之初，各国之间在认识上就出现了四条断层。

1. 温室气体排放正在导致全球变暖，因此必须控制其排放。但排放量的多少由哪个国家控制？原因何在？谈判代表所说的“责任分担机制”就是第一条断层，也是目前最主要的分歧。

2. 以石油输出国组织（OPEC）为首的主要石油生产国对限制排放量带来的经济后果表示担忧。多年来，他们一直试图尽力抹黑气候科学。

3. 相比极易受到气候变化影响的热带国家，对气候变化冲击反应相对平缓的国家——主要位于温带以及更高纬度地区——并没有过多的担心全球变暖的问题。

4. 怀疑和否定气候变化的人不断质疑气候科学，造成了第四条断层，并且成功地拖延了各国应对气候威胁的行动。

气候谈判——各阶段

1992 年，地球高峰会议在巴西里约热内卢召开，会上通过了《联合国气候变化框架公约》。此后，世界各国在《公约》的指导下，开展了不同阶段的谈判。

1. 第一阶段的谈判以 1997 年《京都议定书》的签订为终止。这期间，谈判工作的重点是设计可行的协议，帮助解决温室气体排放量增加的问题，同时在财政和技术方面为发展中国家提供必要支持，帮助发展中国家通过自愿行动解决气候问题。《京都议定书》取得的一项重大胜利就是强制规定发达国家必须削减排放量。但现在想来，这一协定所取得的成功非常片面，这主要是由于美国并未签署这一协定。当时欧盟在发达国家中担任了领头羊的角色，率先签署并严格执行了《京都议定书》，但他们的减排量还不足以抑制全球变暖，无法将其控制在科学家建议的范围之内。

第二阶段的谈判为 1997-2007 年，其中大部分时间用于协商《京都议定书》的细节问题。各国最终协商决定，《京都议定书》的第一承诺期为 2008-2012 年。这十年间，气候科学有了多方面的发展，来自科

学家的警告也愈发严重，但发展中国家没能够有效地向发达国家施加压力，促使其采取更多行动；相反地，发展中国家分裂成为类似小岛屿国家联盟和非洲国家团体这样更小的集团，这实际上削弱了他们的集体谈判权。第二阶段在政府间气候变化专门委员会（IPCC）在其第四篇评估报告中提出的严重警告声中结束。尽管如此，在接下来的巴厘气候峰会上，发展中国家在一系列不同的红线问题上做出了妥协，发达国家则成功将自身需要采取的行动降到了最低。

2. 目前，全球正在进行第三阶段的气候谈判。从哥本哈根气候大会的惨败开始，新兴经济体和其余发展中国家之间的分歧就成为了这一阶段的主要标志。美国等发达国家是这一分歧背后的推手。他们提出，中国和印度是目前全球排名第一和第四的排放大国，但却故意忽略了发达国家才是导致工业时代以来温室气体在地球大气中不断积聚的罪魁祸首。而中印两国的人均碳排放量仅为美国的 1/3 和 1/10。这一分歧让以美国为首的发达国家能够有效地瓦解原先《联合国气候变化框架公约》之下发达和发展中国家之间的分化。目前，除了在文件中，发达国家并没有在法律上受到任何自上而下的全球减排目标的约束。相反，每个国家都自愿提交了自下而上的《国家自主贡献》（INDC）。在 2010 年举行的坎昆气候峰会上，各国达成协议，同意将全球平均气温上升控制在 2 摄氏度以内。而当前的《国家自主贡献》将无法达成这一目标。分析人员估计，最好的情况是将平均温度上升幅度控制在 2.7 摄氏度。对于 2020 年以后的世界而言，这也将是对巴黎气候协议最好的预期。

全球重组

气候公约指导之下，发达国家和发展中国家的二元分化意味着，发达国家不得不大幅度削减排放量，但他们大多不愿意这么做。1992 年以来，发达国家反而不断努力，企图打破 G77+ 中国集团（134 个发展中国家作为一个集团进行气候谈判）。

这个集团保留了下来，但其中许多成员国现在组成了更小的集团，各自也有了不同的意见——最不发达国家、非洲、小岛屿国家联盟、以及小岛屿发展中国家是其中最为突出的几个小集团。

可能是为了应对这一情况，比

小岛屿国家联盟和最不发达国家认为2摄氏度还是太高，会导致海平面上升淹没岛屿国家，并且提出上限应为1.5摄氏度

较大的发展中国家建立了自己的集团——金砖四国集团（BASIC）（巴西、南非、印度和中国）以及立场相近发展中国家集团（LMDC）（成员包括印度、中国、马来西亚、沙特阿拉伯以及其他众多发展中国家）。

然后就出现了由发展中国家和发达国家共同组成的集团，例如卡塔赫纳对话会，这一集团的32名成员国包括了澳大利亚、孟加拉国、英国、法国、德国、加纳、印度尼西亚、肯尼亚、马尔代夫、尼泊尔、新西兰、以及阿拉伯联合酋长国等。拉丁美洲及加勒比独立联盟（AILAC）也是此类混合型集团之一。

欧盟全体成员国以欧盟为代表参与谈判，而包括美国和日本在内的大多数非欧盟发达国家则为伞形集团的成员。

G77+中国集团内部的分裂在2009年的哥本哈根气候大会上表现得最为明显。会上，小岛屿国家联盟和最不发达国家反对将全球平均气温上升控制在2摄氏度以内这一目标。他们认为这一数字还是太高，会导致海平面上升淹没岛屿国家，并且提出上限应为1.5摄氏度。这一提议遭到了金砖四国集团以及印度尼西亚和沙特阿拉伯等国家的反对，因为这样一来，他们剩余的碳排放空间将非常有限。

关于财政支持、如何给予此类支持优先权以及技术转让等问题，发展中国家也存在着严重分歧。最不发达国家正在寻求财政支持，用于帮助他们适应气候变化带来的影响；他们并不太在意这笔资金是以怎样的名义得来的。更大一点的发展中国家虽然更有财力支持自身应对气候变化，但却热衷于确保来自发达国家的资金是“新的、递增的”，而不是变相的援助。较大的发展中国家更热衷于不必支付专利费的技术转让，而最不发达国家则更热衷于国内的能力建设项目。

以上这些情况造成的结果就是削弱了G77+中国集团作为一个整体的声音，而一些发达国家则得以趁机逃脱，拒绝履行《京都议定书》第一承诺期规定的法律义务。发展中国家仍坚持发达国家应履行《京都议定书》第二承诺期（截止2020年）规定的法律义务，但几乎没有发达国家会听取他们的意见。

趋势

这些变化、以及发展中国家和发达国家建立的各种新型双边关系，推动着气候变化控制系统从《京都议定书》这样自上而下的方法朝着《国家自主贡献》这样各国自愿提出的承诺转变。

这就带来了两方面的担忧。首先，正如政府间气候变化专门委员会最新发布的报告显示，气候变化及其影响正在加速恶化，但《国家自主贡献》却不足以遏制这种趋势。其次，在这样一个自愿的体系之中，未能实现承诺的国家无需担心受到国际社会的惩罚。一些国家仍试图建立国际审查制度，对各国做出的承诺进行监督，但其他国家认为这种制度削弱了他们的国家主权，因而予以反对。巴黎气候协议中可能会推出某些审查制度，但力度可能不会很强。

另一个大趋势就是，世界再也不是发达和发展中国家二分的气候世界。谈判代表尽管做出了极大努力，但是类似中国和印度这样的新兴经济体国家现在不得不承担起大量的控制温室气体排放的责任。

就目前来看，发展中国家承诺的排放控制量事实上大于发达国家提出的控制量，这一情况完全不符合气候正义。除此之外，人们对于发达国家财政支持的性质、以及过程中是否存在重复计算的问题也存在严重疑问。根据经合组织最近一篇报告的计算，经合组织成员国为发展中国家提供的财政支持总计超过620亿美元，但发展中国家则指出，联合国绿色气候基金承诺的资助仅为103亿美元。

这些都表明了一个自1896以来未曾改变过的趋势，那就是决策者未能给予科学家足够的重视。不仅是政府间气候变化专门委员会，联合国环境计划署发布的年度“排放差距”报告也未能指出这一点。

《联合国气候变化框架公约》年度气候峰会的官方名称为缔约方会议（COP）。2015年的缔约方会议十分关键，原因在于会议将决定2020年以后全球能源发电系统的发展方向。但从目前的情况来看，今年的巴黎峰会充其量只能通过最低共同纲领，而这样的纲领又太过弱小，无法有效地应对气候变化问题。

乔伊迪普·格普塔，中外对话第三极项目南亚总监

德舍卡·曼达尔，超过八年的气候政策写作经验，涵盖气候政策、国家及国际气候变化政策、气候经济及科学技术领域

The obstacle-strewn path to Paris

Over the past two decades, UN climate talks have struggled to bridge the differences between major negotiating blocs, something that will have to change if Paris is to deliver a strong agreement

Joydeep Gupta and Tirthankar Mandal

Scientists have known about climate change since 1896, when Svante Arrhenius published his findings on the effect of fossil fuel combustion on global temperature. But it was 1972 before policymakers actually started discussing the problem, at the United Nations Conference on the Human Environment, popularly known as the Stockholm Summit.

Apart from the host, only one Prime Minister attended that summit – Indira Gandhi of India – a far cry from the situation now. At least 37 heads of state and government are expected to inaugurate the Paris summit of the United Nations Framework Convention on Climate Change (UNFCCC).

Fault lines

From the very beginning of climate negotiations, four faultlines emerged between countries

1. Greenhouse gas emissions were causing global warming, so these emissions would have to be controlled. But which country would control how much, and why? What the negotiators called the “burden sharing mechanism” was the first faultline, and remains the principal source of discord.

2. Major oil producers – led by the Organisation of Petroleum Exporting Countries (OPEC) – feared the economic consequences of emissions limitations. For years, they tried their best to rubbish climate science.

3.Countries relatively resilient to climate change impacts – mostly in the temperate regions and at even higher latitudes – were not nearly as worried by the thought of global warming as tropical region countries that are extremely vulnerable.

4.Climate change sceptics and deniers opened up the fourth faultline by repeatedly questioning the science and succeeded in delaying action to tackle the problem.

Climate negotiations – the phases

The UNFCCC came into being as one of the results of the 1992 Earth Summit in Rio de Janeiro. Since then, there have been some distinct phases in negotiations held under its aegis.

1.The Kyoto Protocol in 1997. During this phase, the focus was on designing a workable agreement that would help address rising greenhouse gas emissions and also provide developing countries with the necessary support through finance and technologies so that they could tackle the problem through voluntary actions. The signing of the Kyoto Protocol made it mandatory for rich nations to reduce their emissions and was hailed as a major triumph.

But on hindsight, it can at best be called a partial success. The major problem was the non-ratification of the protocol by the United States of America. The European Union was at the forefront of those rich countries that did work according to the Kyoto Protocol, but their emission reductions were inadequate to check global warming to the extent that the scientists recommended.

2. 'Post-Kyoto' 1997 to 2007. Much whose first phase was finally determined to be 2008 to 2012. Climate science advanced manifold in this decade, and scientists ratcheted

up their warnings, but developing countries failed to initiate effective pressure for more actions from developed countries. Instead, developing countries split into smaller blocs, such as the Association of Small Island States and the Africa Group, which had an adverse effect on their collective bargaining power. The second phase came to an end with a dire warning from the Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report, despite which the next UNFCCC summit at Bali saw a series of compromises on different red-lines of the developing world, while developed counties were successful in ensuring minimum actions on their part.

3. The chaos of Copenhagen and the aftermath. From the fiasco of the Copenhagen summit, this phase is being marked by a split between the emerging economies and the rest of the developing world. The split has been encouraged by the US and some other rich countries, which point out that China and India are now the world's largest and fourth largest emitters, but gloss over the fact that rich countries have placed almost all the greenhouse gases that have been accumulating in the earth's atmosphere from the start of the Industrial Age.

Per capita emissions in China are one-third of that in the US and one-tenth of India's. The split has enabled rich countries led by the US to effectively dismantle the original UNFCCC pillar of differentiation between rich and poor nations. Now – except on paper – there is no top-down legal global emission reduction target to be allocated to rich nations. Instead, there are voluntary bottom-up Intended Nationally Determined Contributions (INDC) by every country.

At the 2010 Cancun summit, countries had agreed to keep average global temperature rise within 2C. Current INDCs will fail to do that. Analysts estimate that at best they can hold average temperature rise to 2.7C. And that is the best that can be expected from a Paris agreement for a post-2020 world.

Changes in how countries negotiate in blocs, as well as new bilateral relations between various developing and developed countries (such as the US and China), have moved the climate change control system from a top-down approach like the Kyoto Protocol to one where individual countries make voluntary pledges submitted to the UN as INDCs.

This leads to worries on two counts. First, as shown by the latest report of the IPCC, climate change and its impacts are all gathering pace, but the INDCs are not good enough to rein in the trend. Second, in a voluntary system a country that fails to live up to its pledge does not have to worry about any action by the international community. Some countries are still trying to subject these pledges to an international review system, but that is being opposed by others that see this as a dilution of their sovereignty. Some sort of a review system is likely to be put in place in the Paris deal, but it will probably be weak.

The other big trend is that it is no longer a binary climate world, split between developed and developing countries. Despite strenuous efforts by their negotiators, emerging economies, such as China and India, now have to take a substantial share of the emission control responsibility.

As it stands now, emission control pledges from developing countries are actually bigger than pledges by developed countries, a situation that some feel flies in the face of climate justice. On top of that, there are serious question marks about the kind of financial support rich countries are providing and whether there is any double counting going on. A recent report by the Organisation for Economic Co-operation and Development said commitments of climate finance support from member countries was over US$62 billion, but developing countries point out that the UN's Green Climate Fund has only US$10.3 billion in pledges.

It all points to one trend that has remained unchanged since 1896 – policymakers do not pay sufficient attention to scientists. Apart from IPCC, the annual 'emissions gap' reports brought out by the United Nations Environment Programme have failed to spur decisive political action.

The annual climate summits of the UNFCCC are officially known as Conference of Parties (COP). The 2015 COP is crucial because it can determine the direction to be taken by global energy generation systems after 2020. But by current indications, the outcome will be too weak to combat climate change effectively.

Joydeep Gupta is South Asia director of The Third Pole.

Tirthankar Mandal has more than eight years of experience in climate change policy. He writes on climate politics, national and international policies on climate change, climate finance and technology issues.

巴黎气候协议之后：谁受益？谁受限？

巴黎大会若能达成有力度的减排协议，则低碳技术产业将是未来的赢家，化石能源无疑将退出历史舞台。

杰勒德·韦恩

今年的巴黎气候大会上，各国有望在历史上首次达成关于气候变化的最重要的协议。这次会议的重要性在某种程度上反映出过去二十年里，全球气候变化谈判进程的低效和不足。

若想知道谁有可能成为巴黎气候大会的受益者和受限者，我们需要回顾过去种种协议产生了哪些影响，即使这些影响在当时非常有限。

历史上，全球气候协议的影响主要集中在碳排放权交易和能源领域，比如会给煤炭和可再生能源带来截然不同的发展命运。

1997 年的《京都议定书》是历史上第一部限制各国温室气体排放的国际协议，它规定了近 40 个工业化国家的减排目标，为了完成既定目标，出台了相应碳抵消机制。发达国家可以通过提供资金从发展中国家购买项目温室气体减排量，用以完成协议目标。

《京东协议书》产生的最深远和直接的影响就是衍生了国际碳排放权交易。为了完成在《京都议定书》下的承诺，欧盟颁布减排贸易计划，限制重工业的碳排量，从而造成欧洲工厂和电厂间的交易蓬勃发展，并在发展中国家兴建了大量低碳项目。

最讽刺的是，在这样的碳交易背景下，最大的获益者居然是排污严重的大型重工业。在欧盟减排计划实施初期，钢铁生产厂和化石燃料发电厂都获得了大份额的碳排放权，并在碳交易市场上出售赚取暴利。同时，在中国、印度和韩国的重污染工业也找到了便宜的减排手段并获取更多碳排放权，然后卖给欧洲赚得差价。另外，众多驻伦敦的相关业务经纪人也在这样的交易中获得巨额利润。

虽然 2009 年哥本哈根全球气候大会饱受争议，未能达成一项有效的全球气候变化协议，但却为 90 多个发达国家和发展中国家制定了整体的温室气体减排目标。

其中一些既定目标至今具有重大影响。

例如，欧盟承诺在 2020 前将可再生能源在能源结构中的占比提升至 20%。这一目标极大地推动了欧洲可再生能源产业的发展。丹麦、德国等在这一领域一马当先的国家早在二十年前就已踏出了第一步。欧洲对太阳能和风能的需求导致了能源产出量的剧增和成本的大幅下降，有助于提升全球可再生能源的增长。

同时，中国承诺降低碳强度，即单位 GDP 的碳排放量，这是一项宏伟的目标。这让本就面临空气污染、产出量疲软等问题的煤炭产业雪上加霜。

因此，哥本哈根会议最大的受益方当属欧洲的可再生能源产业，而煤炭产业在未来将备受牵制。

但哥本哈根协议并不具有法律约束力，这让欧盟在减排目标上显得非常谨慎，深怕使本国产业处于发展劣势。鉴于经济危机后产量收缩，碳排交易市场已受重创，欧盟的做法对碳交易市场可谓生死攸关。

纵观历史，已有明确的迹象表明巴黎气候大会将沿袭哥本哈根大会的成果，并进一步支持可再生能源的发展。同样，也只能是为碳排放量最多的煤炭产业的衰败添一把火。

与此同时，碳交易市场虽然受

> 几乎可以肯定的是，巴黎气候大会上达成的协议将推动中国煤炭消费在未来十年达到峰值，而需求增长放缓给煤炭价格带来的负面影响将会很快显现。

创，但依赖于区域的发展仍存有一线生机，比如中国的国家政策和欧洲需求的扩大等。

那我们如何知道巴黎气候大会能够使可再生能源获益？

从各国在巴黎气候大会召开之前提交的目标来看，风能、太阳能和水电的需求将大幅增长。例如，美国表示将在 2025 年实现在 2005 年的基础上减排 28% 的目标，美国环保署颁布《清洁电力计划》将主要负责这一目标的具体执行。

美国能源部专家分析，《清洁电力计划》将在 2030 年累计完成 3.41 亿千瓦的可再生能源发电量，较当前的 1.62 亿千瓦翻了一番。若不是《清洁电力计划》，以美国目前可再生能源发电的增长趋势，到 2030 年预计只可能平稳增长到 1.97 亿千瓦。

巴西、中国、欧盟、印度、墨西哥等其他大型经济体的减碳目标和可再生能源的扶植政策也将产生同样的影响。

我们如何得知巴黎气候大会将唱衰煤炭产业？

作为世界上最大的煤炭消费国，中国承诺最晚到 2030 年实现碳排放峰值。由于煤炭是中国最重要的能源，也是二氧化碳的主要来源，因此煤炭需求量和碳排放量的起伏完全同步。

因此，几乎可以肯定的是，巴黎气候大会上达成的协议将推动中国煤炭消费在未来十年达到峰值，而需求增长放缓给煤炭价格带来的负面影响将会很快显现。

相对于哥本哈根气候大会，巴黎气候大会上各国将采取更有力的气候行动，从而会从四个方面给煤炭和可再生能源调控产生更大的影响。

首先，参与的国家更多：签订哥本哈根协议的只有 90 个国家，而目前已有约 140 个国家向巴黎气候协议主办方提交了各自的气候行动计划；其次，本次各国提交的目标都更为具体，责任更加明确；第三，预计各国都将同意定期评估各自的气候行动计划（从 2020 年开始，每五年一次），从而确保协议长期沿着正确的方向执行；最后，各国政府有望同意信息透明化，公开气候行动计划的实施进程，比如向联合国提交年度或者两年一次的报告。

然而，巴黎气候大会最后的减排力度才是最终决定谁受益、谁受限的关键所在。

大会前的游说情况能有效推测会后受益者。

可以预见，若最终协议能制定出雄心勃勃的减排目标，将极大推动整个可再生能源产业的发展：从太阳能组件、风力发电机的生产，到可再生能源发电，再到通过数字化互联网电网技术整合可再生能源等，都会得到有利的支持。另外，提高能源利用率、减少碳排放的各种技术也会从中受益。

上述公司也纷纷在巴黎气候大会前的新闻发布会上为大力减排而积极游说。

相反，如果巴黎气候大会未能达成有效协议，化石燃料出口国将从中获益。

或许，此次巴黎气候大会上最大的不确定性在于是否能制定出一个本世纪全球经济去碳化的长期计划，这将对未来产业走势产生深远影响。针对这一目标，政府间气候变化专门委员会最新的科学评估指出，如果致力于遏制全球变暖，将升温控制在 2℃以内（与工业化前相比），那么到 2100 年，全球温室气体排放量应该接近于零，甚至是负增长。

虽然这个目标看上去或许会因为过于长远而让人怀疑其实际意义，但是对于低碳经济的发展却能起到至关重要的作用。因为各国若能承诺在本世纪末消除温室气体排放，那就意味着到本世纪中叶，目标至少应该完成一半。因而低碳产业的发展势在必行，投资者和企业家也就能从现在放手参与其中，毕竟起步得越早就越有优势。同时，这也将加快创新和降低成本，进而促进经济的平稳转型，并降低转型代价。

但是目前该长期目标仍处于草拟阶段，尚未决定。很有可能最终结果不到会议结束的那一刻不会敲定，也就是在 12 月 11 日至 13 日期间某刻才能见分晓。

杰勒德·韦恩，环境经济学博士，商业及环境团体顾问，分析能源与气候政策。他曾是路透社的记者和分析师

Who are likely to be the ‘winners’ and ‘losers’ in Paris

Low carbon technologies will only be a clear winner and fossil fuels a decisive loser from Paris if an agreement is suitably ambitious

Gerard Wynn

The targets that nations have already submitted, ahead of the Paris conference, show demand for wind, solar and hydro will grow

In Paris, countries are expected to reach the most significant agreement on climate change in history. But that high standing partly reflects the low level and disappointment of what has gone before in two decades of global negotiations.

Understanding the likely winners and losers from Paris requires a look at the impacts of past agreements, even if at the time these impacts appeared weak.

Historically, global climate agreements have had their biggest impact on markets in carbon emissions permits, and on the energy sector, including contrasting fortunes of coal and renewable power.

The first agreement to assign greenhouse gas (GHG) emissions targets to individual nations was the Kyoto Protocol in 1997. The Protocol set targets for nearly 40 industrialised nations to cut emissions, but allowed them to meet these targets by paying developing countries to cut

emissions on their behalf, through an international market in carbon offsets.

The Protocol's biggest, most direct business impact was to spawn an international trade in emissions permits. To meet its Kyoto targets, the European Union introduced an emissions trading scheme, which put a limit on the carbon emissions of heavy industry. That in turn led to a thriving trade in carbon offsets between these European factories and power plants, and low-carbon projects in developing countries.

The biggest winners from carbon trading, ironically enough, were big industrial polluters. In the early days of the EU scheme, steel producers and fossil fuel power generators received generous allocations of free emissions permits, which they then sold on the carbon market, earning windfall profits. Meanwhile, big industrial polluters in China, India and South Korea found cheap ways to reduce emissions and earn carbon offsets, which they then sold sometimes at vast margins to European buyers. The other big winners were carbon brokerages, largely based in London.

While the much-maligned Copenhagen climate summit in 2009 fell far short of reaching a robust, global agreement to tackle climate change, it did establish broad, headline targets to reduce GHG emissions in around 90 developed and developing countries.

Some of those targets have since had major impacts.

For example, the European Union committed to source one fifth of all its energy from renewables by 2020. That target continued to drive a massive ramp-up in renewable energy across Europe, which leading nations such as Denmark and Germany first began nearly two decades ago. European demand for solar modules and wind turbines has led to a massive rise in manufacturing output and plummeting costs, in turn feeding rapid global growth.

Meanwhile, China committed to reduce the carbon emissions per unit of its economic output, called carbon intensity. It has since emerged that this target was rather ambitious, and the task of meeting it is now adding further pressure on coal demand in China, alongside concerns about air pollution, and flagging industrial output.

A big winner from Copenhagen, therefore, was renewable energy in Europe, and further afield; a big loser was coal.

In legal terms, the outcome of Copenhagen was weak. The summit deterred the EU from making its emissions targets more ambitious, for fear of putting its industry at a disadvantage. That was a nail in the coffin for carbon markets, already reeling from the impacts of a financial crisis that had slashed industrial output.

With the benefit of this historical perspective, there are strong signs that Paris will mean more of the same as what was achieved at Copenhagen. A Paris agreement will underpin further growth in renewable energy, and in the same way, only hasten the decline of coal, the most carbon-emitting form of energy.

The prospects for carbon markets, meanwhile, remain in limbo, hinging more on regional developments, such as national scheme in China and raising demand in Europe.

So how do we know that Paris will be good for renewable energy?

The targets that nations have already submitted, ahead of the Paris conference, show demand for wind, solar and hydro will grow. For example, the US has proposed to cut GHG emissions by up to 28% by 2025 compared with 2005 levels. This target will largely be implemented through the Environmental Protection Agency's proposed Clean Power Plan.

The US Department of Energy's own analysis suggests that the Clean Power Plan will lead to a cumulative 341 GW of renewable generating capacity by 2030, which is more than double the 162 GW in place today. Without a Clean Power Plan, US installed renewable power would likely rise more sedately to an estimated 197 GW in 2030.

There will be similar impacts from targets to cut carbon emissions and support renewable energy in other big economies, including Brazil, China, the EU, India and Mexico.

How do we know that Paris will be bad for coal?

> Perhaps the biggest impact from a Paris agreement will come from the single outcome with the greatest remaining uncertainty, which is whether the agreement will have a long-term goal to decarbonise the global economy by the end of the century.

China is the world's biggest coal consumer, and has committed to halt growth in its carbon emissions by 2030 at the latest. Coal demand and carbon emissions rise and fall in perfect lock-step in China, because coal is the country's biggest source of both energy and carbon dioxide.

A Paris agreement will therefore almost certainly see coal demand by the world's biggest user reach its peak at some point in the next decade, with negative impacts for coal prices far sooner, as demand growth slows.

Paris will see stronger climate action than Copenhagen, and therefore bigger impacts on coal and renewable energy, for four reasons.

Firstly, the agreement will involve far more countries: at the time of writing around 140 nations had submitted plans for climate action under a Paris agreement, compared with 90 under the Copenhagen Accord. Secondly, their targets are far more detailed this time around, making countries more accountable. Thirdly, countries are expected to agree to review their climate action targets, at regular intervals, perhaps in five-year cycles starting in 2020, making this a long-term agreement with a clearer direction of travel. And fourthly, governments are expected to agree to open and transparent disclosure regarding their climate actions and progress, for example, reporting these on an annual or biennial basis to the UN.

Precisely who wins and who loses in Paris, however, will depend on how ambitious the final agreement is.

One useful indicator of who will win from what outcome is the level of lobbying in advance of the conference.

One would expect that an ambitious agreement would help companies involved in the renewable energy sector, whether in manufacturing of solar modules and wind turbines, or the supply of renewable power. Other companies to benefit would be involved in the integration or the integration of renewable energy through the use of digital, internet-based electric grid technologies. In addition, technologies which boost energy efficiency should reduce carbon emissions, and therefore benefit from an ambitious climate agreement.

Sure enough, press statements ahead of the Paris conference see all of the above companies lobbying for ambitious action.

But, on the flip side, a weak Paris agreement will favour fossil fuel exporters.

Perhaps the biggest impact from a Paris agreement will come from the single outcome that carries the greatest remaining uncertainty. This would be whether the agreement will have a long-term goal to decarbonise the global economy by the end of the century. Underpinning such a goal, in its latest assessment of the science, the Intergovernmental Panel on Climate Change said global GHG emissions should be near zero or below, by 2100, if the world wishes to limit warming to 2C above pre-industrial levels.

While such a goal may seem rather irrelevant, being so distant, it could be the clincher for a shift towards a low-carbon economy. That is because a clear commitment to eliminate GHG emissions by the end of this century would imply halving these by the middle of the century. If such a goal can make a low-carbon transition appear inevitable, then investors and entrepreneurs are more likely to engage now – since there is an advantage to get ahead. This would hasten innovation and cost reductions, which in turn could make such a transition swifter and more painless than expected.

But such a long-term goal is still in the drafting stage and by no means sealed. It is likely to remain that way until the final hours of the conference, sometime over the weekend of Dec ember 11-13.

Gerard Wynn analyses energy and climate policy, as an advisor to business and environmental groups. He was formerly a reporter and analyst with Reuters news agency, and has a PhD in environmental economics.

“前途未卜”的巴黎气候谈判

气候分析首席执行官、联合国政府间气候变化专门委员会报告的主要作者之一比尔·海尔，近日向中外对话简述了即将召开的巴黎气候峰会中可能出现的主要意见分歧。

约翰·麦克加里蒂

过去这些年，联合国气候谈判走得磕磕绊绊。即便是当初广受关注的2009年哥本哈根峰会，也还是没有帮助发达国家和发展中地区就削减温室气体排放的责任划分达成一致。这一次，主办方采取了一种“自下而上”的方式，要求各国分别提交自己的碳排放缩减计划，并以此作为未来碳缩减的基础措施。与此同时，低碳科技成本大幅下降，中美合作交流增多，这些或许都会帮助这190多个国家在此次巴黎峰会上携起手来。但是不可否认，主要障碍和潜在陷阱还依旧存在。

中外对话：与2009年哥本哈根峰会相比，巴黎峰会各方的谈判意愿有何不同？

比尔·海尔：这次谈判成功的可能性非常大。因为中国已经肩负起了领导责任，并开始与美国在几大重要领域展开合作，比如削减排放、提高能效和碳捕捉等等。美国方面的表现也与哥本哈根峰会时期有所不同，因为这次他们得到了来自奥巴马政府的多项支持。中美两国，以及包括主办国法国在内的众多国家，都在积极调动本国外交资源，努力推动协议的最终达成。机不可失，这一点大家都明白。但是要达成最终一致，面对的阻碍还有很多。在这一过程中，各国政要也要面对重重挑战。我希望会谈可以延期到12月12日周六那天，甚至是再多一天。今年的大会应该是在12月11日星期五结束，但这种会议很少能在官方截止日期闭幕。如果能在会议刚一开始就把世界各国领导人聚集在一起，那无疑是取得进展的绝佳时机，效果要远好于临近会议结束的时候。怕就怕有些国家的领导人声明意见相左，难以调和。联合国气象对话之德班平台（ADP）将于12月5日发表一篇文章，并对其中的主要问题进行集中解答。这无疑将会对最终的结果产生重大的影响。

中外对话：目前的气候承诺显然无法保证全球气温上升不超过2摄氏度。那么受气候变化影响最严重的国家对签署协议的抵触情绪到底有多严重呢？

比尔·海尔：几大主要温室气体排放国是否能够下定决心帮助世界走上远离气候变暖的道路，对于这一点，各方质疑颇多。显然，仅仅依靠巴黎会谈一纸协议就让大众相信相关国家已经采取了必要措施来挽救气候变化危机，这实在是不大可能。《国家资助贡献预案》中设立的目标只到2030年，而且远高于许多小型岛屿国家要求的1.5摄氏度的温控标准。如果这个标准无法达到，必将引发一场危机。目前发达国家提出的措施根本无法保证实现2摄氏度的温控目标——所以在最终协议中添加一份“每五年进行一次审查”的条例就显得尤为重要了。

中外对话：除了减排规模问题，这些最脆弱的国家还面临哪些棘手问题？

比尔·海尔：这些受气候变化威胁最严重的国家，最希望看到的

是一份令人信服的财政解决整体方案，并对资金来源和使用方式进行详尽说明。这些国家的外长总要带点“实际收获”才能回国。同时，这些国家还希望就“损失和损害”条款达成一致（包括有效的赔偿机制）。而我觉得不管发达富裕国家或者中印这样的排放大户给他们施加多少压力，他们都会全力争取这一权利。对于发达国家采取的“统一监控、报告和证实“模式（MRV），一些发展中国家表达了自己的不满，他们觉得这是要把减排任务强加到他们头上。

气候分析首席执行官、联合国政府间气候变化专门委员会报告的主要作者之一比尔·海尔

中外对话：巴黎会谈将会对协议的最终法律地位给出怎样的定位？

比尔·海尔：美国一定不会签署一份有法律约束力的协议，因为这需要经由美国参议院批准（显然后者不会允许协议通过）。而那些脆弱的小国家则觉得无法接受一份没有法律效力的协议。小型岛屿国家或许也不会接受没有 5 年审查机制的协议条款。退一步讲，即便协议中包括了 5 年审查条款，那么具体的审查到底应该包括什么？具体的审查到底指的是什么，是否会包括进一步的减排义务？这些国家是否愿意提高减排热情？这样的审查是否能够及时弥补排放缺口？如果我们在未来十年不能大幅削减温室气体排放，那么想要避免气候变化失控恐怕就是难上加难了。所以，我们必须在协议中明确给出遏制排放曲线陡然上升的清晰步骤。

中外对话：之前的气候会议总会被个别国家或国家集团挟持，因为他们不愿意参与主流议题的讨论。那么这次粉墨登场的又会是谁呢？

比尔·海尔：这次巴黎峰会，肯定少不了类似这样影响最终协议结果的政治小风波。人们比较担心的是委内瑞拉，因为它曾经挑起过事端，这次没准又会使出什么绊子。想要把这些国家排除在外，《联合国气候变化框架公约》恐怕是无能为力。也许这回俄罗斯也会在协议谈判中出点难题，但是也说不好，毕竟这个国家总是让人摸不透。中东产油国当然不愿意把温控目标限制在 1.5 摄氏度，而主要煤炭消费国（比如澳大利亚、韩国和日本）的想法恐怕也是如此。他们必定会想法阻碍将 2050 去碳化目标写入此次协议。

中外对话：中国已经与美国签订了双边协议。所以在这次巴黎峰会上，印度就成了公认的需要被“安抚”的主要发展中世界温室气体排放国？那么印度方面又是怎么想的呢？

比尔·海尔：印度在巴黎气候会谈中的角色对于会议成功与否至关重要——它肯定会引发许多政治争论，而且没准还会成为此次峰会的“一大阻碍”。如果协议内容符合印度的利益，它可能真的会这么做——不过印度的要求可不少，比如放弃 1.5 摄氏度温控目标（因为按照这一要求，大型发展中国家必须要面对巨大的减排任务），不要法律性约束条款，不提供明确的适应和减排相关的金融以及技术路径。总而言之，印度希望为自己谋得最大限度的灵活性。

约翰·麦克加里蒂，《中外对话》伦敦副编辑

Paris climate talks: the potential pitfalls

Bill Hare, CEO of Climate Analytics, a lead author with the UN's climate science panel and an adviser to countries most at risk of climate change, tells *chinadialogue* where the major areas of discord are likely to be during the two-week summit

John McGarrity

The UN climate talks process is littered with the wreckage of past failures, including the much-hyped Copenhagen summit in 2009, which failed to forge agreement between big developed and developing world emitters on who should take on the burden of cuts in greenhouse gas (GHG) emissions. This time around, a more 'bottom-up' approach has obliged countries to submit their carbon cutting plans as a basis of future carbon cuts. Meanwhile, big falls in the cost of low-carbon technology, and increasing co-operation between China and the US, has raised hopes that tireless French diplomacy will help haul almost 190 countries over the line. But major obstacles and potential elephant traps remain.

***Chinadialogue* (CD): How different will the willingness to negotiate in Paris be compared with Copenhagen in 2009?**

Bill Hare (BH): The probability of success is much better this time, as China has taken up a leadership role and has worked with the US on core issues, such as ways to cut emissions and co-operation on technology, including energy efficiency and carbon capture. The US is also in a different space from Copenhagen, and the process has gathered much more sophisticated support from the Obama administration this time around. The US and China, and many others, including the hosts France, have used a lot of their diplomatic capacity to build momentum towards a deal. Everyone knows we can't have another Copenhagen. But there's a long list of issues that could be big obstacles to an agreement, and achieving a deal will involve major challenges for political managers of the process. I fully expect that negotiations will spill over not only into Saturday December 12, but also into the Sunday. These meetings never finish on the official end date, which this year is Friday December 11. The gathering of world leaders at the start, rather than the end of the conference, is an invaluable opportunity for impetus. But the danger is that heads of government make pronouncements that are difficult to reconcile. The publication of a text from the ADP (Durban Platform for Enhanced Action) strand of UN climate talks on December 5 will trigger a political process under the French Presidency to resolve the outstanding issues. It's a critical stage that will greatly determine the final outcome.

CD: To what extent will the pledges so far, which fall well short of putting the world to meeting the 2C threshold, make it difficult for the most vulnerable countries to sign up to a deal?

BH: There are a lot of doubts about whether large emitters will ever be able to deliver the required ambition to put the world on the required path. It's unlikely that a deal in Paris be enough to convince the general public that countries have taken the necessary steps to avoid worsening impacts of climate change. Targets laid out in Intended Nationally Determined Contributions (INDCs) only run up to 2030, and are far above the 1.5C threshold demanded by many small island states or even hold below the the 2C limit accepted by all countries. If the 1.5C threshold is taken off

the table it could provoke a crisis. . The actions outlined so far by developed countries are at best headed to 2.7C and are from giving the world a likely chance of restricting a temperature rise to 2C.– so getting regular five-year reviews into a final text will be a big issue.

