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Can Chinese climate policy adapt to new pressures?

2018：中国环境回归“旧常态”？
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Five ways to tackle ghost fishing gear

图片来源 source: Paul Hilton / Greenpeace

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Isabel Hilton

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

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PIECES ONLINE
(2018.11 — 2018.12)

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China and the world discuss the environment

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2018：中国环境回归“旧常态”？

经贸压力之下，中国环境政策在 2018 年呈现出一种纠结的状态，但中国环境改革的根基仍在。

□ 马天杰

2018 年的中国环境故事可以说开局良好。年初，中国北方大部分地区的天空依然清冽、湛蓝。这要归功于为实现 2017 年底的大气质量目标而采取的大规模攻坚行动。结果，北京 2017 年的 PM2.5 水平比五年前降低了 35%，这样的结果最初在很多人看来是不可能实现的。

治污的成果如此显著，以至于有研究人员宣称中国即将打赢环保之战。中国政府再次向世界证明了自己有把事办成的能力，虽然蓝天的代价是极高的。为了在短时间内改善空气质量，工厂停产，供暖受限：由于“煤改气”工程实施中的问题，一些地区的贫困家庭只能在没有供暖的家中捱过寒冬。

3 月，一年一度的全国“两会”召开，标志着历时数年的环境治理改革到达巅峰。此次大会上，“生态文明”被写入宪法，并宣布对国务院机构进行重大改组，涉及环境保护和自然资源管理的政府职能得到整合和加强。这些期待已久的举动似乎都表明中国正在稳步走向一场“生态复兴”。

近年来，中国的环境改革一直都建立在一个重要的前提之上，即中国经济向一个更可持续和高质量的模式进行持续的转型。人们普遍认为，减少依赖高污染的重工业这一传统增长引擎显著降低了污染物的主要来源——煤炭的消耗。乐观的学者曾断言，中国经济增长已有效实现了与煤炭消费的脱钩。

然而这一论断在“两会”刚刚胜利闭幕后就受到了考验。从 3 月下旬开始，美国屡次对中国对美贸易顺差发难，并宣布对价值数千亿美元的中国商品征收关税。中国也采取措施予以回击。贸易摩擦在双方多轮你来我往之中愈演愈烈，僵局难破。

随着中国经济前景变得不明朗，通过债务带动基础设施投资，从而刺激经济的言论再次浮出水面。过去，此类措施为水泥、钢铁和其他高碳行业注入了大量资金，促进了经济增长，但代价是地方政府高额的负债和污染。有媒体报道暗示，在


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经济下行的压力下，中国可能会放松其广受赞誉的环境政策。

今年夏天，中国发布了新的“打赢蓝天保卫战三年行动计划”。该计划并未提出超越已有政策的新的约束性目标。这与制定了诸多严苛目标的前一版计划在思路上明显不同。

随着中央政府公布《华北地区2018-2019年冬季大气污染综合治理详细行动方案》，外界很快得出这样一种结论，认为这个行动方案因中美贸易摩擦而弱化了污染控制。该方案允许地方政府更灵活地管理当地的工业生产，并根据企业在同行业中的污染物排放水平自主决定冬季污染高峰时期哪些工厂需要被关停。此前，无论个别企业的环境绩效如何，都需要面临“一刀切”的关停措施。

中央政府官员强烈驳斥了关于治霾措施受到贸易战影响的说法。他们认为，那些为满足环境标准而投入巨资的企业过去被迫与污染企业一样停产限产，新的政策只是对“一刀切”的合理修正。

但难以否认的是，截止11月底，臭名昭著的雾霾再次强势“回归”中国北方，污染水平比去年同期高出约10%。通过对卫星图像和其他公开信息的分析也表明，此前被搁置的煤电项目也出现复工迹象。

2018年的局面再次提醒人们，中国的环境决策发生在复杂的经济和政治语境之中，必须在各种政策诉求的复合影响之下“走钢丝”。保持合理的经济增长水平是一项至关重要的政策诉求，但近年来，最高领导层已表现出愿意以略低的经济增速换取高质量增长的意愿。过去几年重工业去产能的经济结构调整措施反映了对可持续高质量发展的新的政治意愿。但这种“宽容”可能是有底线的。贸易摩擦的冲击是否已经改变了政策制定者的考量，并使其重新向经济刺激倾斜，目前尚未可知。

但人们往往会忽略另外一项政策诉求对环境政策的影响：简政放权，依法行政。今年9月，前财政部长楼继伟罕见地公开谈到“环境保护也需尊重契约精神”，含蓄地批评了环保战役过程中“一刀切”的做法给正常商业活动带来的扰乱。这两项政策诉求在环境领域发生冲突已非首例。2016年，中国对环境影响评估（EIA）流程进行改革，环评审批不再作为可行性研究报告审批的前置条件。支持者认为两项审批“并联”是减少寻租的有效手段，而环保主义者则认为这将使得环保机构的权力进一步边缘化。

无论如今中国领导人优先应对的政策诉求是什么，很明显的是，2018年“回吐”了过去几年取得的一些环境成效。今年中国的碳排放可能同比增长4.7%。资深的中国环境观察者在社交媒体上感叹：“去年冬天的情况看起来越来越像一个异数”。环境保护的“新常态”远未稳固。

那么，2018年发生的这些事件是否会动摇中国环境改革的根基？在近期举行的G20峰会上，中国和美国就贸易战达成了休战协议，由此带来的经贸压力将有望得到缓解。中国在本月的波兰气候大会中发挥了建设性作用，其新颁布的《土壤污染防治法》也表明，中国仍致力于推动更大的生态领域改革。2019年将是这些努力再次经受考验的一年。但2018年至少表明了一件事：曾经无关痛痒的环境政策现已深刻影响着中国的经济表现，无论是收紧还是放松都会触及中国的经济神经。通过一系列环境体制改革，绿色政策现已逐渐进入中国政策的中心舞台。现在应该抓住这一契机，就中国如何协调宏伟的环境目标与其他紧迫的经济和社会政策诉求展开一场开诚布公的大讨论。

马天杰，中外对话运营副主编

2018: Is China returning to old, polluting habits?

Environmental reforms are stuttering under the pressure of a trade war but the government can get back on track

□ Ma Tianjie

Much of northern China was still enjoying a crisp, clear sky at the start of 2018, the fruit of a massive, last-ditch effort to meet an air quality target set for the end of 2017. As a result, Beijing's PM2.5 level was 35% lower than five years ago, an outcome that many thought was impossible.

It was so stunning that researchers declared that China was winning its war on pollution. The government had once again demonstrated to the world that it could get things done. But the blue sky exacted a hefty cost. In the rush to improve air quality, factories were shut, heating services were disrupted and, in some places, poor people were left in cold homes due to a botched coal-to-gas heating campaign.

The annual meeting of the National People's Congress (NPC) in March marked the apex of a years-long reform process to improve environmental governance. The concept of "ecological civilization" was enshrined in the constitution and a major ministerial reorganisation was announced to help consolidate environmental protection and natural resources management. These long-awaited moves all suggested that China was on track to achieve "ecological rejuvenation".

By the end of November, China's notorious smog was back in a big way.

China's environmental reforms in recent years have always been premised on the continued transition towards a more sustainable economic model. The shift from polluting heavy industries as a growth engine is widely credited to have significantly decreased coal consumption, a major source of emissions. Optimistic voices asserted that Chinese economic growth was effectively decoupled from coal consumption.

This notion was soon put to the test after the end of the successful NPC meeting when the US announced tariffs on Chinese goods worth hundreds of billions of dollars, with China responding in kind. Prolonged negotiations failed to break the standoff.

As prospects for the Chinese economy worsened, talk of stimulating it with yet another round of debt-driven infrastructure spending re-emerged, though with some resistance. In the past, similar efforts injected enormous amounts of cash into cement, steel and other high-carbon industries, buttressing growth but at the cost of ballooning local government indebtedness and pollution. In the face of economic headwinds, it's possible China may loosen up its once celebrated environmental policy in the coming year.

Over the summer, China published a new three-year action plan on air pollution that refrained from introducing new

binding targets beyond those set in existing policies. This was a major departure from the stringent targets of the previous plan, which required too much too soon from many cities.

When the central government released a detailed North China air pollution plan for the 2018-2019 winter, a narrative was quickly established that it had taken the US-China trade war into account. The plan gave local governments more flexible control over local industrial facilities. It allowed them to determine which factories could operate and which ones would be shuttered in response to the spike in pollution over the winter months. This decision making would be based on their environmental performance compared to their peers. In the past, a blanket shutdown was imposed on such factories during winter months, with no regard to individual factories' environmental performance.

Central government officials disputed vehemently that the change was a response to the trade war. They argued that enterprises which invested heavily in meeting environmental standards were forced to halt production along with more polluting facilities. The change was a reasonable correction to heavy-handed government rules.

But the results cannot lie. By the end of November, China's notorious smog was back in a big way, with pollution levels 10% higher than the previous year (they were supposed to go down by at least 3%). Satellite images and other public information suggest that shelved coal power projects have been allowed to restart.

Environmental policymaking in China happens in a complex economic and political context in which multiple imperatives must be juggled. Maintaining a reasonable level of economic growth is important, but in recent years, the top leadership has shown itself willing to accept slightly lower growth in exchange for higher quality growth. The economic restructuring in the past few years that cut capacity in heavy industry is a reflection of that new commitment to sustainability. But there might be a limit to that ambition; it is unclear if the shock of the trade war has already changed the calculation to favour unchecked growth.

But there is another policy imperative that's often underappreciated: the need to reform the government to reduce red tape and arbitrary regulation. In September, China's former finance minister Lou Jiwei made a veiled criticism of the heavy-handed disruption of business activities in the war against pollution when he spoke publicly about the importance of "environmental protection to respect contractual spirit". It is not the first time that the two imperatives clashes in the environmental field. In 2016, the reform of China's environmental impact assessment (EIA) process removed the requirement to have one before a project's feasibility study was approved. Supporters hailed the move to allow the two approvals to be done in parallel as an effective means of reducing rent-seeking (the prerequisite for an EIA could be used by environmental officials as leverage to extort applicants) while environmentalists lamented it as a weakening of the environmental agency's already marginal power.

No matter which imperatives Chinese leaders are responding to today, by the end of 2018, it was clear that environmental gains from the past few years were being reversed. The country's carbon emissions are set to increase by as much as 4.7% year-on-year. Environmental journalist Li Jing lamented on Twitter: "Last winter turned out to be an outlier".

So, have events in 2018 shaken the foundation of China's environmental reform agenda? China and the US agreed a truce on their trade war at the recent G20 summit so there is hope that pressure to weaken pollution controls will ease. China was constructive at this month's climate talks in Poland, and its new sweeping soil pollution control law also suggests it is still committed to moving toward greater ecological responsibility. This commitment will be tested again in 2019, but at the very least, 2018 shows that the once inconsequential environmental policy has become so engrained in China's economic performance that tightening or loosening it would affect the country's economic bottom line. The environmental reform has moved green polices to the centre of Chinese politics. There is now a great opportunity to have a robust and open debate about how China should align ambitious environmental targets with other pressing economic and social imperatives.

Ma Tianjie is chinadialogue managing editor in Beijing.

重工业推高中国碳排放

进一步的财政刺激将导致碳排放在 2019 年再次出现增长吗？

□ 白 睿

根据上周三发布的一份全球碳排放评估，继 2017 年增长 1.7% 后，今年中国的排放预计将增长 4.7% 左右。

2014—2016 这三年中国的排放呈现稳中放缓的趋势，人们本来希望未来能多少保持稳定。但最近的增长无疑给大家浇了一盆凉水。

眼下的问题是 2019 年碳排放是否会继续增长，政府的财政政策已经给出了明确线索。

工业驱动

排放增长是煤炭消费增加的结果，而这背后的主要驱动力是工业。根据中国国家统计局发布的 最新官方数据，今年 1 至 10 月钢材产量同比增长 7.8%，水泥生产增长了 2.6%。工业产量增加导致电力需求出现六年来的最快增长，所有这些共同造成今年前三个季度煤炭消费约 3% 的增幅。

中国政府正在努力引导经济走上高质量发展的道路，这是一个普遍被

认为对减少碳排放至关重要的举措。但正如最新数据显示的，高碳产业仍然在进行着破纪录的大量生产。

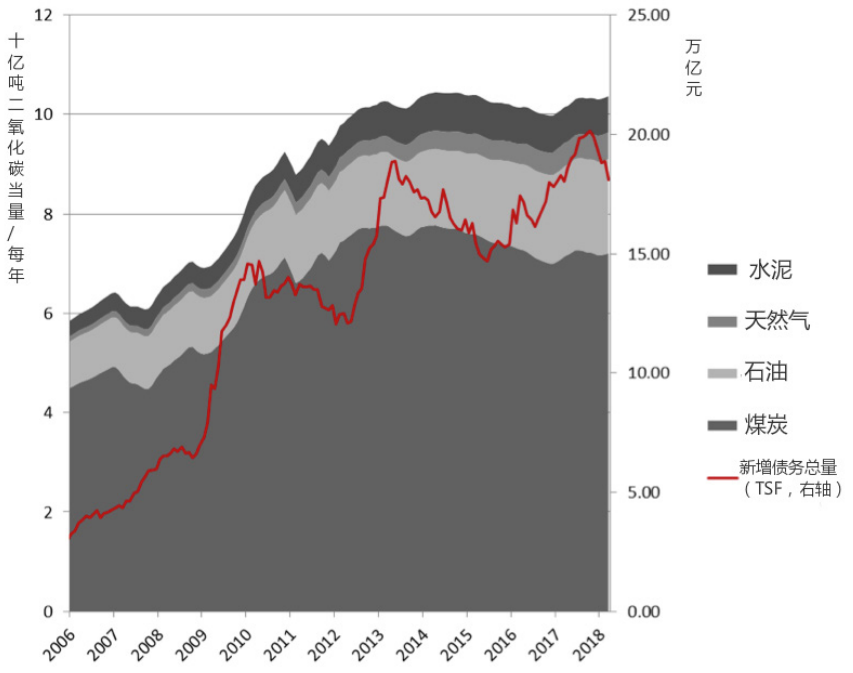
自然资源保护协会的杨富强博士近日在《人民日报（海外版）》的一篇评论中指出，政府必须解决重工业的产能过剩问题。

财政刺激

几周前北京的一次研讨会上，中国工程院杜祥宛院士直言不讳地提到了这个问题，他说："中国水泥产量占全世界的 60%，我们真的需要这么多水泥吗？"

答案显然是否定的。中国对钢材、水泥和其他建筑材料的需求一向都靠地方政府的基础设施项目支持，而其资金来源常常是定期性的政府刺激计划所带来的负债。下面这张图表清楚显示了政府的这种支持，煤炭、石油、天然气和水泥生产碳排放的增加都是在新贷款发放后的几个月内发生的。

中国化石燃料 CO_2 排放和信贷增长之间的关系（12个月尾随总和）



令人担心的是，已经有传言说政府计划未来两年为经济注入巨大的资金刺激。荷兰国际集团（ING）最近的一份分析估计，计划投入的资金规模约为 9-10 万亿元（1.3-1.5 万亿美元），可与之匹敌的唯有 2009 年全球金融危机后的那次经济刺激计划。

ING 经济学家彭日成写道："尽管一些财政资金将被用于偿还债务和贷款展期，但剩下的都将被投入基础设施项目，而这将支撑制造业的生产活动。"

不过，上个月李克强总理视察江苏省时强调，政府坚定推动国家经济转型，并没有大规模刺激经济的计划。

如果政府能够扭转这一趋势，将对全球碳排放产生至关重要的影响。如果 ING 的预测准确，2019 年和 2020 年将不可避免地出现工业产量高企、煤炭消费增加、以及世界最大排放国连续第三年甚至第四年排放增长的局面。

白睿，绿色和平东亚办公室国际媒体主任

Heavy industry drives growth in China's emissions

Further fiscal stimulus could push carbon emissions up again in 2019

□ Tom Baxter

China carbon-intensive sectors are delivering record-breaking output

China's emissions are projected to grow by around 4.7% this year following a rise of 1.7% in 2017, according to an assessment of global carbon emissions published on Wednesday.

The latest growth is a blow to hopes that China's emissions had more or less plateaued after three years of static or declining emissions between 2014-2016.

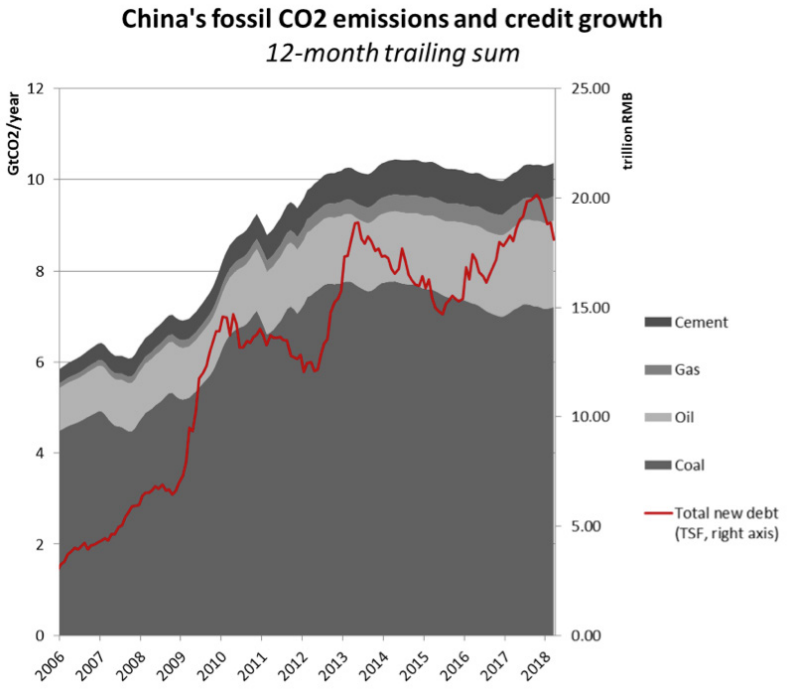
The question now is whether emissions will continue to grow in 2019. The government's fiscal policy is already providing a strong clue.

Driven by industry

The rise in emissions is the result of increased coal consumption driven primarily by industry. The latest official data from China's National Bureau of Statistics shows that steel production from January to October this year increased 7.8% compared to the same period last year, while cement production increased by 2.6%. The increased industrial output also led to the fastest growth in electricity demand in six years. All of which led to a rise in coal consumption of around 3% for the first three quarters of the year.

The government is trying to steer the Chinese economy toward high quality growth, a move that is recognised as critical to reducing carbon emissions. But as the latest data shows, carbon-intensive sectors are still delivering record-breaking output.

In a recent commentary piece for People's Daily, Dr Yang Fuqiang of the Natural Resource Defense Council, said the government needed to tackle overcapacity across heavy industry.



Fiscal stimulus

At a workshop in Beijing a few weeks ago, professor Du Xiangwan of the Chinese Academy of Engineering put the issue plainly. "China produces 60% of the world's cement," he said. "Do we really need that much cement?"

The answer appears to be no. Demand for steel, cement and other construction materials in China has long been supported by local government infrastructure projects, often financed by debt from regular government stimulus packages. This support is illustrated in a graph from Unearthed, which shows how rising carbon emissions from coal, oil, gas and cement production follow the issuance of new debt by a few months.