CD: Besides the scale of emissions cuts, what are likely to be the other main bugbears for most vulnerable countries?

BH: Countries most at risk of climate change are going to want to see a convincing financial package that has much greater clarity on the long term sources of funding and scale, and how it is going to be spent. Ministers from these nations will need to return home with something tangible. Vulnerable countries also want to see a provision for 'loss and damage' to provide resources and mechanisms to overcome permanent damages which will occur over and above adaptation needs included in an agreement. This is something they will fight hard for despite the opposition of richer nations and big emitters, such as China and India. Some developing countries may resist a push by developed countries to impose universal standards of monitoring, reporting and verification (MRV), which they would regard as a backdoor attempt to bind them into emissions cuts.

CD: How will discussion about the legal status of the treaty likely play out in Paris?

BH: The US will clearly say that it can't sign up to a specific emissions reductions because that would require ratification by the Senate (which would almost certainly fail) but the most vulnerable countries will find it difficult to back an agreement that is non-legal in nature. Small island states and least developed countries will also not want to accept an agreement that lacks a five-year review mechanism, but even if that interval is agreed, there are questions of what a 'ratchet' or 'review' would entail. What do countries mean by a review, and will it involve obligations to deepen emissions cutsby 2020? Will countries commit to being publicly-bound on increasing the level of ambition of emissions cuts? And can these reviews close the emissions gap in time? If we don't see sharply falling emissions during the next decade then it's very difficult if not impossible to hold warming below 2C, let alone 1.5C. The agreement needs to agree clear processes that would bend the emissions curve sharply lower.

CD: Previous climate talks have been hijacked by countries, or groups of countries, who have refused to engage with discussions on many of the main strands. Who is likely to be in the 'awkward squad' this time round?

BH: The Paris climate summit will definitely have several political ructions that might threaten an overall deal being done, and there's always the risk that countries such as Venezuela, which has caused problems before, once again moves into a blocking position. The UNFCCC doesn't have a lot of freedom to exclude countries from the process. It's possible that Russia will raise barriers to agreement late in the day, but with Russia it's always hard to tell. The Middle East oil producers certainly don't like an undertaking to cap temperatures rises at 1.5C, and they will likely be joined by big consumers or producers of coal, such as Australia, South Korea and Japan to weaken moves to enshrine some kind of 2050 decarbonisation target in an agreement.

CD: Because of China's bilateral deals with the US, India is now seen as the major developing world emitter that will need to be placated in Paris. What does it want?

BH: India's role at the Paris climate talks will be crucial to their success – it will likely generate a lot of political noise and fears persist that it might become a 'blocker'. In terms of overall ambition India has a long shopping list, such as no in terms of overall ambition 1.5C target (which could compel big emissions cuts from large developing countries), no legally binding clauses and clear access to finance and no five year review by 2020 technology for adaptation and mitigation. India wants a great deal of flexibility.It is important to recognise that over the next decade, India is likely to have the fastest-growing electricity market among the largest economies in the world and that it faces a choice between going faster and harder towards renewable energy, with lower or emissions, or a high emissions path with more coal. Current policies in India are headed towards India's coal-fired power capacity reaching over 380 GW in 2030, far above the 230–250 GW consistent with a below 2C pathway.

John McGarrity is deputy editor of chinadialogue based in London.

巴黎气候协议的范围有多大?

大约四分之一的全球温室气体排放并不包括在巴黎气候峰会将要达成的新协议中，并且迄今许多部门的减排倡议与气候协议的目标并不相符。

亚历山德罗 · 维特利

当法国外交部长洛朗 · 法比尤斯（Laurent Fabius）宣布联合国气候峰会将于 12 月 11-13 日这个周末闭幕之时，一个新的气候协议有望诞生。就覆盖的温室气体排放地域面积来看，新的气候协议将远远超过京都议定书。

尽管新协议对世界温室气体排放的监管范围远大于前，但仍有一些关键的排放部门和排放活动没有被纳入联合国气候变化框架公约（下面简称 UNFCCC）的管辖范围，并在全球温室气体排放总量中占有较重份额。这些部门将如何尽到应有的排放义务以避免危险的气候变化，值得我们在未来密切关注。

众所周知，农业、航空和航海，以及制冷的氢氟烃（简称 HFCs）气体造成的排放几乎占全球温室气体排放的四分之一。由于造成这些排放的行业相当复杂，所以 UNFCCC 框架下的减排行动要么无法开展，要么难以成功。

航空和海上排放

将要达成的巴黎协议无法覆盖民航和海上运输这两个重要部门。1997 年京都议定书谈判时，各国无法就减少航空或航海排放的国际措施达成一致，因此授权给联合国下属的国际民航组织（ICAO）和国际海事组织（IMO）处理相关事务。

国际海事组织估计，2012 年航运带来的温室气体排放占全球总量的 2.5% 以上。根据航空运输执行协会的数据，2013 年航空业产生的排放为 7.05 亿吨二氧化碳当量，约占当年全球排放总量的 2%。

2001 年以来，国际民航组织一直致力于建立一个“以市场为基础的机制”，促使世界各国航空公司减少空中客运和货运造成的排放。但是，目前这个工作还未取得令人瞩目的成果。

“不幸的是，现有的市场解决方案只是着眼于在 2020 年的基础上遏制未来的排放增长，并通过其他部门减排的抵消作用来实现。我们不知道国际民航组织在 2016 年的大会之前是否会真的采纳这些措施。”碳市场观察（Carbon Market Watch）政策顾问卡特 · 沃茨（Kat Watts）说。

除了国际机构之外，还有很多国家开展了减少航空排放的行动，但这些行动均是非强制性的。2012 年以来，欧盟为进出欧盟的航班制定了排放上限，但由于遭到来自美国、中国和印度等国的强烈反对，不得不暂停了对欧盟之外起飞或降落的航班的类似限制。不过，如果国际民航组织的减排计划不够有力的话，欧盟保留了对上述航班重新设置排放上限的权利。

为了对海洋污染进行管理，国际海事组织通过了《国际防止船舶造成污染公约》议定书（即《国际防止船舶造成污染公约》（MARPOL）

> “农业、航空和航海，以及制冷的氢氟烃气体造成的排放几乎占全球温室气体排放的四分之一。”

附录一）。据该组织的说法，这些规则覆盖了全世界 98% 的船只。

该组织拒绝航运彻底减排的号召，声称任何对温室气体进行限排的措施都会损害全球货运和贸易。国际海事组织指出，在现有规则之下，航运在全球总排放中的占比已经从 2007 年的 2.8% 下降到 2012 年的 2.2%。而且，该组织已经采取了能效举措，以减少航运的碳强度（即每公里的二氧化碳排放），而不是航运排放总量。

国际海事组织秘书长关水康司在一份声明中说："全球货运总需求是航运部门无法控制的，这是由全球经济增长所决定的。"

但是，这未能阻止气候团体呼吁航海和航空部门制订绝对的排放上限。

沃茨指出："在巴黎气候峰会上，UNFCCC 应该在具有法律约束力的文件中明确规定国际民航组织和国际海事组织根据其排放比例，制订部门减排目标。这也是大多数国家提出国家自主贡献承诺外应该做的。"

氢氟烃（HFCs）

制冷剂氢氟烃是危害最大的温室气体之一。降低氢氟烃生产过程中的排放一直都是 UNFCCC 的内容之一，但许多化工厂都"逍遥法外"。不过，最近蒙特利尔议定书（一个关于臭氧气体的条约）成员国提出议案，建议为逐步淘汰 HFCs 气体制订一个时间表，从而为减少其危害提供一条更快速也更安全的路径。

© Luis Argerich

可能达成的巴黎协议无法覆盖民航和海上运输这两个重要部门

据美国国家科学院的估计，HFCs 排放从 2007 年的 3.03 亿吨二氧化碳当量增加到 2012 年的 4.63 亿吨，相当于全球总排放的 1% 左右。增长的主要原因是 HFCs 作为破坏臭氧的氟利昂等气体的替代品在空调中得到愈发广泛的应用。

《蒙特利尔议定书》于 1989 年生效，目的是逐步禁止生产在空调、灭火器以及作为溶剂使用的那些破坏臭氧层的气体，尤其是氯氟烃（CFCs）和氢氯氟烃（HCFCs）。人们普遍认为该议定书成功地限制了破坏臭氧层的气体的使用，使其最早可能于 2020 年开始下降。

取代 CFCs 和 HCFCs 的是 HFCs，尽管对臭氧层无害，却被 UNFCCC 认定为威力巨大的温室气体。但是，本月蒙特利尔议定书缔约国同意在下一次会议上制订一个时间表，在全球逐步禁止 HFCs 的使用。

"无论《气候变化框架公约》，还是《京都议定书》，都没有对这些气体采取任何切实措施。在气候谈判中，二氧化碳是最大的焦点。"设在华盛顿的自然资源保护协会的气候和清洁项目主管大卫·多尼格（David Doniger）说道。

多尼格说，蒙特利尔议定书之所以要对 HFCs 进行限制，主要有两个不可抗拒的原因。

"首先，HFCs 增加的唯一原因就是它可以作为 CFCs 和 HCFCs 的替代品，蒙特利尔议定书是造成 HFC 问题的始作俑者，它有责任来解决这个问题。"

"其次，我们在 UNFCCC 的谈判中从未涉及第二层次的各种气体，而这个产业的专家全都站在蒙特利尔议定书这边，这是个范围很窄的行业。"

非政府组织"环境调查局（Environmental Investigation Agency）"的活动家阿德拉·普提讷鲁（Adela Putinelu）指出，结果可能是 UNFCCC 与蒙特利尔议定书二者进行责任划分。

普提讷鲁解释说："UNFCCC 负责包括 HFCs 在内所有温室气体减排的监测和报告，而如果明年蒙特利尔议定书修正案获得通过的话，它将负责减少 HFCs 使用的实际工作。"

农业和林业

联合国粮农组织的数据表明，2010 年到 2014 年，农林业及其他土地利用造成的年均全球排放为 102 亿吨二氧化碳当量，占到了人类活动排放总额的近 20%。

这类排放包括粮食生产和畜禽养殖（如使用排放二氧化氮的肥料和畜禽粪便及消化中排出的甲烷）、森林用途改变、泥炭地退化、以及火灾等。联合国粮农组织估计，如果不采取更强有力的措施实现减排，到 2050 年上述源头造成的排放将增加 30% 以上。

重要的是，农业和林业活动还能吸收或减少温室气体。因此，由于林火造成的森林损失不仅意味着在燃烧过程中产生二氧化碳，还意味着森林吸收二氧化碳能力的丧失。

农林业及其他土地利用排放的部分事务由 UNFCCC 负责。比如，2013 年各国同意建立一个机制来减少森林砍伐造成的排放。但是，各国在如何在保证食品生产不受影响的同时解决农林业排放的问题上并未达成一致。

UNFCCC 将交通和氟化气体等关键部门的排放授权给联合国下属机构及现有条约机制负责，这样一来它就能集中力量加快实现工业和发电部门的减排，这是温室气体的最大来源。

这种做法还有很多其他好处，比如在交通排放等问题的处理上可以避开管辖权问题；更重要的是，还可以回避那些政治敏感问题，比如现有的全球食品生产还不足以消除饥饿。

但是，至关重要的是航空、海上运输和氟化气体生产部门的减排必须同步进行，否则就会有越来越多的声音呼吁联合国气候变化框架公约介入，直接对这些排放源进行监管，这很可能带来巨大的成本，包括政治性的拖延和冗长的讨论。

亚历山德罗·维特利，能源及气候政策领域自由撰稿，曾任彭博社编辑一职、伦敦经济学院客座研究员

Which GHGs will Paris not cover ?

Around a quarter of global GHGs won't be under the remit of a potential Paris agreement, while many sector-based initiatives so far have been unfit for purpose

Alessandro Vitelli

When French Foreign Minister Laurent Fabius brings the UN climate summit to a close on the weekend of December 11-13, a new climate treaty will likely emerge that far outstrips the Kyoto Protocol in its geographical coverage of greenhouse gas (GHG) emissions.

Yet, while the new deal will regulate far more of the world's climate pollution than its predecessor, there will still be key sectors and activities that are not governed by the UNFCCC (the UN's climate arm), and these represent a big share of global greenhouse gases (GHG). How those sectors achieve their share of the big cuts needed to avoid dangerous climate change will be closely watched in the months and years to come.

All told, emissions from agriculture, aviation and shipping, and refrigerant HFCs gases, total almost a quarter of global GHG pollution. The complexity of the sectors that produce these emissions has meant that efforts to deal with them under the UNFCCC have either not happened, or have been largely unsuccessful.

Aviation and maritime emissions

Two key sectors that will not be covered by Paris are civil aviation and maritime transport. At negotiations for the Kyoto Protocol in 1997, nations could not agree on international measures to reduce emissions from aviation or shipping, and so delegated authority to handle the issue to the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO), the respective UN agencies that govern international activity in these sectors.

The IMO estimates that in 2012, GHG emissions from shipping represented more than 2.5% of the global total. For its part, aviation produced 705 million tonnes of carbon dioxide equivalent (CO2e) in 2013, around 2% of the world total for the year, according to data from the Air Transport Action Group.

Since 2001, ICAO has been working towards a "market-based mechanism" that would allow air carriers worldwide to reduce emissions generated through air travel and transportation. So far, its work hasn't impressed climate campaigners.

"Unfortunately, the current proposal for the market-based solution aspires only to stop emissions growth at 2020 levels from 2020 onwards, and to achieve this through offsetting from emissions reductions in other sectors," Kat Watts, a policy advisor with Carbon Market Watch, said by email. "We will not know whether these measures will indeed be endorsed by ICAO until the October 2016 Assembly."

Outside the jurisdiction of international agencies, there are numerous national initiatives to reduce emissions from aviation, but none of these are mandatory. Since 2012, the European Union has capped emissions from flights that originate or end in its jurisdiction, but was forced to suspend coverage of flights taking off or landing outside the bloc after fierce opposition from countries including the US, China and India. The EU has reserved the right to re-impose caps on these flights if it deems ICAO's plan to be insufficiently ambitious.

IMO regulates marine pollution through the Protocol to the International Convention for the Prevention of Pollution

Emissions from agriculture, aviation and shipping, and refrigerant HFCs gases, total almost a quarter of global greenhouse gas pollution.

from Ships, known as MARPOL Annex VI. According to the IMO, these rules cover emissions from more than 98% of the world's fleet.

The organisation has resisted calls for outright emissions cuts for shipping, saying that any cap on GHGs will harm global freight and trade. It points out that under existing rules, shipping's share of global emissions has already fallen to 2.2% in 2012 from 2.8% in 2007. Instead, the IMO has mandated energy-efficiency measures that may reduce the carbon intensity of shipping–the amount of CO_2 emitted per kilometre travelled–but not the total amount.

"What shipping cannot do is control the total global demand for cargo to be carried," IMO Secretary-General Koji Sekimizu said in a statement. "This is directly related to growth in the global economy."

This has not stopped climate groups from calling on the shipping and aviation sectors to set absolute limits on emissions.

"For Paris, the UNFCCC should make a clear call in the binding legal instrument, for ICAO and IMO to set sectoral targets in line with their fair share of action," Watts said. "These should be on top of the national pledges that most countries have so far put forward".

HFCs

Reducing emissions from the production of hydrofluorocarbons, one of the most powerful types of GHGs that are used in refrigerant gases, has been historically handled by the UNFCCC, but many chemical plants are exempt. However, a recent proposal by parties to the Montreal Protocol, an ozone gas treaty, to agree a timetable for the phase-down of HFCs, may offer a faster and more secure route towards reducing their impact.

HFCs emissions are estimated by the US National Academy of Sciences to have grown from 303 million tonnes of CO_2 equivalent in 2007 to 463 million tonnes in 2012, or around 1% of global emissions. This increase stems chiefly from the increased use of HFCs as a replacement for ozone-depleting gases in air conditioning.

The Montreal Protocol took effect in 1989, and was established to phase out production of gases that harm

the ozone layer, in particular chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) gases used in air conditioning, fire extinguishers and as solvents. The protocol is widely viewed as a success, has limited increases in the use of ozone-depleting gases and is forecast to make reductions as early as 2020.

CFCs and HCFCs have been replaced by hydrofluorocarbons (HFCs), which, while not harming the ozone layer, are powerful GHGs that have been covered under the UNFCCC. However, Montreal Protocol member nations agreed in November to set at their next meeting a timetable for a global phase-down of HFCs.

"Nothing substantial has been done under the climate convention or the Kyoto Protocol about those gases," according to David Doniger, director of the Climate & Clean Air Program at the Natural Resources Defense Council in Washington DC. "In the climate talks, CO_2 sucks all the oxygen out of the air."

There are two compelling reasons for the Montreal Protocol to take up regulation of HFCs, said Doniger.

"First, the only reason that HFCs are growing is that they came in as a replacement for CFCs and HCFCs," he said. "The Montreal Protocol effectively created the HFC problem and so it has a responsibility to address it."

"Second, we never get to the second-tier gases under the UNFCCC negotiations, and the expertise in the industries that use this gas is all on the Montreal Protocol side. It's a pretty narrow sector."

The result may be a division of responsibilities between the UNFCCC and the Montreal Protocol, according to Adela Putinelu, a campaigner at the Environmental Investigation Agency.

"The UNFCCC has a duty to monitor and report reductions in GHGs including HFCs," Putinelu explained. "The amendment to the Montreal Protocol, if agreed next year, will govern actual reductions in HFCs use."

Agriculture and Forestry

Data from the UN's Food and Agriculture Organisation (FAO) shows global emissions from agriculture, forestry and other land uses (known as AFOLU) averaged 10.2 billion tonnes a year of CO_2 equivalent over the period 2010-2014, or nearly 20% of total emissions from human activity.

This category includes crops and livestock production (including the use of fertilisers that release nitrous oxide, and methane from livestock waste and digestion), forest conversion to other uses, degraded peatlands and fires. FAO estimates emissions from these sources could increase by as much as 30% by 2050 unless greater measures are taken to reduce them.

Critically, agriculture and forestry activities can also absorb or cut GHGs. Consequently, the loss of forest cover through wildfires means that not only is CO_2 released by the burning, but the forest's capacity to absorb CO_2 is lost.

AFOLU emissions are partly regulated by the UNFCCC: for example, in 2013 nations agreed to establish a mechanism to reduce emissions from deforestation. However, in general countries have been unable to agree how to tackle agriculture and forestry emissions and ensure that food production would not be affected.

By delegating control over emissions from key sectors such as transport and fluorinated gases to UN agencies and existing treaties, the UNFCCC can focus its agreement on achieving more immediate emission reductions from industry and power generation, the largest sources of GHGs.

It can also avoid jurisdictional problems that might exist were it to try to regulate transport pollution, not to mention politically sensitive issues such as agriculture where existing global food production has yet to eliminate hunger.

However, it will be critical that emission cuts from aviation, maritime transport and fluorinated gas production are seen to decline at the same pace, or there will be increasing calls for the UNFCCC to step in and regulate these sources directly, potentially at a considerable cost in terms of political delay and painfully slow discussions.

Alessandro Vitelli is a freelance journalist writing about energy and climate policy. He is a former editor at Bloomberg News and a visiting fellow at the London School of Economics.

发达国家在巴黎会后应提供资金应对森林采伐

若要避免气候变化失控，减少森林砍伐至关重要。关键细节可能只有等到巴黎气候协议达成后才能确定。

弗雷德·皮尔斯

在导致地球变暖的温室气体排放总量中，森林砍伐导致的排放占到了五分之一

森林问题是世界遏制气候变化工作的一个潜在的议题。在导致地球变暖的温室气体排放总量中，森林砍伐导致的排放占到了五分之一。然而，当近 200 个国家的代表齐聚巴黎探讨一个盼望已久的新协议以遏制上述排放时，却没有几个国家对这个“未知领域”进行探讨。

也许对于气候谈判的三大主角——中国、美国和欧盟来说，森林只占其排放日程上的一小部分。但是，对于巴西和印尼等其他国家来说，森林在其目前排放问题和未来减排计划中都是主导因素。

大多数与会国家已经提前递交了各自抵御气候变化的规划，用专业术语来说，这就是提交了各自的国家自主贡献（INDC）。据设在荷兰的气候咨询机构——气候聚焦（Climate Focus）所说，只有 40% 的自主贡献方案中包含减少森林砍伐造成的排放，大多数国家自主贡献的主要内容都针对化石燃料。

这是一个被错失了的良机。供职于华盛顿智库“森林趋势”、同时也是气候聚焦报告的联合作者之一的斯蒂芬·多诺克弗里奥（Stephen Donofrio）认为，所有国家的自主贡献方案落实后，全球温度将上升 2.7 摄氏度，而联合国的目标是 2 摄氏度，森林砍伐造成的排放如果能得到解决，就能填补这个差距。

并且这一点是可以做到的。

过去的半个世纪里，热带森林遭到了肆无忌惮的破坏。寻求小块耕地的小农，伐木公司和如今的罪魁祸首——农业综合企业（它们砍光森林用来种植油棕等经济作物或饲养牲畜）都是造成破坏的原因。

然而，在曾以毁林而著称的巴西，这一趋势得到了极大的遏制。过去十年中，巴西的年森林资源流失率已经下降了 80%，温室气体排放总量则减少了 40%，超过了任何其它国家的减排力度。迄今，巴西减少的温室气体排放量累计达到 30 亿吨。

下一个要数目前全世界最大的森林砍伐国，也是第五大温室气体排放国印度尼西亚了。由于最近的

林火肆虐，印尼的排放量已经稍微超过了美国。但自从2011年以来，该国暂停发放新的原始森林新采伐许可证，因此那里的砍伐狂潮也可以得到遏制。

实际上，全球抵制破坏世界上剩余热带森林的力量正在日益壮大。许多品牌制造商担心背上森林破坏者的骂名，如联合利华和雀巢等商业巨头已经与各国政府一起于2014年9月发表了《纽约森林宣言》，承诺到2030年实现其商品供应链的“森林零净砍伐”，2020年实现该目标的一半。但是，迄今中国和印度的商界领袖还未加入。

全世界能否实现森林零净砍伐的目标？我们如何才能知道是否能够实现目标？

对森林“净”砍伐进行衡量比想象的要难。所谓“净”，指的是得失间的差。国际林业研究中心的彼得·霍尔格伦（Peter Holmgren）说，森林损失可以从上年同期的卫星图像比较中快速而清晰地看到，而再造林的生长则要缓慢得多，也不容易看到。

但这个规模庞大的再造林趋势还在继续，并且多集中在中纬度地区，从美国的新英格兰地区到日本；热带国家也在进行森林再造，常常都是在农民离开土地到城里工作之后。联合国粮农组织的《2015年全球森林资源评估》汇集了各国的土地利用数据。该报告显示，再造林将全世界每年的森林砍伐面积从760万公顷减少到330万公顷，而就在短短五年之前，这个数字还是500万公顷。

如果这一趋势持续下去，到2030年世界将真正实现零净砍伐目标。巴黎气候谈判是否有助于这一目标的实现，并不在于富林国家正式做出的最低限度承诺，而取决于是否有到位的财政刺激来鼓励森林保护和恢复。这里有两个重要的机制要素。

第一个是REDD计划，即“减少源于森林砍伐和退化的排放”。这一机制是用富国的钱来保护穷国的森林。目前该计划正在开展试点，大多数资金来自援助基金（尤其是来自挪威）。

REDD可能在巴黎大会之后正式“启动”。其最初设想是通过全球碳交易市场来获得资金，污染者在这个市场里通过买进REDD的项目来抵消其排放。目前这方面还没有进行太多实践，碳交易市场可能也不会出现在巴黎协议的最后文本里。但是，随着2020年巴黎协议完全生效后对工业排放的限制开始“发威”，公司基金将蜂拥而至地要求买进REDD项目，因为要实现减排目标，这是一个低成本的选择。

第二个潜在的森林保护融资来源是绿色气候基金。在毫无成果的2009年哥本哈根气候谈判中，富裕国家同意设立一个基金，并承诺到2020年前每年拿出1000亿美元来帮助发展中国家“减缓和适应”气候变化。如今巴黎大会将近，承诺仍在，但细节仍然很模糊。

这些细节包括：各国政府要拿出多少资金，私营部门又要拿出多少？REDD项目的资金是否会被作为整个“盘子”的一部分？有多少资金被用于减少排放的“减缓项目”，又有多少被用于帮助人们应对气候变化后果的“适应项目”？（理论上，森林可以满足两方面的标准，因为它们既能储存碳，又能通过降低当地温度、抑制洪水和减少风暴来减缓气候变化的影响。）

上述问题都尚未有答案。许多观察家认为，如果巴黎气候谈判最终无法达成协议的话，原因在于资金，而非减排目标。

森林保护承诺面临的一个问题是由谁来做这件事。各国政府可能想要建立保护区，而私营部门则争相参与其中。但事实表明，原住民和其他森林社区实际上是森林最好的管理者。比如，巴西亚马逊地区森林砍伐的剧减，大部分都是在包括雅诺马马和卡亚波等部落在内的300个原住民区域实现的，占到巴西亚马逊地区面积的五分之一。

去年，世界资源研究所在一份关于130项当地研究的综述中总结说，与其它森林相比，社区管理下的森林被砍伐的更少，储存的碳更多。正如该研究所所长安德鲁·斯蒂尔（Andrew Steer）所说：“如果想要遏制森林砍伐，就把法定权利交给当地人。”正是遵循这一建议，巴黎大会可能会发表一项声明，旨在将森林保护的国际资金直接交给原住民。

许多富林国家的政府不愿意将本国的森林置于国际监管之下。因此，我们在巴黎气候谈判中不可能看到比自愿的森林保护承诺更进一步的行动。但是，金钱万能。排放者想要森林作为补偿；砍伐者面临的消费者压力与日俱增；森林居民想拿回他们的土地。电锯猖獗的日子可能即将走到尾声。

弗雷德·皮尔斯的《人口之震》一书由“伊甸园项目”出版

Can a UN climate agreement curb deforestation.

Reducing deforestation will be essential for the world to avoid runaway climate change, but the essential detail will likely only emerge after a Paris agreement

Fred Pearce

Forests are the hidden agenda in the world's efforts to curb climate change. Deforestation is responsible for up to one fifth of the global greenhouse gas(GHG) emissions that are warming the planet. And yet, when delegates from almost 200 nations gather in Paris to thrash out a long-awaited new deal to curb those emissions, few will be talking about this *terra incognita*.

Perhaps this is because for the three biggest players at the talks – China, the US and the European Union – forests are a small part of their current emissions story. But for other major nations, such as Brazil and Indonesia, forests are the dominant factor behind both their current emissions and future plans to curb them.

Most nations attending the talks have submitted in advance pledges for how they will help fight climate change: in the jargon, these are their Intended Nationally Determined Contributions (INDCs). But according to an analysis by Climate Focus, a Netherlands-based climate consultancy, only 40 submissions include specific actions for cutting emissions from forests. Most INDCs focus largely on fossil fuel burning.

> "'An end to deforestation could bridge the gap between the 2.7C warming calculated as the likely outcome of implementing the INDCs and the UN goal of halting warming at 2C .'"

This is a missed opportunity. An end to deforestation could bridge the gap between the 2.7C warming calculated as the likely outcome of implementing the INDCs and the UN goal of halting warming at 2C, says Stephen Donofrio of the Washington, DC-based think tank Forest Trends, a co-author of the Climate Focus report.

And it could be done.

There has been an orgy of tropical deforestation in the past half-century. Many have got the blame: smallholders looking for land to farm, logging companies and the predominant villains today, agribusinesses clearfelling forests to grow commodities like palm oil and raise cattle.

Yet, in the country once synonymous with deforestation the carnage is much reduced. Brazil has cut the annual rate of forest loss by 80% over the past decade, and so reduced its total GHG emissions by around 40%. No other nation has achieved a bigger cut. It has so far kept an estimated 3 billion tonnes of GHGs out of the atmosphere.

Next up could be Indonesia, currently the largest deforester and the world's fifth largest GHG emitter. During the recent forest fires there, its emissions briefly exceeded those in the US. But since 2011, Indonesia has had a moratorium on issuing new logging licences in primary forests, so the tide may be turning there too.

In fact, there is a growing global effort to halt the loss of the world's remaining tropical forests. Many manufacturers of branded goods are fearful of gaining a reputation as forest destroyers. Giants such as Unilever and Nestle joined governments in September 2014 to sign up to the New York Declaration of Forests, pledging to achieve "zero

net deforestation" in their supply chains by 2030, and to halve it by 2020. Though so far their Chinese and Indian counterparts have held back.

Could the world as a whole achieve zero net deforestation? How would we know?

It is harder than you might imagine to measure "net" deforestation – the difference between what is lost and what is gained. Because, while forest loss is quick and visible from year-on-year comparisons of satellite images, regrowth is much slower and less visible, says Peter Holmgren, director of CIFOR, an international forest research institute.

But there is substantial regrowth going on. Much of it is in middle latitudes – from the US state of New England to Japan – but it is also happening in tropical countries, often as farmers leave their land and move to cities for work. The 2015 UN Global Forest Resource Assessment, which collects national land-use data, reported that regrowth reduced the annual 7.6 million hectares of forests being cut down to a net loss of just 3.3 million hectares. That is down from 5 million hectares just five years ago.

If that trend continues, the world could indeed achieve zero net deforestation by 2030. Whether the Paris talks help to achieve that will depend less on the minimal formal emissions pledges from forested countries than on the financial incentives put in place to encourage the preservation and revival of forests. There are two elements here.

One is the programme known as REDD, for Reduced Emissions from Deforestation and Forest Degradation. It offers rich-world money to protect poor-world forests. Pilot projects are under way, mostly funded by aid budgets – notably from Norway.

REDD will likely "go live" after Paris. The original idea was to fund it through a global carbon market, in which polluters "offset" their emissions by buying into REDD projects. That hasn't happened much yet. And carbon markets may not be mentioned in the final Paris text. But as limits on industrial emissions begin to bite after the Paris agreement enters into full force in 2020, corporate funds may queue up to buy into what is likely a cheap option for meeting emissions targets.

The second potential source of funds for protecting forests is the Green Climate Fund. At the abortive Copenhagen climate talks in 2009, rich nations agreed to establish a fund to help developing countries "mitigate and adapt" to climate change. They promised to pay in US$100 billion a year by 2020. That remains the promise, but details remain hazy in the run-up to Paris.

How much of the money will come from governments, and how much from the private sector? Will funding for REDD projects be regarded as part of the overall "pot"? How much money will go to "mitigation" projects to reduce emissions, and how much to "adaptation" to help people cope with the consequences? (In theory, forests could quality for both, since they both store carbon and help ameliorate the effects of climate change by reducing local temperatures, retaining floodwaters and buffering storms.)

None of these questions are answered as yet. Many observers believe that if the talks ultimately fail to reach an agreement, it will be because of money, not carbon targets.

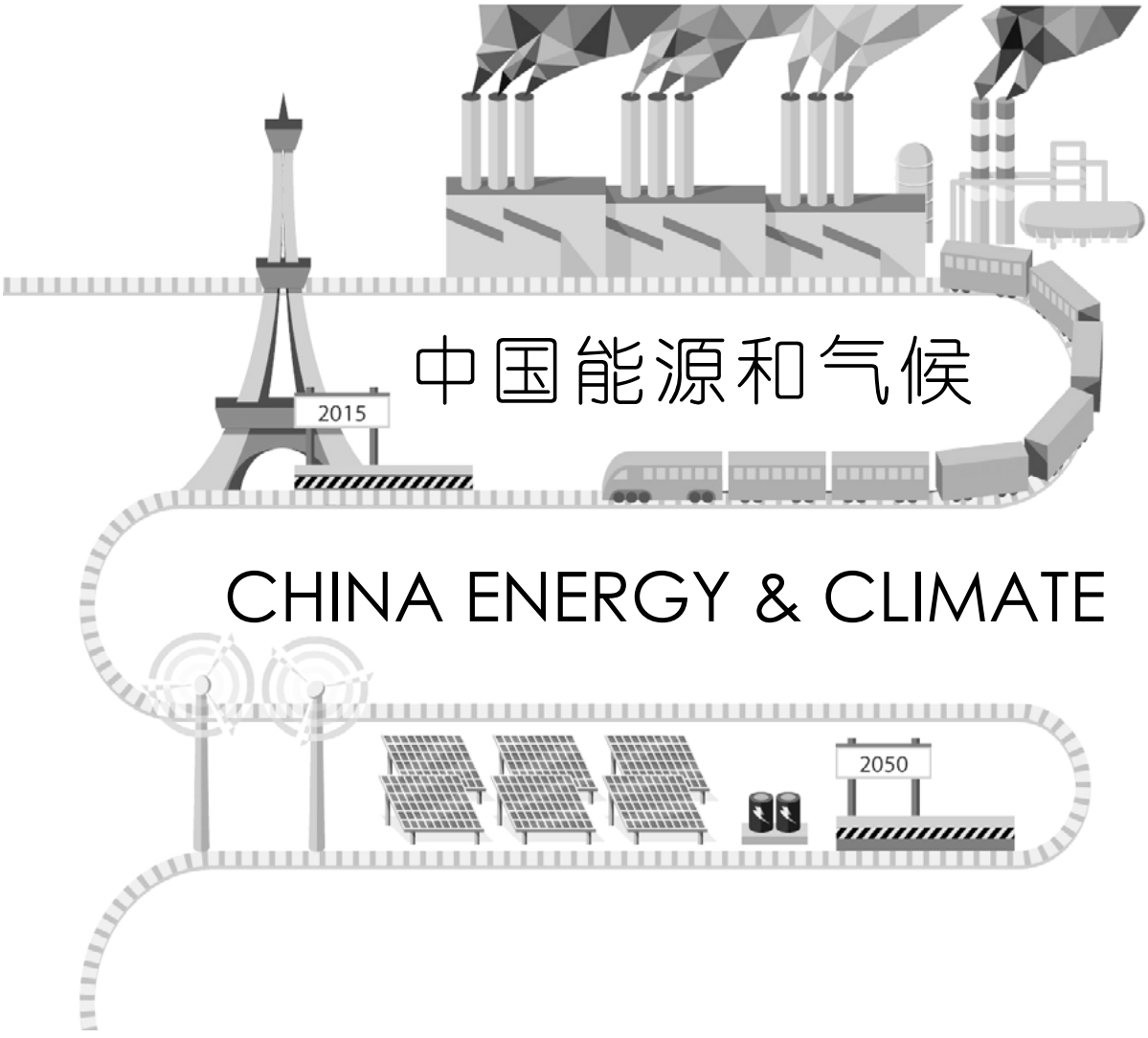
Promising to protect forests begs the question of who can do it. Governments may want to set up protected areas, and the private sector will queue up to be involved. But the evidence is that indigenous peoples and other forest communities are actually the forests' best stewards. The dramatic reduction in deforestation in the Brazilian Amazon, for instance, has been achieved mostly in 300 indigenous territories, covering one fifth of the region, where tribes such as the Yanomami and Kayapo have domain.

Last year, in a review of 130 local studies, the World Resources Institute, a Washington, DC-based think tank, concluded that community-run forests suffer less deforestation and store more carbon than other forests.

As the institute's director, Andrew Steer, put it: "If you want to stop deforestation, give legal rights to communities." Heeding that advice, the Paris meeting is likely to see announcements aimed at funnelling international money for forest conservation directly to indigenous people.

Many governments of forested countries are reluctant to cede international oversight of their forests. So we are unlikely to see anything beyond voluntary pledges on forest protection during the Paris talks. But money talks, emitters will want forest offsets and consumer pressure on deforesters is growing. Forest communities want their land back. The worst days of the chainsaw massacre may be drawing to a close.

Fred Pearce's Peoplequake is published by Eden Project.



中国能源和气候

CHINA ENERGY & CLIMATE

中国气候政策成效如何？走向何方？

世界资源研究所最新评估结果显示，中国要实现长期的减排，必须限制煤炭使用，抑制温室气体排放，并在全国范围内推广排放权交易。

宋然平　齐 晔

中国必须提升可再生能源在其能源构成中的比重，以遏制煤炭使用并阻止二氧化碳排放量持续上升

9月底中美两国就气候变化问题发表了重要的联合声明，而即将达成新的全球性气候协定的巴黎峰会也正在进行中。在这样的时刻，全世界各国都希望了解中国是如何采取气候行动的。中国是世界上最大的温室气体排放国但同时又是一个发展中国家。中国在应对气候变化的全球行动中发挥着关键的作用。

那么中国正在采取哪些减排措施，而为了遏制全球变暖，未来中国又需要做出哪些努力呢？

开放气候网络（OCN）新近发布的两份报告可以就以上两个问题为我们提供一些思路。《中国“十二五”期间气候政策执行情况评估》全面考察了中国自2011年以来在降低温室气体排放以及应对气候变化方面所采取的努力，而《遏制中国二氧化碳排放增长：趋势与缓解潜力》则通过研究反映中国未来增长各个方面的模型，分析未来几十年中国温室气体排放的可能轨迹。研究表明，由于中国此前采取的行动，其温室气体排放量将在2020年到2030年之间达到顶峰，并在此后逐步下降。如果中国能够采取更有抱负的行动，其温室气体排放量峰值将比预期的更低，所造成的累积影响也将小于此前的判断。

气候行动的新时期

“十二五”时期（2011年-2015年）是中国气候行动史上的一个新时期。在这个时期，中国的气候政策由

设定宽泛的目标或者优先事项，转向以具体减排工具为主导的新型政策框架。中国领导人认识到，恰当的气候和能源政策有助于国内经济的发展，特别是通过创造就业、降低污染以及生产效率、能源安全以及健康等方面改善所带来的财政开支降低。

目前，中国即将达到甚至超过“十二五”规划的多个气候和能源目标。十二五规划确立了具有约束力的目标，要求在2015年之前将森林覆盖率提升至21.66%，能源强度降低16%，二氧化碳排放强度降低17%，将初级能源结构中非化石燃料所占比例提高至11.4%。中国2013年森林覆盖率为21.63%，2014年初级能源结构中非化石燃料所占比例为11.2%，均接近2015年的目标。OCN的分析预计，中国2014年能源和碳强度分别降低了13.4%和15.5%。

中国国内取得的进展使其有能力提出由具体国策支持的、有意义的国际承诺。这有助于增强国际社会对中国兑现承诺的信心。

三个需要关注的关键行动

推动一个体量庞大且快速发展的经济体转向更可持续的发展方式对于任何国家来说都是具有挑战性的事情，中国自然也不能例外。不过中国已经在实践中学习，并且中国到现在为止所取得的进展也证明了它正在快速地适应并不断取得进步。如果中国要在现有进步基础之上继续实现其所设想的低碳发展未来，那么它就必须提高透明度和数据的准确性，加强政策执行力度和合规机制，并制定更为具体的政策推进碳捕捉和排放。另外，中国必须改进政策协调水平，鼓励决策创新，建立更为全面的政策执行情况和影响的追踪监控体系。

中国很有希望实现其2015年目标，但兑现其国际承诺并不断推进气候行动要求中国必须不懈地做出努力。对于将于2016年开始的“十三五”阶段，我们的研究提出了可能对中国减排行动产生长远影响的三个关键的政府行动领域：

1) 限制能源与煤炭消费

2012年中国温室气体排放中能源消费贡献的比例为78.5%，而煤炭消费则占到中国能源消费的66%。中国官方正在研究能源和煤炭消费的总体目标，并可能将其纳入国家、行业及省级“十三五规划”。如果真的如此，政府必须为目标确定一种形式，要么是政府直接干预下的约束性目标，要么是通过更温和手段实现的预期目标。政府在目标形式上的选择将表明其雄心的大小，并将直接塑造中国的排放轨迹。

2) 遏制温室气体增长

2014年11月，中国承诺将控制其碳排放量，确保其在2030年或者更早达到峰值。要兑现这一承诺，中国必须制定温室气体排放绝对增长的量化目标。虽然政府没有明确指出峰值的水平，但研究显示中国应该可以通过更为全面的政策使其能源消费相关的二氧化碳排放量在2020年达到大约9-10Gt，而政府已经在采取相关政策。此外，政府官员还需要将全国温室气体排放上限目标分解到各地区（省和市）以及行业，以保证相关政策得到有效执行。

3) 实施国家碳定价计划

研究表明，对碳进行定价是保证碳排放在2030年或者更早之前达到峰值的关键手段。9月25日，习近平主席宣布，中国政府计划在2017年推出全国碳排放交易体系。这是一项重大的举措，为了做好准备，政府正在努力克服一系列技术和政策障碍，例如建立健全的排放测算、报告和认证体系，以及制定和分配排放权限。

走向巴黎

中国近年来推进气候行动的举动具有重要意义。这些举动以及美国、欧盟和其他各方的努力为即将在巴黎召开的国际气候谈判奠定了基础。短短几年，中国的立场已经从之前的没有做出任何国际气候承诺，发展到2009年哥本哈根气候峰会首次承诺降低碳强度，再到如今已经承诺遏制其碳排放量增长并采取一系列政策工具降低排放。如果在接下来几年里中国可以不懈努力，那么中国就可以延续现有的势头，提前实现低碳目标，并激励全世界各个国家和地区的气候行动。

原文刊载于WRI网站。文中提到的报告全文请参见：《中国“十二五”期间气侯政策执行情况评估》以及《遏制中国二氧化碳排放增长：趋势与缓解潜力》。

宋然平，世界资源研究所中国气候与能源团队主管

齐晔，清华–布鲁金斯公共政策研究中心主任及高级研究员

China's climate policies: an audit

Curbs on coal, caps on GHGs and nationwide emissions trading are essential for long-term emissions cuts in China, says an assessment from WRI

Ranping Song and Qi Ye

On the heels of the major China-US joint announcement on climate change in late September, and with the Paris climate talks upon us, people around the world are looking to understand how China is taking climate action. As the world's largest emitter of greenhouse gases and yet a developing country, China plays an instrumental role in the global effort to address climate change.

So what's China been doing, and what does the country need to do in the future to limit warming ?

Two new papers from the Open Climate Network offer some insights to those questions. Assessing Implementation of China's Climate Policies in the 12th Five-year Period is a comprehensive assessment of China's efforts since 2011 to reduce emissions and act on climate change, while Peaking China's CO_2 Emissions: Trends and Mitigation Potential surveys models that project many aspects of China's future growth in order to analyze the likely course of emissions in the coming decades. The research shows how China's climate action has set the stage for its emissions to plateau between 2020 and 2030, and decline thereafter. With further ambitious actions, the country can peak its emissions at a lower level than planned, with lower cumulative emissions than initially thought.

A new era of action

The 12th Five-Year Period (FYP) (2011–2015) marked a new era in China's climate action. Its climate policies shifted from setting broad goals or statements of priority, to an emerging climate policy framework comprised of specific instruments to drive emissions reductions. Chinese leadership now sees climate and energy policies as a way to seize economic benefits domestically, particularly through job creation, decreased pollution and financial savings from improved efficiency, energy security and health.

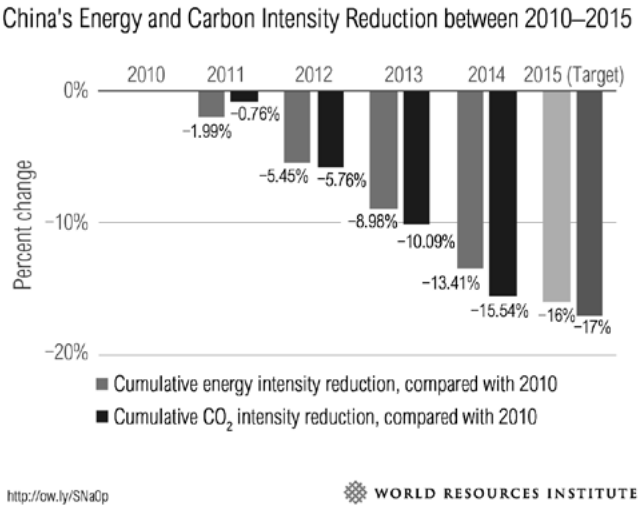
China is now on track to meet or even exceed the numerous climate and energy targets it set for the 12th FYP. The Plan established binding targets to increase forest coverage to 21.66%, reduce energy intensity by 16%, reduce carbon dioxide emissions intensity by 17%, and increase the proportion of non-fossil fuels in the primary energy mix to 11.4%, all by 2015. China's forest coverage rate in 2013 was 21.63%, and the proportion of non-fossil fuels in primary energy consumption was 11.2% in 2014, both very near to achieving the 2015 targets. OCN analysis estimates that China reduced energy and carbon intensity by 13.4% and 15.5% in 2014.

China's progress domestically has enabled the country to put forward meaningful international commitments backed by concrete national policies. This can help inspire confidence in the international community that China will achieve its goals.

Three key actions to watch

Steering a large and quickly evolving economy toward a sustainable future will have its challenges for any country, China included. China has been learning by doing though, and its progress to date demonstrates that it's adapting quickly and making headway. To build on current progress

towards its vision of low-carbon development, China can enhance transparency and data accuracy, strengthen its policy enforcement and compliance mechanisms, and develop more concrete policies to advance carbon capture and storage. Furthermore, it can improve policy coordination, encourage innovations in policy-making, and develop a more comprehensive system for tracking the implementation and impact of its policies.



China has set the stage to achieve its 2015 targets, but meeting its new international targets and carrying its climate action forward will require sustained efforts. For the 13th FYP period set to begin in 2016, our research identifies three key government actions that can have long-lasting impacts on China's emissions:

1) Limiting energy and coal consumption

Energy consumption accounted for 78.5% of China's GHG emissions in 2012, and coal accounted for 66% of energy consumption in 2014. Total energy and coal consumption targets are under consideration, and could be included in the national, sectoral and provincial 13th FYP. If they are, the government will choose a form for those targets to take, which may be either a binding target backed by direct government intervention, or an expected target, which is achieved through softer means. How the government chooses to set this target will indicate the country's ambition level, and will directly shape China's emissions trajectory.

2) Capping GHG growth

In November 2014, China committed to peak its carbon emissions by around 2030, with the intention to peak even earlier. To make good on this pledge, China will need to develop quantitative targets for the absolute growth of GHG emissions. While the government has not identified the peaking level, studies suggest China should be able to cap its energy-related CO_2 emissions at around 9–10 GtCO2 by 2020 with enhanced policies, which the government has started to lay out. Government officials will then need to disaggregate the country's GHG growth cap to regional (provincial and municipal) and sectoral levels to ensure effective implementation.

3) Implementing national carbon pricing scheme

Studies have shown that putting a price on carbon is a key policy lever to ensure carbon emissions peak by 2030 or sooner. President Xi has announced that his administration plans to launch a national emissions-trading system in 2017. To get ready for that major undertaking, the government is working to overcome a variety of technical and political barriers, such as building a robust emissions measuring, reporting and verification system, and determining and allocating emissions allowances.

Approaching Paris

The significance of China's efforts to advance climate action in recent years–combined with those by the USA, European Union and others–has produced a wave of momentum heading into the upcoming international climate negotiations in Paris. In just a few years, China has gone from no international commitment on climate, to committing at the 2009 Copenhagen climate conference to reduce carbon intensity, to pledging to peak its carbon emissions and implement a suite of policy instruments to drive down emissions. With sustained effort in the years ahead, the country can continue this trend, exceed its low-carbon ambitions, and inspire greater climate action around the world.

This article was published originally on WRI's website. Links to full publications are here: Assessing Implementation of China's Climate Policies in the 12th Five-year Period and Peaking China's CO2 Emissions: Trends and Mitigation Potential.

Ranping Song is the developing country climate action manager at WRI.

Qi Ye is a senior fellow and director of the Brookings-Tsinghua Center for Public Policy in Beijing.

中国去碳化道路应该怎么走?

中外对话采访了长期从事中国气候与能源政策研究的清华大学能源环境经济研究所滕飞副教授，请他解读了中国作为全球最大的温室气体排放国，其去碳化路径何去何从。

王亚敏

各国对“公平原则”理解不同

中外对话：UNFCCC 和 UNEP 近日都发布了各国国家自主贡献的相关报告，分析了 146 个国家提交的气候目标与离公约设定的两度目标尚有距离，您觉得提升雄心的机会在哪里？需要怎样的全球合作方有可能？

滕飞：UNFCCC 和 UNEP 的报告都指出一个基本事实，就是各国的 INDC 不足以达成 2 度的目标。

但有意思的是，我们自己做过一个研究，发现由于各个国家对于“公平原则”理解不同，如果各国将 2 度的目标自主分解，会得出不同的分配结果。目前各国的减排方案都是接近对自己最有利的方案。这就是全球会产生减排差距的根本原因。每个国家都倾向于选择对自己最有利的关于公平的阐述和方案，但是加总起来后排放就超过了 2 摄氏度的碳预算。

所以还是需要国际层面的磋商和协调，以缩小各国在这个问题上的差异，能使大家对于公平的原则有一个更接近的理解。

目前自下而上提交的减排机制，就难以避免各国自主地选择公平的指标和范围。从这个角度来讲，我觉得将来唯一能做的是，各国需要将减排与各国内部的发展需求和重点发展目标联系起来，从各国内部去寻找提升减排力度的动力和潜力。

比如中国，现在我们最关心的是空气质量问题，如果中国的空气质量问题能提前解决，对进一步提高中国的减排目标就会产生相当的促进作用。对其他国家也是这样，比如日本的能源安全问题，印度也有国内重要的发展目标。

另外，在一些低碳技术的合作上也可能有一些突破，如降低一些关键性低碳技术的成本，使发展中国家能用得上、用得起。这也会进一步发掘各国在减排上的潜力。

从风险管理的角度来促进决策也是各国需要进一步努力的重要方面。2 度目标达成的可能性是 66% 或者 50%，但是气候变化这种决策问题，可能需要从最坏的结果去考虑：人类能多大程度承担这样一个最坏的结果？仍有 3% 或者 4% 的可能性会温升到 4 度或者 5 度，这种风险我们是否能够承受？人类需要去管理那些虽然概率很小，但是可能会产生灾难性后果的事件。

中国去碳化路径的三个要素

中外对话：您觉得中国的去碳化道路应该怎么走？

滕飞：中国的去碳化路径取决于三个要素：第一是能源效率的提高，通过技术进一步提高，结构进一步优化，使得中国的单位 GDP 的能源效率能维持每年 4% 的增长。

第二是电力部门的去碳化，一是提高可再生能源和核能在电力生产中的比例；二是对于化石能源发电加强 CCS，减少单位发电量的排放，通过这些目标的实现，保证到 2050 年比 2010 年单位发电量的排放降低 90%。

第三是提高终端部门的电气化水平，主要是工业、交通和建筑三个部门。工业上，是用电锅炉替代燃煤锅炉；交通要大力发展电动汽车；建筑要提高电力在采暖、热水供应等方面的运用。

其中第二条和第三条是紧密联系的，首先需要有一个低碳的电力系统，然后再提高终端的电气化水平才能实现减排。否则高碳的电力生产对应高电气化水平只会导致增排。

这三点是中国实现深度去碳化的关键，缺一不可。中国未来几十年的经济增长会维持在相对较高的水平上，我们估计GDP会从现在的7%逐步降低到2030年的5%，到2050年的2.5%-3%。GDP的增长是会推动排放增长的，这就意味着需要发挥能效的提高和能源构成的优化的共同作用，使得中国能在2030年左右达到排放峰值。2030年之后，随着GDP增速的降低，能效的提高和能源构成的进一步调整，才会促成排放绝对值的下降。这是一个大致的路线。

化石能源价格长期低位为政府调整定价机制提供了机会

中外对话：煤炭价格下行，对中国是一个低碳发展的机会还是一个威胁？

滕飞：如果单就化石能源价格下行而言，对于中国实现低碳发展目标是不利的。如果化石能源价格长期处于低位，它与非化石能源就会维持一个较大的价格差。这意味着，要么就是非化石能源的发展受到阻碍，要么政府需要提供更有力的补贴来实现非化石能源的发展，这对政府是个财政负担。

但任何的危机也都孕育着机会。如何去利用这些机会做出一些重要的调整，比如化石能源价格长期处于低位，就为政府重新调整化石能源的定价机制提供了机会。

去年我们和自然资源保护协会（NRDC）的研究，得出煤炭的外部成本在人民币260元/吨左右，约占到现在煤价的一半。但是目前国内煤价体现出来的外部成本只有50元，也就是说目前的定价机制只反映出煤炭五分之一的外部成本。化石能源价格下行的趋势，为政府主动调整化石能源定价机制提供了有利的时机，使其更好地体现社会成本和环境成本。

对煤炭和煤电的投资会变成搁浅资产

中外对话：中国的气候目标对企业释放了什么信号？

滕飞：信号是很明确的。全球要达到2度的目标，对于中国来说，意味着已探明的80%的化石能源储量是不能动用的，否则就会超过2度的全球碳预算。所以对于化石能源行业来说，现在如果继续投资煤炭和煤电，会导致这些投资将来变成搁浅资产，资产的折价也不可避免。

同时，中国为了实现2030年达峰，到2020年，在非化石能源上的投资要比2010年增加一倍，到2030年要达到2010年的三倍。国际能源署去年发布的《世界能源投资展望》估计，要使全球实现2℃温控目标，到2035年全球低碳电力供应投资和能效投资要分别达到2013年的3倍和8倍。这对投资者而言，是一个很明确的政策信号。

同时，对于整体经济发展而言，绿色低碳产业未来也会成为中国新的经济增长点，也是新的就业增长点。这个信号也是吸引企业和投资者向绿色、低碳领域加强投资。

政策信号虽然明确，还需要一些合适的政策手段，将政策信号转化为投资者和企业能感受到的价格信号和市场信号，才能更好的使气候目标落地。比如碳市场和碳价、环境税等。

十三五更强调市场的作用

中外对话：您如何看“十三五”规划对中国实现减排目标的影响？

滕飞：十三五总体而言还是更强调市场的作用，比如用能权、碳市场，让市场更多的发挥作用。

未来比较有意思的，是在政策目标下，政府如何加强市场在达成政策目标中的作用，而非继续强化自上而下的指标分解。

另外政府和市场之间的关系，也有待在十三五之后更加明确。比如碳排放市场，政府能不能放手市场、减少干预，成为一个服务型的政府，而不是面面俱到，从政策设计，到排放权分配，到交易撮合，到第三方核查，整个都包揽下来，这样肯定不利于市场发挥主导型的作用。

王亚敏，《中外对话》气候变化分析师及顾问

How should China decarbonise?

chinadialogue asked Teng Fei, one of China's foremost experts on climate and energy policy, how the world's biggest greenhouse gas emitter can go on a low-carbon diet

Monica Wang

Wind and solar energy that must be deployed on a much bigger scale if China is to make big cuts in its carbon emissions

chinadialogue interviewed Teng Fei, an expert on China's climate and energy policy and associate professor at the Institute of Energy, Environment and Economy at Tsinghua University, on how China can make big cuts in its greenhouse gas emissions in the longer term following a projected peak by 2030 or earlier. Decarbonising the Chinese economy and other large emitters by 2050 is viewed as crucial if the world is to avoid runaway climate change. Teng is is also a lead author of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Chinadialogue (CD): The UNFCCC and UNEP have recently published reports on Intended Nationally Determined Contributions (INDCs) submitted by nearly 180 nations, assessing the gap between those targets and what is necessary to limit average temperature

rises to 2C. Where do you think there is scope for more ambition? What global cooperation is needed to make it possible?

Teng Fei (TF): Both the UNFCCC and UNEP reports stated the same basic fact: the INDCs are inadequate if the 2C limit is not to be breached.

Our research has found that different interpretations of the "fairness principle" mean each country comes to different conclusions on how the work should be divided. Currently each nation's programme is as far as possible in its own interests. And that's why we have that gap. Each country is using the idea of fairness that best suits it – but add it all together and you don't do enough to avoid breaching the 2C limit.

So we still need talks and coordination at the international level, to reduce these gaps and bring about a better consensus on the fairness principle.

The current bottom-up system of submitting climate plans means each nation chooses its own definitions of fairness. So I think the only course of action is for everyone to look at their own emission reduction plans, development needs and key development targets, to find the motivation and potential for bigger cuts.

For example, air pollution is currently a big problem for China. An early resolution to that problem would also help reduce China's emissions. It's the same for other countries. For example, energy security issues in Japan and India as well has its own important domestic development targets.

Also there's the potential for breakthroughs in cooperation on low-carbon technology. For example, reducing the cost of crucial technologies so developing nations can make use of them. That would also result in more potential for emissions cuts.

Risk management is also very important and needs more work. Estimates that we can stick to the 2C limit range from 50% to two-thirds, but climate change policy decisions may need to consider a worst case outcome. What is the worst case humanity can cope with? Can we accept a 3% or 4% chance of a 4C or 5C temperature increase? Humanity needs to manage the small but possible risk of catastrophic outcomes.

CD: How do you think China should decarbonise?

TF: There are three aspects to this. The first is increasing energy efficiency, such as using better technology and structural changes to bring about sustained annual improvements in energy efficiency growth per GDP of 4%.

The second is to decarbonise the power sector by increasing the share of renewables and nuclear energy in the power mix, and using carbon capture and storage in fossil-fuel power generation to reduce the intensity of emissions. Achieving those targets will ensure that by 2050, CO_2 emissions per unit of electricity will be 90% lower than in 2010.

The third is to increase electrification, particularly in industry, transportation and buildings. We should replace industrial coal-fired furnaces with electric ones, increase the use of electric vehicles and use electricity more for heating and hot water.

The second and third methods are closely linked. First,we need low-carbon power generation, then we have to increase electrification in order to reduce direct emissions (from heavy industry).

These three things are all essential to deep decarbonisation – none can be missed out. For the coming decades China will continue to see high levels of economic growth – we estimate annual GDP growth will drop from 7% now to about 5% in 2030 and then 2.5% –3% in 2050. GDP growth does drive emissions growth, which means we need to increase energy efficiency and improve the energy structure if China is to see emissions peak around 2030. After 2030, as GDP growth slows and energy efficiency and structure improves, there will be an absolute fall in emissions. That's a rough idea of what will happen.

CD: Are falling coal prices an opportunity for low-carbon development, or a threat?

TF: Falling prices of fossil fuels alone are not helpful for low-carbon development. If those prices stay low in the longterm, the larger price differential with non-fossil sources of energy will mean either development of non-fossil energy will be hampered, or the government will have to take on the financial costs of subsidising development.

But crisis brings opportunity to make some important changes. If fossil fuel prices remain low, the government can change pricing mechanisms.

Last year, our research in partnership with the Natural Resources Defense Council found that coal has external costs of 260 yuan per tonne – approximately 50% of what coal costs today. But currently only 50 yuan of external

costs are factored into the coal price – one fifth of total externalities. Falling prices give government the opportunity to change pricing mechanisms to better reflect social and environmental costs.

CD: What do China's climate targets mean for business?

TF: There are very clear signals. The 2C goal means that 80% of China's identified fossil fuel reserves must remain in the ground. So for the fossil fuel industry, continued investment in coal and coal power will result in stranded assets and unavoidable writedowns.

Meanwhile, to achieve an emissions peak in 2030, investment in non-fossil sources of energy will increase to twice 2010 levels by 2020, and to three times 2010 levels by 2030. The International Energy Agency's 2014 World Energy Investment Outlook estimated that the 2C limit will require investment in low-carbon power generation and energy efficiency to increase three-fold and eight-fold on 2013 levels by 2035. That's a very clear policy signal for investors.

Also the green and low-carbon sector will become a new point of economic and employment growth. That indicates companies and investors should invest more in green and low-carbon fields.

Although the signals are clear, we still need appropriate policies to send concrete price and market signals if we are to achieve climate targets. For example, carbon markets and pricing, environmental taxes and so on.

CD: What impact will the 13th Five Year Plan have on China achieving its emissions targets?

TF: Overall the plan stresses the role of the markets, for example, using energy rights and carbon markets.

What's going to be interesting is how the government uses markets to achieve policy goals, rather than continuing to hand down targets to be met.

And the relationship between government and the markets still needs to be clarified. For example, in carbon markets – can the government step back and reduce intervention, providing only necessary services, rather than doing everything from policy design to allocating emissions quotas, from deal-making to third-party verification? Micromanaging by government would not help the market play a guiding role.

Monica Wang is a consultant and analyst on climate change with chinadialogue.

中国煤炭难题

中国修正其煤消费数据，体现了中国在能源数据上更为透明的姿态，政策专家解读。

约翰·A·马修斯 谭 浩

《纽约时报》11 月初就中国的煤炭消耗问题发表了两篇重要文章，称中国实际的煤炭消耗量比此前预计的情况要严重得多。11 月 3 日《纽约时报》在头版发表文章，称中国调高了预期煤炭消耗量，并指出其煤炭排放量远高于此前的预计。（原文刊登于 2015 年 11 月 3 日“中国的耗煤量远高于报告数据，使得气候峰会更加错综复杂”）。该文章被广泛转载，并强调所谓的“新事实”，即中国的煤炭消耗量高于此前报告的数据。11 月 11 日，《纽约时报》再次刊文，称中国批准新建大批燃煤电厂意味着碳排放量或有可能高于预期的水平。第二篇报道的内容承袭了德意志银行以及绿色和平东亚分部此前发布的报告。鉴于中国的能源消耗数据在全球气候变化中的重要性，本文将就这些新数据背后的原因和影响进行剖析。

煤炭消耗量和能源数据更新

首先，我们从中国更新过去的燃煤数据着手讨论。统计部门上调了一次能源（以煤当量为基准）和原煤的消耗数据，并将新的数据纳入 2015 年 8 月 1 日出版的《2014 中国能源统计年鉴》，其中有些更新的数据首次出现在 2015 年 5 月发布的《中国统计年鉴 2015 年摘要》中，中国政府当时低调公布数据，《纽约时报》等其他国际媒体也未有评论。据国家统计局介绍，新的数据以 2013 年度的经济普查结果为依据，普查能够更准确地收集国家经济数据，尤其是中小企业上报的数据。这是自新中国成立以来的第三次经济普查，中国政府决定将此前以行业为基础的数据普查纳入到国民经济综合普查中。第一次全国经济普查是在 2004 年，第二次是在 2008 年。

新数据公布以来，新旧数据之间的差异引发了《纽约时报》等国际媒体以及各类研究机构的诸多猜想和质疑。首先，中国政府之前是否故意隐瞒或虚报能源数据？其次，新数据的发布对于分析中国的碳排放量有何影响？需要在多大程度上更新此前发布的数据分析？再次，如何通过新数据来了解中国目前面临的极端污染水平，尤其是近日来多个城市再度遭遇雾霾侵袭。

与《纽约时报》发表文章暗指中国政府“隐瞒”部分煤炭消耗数据，并在后续评论中明确表述这一猜想不同，我们倾向于认为导致这一结果的原因在于中央、省和地方各级部门对能源数据收集和处理缺乏有效的管控。国内外研究学者也早已注意到这一问题，并普遍认为中国在数据收集上出现了系统性失误。从积极的角度看，中国政府更新数据这件事凸显了其宁公开、不隐藏的姿态，这些数据也清楚地彰显了控制温室气体排放的紧迫性。人们可以认为将这一事实公之于众可以敦促国内外各方努力控制温室气体排放，因为虽然可再生能源在能源结构中的比例日益提高，污染程度却比此前报道的更甚。这一观点是合理的，考虑到非化石能源消耗量（以煤当量为基准）也要被上调，并且上调的比例远高于煤炭。这意味着，如果中国政府曾有意“隐瞒”并对外低报耗煤量数据，那么可再

河南省某个煤电厂

生能源使用数据也会被低报；这种做法对于一个追求政治正确的政府来说并不合乎情理。而《纽约时报》和其他西方媒体却只盯着耗煤量数据不放，对新能源数据的少报选择视而不见，着实耐人寻味。

能源密集型产业的能耗数据大幅增加，有可能是因为之前低报了这些行业中新增的产能。比如，今年年初发布的纪录片《穹顶之下》就揭露了中国有大量的小型钢厂和煤矿未经政府批准而建立，而他们不可能如实上报能源使用的情况。另一方面，受环境法的实施以及经济不景气的影响，这些产业近期都出现了严重的产能下降。以钢铁制造业为例，我们认为，该行业面临的危机折射出结构性变革的必要性，并且该行业已经产能过剩。

上调的煤炭消耗数据

《纽约时报》以及所有人真正关注的是上调原煤消耗量的估计值，2012 年原煤消耗量的新估值为 41 亿吨，而此前提供的数值是 35 亿吨。《纽约时报》据此得出一年燃烧的煤炭量多出 6 亿吨，对这一数值我们没有异议。

如果当前的燃煤量继续保持下降趋势，到 2020 年煤炭消费量峰值达 42 亿吨的目标是非常有望实现的。

最后再重申一遍我们一直所强调的事情，中国当前依赖化石燃料（主要是煤）的能源生产和消费模式就如同一艘大船，调头尚需要一定的时间。不过这艘大船一直在努力调头，这从绿色能源增加的幅度中可见一斑，而产能、新投资和发电量的净增加值都说明，可再生能源的优越性大大超出了化石燃料。中国完全有动力去走一条绿色化道路，从而增强能源安全性，并降低颗粒污染造成的雾霾问题。中国更新耗煤量数据意味着我们面对的污染问题比想象的更为严重。但若认为这是中国曾试图低报燃煤量的行为被“戳穿了”，则是大错特错。相反，这说明中国不计后果，以更为开放和有准备的态度来公开数据。诚然，温室气体排放的主体产业在新数据面前面临更多改革的压力。我们注意到，新数据不仅说明过去的燃煤量被低报，对可再生能源（包括水电、风、太阳能）的依赖程度也被低报。对中国或者全球来说，使用可再生能源都是一大利好举措。中国在能源数据上体现的更为公开、透明的姿态让我们有理由相信，报告体现的不只是数字，而是真正的绿色未来。

约翰·A·马修斯，悉尼麦考瑞大学麦格理管理研究生院战略教授，关注东亚国家及企业的新近战略

谭浩，澳大利亚纽卡斯尔大学商学院高级讲师，墨尔本大学亚洲经济贸易中心副教授，2014年曾在台湾国立清华大学担任客座教授

China's coal conundrum

China's revised energy data shows a commitment to greater transparency, say policy specialists

John A. Mathews and Tan Hao

The *New York Times* has recently carried two important stories on China's coal consumption, indicating that the situation is even more serious than previously appeared to be the case. On November 3, the NYT carried a front page report that China has revised its estimates of how much coal it has been burning, and concluding that its carbon emissions have been higher than had been previously reported and assumed.

This was then widely taken up, with the emphasis always on the "new fact" that China's coal burning is higher than previously reported. Then on November 11 the NYT carried a second story concerning a glut of new coal-fired power plant approvals. This second story followed similar reports from both Deutsche Bank and from Greenpeace East Asia. Given the global significance of energy data from China, we explore some of the causes and implications of these developments.

Firstly, let's consider the revision of China's coal burning estimates from past years. It is true that China's statistical agencies have revised upwards their data for primary energy consumption (measured in terms of coal-equivalent) and for raw coal consumption. These revisions were contained in the China Energy Statistical Yearbook 2014, which was published on August 1 2015, and some of the revised data first appeared in the China Statistical Abstract 2015 which was issued in May 2015 without fanfare by the Chinese or any international comment by the NYT or anyone else.

According to the National Bureau of Statistics (NBS) of China, the revised data are based on the results of the 2013 National Economic Census which better captured economic data from the country, especially data from small and medium-sized enterprises. This was only the third such census carried out since 1949 after the country decided to combine previous sector-based censuses into comprehensive national economic censuses. The first National Economic Census was carried out in 2004 and the second one in 2008.

Several questions have been the subject of speculation in the international media, such as, the NYT, as well as, the research community since the new data emerged regarding the discrepancies between the original and revised energy data.

First, did the Chinese government deliberately conceal or fabricate the energy data previously? Second, what are the implications of the new data for statistical analysis of Chinese emissions including the extent to which previously published analysis requires revision? And third, to what extent do the new data assist in understanding the extreme level of pollution threatening China, especially its cities which have suffered from yet another wave of smog over the past few days.

'Hidden' data

Rather than indicating that China had been 'hiding' some of the data on its coal consumption we suggest that this is rather a result of poor quality control in collecting and compiling energy data at the national, provincial and local levels, an issue that has long been noticed by both Chinese and international researchers and is widely viewed as a systemic problem within Chinese data collection.

On the positive side, however, the revision is a strong

indication that the Chinese government is prepared to let the less favorable data be published without hindrance.

The Chinese government seems prepared to release data more clearly indicative of the dimensions of the problem of curbing greenhouse gas (GHG) emissions. One could think of this as having the effect, for example, of strengthening both domestic and international forces for curbing GHG by revealing that pollution levels were higher than previously reported even as renewables provided an increased share of energy production.

Our view on this is reinforced when one considers that the same revision of energy data also carries an upward estimate of non-fossil energy consumption (in terms of coal-equivalent), of a magnitude greater than that for coal in percentage terms.

This means that had the Chinese been 'concealing' their bad coal consumption data, by under-reporting levels of coal consumption, they would at the same time have been under-reporting their usage of renewable energy sources – hardly plausible if political correctness had been the goal.

The substantial revision of energy use data in those energy-intensive industries would likely be a result of the previous under-reporting of capacity additions in those industries. For example, the documentary 'Under the Dome' released early this year suggests that a large number of small steel mills and coal mines in China were built without official approvals. Consequently they are unlikely to report their energy usage properly, if at all. On the other hand, with the enforcement of environmental laws as well as the economy slowing down, many of those industries recently faced significant declines. In the steel industry, for example, one of us has argued that the crisis facing the sector reflects a structural change, and that it has passed its production peak.

Coal consumption

The real interest of the NYT, and of everyone else, is in the upward estimates of raw coal consumption. The increased estimate of raw coal consumption for 2012 adds up to a figure of 4.1 billion tonnes – as compared with the original figure of 3.5 billion tonnes of raw coal consumption. This is how the NYT arrived at its figure of an upward revision of 600 million tonnes of coal burnt in the same year (the difference between 3.5 Gt and 4.1 Gt). Thus we agree with the NYT on the scale of China's correction for its coal consumption.

Keeping on track

The official target for coal consumption which has been set at a maximum of 4.2 billion tonnes by 2020, would still seem to be eminently achievable if the falling trend continues.

In closing, we have always emphasised that China's energy production and consumption patterns with the current dependence on fossil fuels (largely coal) is a large ship that will take considerable time to turn around. But turning is what the ship is doing – as disclosed by the greening at the margin, where net additions to generating capacity, to new investment and to electricity generated all reveal green sources outranking the black. China has every incentive to pursue such a course grounded in enhancing its energy security and in reducing levels of particulate pollution that create unbearable smog.

The new data on China's past coal consumption levels mean that the black picture we have always painted has been even blacker than we imagined. But it would be quite mistaken to project these data revisions as meaning that China has been 'found out' in seeking to minimise its past coal consumption.

On the contrary it reveals a greater openness and preparedness to allow the data to be published, irrespective of what it shows; indeed the new data encourages greater pressure to be brought to bear on major GHG-emitting industries to reform their practices. And we note that the new data reveal not only that coal consumption was under-reported – but also that dependence on renewable sources (hydro, wind, sun) has been under-reported as well – a boon for China and the world.

It is China's preparedness to be more open and transparent in its energy data that gives us greater confidence that the reported trends towards a greening of the system are real trends and not just statistical artefacts.

John A. Mathews is professor of strategy at Macquarie Graduate School of Management, Macquarie University, Sydney. He has specialized in the catch-up strategies of firms and countries in East Asia.

Tan Hao is senior lecturer at Newcastle Business School, University of Newcastle, Australia. He is an associate of the Centre of Asian Business & Economics at University of Melbourne, and was a visiting professor at National Tsinghua University in Taiwan in 2014.

中国传统饮食习惯对全球变暖的启发

虽然中国的肉类消费不断增长，但在得知食用大量动物性蛋白带来的问题后，中国人却比其他国家的人更愿意去改变自己饮食习惯。

弗罗加·安东尼

巨无霸汉堡的“好日子”或许将要到头。全球人均肉类消费现已超过了健康水平，而且预计到2050年还会增长76%。这种不可持续的增长将会严重威胁人类的健康和地球的生态。以美国为例，其人均肉类消费是健康专家建议水平的3倍。

其他工业国家的情况也是一样，随之而来的不仅是肥胖率的增高，癌症和心脏病的发病率也在不断攀升。通常来说，每人每天食用红肉或加工肉制品的总量应不超过70克，相当于一小份汉堡的量。

不同于西方国家，中国的肉类消费水平相对较低。中国人平均每天的肉类消费仅比健康标准高1.5倍。但考虑到文化、经济和地域等因素的差异，仅用这一数值来衡量整个国家的水平还是过于简单化。

肉类及加工肉制品消费增加的同时，运动量却在减少，使得现今中国的超重人口比营养不良人口多了一倍。中国国内消费和出口的肉制品产量也在不断攀升，从1978年的850万吨增长至2011年的7950万吨，年均增长率达6.93%。到目前为止，促进肉类消费仍是政府的一项国策。

畜牧养殖业的二氧化碳排放占全球二氧化碳排放总量的15%，同运输业尾气排放量相当。然而，却很少有人了解饮食与气候变化之间的联系。政府担心干预人们的饮食会引起公众的强烈反对，因而在探讨气候变化的解决方案时，政府从不会将重点放在减少肉类消费上。今日新发布的一份报告指出，必须纠正这一做法。但这并不是要求人们以后都只吃素食，而是让人们向健康的饮食习惯靠拢，向肉类健康消费标准看齐。

查塔姆研究所在研究过程中，曾在12个国家进行了网上调查，还分别在中国、巴西、英国和美国成立了四个深入调查小组，探究政府为扭转公众行为所采取的措施。同时，他们的调查还发现，虽然所有接受调查的人都认为改变人们的饮食习惯存在着很大难度，但不同国家的人对肉类食品的态度不同。

鉴于中国肉类消费水平较低，经济起步较晚这一状况，接受调查的中国人都认为要求他们减少肉食摄入是“不公平的”，其中一人甚至说到，“政府不会那么糊涂（到让人们改变饮食习惯）。”这些事实反应出，肉类消费在中国和巴西其实是代表了社会和经济的进步，越富有的人对肉类食品的需求就越大。

肉类对气候变化的影响并未受

> “在中国，巴西，英国和美国，接受调查的人都说，如果政府出台新政，鼓励人们改变饮食习惯，最初反对之声会慢慢减弱，越来越多的人将愿意去适应变化。”

到中国政府的重视。人们对此也知之甚微，很少会将二者联系在一起。虽然参与调查的中国人对此的了解少于其他国家，但当相关数据摆在他们面前时，中国人对改变饮食结构的接受度却更高。究其原因，一部分可能与城市居民的“生活体验”相关，人们将严重的大气污染同气候变化联系在一起，因此愿意从个人做起减少污染。同时，这也反应出了中国人对于权威和科学的十足信任。

重要的是，在上述这四个国家中，接受调查的人都说，如果政府出台新政，鼓励人们改变饮食习惯，最初反对之声会慢慢减弱，越来越多的人将愿意去适应变化。人们对禁烟令等公共健康干预政策的态度都经过了相似的变化过程。因此，若政府认为改变公众饮食习惯太过困难，那就大错特错了。

中国还具备一个十分有力的条件，那就是传统的饮食习惯本身就以蔬菜和谷物为主，倡导减少肉类食用，因而实现肉食与蔬菜的均衡摄入并非难事。在中国，有不少食品可以替代肉类和奶制品。为了治疗贫血，中国还曾向食品中添加过铁元素。这就意味着中国肉类消费的峰值（同日本一样）有可能会低于西方国家，并成为全世界做出表率。如果每个人的饮食习惯都更加“中式化”，那么世界都有可能变得更加可持续。

安东尼·弗罗加，英国皇家国际事务研究所（查塔姆研究所）的能源、环境与发展项目高级研究员

Why the traditional Chinese diet offers lessons to a warming world

Although China's consumption of meat is rising, the country's citizens are the most likely to give up animal proteins when the environmental drawbacks are made clear

Antony Froggatt

There is more meat in the Chinese diet than before, but the country's consumption is still far below western nations

The days of the 'Big Mac' may be numbered. Global per capita meat consumption is already higher than healthy levels, and is set to rise by 76% by 2050. This is unsustainable and poses significant threats to global health and the planet. In the US, the average person consumes three times more meat than health experts recommend.