Worryingly, rumours are already swirling that the government is planning to inject enormous stimulus into the economy over the next two years. A recent analysis by ING estimated the package could be around 9 to 10 trillion yuan (US$1.3-1.5 trillion), comparable only to the 2009 package after the global financial crisis.

ING analyst Iris Pang wrote: "Though some fiscal money will be used for debt repayment and loan rollovers, the rest will go into infrastructure projects, which will support manufacturing activities."

However, on a visit to Jiangsu province last month, Premier Li Keqiang emphasised that the government is committed to transitioning the country's economy and has no plans for a large scale stimulus.

How this plays out over the next few months will be of critical importance to global emissions. If ING's predictions are correct, it is almost inevitable that 2019 and 2020 will see high industrial output, growing coal consumption and a third or even fourth year of rising emissions from the world's largest emitter.

Tom Baxter is an international communications officer at Greenpeace East Asia.

经贸摩擦之下的中国对美清洁能源投资

能源与交通技术合作会受到中美贸易争端怎样的影响？

□ 白莉莉

2011年一家波士顿电池初创企业将赌注压在了中国身上。当时，这家波士顿动力电池公司（Boston Power）正面临资金短缺，而中国投资公司金沙江资本适时出现了，还带来了一笔不菲的投资。金沙江资本旗下拥有一家急需提高电池寿命的电动汽车生产厂。两年的时间里，波士顿动力电池公司在江苏溧阳建立了一家规模化商业电池生产厂，并投入运营。

这只是中国企业投资美国技术解决环境问题的众多案例之一。中国计划到2020年累积向可再生能源企业投资3610亿美元(约合2.5万亿元人民币)。在历经近十年的持续资金短缺后，美国清洁能源企业非常欢迎这个新的“金主”。

而一个新成立的投资基金则有望进一步巩固这种关系。在今年秋季美国旧金山举办的全球气候行动峰会（Global Climate Action Summit）上，中国-加州清洁技术合作基金（The California-China Cleantech Partnership Fund）正式启动。该基金旨在帮助投资者和企业跨境合作，快速推动清洁能源技术的规模化发展。

但是，一项新的对中方投资严加审查的美国法律却给这项刚刚起步的倡议蒙上了阴影。过去，清洁技术贸易也曾受到类似政策的阻挠。如今，这项新法又再次考验清洁能源合作能否跨越经济民族主义。

新型合作关系

2017年，从美国总统特朗普宣布美国将退出《巴黎协定》的那一刻起，美国就放弃了气候变化领域的领导地位。然而几天后，加利福尼亚州州长杰瑞·布朗却与中国主席习近平在北京就气候变化问题进行了会谈，高调暗示加州将继续与中国携手对抗气候变化。

加州州长中国事务特别顾问戴凡表示，在那次中国行期间，中国投资者“一直都在积极寻求与美国开展清洁技术合作的机会”。为证明加州的决心和承诺，布朗代表团提出建立一个跨境基金的构想。

中国-加州清洁技术合作基金于今年9月正式成立，是在加州政府推动下，由中国私营与具有国有背景的基金共同成立的聚合基金。中方资金计划投资美国的清洁技术领域。该基金与中美绿色基金（US-China Green Fund）类似，后者是在奥巴马政府执政期间，经由中美战略经济对话而建立的一项投资倡议。

最近，政府间气候变化专门委员会呼吁每年投资2.4万亿美元（约合16.54万亿元人民币）用于发展清洁能源，以完成《巴黎气候协定》中提出的保持全球平均温度上升不超过1.5摄氏度的目标。这些双边基金虽然规模相对较小，但却将中国

> “知识产权侵权也是人们长期关注的一个问题。一些企业仍然对进军中国市场犹豫不决，主要原因还是担心知识产权被盗。”

投资引入了清洁能源领域，为中美气候合作提供了难得的合作机会。

行业合作呼吁创新

清洁技术基金执行合伙人艾什莉·熊（Ashley Xiong）表示，在多个合作型的涉及到各类地区与企业的基金中，北京的基金是最成熟的。该基金的源头还要追溯到布朗州长访华期间，由加州与北京市海淀区政府共同签署的那份谅解备忘录。在协议第一阶段，该基金从北京企业及海外基金融资 10 亿元人民币（约合 1.45 亿美元）。

中国 - 加州清洁技术合作基金主要关注加州的高能电池、智能电网和电动汽车技术。中国制定了很高的清洁能源目标，并在国内开展大规模空气污染减控行动，这些都为清洁能源技术创造了不小的国内需求。

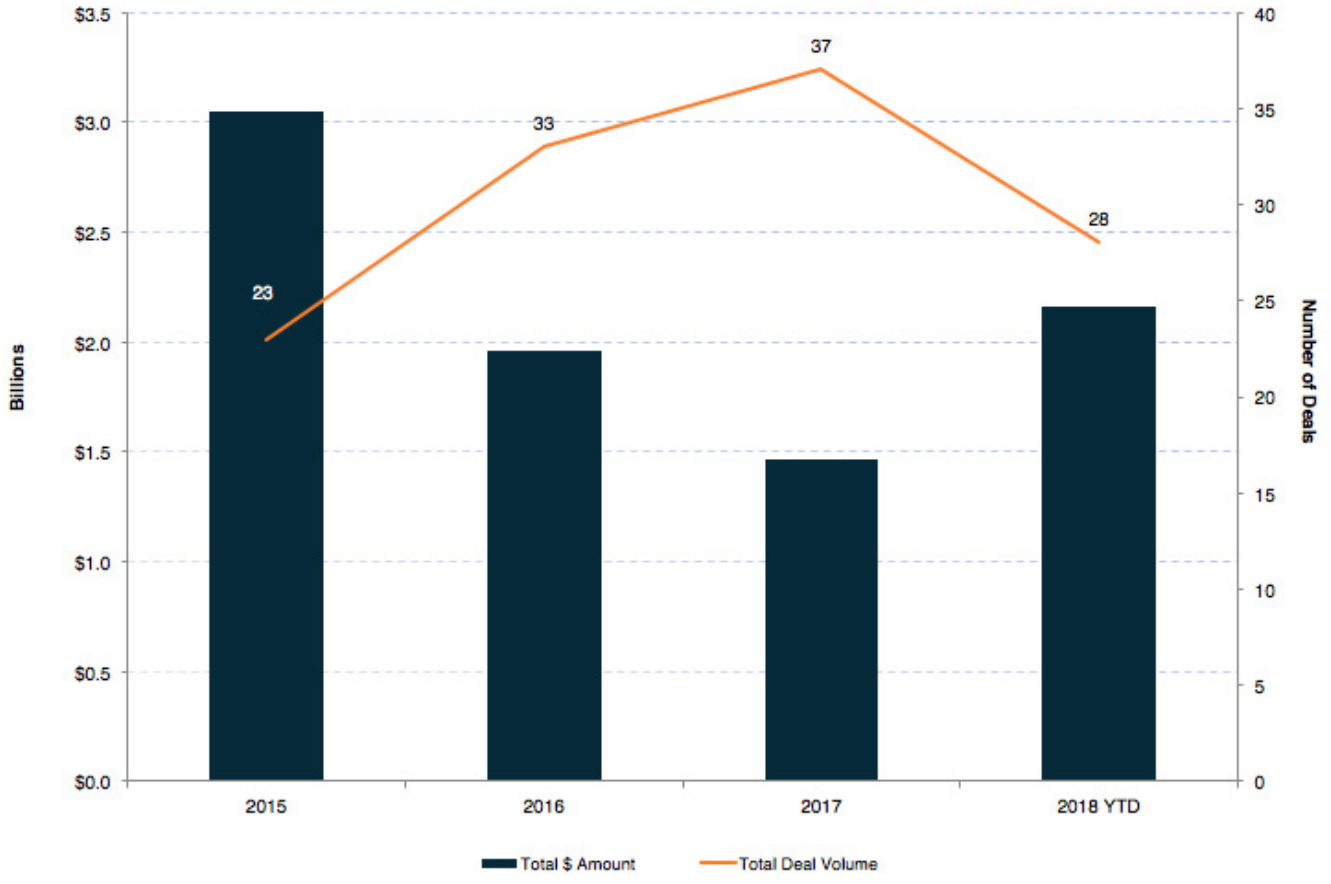
中方资金的主要目标是利用加州的技术优势。尽管近年来中国在可再生能源装机上占据优势，并逐渐成为了重要的清洁技术创新力量，但是美国在一些关键领域仍然保持着优势。位于美国的清洁技术集团（Cleantech Group）研究经理 Leo Zhang 表示：“美国在清洁技术创新方面仍然领先全球。”，尤其是在储能和电池材料方面。

据戴凡介绍，为帮助这些资金发现相关的技术投资目标，加州政府专门建立了一个包含 170 家当地技术企业的数据库。她表示，这项合作对当地企业来说也是一个机会。“对那些想要探索中国市场的加州公司，我们肯定会鼎力支持他们利用清洁技术基金走向中国市场。”

创新之战的新战场？

自 2017 年以来，中国对美投资大幅下降，但是在清洁技术方面却是个例外。然而，紧张的地缘政治局势之下，清洁技术恐怕也难以独善其身。

2016 年，美国禁止中国投资者收购总部位于加州的荷兰 LED 照明企业 Lumileds 的控股权，理由是美国政府依法有权以国家安全风险为



数据来源：清洁能源机关；图表绘制：清洁能源机关

由对外商的收购行为设限。专家表示，该公司 LED 产品中的半导体材料氮化镓可用于雷达设备，这引起了中国军方的兴趣。

今年 9 月，新清洁技术基金刚刚启动，美国政府就扩大了外商对美投资的限制，以防止这些投资威胁美国“未来经济繁荣”。

来自一项试点项目的信息显示，新规针对的是“关键性技术”。而所谓的“关键性技术”涵盖 27 个行业，其中就包括电池制造等清洁能源技术。荣鼎集团（Rhodium Group）的研究显示，去年中国对美投资中有大约 40% 都有可能受到审查，具体还要看新规落实情况而定。

与此同时，贸易战也推动了中国科技界民族主义的兴起。习近平主席号召中国科技界“自力更生”，努力实现建设自有先进技术的目标。而包括能源技术与新能源汽车在内的清洁能源技术包含在这一战略中。

中国在对美国公司进行投资时，一般都会明确提出在中国推广相关技术。在硅谷涌现的 50 多家中资孵化器和商业中心的建立使得推广得以实现。中关村（国际）控股公司首席运营官罗炜对路透社说道：“我们正在建设通往中国市场的大门和桥梁。”中关村（国际）控股公司负责运营位于硅谷的中关村创新中心，并与北京市政府有着密切的联系。

一些美国公司表示，他们并不清楚中国投资方与中国政府的联系。联想到中国曾表示要在关键技术方面积累专业知识，这不免让美方感到有些担忧。

公平竞争？

过去对清洁技术领域竞争力的担忧促使政府采取了一些行动，比如在某些情况下暂缓清洁能源技术的使用。

随着中国清洁技术制造业在全球范围内的崛起，不少国家开始频繁禁止进口廉价的中国太阳能产品。在特朗普总统上台之前，奥巴马政府就在 2012 年对中国太阳能电池板征收了关税，随后欧盟也颁布了类似的举措。

今年 1 月，特朗普政府延续了这一政策，对太阳能电池板征收进口关税，导致美国可再生能源企业取消或冻结的项目总额达到 25 亿美元(约合 170 亿元人民币)。今年夏天，印度也采取了类似的关税政策。印度政府指控中国对太阳能电池板生产企业不公平地进行了补贴，导致其他市场企业无法与之公平竞争。然而布鲁金斯学会（Brookings Institution）认为，这种政策至少对美国来说带来的经济损失远大于收益。

知识产权侵权也是人们长期关注的一个问题。戴凡援引加州针对当地清洁技术公司的一项调查表示，一些企业仍然对进军中国市场犹豫不决，主要原因还是担心知识产权被盗。

翼迪投资公司（Idinvest）运营合伙人朱利安 · 米亚拉雷曾经帮助一些企业打入了中国市场。他表示，对于某些领域来说，这样的知识产权风险远比其他行业更大。例如有证据显示，将清洁技术数据分析公司带到中国就非常具有挑战性。“我们必须在中国拥有数据中心，必须在中国运行算法，而这些都是我们现在不愿意接受的风险。”

清洁技术合作的未来

当波士顿动力电池公司决定在 2011 年接受中国投资的时候，金沙江资本的董事长就表示：“波士顿动力电池公司还是一家美国企业，只不过从现在起，它将充分利用中国的市场机遇和政府支持，成为一家国际性企业。当美国做好准备扩展电动汽车市场的时候，我们也会提供坚定支持。”然而就在去年，波士顿动力电池公司，这家马萨诸塞州曾经的清洁技术领军企业却宣布，正在缩减波士顿的团队规模。

朱利安 · 米亚拉雷表示，美国可以像中国和加州那样制定一些政策，鼓励美国清洁技术公司的蓬勃发展，而不是采取冷战思维并完全阻止中国投资。布鲁金斯学会的研究显示，中国现在的能源研发投资规模是美国的三倍多。

随着美国对外政策收紧，保护主义抬头，中美清洁技术合作和新合作基金可能会遭遇一些困难。如果新的美国投资政策让进军加州市场变得异常艰难，那么这些基金很有可能会到美国以外的其他国家进行投资。

米亚拉雷警告称：“如果中美之间没有合作，那对所有人来说都是一场失败。”

白莉莉，中外对话研究员，北京能源网络 (Beijing Energy Network) 执行制作

Competition fears threaten Chinese investment in US clean tech

Energy and transport technologies could get caught in the crosshairs of the economic standoff

□ Lili Pike

US levies on Chinese solar panels pre-date President Trump's protectionist policy

In 2011, a Boston-based battery startup took a bet on China. The company, Boston Power, was facing a funding setback when Chinese firm Golden Sand River swooped in with a compelling investment offer. It had a Chinese electric vehicle company in its portfolio that needed a boost. Within two years, Boston Power had a commercial-scale factory up-and-running in Liyang, a city west of Shanghai.

This deal is one of many cases where Chinese companies have turned to US technology to solve environmental problems. China plans on pouring US$361 billion (2.5 trillion yuan) into renewable energy by 2020. US cleantech companies have welcomed this fresh source of capital after enduring funding dry spells over the last decade.

A new investment fund is looking to strengthen this relationship. The California-China Cleantech Partnership Fund was launched at the Global Climate Action Summit in San Francisco in the autumn. It aims to help investors and companies operate across borders to rapidly scale up their clean energy technologies.

But a new US law scrutinising Chinese investments poses a threat to the fledgling initiative. Clean technology trade has been snagged by similar policies in the past. Now this law is testing, once again, whether clean energy cooperation can overcome economic nationalism.

A new partnership

President Trump renounced US leadership on climate change when in 2017 he announced the US would withdraw from the Paris Agreement. However, days later, California governor Jerry Brown met with President Xi in Beijing to discuss climate change, defiantly signalling that California would take on the mantle jointly with China.

Fan Dai, the governor's special advisor on China, says that during the trip Chinese investors "were actively seeking opportunities to work with us on clean technology". Brown's delegation envisioned a new cross-border fund as a way to demonstrate California's commitment.

Formally launched in September, the California-China Clean Technology Partnership Fund is a conglomeration of Chinese private and state-affiliated investment funds facilitated by the California government. The Chinese funds intend to invest in the state's clean technology sector. The fund is similar to the US-China Green Fund, an investment initiative launched through the US-China Strategic and Economic Dialogue under Obama.

The Intergovernmental Panel on Climate Change recently called for US$2.4 trillion (16.54 trillion yuan) in clean energy investment annually to meet the Paris Agreement ambition of staying below a 1.5C temperature rise. These bilateral funds, though relatively small, contribute by funnelling Chinese money into the sector while providing rare opportunities for US-China climate cooperation.

> The trade war has spurred rising nationalism in the technology sector. President Xi has called for "self-reliance".

Innovation wanted

Among the various regional and corporate funds that compose the partnership, the Beijing fund is the most developed, according to Ashley Xiong, the initiative's China partner. Its genesis was a memorandum of understanding signed by the California and Beijing Haidian District governments during Brown's visit. In its first phase, the fund has raised over one billion yuan (US$145 million) from Beijing companies as well as overseas funds.

The Beijing fund has trained its eye on the advanced battery, smart grid, and electric vehicle technologies coming out of California. China's ambitious clean energy targets and its campaign to reduce air pollution are driving demand for such technologies domestically.

Leveraging California's technological advantages is a key aim of the Chinese funds. Although China has dominated global renewable energy installations and become a major clean technology innovator in recent years, the US maintains some key advantages.

Leo Zhang, research manager at the Cleantech Group says: "The US still leads the globe in clean technology innovation." He points to energy storage and battery materials in particular.

To assist the group of funds in identifying relevant technologies, the California government has supplied a database of 170 local companies for their investment pipeline, according to Dai. She says that it is an opportunity for the companies, too.

"We definitely would support Californian companies that have an interest in exploring the Chinese market to use this clean tech fund as a vehicle or bridge to get to their destination in China."

A new battlefield in the innovation war?

Chinese investment in the US has fallen dramatically since 2017, but not in clean tech. However, the sector is not immune to geopolitical tensions.

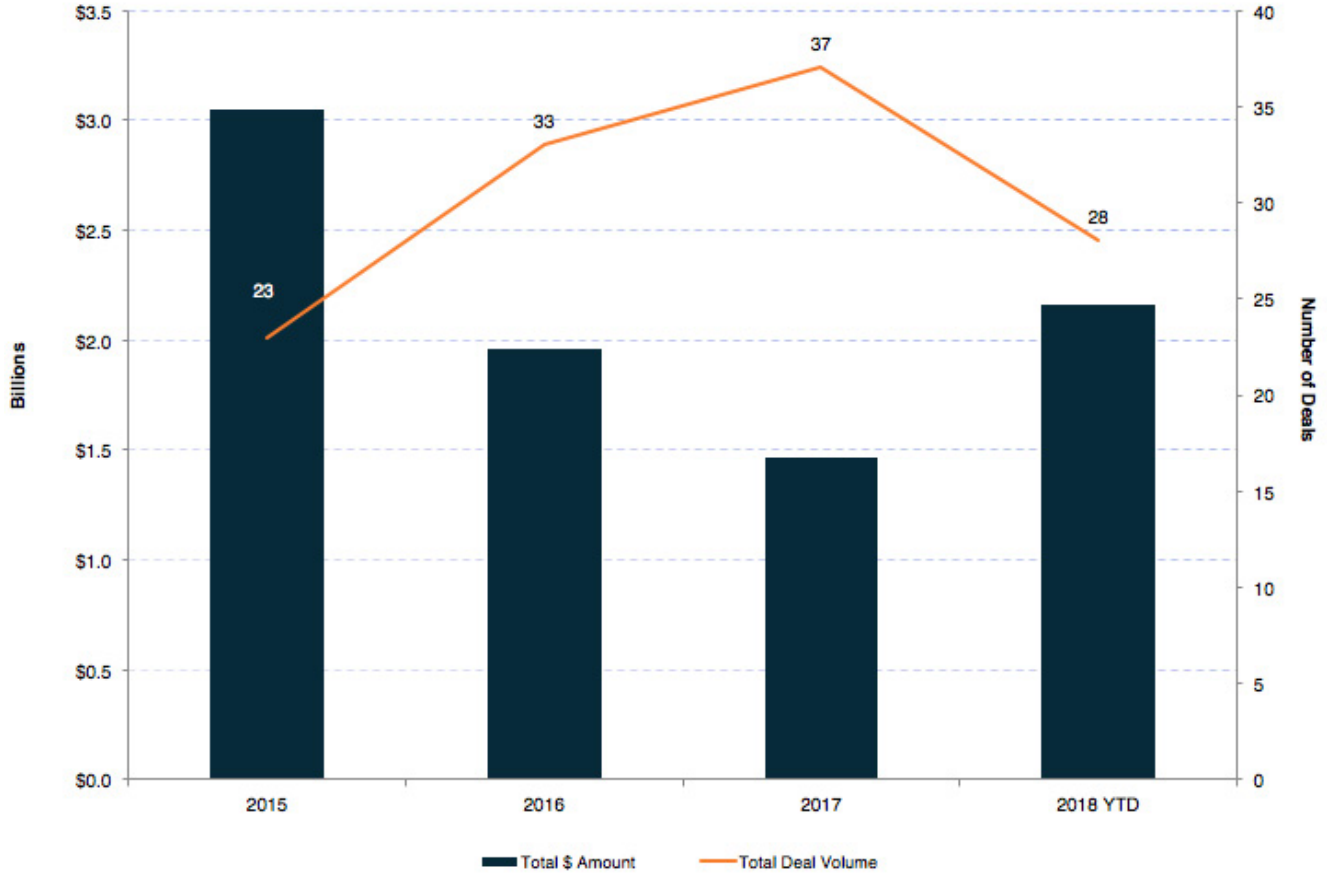
The new U.S. law will target foreign investment in "critical technologies", a category that spans 27 industries, including some related to clean energy such as battery manufacturing. Research from the Rhodium Group found that almost 40% of China's US investments last year could be subject to review depending on how the rules are applied.