Per capita consumption is significantly above recommended levels in other industrialised countries too, where it is associated with rising levels of obesity, cancer and heart disease. A rough rule of thumb is that people should aim to eat no more than 70g of red or processed meat a day–about the same as a small hamburger.

The picture is a bit different in China, where meat consumption is lower than in the West. On average, Chinese people eat about one-and-a-half times as much meat every day as recommended, although aggregate levels are an

overly simplistic measure given the country's cultural, economic and geographical diversity.

The impact of rising consumption of meat (and processed foods) coupled with a lack of exercise is being felt: there are now approximately twice as many overweight as malnourished people in China. Levels of Chinese meat production – for domestic consumption and export – are also rising. In 1978, China's meat production was 8.5 million tonnes. By 2011, it had reached 79.5 million, an average annual increase of almost 7%. And until recently, increasing meat consumption was an explicit government strategy.

Globally, the livestock sector accounts for 15% of carbon dioxide emissions – as much as the exhaust fumes from all forms of transport. And yet public awareness of the link between diet and climate is very low. Governments are afraid of the backlash if they tell people what to eat and as a result place very little emphasis on reducing meat consumption when talking about the solutions to climate change. A new report out argues that this must change. This does not mean everyone should become vegetarian. Rather, they should shift to healthy diets, and reduce the amount of meat that is consumed, to bring it in line with recommended levels.

In researching the report, Chatham House carried out an online survey in 12 countries, and in-depth focus groups in China, Brazil, the UK and US. The focus groups threw light on what governments will need to do to shift public behaviour. They also revealed interesting differences between people's attitudes to meat in different countries - though all respondents identified strong social barriers to changing diets.

Changing behaviour

In light of their lower aggregate consumption levels and China's later economic development, Chinese participants tended to think that asking people to reduce their meat eating would be 'unfair'. One respondent said that 'governments wouldn't be that stupid'. This reflects the fact that in China – and Brazil – meat consumption is seen as a sign of social and economic progress, with wealthier respondents expressing a desire to eat more meat.

The impact of meat on climate change is not on the public agenda in China. There is a low level of public knowledge about this issue and a high degree of confusion. However, while Chinese participants tended to know less than people in other countries about the link between diet and climate change, they were more likely to be prepared to change their diets on being presented with the facts. This may in part be to do with the 'lived experience' of Chinese people in urban areas, who associate high levels of atmospheric pollution with climate change, and are ready to take individual action to reduce this. It also reflects higher levels of trust in the authorities, and lower scepticism about science.

Intervention

Importantly, respondents in all focus group countries said that if governments did introduce new policies to encourage a change in diet, the initial resistance would subside and people would go along with the changes, as they have with other public health interventions, such as restrictions on smoking. This suggests that governments' assumption that effecting dietary change is too difficult is unjustified.

A particular cause for optimism in China is that the traditional diet lends itself to reduced meat content. It is heavy in vegetables and grains, and achieving a sustainable meat to plant ratio is not difficult. There are also many alternatives to meat and dairy and a history of fortification of food products with iron to address anaemia. This means that China's meat consumption (like Japan's) is likely to peak at lower levels than in the West. It also suggests that China could set an example to the rest of the world. If everyone ate a more 'Chinese' diet we might be able to feed the world sustainably.

Antony Froggatt is a senior research fellow in the energy, environment and development programme at Chatham House – The Royal Institute of International Affairs.

中国的电动汽车推广坎坷

专家表示，经历长期停滞之后，中国的电动汽车销售终于有所起色，但为了取得决定性转变，政府仍需加快充电基础设施建设，并且推出有效的财政激励措施。

尼古拉斯·奥尔科扎克

9月中，大众集团排放造假的丑闻让人们开始关注汽车及燃料工业造成的环境污染，并且人们意识到，我们必须坚定切实地实现绿色交通转型，从而减少世界主要城市的雾霾污染。

对中国而言，这一点尤为重要。在即将发布的第十三个五年计划中，中国制定了极为远大的目标，提出将发展新能源汽车（NEVs）作为推动绿色经济增长、提高空气质量工作的一部分。

长期以来，中国在扩大新能源汽车保有量方面所做的工作一直未能取得显著进展。中央不得不开拓思路，以提高人们对电动汽车的兴趣。中国还将与美国最大的汽车市场加利福尼亚州展开合作。加利福尼亚州已经颁布相关法律，要求各大汽车制造商必须生产一定数量的零排放汽车，否则其制造的车辆将不得在加州销售。北京市政府可能会利用加州的零排放车辆积分交易机制，扩大在当地的汽车销售。

中国汽车工业协会近期的数据显示，9月份新能源汽车销售量为28092辆，2015年前9个月的新能源汽车销售总量为136733辆，远低于十二五计划中提出的50万辆的销售目标。

中国尽管投入了总额370亿人民币（57.8亿美元）的资金推广电动汽车，但依然可能无法在2020年前实现累计销售量500万辆的目标。

9月，李克强总理曾重申了政府希望大力推广电动汽车的愿望。但要想让电动汽车的发展驶入快车道，中央和地方政府还需解决一些问题。

其中最重要的是要大力改善落后的充电基础设施，这也是导致人们不愿意购买电动汽车的主要原因。

此外，潜在购买者对电动汽车质量和价格的担忧也应得到政府的关注。

能源基金会北京办公室交通项目主任龚慧明解释道，尽管姗姗来迟，但中国政府最终还是将重心从鼓励生产（为制造商、供应商、消费者及研究人员提供补贴），转向直接补贴电动汽车购买者等刺激需求的措施上来。

政府还出台了相关措施，规定电动汽车购买者可免缴10%的汽车购置税以及年度注册税。

除了这些国家政策，龚慧明表示地方政府也开始推出相应的财政补贴，以及其他激励机制。例如，2015年5月北京市政府宣布，纯电动汽车不受尾号限行的影响。此后，北京纯电动汽车需求量出现大幅上涨。

地方政策

在地方政策的支持下，一些城市电动汽车数量的增长速度要高于国家平均水平。“一线城市（如北京、上海和深圳）的表现最好。”思迈汽车信息咨询公司亚太区总监赵英智说，“造成这一现象的主要原因在于地方性补贴，或者电动汽车尾号不限行的规定，并且这些城市电动汽车购买者的收入水平通常高于其他地区。”

但在全国范围内，政府措施目前尚不能促进电动汽车购买量的快速增长。“当前的政策还不足以推动电动汽车的大规模普及。”赵英智说。

2015年4月，麦肯锡（McKinsey）公司发布题为《为中国电动汽车发展增压》的报告，对以上诸多问题进行了研究。

除了电动汽车销售疲软的问题，报告还指出中国也未能完成充电基础设施建设以及技术发展方面的目标。

充电站

麦肯锡报告建议政府可以通过鼓励公私合作，以加快基础充电设施的建设，例如，鼓励美国电动汽车公司特斯拉这样的企业参与充电设施的建设。

“在解决这一尖锐的问题方面，政府做的还不够。”赵英智表示，“标准化是一个问题。制定更加明确的充电站指导方针也会有所帮助。”

目前，中国各地的充电站制式千差万别，都只能兼容特定车辆。要解决这一问题，就必须引入标准化的充电系统。

几个月以来，为了刺激充电基础设施投资，中国政府要求地方政府推出税收减免政策，并且为私营公司建设新的充电站提供廉价土地。

电动汽车的选择范围和可用性也是一个问题，但地方政府直至近几个月才认识到这一问题。

进口车型由于关税高（因而价格贵），且不享受政府补贴，因而中国购买者的选择范围仅局限于国产车型。但由于中国购买者的品牌意识较强，国产车型相对并不受欢迎。

相关部门已经开始取消对新能源汽车的购买限制及交通管制。北京市政府宣布，特斯拉、宝马等外国公司生产的电动汽车将和国产品牌享有同等待遇，无需参与摇号。

补贴

此外，研究机构 GfK 表示，价格高也是导致中国人不愿购买电动车辆的主要原因之一。该机构认为，政府应加大补贴力度，鼓励消费者购买电动汽车。

目前，中国的决策部门正在借鉴加利福尼亚州此前的措施，针对电动汽车所有者制定了各种不同的财政激励措施。其中可能包括建立电动汽车驾驶人积分机制，规定电动汽车行驶里程可换算成现金返还给驾驶人。

麦肯锡公司表示，其他类型的激励机制也会有所帮助，包括建立电动汽车专用停车场、允许电动汽车使用公交及专用车道、以及允许电动汽车进入低排放区。所谓低排放区，就是禁止高污染机动车进入的城市区域。目前北京等城市正在考虑在城市中设立低排放区。

尼古拉斯·奥尔科扎克，自由撰稿人，现居北京

China remains a rocky road for electric cars

China's sales of electric vehicles are at last picking up speed, but a faster roll-out of charging infrastructure and effective financial incentives are needed for a decisive shift, say experts

Nicholas Olczak

Revelations about Volkswagen's emissions in mid–September have focused attention on the environmental damage caused by the auto and fuel industries – and the need for a decisive shift towards genuinely green transport that can cut smog in the world's major cities.

This is particularly so in China, as the country readies its 13th Five Year Plan that will include ambitious targets for the use of New Energy Vehicles (NEVs) in the country as part of a wider drive for greener growth and improved air quality.

China has long been lagging in its efforts to persuade motorists to shift to greener alternatives, prompting a rethink at the highest levels on how electric vehicles can be made more attractive. China will also co-operate closely with California, the biggest car market in the US. California has enacted laws that require major manufacturers to build a certain amount of zero emissions vehicles if they want to sell cars there, and Beijing's municipality may use a version of the US state's zero-emission vehicle credit trading mechanism in an attempt to spur sales.

Recent data from the Chinese Association of Automobile Manufacturers shows that in September, 28,092 new energy vehicles were sold, bringing total sales in 2015 to just 136,733, far below the 500,000 targeted for this year under the 12th Five Year Plan.

Despite overall spending of 37 billion yuan (US$5.78 billion) on promoting electric vehicles, China might miss a target to have 5 million electric cars on its roads by 2020.

In September, Premier Li Keqiang once again spoke of his desire that electric cars occupy a much bigger share of the Chinese market, but central and local government will have to solve a number of problems if electric motoring is to move into the fast lane.

Foremost among these is a drastic improvement in very patchy charging infrastructure, which is perhaps the main deterrent to electric car sales in China.

Concerns among potential buyers about the quality and cost of vehicles will also need to be addressed to help spur electric car ownership.

China's government, belatedly, has switched emphasis from encouraging production (subsidies to manufacturers, suppliers, consumers and researchers) to measures that encourage demand, such as offering buyers a direct subsidy when they purchase an electric vehicle, explained Huiming Gong, programme director of the Transportation Program at Energy Foundation China.

A lack of standardised charging points in China is cited as one of the main reasons why low carbon motoring has struggled to shift gear in the world's biggest car market

The government has also introduced measures exempting buyers of electric vehicles from the 10% purchase tax normally levied on car purchases and annual registration taxes.

Alongside these national policies, Gong says local governments are starting to offer matching subsidies as well as other incentives. In May 2015, for example, Beijing's municipal government declared electric vehicle owners would be exempt from the city's traffic restrictions. Beijing then saw major growth in demand for battery-power cars.

Local policies

Local policies have helped particular cities achieve better-than-average uptake of electric vehicles. "Tier 1 cities (such as Beijing, Shanghai and Shenzhen) have fared the best," said James Chao, Asia-Pacific managing director for consultancy IHS Automotive. "This is due mainly to certain local subsidies, fewer license plate restrictions and the generally higher income levels of electric car buyers."

But across the country, the government's measures have so far failed to bring about a rapid rise in purchase of electric vehicles. "Current policies have proven not to be sufficient to roll out EVs on a large scale," says Chao.

An April 2015 report by McKinsey, 'Supercharging the Development of Electric Vehicles in China', examines many of the problems.

Alongside sluggish sales of electric cars, the report shows China has also missed targets for the installation of charging infrastructure and technology development.

Charging stations

The McKinsey report also recommends that government speed up installation of charging infrastructure by encouraging public-private cooperation, such as that being installed by US electric car company Tesla.

"Governments haven't been doing enough to address this acute problem," says Chao. "Standardisation is an issue and clearer guidelines on charging points would be helpful."

A standard system of charging needs to be introduced to solve the current problem of different types of chargers, compatible only with a select number of vehicles, being built in different places around China.

In the past few months, in a bid to spur investment in the necessary infrastructure, China's central government urged local authorities to provide tax breaks and cheap land for the private sector to build new charging stations.

Choice and availability of electric vehicles is a problem too, and only in recent months has the problem been acknowledged by local government.

Because of the high import tariffs imposed on foreign models (which make them expensive), and their exclusion from government catalogues of cars qualifying for subsidies, Chinese buyers of electric cars have been limited to domestic models that have been relatively unpopular among brand-conscious buyers.

The authorities have begun to lift purchase restrictions and remove traffic controls for NEVs. Beijing's municipal government responded by declaring that electric vehicles made by foreign companies such as Tesla and BMW would, like domestic electric cars, be exempt from its licence plate lottery system.

Subsidies

In addition, the high costs of electric motoring in China is also a major deterrent, says research organisation GfK, which said increasingly-generous subsidies might be needed to persuade Chinese buyers to make the switch.

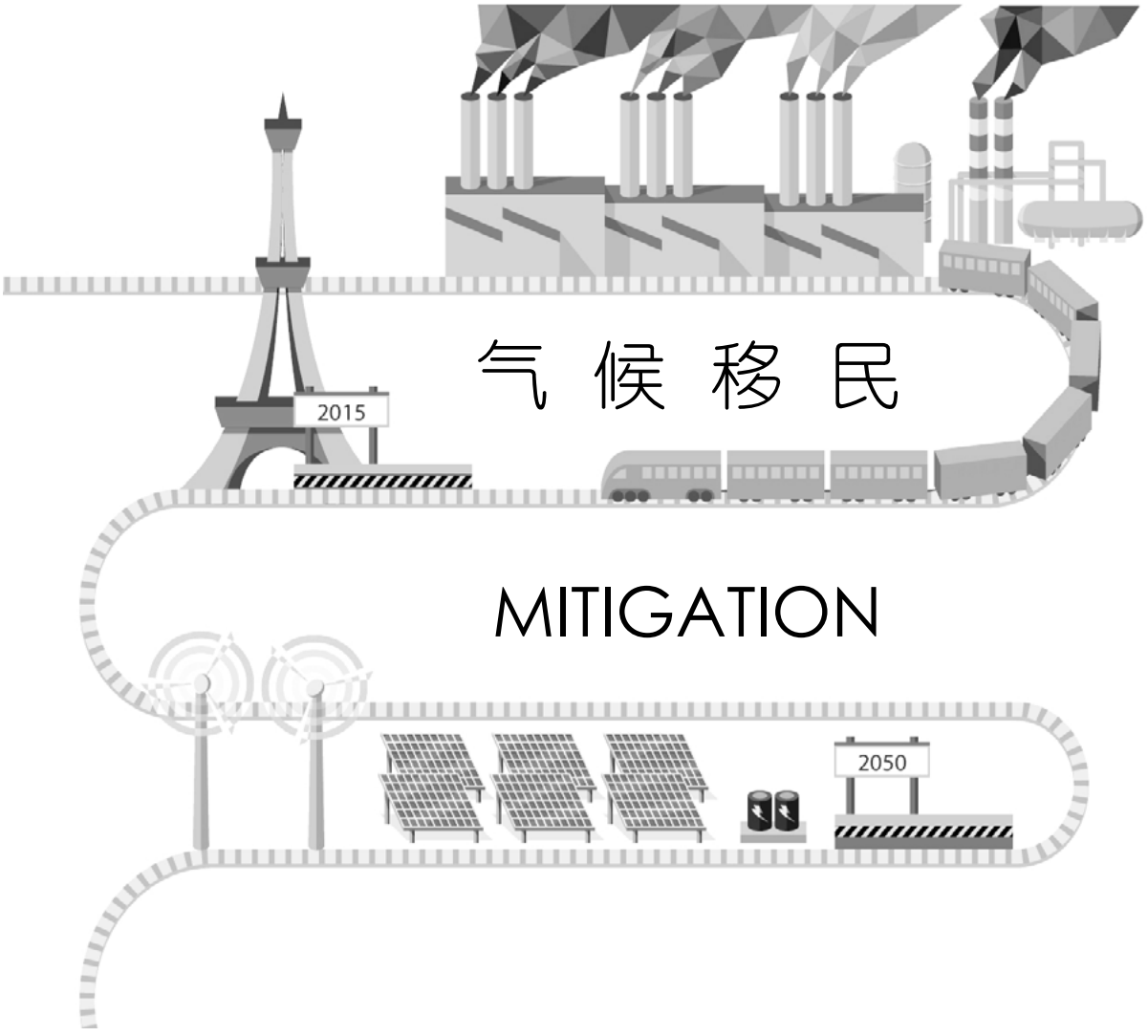
Beijing policymakers are currently working on developing different kinds of financial incentives to offer drivers of electric cars, taking their cue from measures previously used in California. These may include a scheme where drivers accrue points that can be redeemed for cash for each mile they drive an electric vehicle.

Other incentives might help, says McKinsey, such as dedicated parking, allowing electric vehicles to share of bus and carpool lanes, and access to low-emission zones. These are areas of the city where heavily polluting vehicles are banned and are being mulled for cities including Beijing.

Scaling up incentives for electric cars, charging infrastructure and making low-carbon vehicles attractive to the consumer will be essential if China is to ditch fossil-fuelled cars.

And while progress has so far been slow, global trends might also help speed up a roll-out, such as the falling prices of big batteries (which would make electric cars cheaper) and new entrants to the market. Apple's rumoured plans for an electric car could potentially have a transformative impact, given the brand's massive popularity in China.

Nicholas Olczak is a freelance journalist based in Beijing.


气 候 移 民
2015
MITIGATION
2050

展望巴黎峰会：如何保证全球变暖不超过2摄氏度

伦敦政治经济学院全新政策文件概述了，如何通过国际合作避免气候变化失控。

约弗格斯·格林

有效的国际合作不仅能够使全球温升幅度不超过工业化前水平2摄氏度的目标更易实现，还能帮助人们更好地适应因过往和当下温室气体排放造成的气候变化。此外，各国亦可以抓住低碳经济转型过程中的种种机遇和好处，争取实现经济的全面可持续发展。 2015年年底在巴黎举办的联合国气候变化大会将是取得上述目标的一个重要机会。

作为巴黎峰会的举办方，法国政府此次的目标是建立一个“巴黎气候联盟”。联盟的任务主要包括以下四个方面：达成一个适用于所有国家且具有法律效力的气候协定；各国就温室气体控制和减排做出承诺；加大气候变化减缓和适应措施的金融和技术支持力度，同时保证国际社会与贫弱国家的和谐团结；在既定的约束性承诺基础上，提出“解决方案议程”，加速推进更高目标的发展计划。

目前正在起草的这份协议内容繁杂，既包括集中化和分散化的因素，也包括约束性和非约束性的因素。这份协议将与各国的“国家自主贡献预案”(INDCs) 相结合，但各国“国家自主贡献预案”中的限制和减少排放目标实现与否并不具有国际约束力。此外，这份协议还有可能包括常规的集中化措施，以监督各国政策实施的透明性。同时，有关方面也建议添加定期“审查 - 修改”程序（比如每五年进行一次），以提升各国履行长期减排承诺的积极性。但是，无论是巴黎峰会，还是更加公平有效的长期气候变化应对措施，亟待解决的问题还有许多。

我们昨日（8月31日）发布的文章主要关注了以下三个方面：1. 成功的气候合作需要达成哪些共识；2. 气候变化行动和合作的关键目标、原则、政策和机制；3. 如何将这些内容与巴黎峰会协议和相关努力措施联系起来。

国际协议需要建立在共识的基础上。因此与会各方要明确了解我们目前面临的问题，以及应对措施可能带来的机遇和益处。

我们需要逐步削减全球年温室气体排放量，以保证全球温度升高幅度不超过2摄氏度。目前全球温室气体排放水平是510亿公吨二氧化碳当量，而到2030年和2050年，这一数字应分别下降到350亿公吨和200亿公吨，并最终在本世界末争取实现接近零排放——如果届时的年排放量高于上述水平，就需要达到“净负排放”。近期对美国、欧盟和中国减排承诺的分析显示，如果上述三方能够履行承诺，那么2030年全球年排放量将显著低于目前的“基准”水平。

尽管这个消息听起来振奋人心，但有一个问题不容忽视。因为2030年的减排目标基准量（大约350亿公吨二氧化碳当量）和各国提交巴黎协议的2030年减排总预算之间存在大约200亿到250亿公吨碳当量的差距。各国必须做到对这个问题心中有数，并且在12月巴黎会议前尽可能地提高各自的减排目标。假设将来在巴黎峰会后还有差距，那么巴黎会议上的承诺就不应该再被当作减排目标，而应该被视为各国为在本世纪后半叶最终实现零排放目标的一份初期贡献。

此外，国家自主贡献预案（INDCs）还要明确各国国内政策和法规对零碳经济转型所能给予的支

持。目前已经有这样的例子，比如人们开始扶持低污染、低拥堵和低浪费的城市、能源系统和土地使用系统，因为这样的资源高效创新利用将有助于构建更加有活力和吸引力的经济增长环境。这种以国家自身利益为基础的理性决策对整个气候环境也是有益的。然而在某些情况下，可能还存在对最初温室气体减排措施的后续需求。如今，科研探索不断发展，创新产业规模不断扩大，新兴网络、规范和机制的影响也逐渐增加。构建上述‘理性’发展路径的成本也会逐渐下降，带来的收益则会不断上升。

正因为如此，各国的减排意愿也会越来越强烈。所以我们有必要尽快建立一个国际机制，帮助各国了解经济转型的动态实质，提升他们的转型热情。我们同样也必须认识到，建立这样的理性决策机制会面临很多障碍，其中有很多是技术性的，如制度、法规、金融和科技等方面；还有一些则是在政治和分配层面上的，如结构性变化带来的成本和收益分配不均可能会使个别群体（比如现阶段的某些既得利益集团）受到影响，从而最终从政治层面影响整个低碳经济转型。此外，还有一些因素是观念方面的，一些旧规则和僵化的价值观是很难改变的。

基于以上共识，我们建议在国际气候合作中采取如下的目标、规则、政策和制度：1. 在本世纪后半叶实现全球温室气体零排放（具体细节详见七国集团公报，这也是保证全球 2 度温控目标的关键因素）；2. 在本世纪中叶实现电力产业脱碳，并在 2050 年前逐步淘汰未配备减排措施的燃煤发电设施。

> “我们有必要尽快建立一个国际机制，帮助各国了解经济转型的动态实质，提升他们的转型热情。”

在国际协议和声明中明确上述目标将有助于投资者对国际国内经济的长期无碳化发展形成预期。除了能够降低气候风险，低碳经济转型还能为我们带来不少的机遇和好处。这也能够让我们从更加动态、协作和机遇至上的角度阐释“共同但有区别的责任及相应的能力”（CBDR）中所述的公平原则（涵盖在联合国气候变化框架公约中）。

“公平获取可持续发展”的理念就是以“公平但有区别的责任”（Common but Differentiated Responsibilities，简称 CBDR）为依据，并且被纳入了 2010 年坎昆气候变化大会协议。这一理念很好地诠释了上文的观点。所以，除了上述这些目标和原则，巴黎协议还应当通过一些动态要素来提振人们应对气候变化的长期决心，比如定期对减排目标进行“审查 - 修订”（每五年进行一次）。此外，还应当鼓励和协助各国通过本国的制度、法律、政策和政治手段来提高减排目标，抓住更好的发展机遇，以及有效落实气候承诺。融资（减缓和适应气候变化）和创新是这一制度革新的两个关键。就融资方面来说，未来 15 年内，全球每年必须在基础设施建设方面投入大约 6 万亿美元，并且这些投入主要将集中在发展中和新兴市场国家。

一旦确立了正确的制度和政策，资金就会向着资源节约、低污染、低拥堵、能源安全、低碳和高环境适应力的基础设施建设转移。多边开发银行、国家开发银行和“绿色投资银行”是降低此类项目成本的关键机构。

今年 7 月在亚的斯亚贝巴召开的可持续发展金融会议是推动金融资源向满足可持续发展目标（SDGs）及更广泛的可持续发展需求迈出的重要一步。由联合国气候变化框架公约下巴黎会议推动的这番气候融资（旨在推动富裕国家在 2020 年前每年向贫困国家援助 1000 亿美元）应该作为可持续发展目标融资的补充部分（从而进一步强化后者在可持续发展领域的作用）。

支持低碳创新的国家并不少。但从全球来看，目前清洁创新还面临着资金不足、进展不够的困境。全球低碳创新领域的合作应该包括：协作提升国家层面的研究和开发支出水平；建立新的公私网络推广展示地方性技术和程序革新；加大对创新型清洁技术公司的公共投资力度；加强清洁能源开发的国际合作和支持。

成功的国际气候合作将会为我们创造一个充满吸引力和活力的经济增长和发展态势，人们的居住环境将更加健康，贫困现象会越来越少，社会将沿着长期可持续发展的道路走下去。巴黎协议的意义重大，因为它为我们指明了只有气候合作才是未来全球经济发展的正确道路，激励我们必须采取切实措施为实现这一目标而努力奋斗。

弗格斯·格林，伦敦政治经济学院尼古拉斯·斯特恩教授的政策分析和研究顾问

How the world can limit global warming to 2C

Closer international cooperation can help deliver a deal in Paris, but cuts in CO_2 emissions will need to be scaled up swiftly, writes climate policy expert Fergus Green

Fergus Green

Panorama of Paris. International cooperation will be crucial for an ambitious climate deal to be agreed in the French capital at the end of this year

The crucial climate change conference in Paris this December could still be deemed a success, even though it is highly unlikely that countries will agree targets to limit global warming to no more than 2C above pre-industrial levels.

Success in Paris will depend largely on whether the new agreement will enable a scaling up of ambition in the years following this year's climate summit. An ambitious agreement will create a process for countries to evaluate their commitments to reduce greenhouse gas (GHG) emissions at regular time periods.

Countries could then deepen their cuts every five years as new low-carbon technologies become available and the costs of existing technologies continue to fall, and the freedom of manoeuvre for tougher action on climate change grows.

The French Government, which will host the Paris summit, has indicated that it will seek a 'Paris Climate

Alliance' as an outcome from the conference. This will be based on four aspects:
1. A universal legal agreement, applicable to all countries;
2.National commitments covering control and reduction of emissions;
3.Scaling up finance and technology for climate change mitigation and adaptation, while guaranteeing international solidarity with the most vulnerable countries; and
4. An 'Agenda of Solutions' aimed at implementing accelerator measures to ensure more ambitious progress above and beyond binding commitments

The legal agreement that is emerging is a hybrid, involving a mix of centralised and decentralised, binding and non-binding elements.

Some elements of the agreement will likely be legally-binding, setting out common goals and procedures. It will be associated with the pledges, or 'intended nationally determined contributions' (INDCs), submitted by countries to restrain and reduce emissions. However, the INDCs will not be legally-binding at an international level.

It is hoped that the agreement will contain a number of useful elements. The first is a set of shared medium and long-term goals concerning the decarbonisation of the global economy. These could include the long-term objective of achieving net zero emissions within the second half of this century. This is also associated with medium-term goals, including the decarbonisation of electricity by mid-century at the latest, the phasing out of unabated coal-fired electricity generation and associated measures to curtail coal mining well before 2050.

The second is an improved set of common rules and procedures for transparently measuring and accounting for countries' progress toward their own INDCs and the long-term global goal.

And the third is a review and revision process for countries to scale up their ambition over time, so that efforts converge on a pathway sufficient to reach the long-term goal. The INDCs that countries have so far submitted ahead of Paris should be seen as initial contributions to an ongoing process.

Ambition

It is important for countries to see the Paris conference, and wider efforts to decarbonise their economies, in a collaborative way. Action on climate change is an opportunity to be grasped. Countries must recognise that a low- and zero-carbon development can bring economic, social and environmental benefits.

With deeper forms of cross-border collaboration and coordination, both within and beyond the UN process, the benefits of decarbonisation can be expanded and costs reduced still further. Channelling finance toward the zero carbon economy, and policy support for clean technology innovation are two areas where international cooperation is especially important. There is great scope to raise ambition beyond Paris, including through the G20 and through bilateral or regional initiatives.

Finally, all of this can occur in a way that is sensitive to the principle of equity, which is defined by the United Nations Framework Convention on Climate Change as "common but differentiated responsibilities and respective capabilities". However, this principle must be interpreted in light of the much-improved understanding of the attractiveness of many measures to reduce emissions and adaptation to climate change.

The prize

All countries should be encouraged and assisted to develop domestic institutions, laws, policies, and political configurations that are conducive to increasing ambition over time. There are opportunities for better quality growth to be seized. All nations should implement international commitments effectively.

The prize of successful international climate cooperation is a much more attractive and dynamic form of economic growth and development that creates a much healthier environment for people everywhere, overcomes poverty, and can be sustained over the long term.

An agreement in Paris can play a very important role in signalling to the world that this is the future direction of the global economy, and in accelerating tangible initiatives to achieve it.

This article is a shortened version of an LSE paper.

Fergus Green is a policy analyst and research advisor to Nicholas Stern at the London School of Economics.

中美气候合作应超越能源领域

新加坡学者张宏洲认为，中美应对气候变化的努力应扩展到能源以外的其他领域。

张宏洲

12月召开的巴黎气候峰会一直被视为是防止气候恶化、拯救世界的“最后机会”。然而，此次峰会上国际社会能否最终达成新的气候变化协议目前还尚待分晓。作为世界最大的两个经济体和温室气体（GHGs）排放国，中美不仅是巴黎峰会成功的关键，更关乎长期全球应对气候变化的成败。

幸运的是，虽然诸多领域局势愈发紧张，中美两国在气候变化方面的合作却取得了喜人的进步。2014年11月，两国签署了具有历史性意义的气候变化协议。9月，习近平主席对美国进行首次国事访问期间，两国又发布了一系列抗击气候变化的新政策，包括中国将在全国范围内开展“碳总量控制与排放交易”活动，并将出资30亿美元支持发展中国家遏制全球变暖。

能源合作

中美两国能够在气候合作中取得显著的成绩，原因有很多：国内的压力、民间交流的稳定和兴旺、国家对于某些关键气候问题态度的改变等等，不一而足。其中，两国在能源合作（尤其是清洁能源合作）中打下的坚实基础是推动气候合作发展的关键因素。然而，仅仅依靠能源工业是有风险的，尚不足以推动中美气候合作持续发展，无法遏制全球变暖。

> “中美两国想要拓宽气候合作，寻求潜在的合作领域，农业就是极好的选择。”

中美两国发展清洁能源的承诺并不是理所当然的。在美国，奥巴马政府确实将抑制化石燃料使用作为其工作的重点，也为此出台了相关政策法规，做出了极大的努力。然而，这些措施能否经得住反对派的抵制目前还未可知。2016年的总统大选将是美国气候政策发展的重要节点。另外，页岩气革命不仅使美国在能源方面实现了自给自足，而且使其有望成为全球最大的化石能源出口国。这意味着美国政府可能不再将能源安全问题视为工作重点，其发展清洁能源的意愿也会随之弱化。

对中国而言，如果目前经济衰退的情况没有好转，政府可能不得不重新考虑自己原本雄心勃勃的碳减排计划。多年来，中国减缓气候变化工作的底线一直是在经济发展和气候问题治理之间寻找平衡。但近几年，随着环境污染迅速恶化，中国更加愿意采取果断措施，以牺牲经济增长为代价，抑制国内温室气体的排放，如减少使用廉价煤炭、关停能源密集型工厂等。然而，中国仍有数亿人口生活在贫困之中，其人均收入也远低于发达国家。中国仍迫切需要发展经济，而保持经济的稳定增长也是政府的首要任务。因此，如果国内经济形势持续恶化，中国政府完全有可能为了稳定经济而放弃减排工作。

农业与粮食

中美两国想要拓宽气候合作，寻求潜在的合作领域，农业就是极好的选择。首先，农业既是造成气候变化的元凶之一，又是气候变化的主要受害者。一方面，虽然农业及其相关行业在温室气体排放总量中所占比重到底有多少还有待商榷，但研究表明，其温室气体排放量可能远高于公众的想象：粮食系统的温室气体排放量占全球排放总量的25%-50%。因此，减少农业相关的温室气体排放量对抑制气候变化极为重要。另一方面，农业生产和粮食系统非常容易受到气候变化的冲击。诚然，全球变暖并不是只会制造麻烦——某些赤道地区可能会出现粮食增产，温带也可能会出现作物生长期延长或者一年多熟的情况。但是许多研究结果都表明，就全球范围而言，气候变化对农业生产和全球粮食安全都造成了可怕的威胁。气候变化将会引发或加剧全球粮食安全问题，进而导致饥饿、饥荒、社会动荡、恐怖主义猖獗以及难民等更为严重的问题。

其次，作为全球最大的两个农业生产国和贸易国，中美两国也是全球主要的农业碳排放国。这更加突出了两国在减少全球农业碳排放工作中的关键地位。此外，不同于加拿大和俄罗斯，中美两国无法从全球变暖中受益，气候变化对两国的农业带来的影响是负面的。极端天气不仅会给将来两国粮食生产带来不确定性，也将威胁着两国的粮食安全。

中美两国农业部门的联系十分紧密，因此两国也必然逃不过粮食-气候的关联。这些紧密的联系给两国的气候变化应对工作带来的有机遇，也有挑战。一方面，中国的农业向来以小型家庭农业为主，因此从美国进口大豆、玉米等农作物给中国开展植树造林和土地复垦等减少净温室气体排放的重要举措提供了可能性。另一方面，农业的紧密联系也意味着其中一国遭遇的气候影响将会波及另一个国家。以苜蓿这种不太为大众了解的农产品为例，美国是全球最大的苜蓿生产国，2012年对华出口量占中国苜蓿进口总量的95%。苜蓿生长需要大量水分，此前加利福尼亚州（美国最大的苜蓿产区）遭遇大旱，中美苜蓿贸易就因此饱受诟病。

中美两国农业关系目前仍在发展中，气候对其造成的影响将不会仅局限于这两个国家；更确切地说，全球各地都会受到波及。美国长期以来一直是中国最大的农产品供应国。但是中国越来越担心对美国的过度依赖可能会危害本国的粮食、甚至国家安全。因此，中国一直在寻求多元化的进口策略，大豆进口尤其如此。二十世纪九十年代后期，中国的大豆进口中80%以上来自美国；现如今，来自拉美国家，尤其是巴西和阿根廷大豆的进口比重不断提高。2014年，美国大豆占中国大豆进口总量的比重跌至约40%。中国的多元化进口策略确实能够避免对美国大豆的过度依赖，保证本国的粮食安全。但是，随着拉美国家对华大豆出口量的飞涨，亚马逊地区森林滥砍滥伐的情况也日益恶化。伴随滥砍滥伐而来的碳排放将会导致气候恶化，直接影响全球。因此，中国这一策略实际上会给全球减缓气候变化工作带来负面影响。

中美两国应该联合起来，将保证农业和粮食安全作为抗击气候变化工作的首要任务，拓展双边农业贸易和投资合作，加紧农业技术研究，强化全球粮食系统，担任起中流砥柱的角色，将农业从催生气候变化的主要因素变成政府解决这一问题的方法之一。

本文原载于The Diplomat。

张宏洲，新加坡南洋理工大学RSIS中国项目研究员

Joint China-US climate action should move beyond energy

The two countries need to think beyond the energy sector in their joint efforts to tackle climate change, writes academic Zhang Hongzhou

Zhang Hongzhou

The Paris summit is being seen as the "last chance" to save the world from the worst ravages of climate change, yet whether the international community can reach a new climate change agreement remains to be seen. The US and China, the two biggest economies and largest emitters of greenhouse gases (GHGs) in the world, hold the key to the success of not only the Paris summit but also long-term global efforts to combat climate change.

Thankfully, unlike most aspects of Sino-US relations where tensions are rising, bilateral cooperation on climate change has made remarkable progress, highlighted by the historic climate change agreement signed by the two countries in November 2014. During Xi Jinping's first state visit to the US last month, the two sides announced a new set of policies to combat climate change, including a national cap-and-trade programme in China and a US$3 billion fund from China to help developing countries curb global warming.

Energy cooperation

The remarkable success in Sino-US climate change cooperation can be attributed to a wide range of factors, including growing domestic pressures, stable and flourishing non-official exchanges, and a change of attitude towards some of the key climate issues, to name but a few. Nonetheless, the solid foundation which has been laid on bilateral energy cooperation, clean energy in particular, is the key driving factor. However, relying on the energy sector alone is risky, and efforts in the energy sector might not be sufficient to sustain Sino-US climate change cooperation and curb global warming.

The two countries' commitment on clean energy should not be taken for granted. In the US, the Obama administration certainly has put curbing fossil fuels top of its policy agenda and has made very real efforts to enact policies and regulations to achieve these goals. However, whether those measures can survive political opposition remains uncertain. The 2016 presidential election could be a critical moment in the trajectory of US climate policy.

Moreover, the shale gas revolution not only enables the US to carriage return needed achieve energy self-sufficiency, it may also make America the world's top exporter of fossil energies. This means energy security concerns might no longer be the top policy issue for

> "As the biggest agricultural producers and traders, the US and China are also among the world's top agricultural GHG emitters. This highlights the critical role the two countries have in reducing greenhouse gas emissions from the farm sector."

the US, which could then weaken the government's commitment towards developing clean energies.

In the case of China, the current economic slowdown, if it persists, could force the country to rethink its ambitious plans for carbon emission reduction. For years, the bottom line for China on climate change mitigation has been to strike a balance between economic development and climate concerns. While in recent years, amid rapidly worsening pollution, China has been more willing to take decisive action, such as breaking away from cheap coal and closing down energy intensive factories to curb domestic GHG emissions at the expense of economic growth. However, it does not mean that climate change concerns will prevail over economic development. With hundreds of millions of people still living in poverty and per-capita incomes lagging far behind those of the developed countries, China's development needs are immense, and the government's top priority is to maintain stable growth. Therefore, if the economic situation in China worsens, it will be no surprise if the Chinese government retreats from efforts to curb emissions in favour of stabilising economic growth.

Agriculture and food

In seeking potential areas to expand Sino-US climate change cooperation, agriculture offers great potential. For starters, agriculture is both a major contributor to and victim of climate change. On the one hand, while the exact contribution of the agricultural and related sectors to total GHG emission remains debatable, studies show that emissions generated by agricultural and related sector activities could be much higher than the public perceives. The overall food system could contribute 25%-50% of global GHG emissions. Therefore, reducing agriculture's GHG emissions should be central to limiting climate change. On the other hand, agricultural production and the food system are highly vulnerable to climate change. Certainly, global warming is not uniformly problematic – it could lead to improved productivity in certain tropical regions and extend the cropping period or allow multiple harvests in temperate zones. For the world as whole, however, climate change poses a dire threat to agricultural production and global food security, an assertion widely supported by findings from numerous studies. Climate change will trigger or exacerbate global food insecurity, which might eventually lead to hunger, famine, social unrest, the rise of terrorism, and refugees.

Next, as the biggest agricultural producers and traders, the US and China are also among the world's top agricultural GHG emitters. This highlights the critical role

US and China can cooperate in cutting emissions in addition to the energy sector, such as in agriculture for example

the two countries have in reducing GHG emissions from the farm sector. Moreover, unlike Canada and Russia, where agriculture may well benefit from global warming, the impacts of climate change on the agricultural sectors of both China and the US are negative. Extreme weather brings uncertainty to future food production and threatens food security.

China and the US are already deeply locked in the food-climate nexus, given their strong agricultural ties. Those close ties bring both opportunities and challenges to the efforts of the two countries to deal with climate change. On the one hand, China's farm sector is dominated by small household farming, so importing soybeans, corn, and other agricultural products from the US allows China to then implement its afforestation and land restoration plans - important steps in reducing net GHG emissions in China. On the other hand, close agricultural ties also mean that the climate impacts in one country will have repercussions for the other. To take a somewhat more obscure agricultural product, alfalfa, as an example, the US, the largest alfalfa producer in the world, accounted for nearly 95% of China's total alfalfa imports in 2012. As alfalfa requires substantial volumes of water, the Sino-US alfalfa trade has come in for criticism amid a historic drought in California, the largest alfalfa producing region in the US.

The potential climate impact of the evolving Sino-US agricultural ties would not be limited to those two countries alone; rather, the whole world could be affected. The US has long been the biggest supplier of agricultural products to China. Increasingly, however, there are concerns in China that an over reliance on the US for food will jeopardise China's food security and even its national security. Thus, China has been pursuing a diversification strategy. This is especially the case with soybeans. In the late 1990s, China imported more than 80% of its soybeans from the US; now, it is importing more soybeans from Latin American countries, particularly Brazil and Argentina. In 2014, the US share of China's total soybean imports declined to about 40%. While diversifying imports away from the US is beneficial to China's food security, it has negative repercussions for global climate change mitigation because China's soaring soybean imports from Latin America are contributing to deforestation in the Amazon, considered to be the biggest carbon sink in the world. As deforestation progresses, it releases carbon, with a direct impact on the entire world, helping to drive climate change.

The US and China should prioritise agricultural and food security in their bilateral efforts to combat climate change. The two countries could play a major role in shifting agriculture from being part of the problem to being part of the solution to climate change, by expanding bilateral agricultural trade and investment cooperation, stepping up efforts in agricultural research and technology, and strengthening global food systems.

This article is republished from The Diplomat's website.

Zhang Hongzhou is an Associate Research Fellow with China Programme at the S. Rajaratnam School of International Studies, Nanyang Technological University Singapore.

德国：告别褐煤是一场持久战

政策失误、行业及人口压力让褐煤出人意料地重燃生机。

穆素彬

德国“能源转型”已陷入所谓的两难境地：尽管德国可再生能源发电比例高达三分之一，高居主要工业化国家之首，但褐煤的发电量也同样名列前茅。而褐煤则是二氧化碳排放量最高的一种化石燃料。

在德国，燃煤发电不仅没有被清洁燃料挤出市场，一直以来反而是稳坐江山。无烟煤和褐煤发电量占德国电力生产总量的 40% 以上。其中，褐煤的占比更是一直稳定在 25% 左右。目前，褐煤在德国一次能源消费结构中所占比重达到 12%。

最近，默克尔领导下的德国政府与多家电力企业达成协议，将在 2020 年之前逐步淘汰八个污染最严重的褐煤发电设施，这是其朝着在 2050 年之前彻底淘汰燃煤发电目标迈出的第一步。

柏林独立智库机构 Agora Energiewende 负责人帕特里克 · 克拉琛（Patrick Graichen）说：“每个德国人都明白这只是电力部门‘去碳化’的开始。”

2012-2013 年德国燃煤发电量曾一度大幅上涨，虽然这样的“复兴之象”是短暂的，但仍然很难打破德国对于燃煤发电的依赖。

德国是全球最大的褐煤生产国，400 亿吨的褐煤储量在世界上也堪称首屈一指。德国褐煤发电厂每年释放 1.7 亿吨二氧化碳，几乎占全国所有发电厂二氧化碳排放量的一半。

褐煤虽然开采成本低，但由于其含水率高、能源密度低，不适于运输或贸易，因而通常只能就地使用。另外，随着中国消费增长放缓，再加上美国页岩油的蓬勃发展，国际煤炭市场价格走低，这也使成本较高的硬煤发电厂的情况相对较为景气。

“德国是全球最大的褐煤生产国，400亿吨的褐煤储量在世界上也堪称首屈一指。德国褐煤发电厂每年释放1.7亿吨二氧化碳，几乎占全国所有发电厂二氧化碳排放量的一半。”

德国环保人士表示，2011 年日本福岛核泄漏事件后，德国决定弃用核能，但燃煤发电的复苏更多是因为能源决策上的失误所致，因为新的燃煤电厂看似在福岛事件之后才开始并网发电，但其实早在核泄漏事故之前就已经纳入规划了。

德国国内目前已有一些决策者对“能源转型”初期所采取的政策感到后悔。斯图加特独立能源分析师阿恩 · 云约汉纳（Arne Jungjohann）分析，欧盟碳排放交易体系 (EU ETS) 虽然大力鼓励电力公司提高效率，淘汰旧式发电厂，但却忽视了转变燃料来源。“现在这个决策的弊端已经凸显。

云约汉纳认为，这才是导致 2012 年“燃煤复苏”的根本原因，而非福岛事件后的废核决定。在他与克雷格 · 莫里斯（Craig Morris）合写的报道《德国燃煤之困》（The German Coal Conundrum）中指出，得益于可再生能源的发展，德国能

源转为供大于求，对临国的能源出口量也在刷新，在此背景下，“废核”决定带来的市场空白被褐煤所替代。

云约汉纳认为，德国政府本来应该鼓励燃气电厂的发展，而不是让燃煤电厂有机可乘。相比于燃煤发电，天然气发电的二氧化碳排放量少，又可以为受天气影响很大的可再生能源提供灵活的补充，因而是可再生能源最佳的备用燃料。

2005 年欧盟碳排放交易体系出台之初，决策者们都以为碳排放交易价格的上涨能有利于燃气发电的发展，然而结果却证明他们太乐观了。实际上，碳排放权价格却降至历史低位。克拉琛认为：“人们都没有料到，燃气发电居然被挤出了市场，但燃煤发电却依旧坚挺。”2010-2014 年，天然气在德国能源结构的占比从 14% 以上下降到不足 10%。

现在普遍认为，想要修正目前的市场非常困难。位于柏林的德国经济研究所（German Institute for Economic Research）能源研究中心负责人克劳迪娅·凯菲尔特（Claudia Kemfert）估计：“若希望燃气发电能够取代燃煤发电，二氧化碳排放交易价格至少需要达到每吨 40 欧元，但目前的价格仅为每吨 7 欧元。”

尽管欧盟碳排放交易体系已经开始逐步缩减市场上超发的排放许可，但凯菲尔特认为二氧化碳价格上涨幅度远不足以让燃煤发电退出市场。包括她在内的一些专家表示，目前的产能过剩是不可持续的，而且从长远来看将会损害整个化石燃料部门。

面对目前这种“煤”喜“气”忧的状况，再加上近期市场也无调整的可能，德国政府担心难以在 2015 年巴黎联合国气候变化大会前扭转其气候变化数据，因而决心采取行动。今年早些时候，政府决定在 2016 年到 2019 年间，关闭 270 万千瓦的褐煤发电厂，相当于当前总装机容量的 13%。德国的目标是到 2020 年在 1990 年基础上减排 40%。若要实现这一目标，就需减排 2200 万吨。而德国政府所采取的举措将减少 1,200 万吨的排放量，是实现上述目标减排量的一半以上。

计划最开始希望通过向这些电厂征税从而引导其退出市场。但迫于矿业公会以及当地联盟组织的压力，德国政府不得不采取“曲线救国”的办法，对政策进行修订：在能源转型阶段，RWE, Vattenfall 和 Mibrag 三家电力公司将停止生产，并转为应急储备，以应对能源需求突然上涨情况，而企业将为此每年获得 2.3 亿欧元的补贴，七年总计高达 16 亿欧元。为此，德国电力用户则需要每度电多支付 0.05 欧元。

此举一出便备受责难。人们认为这是给能源公司白白送福利，一些批评人士甚至质疑此举是否违反了欧盟政府补贴原则。能源分析师云约汉纳说：“我们的能源储量充足，即使在冬天也不必担心能源安全问题。”他还表示，燃煤发电耗时很长，要预热 10 天左右才能发电，难以在短时间内应对短期供给瓶颈，因此，不适合担任应急后备军的角色。

不过，德国政府前环境政策制定人克拉琛（Graichen）却高度赞扬这个妥协方案，他说“这是企业、公会和政府在关闭发电厂方面首次达成一致，共同致力于改善气候。”虽然他承认褐煤电厂 2.1 万个工作岗位在德国庞大的劳动力市场上并不起眼，但他指出，能源产业依旧是德国一些地区的支柱产业。因此，“重要的是要让这些电厂的职工看到新的前景，并且为他们创造就业机会”。

同时，德国东部经济不景气的劳西茨地区（Lausitz）的褐煤开采和发电企业的头上可能还悬着另一道生死令。为了提升其国内形象，不再与褐煤挂上钩，一家瑞典电力企业计划关闭在该地区的所有设施。但根据最新消息，两家捷克集团有意收购这些资产。

克拉琛不愿去揣度这两家潜在买家的动机，但是他明确表示不看好这项交易。“在我看来，投资高碳资产不仅在道德上站不住脚，也与未来“去碳化”的发展趋势相悖，本身就是一个风险极大的投资。”

然而，包括克拉琛在内的诸多德国环保人士仍乐观地认为，最近德国燃煤发电的复苏并非代表了产业的未来走势，更多可能只是最后的回光返照。

穆素彬，美国华盛顿记者

Germany’s lignite dilemma

Angela Merkel's government plans to phase out the dirty coal smudging Germany’s energy transition

Sabine Muscat

It has been called the paradox of the German energy transition. Although Germany is on track to generate a third of its electricity from renewables this year – the highest share among major industrialised countries – it continues to lead the world in the amount of energy produced from the most-CO_2 intensive fossil fuel: lignite coal.

Rather than being pushed out of the market by its clean competitors, coal-fired power generation has held steady in Germany. Together hard coal and lignite generate more than 40% of Germany’s electricity, and the share of lignite has stubbornly remained at around 25% of gross power generation. Its share of Germany’s primary energy mix currently stands at 12%.

According to German environmentalists, the resilience

A vast lignite mine in western Germany. A reliance on dirty coal has tarnished the achievements of the country's energy transition

“According to German environmentalists, the resilience of coal has more to do with mistakes in energy policymaking than with the decision in 2011 to phase out nuclear energy after the disaster in Fukushima.”

of coal is a result of the lack of a consistent energy policy – including a clear approach to coal.

The Merkel government has now taken a first step towards the goal of a permanent coal phase-out by 2050. It recently reached a deal with energy utilities to gradually shut down the country's most polluting lignite plants by 2020. The decision will take 2.7 GW of coal-fired power, some 13% of current lignite capacity, off the grid between 2016 and 2019. This will result in emission reductions of 12 million tonnes of carbon dioxide, more than half of the 22 million tonne gap Germany will need to close if it is to meet its 2020 goal of reducing CO_2 emissions 40% below 1990 levels.

"Everyone in Germany knows that this is only a first step towards decarbonising the power sector," says Patrick Graichen, director of the energy policy think-tank Agora Energiewende in Berlin.

Even though the German "coal renaissance" of 2012 and 2013, when coal-fired power generation increased substantially, turned out to be short-lived, Germany's addiction to coal remains difficult to break.

Germany is the world's biggest producer of lignite, and with 40 billion tonnes, it is has some of the world's largest reserves. The country's lignite-fueled power plants emit some 170 million tonnes of CO_2 per year, almost half of the total CO_2 emissions from the German power sector.

The brown coal is cheap to mine and has to be burnt locally because its high moisture content and low energy density make it inefficient to transport or trade. Comparatively expensive hard coal-fired plants have also held up relatively well due to the slumping price of coal on world markets, the result of slowing consumption in China and the US shale oil boom.

According to German environmentalists, the resilience of coal has more to do with mistakes in energy policymaking than with the decision in 2011 to phase out nuclear energy after the disaster in Fukushima in Japan (the new coal plants brought online post-Fukushima were commissioned long before the accident).

Domestically, some policymakers now regret decisions taken during the energy transition's early days. Under the European Emissions Trading Scheme (EU ETS), utility companies were given strong incentives to decommission old power plants and replace them with more efficient ones. But in the initial years of its implementation in Germany there were no incentives to switch fuel sources, explains Arne Jungjohann, an independent energy analyst based in Stuttgart.

According to Jungjohann, these incentives, and not the nuclear phase-out that was reinstated by the Merkel government after Fukushima, prompted the "coal renaissance" in 2012.

In their report "The German Coal Conundrum" he and his co-author Craig Morris point out that, rather than filling a gap left by nuclear, additional lignite capacity came online at a time when Germany – thanks to the boom in renewables – started producing more energy than it needed, exporting record amounts to neighbouring countries.

The German government should have focused on strengthening the position of gas plants in the power sector rather than throwing coal a lifeline, says Jungjohann. Natural gas is the fossil fuel that is most compatible with renewable energy. Gas plants are less carbon intensive than coal plants and their relative flexibility makes them the fuel of choice to compensate the irregular production cycles of the weather-dependent renewables.

When the European cap-and-trade system started in 2005, policymakers also hoped that putting a price on carbon would increase gas-fired generation's cost-effectiveness relative to coal-fired generation. Looking back, most experts agree that the cap was not set at a level ambitious enough to reach this goal. The global economic crisis of 2008 led to lower economic output and lower emissions, causing the carbon price to drop to record lows – with the effect that gas rather than coal plants were being pushed out of the market. Between 2010 and 2014, gas's share of Germany's power mix declined from more than 14% to under 10% of Germany's power mix.

All agree that it is extremely hard to fix this market. "In order to substitute coal with gas, we would need an emissions trading price of a minimum of €40 per tonne of CO_2 " estimates Claudia Kemfert, head of energy research at the German Institute for Economic Research in Berlin. "But the price right now is €7 per tonne of CO_2." Despite recent steps to reduce the oversupply of emissions allowances on the EU ETS market, Kemfert does not believe the price of CO_2 will rise high enough to phase out coal.

Instead, a political decision was needed to herald the end of coal-fired power generation in Germany. And just as during the introduction of the European cap-and-trade system, the German government had to compromise to reach an agreement with the industry and its unions.

Deal

The initial plan was to impose a tax on the plants that would likely have led to their shutdown. But, bowing to pressure from mining unions and their local allies, the Merkel government sweetened the deal. Under the recently revised policy, power companies RWE, Vattenfall and Mibrag will be paid not to produce power during a transition phase – with the exception of the unlikely event of emergency conditions in which energy demand would exceed supply. For German consumers, this means they will have to pay €0.05 more per kilowatt hour to fund reimbursements to the providers of around €230 million per year, adding up to €1.6 billion over seven years.

The decision has been criticised as an unnecessary farewell gift to the power companies, with some critics even asking if the reimbursements would violate EU guidelines on unnecessary government subsidies. "We already have a capacity reserve for winter times which is big enough to provide energy security at all times," Kemfert notes. Also, as energy analyst Jungjohann remarks, coal plants are not suited to a reserve role since heating them up takes too long to overcome a short-term supply bottleneck.

Nevertheless, Graichen, a former environmental policy-maker in the German government, calls the compromise a major accomplishment. "This was the first time ever that utilities, unions and the government agreed on shutting down power plants as part of climate policy," he says. While he acknowledges that the 21,000 jobs in the lignite industry are a tiny part of Germany's workforce, he notes that the industry remains a key economic contributor to some regions, and that "it will be important to offer those employees new perspectives and job opportunities."

Divestment

Meanwhile, lignite miners and power plant operators in East Germany's economically-depressed Lausitz region might get yet another reprieve. In order to divest itself of lignite, Swedish utility company plans to sell all of its facilities in the region. According to news reports, two Czech consortiums are in the running to acquire the assets. The environmental campaign group Greenpeace had also previously expressed its interest to purchase the mines and plants with the intent to shut them down, but has been informed by Citigroup, the bank that handles the transaction, that it has been excluded from the bidding process.

Graichen refuses to speculate about any serious potential buyers' motivation, but he makes it clear that the proposed deal sounds like a bad idea to him: "To my mind, investing in high carbon assets is not only morally wrong but also financially very risky since it would be a bet against future decarbonisation policies."

He and others in the German environmental community continue to express confidence that the country's recent coal renaissance, rather than being a turnaround in the industry's fortunes, has more than likely been its last hoorah.

Sabine Muscat is a journalist based in Washington DC.

可再生能源时代核能日渐衰落

低碳资源可提供的世界能源供应比例正逐年增加，可英国却偏偏在这个时候大手笔进行核能建设，保罗·多尔夫曼表示。

保罗·多尔夫曼

10月有大量报道称，中国国家主席习近平与英国首相大卫·卡梅伦已就重振英国停滞的核产业达成协议。虽然英国财政部为法国制造商和中国核能企业提供了大量的财政激励措施，但是目前两国尚未签署任何一项具体协议。

英国评论家一致认为，欣克利核电项目会给纳税人带来严重的财政负担。因为除了20亿英镑（约合192亿人民币）的贷款担保之外，英国还会以两倍于目前电价的价格背负上一个为期35年的预购价格电力供应协议。

一旦签署合同，中国核电集团（CGN）将会持有法国电力公司这个陷入麻烦的欣克利C角项目的三分之一股份，并将在英国的土地上建设和运营由中国设计的反应堆项目。

中国已经为本国核工业开拓国际市场做好了充足准备，即便前期在英投资有所损失也在所不惜。然而，世界其他地区的核工业计划却进展缓慢。无论是发达国家，还是快速工业化的经济体，都在逐渐淘汰以大型火力发电或核电为核心的老式基载电力生产模式。

依据最新的全面能源策略，此次能源结构转换将包括多个方面，比如利用各种陆上和海上风能和太阳能等可再生能源。燃气电厂也会作为一种灵活的补充，同时还通过能效措施和节能措施、需求侧管理、负载平衡、大型输电网升级和地区电网分配等多项措施。

气候免疫?

这样看来，下一次工业革命应该是发生在可再生能源领域。那么问题来了，为什么我们还要死抱着核能不放？经合组织国家和发展中国家由核电带动的经济效益已经向我们表明，这些核能建设资金花在其他地方或许能够产生更好的效益。

之所以有些地方还在固守着发展核能的理念，原因之一就是核工业不顾核能在环境和 后勤方面存在的一些固有的缺陷而将其粉饰成了应对全球变暖的一种手段。

英国机械工程师协会（the UK Institute of Mechanical Engineers）警告称，拟建的新反应堆以及放射性核废料储存设施通常都会建在海岸边，因此也就更容易容易受到海平面上升、洪水、风暴潮和海啸的影响。该组织补充道：“需要对海岸沿线的核设施投入大笔资金，保证其不受海平面上升的影响。长远来看，这些核设施要么完全废弃，要么选址重建。”

世界核能协会（the World Nuclear Association）坚持认为，全球核电装机容量正在稳步增加，目前拥有核反应堆新建项目的国家共有13个，其中有些国家正在考虑建设首个核反应堆（比如白俄罗斯和阿联酋），有些已经签署了建设协议（比如立陶宛和土耳其），还有一些则已经拟定了初步计划（比如孟加拉国、约旦、波兰和越南）。

而相对更为独立的《世界核工业现状报告》却指出了截然相反的行业态势。报告指出，2006年全球核能最大发电量为2.66亿千瓦，而2013年这一数字则下降到2.35亿千瓦，运行的反应堆数量也比2002年的最高值减少了50个，总装机容量

上图为计划在英格兰西部地区兴建的欣克利反应堆的电脑图纸，很多观察家认为这座核电站简直就是个华而不实的“怪物”

也回到了二十年前的水平。BP 集团最近的《能源展望》也印证了这一下降趋势。

财政风险

此外，无论从普通民众、整体环境还是核工业的未来来看，我们始终担心会有新的大型核电事故发生。类似福岛核电站这样的超出设计范围的反应堆故障才是最大的单一财政风险，远比市场、信贷、建设和运营不当带来的风险总和要大。

为了防患于未然，核反应堆变得更加昂贵和复杂，无论是从施工进度，还是从项目预算来说，建设难度也都越来越大。而新建项目要想继续运行，只能依靠大笔国家补贴和贷款担保 ,，包括长期购电协议。

因为核电建设是一个高价值高风险的过程，而且很可能面临项目延期、成本超支和投资者风险等情况，所以私营部门无法独立完成核电厂建设。

比如，法国设计的奥尔基洛托（Olkiluoto）EPR 核电站项目就出现了严重延期，为此芬兰电力公司（TVO）要求对方支付 27 亿欧元的补偿。反过来，法国方面也要求芬兰电力公司支付 35 亿欧元。该项目在 2005 年的总承包费用为 30 亿欧元，而目前则预计达到 85 亿欧元，预计建设期限长达 13 年以上。

世界性行业放缓

全球新建核电项目亦不稳定。在建的 67 个项目中，有 8 个建设周期已经超过 20 年，还有一个已经达到 12 年。此外，至少还有 49 个项目处于严重延期的状态。而剩余的 18 个反应堆项目，要么是在过去 5 年内刚开始建设，要么就是还没有确定项目的具体开工时间。

其中有很多项目都与俄罗斯国有核电集团 Rosatom 有关。该集团主要在俄罗斯和白俄罗斯进行核电建设，同时声称获得了伊朗、土耳其、越南、孟加拉国、约旦、匈牙利、芬兰、埃及、印度和南非等多国的核电反应堆订单。有人质疑，Rosatom 集团是否有足够的资金和供应链资源来完成哪怕其中一小部分的项目。要知道这家集团主要依靠俄罗斯的财政支持，而近些年的油价下跌和西方制裁对俄罗斯打击颇大。由于资源不足，Rosatom 在俄罗斯本土的项目已经出现了延期。

尽管总体经济出现了下滑，中国目前仍有 28 个在建的核反应堆项目，占全球新建反应堆数量的 42%。中国目前运行的反应堆数量为 21 个（装机容量 1700 万千瓦），占该国

2013 年发电总量的 2.1%。仅 2013 年一年，中国就有装机容量 1200 万千瓦的太阳能发电设施投入运营，是 2012 年的 3 倍，预计 2017 年中国太阳能发电装机容量将增长到 6600 万千瓦。

最近发生的一系列事件对中国的核能计划提出了挑战，比如常见的建设延期、成本增加、内陆地区对反应堆选址的怀疑、以及对于安全性和监管问题的质疑等等。而最令人担忧的是，已经在广东安装完毕的法国设计的台山 1 号和 2 号反应堆压力容器出现了重大隐患。

未来迎接我们的会是什么?

福岛核电站事件后，一般观点认为未来十年核电建设将会受到限制。芬兰、法国和英国还有计划兴建核电厂，但是意大利和瑞士都已经取消了新建反应堆的计划，比利时也确定将逐步淘汰核电项目，而瑞典和西班牙则表示会暂时搁置核电项目。此外，八个欧盟国家还签订了统一的声明，宣布核电的发展不符合可持续发展的理念。

作为欧洲主要的用电国，德国已经明确表示将在 2022 年前逐步淘汰核电，转而投资可再生能源、能效措施、电网设施以及能源储备建设。这样的举措对欧洲乃至全球的能源政策都意义非凡。

风能、太阳能和生物能等清洁能源为德国能源出口带来了不小的收获，弗劳恩霍夫太阳能研究所（Fraunhofer ISE Institute）近期的一项报告证实，今年德国可再生能源销售额增长最高达到 20 亿欧元。

销售额的增加主要归功于可再生能源的快速发展。2010 年到 2014 年，德国核能发电量缩减了 410 亿千瓦时，达到了 920 亿千瓦时，而同期清洁能源发电量则一跃从 200 亿千瓦时增长到了 1380 亿千瓦时。2015 年，可再生能源将满足德国总能源需求的 33% 左右，约 1930 亿千瓦时，比 2014 年上涨 20%，光伏发电和风能发电将成为主要的增长驱动力量。

德国的转变

对德国的能源转型持批评观点的人士认为，可再生能源无法弥补淘汰核能反应堆带来的能源缺口，解决的方法只能是重新启用燃煤发电。然而，德国的燃煤发电和电力部门的二氧化碳排放量却在逐年减少，整体化石燃料使用量也下滑到 35 年以来的最低水平。天然气消费量的缩减速度更是惊人。因此，德国的碳排放仅 2014 年一年就下降了 4% 到 5%。

德国能源转型的一个主要动力是能源生产的民主化——将权利下放到地方。也就是说，地方政府有权为当地的可再生能源生产设立目标和选址，从而确保了当地的能源资源和由消费者（通过上网电价）或纳税人（通过德国的开发银行 KfW 提供的廉价贷款）所支付的财政补贴能够为能源企业和当地民主同时带来好处，并保证当地的收益和劳动力机会不外流。

英国国家电网首席执行官史蒂文 · 霍迪利（Steven Holliday）表示，以大型燃煤电站或核电站作为基载电力供应的理念已经过时了，因为能源市场现在更青睐分布式发电和小型电网。“基载电力的理念已经过时了。驱动未来电力市场的将是供应能力，以及需求侧的反应和管理。”

建设低碳能源未来的关键在于区分好资金、前景和责任的价值认定。未来的长期资金量需求量一定会很大，而且这一过程中还会涉及一系列重要的社会、环境和经济决策。气候变化的威胁日益紧迫，那些危险、昂贵、集中、僵化的技术才是我们最应该放弃的。

保罗 · 多尔夫曼，英国伦敦大学学院（UCL）能源研究中心高级荣誉研究员，方正核咨询集团（NCG）创办人，约瑟夫朗特里慈善信托（JRCT）核政策研究员

Case for nuclear wanes as grids adapt to nuclear energy

The UK is wasting a huge sum on nuclear energy at a time when low-carbon sources can provide a growing share of the world's electricity supply, writes Paul Dorfman

Paul Dorfman

It was widely reported in October that Chinese President Xi Jinping and UK Prime Minister David Cameron had struck a deal to try to reinvigorate the UK's stalling nuclear ambitions. But the reality is that nothing has been signed yet, despite the huge financial incentives being offered by the Treasury to French and Chinese nuclear corporations.

There's a strong consensus amongst UK commentators about the huge financial burden on taxpayers, as Hinkley would lock the UK into an index-linked 35-year contract for electricity, at twice the price consumers currently pay, on top of a £2 billion (19.2 billion yuan) loan guarantee.

If a contract is signed, China General Nuclear Power Corporation (CGN) would take a one-third share in the troubled French EDF project at Hinkley C, with a promise to build and operate Chinese-designed reactors on UK soil.

Whilst China may be prepared to lose money on its investment in UK nuclear in order to open up the international market for Chinese nuclear industry, plans for nuclear worldwide are stuttering. Both fully-developed and fast-industrialising economies are moving away from old-style baseload power models built around large coal and nuclear plants.

This shift is based on a more rounded strategy for energy, which involves deploying large arrays of on-and off shore wind and solar renewable energy. These will be complemented by flexible gas-fired back-up plants and combined with energy efficiency and conservation, demand-side management, energy load-balancing, big transmission grid upgrades and local distribution.

Accordingly, it seems that the next industrial evolution will be renewable. So the question remains, why persist with nuclear? Looking at the economics of generating from nuclear in both OECD and developing countries, it's easy to see how public money could be better spent to much greater effect.

One of the reasons is that nuclear has had a makeover, with the industry now presenting itself as a partial response to global warming. This is despite the industry's obvious environmental and logistical flaws.

The UK Institute of Mechanical Engineers warns that proposed new reactors, together with radioactive waste stores including spent fuel, will be generally located on coasts, potentially vulnerable to sea-level rise, flooding, storm surge and tsunamis. It adds: "Nuclear sites, based on the coastline, may need considerable investment to protect them against rising sea levels, or even abandonment or relocation in the long term."

The World Nuclear Association maintains that nuclear power capacity worldwide is increasing steadily, with reactors under construction in 13 countries. They say that countries are either planning to build for the first time (Belarus and United Arab Emirates), have signed contracts (Lithuania and Turkey), or have some plans to build (Bangladesh, Jordan, Poland and Vietnam).

In contrast, the arguably more independent World Nuclear Industry Status Report describes a declining trend, with annual nuclear electricity generation reaching a maximum of 266 GW in 2006 and dropping to 235 GW in 2013 –

> At the heart of planning the low-carbon energy future are differing views on value for money, foresight and responsibility. Huge long-term investments are needed and it's clear there are critical social, environmental and economic decisions to be made.

with 50 fewer operating reactors than the peak in 2002, and total installed capacity comparable to levels last seen two decades ago. This decline is also confirmed in BP's recent *Energy Outlook*.

Financial risk

Moreover, a sense of unease persists about the risk to people, the environment and to the future of nuclear energy from another major accident. Reactor malfunctions related to "beyond design-base" cascading events, such as the Fukushima disaster, are the single largest financial risk – far outweighing the combined effect of market, credit, construction and operational dangers.

In trying to prevent such accidents, reactors have become much more expensive, complex, and therefore difficult to build on time and on budget. New-builds are only likely to go ahead with the help of large public subsidies and loan guarantees, including long-term power purchase agreements.

This is because the private sector can't afford to build new nuclear plants themselves, since new-builds are high-value, high-risk projects with a marked tendency for significant delay, cost overruns and investor risk.

For example, in Finland Teollisuuden Voima Oyj (TVO) is pressing a €2.7 billion compensation claim for severe delays to the French-designed EPR nuclear power plant at Olkiluoto. In turn, the French are demanding €3.5 billion from TVO. The project's turnkey price was €3 billion in 2005 and the current estimated price stands at €8.5 billion, with a construction time of 13 years and rising.

Worldwide slowdown

Nuclear's worldwide new-build record is equally fragile. Of the 67 reactors currently being built, eight have been under construction for more than 20 years, another one for 12 years; and at least 49 have been significantly delayed. For the remaining 18 reactor units, construction either began within the past five years or the reactors haven't reached projected start-up dates.

A large number of these projects involve the Russian state nuclear corporation Rosatom, which is building plants in Russia and Belarus and claims more reactor orders from Iran, Turkey, Vietnam, Bangladesh, Jordan, Hungary, Finland, Egypt, India and South Africa. There are doubts over whether Rosatom has the cash and supply chain capacity to carry out more than a small fraction of these; most depend on Russian finance, hit hard by the recent plunge in oil prices and western sanctions. Rosatom is already facing delays in its own homeland due to lack of resources.

Despite its own economic downturn, China has 28 reactors under construction – 42% of the world's total new-build - with 21 reactors (17 GW) in operation, which in 2013 provided 2.1% of the country's electricity. To put this into perspective, in 2013 alone, China installed 12 GW of solar, (a threefold increase over 2012), with plans for solar to grow up to 66 GW by 2017.

Recent events have challenged China's plans for nuclear. There have been the usual construction delays, cost increases, doubts over the siting of reactors in inland provinces, and questions over safety and regulatory oversight. Most worryingly, in recent months significant faults have been found in the reactor pressure vessels already installed in the French-designed units at Taishan 1 and 2 in Guangdong province.

What next ?

The general post-Fukushima situation suggests that nuclear construction will be constrained in the coming decade. Although some European plants are still planned in Finland, France and the UK, Italy and Switzerland have cancelled plans for new reactors, Belgium has confirmed a nuclear phase-out, Sweden and Spain are maintaining a nuclear moratorium, and eight EU countries have signed

a declaration that nuclear power is incompatible with the concept of sustainable development.

Germany, Europe's dominant electricity user, has made its choice. Its decision to phase out nuclear power by 2022 and to instead invest in renewables, efficiency measures, grid infrastructure and energy storage, will prove significant for both European and international energy policy.

Clean energy from wind, solar and biomass is generating windfall sales for German power exports, with a recent report by the Fraunhofer ISE Institute showing that net sales this year may grow to as much as €2 billion.

Underpinning this surplus is a surge in renewable energy. German nuclear generation shrank by 41 terawatt-hours to 92 terawatt-hours in the four years through 2014, while clean energy grew to 138 terawatt-hours from 20 terawatt-hours over the same period. In 2015, renewable energy is set to cover around 33% of Germany's gross energy demands, or 193 billion kWh, 20% from 2014, with PV and wind the main contributors.

Germany's transition

Critics of Germany's Energiewende (energy transition) base their argument on the claim that renewables can't fill the gap created by retiring nuclear reactors, and that this shortfall must be met by coal. Yet Germany's coal-fired power generation and CO_2 emissions from power generation are continuing to decline steadily, and total fossil fuel use has fallen to a level not seen in the past 35 years. Gas consumption was down even more dramatically. As a result, Germany's carbon emissions fell by around 4% –5% in 2014 alone.

A key Energiewende driver is the democratisation of energy production–with power devolving to the local level. Regional governments have the authority to set goals and locations for renewable generation. This ensures that local energy resources and financial subsidies–paid for by customers (through feed-in tariffs), or taxpayers, (through cheap loans provided by KfW, the government development bank)–benefit not only the energy companies but also the local people, with profits and employment kept in the region.