Meanwhile in China, the trade war has spurred rising nationalism in the technology sector. President Xi has called for "self-reliance", echoing the country's goal to build its own advanced technologies, as articulated in the Made in China 2025 plan. Clean technologies, including power technologies and new energy vehicles, feature in this strategy.

Chinese investment in US companies often explicitly includes plans to scale technologies in China. Over 50 China-affiliated incubators and business centres have sprung up in Silicon Valley to facilitate this flow. "We are building the door or bridge to the Chinese market," Wei Luo, chief operating officer at ZGC Capital Corporation, which runs the ZGC Innovation Centre – a group with ties to the Beijing government – told Reuters.

Some US companies said they were unaware that their Chinese investors had ties to the government. This has stirred fears given the government's stated agenda of building expertise in key technologies.

Chinese investment in US clean tech companies



Data source: Cleantech Group; Chart: Cleantech Group

> "If we do not have collaboration between China and the US, everyone is going to lose out."
>
> — Julien Mialaret, Idinvest

Fair play?

Past concerns about competitiveness in the clean technology sector have led governments to act, in some cases slowing the adoption of clean energy technologies.

Following China's global rise in clean tech manufacturing, countries have frequently barred cheap Chinese solar imports. Even before Trump, the European Union levied tariffs on Chinese solar panels after a similar decision from the Obama administration in 2012.

The Trump administration followed suit in January, imposing a tariff on solar panel imports that has caused US renewable energy companies to cancel or freeze over USD$2.5 billion (17 billion yuan) in projects. India enacted a similar policy this summer. The governments contended that China had unfairly subsidised solar panel production making it impossible for other markets to compete. However, the Brookings Institution argues such policies, at least in the US, will cause greater economic losses than gains.

Intellectual property infringement has also been a longstanding concern. In a survey of California clean tech companies conducted by the state, some reported hesitation about entering the Chinese market due to fears that their intellectual property would be stolen, according to special adviser Fan Dai.

Julien Mialaret, operating partner for investment firm Idinvest, has helped companies enter the Chinese market. He says these risks are more relevant for some sectors than others. For instance, bringing a clean tech data analytics company to China had proved challenging. "We have to have the data centres in China, and we have to have the algorithms run in China, and that's a risk right now that we are not willing to take."

The future of clean tech collaboration

When Boston Power decided to take investment from China in 2011, the chairman of Golden Sand River said, "Boston Power is still a US company, it's just becoming a global company now, taking advantage of a market opportunity and government support in China. When the US is ready to expand its electric vehicle market, we'll be here." However, last year Boston Power – once considered one of Massachusetts's leading clean tech businesses – announced it was downsizing its Boston team.

Instead of adopting a cold war mentality and blocking Chinese investment altogether, Julien Mialaret said that the US could develop policies like those in China and California to give US clean tech companies incentives to flourish. Research from the Brookings Institution shows that China now spends three times more on energy research and development than the US.

As the US closes its borders, China-US clean tech cooperation and the new partnership fund may be at odds with the protectionist era. If the new US investment rules make it prohibitively difficult to access the Californian market, the fund may have to invest in other countries rather than the US.

"If we do not have collaboration between China and the US, everyone is going to lose out," warned Mialaret.

Lili Pike is a researcher for chinadialogue and the executive producer of the Beijing Energy Network's podcast, Environment China.

中国能否抓住这未来十年最大的环保机遇？

目前低碳基础设施需求巨大，但借贷方仍需迅速调整策略适应这一需求。

□ 西恩·吉尔伯特　叶王　周立欢
莱昂纳多·马丁内斯-迪亚斯

为了能让自己的国家在21世纪保持繁荣发展，亚洲、非洲和欧洲等地的70多个发达国家和新兴经济体国家计划投资约6万亿美元进行基础设施建设。这些国家不再热衷于20世纪的高碳排放基础设施，而是越来越多地通过本国的气候计划表明自己对于现代化的、适应气候变化的可持续基础设施方案的青睐。

在如何填补这个基础设施缺口将成为本世纪经济与商业领域最重要的机遇之一。那么谁能抓住这个机遇呢？

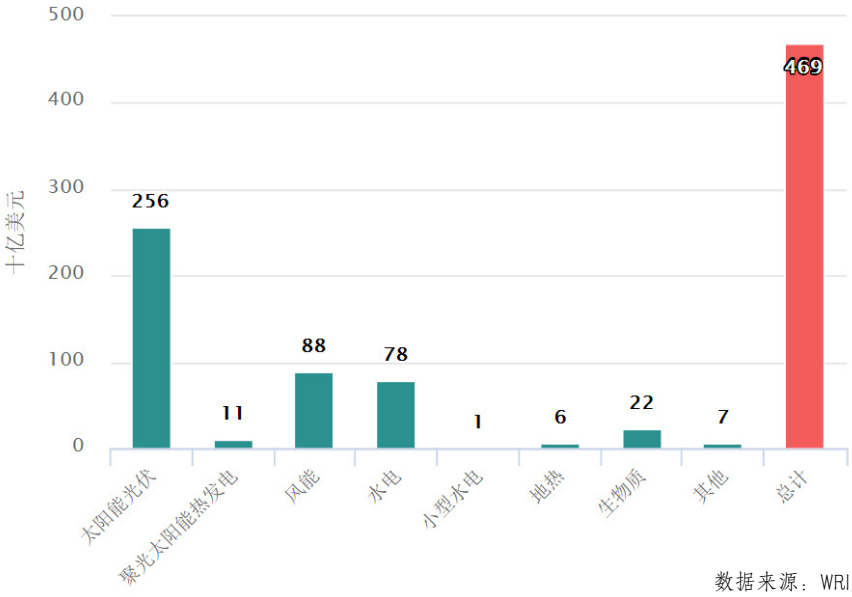
中国政府就是其中之一。中国政府已经明确表示，希望中方金融机构和企业能够发挥带头作用。2017年5月，中国政府允诺将提供1130亿美元的“专项”政府基金，鼓励银行和企业对“一带一路”（Belt and Road Initiative，简称BRI）沿线非洲、亚洲和欧洲国家进行投资。

中国可以在满足全球绿色基础设施建设方面发挥重要作用，但是前提是要保证其资金投入与“一带一路”国家低碳投资需求相一致。

紧抓绿色环保机遇

要了解中国面对的投资机遇规模，我们有必要先了解一些数字。世界资源研究所近日与波士顿大学全球发展政策中心的同事合作研究了“一带一路”沿线各国的国家气候规划，也就是提交《巴黎气候协定》（Paris Agreement）的有关气候变化的国家自主贡献预案（Nationally Determined Contributions，简称

31个“一带一路”沿线国家的自主贡献预案中，可再生能源领域各项技术



数据来源：WRI

NDCs）。在所有这些预案文件中，我们主要关注 31 个提供了量化目标和财务预算的国家预案。

我们的研究团队从中发现了巨大的机遇。仅这 31 个国家完成可再生能源承诺就需要 4700 亿美元投资，其中近半数投资将用于支持太阳能光伏（solar photovoltaic，简称 PV）项目，40% 将用于风能和水力发电项目。

我们预估计大部分融资都将以债务的形式出现，为银行带来大量机遇，比如满足太阳能光伏发电承诺就需要 1900 亿美元的债务融资。此外，股权投资的空间也很大，实现太阳能和风能的建设目标大约需要 1000 亿美元的股权投资。

由于国家自主贡献预案（NDCs）常常缺乏细节信息，因此，要对“一带一路”地区交通运输领域的潜在投资进行量化更是困难。但是，即便如此，从相关国家的承诺来看，投资机遇也是非常大的。目前，已经有 24 个“一带一路”国家将交通基础设施建设纳入了国家自主贡献预案中，其中包括地铁、公交线路、铁路（高铁和传统铁路）和新建道路等减少交通拥堵的措施。国际金融公司利用另外一种方法论进行的研究显示，从 2016 年到 2030 年，17 个“一带一路”沿线国家交通领域的私营、低碳化投资机遇就高达 2.4 万亿美元。

能源与交通领域的发展已经明确说明：各国在《巴黎气候协定》中的承诺为低碳基础设施领域带来了巨大的投资机会。

环保投资魅力不敌传统能源

中方在填补低碳基础设施投资资金缺口方面或许能够发挥重要作用。中国政府发布的几份重要文件和政策都明确表示，希望“一带一路”投资能够具有环境可持续性。

然而我们发现，中方目前的投资走向与这一愿景并不完全一致。如果要真正为“绿色一带一路”做出贡献，中国的银行和股权基金就必须更加适应，并且更加熟悉海外低碳解决方案投资。只有与相关投资项目所在的“一带一路”国家合作，中国的资金才能更好地服务可持续发展模式。

以下这些数据就非常具有指导意义。从 2014 年到 2017 年，6 家中国银行（包括中国国家开发银行（CDB）、中国进出口银行和“四大”国有银行）参与“一带一路”地区能源与交通领域联合贷款高达 1430 亿美元，其中约有四分之三的资金都流向了石油、天然气和石化行业。而发电行业获得的贷款中，化石燃料电厂占到了半数以上，其中燃煤电厂获得的贷款高达 100 亿美元。

同一时期，中国国家开发银行（CDB）和中国进出口银行还向“一带一路”国家的能源领域提供了 450 亿美元的直接贷款，其中有超过 40% 流向了石油、天然气和石化项目。而在发电行业获得贷款中，燃煤电厂获得的资金最多，大约占到了五分之一。

我们的研究还调查了中国企业的投资。在发电与输电领域，中国企业主要选择投资新建电厂，而不是收购现有电厂。可以说，中国国有企业在化石燃料发电行业投入了巨资；2014 年到 2017 年间对该行业的投资基本上都是化石燃料发电项目。

有意思的是，中国私营企业的表现则完全不同。在这 4 年中，中国私营企业在太阳能光伏和风电领域投下重金，投资额分别达到 70 亿美元和 55 亿美元。然而就投资规模而言，私营企业显然无法与实力雄厚的国有企业相提并论。

中国会抓住这次机会吗？

虽然中国对“一带一路”国家传统能源的投资比例高于新能源领域，但中国的金融机构仍然可以通过几种方式来扭转这一局面。

首先，中国政府应该要求获得政府专项基金的实体在制定投资策略时将国家自主贡献预案纳入考量。世界银行和亚洲开发银行等多边开发银行就已经为我们做出了表率。此外，亚洲基础设施投资银行

> “中国政府发布的几份重要文件和政策都明确表示，希望“一带一路”投资能够具有环境可持续性。然而中方目前的投资走向与这一愿景并不完全一致。”

（AIIB）也表示，支持投资决策与成员国国家能源规划（包括国家自主贡献预案）保持一致。

其次，在分配专项资金时，中国政府还应该要求相关金融机构充分利用自己的比较优势，设计专门解决“一带一路”地区特定绿色融资障碍的工具或基金。比如，在为绿色环保企业提供早期风投资金方面，由中国外汇储备资助的私募股权基金“丝路基金”可能更有优势。

最后，“一带一路”规划沿线各国政府也应发挥作用。“一带一路”各国当局应当充分提升国家自主贡献预案的信息颗粒度和量化信息，这样投资者才能了解政府政策的未来走向和国家基础设施的优先发展领域。从更广泛的角度来看，各国当局应该将国家自主贡献预案纳入该国与所有国际合作伙伴的经济援助与投资对话中。这样才能给银行和其他投资者——比如中方或他国投资者——传递一个明确的信号，那就是这些国家在绿色科技和项目方面具有重大投资机遇。

中方金融机构有能力为这个历史上最大规模的具有气候适应性的可持续基础设施发展提供资金支持。唯一的问题就是他们是否能够抓住这次机会。

本文原载于世界资源研究所

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Will China seize the biggest green opportunity of the coming decade?

There's huge demand for low-carbon infrastructure but lenders need to adapt quickly to meet it

□ Sean Gilbert Wang Ye Zhou Lihuan
Leonardo Martinez-Diaz

To help them prosper in the 21st century, a group of about 70 advanced and emerging economies in Asia, Africa and Europe has planned infrastructure investments worth an estimated US$6 trillion. These countries don't want high-carbon, 20th-century infrastructure. More and more of them are making it clear through their national climate plans that they want modern, sustainable, climate-resilient solutions.

The need to fill this infrastructure gap is one of the most important economic and business opportunities of the century. But who will capitalise on it?

The Chinese government, for one, has made it clear that it wants its financial institutions and companies to play a leading role. In May 2017, the Chinese government pledged US$113 billion in "special" government funds to encourage its banks and enterprises to invest in Africa, Asia and Europe under its "Belt and Road Initiative" (BRI).

China can play a massive role in meeting green infrastructure needs worldwide, but only if it can align its financial flows with low-carbon investments in BRI countries.

Sizing up the opportunity

To understand the scale of the investment opportunity for China, it is helpful to put some numbers on the table. World Resources Institute recently collaborated with colleagues at Boston Universit's Global Development Policy Center to examine BRI countries' national climate plans, or "Nationally Determined Contributions (NDCs)" submitted as part of the international Paris Agreement on climate change. Of all the NDCs, we focused on the 31 that contain quantitative targets and estimated the financing required to meet them.

Our research teams found enormous opportunities. Those 31 countries alone will need about US$470 billion just to implement renewable energy commitments. About half of that would finance solar photovoltaic (PV) projects, and 40% would go to wind and hydropower.

We estimate that much of this financing will be in the form of debt, generating major opportunities for banks, and that meeting the solar PV commitments alone will require as much as US$190 billion in debt financing. There will also be room for equity investors; as much as US$100 billion in equity investments will be needed to meet the solar and wind targets.

Quantifying potential investments in the BRI region's transportation sector proved more difficult, as the NDCs generally lack detailed information. But here, too, the commitments suggest major investment opportunities. Twenty-four BRI countries included transportation

Country commitments under the Paris Agreement are generating substantial investment opportunities in low-carbon infrastructure

infrastructure in their NDCs, including metro and bus lines, railways (both high-speed and traditional) and new roads to reduce congestion. According to an International Finance Corporation study that used a different methodology, private, low-carbon opportunities in the transportation sectors of 17 BRI countries amount to US$2.4 trillion from 2016 to 2030.

In both the cases of energy and transport, the underlying message is clear: countries' Paris commitments are generating substantial investment opportunities in low-carbon infrastructure.

More brown than green

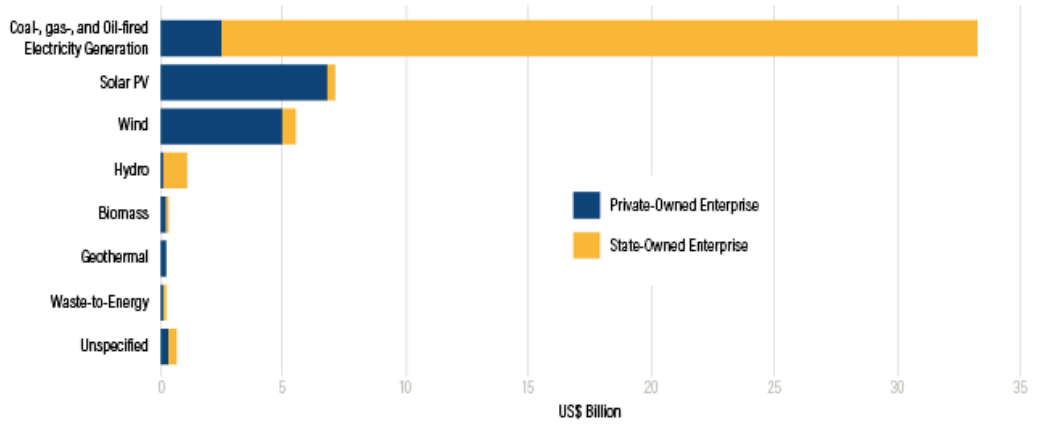
Chinese finance may well play a key role in filling this financing gap. Indeed, the Chinese government has made clear through several high-level documents and policy pronouncements that it wants BRI investments to be environmentally sustainable.

However, we found that the actual flow of Chinese investments so far has not always matched this ideal. Chinese banks and equity funds will have to get considerably more comfortable with – and more adept at – financing low-carbon solutions abroad if they are going to contribute to a "green" BRI. Chinese capital can do much better at financing sustainable pathways, in collaboration with the BRI countries in which the investments will take place.

A few data points are instructive. Between 2014 and 2017, six Chinese banks (the China Development Bank (CDB), the Export-Import Bank of China and the "Big Four" state-owned commercial banks) participated in US$143 billion worth of syndicated loans to the BRI region's energy and transportation sectors. Almost three-quarters of the total volume of this finance went to the oil, gas and petrochemical industries. Of the finance that went to the power-generation sector, more than half financed fossil fuel power plants, including US$10 billion for the coal plants.

Over the same period, CDB and the Export-Import Bank of China also provided US$45 billion in direct loans to the energy sectors of BRI countries. More than 40% of that finance went to oil, gas, and petrochemical projects. Of the loans that went to power generation, coal-fired plants

Greenfield investments and M&As by Chinese corporations in the power generation and transmission sector by ownership in 56 BRI Countries (2014-2017)



received the most lending, about a fifth of the sector's total.

Our study also examined investments by Chinese corporations. In electric power generation and transmission, Chinese enterprises invested mainly in new power plants, rather than in acquiring existing ones. Chinese state-owned enterprises invested overwhelmingly in fossil fuel power generation; virtually all investments in the sector between 2014 and 2017 went to fossil fuel plants.

Interestingly, Chinese privately-owned enterprises behaved differently. They invested heavily in solar PV and wind power, reaching US$7 billion and US$5.5 billion, respectively, over the four-year period. Still, privately-owned firms were no match in terms of financing volume to their much larger state-owned counterparts.

Will China seize the opportunity?

While China's financial flows to BRI countries have been more brown than green, there are a few ways Chinese financial institutions can change course.