Steve Holliday, chief executive officer of the UK's National Grid, says the idea of large coal-fired or nuclear power stations for baseload power is obsolete, as energy markets move towards much more distributed production and towards microgrids: "The idea of baseload power is already outdated. The future will be much more driven by availability of supply; by demand side response and management."

At the heart of planning the low-carbon energy future are differing views on value for money, foresight and responsibility. Huge long-term investments are needed and it's clear there are critical social, environmental and economic decisions to be made. Given the ever-increasing warnings of climate change, the very last thing the population needs is risky, expensive, centralised and inflexible technology.

Dr Paul Dorfman is Honorary Research Fellow at The Energy Institute, University College London (UCL); Founder of the Nuclear Consulting Group (ncg); Nuclear Policy Research Fellow at Joseph Rowntree Charitable Trust (JRCT).

英国：碳捕捉技术遭遇重挫

英国约克德拉克斯发电厂碳捕捉项目的停摆是该技术遭遇的一次重大挫折。

亚历山德罗·维特利

9月末，英国德拉克斯发电厂（Drax）宣布将终止对约克郡碳捕集和封存计划的投资，主要原因是政府削减了对该项目的补助。这一重大挫折也令人们开始质疑碳捕集和封存技术（CCS）是否能够减少二氧化碳的排放量，考虑到这项技术若想获得经济效益，就必须与石油开采相结合。

CCS技术深受燃煤电厂的支持和喜爱，因为这一技术有可能在不改变现行生产模式的前提下实现碳排放的大幅度减少，从而有助于将全球温度上升幅度控制在2摄氏度之内。与大量研究及多家学术研究机构一样，国际能源署（IEA）、联合国政府间气候变化专门委员会（IPCC）及世界银行也都强调了CCS技术的重要性。

包括国际能源署在内的一些机构称，现有的上千家发电厂和水泥厂等工业设施在世纪中期之前仍需要保证正常运营，从而给避免气候变化留下一线生机。

但是，高昂的成本和技术困难决定了在未来十年内并不会开发出许多CCS技术项目，阻碍了这项技术的长期推广。这意味着，对于科学家们所说的必须在2050年之前实现大幅减排的目标，CCS技术并不能发挥太大的作用。

所谓CCS技术就是在捕集二氧化碳气体后，将其安全输送至地下废弃的石油、天然气井中进行永久封存。该技术作为现有油气井增产的手段之一已经使用多年。

全球碳捕集与封存研究院（GCCSI）称全球现有11项处于运行状态的大型石油增产（EOR）项目。这些项目每年可封存2,600万吨二氧化碳。到2020年，EOR项目计划将二氧化碳年封存量提高到1,800万吨。

法国兴业银行（Societe Generale）伦敦全球电力部主任阿伦·贝克（Allan Baker）称，CCS技术也碰到了不少海上风电场建立初期时遇到的问题。

“高昂的成本和技术困难决定了在未来十年内并不会开发出许多CCS技术项目，阻碍了这项技术的长期推广。”

“虽然碳捕集技术并不是新技术，但大规模的实施需要综合多种技术，因而需要推出示范项目以树立人们的信心。”

由于全球很多发电厂都不会与那些能够提高陈旧油井产量的网络挂钩，所以，CCS技术若想发挥作用，除了大幅提高排放费用，还要在现有基础上大幅降低技术成本。然而，即使降低了成本，由于油价的波动，也不一定保证这些项目绝对能够实现经济效益。

正在运营的“纯”碳封存项目（即并不作为石油增产手段）目前只有两个，均位于挪威北海的天然气生产平台。

燃煤电厂和燃气电厂的碳捕集所用的是一种较新型的技术，比在北海实施的项目更为复杂。二氧化碳的输送和封存技术虽已经过验证，但碳捕集技术尚未经过测试。虽然企业现已研发了一系列在燃烧前后捕集二氧化碳的方法，但该技术仍未经过大规模验证。

目前，共有两个欧洲国家对商业推广CCS技术表示支持，一个是英国，另一个是荷兰。在德拉克斯发电厂撤资之前，英国国内有两个项目一直在争取政府对商业示范项目的资金支持。意昂集团（EON）和法国燃气苏伊士集团（Engie Energy）也有意在鹿特丹电厂建立CCS部门。英国和荷兰的上述项目预计将于2016年年初取得最终的投资结果。

在北美，由于CCS技术在石油增产方面的应用，使得发电厂在技术的应用上已进入到了一个更为成熟的阶段。加拿大电力公司SaskPower自去年起开始在位于博尔德大坝（Boulder Dam）的燃煤发电厂进行碳捕集。在密西西比州，南方公司（Southern Co.）位于肯珀县的电厂正在新建一座碳捕集设施。

潜力无限？

分析人士认为，在发展中国家，引入CCS技术有助于提高发电的经济效益。包括印度和菲律宾在内的很多国家目前都在开发大规模的廉价发电项目，其中多以燃煤和天然气发电项目为主，而这些资源原本可以在地下“封存”50年之久。发达国家应用可再生能源和其他低碳能源的步伐在不断加快，而新兴国家和欠发达国家却并不具备强大的经济实力，因而无法大规模获得或开发能够取代化石能源的先进技术，如太阳能光伏发电、风力发电等。

世界银行指出，若要实现2100年净排放值为零的目标，就需要广泛应用CCS技术，以避免减排成本的成倍增长。

但是，CCS技术的成本确实不低。

GCCSI 2015年7月发布报告指出，CCS技术的减排成本在48美元/公吨-109美元/公吨之间。这就意味着，当前欧洲市场的碳补贴价格还需要再增加六倍才能使CCS技术具备价格竞争力。

发展缓慢

成本是导致CCS技术发展缓慢的一个主要因素。企业不确定如此大的一笔投资是否能够收回成本，因此不愿意进行注资或是独立出资建设碳捕集设施。

萨斯喀电力公司（SaskPower）电力公司碳捕集和碳封存计划负责人迈克·莫内（Mike Monea）称，公司从首个碳捕集项目上获得的经验有助于其降低成本。

他说：“第一个项目的建设成本很高，但下一个项目的成本就会降低30%。”

法国兴业银行的贝克称，技术的复杂性也是此类项目面临的一大挑战。虽然CCS技术在美国的应用已有年头，但在欧洲，还需要从基础设施建设开始做起。

他说：“至少美国目前已经有了捕集二氧化碳，并将其输送至德克萨斯州的油田的设施。然而，在欧洲，我们则需要从基础设施的建设起步。虽然未来用二氧化碳实现石油增产或许是可行的，但目前离这一天仍有距离。在欧洲发展CCS技术是一项更大的挑战，我们需要把管道、封存同发电厂连接到一起，造成项目风险的叠加。”

观察人士称，还需要出台指导CCS技术发展的规章制度。

贝克说：“考虑到项目的规模、复杂程度，以及市场的不成熟，CCS技术的推广还需要一段时间。”

因此，大多数国家更愿意把可再生能源的应用作为推动温室气体减排的首选，CCS技术在太阳能和风能前只会相形见绌。然而，萨斯喀彻温电力公司的莫内塔则认为各国应重新思考这一问题。

“很多国家都尝试发展太阳能或风能，但结果却是发电成本的飞涨。我们需要面对现实。如果CCS技术能够使化石燃料变得更加清洁，并且能够将排放降至最低，那么对于电力公司来说，这不失为一种解决方案。”莫内说道。

CCS技术在很多主要国家中缺少政治支持给其发展前景笼罩上了一层阴影。例如，2011年，由于德国联邦立法机构未能出台CCS技术应用相关的法律法规，从而导致CCS技术的研发陷入停顿。结果就是，德国四大电力公司之一的瀑布集团（Vattenfall）停止了在岩史瓦顿（Jänschwalde）的示范项目，称其将会在明晰的法律框架出台后再推进这一项目。

萨斯喀电力公司的莫内认为，CCS技术能使中国受益颇多。

“我们与中国接洽已经有几年了。毫无疑问，中国的空气质量确实糟糕。中国需要知道的是，我们的工厂不仅能够捕集二氧化碳，同时还可以捕集大部分的细颗粒物，以及全部二氧化硫，这些都是造成呼吸疾病的源头。”

亚历山德罗·维特利，能源及气候政策领域自由撰稿，曾任彭博社编辑一职、伦敦经济学院客座研究员

Carbon capture an increasingly distant prospect

The withdrawal of UK power generator Drax from the development of a carbon capture project underlines the slow progress in rolling out the technology

Alessandro Vitelli

The Drax coal-fired power station in northern England where the owners have withdrawn from a planned CCS project

In late September 2015, Drax, a UK power generator, announced it would not invest in the construction of a much-touted carbon capture and storage (CCS) project being planned at its site in northern England. This latest setback, prompted mainly by a cut in government subsidies, casts further doubt on the feasibility of the technology as a means to cut carbon dioxide (CO_2) emissions, as the process is only economic when it is combined with oil extraction.

CCS had been lauded by the coal and power industries as having potential to deliver big cuts in 'business-as-usual' carbon emissions and as a tool to help keep global temperature increases to less than 2℃. The International Energy Agency, the Intergovernmental Panel on Climate Change and the World Bank have all highlighted the urgent need for CCS, as have numerous research and academic bodies.

Some, such as the IEA, have said that thousands of

> Huge costs, and technological challenges, suggest that no more than a handful of projects will be developed in the coming decade, hindering a longer term roll-out.

power plants and industrial facilities, such as cement plants,would need to be operational by mid-century to give the world a fighting chance of avoiding climate change.

But huge costs, and technological challenges, suggest that no more than a handful of projects will be developed in the coming decade, hindering a longer term roll-out. This could mean that the technology only makes a miniscule contribution to the huge cuts GHG emissions that scientists say are required by 2050.

CCS involves collecting carbon-dioxide gas (CO_2) and transporting it to underground reservoirs, such as depleted oil and gas wells, where it can be stored safely and permanently. Elements of the technology have been used for many years as a way to boost recovery of oil from existing wells.

The Global CCS Institute (GCCSI) has identified 11 large-scale projects for enhanced oil recovery (EOR) currently in operation worldwide that store more than 26 million tons a year of CO_2. EOR projects that plan to store another 18 million tonnes a year are planned to come online by 2020.

Allan Baker, global head of power at Societe Generale in London, says CCS has run up against many of the early challenges that hindered offshore wind.

"While carbon capture technology isn't new, a combination of technologies on this scale need to be demonstrated to build confidence."

Because many power plants round the world wouldn't be hooked up to a network that could squeeze oil out of old wells for CCS to make a big difference, the costs of emitting will need to rise sharply and the expense of the technology would also need to fall far from current levels. And, even if they were, there is no guarantee that these projects would be economic, given volatility in oil prices.

Only two 'pure' storage projects (i.e schemes that don't use EOR), both located on gas production platforms in Norway's North Sea, are presently operational.

The capture of CO_2 from coal- or gas-fired power plants is a newer technique and more complicated than the current projects in the North Sea. While transport and storage of CO_2 has been proven, capture technology is relatively untested. Although companies have developed a range of ways to trap the gas, both before and after fuel is burnt, their technology has yet to be proven on a large scale.

Two European countries are supporting efforts to develop commercial CCS projects at power plants. In the UK, before Drax's withdrawal, two projects had been seeking to win government funding for commercial demonstration plants, while in the Netherlands. EON and Engie Energy are looking to build a CCS unit at a power station in Rotterdam. The UK and Dutch projects expect to receive final investment decisions early in 2016.

In North America, the deployment of CCS at power plants has reached a more mature stage than in Europe, but these benefit from the revenues flowing from EOR. Canadian utility SaskPower started capturing CO_2 from its Boulder Dam coal-fired power station last year, while in Mississippi, Southern Company. is constructing a capture unit at its Kemper County power plant.

Potential?

In developing countries, the economics of power generation underline the need for CCS in the views of many analysts. India and the Philippines are among those in pursuing the cheapest forms of large-scale power, which is most often produced by coal or gas and could be 'locked in' for up to 50 years.

While developed countries are deploying renewable and other low-carbon sources of energy at an increasing pace, emerging nations and the least-developed countries do not have the economic resources to acquire or develop advanced technologies such as solar photovoltaic and wind power at the scale required to replace fossil-fuel use.

The World Bank has pointed out that if the world is to achieve a goal of zero net emissions by 2100, carbon capture and storage will have to be widely used to prevent the cost of reducing emissions from doubling.

Nonetheless, the cost of CCS is already extremely high.

Expressed in terms of the cost of reducing CO_2 emissions, CCS and coal can achieve reductions at between $48-109/mt, according to the GCCSI in a July 2015 report, which suggests that current carbon allowance prices in the European market would need to increase by a factor of at least six before CCS can be considered competitive.

Slow progress

Cost has been a major factor in the relatively slow development of CCS; companies are uncertain whether they would ever see a return from such a large investment, and are reluctant to take on the task of funding and building a carbon capture plant on their own.

Mike Monea, president of capture and storage initiatives at SaskPower, said the company's experiences with its first project means it can drive costs down.

"Our plant was expensive to build but the next one will be 30% cheaper," he said.

The complexity of the technology is also a major challenge. While CCS has been used in the US for a number of years, in Europe the infrastructure has to be assembled from the ground up, according to Societe Generale's Baker.

"In the US there is at least an existing infrastructure for gathering the CO_2 and delivery to the Texas oilfields," he said. "In Europe we're starting from scratch; all the infrastructure has got to be built, and although using CO_2 for EOR may be viable in the future, that's some way away. Developing CCS in Europe is a bigger challenge because you're combining pipelines and storage with a power station, leading to project-on-project risk."

Rules will also have to be put in place to guide the development of CCS, observers point out.

"The bottom line is that it will take time, given the scale and complexity of the projects and the lack of maturity of the market to support the projects," says Baker.

Most countries have therefore focused on deploying renewable energy as an initial way to cut GHG pollution, and CCS may have languished in comparison with wind and solar. However, SaskPower's Monea thinks nations may be ready to reconsider.

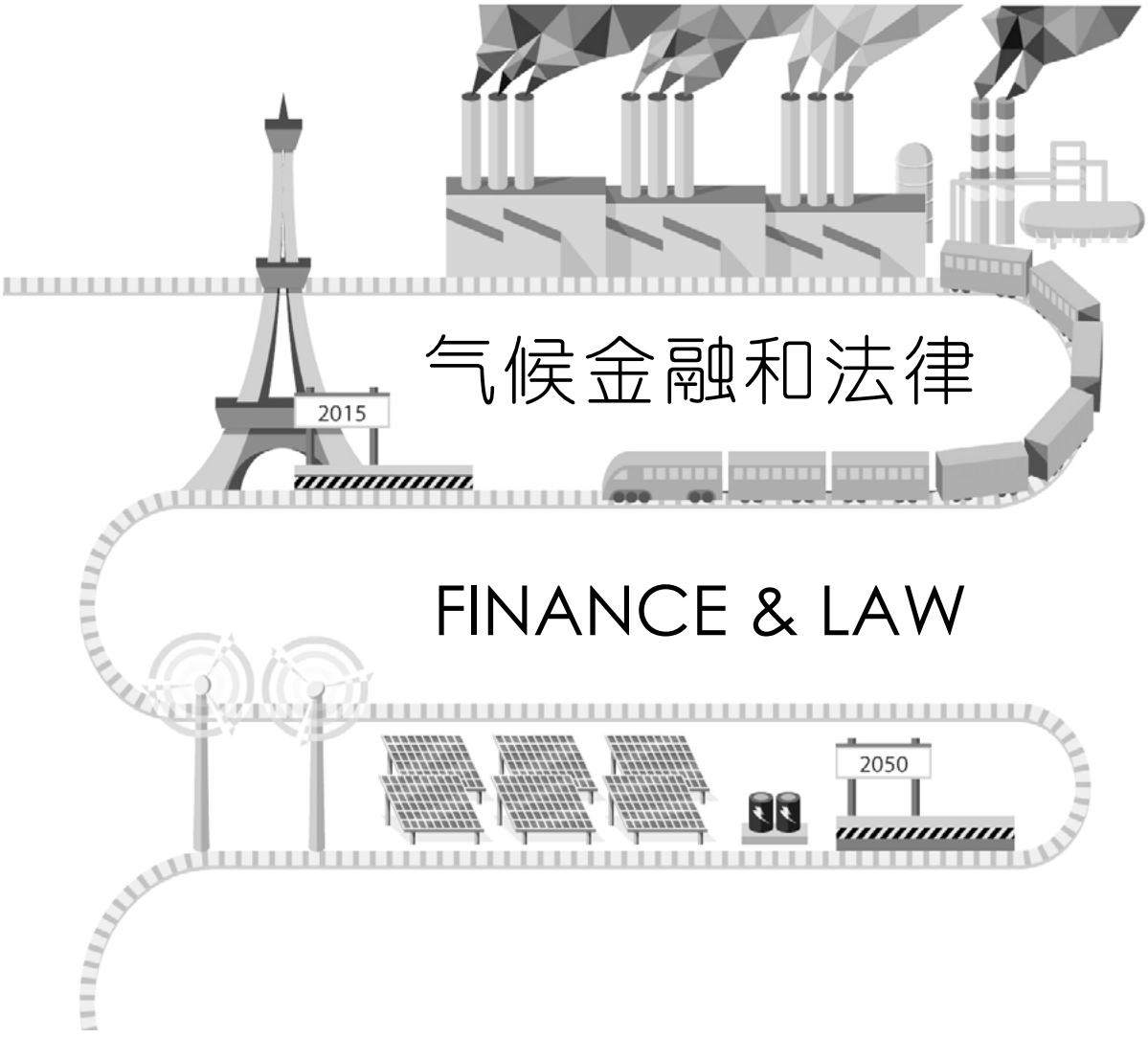
"A lot of countries have tried things like going to solar or wind, and have found the cost of their electricity has skyrocketed," Monea said. "Reality is setting in, and if you can clean up the fossil fuels and reduce emissions to a very low level with CCS, that's one of the solutions that power companies could use."

CCS' prospects are not helped by a lack of political support in many key countries. For example, efforts to develop the technology in Germany came to a halt in 2011 when the federal legislature failed to agree a law regulating the use of CCS. As a result, Vattenfall, one of the four largest utilities in the country, halted development of a demonstration project at Jänschwalde, saying it needed a clear legal framework in order to progress with its plans.

SaskPower's Monea sees additional benefits from the use of CCS in China.

"We've been involved in China for quite a few years, and I think there's no question that they have a problem with air quality," he said. "What China's learning is that our plant doesn't just capture CO_2; it also captures the majority of the particulates, and all the sulphur dioxide, those elements that cause breathing problems."

Alessandro Vitelli is a freelance journalist writing about energy and climate policy. He is a former editor at Bloomberg News and a visiting fellow at the London School of Economics.



气候金融和法律

FINANCE & LAW

富裕国家必须正视气候融资承诺

我们现在必须建立起一个公平、公正的体系，让苦苦挣扎的国家获得所需的气候融资，同时让那些小气的富裕国家亮亮相，让他们为自己的行为感到羞耻。

约·海

应对气候变化的过程中金融手段必然会发挥重大作用。如今巴黎气候峰会日益临近，而气候融资的状况眼下却是一团糟。

除了少数几个承诺全力承担融资责任的国家外，多数国家做的还远远不够。然而，对于那些“袖手旁观”的国家，我们却也无可奈何。

几家多边发展银行正在竭尽所能，但若没有新的资本注入，他们能做的也只是在现有资金范围内“拆东墙补西墙”。

所以说，一场彻底的变革已经迫在眉睫了，不过随之而来的将会是一场政治硬仗。

绿色技术投资的脚步正在加快，但是仍然不足以遏制气候变化的态势，而且很多都没有落实在最需要帮助的贫穷国家。这些国家对全球变暖的“贡献”最少，然而海平面上升和极端气候这样的事件却对他们影响最大。

对于这个问题，我们其实已经有解决方案了，只不过实施过程中遇到了一些阻碍。

2009 年哥本哈根气候峰会时，与会各方并没有就削减温室气体排放达成一致，但是他们觉得总归要让外界觉得大会还是取得了一些成果。

所以发达国家许诺，2020 年之前（这个遥远的时间点选的好像不错）他们会每年“筹措”1,000 亿美元作为向发展中国家提供的援助资金，从而帮助后者（慢慢地）减缓并适应气候变化的影响。这笔资金原本计划从 2009 年到 2020 年将逐年增加。

六年过去了，也许你会觉得这些富裕国家应该已经计算好了每个国家所应承担的份额，以及哪些钱该花，哪些不该花。

根本不是那么回事。

联合国气候变化框架公约第 21 届成员国会议即将于 12 月在巴黎召开，这也被认为是达成全球气候

几家多边发展银行正在竭尽所能，但若没有新的资本注入，他们能做的也只是在现有资金范围内“拆东墙补西墙”

变化应对协议的最后一次机会。发达国家终于也意识到，他们需要拿出些行动兑现 1000 亿美元的援助承诺。否则，发展中国家可能会在巴黎峰会中不做表态，拒绝削减温室气体排放量。

所以，秘鲁和法国这两个气候大会即将离任和上任的轮值主席国在 7 月发表声明，将委派经济合作与发展组织国家进行首次官方调查，就富裕国家为发展中国家提供的气候融资援助给出一个具体的答案。

10 月 9 日，国际货币基金组织 / 世界银行年会在利马举行，该份调查报告也同时发布。调查显示，2013 到 2014 年，发达国家提供的气候融资总额为 570 亿美元。用发达国家的话说，这一数字为在 2020 年实现 1,000 亿美元目标“从政治上指明了一条可靠的道路”。

但是，发达国家的表现最多只能算是及格。

重新定向的援助

首先，发展中国家肯定觉得他们曾经得到过承诺，这 1,000 亿美元气候融资不会影响到现有的捐助计划。但是，其实发达国家正是用本来的援助资金补了这 1,000 亿美元的窟窿。

比如，2014 年英国曾表示要向为了帮助协调哥本哈根会议的资金流向而成立的绿色气候基金组织提供 7.2 亿英镑的资金，称“英国政府许诺每年将其国民生产总值的 0.7% 用于海外发展援助，而此次的资金正是来自这一款项下属的国际气候基金”。

款项稀释

更严重的是，哥本哈根协定还允许私人资本参与到这 1,000 亿美元的计划中来，而且并没有设立特别的限制。

当然了，人们的第一反映是——“太好了，我们正需要私人资本的参与”。

我们的确需要这些资金。但是这也正是为什么公共款项的比例要越高越好。

因为公共款项能够带来乘数效应。如果一国政府或者发展银行为某个项目投入 1,000 万美元，那么自然也会吸引来其他的私人资本。

有时候，公共部门投资可以帮助私人投资者规避风险，有时候则能够降低整体融资成本。即便公私两方资本借贷的条件相同，政府资本的出现无疑给了私人资本巨大的投资信心。

所以说，这 1,000 亿美元的援助资金中公共投资的比例越大，带来的总体社会效益就越多（同时带给私人资本市场的机会也就越多）。

有一点我们必须清楚，有人曾经计算过，要完成全球经济的低碳转型，大概每年需要 1 万亿到 5 万亿美元，所以说公共投资比例最大化的重要性自然是不言而喻。

自愿捐资

第三个严重的问题在于，尽管从法律上讲，兑现千亿美元的承诺是发达国家的义务，但是各方却没有就责任分配给出具体的方案。

结果就是，每个国家都按照自己认为的责任比例行事。最终导致了援助任务分配的严重不均，重新划分责任也就成了当下的首要任务。

经合组织的统计显示，目前已落实的 570 亿美元气候融资中，大约有 4 成（228 亿美元）来自政府，还有 16 亿美元主要是可再生能源的出口信贷。

多边发展银行累计提供了 179 亿美元（约占 31%）的援助，而私人资本领域的协同投资为 147 亿美元。需要说明的是，经合组织关于多边发展银行的统计只包括了发达国家的资本额，而多边发展银行日常的资本来源也包括发展中国家。

尽管经合组织一直在强调透明公开，但是却没有公布每个国家具体的援助金额。

世界资源研究所的数据显示，这一数字主要依据的是 2012 年的承诺金额，其中有 171 亿美元来自各国政府，154 亿美元来自多边发展银行。

这样的现实读起来的确不大乐观，但是的确只有挪威和法国担负起了自己应有的义务。

> “每年各国需要提供的资金比例如下：美国440亿美元，日本94亿美元，德国79亿美元，英国76亿美元，法国58亿美元，而意大利、加拿大、澳大利亚和西班牙分摊剩余的250亿美元。”

致敬“后进者”

根据1992年在里约热内卢签署的《联合国气候变化框架公约》，有23个国家被认定为发达国家，并有义务向发展中国家提供经济援助，帮助他们逐步减缓和适应气候变化带来的影响。

这些发达国家包括欧洲西部的欧盟国家，以及挪威、瑞士、冰岛、美国、加拿大、日本、澳大利亚和新西兰。

而经合组织的报告显示，另有四个国家也被加入了这一发达国家列表，他们分别是波兰、捷克、斯洛伐克和斯洛文尼亚。

根据世界货币组织对2020年各国国内生产总值的预测，人们可以大概对这23个国家的千亿美元援助责任分配有一个预估。

具体来说，每年各国需要提供的资金比例如下：美国440亿美元，日本94亿美元，德国79亿美元，英国76亿美元，法国58亿美元，而意大利、加拿大、澳大利亚和西班牙分摊剩余的250亿美元。以上数字大致分别相当于这些国家国内生产总值的0.2%。

从世界资源研究所根据以上各国提供的资料计算出的一组2012年的数据来看，挪威已经（双向）完成了这一2020年融资目标的91%，其余国家的完成比例分别为法国61%、日本44%、德国26%、英国10%、美国5%。

巴黎峰会前夕，一些国家纷纷表示会提高本国的气候融资总额。法国表示将在2020年把这一数字提高到每年56亿美元。这意味着，按照该国国内生产总值计算，法国的捐助资金总额与其在千亿美元计划中的责任数额基本相当。此外，法国方面还表示这些新增资金将不会影响之前允诺的援助款项。

德国也迈出了正确的一步，承诺将总额提升到45亿美元。不过英国政府的27亿美元计划显得就有些诚意不足了。

最大的问题其实出现在美国。虽然美国的经济规模是法国的六倍，但是它的气候融资金额却远远不及法国。

假如美国能够担负起自己的责任，想必其他发达国家也会紧随其后。不过遗憾的是，恐怕现在还没有哪个国家能够说服美国遵守承诺。

表明立场

各国似乎希望能够在不经意间通过包括私人资本和多边发展银行在内的各种渠道凑足这1,000亿美元。

在利马，各多边发展银行竞相提高气候融资目标。

比如，世界银行集团就宣布将在2020年将目前每年103亿美元的融资额提升到160亿美元。然而这笔钱不过是从其他项目中借调过来的，因为世界银行并没有得到新的资金来源，他们还想把自己的资金充分利用起来。该集团的确也曾经呼吁增加资本投入，不过前提是投资方必须“支持联合国发展目标”。

没人知道发展中国家在巴黎峰会上将就争取金融援助做出怎样的努力，不过无论怎样，这都是他们的权利。

至少，发展中国家有权坚持要求发达国家在2016年底，就这1,000亿美元的融资计划组成，以及具体的资金来源分配给出一个更为明确的计划。

最好他们能够坚持要求资金全部来自于公共投资领域。不过现实一点来说，如果可以达到七到八成的比例也很好。

同时，发展中国家还应该坚持气候融资不会影响现有的资金援助。

对于多边发展银行这种超越国家层面的组成部分来说，发展中国家应该要求其有新的资本注入。如果发达国家足够聪明，他们应该能看懂其中的逻辑——通过多国发展银行这种高效的资本渠道，他们的资金能够得到更好的利用。

最后，发展中国家应该坚持气候变化适应援助必须达到一定比例，而不只是对减缓措施的援助。要想让私人资本投资风电场很容易，因为这会产生利润。但是想要说服商业资本投资海堤或者抗旱系统，可就没那么简单了。

富裕国家也许会要求继续壮大他们的队伍，比如把新加坡、韩国以及海湾国家等新晋的富裕国家也列入其中，尽管后者的温室气体排放量要小得多，对气候变化的影响也没有那么大。

在气候融资这个问题上，发展中国家的反对也许会让巴黎峰会的气氛变得紧张压抑。但是，这个问题的重要性已经容不得多一分的拖延了。

本文原载于环球资本杂志官网。环球资本杂志是一家全球领先的新闻、意见和数据平台，主要服务对象为使用或参与全球资本市场运作的个人或机构。

约·海，全球资本报（GlobalCapital）财务编辑，专长环境金融和绿色债券写作

Rich countries must stop shirking promises on climate finance

It's time for a proper, fair system so struggling countries get the climate finance they need, and the rich penny-pinchers are named and shamed, writes *GlobalCapital*'s Jon Hay

Jon Hay

Finance is set to play a key part in the fight against climate change. But by the time of the Paris Summit upon us, climate finance provisions are a mess.

With a few honourable exceptions, countries are doing far less than they should. Yet there is no mechanism for correcting the shirkers.

The multilateral development banks are doing what they can–but without fresh capital, they can only divert funds from other needy causes.

A thorough shake-up is badly needed, but it will involve painful political battles.

Investment in green technology is accelerating, but not nearly fast enough to curb climate change, and not much of it is going to the poorest countries. They have done the least to cause global warming, but are already suffering worst from its effects, such as rising sea levels and extreme weather.

The world has an engine to address that, but it remains parked in a field, choked in weeds.

At the Copenhagen summit in 2009, when states failed to reach agreement to cut greenhouse gas emissions, they had to have something to show for the meeting.

So the developed countries promised that by 2020–a nice, far-off date–they would be "mobilising" US$100 billion a year to developing countries, to help them mitigate (i.e. slow) and adapt to climate change. The amount was supposed to ramp up between 2009 and 2020.

Six years on, you might think the rich countries would have worked out a formula for how much each country was supposed to pay, and decided what counted and what didn't not a bit of it.

At the the Paris COP 21 conference–widely seen as the world's last chance to get a deal that begins to tackle climate change–is here. The developed countries have realised they need to show some action on that US$100 billion promise–otherwise, the developing countries might just say "get lost" and refuse to cut their emissions.

So in July, Peru and France, the outgoing and incoming chairs of the COP process, commissioned the OECD to prepare the first official survey of how much the rich countries are actually doing on climate finance for the developing world.

The report, presented at the IMF/World Bank annual meetings in Lima on October 9, showed an average of US$57 billion a year had been committed, over 2013-14. The rhetoric from the rich countries in Lima was that this showed a "politically credible pathway" to reaching the US$100 billion in 2020.

But the developed countries deserve at best a 'C' grade for their efforts.

Redirected aid

First, the developing countries clearly felt they had been promised that the US$100 billion would not just be purloined from existing aid budgets. But much of what the developed countries are paying is indeed part of aid.

For example, when the UK said in 2014 that it would contribute £720 million to the Green Climate Fund, which was set up to channel some of the Copenhagen money, it said this came "from existing funds earmarked for international climate work under the UK's commitment for

“About US$44 billion a year would be needed from the US, US$9.4 billion from Japan, US$7.9 billion from Germany, US$7.6 billion from the UK and US$5.8 billion from France, leaving US$25 billion for the smaller states led by Italy, Canada, Australia and Spain.”

0.7% of gross national income to overseas development assistance”.

Dilution

Even more seriously, the Copenhagen text left the door open for the US$100 billion to include private sector capital flows, and without any specific limit.

The kneejerk reaction is to say “great–we need the private sector to get involved”.

Of course they do–but that is exactly why the public sector contribution needs to be as large as possible.

There is a multiplier effect. If a government or development bank puts up US$10 million for a project, extra private investment can be attracted alongside.

Sometimes the public sector can shield private investors from risk; other times it can bring down the average cost of funds; and even if public and private money is lent on the same terms, the presence of a state investor gives the private sector confidence to co-invest.

Thus, the more of the US$100 billion ends up being public money, the greater, by a multiple, the overall benefit (and, incidentally, the opportunity for the private capital markets).

Bear in mind that the real amount needed to redirect the world’s economy towards low-carbon development has been estimated at US$1 trillion-US$5 trillion a year and the importance of maximising the public component becomes clear.

Paying is voluntary

A third grave problem is that while the US$100 billion commitment is legally binding on the group of developed countries, there is no agreed means for how to share this out. The result is that each is just doing what it feels it can, leading to a grossly unfair distribution of the burden, and a heavy reliance on redirecting existing budgets.

In the US$57 billion in commitments so far counted by the OECD, US$22.8 billion, or 40%, came from governments, plus US$1.6 billion in export credits, mainly for renewable energy.

Multilateral development banks provided $17.9 billion or 31% and the private sector US$14.7 billion in co-financing. For the MDB part, the OECD counted only the share of the banks’ efforts that is supported by developed countries’ capital, as the MDBs also have capital from developing states.

But, for all the OECD’s talk of transparency, it did not publish a list of how much each country had given.

The latest figures for that refer to 2012 commitments, which totalled US$17.1 billion from states and US$15.4 billion from MDBs, according to the World Resources Institute.

These make depressing reading. Only Norway and France come anywhere close to pulling their weight.

Laggards

Under the UN Framework Convention on Climate Change, signed in 1992 at Rio de Janeiro, 23 countries are defined as developed, and are obliged to provide financial resources to developing countries to help them mitigate and adapt to climate change.

They are the west European members of the EU, plus Norway, Switzerland, Iceland, the US, Canada, Japan, Australia and New Zealand.

For the OECD’s report, four countries – Poland, the Czech Republic, Slovakia and Slovenia – asked to be included too.

Based on the IMF’s predictions of national GDPs for 2020, one can work out a rough version of a fair distribution of the US$100bn among the 23 responsible countries.

About US$44 billion a year would be needed from the US, US$9.4 billion from Japan, US$7.9 billion from Germany, US$7.6 billion from the UK and US$5.8 billion

from France, leaving US$25 billion for the smaller states led by Italy, Canada, Australia and Spain. This is about 0.2% of GDP for each country.

Using the World Resources Institute's figures for 2012, which are based on what countries themselves reported, Norway was already contributing bilaterally 91% of this 2020 target, France 61%. Japan was putting in 44%, Germany 26%, the UK 10% and the US 5%.

In the run-up to Paris, several countries have pledged to increase their climate funding. France has said it will go up to US$5.6 billion a year in 2020. That would mean it was contributing about its fair share of the full US$100 billion, based on GDP breakdown. France also said this new money would not come out of aid.

Germany has promised to go up to US$4.5 billion–on the right track. The UK's offer of US$2.7 billion is less impressive.

The most gaping hole remains the US, which in 2012 was contributing much less than France, though its economy is six times bigger.

Were the US to put its shoulder to the wheel, all the others would fall into line,but no other country has the clout to make the US live up to its commitments.

Taking a stand

Countries seem to be hoping they will somehow, haphazardly, make it to US$100 billion, by scraping together what they can find in various kitties, including private money and a lot from the MDBs.

In Lima, the MDBs vied with each other to announce increased targets for climate finance.

The World Bank Group, for example, said it would raise its contribution from US$10.3 billion a year now to US$16 billion in 2020. But that money is just being diverted from other purposes–since the World Bank has not been given a capital increase, and would have planned to use its capital fully anyway. It has asked for a capital increase, but said only that this will be to "support the UN's development goals".

No one knows how much of a fight the developing countries plan to put up about finance in Paris. But they would be well within their rights to dig their heels in.

As a minimum, developing countries should insist that, by the end of 2016, developed states come up with a clear plan for what the US$100 billion will consist of, and how it will be divided among the various providers.

They would be well advised to insist that all of it is public money. More realistically, they may have to settle for a firm percentage, perhaps 70% or 80%.

They should extract a promise that new commitments should not come from existing aid flows.

As for the MDBs, the developing states ought to request that the supranational banks' component in the US$100 billion be backed by fresh capital increases. If they are wise, the developed countries will see the logic of that– their money will go a lot further channelled through the efficient capital structures of the MDBs.

Finally, the developing states should insist on a hard percentage being earmarked for adaptation to climate change, rather than mitigation. It is relatively easy to get the private sector to invest in a wind farm, because it generates revenue. It is much harder to get commercial investment for a sea wall, or systems to cope with droughts.

For their part, the rich countries could argue that their number should be broadened to include such newly wealthy states as Singapore, South Korea or the Gulf states–though these have contributed much less to the emissions which cause climate change.

Resistance by the developing countries might make the meetings in Paris ugly and stressful. But climate finance is too important to be allowed to languish for much longer.

This article was published originally on the website of GlobalCapital, a leading news, opinion and data service for people and institutions using and working in the international capital markets.

Jon Hay is corporate finance editor at GlobalCapital newspaper and writes regulary on environmental finance and green bonds.