For one, the Chinese government should require entities receiving special government funds to consider NDCs when developing their investment strategies. The multilateral development banks, such as the World Bank and the Asian Development Bank, have already started doing this. The Asian Infrastructure Investment Bank (AIIB) has also expressed support for aligning investments with member countries' national energy plans, including NDCs.

When allocating special funds, the Chinese government should also ask the relevant financial institutions to design instruments or funds that address specific green financing barriers in the BRI region in a way that leverages their comparative strengths. For example, the Silk Road Fund, a private-equity fund financed with China's foreign-exchange reserves, may be better positioned than other institutions to provide early venture capital funding to green enterprises.

BRI country governments have a role to play as well. BRI-country authorities would be well-advised to update their NDCs with sufficient granularity and quantitative information, so investors can understand the future path of government policy and national infrastructure priorities. More broadly, national authorities should incorporate NDCs into their economic assistance and investment dialogues with all international partners. This will send a clear signal to banks and other investors – Chinese or otherwise – that their countries offer major investment opportunities in green technologies and projects.

Chinese financial institutions are well-positioned to help finance the largest expansion of sustainable, climate-resilient infrastructure in history. The only question is whether they will seize the opportunity.

This article was first published by the World Resources Institute

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极端天气与气候变化：归因为何重要？

现在我们可以将极端天气与气候变化联系起来，
并用研究结果帮助我们应对这个不断变化的世界。

□ 彼得·斯托特

飓风哈维引发的洪水让美国德克萨斯州化为一片汪洋

随着地球气候变暖，人类面临着越来越多的自然灾害威胁，比如海平面上升、破坏力更强更加频发的风暴、热浪、火灾和干旱等等。当这些事件发生时，人们想要了解它们是否与气候变化有关。

而归因科学就可以帮我们做到这一点。它将观察到的气候变化与自然原因和人为原因联系起来。近年来，归因科学掌握的大量证据表明，气候变化主要受到人为温室气体排放的影响。正如联合国政府间气候变化专门委员会（IPCC）第五份评估报告中所说的那样："人类对气候系统的影响是显而易见的。"

归因科学有力证明了采取减排行动以避免气候变化最坏影响的必要性。社会各界可以利用这类科学信息帮助他们适应即将到来却无法避免的气候变化，并确保建立适当的监管和法律框架。

发展中的科学

2003 年，一场极端热浪席卷欧洲，造成超过 7 万人死亡。正是从这一年开始，人们意识到个别天气事件可能与整个气候变化有关。牛津大学地理系统学教授迈尔斯·阿伦（Myles Allen）由此提出了事件归因的概念，并认为我们有可能计算出因气候变化而导致特定事件的风险累计程度。2004 年，我与迈尔斯以及牛津大学的另外一位同事戴西·斯通（Daithi Stone）共同在《自然》杂志上发表了一篇论文。该论文表明，人类引起的气候变化很可能会使类似于 2003 年热浪天气的风险增加一倍以上。这篇文章就是归因科学的开始。

自此之后，归因科学开始逐步生根发芽。气候学家研究了全球各地的多种天气事件，包括热浪、强降雨、热带气旋和干旱。

中国在归因科学方面也一直处于领先地位，一部分原因还要感谢中英两国科学家之间的“中英气候科学支持服务伙伴关系项目”。该项目的部分研究成果已经被发表在项目的年度报告《从气候角度评估极端事件》中。这份报告对前一年的气候事件进行归因。例如，由中国国家气候中心孙颖女士领导的一个中英合作研究项目发现，人为影响导致中国东南部地区发生 2017 年 6 月的那场极端降雨几率增加了一倍，这场降雨引发的严重洪灾最终造成 1000 多万人受灾，38 人死亡，约 80 万人被迫搬迁。

归因科学的迅速发展引发了关于其未来潜力的三个关键问题。这门科学的可靠性如何？哪些方面还需要改进？以及如何实现结果产出的快速化和常规化？

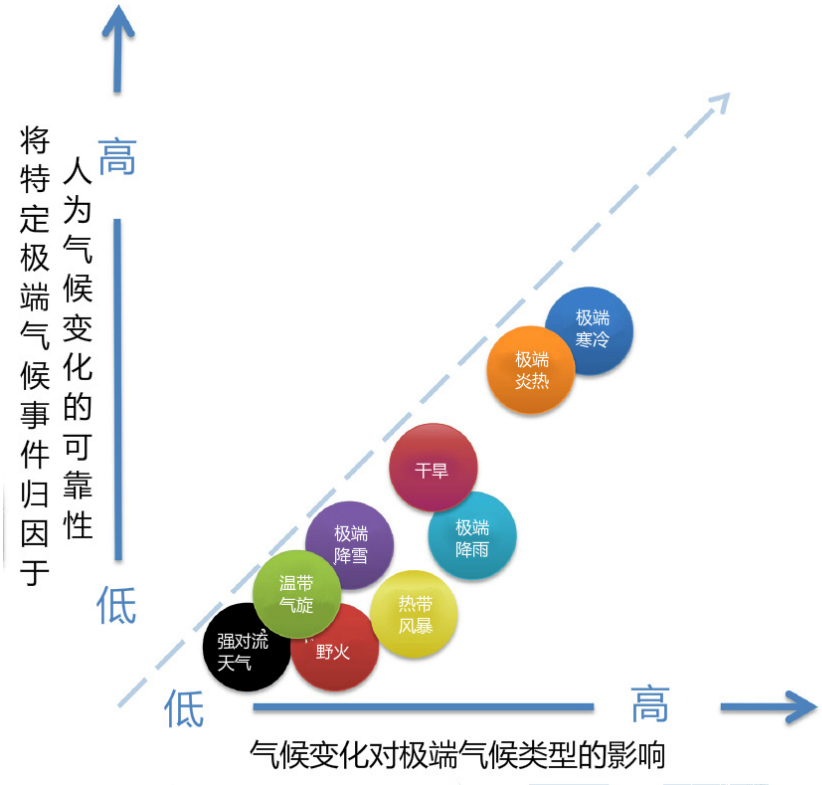
事件归因科学的可靠性如何？

模型是所有事件归因评估的基础。计算“人类活动未改变气候”这种反事实情况也需要首先建立模型。典型的做法就是考虑自然和人为两种情况对气候的影响，通过多次运行模型，模拟当前高水平温室气体浓度下的气候状况。再将结果与另一种只考虑自然因素的模型模拟结果进行比较，比如考虑进去太阳辐射输出的变化或火山爆发导致的气候效应等的模型。当然，这些模型中还会包含自然气候的可变因素，比如厄尔尼诺南方涛动现象导致的太平洋水温变化和对全球地表温度的影响。

但是，这些模型能否完全代表观察到的现实呢？ 2016 年，美国国家科学院召集了一个由气候学家和统计学家组成的独立专家小组，对事件归因模式的有效性进行评估。专家小组给出的结论是：“对于人为造成的气候变化在多大程度上影响了某类特定事件发生的量级或可能性，现在事件归因通常能对此进行定量陈述并作出辩护。”

美国国家科学院的报告得出的结论是，归因科学在分析与温度相关的极端事件方面的置信水平是最高的，其中对极端高温和寒冷天气的分析最令人折服，其次是水文干旱和强降水，而对强对流风暴和温带气旋的预测置信水平最低。

置信水平较低与模型表达极端事件形成过程的能力有关。虽然气候模型通常可以可靠地表现较大区域温度的变化和可变性，但当遇到强对流风暴天气的降雨强度等其它类型气候事件时，气候模型的作用



数据来源：NAS，2016

可能就有些捉襟见肘。这是因为它不具备解析此类气候事件形成过程的空间分辨率和时间分辨率。

哪些方面需要改进?

事件归因的目的就是提高我们对气候过程及其在气候模型中表达形式的了解。这包括提高模型的空间表述性，使模型能够涵盖更多的天气过程。还包括提高模型与观测结果的对比能力，比如评估模型在多次发生此类事件时重现天气事件演变关键特征的能力。

正如美国国家科学院的报告指出的那样，长期观测记录的进一步发展也能使模型得到完善。此外，正确构建归因问题也很重要。例如，某个归因研究可能会考虑气候变化如何在厄尔尼诺现象发生时对某场特定的洪水产生影响。这就要求反事实模型要明确与厄尔尼诺现象相关的海面温度模式，从而通过这种形式将厄尔尼诺现象考虑进去。相比于不考虑厄尔尼诺现象而单纯研究气候变化对洪水风险的影响，这样的研究结果可能会不同。两种类型的归因研究可能都具有价值，但两者之间需要明确沟通以避免混淆。

如何更快产出结果?

公众和媒体总是对极端天气事件与人为气候变化之间的联系非常感兴趣。目前，事件归因科学已经可以针对近期发生的这些极端天气事件，至少是极端温度事件进行可靠评估。这些评估可以借鉴同行评审的方法，但不是说每个单独的评估都要经历一个冗长的过程，这种评估不见得应该比一个天气预报花费更久的时间。

通过补充气候监测和预测，定期更新气候变化如何改变最近极端天气事件的概率和程度的信息，归因评估有可能成为常规气象服务的一部分。

但是，关于哪些天气事件需要纳入这类活动，我们还要仔细考察。正如美国国家科学院报告提到的那样，不同类型天气事件在归因评估中的置信水平是不同的。诸如强对流风暴这类置信水平低的事件，仍应该进行经过同行评议的研究，并且很有可能短期内不会被纳入常规气候服务评估中。但随着气候科学的发展，以及气候评估模型的完善，更多极端事件将被更确切地、更经常地就自然和人为原因进行归因。

展望未来

归因科学评估极端天气事件与气候变异和变化相关程度的能力在提高。但是科学上的不确定性仍然存在，而且我们仍然无法对所有极端天气事件做出有力的归因陈述。 但是，极端天气事件在全球范围内发生的频率和强度都在明显增加。对于一些极端事件（包括长时间大范围的温度相关事件）的风险在多大程度上受到人为排放的影响，我们越来越有可能得出有力的结论。这些信息对于减缓和适应气候变化，提出相关气候诉讼都将具有重要价值。

彼得·斯托特，英国气象局哈德利中心气候监测和归因团队的负责人，同时担任埃克塞特大学教授一职

Why the science of extreme weather attribution matters

Linking climate change with heatwaves, storms and other events can help us prepare for a changing world

□ Peter Stott

As the earth's climate warms, people face mounting threats from rising seas, and more intense and frequent storms, heatwaves, fires, and droughts. When these events hit, people want to understand whether they are connected to climate change.

The science of attribution can do this. It links observed changes in climate to natural and human-induced causes. In recent years, it has amassed a wealth of evidence to show convincingly that these changes are dominated by the effects of human-induced greenhouse gas emissions. As the IPCC concluded in its Fifth Assessment Report: "Human influence on the climate system is clear".

Attribution science has been key to demonstrating the need for action to reduce emissions in order to avoid the worst effects of climate change. Societies can use such information to help them adapt to the inevitable changes in the climate coming our way, and ensure that suitable regulatory and legislative frameworks are put in place.

Human influence doubled the chances of the extreme rainfall in south-eastern China in June 2017, when floods affected more than 10 million people.

A developing science

The realisation that individual weather events could be linked to climate change came in 2003 when a devastating European heatwave was estimated to have killed more than 70,000 people. Myles Allen, professor of geosystem science at Oxford University, proposed the concept of event attribution, arguing that it would be possible to calculate the increased risk of a particular event due to climate change. The following year, I published a paper in Nature, co-authored by Myles and another Oxford colleague, Daithi Stone, which showed that human-induced climate change had very likely more than doubled the risk of such a heatwave.

This science has since burgeoned. Climate scientists have studied a wide range of weather events around the world, including heatwaves, heavy rainfall events, tropical cyclones and droughts.

China has also been leading, thanks in part to the Climate Science for Service Partnership - China project, a collaborative partnership between UK and Chinese scientists. Some of the results have been published in the annual reports, "Assessing Extreme Events from a Climate Perspective", which attribute events from the previous year. For example, a collaborative China-UK study led by Ying

Sun of the China Meteorological Organisation has shown that anthropogenic influence roughly doubled the chances of the extreme rainfall in south-eastern China in June, 2017, when heavy floods affected more than 10 million people, with 38 dead and about 800,000 people forced to relocate.

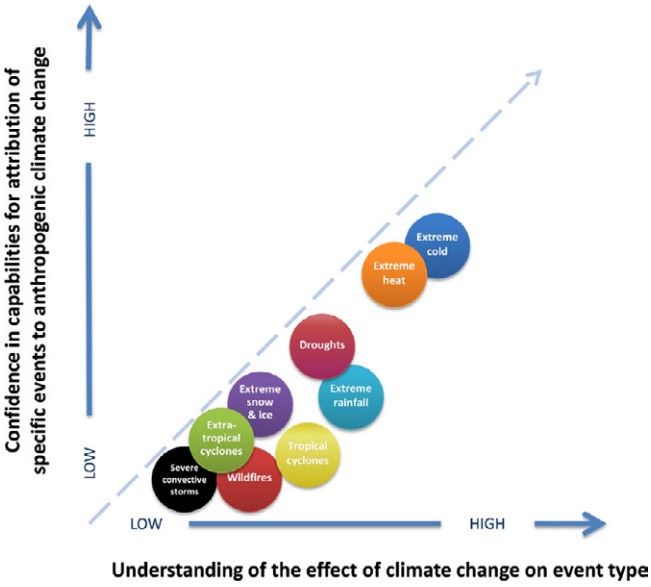
The rapid development of attribution science has raised three key questions concerning its future potential. How reliable is it? What aspects of the science need to be improved? And how quickly and routinely can results be produced?

How reliable is event attribution science?

The basis of all event attribution assessments is a model. This is needed to calculate the counter-factual situation in which human activities had not changed the climate. A typical approach is to run a model many times to simulate the current climate in which greenhouse gas concentrations are at today's elevated levels, taking account of natural and anthropogenic influences on the climate. The results are then compared with alternative simulations in which the climate model includes only natural factors, such as changes in solar output or the climatic effects of volcanic eruptions. These models also include natural climatic variability, such as changes associated with the El Nino Southern Oscillation phenomenon by which temperatures in the Pacific Ocean vary and influence global surface temperatures.

But can these models reliably represent observed reality? In 2016, an independent expert panel of meteorologists and statisticians was convened by the National Academies of Sciences (NAS) in the United States to assess the capability of event attribution. They concluded that "It is now often possible to make and defend quantitative statements about the extent to which human-induced climate change has influenced either the magnitude or the probability of occurrence of specific types of event or event classes".

The NAS report found that confidence is greatest for extreme events related to an aspect of temperature, being highest for extreme heat and cold events, followed by hydrological drought and heavy precipitation. They found



Source: NAS, 2016

lowest confidence for attribution of severe convective storms and extratropical cyclones.

The reason for lower confidence is related to the ability of models to represent the processes involved in the formation of the extreme events. Whereas climate models can typically represent changes and variability in temperature over large regions very reliably, they can struggle with other types of event, for example, representing the intensity of rainfall in severe convective storms. This is because they do not have the spatial and temporal resolution to resolve the processes involved.

What needs to be improved?

The aim of event attribution is to improve our understanding of climate processes and their representation in climate models. This includes increasing the spatial representation of models so they incorporate a wider range of weather processes. It also includes improving the capability to compare models with observations, for example by assessing the ability of models to replicate key features of the evolution of weather events over many occurrences of such events.

As the National Academies of Sciences report pointed out, improvement will also come from the further

development of long observational records. It's also important to frame the attribution question correctly. An attribution study might for example consider how climate change has affected a particular flood in the presence of El Nino. This would require the counterfactual model simulations to also include an El Nino by specifying the pattern of sea surface temperatures associated with the phenomenon. This may give different results to a study that evaluates the effects of climate change on flood risk irrespective of whether there was an El Nino or not. Both types of attribution study may have value but both need to be clearly communicated to avoid confusion.

How quickly and routinely can results be produced?

During an extreme weather event there is often considerable public and media interest in the link with human-induced climate change. Event attribution science can now deliver robust assessments of very recent events, at least for extreme temperature events. These can draw on peer-reviewed methodologies but each individual analysis does not necessarily need to go through such a lengthy process any more than an individual weather forecast needs to.

There is potential for attribution assessments to become part of the regular production of climate services, by complementing climate monitoring and prediction with regular updates on how climate change is altering the probability and magnitude of recent extreme weather events.

However, caution will be needed in which types of weather event are incorporated into such activities. As the National Academies of Sciences report pointed out, confidence for different types of weather event differs. Low confidence events such as severe convective storms will still be studied in peer-reviewed publications, and it is likely to be some time before such events are routinely included in regular climate service assessments. But as climate science develops, and as climate models improve, a wider range of extreme events will be robustly and regularly attributed to natural and human-induced causes.

Moving forward

Attribution science has developed the capability to assess the extent to which extreme weather events are linked to climate variability and change. Scientific uncertainties still remain and it is not possible to make robust attribution statements about all extreme weather events. But it is clear that such events are increasing in frequency and intensity globally. It is also increasingly possible to draw robust conclusions about the extent to which the risks from some extreme events, including large-scale long-lasting temperature-related events, have been affected by human-induced emissions. This information could be of great value for informing climate mitigation, adaptation and litigation.

Peter Stott leads the climate monitoring and attribution team at the UK Met Office Hadley Centre and is a professor at the University of Exeter.

中国土壤污染治理将有法可依

2019 年开始实施的《土壤污染防治法》，将开启中国土壤治理的新时代吗？

□ 王 晨

广东省贵屿镇，粉碎过程中产生的墨盒污泥

两年多前的“常州毒地”事件曾让中国公众猛然意识到土壤污染的环境健康风险。长久以来无法可依的状态，使中国土壤安全问题成为悬在中国社会头顶上的“达摩克利斯之剑”。但中国土壤污染治理将随着《中华人民共和国土壤污染防治法》（以下简称《土壤法》）在 2019 年 1 月 1 日的正式实施而翻开新的一页。

在 2016 年的《土壤污染防治行动计划》（以下简称“土十条”）的防控思路基础上，这部效力等级更高的法律细化明确了责任人制度，并体现了预防为主和风险防控的原则。尽管还需要更多的细则出台以保障新法的有效执行，但它已为土壤治理提供了明确方向，被认为是防止类似“常州毒地”污染事件再次发生的一道屏障。

> 《土壤法》的一大亮点是提出污染防治基金机制。在政府资金不到位而污染责任一时难以认定时，基金制度或将成为保证污染得到治理的一道保险。

土地污染，沉疴痼疾

近 10 年来，土壤问题在中国集中爆发。中国科学院地理科学与资源研究所环境修复中心主任陈同斌研究员在此前接受采访时介绍说，不同于大气和水污染，土壤问题隐蔽性高，“潜伏期”长，污染问题从产生到爆发会间隔数年甚至十数年，治理难度与代价也很高。

以“常州毒地”事件为例，处于争议中心的污染地块是由当地的老化工厂和农药厂在数十年跨度内产生的，因土壤修复过程中的二次污染对周边居民造成伤害。危害爆发时，造成污染的企业早已改制重组并整体搬迁，导致无法追究责任人。

环保组织自然之友总干事张伯驹说：“土壤污染最不引人注意，却又经常造成污染事件，因为它和人的健康、食品安全等有非常强的关系。”

土壤问题的堆积，和中国改革开放 40 年来长期粗放的经济发展方式、工矿产业居高不下的污染物排放量、农药化肥的使用等关联密切。2014 年 4 月，当时的环境保护部联合国土资源部发布的《全国土壤污染状况调查公报》指出，全国土壤环境状况总体不容乐观，部分地区土壤污染较重，耕地土壤环境质量堪忧，工矿业废弃地土壤环境问题突出。

严峻的土壤污染问题背后，是一系列现实的问题：如何防止问题进一步恶化，如何治理面积广泛而隐蔽的污染，谁来承担治理责任，治理费用从哪里出，采用何种技术进行土壤修复…… 在“常州毒地”案中，上述问题也集中出现：原污染企业搬迁、土壤修复工程操作不当、环境评估报告存在严重瑕疵。《土壤法》能否为这些问题提供解决方案，是其能否扭转土壤污染局面的关键

明确主体责任

“过去土地使用方对土壤保护和修复的意识很薄弱。项目建设前的环境影响评价通过，基本上就可以高枕无忧了。“自然之友法律与政策倡导总监及环境律师葛枫告诉中外对话，“生产和开发过程中造成土壤污染的责任是缺乏认定依据的，土地的使用方经常可以污染却不担责。”

《土壤法》通过明确土壤污染防治过程中的责任义务，来规范用地过程以及落实被污染土地的修复治理追责。

在新法中，土地污染责任主体被细致地划分为十三类，包括污染排放者、建筑物和工业设施的拆除者、尾矿库的运营、管理者、农药化肥的生产者、销售者和使用者、土壤修复施工单位、土地使用权人和地方政府等。每一类都被分配了相应的法律责任。在主体有争议时，《土壤法》将不同性质土地的责任认定工作落实到了相关部门。

被污染的土地能“债有主”，未被污染的地块则分别由监督管理部门与即将使用开发地块的责任主体承担污染风险。土地使用方需要在使用前进行污染风险评估，在使用过程中避免可能产生污染的活动，在实施修复活动中确保不会造成污染扩散。

管控风险

新的《土壤法》将“预防为主、保护优先”的治理原则写进了法律。

中国环境修复网执行主编高胜达告诉中外对话，“污染源没有被切断，盲目进行修复或者生产建设都是不科学也是不经济的。”

同时，新法规定，各级政府部门有责任制定和更新包括土壤有毒有害物质、土壤污染重点监管单位、建设用地土壤污染风险管控和修复等几类名录。张伯驹说打了个比方，“首先得知道家底儿是什么，才能着手治理。”

《土壤法》也继承了“土十条”的分类施策原则，根据污染程度和土地用途将农用地和建设用地分为几个类别，每个类别的管理措施不同。对未污染和已污染的土壤实施区别对待，分别提出保护、管控及修复的针对性措施。

生态环境部土壤司副司长钟斌在访谈中表示，土壤和大气不同，后者无法进行完全隔离。而对受污染的地块，在完全治理不具有经济可行性的时候，可以采用风险管控措施，避免它们通过农产品等途径影响人类健康。

新法落地前，生态环境部曾在今年 7 月联合国家市场监督管理总局陆续发布了农用地、建设用地土壤污染风险管控标准，为监测、实施、监督工作提供具体标准和要求。包括“受污染耕地治理与修复导则”在内的其他标准的制定工作也已经进入征求意见的阶段。

“超级基金”在中国落地?

面对大量需要治理的污染土地，中国面临资金投入不足的问题。中国土壤修复资金投入在环保产业占比不到 1%。而土壤污染责任主体认定的复杂性导致修复资金“钱该谁出”的问题成为了困扰。新法的一大亮点是提出污染防治基金机制。在政府资金不到位而污染责任一时难以认定时，基金制度或将成为保证污染得到治理的一道保险。

《土壤法》将在中央和省级层面设立土壤污染防治基金，用以治理农业用地土壤和无法认定责任人的污染地块。

“虽然污染防治基金制被写进这部法律里，但具体制度还有待研究。”高胜达表示。

在毒地治理经验丰富的美国，“超级基金”（Superfund）的存在使得全国范围内的污染场地治理能够有序地开展。该基金中的资金来自于财政拨款、向可能污染土壤的化工原料和行业征收的税费以及向负有环境损害责任的公司或个人追回的罚款。

目前《土壤法》并未对防治基金的资金来源做明确说明。而关于资金的管理办法，新法规定将由国务院财政主管部门会同生态环境、农业农村、自然资源、住房城乡建设、林业草原等主管部门制定。

基金制度对于农业用地的污染治理将是一个好消息。中国科学院日前公布的最新研究结果显示，中国粮食主产区耕地土壤重金属点位超标率为 21.49%，其中重度污染比重为 5.02%，几大主要粮食产区无一幸免。依靠农产品产生的收益无法支持农用地修复巨大的资金需求。基金制度有可能填补农用地治理方面的部分资金缺口。

信息透明化信号

信息不公开是导致中国土壤污染严重性长久不为公众所知的重要原因。2005 年环境保护部会同国土资源部开始了历时八年的首次全国土壤污染状况调查。但环保部一度以“国家秘密”为由拒绝公开相关调查方法和数据信息。这次预算高达 10 亿人民币的调查，因为迟迟不公布调查数据而曾饱受诟病。

《土壤法》规定将“建立土壤环境信息共享机制”，“公众参与”也被囊括进了基本原则，土壤污染信息和公众之间的壁垒或将被推倒。

新法同时规定每十年至少组织开展一次全国土壤污染状况普查。生态环境部土壤司副司长钟斌在访谈中表示普查信息将依法公开。但他同时也提到，出于预防人为干扰普查结果的考量，具体点位信息一般不予公开。

主管官员的表态显示，中国治理土壤污染的努力，势必还会面对很多复杂的情况。但是德国图宾根大学地球科学学院学者曹左男认为：“从无到有，本身就是一大突破。《土壤法》能够为国内土壤污染的防控及治理翻开新的一页，是很值得期待的。”

王晨，中外对话编辑助理

Can China's new soil pollution law reverse decades of harm?

It's been hailed as a 'breakthrough' but the law will be complex and costly to implement

□ Wang Chen

When students at the new Changzhou foreign language school started complaining about headaches and skin problems in 2016, the contamination of the local soil would soon become one of China's most high profile scandals. The students fell ill when the effort to remediate soil polluted by a chemicals factory spread it further afield.

There's no law governing soil pollution in China but a string of high profile pollution cases over the past decade has spurred the government to act.

On 1 January the Law on the Prevention and Control of Soil Pollution will come into effect. This is a stronger version of a 2016 soil pollution action plan. It includes more detail on holding soil polluters accountable and adopts a protection-first and polluter-pays approach. Additional rules on implementation will be needed if the law is to be effective, but it has clarified the government's approach to soil management and should prevent another scandal like that in Changzhou.

Soil pollution is connected with intensive mining and use of fertilisers during four decades of rapid economic growth.

An invisible problem

Unlike water and air pollution, soil pollution is often invisible and decades can pass between when the pollution occurs and the problem becomes apparent, says Chen Tongbin, director of the Centre for Environmental Remediation at the Chinese Academy of Sciences' Institute of Geographic Sciences and Resources Research.

In the Changzhou case, the land was formerly used by companies manufacturing chemicals and fertiliser. By the time the pollution was detected, the original firms had long since been restructured and merged with others and moved to other sites, making it impossible to identify who was responsible.

The company that did the remediation planned to remove the polluted soil and replace it. However, the removal process was botched, releasing toxic chemicals trapped in the soil in the form of noxious gases.

"Soil pollution gets the least attention, but results in frequent scandals, as soil is closely linked to human health," says Zhang Boju, secretary-general of environmental group Friends of Nature.

The accumulation of soil pollution is connected with intensive mining and use of fertilisers during four decades of rapid economic growth.

In April 2014, the Ministry of Environmental Protection and the Ministry of Land and Resources jointly published a national soil survey. It concluded that China's soil environment was not good, with serious pollution in some areas, worrying environmental quality of arable land, and particular issues with pollution of former mining and industrial sites. According to the survey, 16.1% of soil samples collected from around the country showed evidence of pollution.

The problem will be complex and costly to deal with. The government must consider how to stop soil quality worsening, and tackle pollution that is both hidden and spread over vast areas. It must also clarify responsibility for cleaning it up, decide where the money will come from to do this, and what technologies should be used.

These problems were perfectly illustrated by the situation in Changzhou: the original polluters had moved on, inappropriate remediation techniques were used, and the environmental impact report was deeply flawed. The new soil law must solve these issues if it is to make a difference.

Who is responsible?

"In the past, the people using the land had very little awareness of soil protection and remediation. Once a project's environmental impact assessment was accepted you could rest easy," says Ge Feng, an environmental lawyer and director for legislation and policy advocacy with Friends of Nature.

"There's no basis on which to assign responsibility for pollution arising during production and development, and usually whoever is using the land can pollute it without any consequences," adds Ge.

The new law should change this as it clarifies responsibility for the prevention and management of soil pollution. The law establishes 13 types of responsible party, including those demolishing buildings or industrial facilities; operators and managers of mine tailing ponds; the producers, retailers and users of fertiliser; soil remediation firms; land owners and local government. Each has its own legal responsibilities. If there is dispute over who is responsible in a particular case, the new law allows relevant local government departments to make a determination.

The law stipulates that a pollution risk assessment must be obtained before a site is used.

In this way, a responsible party can be identified when soil is polluted, and the risks of potential pollution when a site is to be developed are to be shared between regulators and the developer. The law stipulates that a pollution risk assessment must be obtained before a site is used. Polluting activities must also be minimised when land is in use, and remediation must not cause secondary pollution.

Risk management

The new law puts prevention and protection first. Gao Shengda, executive editor of China Remediation, an environmental remediation website, says: "If sources of pollution aren't shut down, it is neither rational nor economic to blindly press ahead with remediation, production or construction."

The new law also makes local governments responsible for creating and maintaining lists of soil pollutants, key soil pollution regulators, and construction and remediation risks with specific sites. As Zhang says: "You've got to know what the problems are before you can tackle them."

The new law continues with the action plan's method of categorisation, with both agricultural and building land divided into several types, each managed differently, according to the degree of pollution and nature of land use. Unpolluted and polluted land are treated differently, with targeted measures to either protect, control or remediate, as appropriate.

Zhong Bin, deputy head of the Ministry of Ecology and Environment's (MEE) soil department, said in an interview with Chinese news site thepaper.cn that polluted soil can be sealed off, unlike polluted air. If polluted sites cannot be

economically restored, a risk management approach can be taken to prevent pollution affecting human health through agricultural products or other routes.

In July, the MEE published standards for management of pollution risks on agricultural and building land, in cooperation with the State Administration for Market Regulation, providing specific requirements for the monitoring, use and supervision of these sites. Consultation drafts of other standards, including regulations for the management and remediation of polluted arable land, are in circulation.

A Chinese superfund?

But funding to clean up so many polluted sites is not in place – spending on soil remediation in China accounts for less than 1% of the environmental protection sector as a whole. Though the new law will make it clear who is responsible for paying for future pollution to be cleaned up, there are many existing sites where responsibility cannot be determined.

These funds will be set up at both central and provincial level, to tackle pollution of agricultural land and sites. However, although the fund mechanism is included in the law, further work is needed to determine how it would function Gao points out.

In the United States, which has ample experience of managing polluted sites, a "superfund" is used to ensure remediation is carried out. It is funded by the government, via a tax on potentially polluting firms and fines imposed on companies or individuals found to have harmed the environment.

The new law does not say where the money for the funds will come from, but that rules for the management of the fund will be produced by the State Council in cooperation with the ministries and authorities governing environmental protection, agricultural and rural issues, natural resources, housing and construction, and forestry.

Such a fund would be good news for the remediation of agricultural land. Recent research from the Chinese Academy of Sciences shows that 21% of points tested on China's grain growing land had excessive levels of heavy metals, with 5% classed as heavily polluted, and not one key grain-producing area free of all pollution. Agriculture does not bring in enough money to cover the huge costs of cleaning up that soil, but the fund could make up the shortfall.

Transparency signals

A lack of transparency meant that in the past, the Chinese public remained unaware of serious and long-standing soil pollution issues. In 2005, the Ministry of Environmental Protection and the Ministry of Land and Resources started an eight-year nationwide survey of soil pollution – only for the MEP to refuse to release the data and methodology used, describing them as "state secrets". The survey cost one billion yuan (US144 million) and the failure to publish the data has come in for fierce criticism.

The new law will see the creation of a system for sharing soil environmental information. This may finally make information on soil pollution available to the public.

National surveys of soil pollution will become regular events as the new law requires one at least every decade. Zhong Bin told thepaper.cn that the findings of the surveys would be made public. But he also pointed out that the location of specific testing sites will not be revealed, to prevent interference with the survey through site-specific remediation.

These comments from an official responsible for soil pollution indicate that China's efforts to tackle the problem face complex challenges. But Cao Zuonan, of the Department of Geosciences at the University of Tuebingen in Germany, said: "Just the existence of the law is a breakthrough. It's a new start for the prevention, control and remediation of soil pollution in China and worth looking forward to."

Wang Chen is one of our junior researchers on our Beijing editorial team.

中国北方清洁供暖的“平衡术”

今年的供暖季，中国如何平衡经济发展、环境保护与民生保障之间的关系？

□ 冯 灏

直径有半米的热水管被高高地架起来，将热水从发热站通往西北旺的各家各户

午后三点，七十岁的李爱英（化名）和朋友坐在位于北京西北郊区韩家川村口聊天。11 月中旬，北京午后的气温不过 10 摄氏度。老人们从上到下包裹得很严实。“家里已经穿不了这么多了，单衣单裤就行。”李爱英说。

今年韩家川村从 11 月 7 日就开始试供暖，比北京正式供暖日期 15 号提早一周。从去年开始，韩家川村陆续拆掉了村民家里的燃煤取暖设备，开始像城市一样集中供暖。直径有半米的热水管被高高地架起来，将热水从建在西北旺镇的电发热站通往各家各户，有数公里。李爱英感叹说：“今年不用买煤烧煤，我们省事儿多了。”

“供暖季”是中国北方特有的集中供应暖气的时期，从入冬到第二年天气转暖，时间长短不一。随着中国公众对空气质量越来越关注，“供暖季”也成为了让人担忧的日子。长期以来满足城乡居民和工业生产的能源供应以燃煤为主，因此供暖季往往伴随着空气污染。以北京为例，2010-2014 年的五年间，冬季采暖季比非采暖季 PM2.5 浓度高 50% 以上。平衡供暖季的采暖需求

和空气质量成为中国决策者面对的难题。

向污染宣战

2013 年，中国政府开始向雾霾宣战，要求到 2017 年，包括北京在内的重点城市和区域空气污染显著下降。2017 年，达标进入倒计时前夕，北方迎来了史上最大规模“煤改气”行动，力保空气质量。以北京为例，全市 336 个村、14 万余户农村居民告别燃煤。与此同时，“最严停工令”也全面执行，11 月 15 日至次年 3 月 15 日的供暖季四个月期间，石家庄、唐山、邯郸、安阳等重点城市钢铁产能限产 50%；电解铝厂限产 30% 以上；氧化铝企业限产 30% 等。

治霾雄心有了成效，2013 年立下的五年目标在 2017 年顺利实现，京津冀、长三角、珠三角等重点区域 PM2.5 平均浓度比 2013 年分别下降 39.6%、34.3%、27.7%。

但是操之过急的空气治理措施也造成了问题。煤改项目在一些地区造成了供暖不足和“气荒”，大规模的“限产”措施也使不少企业陷入生存困境。中国不得不开始考虑更加灵活的政策工具，以平衡经济发展、环境保护与民生保障之间的关系。

煤改项目的困境

“就是因为改气，你知道有多少老头老太太的生活受到影响吗？”河北鹿泉区石井村村民李森林（化名）在今年夏天的一次访谈中表达了他对煤改气的意见，“这些平日里独居的老人不能用熟悉的煤炉生火做饭，也没人教他们怎么用天然气。有人操作不当伤着了自己，不敢动气的大冬天就只能吃冷食”。

由于缺少足够的时间规划，石井村通气设备在 2017 年冬天没有时间埋设在地下，空中走管造成了安全隐患，尤其是对独居的老人。

去年，媒体也曾广泛报道中国北方不少地区因为没有在入冬前完成煤改，取暖受到影响。 在陕西农村的一些学校中，因为燃煤锅炉被拆除，而天然气管道不能及时接入，在校师生无法取暖。山西临汾设置了 155 平方公里的“禁煤区”，居民不仅被要求拆掉燃煤锅炉，并且家中不能留散煤，但是在气温普遍零度以下的情况下居民家里迟迟没能迎来暖气。而李爱英所在的北京韩家川村也经历了取暖季后二十多天内没有供暖的窘境。

吸取去年的教训，2018 年 9 月生态环境部正式公布的《京津冀及周边地区 2018-2019 年秋冬季大气污染综合治理攻坚行动方案》强调“先立后破”，对以气代煤、以电代煤等替代方式，在气源、电源未落实情况下，原有取暖设施不予拆除。此外，各地完成散煤替代户数不再提前制定好目标，而是按照实际情况上报。2018 年 7 月国务院发布的《打赢蓝天保卫战三年行动计划》中也提到“确保北方地区群众安全取暖过冬”。这个冬天温暖不再盲目让位于清洁。

供暖与公平

中国计划淘汰北方农村家庭普遍使用的劣质散煤的历史可以追溯到 2016 年 7 月中国工程院发布“大气十条”中期评估之后。该评估报告认为，散煤对京津冀秋冬季的重污染贡献巨大。而在煤改电、煤改气之间，大多数地方政府选择了天然气，因为前者成本较高，且电力供暖改造将给电力基础设施带来难以承受的额外压力。

但大范围的煤改气增加了天然气的需求，在去年冬天引发了严重的气荒。今年，煤改气还在持续推进。由于供需之间仍存巨大缺口，天然气价格不得不做出调整。五月，国家发改委发布允许居民用气的价格在 20% 以内上浮，发改委负责人解释说，调整是由于居民用气平均门站价格低于供应成本。文件一出，各地气价应声上涨。

中国人民大学经济学院副院长、能源经济学教授郑新业表示，能源价格上涨、市场化，冲击的是最低收入人群。北方大部分地区已经对于城镇低收入群体和农村“煤改气”家庭，采取了发放补助、提高最低生活保障标准等措施。但是，各地财政补贴的

> 中海油研究总院规划研究院综合规划资深工程师许江风认为，中国对天然气的需求量大，集中购买往往刺激气价的反弹。

意愿和能力大不相同。以北京西北旺镇为例，分户取暖的住户补贴标准达到了最高每年 360 元 / 平方米。李爱英说去年冬季的采暖支出和往年烧煤基本没有区别。而这样的高水平补贴在经济欠发达地区难以实现。中国城镇供热协会副理事长刘荣认为，资源不平衡是清洁供热推进过程中很明显的问题。

“河北就非常羡慕北京，煤改气后，倾全国之力先保北京，但河北禁止燃煤后有多少燃气资源？”刘荣说。

天然气供应的内忧外患

成功推广“煤改气”的前提是有气。中国天然气的对外依存度高达 39%，近年来，天然气的产量及增量更是远远满足不了国内不断增长的用气需求，因此，地方上有多少燃气资源可分配，还要取决于国际市场。