荷兰法院开创先例 政府将面临气候官司潮

荷兰海牙法院支持了来自荷兰人民起诉自己政府的诉求，要求荷兰政府采取更多措施来防止气候变化。

凯利·沃诺克

海牙一家法院6月做出全球首例判决，要求政府削减温室气体排放，这为其他国家采取类似举措铺平了道路。

非政府组织Urgenda控告荷兰政府“严重失职”，而海牙的这家法院支持了这一观点。法院认为，荷兰当局没有采取足够措施应对危险的气候变化，没有履行其对荷兰社会应尽的义务。

这一裁决不仅会推动类似的国际气候诉讼，同时也会促使各国，尤其是发展中国家重新尝试采取跨境环境法律行动。在万众瞩目的联合国巴黎气候谈判即将于12月举行之际，这份裁决来的恰逢其时。没有完成减排承诺的国家可能会面临法律诉讼，从而让这些国家了解到，若不采取积极行动减排最终会导致严重的法律后果。

荷兰的决定

一直到2010年，荷兰的减排目标是在2020年前将本国的温室气体排放量降低到1990年排放水平的七成。荷兰政府承认，只有在2020年前将国家减排目标锁定在25%到40%之间，才能有效防止全球升温超过2摄氏度。但是在实际行动中，政府最终只完成了17%的减排量。

对于既定的30%减排目标，政府既没有辩解说科学共识发生了变化，也没有说原来的目标从经济角度来看无法实现，只是说政府没有法律义务完成更大规模的减排任务。荷兰政府官员还表示，政策制定本来是政府的专有权利，而这类裁决只会让法律界打乱了这种节奏。法院方面则否决了这一说法，并敦促荷兰政府在2020年前将温室气体排放削减25%。

法院还认为，司法部门有明确的责任解决气候变化威胁问题。在公共诉讼过程中，法院的责任就是通过判定政府行动的合法性来保证公民基本权利。然而，有时候很难将司法和政治权利区分开来，因为理清“保护的责任”和如何进行保护这件事也并不容易。

但是在这种情况下，法院也意识到了气候变化的不同之处。最低标准的保护措施也会被弱化成可以量化的单位，或者具体的削减比例，并且会与如何进行温室气体减排这个政策问题区分开来。这样的话，法院就可以在合理的范围内扮演自己的角色，在不插手政策制定的同时保护公民的权利。

为什么这么重要?

现在的关键问题在于，Urgenda案件的最终判决是否会推动其他地区的司法诉讼。这家法院裁决过程中采用的三点意见或许会对将来类似案件的诉讼起到一定的启示作用。

首先，法庭驳回了避免单边行动这个气候变化领域多年来“陈词滥调”的借口。温室气体排放由第三方引发这种说法是站不住脚的：控制本国领土范围内的温室气体排放是政府的主权，同时也是其应负起的系统责任。

法院认为，没有证据证明荷兰方面存在“碳泄露”的说法。碳泄漏是指企业由受温室气体排放法规限制的国家向不受排放限制的国家

转移的现象。法官还判定，因为存在“水床效应”，即便上述说法成立，也不会对欧盟国家的排放和贸易机制产生负面的影响。

其次，法庭还驳回了“若无法则”的论点，即需要证明若不是被告的行为，损害就不会发生。因为导致气候变化的因素有很多，所以一直以来“若无法则”也就成了侵权诉讼的一个重要障碍。法院给出的解释是，荷兰对于全球温室气体排放的贡献相对较小的说法是不成立的。

法庭在判决书中写道：“任何人为的温室气体排放，无论其多少，都会对大气二氧化碳水平造成影响，进而导致严重的气候变化。因此，减排不仅仅是《联合国气候变化框架公约》所有缔约国的集体责任，也是每个国家的责任。”上述司法解释有可能引起其他在“特雷尔冶炼厂”原则基础上提起的过失索赔要求，即任何国家都有责任在其法律权限范围内，阻止可能对他国领土造成危害的行为。

再次，尽管 Urgenda 一案并不是以违反宪法权利为依据而获得的胜利，但还是应该将其看作是一场权利之战。在许多国家，法院一直被认为是维护基本权利的“最后一道防线”。正如作出判决的荷兰法庭所说，目前世界正面临着前所未有的环境破坏，“这样的严重后果”让生命的基本权利也变得岌岌可危。

可以说，荷兰法院对这一事实的认定将有助于推动以权利为基础的法律体系的建设，在发展中国家尤为如此。其实，已经有人开始进行此类维护人权的行动，比如尼日利亚就成功地对造成污染的原油企业提起诉讼。

气候诉讼的滚滚大潮

荷兰法庭作出的这份判决或许会推动司法界的一场“巨变”。在 ClientEarth 诉环境、食品和农村事务大臣一案（[2015]UKSC28）（2015 年 4 月 29 日）中，英国最高法院就要求英国政府遵守欧盟空气质量指令中对于二氧化氮的排放限制——该气体是一种非直接温室气体，并且不在《京都议定书》覆盖范围内。

批评人士可能会认为，诉讼充其量只能算作是一种零敲碎打的方式，并不能很好地解决气候问题，因为，要想解决气候问题就需要全世界携起手来，共同加以应对。但是这样的评价其实过于简单了，Urgenda 一案有可能带来非常重大的间接影响。例如，今后政府机构、业界、以及金融领域如果继续以“无所作为的”方式应对气候变化问题的话，他们就要重新考量一下由此带来的诉讼风险。

更重要的是，荷兰的判例是一个标志性的胜利。多年以来，由于政界在意愿和能力方面的欠缺，导致一直无法很好地保护人民的基本权利，以不作为的态度应对气候变化的问题。而荷兰的司法界却站了出来，让削减温室气体排放不再受政治影响，把政府从“惰政”中解放了出来，强迫政府把重心放在那些能够保卫人们的生活环境的基本政策上。

凯利·沃诺克，任教于新西兰奥塔哥大学，主要研究领域包括环境法，气候变化和能源相关法律

Govts braced for climate lawsuits worldwide

Governments failing to meet agreed emissions targets may be dragged through the courts by their own citizens and other countries, writes climate law expert Ceri Warnock

Ceri Warnock

A court in The Hague in June became the first in the world to order a state government to cut greenhouse gas (GHG) emissions, smoothing the path for similar moves in other countries.

The court found in favour of environmental NGO Urgenda, which had brought the case against the Dutch government based upon 'hazardous state negligence'. The court said the Netherlands was in breach of its duty of care to Dutch society for failing to take sufficient measures to prevent dangerous climate change.

This decision could prompt similar climate litigation cases across the world and spur countries – particularly developing nations – to re-explore the prospects for cross-border legal action. The judgment is also timely, coming in the run up to the crucial UN climate negotiations in Paris in December. States failing to meet quantifiable reduction commitments will be open to potential lawsuits, ensuring that weak action to cut emissions could have major legal consequences.

Gavels could be going down across the world on climate cases if governments take weak action on cutting carbon

Dutch decision

Up until 2010, the Netherlands had a national target for 2020 of reducing emissions by 30% compared with 1990 levels. The government accepted that national reductions of 25%–40% by 2020 were needed to effectively support the global aim of preventing temperatures rising above 2C, but the government only managed to deliver emissions cuts on a path of 17%.

The government did not argue that the scientific consensus had changed or that the original 30% target was economically unachievable. Instead, it said the state had no legal obligation to deliver deeper cuts. Dutch officials also claimed that allowing the case to go forward would mean the courts were straying into the policy sphere, which is the preserve of the government. The court rejected these arguments and ordered the Dutch government to reduce national greenhouse gas (GHG) emissions by 25% by 2020.

The court also found that the judiciary had a clear role in addressing the threat of climate change. In public law litigation, the courts' role is to protect citizens' fundamental rights by determining the 'lawfulness' of state activities. Sometimes, however, it is difficult to appropriately separate the judicial role from the political, where questions

concerning 'a duty to protect' are conflated with the issue of how that protection is be achieved.

But, in this case, the court acknowledged that climate change is different. A minimum standard of protection can be reduced to quantifiable terms, the percentage reduction, and separated from how that reduction is achieved – the policy issue. In doing so, the court has remained within the correct confines of its role, protecting rights but not creating policy.

Why this is so significant

The critical question now is whether or not the Urgenda decision will prompt litigation in other jurisdictions. Three points raised by the court in making the decision are particularly relevant to the potential for future cases being brought.

Firstly, the court dismissed the excuses for avoiding unilateral state action that have been part of the climate change discourse for so many years. The fact that GHG emissions were caused by third parties was deemed irrelevant: the government had the sovereign power to control emissions and so had 'systemic responsibility' within its territory.

The court said there was no evidence to support contentions of 'carbon leakage' in the Dutch context. This is the concept that companies impacted by GHG regulations would migrate to non-regulated countries. The judges also ruled that allowing the claim would not adversely impact upon the EU emissions trading scheme through what is called the 'waterbed' effect. This theory assumes that an achieved reduction in one country would be balanced with extra emissions in another country.

Secondly, the court also rejected the 'but for test' argument – the need to show that harm would not happen but for the actions of the defendant. This has always seen as a major hurdle to tort based litigation as there are multiple contributors to climate change. The court reasoned that the comparatively minor contribution of the Netherlands to global GHG emissions was inconsequential.

The court said in its judgement "any anthropogenic greenhouse gas emission, no matter how minor, contributes to an increase of CO_2 levels in the atmosphere and therefore to hazardous climate change. Emission reduction therefore concerns both a joint and individual responsibility of the signatories to the UN Climate Change Convention". This reasoning could lead to other negligence-based claims based upon the 'Trail Smelter'principle – states have duties to prevent activities within their jurisdictions that cause harm to the territories of other states.

Thirdly, although the success of the claim did not depend upon a breach of constitutional rights, Urgenda can be framed as a rights-based case. In many countries, the courts are seen as 'last-bastion' guardians for the protection of fundamental rights. Environmental destruction is now occurring on such a huge scale the world, as the Dutch Court put it, is facing "catastrophic consequences" that put the fundamental right to life at risk.

The acknowledgment of this fact by a court of law has the potential to re-invigorate rights-based jurisprudence particularly in developing nations. There have already been examples of action taken based on human rights, such as the successful Nigerian cases against polluting oil companies.

Growing tide of climate litigation

The Dutch case might contribute to a legalistic 'sea change'. In ClientEarth, R (on the application of) v Secretary of State for the Environment, Food and Rural Affairs [2015] UKSC 28 (29 April 2015), the UK Supreme Court ordered its government to comply with the limits in the European Union Air Quality Directive for nitrogen dioxide – an indirect GHG that isn't covered by the Kyoto Protocol.

Critics might allege litigation constitutes an unsatisfactory, piecemeal approach to the climate problem when global consistency is required. But that assessment is simplistic and the Urgenda case could have significant indirect impacts. For example, government agencies, industry and the financial sector may have to re-assess the risk of litigation if they continue with a 'business-as-usual' approach to climate change.

More importantly, the Dutch case is an emblematic victory. After decades of inaction where the political branch has been unwilling or unable to protect fundamental rights, the judicial branch in the Netherlands has taken a stand. It has intervened to make the need to reduce GHG emissions apolitical, freeing the government from the shackles of 'political palatability', and forcing it to focus on policies required to safeguard life.

Ceri Warnock teaches at the University of Otago in New Zealand. Her primary research interests include environmental law, the law relating to climate change and energy law.

绿色债券填补融资缺口

绿色债券市场的发展关键在于公共资金的支持。

肖恩·基德尼 贝亚特·桑娜德

政府决策者和市场面临缓解气候变化并应对其后果的巨大挑战。将国际国内政策落到实处有赖于公私两大板块资金的大力支持。而全球基础设施建设能够帮助人们了解所涉及的资金数目。

低碳情境下每年投入基础设施建设的资金为6.2万亿美元，为了使这些基础设施有助于将温升控制在2℃以内的目标，并能够抵御气候的变化，则还需要每年至少投资1500亿美元。

普遍观点认为，目前每年基础设施的投资缺口达到1万亿美元。

据估计，目前能够应对气候变化影响的低碳基础设施项目只占到7%-13%。

对于电力、能源、水力、数据传输还有通信网络等使用寿命长达数十年的有形资产来说，未来气候的变化将不仅仅是理论上的威胁，而是切实地给设计和服务埋下了隐患。

这一融资缺口需要寻找新的具有长远战略目标的资金来填补。包括养老基金和保险公司在内的全球资产所有者和管理者，有实力、也有意愿扩大对气候项目的投资。

然而，要想不断吸引投资者加大对气候资产的投资，必须给以有竞争力的风险调整收益率。绿色债券就是一个途径，通过高额回报率，引导资金流入相应的有形产业中并获利，而非为环境福利做出牺牲。

债券，尤其是基础设施建设债券，是一种期限较长的投资形式，不仅符合机构投资者对长期负债的需求，也能够满足其对资产负债相匹配的要求。此外，债券还能够在满足投资者多元化需求的同时，提供更有吸引力的收益，在债券品种有限、政府债券一枝独秀的市场上，情况更是如此。同时，与股票相比，债券收益相对稳定，可预见性较强。这一点对某些机构投资者来说非常重要。

绿色债券市场增长迅速，发行量在一年之间增长了三倍，从2013年的110亿美元涨至2014年的366亿美元。预计2015年这一数字将增

© Omiheidi

据估计，目前能够应对气候变化影响的低碳基础设施项目只占到7%–13%

长至 500 亿美元左右。“绿色债券”之所以称其为“绿色”是因为其收入都投入到绿色项目，其中最常见的是致力于改善和应对气候变化项目的绿色债券。一家机构如果能够发行债券，就能够发行绿色债券，因为决定债券“绿色”属性的是债券所支持的项目类型，而非发行方的资质。所以能够发行绿色债券的机构范围很广，包括在机构投资者投资组合中占有重要比重、信用良好的知名企业。

发达经济体以及包括中国、巴西、印度、墨西哥等新兴市场都已经发行了绿色债券，且在投资者中反映良好。

虽然大型的全球资产管理公司及资产所有者已做好了投资绿色债券的准备，但是其政策框架和市场结构都尚未完善，不足以实现绿色债券市场规模从数十亿美元向万亿美元的飞跃。气候债券倡议组织（The Climate Bonds Initiative）估计，到 2020 年需要发行约 1 万亿美元的绿色债券，用以修建应对气候变化的基础设施。

从十亿到万亿的飞跃

阻碍目前绿色投资增长的因素包括：市场参与者缺乏认识，银行缺少认可的绿色项目，缺少成熟的绿色项目运作方式，缺少“绿色债券”的衡量标准，风险规避型投资者对绿色投资前景的分析能力不足以及难以汇聚众多小型投资者等。

在市场主导下，解决绿色债券发展壁垒的关键在于相关原则和标准的规范化。规范化有利于降低发行方和投资方的交易成本，从而使绿色债券带来的气候福利在遵循最新气候科研成果的同时，做到具象化、透明化、和公开化。

气候债券标准是目前市场上唯一可循的准则，其内容包括绿色债券发行流程、“绿色”的定义（包括科研专家对它定义的补充和发展）。该准则由学术和技术领域的专业人士共同制定，并由管理资产达 34 万亿美元的投资董事会负责监管。

市场调控是一个重要的起点，鉴于气候变化的紧迫性，公众部门的支持对于加强市场驱动力，解决上述障碍，并在市场调节未能触及的地方发挥的作用至关重要。

中国：全球绿色债券引领者

从投资意向到实际行动，中国都是当下的引领者。2015 年 4 月，中国人民银行和联合国环境规划署 (UNEP) 携手开展可持续金融体系设计，并出台了包括税收激励和优惠风险加权在内的一系列旨在积极推动中国绿色债券市场发展的议案。中国人民银行将很快出台绿色债券的指导性意见。

2015 年 10 月，中国农业银行率先在伦敦发行首支人民币面值的绿色债券，成为业界的榜样。

资本需求扩大也是市场兴起的另一个信号。11 月 4 日《上海日报》援引中国人民银行首席经济学家马骏的话表示，中国未来五年每年需要 2 万亿（3,150 亿美元）以上的绿色投资投入到节能、环保等领域。随着绿色债券和股票市场的成熟和规范，积极鼓励社会资本参与其中。

伦敦能源和气候智库（ECIU）的最新报告（中国走向低碳未来）指出：中国“十三五”规划有望加强环境和气候领域的投资。ECIU 强调，随着中国经济寻求低碳增长模式，碳排量稳步降低，投资机构将迎来新一轮机会。

鉴于中国政府大力支持绿色债券的发展，以及未来中国绿色基础设施的广阔投资市场，气候债券倡议组织预计到 2018 年，中国将成为全球绿色债券发行量最大的国家。

债券是应对气候变化融资挑战的金融工具之一。我们也许会发现，在推动自身低碳业基础设施投资，致力绿色发展方面，东方跑在了西方的前面。

肖恩·基德尼，气候债券倡议组织首席执行官
贝亚特·桑娜德，气候债券倡议组织政策分析师

Green Bonds can help plug the finance gap?

Public sector support is crucial to accelerate the growing market in green bonds

Sean Kidney and Beate Sonerud

Climate change mitigation and adaptation present huge challenges for policy makers and markets. Converting national and international policy into effective action requires enormous financial commitments from both public and private sector pools of capital. Global infrastructure provides an easy understanding of the numbers involved.

The annual allocation required for infrastructure investment in a low-carbon scenario is US$6.2 trillion annually. Investment to make infrastructure resilient to the changing climate adds at least another US$150 billion annually, consistent with a 2C warming outcome.

It is generally recognised that there is an investment shortfall with an annual infrastructure investment gap of more than US$1 trillion.

Moreover, only 7%-13% of current infrastructure projects are estimated to be low-carbon and designed to deal with the additional impacts of a changing climate.

For physical assets with multi-decadal operational life, power, energy, water, data transport and communication networks, future climate impacts move from being a theoretical to an actual design and service risk.

New sources of capital with a longer-term investment horizon will need to be sourced to close this gap. Global asset owners and managers–including pension funds and insurance companies–have both the necessary capital and a professed interest in lifting their exposure to climate–based investments.

However, for investors to increasingly allocate their capital to climate-friendly assets, these must offer competitive financial risk-adjusted returns. Green bonds offer one way to leverage increased capital towards tangible investment by offering financially competitive investment opportunities where the environmental benefits are a bonus, not a sacrifice

Bonds, especially to finance infrastructure, can offer long-term maturities. These are a good fit with institutional investors' long-term liabilities, and allow asset-liability matching. They can also provide much-needed diversification and more attractive yields, particularly in markets with a limited supply of bond instruments and a high concentration of investments in government securities. At the same time, bond returns are relatively stable and predictable when compared with equities, an important feature for some institutional investors

The green bond market has grown rapidly, with issuance tripling from US$11 billion in 2013 to US$36.6 billion in 2014. Around US$50 billion of issuance is expected in 2015. Labelled green bonds are ones whose proceeds are used for green projects, most usually climate change mitigation and adaptation, and are labelled accordingly. If an entity can issue a bond, it can issue a green bond, as the 'green' label depends upon the specific type of projects funded, not the environmental credentials of the issuer. So labelled green bonds can be issued by a wide range of entities, including larger well-known corporations with high credit ratings that account for a sizable share of institutional investor portfolios.

Labelled green bonds have been issued in emerging

markets, including China, India, Brazil and Mexico, as well as in developed economies, and there is a strong appetite for them amongst investors.

Whilst large global asset managers and owners as a group 'stand ready' to commit, the policy frameworks and market structures around green bonds are not yet robust enough to move the market from billions to the trillions. The Climate Bonds Initiative has estimated that US$1 trillion of green bond issuance is required by 2020 to build the climate-aligned infrastructure needed.

From billions to trillions

Current barriers to growth include education of market players; lack of bankable green projects and robust green project pipelines; lack of standards for what is green; risk-averse investors with limited capacity to analyse green investments and lack of aggregation mechanisms for relatively small investments.

A central market-driven action to address the barriers to green bond growth is the development of green bond guidelines and standards. Green bond standards reduce transaction costs for both issuers and investors in ensuring the climate benefits of the green bonds are measurable, transparent, disclosed and in line with the latest climate science.

Currently, the only standards available in the market are the Climate Bonds Standards. They cover both the green bond issuance process and what is green and are developed by scientists and technical experts and overseen by a board of investors with US$34 trillion of assets under management.

Market-led actions are an important starting point, but given the urgency of the climate challenge, public sector support is crucial to accelerate the market-driven actions to address these barriers and act where the market has yet to do so.

China: a global green bond leader

China is a leader in moving from interest to action on green bonds. In April 2015, the People's Bank of China (PBOC), in association with the UNEP Inquiry into the Design of a Sustainable Financial System, published a range of policy proposals for kick-starting a Chinese green bond market, including tax incentives and preferential risk weightings. The PBOC is soon to publish official guidelines for green bonds.

The first renminbi-denominated green bond from a Chinese issuer came to market in October 2015, when Agricultural Bank of China issued in the London markets. The precedent is now set for others to follow.

Additional signals are emerging of the levels of capital required. PBOC chief economist Ma Jun was quoted in the *Shanghai Daily* of November 4 advising that China needed 2 trillion yuan (US$315 billion) of "green" investment annually in environment and energy-saving sectors in the next five years and private funds in these areas will be encouraged, with new rules to nurture the market for green bonds and stocks

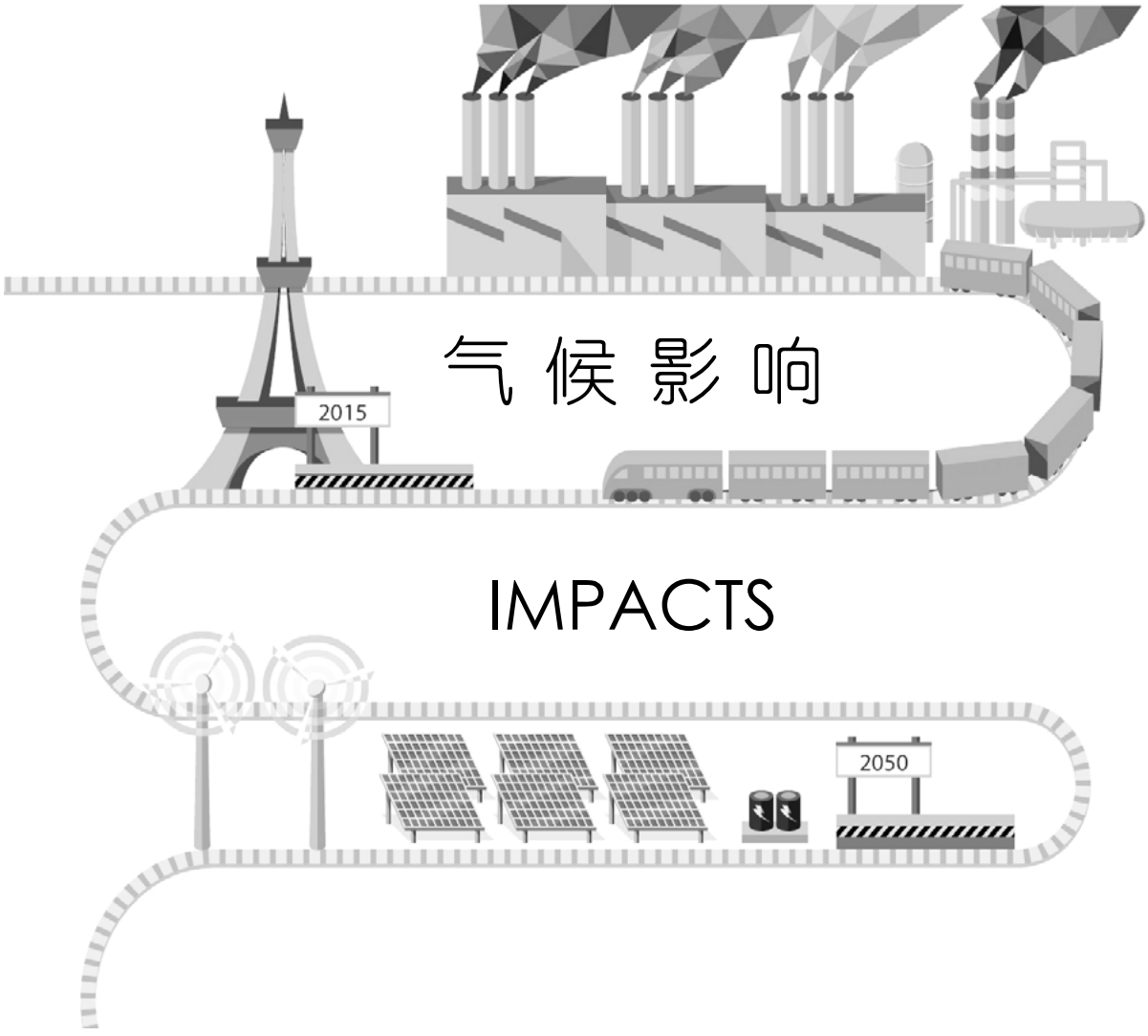
The London-based Energy and Climate Intelligence Unit (ECIU) in a recent report (China Heads to a Low Carbon Future) says 13th Five Year Plan is expected to confirm the need for increasing environmental and climate based investment. The ECIU highlights the opportunities that will arise for institutional investors as China seeks a low- carbon growth path that slows then stabilises emissions.

With the strong government support given to green bonds and the massive investment needs in China for green infrastructure in the next years, the Climate Bonds Initiative expect China to be the largest green bond issuer globally by 2018.

Bonds are one of the financial tools needed to meet the climate finance challenge. We may yet find that east leads west in their use to drive low-carbon infrastructure investment and climate-friendly development.

Sean Kidney is CEO of the London-based Climate Bonds Initiative, originally a project of NSFM. The Climate Bonds Initiative works to mobilize debt capital markets to fund a rapid, global transition to a low-carbon economy.

Beate Sonerud is a Policy Analyst at the Climate Bonds Initiative.



气候影响

IMPACTS

北极：一方净土难自守

壳牌的石油计划直指北极冰层，诸多资源企业也把目光投向了环境脆弱的地区。

泰罗·穆斯托宁

气候变化不仅使北极地区逐渐变暖，同时使该地区面临着其他严峻的压力，如对北极地区石油、天然气等自然资源的不断开发。这些油气一旦燃烧，无疑将会增加大气中温室气体的浓度，并对北极乃至全球的环境带来巨大的威胁。北极地区的原住民和生态系统除了经受气候变化带来的挑战外，还要面临新的、更严峻的危机。

荷兰石油和天然气制造商皇家壳牌集团日前决定暂且搁置阿拉斯加附近楚科奇海的石油开采计划。此举被看作是环保人士取得的一次重大胜利。这项在世界上生态最为脆弱的地方开采石油的计划多年来一直受到环保人士的反对。虽然该计划目前被搁置，但该地区面临的威胁依然严峻。随着全球，尤其是极地地区逐渐变暖，其他石油公司以及采矿和运输部门仍将继续在这一地区开采资源。意大利石油公司埃尼集团（Eni）就是其中之一。该公司并未受到壳牌公司的决定，以及化石燃料价格疲软的影响，于9月表示将为一项位于挪威北极圈（Norwegian Arctic）的项目投资55亿美元。

北极地区的气候变化将在极大程度上影响整个地球未来的气候状况

到目前为止，气候变化对北极地区的影响均有据可查。随着永久冻土层的融化，西伯利亚的驯鹿牧民眼睁睁地看着冻土带在他们眼前消失；因纽特猎人则目睹了海上冰盖的消融，以及随着冰盖的消失，海豹等动物生活习性的改变。土著萨米人说，他们的传统历法已经不再适用了，无法再据此预测天气。

包括北方生态体系在内的北极地区正进入一种“新常态”。当地的自然、基础设施、以及人民的未来都充满了各种风险。气候变化在给北极地区逾2.1万种地方性物种带来严重威胁的同时，也使不可预测性成为这一地区的常态。目前看来，2009年哥本哈根气候峰会上提出的2摄氏度的全球平均气温上升阀值越来越遥不可及，这就意味着两级地区将经历不可逆转的变化。

北极地区的变化已经非常明显。2000 年代中期以来，海平面已经上升了 8 厘米。此外，格陵兰冰川的不断变化，以及永久冻土层的大面积消融可能会释放大量的甲烷，而甲烷是一种强效的温室气体。因此，北极地区的气候变化将在极大程度上影响整个地球未来的气候状况。地球之巅的气候状况对于全球气候来说无异于是一种警示信号。

北极地区面临的气候风险众多，从被倾倒到海洋中的沉积物与核反应堆所带来的化学废弃物，到可危及北方航道沿线的核电池灯塔的洪灾等。这一地区新的石油和天然气资源的开发给这块工业净土带来了环境威胁。

去年发生的一起严重事件就是关于潜在风险的一个极有说服力的例证。2014 年 11 月，一艘 M/T Triathlon 型油轮正停泊在挪威东北部峡湾。然而，附近海域大风骤起，30 分钟之内，风速就从 17 米每秒增加到 35 米每秒，导致该船脱锚，飘向海崖。虽终逃过一劫，但也是千钧一发。在极地的冰天雪地中很难彻底清除海面上的溢油，而一旦发生石油或工业漏油，就只有依靠这一地区的强国俄罗斯。只有俄罗斯的舰队才具备足够的能力在这一地区开展基础的清污工作。

北极理事会（Arctic Council）早已承认该地区国家和人民之间的利益冲突和优先权。2004 年《北极气候影响评估》指出，“评估某个影响是消极的还是积极的，通常取决于一国的利益。”因此，评估报告中表示，海上冰盖的减少可能会给北极熊、海豹以及当地以这些动物作为食物来源的居民带来严重的后果。然而从另外的利益角度来看，冰盖减少则有利于开发海洋资源，给航运及海上石油开采带来新的机遇。”

> “冰盖的融化为开发以前无法开采的石油等自然资源打开了新的渠道，而石油的燃烧又加剧了气候的变暖，使气候变化的影响进一步恶化。”

反馈环

几十年来，人们已经深入部分北极地区开采矿产、石油、天然气和水电等资源。很多情况下，这些行为已经给当地的土著家园带来了极大的破坏，如西伯利亚的汉特人的聚居地等，而开采之后的土地要么有待处理，要么需要修复。冰盖的融化为开发以前无法开采的石油等自然资源打开了新的渠道，而石油的燃烧又加剧了气候的变暖，使气候变化的影响进一步恶化。结果仍是北极偏远地区的原住民承担这些变化所带来的冲击。

新的北海航线点燃了各国的地缘政治野心。俄罗斯宣称其国家的主权一路延伸到了北极，将 130 万平方公里土地纳入自己囊中。作为世界上国土面积最大的国家，俄罗斯将北极看作是需要保护其不受外来利益侵犯的“国内安全区”。尽管目前全球市场价格疲软和西方国家的制裁影响了俄罗斯化石燃料的整体收入，但西伯利亚地区的石油和天然气仍为国家带来了亟需的税收，其产值更占到俄罗斯目前国内生产总值的五分之一。

中国兴趣渐浓

由俄罗斯天然气公司、壳牌公司以及意昂集团提议修建的新的输气管道将给出产天然气的北极和北方地区带来影响。环境影响评估谈判目前已经展开。而最早对该计划表示关切的人中就有欧盟委员会委员马洛斯·塞夫科维奇（MarošŠefčovič）。

随着冰雪地带的消融，气候变化将会对北极地区的基础设施以及原住民带来极为不利的影响。

俄罗斯仍试图维持对北极地区的传统控制权，而作为东亚地区的强国，中国尽管目前官方尚未出台北极战略，但已经准备开始向这一霸权发起挑战。

中国早已对这一地区的运输通道、能源供应和渔业前景产生了浓厚的兴趣。

撰写本文时，作者咨询了芬兰银行的高级顾问劳拉·索兰科（Laura Solanko）以及芬兰国际事务部高级研究员于尔基·卡利奥（JyrkiKallio）

泰罗·穆斯托宁。著名学者，研究北极生物多样性，气候变化和土著问题

How climate change threatens the Arctic

Shell has shelved plans to drill the Arctic, but many other resources firms are eyeing exploitation of the environmentally-vulnerable region

Tero Mustonen

Climate change is warming the Arctic and, with it, is opening up the region to other mounting pressures, such as the increasing exploitation of natural resources. These include oil and gas, which, when burnt, will add to the greenhouse gases (GHGs) in the atmosphere that are a such a big threat to the region and the planet as a whole. Indigenous peoples and ecosystems in the Arctic already facing up to climate change are now also being threatened by new and greater dangers.

A recent decision by Anglo-Dutch oil and gas producer Shell to shelve plans for drilling in the Chukchi Sea near Alaska was viewed as a major victory by environmentalists, who have long campaigned against the company's plans to drill in one of the world's most environmentally sensitive areas. But the threat remains grave that other oil companies, as well as the mining and the shipping sectors, will exploit the region as the world-and the polar regions in particular-warm. Undeterred by Shell's decision and the weakness in hydrocarbon prices, Italian oil firm Eni said in September it would invest US$5.5 billion in a project in the Norwegian Arctic.

The impact of climate change so far in the region is well documented. In Siberia, reindeer herders witness the tundra disappearing in front of their eyes as permafrost melts. Inuit hunters watch as the sea ice recedes into the ocean, changing the behaviour of seals and other animals. The indigenous Sámi people say their traditional calendar is now out of sync – they cannot predict the weather anymore.

Arctic regions, including boreal ecosystems, are moving to a 'new normal'. The future is filled with risks to nature and infrastructure, as well as Arctic peoples. Unpredictability is becoming the norm with climate change viewed as a serious threat to over 21,000 endemic Arctic species. An increase in global average temperatures of 2C, a threshold agreed at the Copenhagen climate summit in 2009 and looking increasingly out of reach, would mean irreversible changes in the polar regions.

In the Arctic, the changes are already very apparent, with the sea level having risen by about 8 cm since the mid-2000s. Further changes to the Greenland Ice Sheet, combined with the extended melt of permafrost, would likely result in massive releases of methane, a potent GHG. Thus, what happens in the Arctic will play a major role in the future of the Earth's weather. What happens at the top of the world has already been likened to a canary in the mine for the global climate.

> "The melting ice unlocks new flows of previously inaccessible natural resources such as oil, the burning of which further warms the climate and worsens the impacts. Again, it will be remote local communities that will bear the brunt of these changes."

Climate risks in the Arctic range from the release of chemical waste from sediment and nuclear reactors that have been dumped in the ocean, to floods that would damage the nuclear battery lighthouses along the Northern Sea Route. The opening of new sources of oil and gas pose environmental threats to a region often untouched by such industries.

A serious incident last year provides a telling example of the potential risks.In November 2014, winds picked up around the oil tanker M/T Triathlon in anchor in a North-eastern fjord in Norway. Within 30 minutes the winds shifted to 35 metres per second (m/s) from 17 m/s, causing the anchor to fail and the ship to drift towards coastal cliffs. A catastrophe was prevented at the last minute, but the risk was huge. A proper clean-up of oil spills cannot be carried out amidst polar ice, and only Russia, a regional superpower, has a fleet big enough to provide for basic services in the event of oil or industrial spills.

The Arctic Council has long acknowledged the competing interests and priorities of countries and peoples in the region. The 2004 Arctic Climate Impact Assessment has pointed out: “Whether a particular impact is perceived as negative or positive often depends on one’s interests”. Therefore, the report said, a reduction in sea ice is likely to have grave consequences for polar bears, seals and local people dependent on these animals as a food source. However, to other interests, a reduction in sea ice could increase marine access to resources, “expanding opportunities for shipping and possibly for offshore oil extraction”.

Feedback loop

Some parts of the Arctic have been exploited as a source of minerals, oil and gas and hydropower for decades. In many cases, these actions have devastated indigenous homelands, such as the Khanty lands in Siberia, and left a legacy yet to be tackled or rehabilitated. The melting ice unlocks new flows of previously inaccessible natural resources such as oil, the burning of which further warms the climate and worsens the impacts. Again, it will be remote local communities that will bear the brunt of these changes.

New access to the Northern Sea Route has triggered geopolitical ambitions. Russia has claimed sovereignty all the way to the North Pole, claiming 1.3 million square kilometres of territory. The world’s largest country by land mass sees the Arctic as a ‘domestic, secure zone’ to be defended against outside interests. Siberian oil and natural gas provide much-needed revenue and one fifth of Russia’s current GDP, although weaker global prices and western sanctions have eroded the overall cashflow from hydrocarbons.

China's interest grows

New pipelines proposed by Gazprom, Shell and E.ON would impact the Arctic and boreal regions as gas would be sourced from the region. Environmental impact assessment talks are already underway and EU Commissioner Maroš Šefčovič was amongst the first to express concern over the pipeline plans.

As frozen ground thaws, climate change will also have a majorly detrimental impact on infrastructure in the Arctic region, as well as for indigenous peoples.

As Russia attempts to sustain its traditional stranglehold over the region, China has emerged as a challenger to this hegemony, although the east Asian giant has no official Arctic strategy.

Yet China already has a major interest in the region, which revolve around potential transport corridors, energy supplies and fisheries.

The author consulted Senior Adviser Laura Solanko at Bank of Finland, Senoir Research Fellow Jyrki Kallio at the Finnish Institute of International Affairs and Vilja Haapalainen from village of Selkie for this article.
Tero Mustonen is a well-known scholar of Arctic biodiversity, climate change and indigenous issues.