国际市场的供应不容乐观。随着中美之间的贸易摩擦升级，两国互加关税。彭博船运数据显示，美国销售到中国的液化天然气（LNG）从 2018 年 5 月的近 40 万吨降至 7 月的仅 13 万吨。随着中国宣布对从美国进口的 LNG 加征 25% 的关税，进口美国 LNG 进一步失去竞争力。

由于购销价格谈不拢，中国与世界头号天然气出口国俄罗斯之间的中俄西线供气项目“马拉松式”谈判也时断时续。独立能源研究咨询机构水石能源创始人张柳潼认为，因为大部分的长期协议还没有谈好，中国主要的天然气供应来源中亚市场也可能再次出现“意想不到的”破坏因素，“非常有可能的情况是，在中国最需要天然气的时候，天然气供应突然中断”。中海油研究总院规划研究院综合规划资深工程师许江风认为，中国对天然气的需求量大，集中购买往往刺激气价的反弹。

另一个瓶颈在于基础设施。国家能源局石油天然气司副司长李英华在 2018 年 8 月的一个论坛上表示，中国天然气管道里程仅有 7.4 万千米，相当于美国的 15%，而由于天然气通行的“道路”不够长，导致管网负载程度是美国的两倍。天然气存储设备也有很大的缺口，中国地下储气库只有全国表观消费量（当年产量加上净进口量）的 3.2%。与去年相比，今年 LNG 终端实际增加的额外接收能力非常有限。李英华认为中国天然气供应紧张的局面在近几年内是没有办法缓解的。

“国有石油公司现在什么也做不了。”张柳潼说，“唯一积极的事情是，目前现有的 LNG 储气设施是装满了的，可以对冲 1~2 周冬季的尖峰需求。

“限产”松绑

今年北方冬季雾霾治理还面临另一个复杂因素。

去年的“最严停工令”曾让重工业企业叫苦不迭。而生态环境部九月印发的《京津冀及周边地区 2018-2019 年秋冬季大气污染综合治理攻坚行动方案》表明，今年的限产将更具灵活性。方案没有规定统一的、强制性的产能限制比例，而是由地方根据排放标准打分，实行差别化错峰生产。

禁止“一刀切”无疑是手段上的进步，但给大气治理带来了更大压力。地方为了兼顾经济发展和空气治理，可能会加大煤改电、煤改气方面的努力。

艰难的平衡

本月中旬，刚刚进入供暖季的北京又遭遇了入冬以来最大的雾霾天气，城区 PM2.5 浓度数日超过 300 微克 / 立方米 . 并启动空气重污染黄色预警。媒体评论说，蓝天不应该是应急措施之下的临时用品，“治霾工程还任重道远，不能好了伤疤忘了痛，甚至只是’减缓’一下疼痛，就忙着叫’停药。”公众对蓝天的渴望不减，供暖与治污之间的张力势必会持续存在。

西北旺的韩家川村，雾霾给村中笼上了一层灰白。村民戴上了口罩，在雾霾中接送孩子上下学，父母隔着厚厚的口罩和孩子聊天。

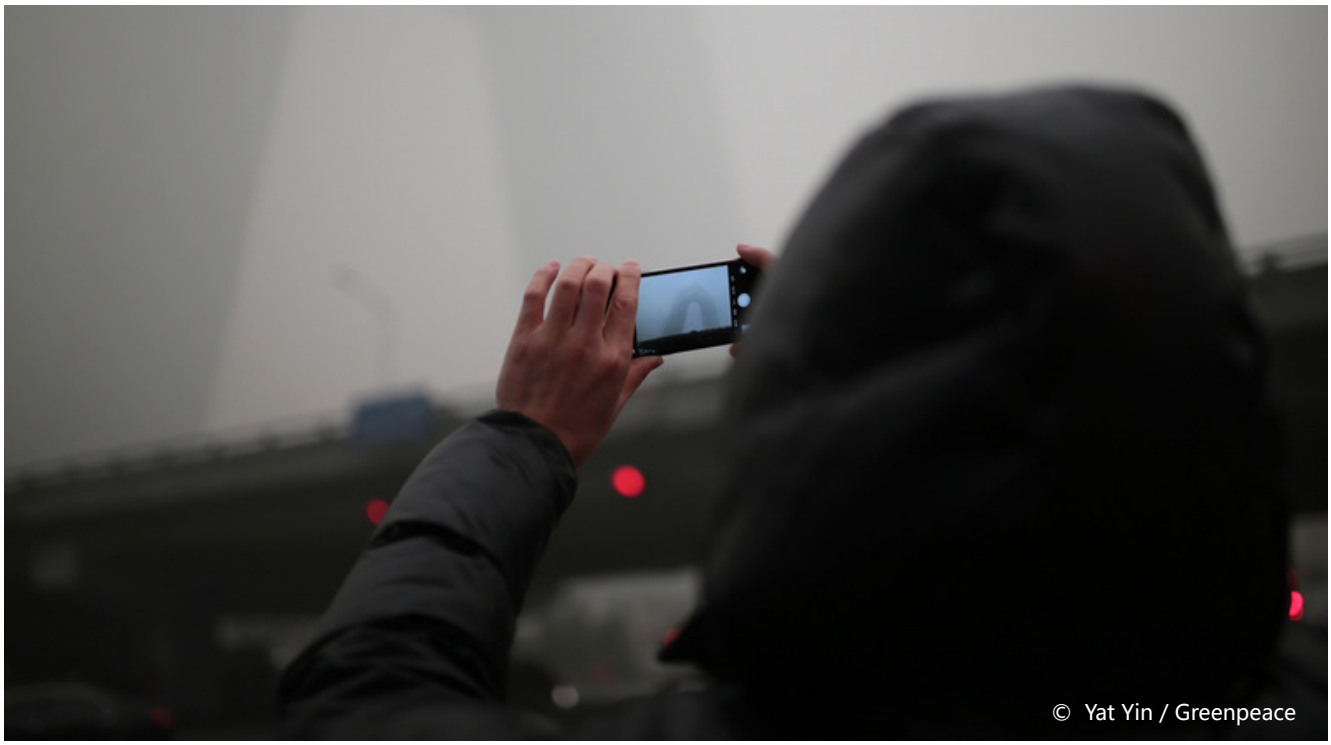
“为了搭这些粗管道，村里可是花了不少钱，但要是能换来好天气，也算没有白花钱。”李爱英指着高高的管道说。

冯灏，中外对话研究员

China softens approach to home heating switch

After last year's fiasco, households moving from coal to gas shouldn't go cold this year

□ Feng Hao



The government is trying to balance an orderly switch from coal to gas heating with public demands to act quickly on air pollution

It's a mid-November afternoon and Li Aiying, 71, is sitting with friends at the entrance to their village, Hanjiachuang, on the north-west outskirts of Beijing. The temperature is no more than 10C, so everyone is wrapped up well. But at home it's a different story, says Li. "We don't have to wear this much, a single layer's enough."

Since last year the village has been replacing coal-burning household stoves with a new village district heating system. Pipes, half a metre in diameter, have been installed above ground to bring hot water from an electric heat plant several kilometres away in Xibeiwang. "It's a lot less hassle this year," sighs Li, "we don't need to buy coal and keep the stove going".

The "heating season" in northern China refers to a period each year when centralised district heating systems are switched on to provide heat to local homes. But the bulk of residential and industrial energy needs have long been met by coal, so the season is also marked by a spike in air pollution. In Beijing, from 2010 to 2014, PM2.5 levels went up over 50% during the season.

The war on pollution

The government launched a war on smog in 2013 to reduce pollution in key cities and regions by the end of 2017, including in Beijing. As the deadline approached, northern China experienced the biggest ever campaign to replace coal with natural gas. In Beijing alone, 140,000 households across 336 villages bid farewell to coal.

The toughest ever restrictions on industry were also put in place – from mid-November to mid-March 15 key cities including Shijiazhuang, Tangshan, Handan and Anyang had to cut steel manufacturing output by 50%, and aluminium production by 30%.

The ambitious targets set five years earlier were easily met. PM2.5 levels fell 39.6% in the Beijing-Tianjin-Hebei area; 34.3% in the Yangtze delta; and 27.7% in the Pearl River delta.

But the rushed measures caused serious problems. The removal of coal heating increased demand for gas, which led to shortages and inadequate heating for many households. The restrictions on industry left some firms struggling to survive.

The coal dilemma

"Do you know how many elderly people were affected by the change to natural gas?" asks Li Senlin, a villager from Shijing in Hebei province, when interviewed this summer about the fuel switch. "All those old folks, living alone, couldn't cook on the stoves they're familiar with, and nobody taught them how to use the gas. Some hurt themselves as they didn't know how to work it and ended up eating cold food all winter as they didn't dare to use gas."

There wasn't enough time to install the gas pipes underground in Shijing, so they were left above ground – another safety risk.

There were also widespread reports last winter of heating problems caused by failures to complete the switch to gas on schedule. Some schools in rural Shaanxi had no heating as the coal-fired boilers had been removed before natural gas pipes were installed. Linfen, in Shanxi, had a 155 square kilometre "no coal zone" where residents had to remove coal stoves and weren't even allowed to keep coal at home – yet no alternative heating was provided, despite sub-zero temperatures. Li Aiying's village of Hanjiachuan lacked heat for the last three weeks of the heating season.

Keen to avoid a repeat of last year, the Ministry of Ecology and Environment published a plan in September to tackle air pollution during the coming heating season. It stressed that new gas or electric heating systems should be in place before the removal of coal ones. There would be no target for the number of households to switch – local governments only needed to report the actual number of conversions. The State Council also published a three-year cleaner skies plan in July 2018 that said households in northern China would have safe access to heating. This winter, heating will not be sacrificed for the sake of cleaner air.

Burning injustice

Plans to eliminate the inefficient coal stoves can be traced back to July 2016 when the Chinese Academy of Engineering assessed efforts to address air pollution. The report singled out domestic coal burning for its huge contribution to winter air pollution in the Beijing-Tianjin-Hebei region. When choosing a replacement for coal, most local governments opted for gas over electricity because it was cheaper. Opting for electricity would have also placed a strain on the power grid.

No alternative heating was provided, despite sub-zero temperatures.

> "[Until infrastructure catches up with demand] there's nothing the state-owned oil and gas firms can do."
> — Zhang Liutong, Water Rock Energy

But the widespread switch to gas increased demand, leading to severe shortages last winter. The switch is continuing this year, and the huge supply gap means that prices have gone up. In May the National Development and Reform Commission announced increases of 20% in the cost of gas for domestic use would be permitted. An official explained that households were buying gas at below the cost of supply. The announcement led to immediate price increases.

Zheng Xinye, deputy head of the School of Economics at Renmin University and a professor of energy economics, said that the rise in energy prices and market reforms could hurt low-income households. Most areas of northern China already provide subsidies or higher welfare payments to such households affected by the coal phase-out. But the willingness and capacity of local governments to do this differs. In Xibeiwang, Beijing, the subsidy can be as much as 360 yuan per household per square metre. Li Aiying says that meant heating last year wasn't any more expensive than it was when they burned coal.

But providing such high subsidies in less developed regions is harder. Liu Song, deputy director of the China Urban Heating Association, says there have been issues with uneven distribution of resources during the roll-out of cleaner heating. "Hebei envies Beijing. After the switch the whole country's resources went to help Beijing. In Hebei they banned coal, but how much natural gas was there to replace it?"

Gas supply concerns

A successful coal-to-gas switch relies on an adequate supply of gas and infrastructure to transport it. China depends on imports for as much as 39% of its natural gas supply, and in recent years, demand for gas has outstripped supply increases.

The outlook for gas imports is not good. Trade friction between China and the United States has led to tariffs being enforced. Shipping data from Reuters shows that the US sold 130,000 tonnes of liquified natural gas (LNG) to China in July – down on 400,000 tonnes in May. And US LNG imports became even less competitive in August, when China imposed a 25% tariff.

Meanwhile, disagreements over price have meant the marathon negotiations over a new Russia-China gas pipeline have seen little progress. Zhang Liutong, founder of Water Rock Energy, an independent energy consultancy, says that as long-term arrangements have not yet been decided, it is possible that Central Asia, which is China's main source of natural gas, could create "unexpected" security issues. "A very likely situation is that when China's need for natural gas is greatest, the supply is suddenly cut off."

Although China is building out its gas network, the surge in liquified natural gas (LNG) imports has contributed to an infrastructure bottleneck. Li Yinghua, deputy head of the National Energy Administration's oil and gas department, said at a seminar in August that China has only 74,000 kilometres of gas pipelines – 15% that of the United States. The limited pipeline infrastructure means the load on the network is twice that of the US.

There is also a shortage of gas storage. China only has enough for 3.2% of annual consumption (gas production plus net imports), and little extra offloading capacity has been added at LNG terminals. According to Li, natural gas shortages will not ease off in the coming years.

Until infrastructure catches up with demand, "there's nothing the state-owned oil and gas firms can do," said Zhang Liutong. "The only good news is that existing LNG storage facilities are full and can deal with one or two weeks of peak winter demand."

Getting back to work

The restrictions on industry last year also led industry to complain. Plans for this winter, published by the Ministry of

Ecology and the Environment, show that restrictions will be more flexible this time round: there are no orders for certain sectors to cut production by set percentages; instead, local governments can look at emissions and reduce manufacturing as and when is necessary.

This more targeted approach is definitely an improvement, but it could make tackling air pollution more difficult. Local governments may opt to boost efforts to replace coal with gas or electricity, so they can keep the factories running without worsening air quality.

A difficult balancing act

Beijing saw the worst smog of the winter in the middle of November, just after the start of the heating season, with PM2.5 levels of over 300 microgrammes per cubic metre and an amber air pollution alert issued. An editorial on Chinese news site thepaper commented that blue skies shouldn't just be a temporary good, enjoyed when emergency measures are in effect: "There's a long way to go to tackle smog, and we must not cease our efforts just because things get a bit better." The people still want cleaner air, and so the tension between heating provision and air pollution is bound to continue.

Back in Hanjiachuan, the village is shrouded in smog. Parents meeting their children at the school gate chat to them through thick pollution masks.

Pointing at the at the new above-ground pipework, Li Aiying says: "It cost the village a lot to install these pipes, but if it means better weather then it hasn't been wasted."

Feng Hao is a researcher at chinadialogue.

鹿泉：水泥小镇能否破土重生？

河北小镇的转型，凸显了中国大气污染治理和重工业整顿中的公平性挑战。

□ 冯 灏

祁花花宽松的衬衫上写着企业口号“自然的世界，你的我的”(Natural world, yours and mine)。公司并不要求她必须穿这个上班，但她喜欢穿这件“工作服”。

她打工的食草堂是位于中国河北省石家庄市鹿泉区的一家日用品和皮具品制造企业，但祁花花和其他百余位工友显然不像刻板印象中的制造厂女工，各个倒颇有艺术家的气质，在宽敞的工作台做着手工。

这个工厂区是一个类似北京798艺术园区的“工业旅游区”。从前的工厂厂房被改造成餐厅、画廊、工艺品店，而鹿泉曾经最大的工业部门是水泥制造。

“水泥小镇那是二十多年前的定位了，现在鹿泉的定位是省会西花园”，鹿泉本地人郭晓番告诉中外对话。他是当地一个旅游产品博览会的志愿者。

不过，在食草堂这样耀眼的城市名片之后，一整座水泥重镇向休闲旅游业转型跋涉的过程是艰难的。而类似食草堂的新业态究竟能否承接、能承接多少曾经捆绑在雾霾制造链条上的产业工人，仍然是一个未知数。

一座水泥立窑旧址上标注了它的服役历史（1981年到2008年）

而中国生产了世界四分之三的水泥和将近一半的粗钢。在政府治理大气污染、整顿重工产业的背景下，无数的鹿泉将要面对不确定的未来。

去产能进行时

2013年9月，在空气质量严重威胁公众健康、形成强大政治压力的背景下，中国政府开始“向污染宣战”，而头号战场就是京津冀地区。

煤炭，以及消耗大量煤炭和能源又释放大量粉尘和废气的重工业，被认为是中国空气污染最大的来源。十三五期间（2016-2020年），中国要淘汰1亿吨钢铁产能；2018年到2020年，中国要淘汰3.9亿吨水泥产能，关闭540家水泥企业。这意味着生产了中国四分之一钢铁的建材大省河北面临空前的治理压力。

最终，河北省决定，“大气十条”期间，河北制定并执行严于国家的环境标准。2013 年到 2017 年，全省累计压减炼钢产能 6993 万吨，这个数字超过地球上绝大多数国家全国的炼钢产能。

鹿泉区政府工信局崔振红介绍说，大概 2007 年鹿泉就开始了政府引导下的水泥厂转型，2012 年仅仅用了半年时间就拆了五十多家水泥厂，2013、2014 年又接着拆掉了二十多个。

几轮去产能下来，如今的鹿泉仅剩下三家水泥厂。

好空气的代价

“之前走到哪里都是一层灰，空气里可都是粉尘，还呛人呢，把水泥厂陆陆续续关掉之后才慢慢好起来。”在当地居民郭晓番看来，水泥厂的离开带来了肉眼可见的环境改善。

但也有很多人成为了去产能运动的失意者。52 岁的鹿泉牛山村村民张春英受到治霾关厂的影响，和爱人两口子都没了工作，在她看来，所谓“去产能”就是“关厂子”，就是“丢饭碗”，她觉得自己还有浑身的力气，但就是挣不上给儿子盖婚房的钱。

同村的张密娟也有两年没有活干了，她说，“如果有工作，不管挣得多挣得少，两口子之间就不会吵架，两口在家都闲着矛盾当然就多了”。她今年 40 岁，感觉自己正年轻，还能干很多事，但由于找工作的人很多，多数企业把工作录用年龄卡在 35 岁。

崔振红表示，最近一轮的关停水泥厂直接影响到鹿泉 2000 多人的就业，算上交通运输和餐饮等相关产业，就不下万人了。

随着水泥厂的大规模关停，水泥的市价也翻倍了，这个几十年和水泥打交道的家庭承担不起泥瓦房四五十吨水泥的开销。村子里这样因为家庭收入锐减、水泥价格高企而盖不起房子的农户不在少数。而在中国广大的农村地区，新房被认为是结婚的前提条件，牛山村不少超龄青年也因此陷入结不起婚的窘境。

北京师范大学社会发展与公共政策学院副教授杨力超告诉中外对话，在实现转型的过程中，要建立相应的社会制度框架来确保受影响工人群体的工作和生计不受到严重的损害，“这个车子突然刹车，还不系安全带，车里的人就会撞上挡风玻璃，撞得头破血流”。

企业主和政府同样面临难题

张建斌曾经在鹿泉有三家水泥厂，如今只剩一家还在勉力维持。他

被关停的兴华水泥厂旁边的小饭店和小商店也随之倒闭

鹿泉本地乳品企业君乐宝开办的“工业旅游区”设计了亲子活动，周末和节假日吸引了不少大人孩子

告诉中外对话，“在 2012 年之前，政府的思路还是改，按照环保部门的要求做清洁改造，出什么标准我们就上什么设备，但近几年思路就是关。”

鹿泉区宜安镇发展办主任戎建强无奈表示，“不是不让水泥厂改，而是根本改不到现在要求的标准”。

河北省执行严于国家标准的排放限值。以主要的空气污染物二氧化硫为例，按照河北省《水泥工业大气污染物排放标准》，排放限值为 50 毫克 / 立方米，是国家规定的上限的一半。

事实上，地方政府把清退水泥产业的冲击比作“壮士断腕”。中央政府为钢铁和煤炭行业的去产能设立了总额 1000 亿元的专项基金，主要用于人员安置。水泥等其他行业则没有这样的支持。

《经济日报》2014 年的调查报道指出，鹿泉、平山两个水泥小镇的水泥去产能共需市县两级财政筹集 10.7 亿元安置赔偿款。当时的石家庄市副市长郝竹山表示，石家庄市级财政准备了 3 个多亿，鹿泉、平山两地财政筹备了 7 个多亿。这对于被迫砍掉原本的支柱产业的区级政府而言，是沉重的负担。

替代产业在哪里

郝竹山表示，我们集中拆除水泥过剩产能，就是要断了企业的念想，逼着他们把料仓拆掉，把磨机卸掉，让他们有足够的积极性去进行二次创业。

为了激发水泥老板们的二次创业，当地政府组织了企业老板到外地参观学习。政府也谋划了新的工业园区，试图引进一些企业来到当地。

鹿泉区宜安镇政府的戎建强列举了几家大型的企业，涉及到休闲旅游、医疗器械制造、汽车维修生产、低速风力发电等多个科技含量高、带动性强、成长性好的行业。但从水泥行业退下来的职工要在这样的行业找到新工作，并不简单。

长期关注供给侧结构性改革背景下转型公正的中国社会科学院城市发展与环境研究所副研究员张莹对此也颇有感触，她强调说，针对转岗职工的技能培训非常重要，对于劳动者、企业和政府的人力资源和社会保障部门都是如此。

从这个意义上说，吸纳了不少当地女性村民，并且通过培训发掘了她们内在的手工艺才能的食草堂，似乎成为了这个重工业小镇转型变身的模范。在食草堂工作了十年的祁花花觉得，新业态比水泥厂自然好得多，又干净又挣钱。

食草堂技术部总监李牧遥表示，“工业旅游”的概念也很成功，“工业旅游区没有门票，但来了不就得吃东西、买东西嘛，有人气自然有钱挣”。

不过对于鹿泉来说，如何复制出更多的食草堂，让新兴产业园区像当年的水泥厂一样遍地开花，将是决定水泥小镇能否脱胎换骨的胜负手。

冯灏，中外对话研究员

Can a cement-making district reinvent itself ?

Luquan is on the front line of national attempts to cut air pollution and heavy industry

□ Feng Hao

Leatherware firm Herbal Heaven is located in the industrial tourism zone and makes use of abandoned facilities

Qi Huahua crafts leather goods by hand for Herbal Heaven, a handbag and wallet maker that sells worldwide in department stores and online, and one type of industry that local officials hope can rejuvenate Luquan district.

Luquan was one of China's foremost cement-making areas until a central government crackdown on air pollution five years ago set in motion sweeping changes. The district is on the outskirts of Hebei province's capital, Shijiazhuang – a city of 10 million that is one of China's most polluted and whose prevailing winds funnel its filthy air towards the huge metropolises of Beijing and Tianjin.

China's State Council acknowledged the health risks

from air pollution by declaring a "war on pollution" in September 2013 and launching the National Action Plan for Air Pollution, Prevention and Control (2013-2017). The Beijing-Tianjin-Hebei region became one of three key national battlegrounds. Local officials began closing – and dynamiting – Luquan's cement works.

Some Luquan factories have since been turned into restaurants, galleries and art shops. Qi and her hundred-plus colleagues toil in an airy workspace that looks more like an artist's studio than a factory. Guo Xiaofan, a local volunteer at a nearby tourism exhibition, told chinadialogue, "Now we aim to be a leisure destination for Shijiazhuang".

A demanding transition

But while Luquan has attracted big names like Herbal Heaven, shifting a district of almost half a million people from cement-making to leisure and tourism is no easy task.

China produces three quarters of the world's cement and half of its raw steel. With the government tackling smog and attempting to shift the economy away from heavy industry, countless districts like Luquan face an uncertain future.

Coal and coal-reliant heavy industries, such as steel, were China's biggest sources of air pollution. China's 13th Five Year Plan therefore aimed to cut steel-making capacity by 100 million tonnes; to reduce cement-making capacity by 390 million tonnes; and close 540 cement-makers. That placed unprecedented pressure on Hebei, which manufactures one quarter of all China's building materials.

Luquan now has just three cement factories remaining.

Tough standards

Hebei decided to implement even tougher environmental standards than the nationwide rules set by the air pollution action plan. In four years, the province cut steel manufacturing capacity by 69.93 million tonnes – equivalent to South Korea's entire production in 2015.

The government-led conversion of cement plants started in 2007 and gained pace with the efforts to reduce air pollution, explained Cui Zhenhong, who works for the Industrial Department of Luquan. Fifty cement plants were demolished in just six months in 2012 and another 24 between 2013 and 2014.

China produces three quarters of the world's cement and half of its raw steel.

The cost of clean air

"There used to be a layer of dust over everything – it was in the air, in your throat, and it only got better once they closed the factories," says Guo Xiaofan.

But many have lost out. Zhang Chunying, 52, lives in the Luquan district village of Niushan. She and her husband have been left out of work by the closures. They both want jobs but can't find anything, and so can't afford to build their son and his new wife a home.

Zhang Mijuan, also from Niushan, hasn't worked for two years: "If you've got work, no matter how much it pays, you don't fight with your partner. But if both of you are at home all day, of course, you fight." Zhang is 40, but with so many jobseekers available, many companies set an upper age limit of 35 when recruiting.

Cui Zhenhong says over 2,000 people lost their jobs in the latest round of cement factory closures. Overall, more than 10,000 jobs disappeared locally when related jobs in transportation, logistics and catering are included.

The cost of cement has rocketed too as incomes have fallen, leaving many unable to afford the four or five tonnes needed to build a new home. In China's villages, a new home is regarded as essential before couples can get married, so young people in Niushan find themselves stuck.

Support frameworks are needed to ease people through such complex economic transitions, says Yang Lichao, associate professor at Beijing Normal University's School of Social Development and Public Policy. "If you slam the brakes on and nobody's wearing a seatbelt, they're going to go through the windscreen."

Luquan has carefully crafted its night-time appearance to attract tourists from neighbouring Shijiazhuang

Business worries

Cement factory owner Zhang Jianbin used to own three plants in Luquan and has one left. "Up until 2012 the government preferred to make the factories cleaner by bringing them up to environmental standards. We'd install whatever equipment they wanted. More recently they've decided to just close them down," he told chinadialogue.

Rong Jianqiang, a development official in the Luquan township of Yi'an added: "It's not that we didn't want to upgrade them, but there was just no way to bring them up to the current requirements."

Hebei's tougher environmental standards mainly targeted sulphur dioxide (SO2). Provincial rules for the cement industry limited levels of the gas to 50 milligrams per cubic metre – half the national limit.

The local government says the impact on the cement industry was the result of a determined but painful decision. A 100 billion yuan fund (US$154 million) was set up to help workers affected by cuts in capacity in the steel and coal sectors – but similar provisions were not made for other sectors, such as cement.

A 2014 investigation by the Economic Daily found that the reduction of cement output in the towns of Luquan and Pingshan districts had cost the two local county governments 1.07 billion yuan (US$155 million) in compensation payments. These were given to businesses to distribute to workers through compensation and pensions.

Hao Zhushan, then deputy mayor of Shijiazhuang, says the city government provided over 300 million yuan (US$44 million), and the two county governments a further 700 million (US$101 million). Those are huge sums for a local government to find when the most important local industry is shrinking.

Skills training

Hao Zhushan has defended the policy of forced demolitions as essential to motivate cement factory owners to establish different businesses. The local government also organised

study trips and set up new industrial zones to attract high-tech and high-growth companies. Several firms in the tourism, manufacturing and vehicle maintenance sectors have moved in, including one specialising in low-speed wind-power.

More stringent environmental constraints are creating new business and employment opportunities in the area. Hebei Weilan New Energy Technology was set up in 2015 to manufacture air-source heat pumps. Following the overzealous coal-to-gas switch at the end of 2017, which left thousands of rural students to study without heating, it sold its technology to six schools through a government procurement agreement. The company has since expanded to nearly 100 people. Sales manager Yang Baomin accepts that the transformation of Luquan to a low-carbon economy will be hard but is confident the market will expand and create jobs. "That is where the future lies," he says.

But if former cement workers are going to find work in new sectors then they will need to reskill. Technical training for laid-off employees is crucial and benefits employees, companies and the local government, says Zhang Ying, a deputy researcher with the Institute for Urban and Environmental Studies at the Chinese Academy of Sciences.

Herbal Heaven recruits and trains local women. Qi Huahua says it's much better than working at the cement factory – it's cleaner and pays better.

And Li Muyao, Herbal Heaven's technical directory, says that "industrial tourism" is also proving successful. "There's no entrance fee, but people come, and they eat and shop. If people are coming, there's money to be made."

Feng Hao is a researcher at chinadialogue.

中国科学界激辩争议项目

中国科学家集体谴责缺乏科学基础的工程项目，科学监管问题再次成为关注焦点。

□ 白莉莉

“天河工程”被看作西线工程的组成部分，在大气层中完成水资源输送

11月初，中国科学家们宣布一项规模巨大的天气干预工程取得进展；11月底，又有中国研究人员宣称世界首例基因编辑婴儿诞生。这两份具有“突破性”的公告在中国遭到了强烈的批评。100多位科学家签署了联合声明，谴责基因编辑实验盲目追求进步，有违道德伦理。与此同时，一群气象学家对政府投资“天河工程”这么一个仍停留在理论层面的大规模人工降雨项目提出公开质疑。

中国科学界罕见的发声暴露出前沿科学实践的管理缺陷。随着中国为应对环境和社会挑战而寻求科学和技术领域的突破，这些问题愈加突出。

空中调水

“治”这个字是水字旁的。千年以来，对中国的统治者而言，治理长江流域的洪水及黄河流域的干旱问题一直是中国政治合法性和稳定性的核心。受气候变化的影响，预计中国各地的干旱将不断加剧，西北部

受干旱影响的地区不断增加，中国科学家们面临更加严峻的水资源供应管理压力。

南水北调工程的设想在20世纪50年代被首次提出。目前该工程的两条输水线路已经完工并投入运营，每年向北方地区输送278亿立方米的水（约占长江年径流量的3%）。然而，将长江支流的水从青藏高原的源头输送至黄河的西线工程却由于工程方面的挑战而一直被搁置。

为了避免陆地调水的难题，科学家们向天空寻找灵感。“天河工程”被看作西线工程的组成部分，不过这次不是通过陆地水道，而是在大气层中完成水资源输送。

早在20世纪90年代初，麻省理工学院的科学家就用“大气河流”概念来描述他们在对流层中发现的水汽输送带。中国的“天河工程”提出利用人工降雨技术来对这些水汽输送带进行大规模人为干预。

根据青海大学校长、“天河工程”研究团队负责人王光谦院士的说法，该项目的初衷是增加“云水资源量丰富”的长江和黄河源区的降雨量。若无人为干预，这些气象系统通常会移动到长江流域，那里会自然产生降雨。该团队设想，通过人工降雨技术切断青藏高原云雨的迁移，可以补充北方黄河流域的水量。

天水之梦

据科学网(ScienceNet)报道，2015年，清华大学、青海大学和青海省气象局联合启动了“天河工程”，建立了研究伙伴关系。

该工程迅速获得了政策支持：被确定为青海省“十三五”规划的重点工程，并从省政府和青海大学获得了5300万元（770万美元）的资金支持。清华大学还承诺每年拨付100万元人民币（14.5万美元）。

该项目还获得了国家级的资金和支持。2016年，该项目被科技部评为“科技创新国际化环境项目”。据王光谦介绍，此后该项目还被确定为国家重点研究项目。

该团队一直在尝试在大范围区域试验人工降雨技术。一种方法是通过燃烧室将碘化银颗粒输送至大气中以产生雨云。该项目一位研究人员告诉南华早报，“[迄今为止]已有500多台燃烧器部署在西藏、新疆和其他地区的高山斜坡上，以进行相关实验。”研究人员描述道：“有时我们一启动燃烧室就马上下雪，就像站在魔术表演舞台上一样。”该项目打算安装上万个燃烧室。

科学界的抨击

中国开展局地人工降雨已长达50余年，但实施如此大规模的人为干预项目是前所未有的。根据2016年发布的计划，“天河工程”中远期有望使年降水量增加50亿立方米，几乎是现有南水北调输水量的五分之一。仅“十三五”期间，该团队就计划将青藏高原三江源地区的年降雨量增加25亿立方米。中国科学院大气科学家吴国雄对科学网表示：“人工增雨仍处在试验阶段，目前最好的成绩是增加10%～20%的雨量。”

> “从疾病的传播到适应气候变化，科学家们将在21世纪面临越来越大的压力，让他们不得不突破各自领域的边界，而现有的治理机制也将难免受到挑战。”

上个月中国航天科技集团宣布，中国已正式启动“天河工程”卫星和火箭工程研制 。此消息一出，关于该工程的争议顿时升级。该公司表示，他们计划在2020年完成双星发射，到2022年完成六星组网建设。

如此高调的技术投资引发了科学家们的批评。国防科技大学气象海洋学院教授陆汉城对科学网表示，“这是一个既没有科学基础也没有技术可行性的荒诞幻想项目，居然得到立项支持，是不可思议的。人民的血汗要珍惜！”其他专家评论说，目前该工程无任何气象学家参与，应征询气象科学家的意见。

在接受中国网采访时，王光谦强调，该项目还处于科学探索研究阶段。 他还表示，该项目经过了严格的审查，而且审查过程中有气象学家的参与。 他坚持认为，他们会精打细算地用好政府的每一分资金，并表示除了“天河工程”之外，这些卫星还将用于其他方面。

需建立管制机制

虽然该工程可能远未达到全面实施的阶段，然而，批评人士认为，如果没有适当的保障措施，中国的科学实验可能会迅速从概念层面升级到实施阶段。最近的基因编辑实验就是一个例子。科学家贺建奎在既没有提交同行评审，也没有向有

关部门进行临床试验备案的情况下，就将修饰后的胚胎植入受试者体内。这是一个全球科学家们都认为是超出了底线的行为。

贺并没有人类临床实验的经验。同样，“天河工程”团队也因主要成员为水文学家而非气象学家而备受诟病。

中国社会科学院研究员陈迎表示，除了科学基础的重要性外，项目还需要进行更全面的评估。她说，“天河工程”考虑的只是解决水资源的技术问题，而“技术是基础，但即使技术可行，也不一定要做。需要全面客观地评估经济、生态、伦理等方方面面的影响。”

跨界影响？

接受“中外对话”采访的专家表示，由于研究不充分，“天河工程”所带来的风险仍不明朗。据报道，当前人工降雨使用的燃烧室较为清洁，可以在保护区内使用，但一样会排放二氧化碳。虽然尚没有充分证据证明这些排放所带来的更大范围的影响，以及对该地区气候的改变，但因为该项目将发生在亚洲主要河流的源头地区，故而可能会改变当地和跨国的生态系统。

陈迎和北京师范大学地球工程研究专家、英国科学家约翰·摩尔都表示，与过去的小规模人工降雨不同，“天河工程”可以被视为一项大规模的地球工程，即改造自然系统来应对气候变化。“如果该项目大规模实施的可行性得到证实，并且可以达成既定目标，那么我会认为这是气候工程。但从科学的角度，我对其究竟是否可行性持怀疑态度。”约翰·摩尔表示。

陈迎说，地球工程科学家都了解这背后的风险，不会急于进行户外实验，但有必要注意那些在不了解地球工程的情况下就盲目开展类似实验的科学家。她认为，为了避免这种情况发生，需要建立管制机制。

牛津大学的研究人员提出了一套地球工程的全球治理原则，包括公众参与、第三方影响评估，以及最重要的“先管制，后部署”原则。然而，这些原则尚未被国际法采纳。唯一现有的国际规则是在联合国生物多样性公约（CBD）下建立的地球工程实地试验指南。该指南允许在“事先对环境潜在影响进行全面评估的条件下”进行小规模的实地研究。中国是联合国生物多样性公约成员国，应遵守该指南。

将理论付诸实践

近来的争论带来的一个影响是国内外的学界的积极发声。公众压力已产生了一些影响。进行基因编辑婴儿实验的科学家贺建奎正在接受调查。中国科技部副部长表示，将暂停他的科学工作。气象学家的批评也让“天河工程”变得更加透明。王光谦说，欢迎公众到该项目在青海的实验基地看看。

从疾病的传播到适应气候变化，科学家们将在21世纪面临越来越大的压力，让他们不得不突破各自领域的边界，而现有的治理机制也将难免受到挑战。在采访中，“天河工程”负责人在回顾其开展这项研究背后的动力时说，“我们不想仅仅写理论文章，我们想把论文写在大地上。”

白莉莉，中外对话研究员，北京能源网络（Beijing Energy Network）执行制作

China's scientific community confronts 'rogue science'

A lack of oversight and transparency for boundary-pushing projects is worrying experts

□ Lili Pike

November began with Chinese scientists advancing the world's largest weather modification project and ended with a Chinese researcher's claim to have produced the first gene-edited babies. Both of these futuristic announcements were met with a fierce backlash in China. Over 100 scientists signed a statement criticising the gene-editing experiment for sacrificing ethics in the blind pursuit of progress. Meanwhile, a group of meteorologists publicly questioned the government's investment in "Sky River", a sweeping artificial rain project that remains theoretical.

These rare outcries from China's scientific community have exposed flaws in the governance of cutting-edge scientific experiments, which loom large as the country looks to science and technology breakthroughs to address its environmental and social challenges.

Diverting water in the sky

The root of the Chinese character "to govern" (治) is water. For rulers over the centuries, controlling floods in the southern Yangtze River Basin and managing drought in the northern Yellow River Basin has long been central to political legitimacy and stability in China. With climate change projected to increase the intensity of droughts throughout China and widen drought-affected areas in the north-west, among other regions, Chinese scientists have faced greater pressure to manage water supplies.

Through the South-North Water Diversion project, first envisioned by Mao Zedong in the 1950s, the Chinese government has built two major canals channelling an additional 27.8 billion cubic metres of water north every year (about 3% of the Yangtze's annual discharge volume). However, a third route, which would divert water from the Yangtze's tributaries to the Yellow River at their headwaters on the Qinghai-Tibetan Plateau has stalled due to engineering challenges.

To avoid the hassle of moving water on land, scientists have looked to the sky for inspiration. The "Sky River" project is considered part of the third route, except the water transfer would happen in the atmosphere, rather than through canals.

Back in the early 1990s, MIT scientists used the concept of "atmospheric rivers" to describe water vapour transport bands they identified in the troposphere. China's Sky River project proposes large-scale manipulation of these bands of water vapour using cloud-seeding techniques that could manufacture rainfall.

According to Wang Guangqian, president of Qinghai University and the leader of the Sky River team, the project seeks to increase rainfall at the headwaters of the Yangtze

The Qinghai-Tibetan plateau could get more rainfall under the proposed Sky River project

and Yellow rivers where "cloud resources are abundant". Without intervention, these weather systems would typically move to the southern Yangtze basin where rainfall would naturally occur. By cutting off the migration of rain clouds in the Qinghai-Tibetan plateau using cloud-seeding, the team hypothesises they could supplement the flow of the northern Yellow River.

Manufacturing rain

In 2015, Tsinghua University, Qinghai University, and the province's meteorological bureau set the Sky River project in motion, forming a research partnership, according to ScienceNet.