报告称拯救海洋于气候变化迫在眉睫

我们都知道必须采取措施将全球气温升高幅度控制在2摄氏度之内，但只有强有力的领导才能确保行动到位。

奥乌豪·厄格古尔伯格

如果以前你认为海洋只是地球生态系统中微不足道的一部分，海洋的变化也不会带来什么影响的话，是可以被原谅的。毕竟全球目前已经出版的关于气候变化的报告中只有5%涉及海洋系统。负责对经同行审查的科学文献做出评估的政府间气候变化专门委员会（IPCC）此前也没有对与海洋有关的问题做过专门的论述，直到近期才发布了与之有关的报告。

海洋系统举足轻重：它掌管全球温度和大气，养育着30亿人口，并在很大程度上决定了地球的天气情况。海洋还具有很强的“惯性”——也就是说要使海洋发生变化需要极大的能量，而海洋一旦开始变化，要减缓其变化的速度则是几乎不可能的事情。

我和几位同事7月初在《科学》杂志发表了一篇论文。论文指出，阻止海洋发生重大变化的宝贵机遇可能会转瞬即逝，并同时触发一系列全球性的气候变化。IPCC去年就气候变化对海洋的影响进行了广泛深入的评估；在此基础上，我和本文的其他作者整理了最新的证据，提出了我们对人类活动引起的剧烈的气候变化对于海洋影响的预测性判断。

结果并不乐观。如果我们不能采取有效措施遏制全球变暖，那么海水将变得更暖、更污浊，某些地区海洋的含氧量和生产能力会下降，另外一些地区的海洋生态系统将会发生改变或者彻底消失。许多地区的渔业乃至国民经济面临拐点。海平面上升、风暴强度提高以及重要海洋地貌的丧失将导致沿海地区的生活多变而危险，从而与今日情景完全不同。

很多问题都取决于我们能否成功地守住2摄氏度这个各国家和地区一致同意的“防线”。然而，人们担心在世界各地目前的经济策略下，这样的目标是否可以达到，甚至有人质疑即便将全球气温上升幅度控制在2摄氏度以内也不安全。

如果我们有更安全的备选方案，那么质疑目前的目标不够安全也没有什么问题。然而我们没有。因此，年底召开的巴黎气候峰会要完成的任务实际上比我们任何人所理解的都要艰巨。正如我接下来会详细解释的那样，我们需要达成一项全球协议，在接下来的20年中将全球温室气体排放水平降至零，否则我们将面临巨变。

呼吁行动

幸好世界各国领导人已经开始直面海洋问题的挑战。美国国务卿约翰·克里（John Kerry）和摩纳哥亲王阿尔贝二世（Prince Albert II）等要人已经发声，提醒人们危险迫在眉睫。

> “要使海洋发生变化需要极大的能量，而海洋一旦开始变化，要减缓其变化的速度则是几乎不可能的事情。”

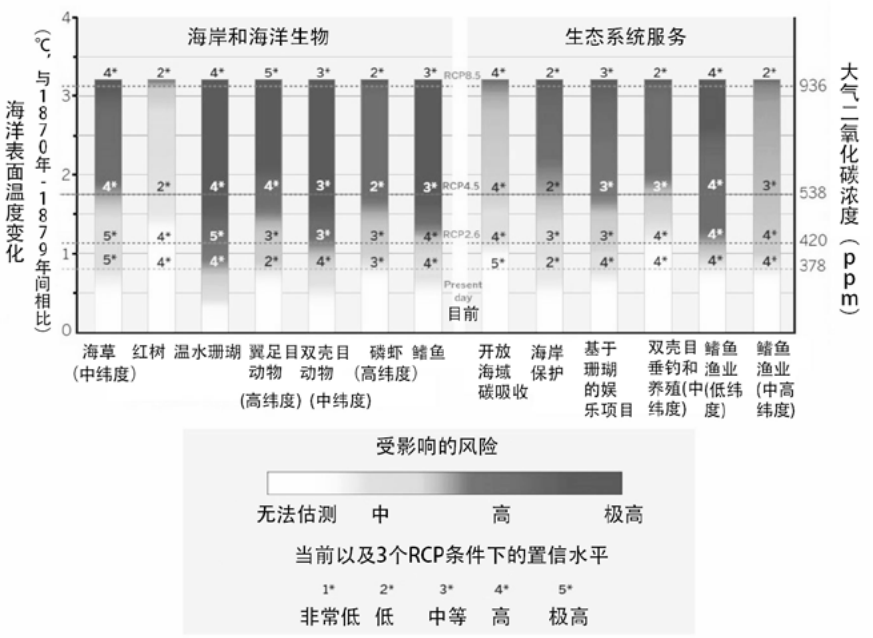
最新发出呼吁的是教皇方济各（Pope Francis），他也是首位就海洋变暖、酸化和海平面上升发出警告的教皇。在近期发布的通谕中，教皇指出“全球四分之一的人口居住在沿海或近海地区，而且……大多数超大型城市都位于沿海地区。”

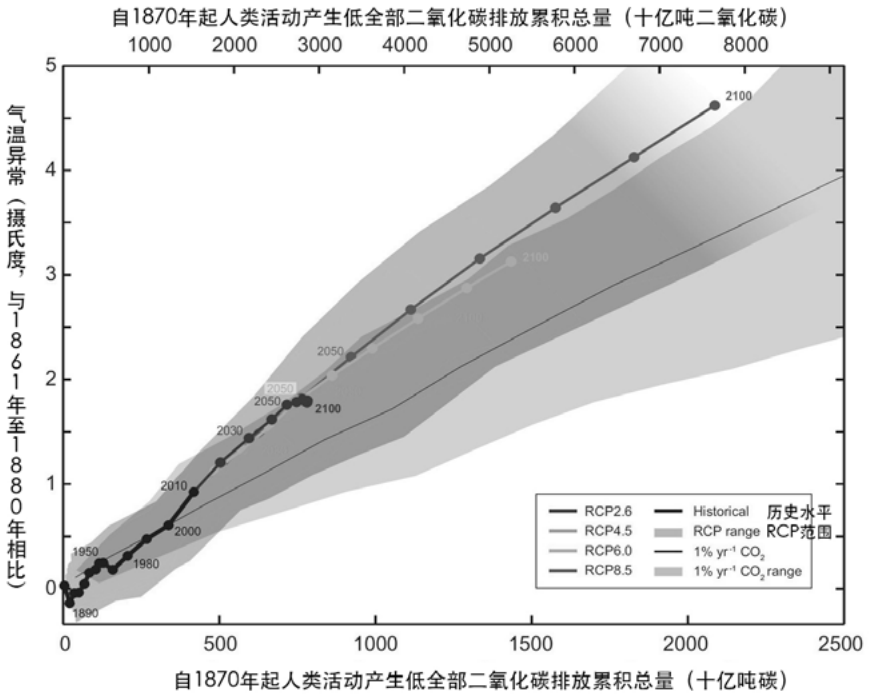
基于不断增加的证据，我们的研究再次表明上述领导人的正确性，我们的确需要对化石燃料排放和其他引发气候变化的因素采取果断措施。

IPCC 的报告给出的最惊人的结论之一就是声称，“目前海水酸化的速度和程度比过去 6500 万年中的任何时候都至少高出 10 倍”。与目前的酸化速度相比，过去千万年中酸化速度较快的几个时期已经算是慢的了。即便如此，其也导致大量生物灭绝以及生态系统崩溃。仅仅考虑这一点我们就应该采取行动。

在北海等少数几个地区，冰线后退、海水变暖造成了海产品产量暂时上升的情况。但这些受益于海洋变暖的现象不过是少数个例，并很可能随着海洋进一步变暖和酸化而消失。

珊瑚礁或许是证明教皇通谕正确性的最佳事例。人们欣赏珊瑚的美丽，深知它的价值，但很少有人意识到珊瑚礁在保护海岸线、支持渔业等行业方面的重要作用。珊瑚礁每年创造几千亿美元价值，并维持着全球各地超过 5 亿人——大多数是贫困人口——的生计。我们的报告强调了珊瑚礁等生态系统对海水变暖和酸化的极度敏感性。





巴黎峰会的任务

当踩着这些重要生物的遗骸走向巴黎，我们都应该深知巴黎峰会上要完成的任务是何等艰巨。世界“碳预算”（参见此处和此处）的分析表明，如果要把全球气温上升幅度控制在工业化之前平均水平的 2 摄氏度之内，我们还可以排放大约 5000 到 8000 亿吨二氧化碳。也就是说，距离全球碳排放必须降为零的时点还有二十年。这的确是一项艰巨的任务。

不过希望尚存。近期美中两国的气候协定让我们有理由乐观地估计，巴黎的谈判将比2009年哥本哈根谈判进行的更加顺畅。但我怀疑，各国领导人是否清楚要避免灾难发生所需要完成的工作量究竟有多大。或许近期中国重申其新的气候承诺的坚决性可以证明这一点。

计算之后我们会变得冷静：想象一下世界其他地区都按照美国和中国的标准制定气候目标。那时候全球各国和地区还将消耗掉多少碳预算呢？

答案是全世界仍将排放1400亿吨二氧化碳，约合全球碳预算余额的175%到280%，这会导致全球平均气温上升超过3摄氏度（参见下图橙色线条）。这将给我们以及子孙后代带来灾难性的后果，如今海洋带给我们的诸多好处（珊瑚、海产品、海边的居住环境）都将变得面目全非。

道德的回应

提到“我们以及子孙后代”让我们想起教皇方济各，和其所说的对任何事情都不要仅仅考虑经济价值这句话的重要性。即便是从纯粹的经济意义考虑，按照IPCC计算，将大气中二氧化碳含量控制在百万分之450个单位以下（这使我们很有希望守住2摄氏度的安全线）仅需花费全球每年消费量增长额的0.06%。考虑到这点，我们不禁疑问为什么我们不立即采取行动，尽早解决这个问题？

对于这一点，教皇方济各提出了一个重要的观点：

一言蔽之，商业利润只计算并支付了一部分成本。只有当“用尽所有人共享的环境资源的经济和社会成本都被透明地确认并全部由造成这些成本的人而不是其他人或者子孙后代承担”时，业界才能从商业道德的角度认识到这些行动的必要性。

我们只能希望，即将参加巴黎峰会的各国和地区领导人能够听从教皇的感召，朝着新的方向努力。

原文发表于 theconversation.com.

奥乌豪厄格古尔伯格教授，昆士兰大学全球变化研究所主任

The chance to rescue the world's oceans is drifting away

Rapid warming of oceans means a 2C threshold would still be highly dangerous for the world's climate, writes marine biologist Ove Hoegh-Guldberg

Ove Hoegh-Guldberg

Until recently, you might be forgiven for thinking the oceans were a trivial component of Earth's climate system, and that the consequences of change were minimal. After all, only 5% of papers published on climate change involve ocean systems. The Intergovernmental Panel on Climate Change (IPCC), which evaluates the peer-reviewed scientific literature, did not devote a regional chapter to the ocean until its most recent major report.

Yet, the ocean system could not be more important: it regulates the global temperature and atmosphere, feeds 3 billion people, and largely determines our weather. The ocean also has lots of "inertia" – which means getting the ocean to change takes a lot of energy, but once it begins to change, slowing it down becomes more or less impossible.

A recent paper published in Science, of which I am one of the authors, has issued a warning that our window of opportunity to save the oceans from major changes is in danger of slamming shut, bringing with it the risk we will encounter planetary-scale tipping points in the behaviour of the climate. Building on the IPCC's extensive assessment last year of the effects of climate change on the oceans, my co-authors and I have compiled the latest evidence and projections about the ocean under rapid human-driven climate change.

The news is not good. Failure to act on climate change will see warmer and more stagnant oceans, with declining oxygen levels and productivity in some regions, and the removal or modification of ecosystems in other areas. Fisheries and national economies are in the crosshairs in many regions. Rising seas and intensifying storms, plus a loss of critical coastal features, will make life on the shores of a rapidly changing ocean dangerously different to today.

A lot hinges on whether we can meet the globally agreed 2C "warming guardrail", but there are fears this is impossible within current economic strategies, and that even this target is unsafe.

It would be fine to state this if we had a safe alternative, but we don't. Consequently, the bar for the end-of-year Paris climate summit is set much higher than many understand. As I'll explain below, we need a global deal that reduces global emissions to zero over the next 20 years, or else we will see momentous changes.

Calls to action

Thankfully, world leaders are beginning to wake up to the challenge facing our oceans. US Secretary of State John Kerry and Prince Albert II of Monaco, are among those who have spoken out against what many see as impending chaos.

The latest is Pope Francis, who became the first pontiff to warn of ocean warming, acidification and sea-level rise, pointing out in his recent encyclical that "a quarter of the world's population lives on the coast or nearby, and … the majority of our megacities are situated in coastal areas".

Our research adds to the mounting evidence that these leaders are right when they say we need to act decisively on fossil fuel emissions and other drivers of climate change.

One of the most stunning conclusions from the IPCC's report is the statement that "the current rate and magnitude of ocean acidification are at least ten times faster than any

event within the last 65 million years". Given that periods of rapid acidification over tens of thousands of years – slow by our current human-driven standard – resulted in mass extinction and ecological collapse, this alone should be reason to act.

In a few regions, such as the North Sea, temporary increases in fisheries production are being reported, as the ice retreats, seas warm, and productivity increases. But these benefits are few and far between, and are likely to disappear over time as the ocean warms and acidifies further.

Coral reefs perhaps provide the perfect parable for the Pope's encyclical. Everyone appreciates their beauty and value, but few may be aware of the crucial role they play in terms of protecting coastlines, and supporting fisheries and other industries. They generate hundreds of billions of dollars each year and support some 500 million – mostly impoverished – people worldwide. Our report highlights the extreme sensitivity of these ecosystems to ocean warming and acidification.

Work to do at the Paris summit

As we progress down the road to Paris, paved with skeletons of these important organisms, there is little doubt about the amount of work that needs to be done in Paris. Analysis of the world's "carbon budget" suggests we can emit about another 500-800 billion tonnes (gigatonnes) of carbon dioxide before we push global temperatures beyond 2C above the pre-industrial average. This gives us about 20 years before net global emissions have to fall to zero – a tall order, indeed.

There is hope. The recent US-China climate deal is one reason to be optimistic that negotiations in Paris will be smoother than at the Copenhagen climate talks in 2009. But I wonder whether leaders are aware of the true scale of the work that needs to be done to avoid catastrophe. Perhaps the fact that China this week made clear the strength of its new climate commitments is evidence of this.

Yet here is a sobering calculation: imagine the rest of the world falls into line with the US and Chinese climate targets. How much of the world's budget would we then still burn?

The answer is the world would still emit 1,400 gigatonnes of CO_2, or 175%-280% of our remaining budget, dragging average global warming to 3C and beyond. This would be disastrous for us and our children, and many of the benefits of our oceans (coral reefs, fisheries, coastal living) would be transformed beyond recognition.

An ethical response

Mention of "us and our children" brings us back to Pope Francis and the importance of not reducing everything to a dollar value. Yet, even in pure economic terms, given that the IPCC calculates that keeping atmospheric CO_2 below about 450 parts per million (which would give us a good chance of staying within the 2C guardrail) would cost just 0.06% of global consumption growth per year, one is left wondering why we are not jumping right in and solving this problem.

To that end, Pope Francis made an important observation:

In a word, businesses profit by calculating and paying only a fraction of the costs involved. Yet only when "the economic and social costs of using up shared environmental resources are recognized with transparency and fully borne by those who incur them, not by other peoples or future generations", can those actions be considered ethical.

One can only hope the leaders in Paris will heed his words and drive their efforts in a new direction.

This article was originally published on theconversation.com.

Ove Hoegh-Guldberg is the director of Global Change Institute at The University of Queensland.

减排需要低出生率的助力

全球人口的增长加重了削减碳排放以及避免严重气候变化的负担。

西蒙·罗斯

过去 50 年，全球人口增长了一倍。虽然人口增长多发生在人均碳排放量较低的国家，但全球范围内人口数量的激增仍导致温室气体排放的增加。随着人口增多，发达国家和发展中国家工业化和人均消费水平的提高也增加了温室气体的排放量。倘若对此不加以控制，地球升温将一发而不可收拾。

根据联合国的最新预测，到 2050 年，全球人口将从目前的 70 亿增长到 100 亿。增长的人口多数来自低碳排放的国家，而这些国家正在经历快速的工业化过程，同时全球范围内从发展中国家移民到发达

© Antoine SIPOS

若中国及其他国家的出生率上升，或给全球削减二氧化碳排放量带来挑战

国家的人口数还将持续增长。

预计到2050年，全球人口增长数的一半将来自9个国家。这些国家按人口增长的数量排列依次是：印度、尼日利亚、巴基斯坦、刚果民主共和国、埃塞俄比亚、坦桑尼亚、美国、印度尼西亚和乌干达。

其中，美国和印度分别是目前世界上位列第二和第三的用煤大国。印尼是化石燃料的主要消费国，而巴基斯坦和刚果历史上很少使用煤。其余四个国家煤炭需求量微乎其微。印度和印尼的煤炭储量丰富，短期内还将继续使用这种不洁燃料。

煤炭是导致气候变化、以及雾霾等其他环境问题的最主要原因，因此发达国家已经开始转向清洁能源。在迅猛的工业化进程中，中国对煤炭的消费在世界煤炭总消费中占有很大比重，这也是导致中国空气、水源污染及土壤破坏的罪魁祸首。

有人认为，中国的“独生子女政策”控制了人口增长，有利于避免环境恶化。而实践过程中，评估一项社会政策的影响并非易事。国家除了对超生实施制裁和处罚外，还颁布计划生育服务条例，并为独生子女家庭提供福利。这些措施多管齐下，很难辨明各自产生的效果。

此外，在实施独生子女政策期间，中国社会正经历着巨大的经济、社会变革，因此很难厘清生育政策以及社会变化带来的影响。也有观点指出，许多没有实行计划生育的国家，生育率同样也大幅下滑。

不过，各国国情不同，不能因此盖棺定论，认为中国的独生子女政策对出生率毫无影响。

目前中国全面放开二孩政策，再一次引发了人们对该政策将如何影响出生率的猜想。当前全球的趋势是越来越小的家庭规模，这在富裕国家尤为明显。

计划生育措施开展得好的国家，一般家庭都倾向于少生，除非国家对生育家庭的补助水平和就业扶持达到较高水平。如果说子女需要更多的教育才能获得体面的生活，那么小家庭无疑是受益者。不过尽管如此，据《金融时报》估计，政策的松动将使出生率上升六分之一到三分之一。人口增加带来的环境影响部分取决于中国能否成功摆脱对化石燃料的依赖，而对于其全球最大的化石燃料能源系统来说，脱碳则是一个巨大的挑战。此外，即便电力部门减少对煤炭的依赖，人口增长也会在其他方面增加温室气体的排放，如对交通（尤其是航空）以及家畜（主要是肉类）的需求增加。

通常情况下，一国应对人口老龄化的手段是提高出生率或移民率。世界人口结构正在发生变化，人均寿命更长，而出生率在下降。不过，鉴于目前面临的环境问题，我们不能诉诸于提高人口数量来应对老龄化。要知道，1950年中国只有5亿人口，而现在却是14亿！相反，应该通过推迟退休年龄、鼓励妇女和年轻人加入劳动力大军、提高生产力和自动化水平等手段来缓解劳动人口数量下降的困境。

人口规模扩大、人均消费水平提高对气候变化和其他环境问题带来的影响不可估量，如水资源短缺、耕地面积减少等。地球环境的未来如此不明朗，我们必须打起十二分精神。

作为一家关注长期可持续发展的组织，我们呼吁稳定世界人口、降低消费水平，从而适应当今能源、原材料和农业资源的供给能力，这包括使用降低能源消耗的技术，更加关注生活方式、倡导社会公平，减缓或逆转人口增长的趋势。

在抑制人口增长方面，为所有家庭提供合适、便捷而价格合理的计划生育服务，保证女性享有教育和就业的平等权利，增加小规模家庭的个人和社会福利等措施已被证明行之有效。

西蒙·罗斯，人口问题（Population Matters）首席执行官的。人口问题是英国领先的研究人口及其对可持续发展影响的组织

Lower birthrates needed for global CO_2 emissions

Growth in global population will make it difficult to cut carbon emissions and avoid the worst of climate change, writes Simon Ross of campaign group 'Population Matters'

Simon Ross

The number of people on the planet has doubled in the last 50 years. While much of this growth has been in countries with relatively low per capita carbon emissions, the sharp rise in global population has contributed to increased output of greenhouse gases. Not only are there more people on the planet, industrialisation and rising per capita consumption in both developed and developing nations have played their parts in driving up output of gases that if uncontrolled, will cook the planet.

The latest projection by the United Nations is that the global population will rise from just over 7 billion today to 10 billion by 2050. Again, most of this will be in lower emission countries, but some of these countries are industrialising fast, while global migration from developing to fully-developed countries is expected to increase.

Nine countries are expected to contribute over half of the estimated population growth between now and 2050, these being, in descending order of magnitude: India, Nigeria, Pakistan, the Democratic Republic of Congo, Ethiopia, the United Republic of Tanzania, the US, Indonesia, and Uganda.

Of these, the US and India are currently the world's second and third largest users of coal. Indonesia is a major consumer of the fossil fuel, while Pakistan and the Congo have historically used very little of coal. The remaining four countries are negligible in terms of coal demand. India and Indonesia have large coal reserves and are expected to continue to rely on the dirty fuel for the foreseeable future.

Coal is the largest single contributor to climate change and its other environmental consequences – such as smog – has prompted developed countries to switch to cleaner alternatives. China accounts for a large proportion of world coal use and this, along with other consequences of its rapid industrialisation, is the principal cause of air pollution and a major contributor to poisoned water and damaged soil.

It has been argued that China's so-called 'one child policy' has, by reducing population growth, helped to prevent even worse pollution. In practice, assessing the impact of social policy is not easy. Sanctions and punishments were accompanied by other measures, such as provision of family planning services and promotion of the benefits of smaller families. When a number of measures are introduced together, it is hard to distinguish the contribution of each.

Moreover, China underwent huge economic and social changes during the period of the one-child rule. Again, it is not easy to separate the impact of the policy on family size or other changes in society. It has also been pointed out

> "It is hard to overestimate the potential impact of rising population and increasing per capita consumption on climate change and other environmental problems, including declining availability of water and fertile land."

that the fertility rate has fallen sharply in a number of other countries without such controls on family size.

However it could be argued that circumstances vary between countries, so this is not conclusive evidence that China's one-child policy had no effect on birthrates.

China now-favoured 'two-child policy' again raises the question of what impact this will have on the birthrate. Certainly, the global trend is towards smaller families and this is particularly the case in wealthier countries.

Where there is good access to family planning, couples tend to prefer smaller families unless there is a high level of state subsidy and employer support for those who have children. When children require an extended education to be successful in life, they and their parents benefit from being part of a small family. That being said, the Financial Times estimates that the relaxation of the policy will result in a rise in the birthrate of between one sixth and one third.

The environmental impact of this increase will depend partly on China's success in moving away from fossil fuel use, and decarbonisation of the world's biggest fossil fuel energy system poses huge challenges. Moreover, even if the power sector becomes much less dependent on coal, population growth increases emissions in other ways, such as greater demand for transport (particularly aviation) and livestock (mainly through increased demand for meat).

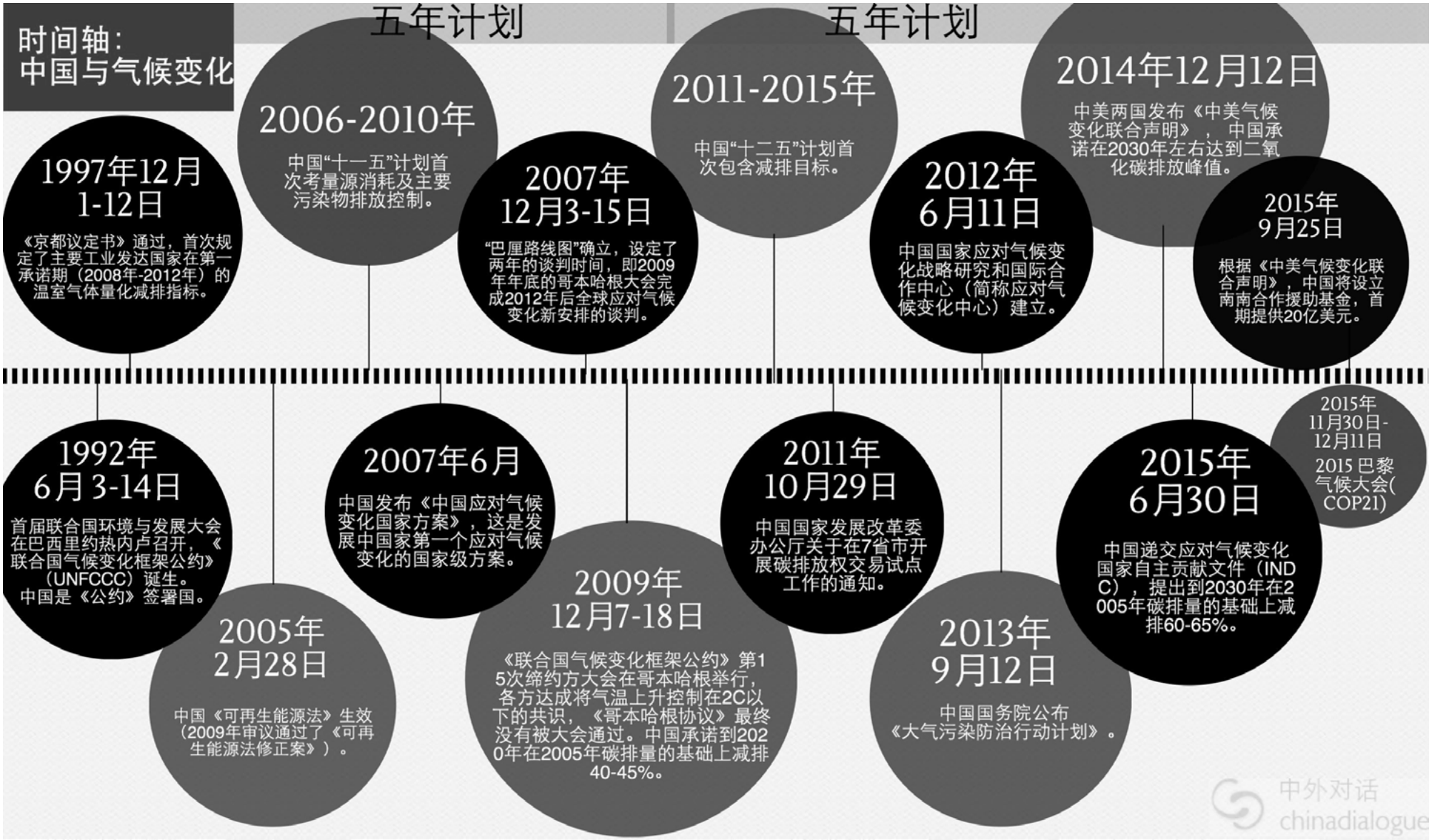
Often, a high birthrate or, in some countries, high migration are promoted as the solution to an ageing population. Worldwide, demographics are changing as people live longer birthrates fall. However, the answer cannot be to increase our numbers given the environmental issues the planet faces. We should not forget that the population of China was 500 million in 1950 and is now 1.4 billion. Instead, a falling working age population should be addressed by helping older people to remain in work for longer, and helping mothers and young people to contribute and increasing productivity and automation.

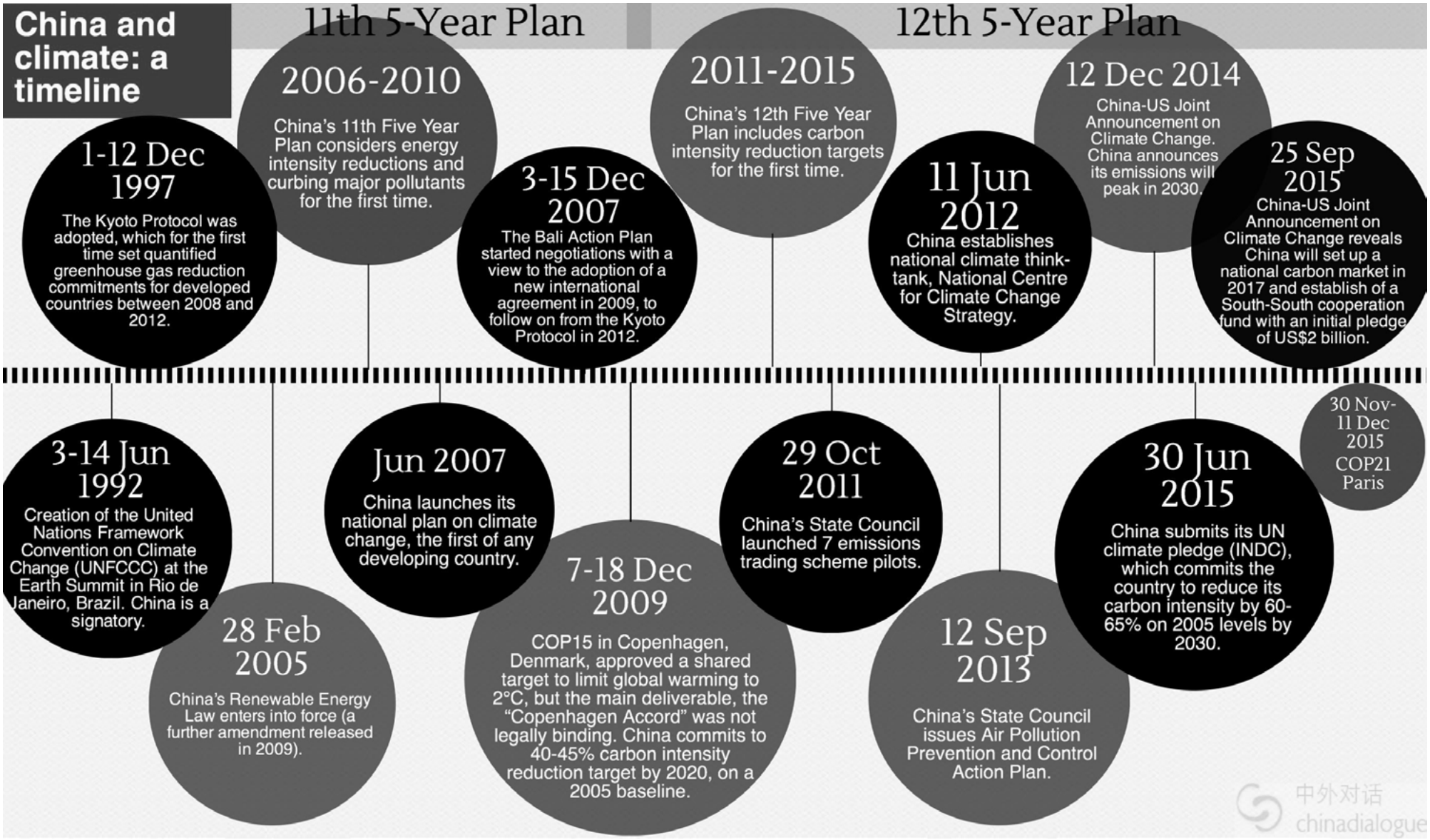
It is hard to overestimate the potential impact of rising population and increasing per capita consumption on climate change and other environmental problems, including declining availability of water and fertile land. That the environmental future of the planet is so uncertain is surely a reason for greater rather than less caution.

As an organisation concerned with long-term sustainability, we advocate that the world's population should stabilise and consumption fall to a level that can be met from resources of energy, materials and agriculture. This includes using technologies that result in lower resource consumption, moving to more egalitarian and mindful lifestyles and slowing and reversing population growth.

For the latter, we recommend the proven approaches of universal access to appropriate, available and affordable family planning services, equal access for women to education and employment at all levels, and the promotion of the personal and social benefits of smaller families.

Simon Ross is the chief executive at Population Matters. Population Matters is the leading UK organisation concerned with population and its impact on sustainability.


时间轴：
中国与气候变化
五年计划
五年计划
1997年12月
1-12日
《京都议定书》通过，首次规定了主要工业发达国家在第一承诺期（2008年-2012年）的温室气体量化减排指标。
2006-2010年
中国“十一五”计划首次考量源消耗及主要污染物排放控制。
2007年
12月3-15日
“巴厘路线图”确立，设定了两年的谈判时间，即2009年年底的哥本哈根大会完成2012年后全球应对气候变化新安排的谈判。
2011-2015年
中国“十二五”计划首次包含减排目标。
2012年
6月11日
中国国家应对气候变化战略研究和国际合作中心（简称应对气候变化中心）建立。
2014年12月12日
中美两国发布《中美气候变化联合声明》，中国承诺在2030年左右达到二氧化碳排放峰值。
2015年
9月25日
根据《中美气候变化联合声明》，中国将设立南南合作援助基金，首期提供20亿美元。
1992年
6月3-14日
首届联合国环境与发展大会在巴西里约热内卢召开，《联合国气候变化框架公约》（UNFCCC）诞生。
中国是《公约》签署国。
2005年
2月28日
中国《可再生能源法》生效（2009年审议通过了《可再生能源法修正案》）。
2007年6月
中国发布《中国应对气候变化国家方案》，这是发展中国家第一个应对气候变化的国家级方案。
2009年
12月7-18日
《联合国气候变化框架公约》第15次缔约方大会在哥本哈根举行，各方达成将气温上升控制在2C以下的共识，《哥本哈根协议》最终没有被大会通过。中国承诺到2020年在2005年碳排量的基础上减排40-45%。
2011年
10月29日
中国国家发展改革委办公厅关于在7省市开展碳排放权交易试点工作的通知。
2013年
9月12日
中国国务院公布《大气污染防治行动计划》。
2015年
6月30日
中国递交应对气候变化国家自主贡献文件（INDC），提出到2030年在2005年碳排量的基础上减排60-65%。
2015年
11月30日-
12月11日
2015 巴黎气候大会(COP21)
中外对话
chinadialogue


China and climate: a timeline
11th 5-Year Plan
12th 5-Year Plan
1-12 Dec 1997
The Kyoto Protocol was adopted, which for the first time set quantified greenhouse gas reduction commitments for developed countries between 2008 and 2012.
2006-2010
China's 11th Five Year Plan considers energy intensity reductions and curbing major pollutants for the first time.
3-15 Dec 2007
The Bali Action Plan started negotiations with a view to the adoption of a new international agreement in 2009, to follow on from the Kyoto Protocol in 2012.
2011-2015
China's 12th Five Year Plan includes carbon intensity reduction targets for the first time.
11 Jun 2012
China establishes national climate think-tank, National Centre for Climate Change Strategy.
12 Dec 2014
China-US Joint Announcement on Climate Change. China announces its emissions will peak in 2030.
25 Sep 2015
China-US Joint Announcement on Climate Change reveals China will set up a national carbon market in 2017 and establish of a South-South cooperation fund with an initial pledge of US$2 billion.
3-14 Jun 1992
Creation of the United Nations Framework Convention on Climate Change (UNFCCC) at the Earth Summit in Rio de Janeiro, Brazil. China is a signatory.
28 Feb 2005
China's Renewable Energy Law enters into force (a further amendment released in 2009).
Jun 2007
China launches its national plan on climate change, the first of any developing country.
7-18 Dec 2009
COP15 in Copenhagen, Denmark, approved a shared target to limit global warming to 2°C, but the main deliverable, the "Copenhagen Accord" was not legally binding. China commits to 40-45% carbon intensity reduction target by 2020, on a 2005 baseline.
29 Oct 2011
China's State Council launched 7 emissions trading scheme pilots.
12 Sep 2013
China's State Council issues Air Pollution Prevention and Control Action Plan.
30 Jun 2015
China submits its UN climate pledge (INDC), which commits the country to reduce its carbon intensity by 60-65% on 2005 levels by 2030.
30 Nov-11 Dec 2015 COP21 Paris
中外对话
chinadialogue

气候变化：巴黎之后

今年年底在巴黎举行的联合国气候大会旨在避免气候变化失控，主要通过化石燃料的转型，在全球范围内削减温室气体排放。巴黎大会可能成为遏制全球变暖的重要里程碑，

一个成功的协议需要各个排放大国坚定不移地向低碳发展转型的决心。这将是一个庞大而昂贵的计划，但是只要有足够的政治意愿，这一构想是可以实现的。本期特刊分析了气候协议的可能走向，全球变暖所面临的巨大挑战，巴黎大会外还需要怎样的努力才能确保这一万众瞩目的峰会能成为扭转格局的契机，而不是遗憾的错过机会。

Climate change: Paris and beyond

UN climate talks in Paris at the end of this year aim to avoid runaway climate change by mobilising cuts in greenhouse gases, mainly through a shift away from fossil fuels. While the meeting in the French capital could be a major milestone in efforts to stop global warming, a successful agreement will require an unwavering determination by the world' s largest emitters to move swiftly towards low-carbon development. This is a huge and expensive task. But with enough political will, it is also an achievable one. This special issue of our journal examines the likely main strands of a future climate deal, the big stakes for the planet as the world warms, and what will likely be needed beyond Paris so that the much-anticipated summit is an opportunity taken rather than one missed.

伦敦办公室 / London Office

Suite 306 Grayston Centre,
28 Charles Square,
London, N1 6HT, UK

电话 / Tel: (+44) (0) 20 7324 4767

北京办公室 / Beijing Office

北京市海淀区中关村西区善缘街1号立方庭大厦2-123 (100080)
Rm.2-123 Core Plaza, NO.1 Shanyuan St.,
Haidian District,Beijing, China, 100080
电话 / Tel: (+86) 010 6241 6774

http://www.chinadialogue.org.cn
https://www.chinadialogue.net