Sky River quickly gained political support: it was featured in Qinghai province's 13th Five-Year Plan and received 53 million yuan (US$7.7 million) of funding from the provincial government and Qinghai University. Tsinghua also committed one million yuan (US$145,000) a year.

The project also received national level funding and support. In 2016, the Ministry of Science and Technology accepted the project as a "technological innovation project with international significance". Subsequently, it was designated a national key research project, according to Wang Guangqian.

The team has been experimenting with techniques to seed clouds over large geographies. One method uses chambers that burn and send silver iodide particles into the atmosphere to seed clouds. One of the project's researchers told the *South China Morning Post*, " [So far,] more than 500 burners have been deployed on alpine slopes in Tibet, Xinjiang, and other areas for experimental use." The researcher described how "sometimes snow would start falling almost immediately after we ignited the chamber. It was like standing on the stage of a magic show." The project intends to build tens of thousands of these chambers.

Backlash from the science community

China has engaged in localised cloud-seeding for over 50 years, but implementing such an extensive project

would be an unprecedented intervention. According to plans released in 2016, the project hopes to increase rainfall in the medium- to long-term by five billion cubic metres – nearly one fifth of the water transferred through the existent South-North canals. In the 13th Five-Year Plan period alone, the team plans to boost rainfall in the Sanjiangyuan region of the Tibetan plateau by half that amount. Wu Guoxiong, an atmospheric scientist at the Chinese Academy of Sciences, doubts that it is possible to reach those levels of artificial rainfall: "Artificial rain is still in the experimentation phase, so far the best results have increased rainfall by 10-20%."

Criticism escalated last month when China's Aerospace Science and Technology Corporation announced that it was developing monitoring satellites and rockets to aid the Sky River project. The company said they would launch two satellites by 2020 and complete a network of six by 2022.

Scientists lambasted the high-profile technology investment. Lu Hancheng, a professor at the National University of Defense Technology's Institute of Meteorology and Oceanography, told ScienceNet, "This is an absurd fantasy project with neither scientific foundation nor technical feasibility. That it got support to launch is incomprehensible. Public funds should be cherished." Other experts commented that meteorologists, who they say have not been included so far, should have been consulted.

In an interview with China.com Wang Guangqian, emphasised that the project is still at an early stage. He also said the project has gone through serious review with meteorologists involved. Government funding has been spent judiciously, he maintained, saying that the satellites would be used for other purposes beyond the Sky River project.

Governance scheme needed

The project may be far from operating at full-scale; however, critics say China's scientific experimentation can rapidly escalate from concept to implementation without proper safeguards. This was the case with the recent gene-editing experiment. The scientist did not submit his work for peer review or file the experiment as a clinical trial with the government before implanting genetically modified embryos in real human subjects, a step that scientists globally have considered out of bounds.

The gene-editing experiment was undertaken by a biophysicist without experienced in human clinical trials. Similarly, the Sky River team has been criticised for being composed primarily of hydrologists not meteorologists.

Beyond the importance of a project's scientific basis, Chen Ying, senior research fellow on the governance of geoengineering at Chinese Academy of Social Sciences, said that projects also need to be reviewed more holistically. She said that Wang Guangqian, the Sky River project leader, has focused on water resources without considering governance issues. "Technology is the foundation, but even if the technology is feasible, it doesn't mean the project should be carried out. You need to comprehensively and objectively evaluate economic, ecological, ethical and other effects," she said.

Cross border impacts?

Experts interviewed by chinadialogue said that the risks involved in the Sky River project remain unclear due to insufficient research. The cloud-seeding chambers in use are reportedly clean enough to operate in conservation areas, but they emit carbon dioxide. The larger effects of altering the region's climate are not well-documented, but the project could affect local and transnational ecosystems given it will take place at the source region of Asia's major rivers.

Both Chen Ying and John Moore, a British scientist at Beijing Normal University who leads China's national

> " We don't want to just publish theoretical papers, we want to apply our papers to the earth."
>
> — Wang Guangqian

geoengineering research, said that unlike past small-scale cloud seeding, the Sky River project could be considered a form of large-scale geoengineering, the alteration of natural systems to fight climate change. “If the full-scale project were shown to be feasible and could achieve what they want, I would say it's climate engineering. But I am highly sceptical that it is at all feasible from a scientific perspective,” said Moore.

Geoengineering scientists understand the risks and would not rush into outdoor experimentation, Chen Ying said, but it is necessary to remain alert to scientists who don’t understand geoengineering inadvertently pursuing similar experimentation. Governance mechanisms are required in order to avoid this, she said.

Researchers at Oxford University proposed a set of global principles governing geoengineering, including public participation, independent assessment of impact, and most importantly, “governance before deployment”. However, these have yet to be adopted as international law. The only international rule that exists is a guideline for geoengineering field experimentation established under the UN Conference for Biological Diversity (CBD). The guidance permits small-scale field studies “subject to a thorough prior assessment of the potential impacts on the environment”. China, as a party to the CBD, is held to this guideline.

Theory into practice

One outcome of the recent controversies is that the Chinese and international scientific communities have become more outspoken. Already, public pressure has had an effect. He Jiankui, the scientist behind the gene-edited babies, is under investigation and China’s vice minister of science and technology said his scientific activities would be suspended. As for the Sky River project, after the meteorologists’ criticisms, it has taken a step toward greater transparency. Wang Guangqian said that the public is welcome to visit the project’s Qinghai lab.

From the spread of diseases to adapting to climate change, scientists will come under increasing pressure in the 21st century to push the boundaries of their fields, inevitably straining existing governance mechanisms. In his interview, the Sky River project leader reflected the impulse to act saying, “We don't want to just publish theoretical papers, we want to apply our papers to the earth”.

Lili Pike is a researcher for chinadialogue and the executive producer of the Beijing Energy Network's podcast, Environment China.

泰国产业改革寻求中国投资

泰国政府希望通过新的经济走廊改革东部省份。

□ 帕里他·旺奇亚

东部经济走廊的关键性目标之一，是在曼谷和泰国东部之间建立一个“无缝衔接的”运输网络

泰国将有大动作，政府计划在曼谷以东的三个省份建设智慧城市、高铁、新的港口和机场，以此推动国家经济的现代化发展。

11月，副总理颂奇·乍都西披塔带领政府官员和泰国65家私营企业参加了在上海举行的首届中国国际进口博览会，并向中国投资者宣传这一名为“东部经济走廊（Eastern Economic Corridor，简称EEC）”的项目。

据新华社报道，中国国务院副总理韩正在北京会见颂奇时，两人讨论了中泰之间的经济合作。

泰国政府从一开始就热衷于让中国参与“东部经济走廊”的建设，并将该走廊形容为是中国“一带一路”国际基础设施建设网络中的一个“支撑阀”。

远大前景

泰国的制造业基础需进行重大升级，因此政府制定了一套名为“泰国4.0”的宏观经济整体规划，将目前以重工业为基础的经济发展为更加灵活的数字化创新型经济。“东部经济走廊”正是这一愿景中的关键部分。

二十世纪80年代，为了建立出口导向型的制造业，泰国向国际投资者敞开大门，尤其是对来自日本的汽车和电子公司。到1988年，其国内生产总值年增速达到了13%。但到了世纪之交，泰国经济增长停滞不前，年均增速仅为3%到4%。泰国对过时的制造技术和廉价劳动力过度依赖的问题被形容为是导致泰国陷入“黑暗时代”的根本原因。“泰国4.0”计划和“东部经济走廊”旨在解决这一问题。

当地人的担忧

但对许多人而言，“东部经济走廊”已经像是一场灾难。现年60岁的普拉克布·辛格哈纳特一家10口人被要求离开他祖父在北柳府的邦南普里奥（Bang Nam Priao）地区创立的水稻农场。他们收到了一封命令他们离开的官方信件，还远远看到一群群军队和政府官员一声不响地视察北柳府东部经济走廊带附近的居民区。

他们听到过建设智慧城市的计划，据说到时候会有高铁、数字中心和创新工业区。只要泰国企业、外国投资者和跨国公司的投资到位，项目就能带来数万个就业机会。

“但从来没有人来和我谈过，”普拉克布愤怒地说，“我只知道我和家人离开这个农场就没地方可去了。”

生活在1580英亩的土地上的另外635人也同样面临着被驱逐的威胁。他们祖上三代都在那里务农，但并没有土地的合法所有权，也不知道他们耕种的土地曾几经转手，最终转为国有。

50公里以外的地方，土地中介劝说更多农民离开他们的土地，为东部经济走廊高新技术产业开发区让路，但没有人准备搬离。

小小的胜利

“东部经济走廊”由泰国政府发起，公众对其规划过程的参与很少。由于需要大量土地用于新的工业园区和基础设施建设，项目启动后，土地权成为公众讨论的主要议题。

2018年初泰国议会通过的东部经济走廊法案给了投资者许多特权，包括土地所有权或者长达99年的国有土地租赁期，以及公司所得税优惠和进口关税豁免等。

邦南普里奥的农民们抗议驱逐令已经有近一年的时间。今年10月，他们在与东部经济走廊办公室（负责该项目的政府机构）副秘书长塔桑尼·基塔帕塔普拉博恩的对话中获得了部分胜利。塔桑尼说，政府不准备征用该地区的农田用于东部经济走廊的建设，并承诺今后一切决定都将公开征询意见。

与中国合作

与此同时，随着泰国政府不断吸引中国投资者，东部经济走廊的规划在11月加快了步伐。

在上海参加进口博览会期间，颂奇会见了华为和中兴的高管，呼吁他们投资东部经济走廊的数字产业和泰国5G网络的建设。据报道，颂奇与阿里巴巴集团执行董事长马云举行了第二次正式会议。马云是“一带一路”计划的主要公开支持者，今年4月曾承诺投资110亿泰铢（约23亿人民币），用于支持数字商业、旅游推广、大数据设备以及为当地企业家提供电子商务培训。

颂奇在访华期间宣布，2019年将会是泰国的“投资黄金年”，并要求投资委员会制定一套新的对投资者友好的政策。

很显然，中国投资者是这套新政策的主要关注目标。颂奇看到把泰国市场和“一带一路”联系起来的机会越来越大，尤其是中美贸易战可能会促使中国投资者寻找新的投资目的地和市场，以躲开特朗普政府对中国产品额外征收的关税。

一带一路协同效应

中国评估所有“一带一路”伙伴国家的经济政策，以寻找协调这些政策和“一带一路”倡议的方法。“泰国也一样，泰国4.0和东部经济走廊大型项目与‘一带一路’倡议相协调的潜力很大，”泰国国立政法大学经济系中泰关系专家阿科颂思力·帕尼石桑博士说。

“东部经济走廊”和“一带一路”6条经济走廊中的中国－中南半岛经济走廊也有着地域上的协同效应。阿科颂思力说中国认为泰国是“这个半岛上最重要、从根本上讲最有活力的国家”。

泰国的“东部经济走廊”与中国的“中国制造2025”战略之间也有相似之处。中国正试图借助数字化升级

现有的高科技产业，“东部经济走廊”也试图吸引同样的产业，尤其是航空和机器人行业。“一带一路”框架内部的协调合作可以强化中泰供应链网络，扩大出口市场。

“但泰国必须谨慎。”阿科颂思力说，“中国与‘一带一路’伙伴国打交道时，做出的似乎都是单方面决策，‘一带一路’项目也缺乏足够的透明度和完善的管理”。

交通基础设施

除了吸引新的投资者，“东部经济走廊”还有一个关键性目标，即在曼谷和泰国东部之间建立一个“无缝衔接的”运输网络，以及一条能让泰国货物途经老挝抵达中国南方从而将泰国和“一带一路”联系起来的陆上线路。

中国目前正在开发连接曼谷和泰国东北部主要城市呵叻府的双铁轨线路。未来该线路可能会延伸至泰国和老挝边境的廊开府，并通过另一条造价 2250 亿泰铢（473.5 亿人民币）的高铁与东部经济走廊相连。这条高铁线路是曼谷廊曼和素万那普两大国际机场与东部罗勇府乌塔堡国际机场之间的联络线。

海上路线方面，泰国政府计划扩大东部地区两个和“一带一路”有交集的深海港的运力。这两个港口分别是位于春武里府的林查班港口（三期）和位于罗勇府的玛塔普工业口岸（三期）。

这两个港口以及罗勇府的高铁和乌塔堡国际机场都属于“东部经济走廊”的基础设施项目。泰国政府近期已经面向私营企业开始项目招标。

政府预计”东部经济走廊”项目将创造总计 5000 亿泰铢（1052 亿人民币）的投资，通过政府和社会资本合作（PPP）的方式建设，PPP 形式的法人实体保持 30 到 50 年。

赢家和输家

11 月 12 日，东部经济走廊办公室透露了机场高铁联络项目的竞标者。由泰国正大集团牵头组建了一个包含中国铁路建设有限公司、意大利泰国发展有限责任公司（Italian-Thai Development PCL）和朝甘昌股份有限公司（CH Karnchang PCL）的财团参与了竞标。

另外一个竞标方是泰国 BRS 合资企业，包括曼谷城市捷运集团控股（BTS Group Holdings）、中泰工程与建设公司（Sino-Thai Engineering and Construction）、以及泰国叻丕省发电控股（Ratchaburi Electricity Generating Holding）。

“中国很可能会参与大多数基础设施项目，”来自泰国东部的独立社区研究员颂努克 · 琼米瓦辛说。

颂努克认为，中国对“东部经济走廊”的影响力不断上升，这其中的一部分原因是军政府领导下的泰国政局持续动荡，可能会出现地方反对势力，因此其他外国公司不愿在泰国进行新的投资。

尽管“东部经济走廊”承诺每年超过 1000 亿泰铢（210 亿人民币）的投资回报，但问题在于要如何让从国家到地方的所有人都能受益。

除了泰国的主要企业集团以外，当地企业和农民一样被蒙在鼓里。企业不知道拟建工业区或者铁路的确切位置，没有详细的项目时间表，也不知道什么时候法律突然就宣布允许农业用地可以用作工业发展。

春武里房地产协会首席执行官梅萨克 · 春哈拉克肖特说，东部经济走廊总的来说将提振泰国的经济，“但问题是，该项目的实际操作方式并不明确，地方上一些投资者也想投资，但现在不知道怎样才能参与进去。”

2018 年年中议会上通过东部经济走廊法案后，房地产业遭遇投机性购买土地的浪潮，成为最早感受到该项目影响的行业之一。“土地价格翻了一番。”梅萨克说，并警告称新的开发需要很多年的时间。

在稻农普拉克布的家乡北柳府农村，计划中可以容纳 200 万人，拥有新的大学、数字教育中心和良好交通的智慧城市吸引了大量土地购买者，导致土地价格飙升。这一点得到了北柳府商会秘书长乔蓬 · 朱塔布提姆的证实。

他担心政府是否能协调发展，满足人们的需求，尤其是在缺乏磋商的情况下：“政府是在通过东部经济走廊向当地民众兜售梦想。我们欢迎这些变化，但它们必须向好的方向发展，不是越走越坏。”乔蓬说。

帕里他·旺奇亚，曼谷独立撰稿人，专注于人权、发展和环境问题

Thailand woos Chinese investment for major industrial revamp

The government wants to transform the country's eastern provinces with a new growth corridor

□ Paritta Wengkiat

The Thai government has ambitious plans to modernise the country's economy by transforming three provinces east of Bangkok with smart cities, high speed rail, new ports and airports.

In November, Deputy Prime Minister Somkid Jatusripitat led sales pitches to Chinese investors when he took government officials and 65 Thai private companies to Shanghai to promote the project, known as the Eastern Economic Corridor (EEC), at the First China International Import Expo (CIIE) in Shanghai.

Somkid met with China's Vice Premier Han Zheng in Beijing to talk about Thai-Chinese economic cooperation, according to China's Xinhua news agency.

The Thai government has been keen to involve China from the beginning, and previously described the EEC as a "support valve" for China's immense global network of infrastructure projects known as the Belt and Road Initiative (BRI).

> " China is likely to get shares in most of the infrastructure projects. "
> — Somnuck Jongmeewasin, community researcher

Big vision

Thailand's manufacturing base needs a major upgrade, so the government has come up with its own macro-economic grand plan – which it calls "Thailand 4.0" – to transform its heavy industrial base into a more nimble digital and innovation-based economy. The EEC is a key part of this vision.

In the 1980s, Thailand opened up to international investors, especially Japanese automotive and electronic companies, to establish export-oriented manufacturing. By 1988, its GDP was growing at 13% per annum. But by the turn of the 21st century growth had stagnated, averaging 3% to 4% a year. Thailand 4.0 and the EEC are designed to tackle over-dependence on outdated manufacturing technology and cheap labour that has plunged the country into the so called "dark decades".

Local pain

To many people though, the EEC already feels like a disaster. Prakob Singhanat, 60, and his family of 10 have been ordered to leave the rice farm in Bang Nam Priao district founded by his grandfather. They've

had an official letter ordering them to vacate and seen distant groups of military and government officials wordlessly inspecting the neighbourhood in EEC-belt Chachoengsao province.

They have heard of plans for a new smart-city with high-speed railways, a digital hub, and innovative industrial zone. The project promises tens of thousands of jobs once investment arrives from Thai conglomerates, foreign investors and multinationals.

"But no one has ever come to talk to me," says Prakob angrily. "I only know that if I and my family must leave this farm, we have nowhere else to go."

Another 635 people are threatened with eviction from land totalling 1,580 acres. They have farmed there for three generations but have no legal title to the land, and were unaware that the land they cultivated was being passed from one private owner to another before ending up in the hands of the state.

Fifty kilometres away, land brokers have told yet more farmers to leave and make way for an EEC high-tech industrial zone. None of them are preparing to move out.

Small victory

The EEC was launched by Thailand's military government but there was minimal public participation in drawing up the plans. Land rights have since become a major topic of public debate as the EEC requires a lot of land for new industrial zones and infrastructure.

The EEC legislation passed by parliament in early 2018 gives investors many privileges, including land ownership rights or long leases on state land of up to 99 years, plus low corporate income tax and import duties exemption.

The farmers at Bang Nam Priao have been protesting against eviction for nearly a year. In October, they won a partial victory when the EEC Office – the official government body promoting the EEC – dispatched its deputy secretary general Tasanee Kiatpatraporn to talk to them. She said the government had no intention of using farmland in the area for the EEC and promised public consultations on any decisions.

Courting China

Meanwhile, the EEC plans gathered pace in November as the Thai government wooed Chinese investors.

During the Shanghai expo, Somkid met executives of Huawei and ZTE Corporation, and called on them to invest in the EEC's digital industries and Thailand's development of 5G. He reportedly held a second official meeting with Alibaba Group executive chairman Jack Ma, a major public supporter of the BRI who in April promised to pour 11 billion baht (US$333 million) into the project for digital business and tourism promotion, big data facilities and e-commerce training for local entrepreneurs.

In China, Somkid declared that the year of 2019 would be the "golden year of investment" in Thailand, and ordered the Board of Investment to design a new package of investor friendly policies.

Apparently, Chinese investors are the main target of this new package. Somkid sees rising opportunities to link Thai markets to the BRI, especially as the US and China trade war may prompt Chinese investors to look for new investment destinations and markets to avoid the additional tariffs on Chinese products imposed by the Trump administration.

BRI synergies

Chinese officials assess the national economic policies of every country that participates in the BRI to look for ways to coordinate them with the global initiative. "It's also happened in Thailand where the Thailand 4.0 and EEC mega projects have a lot of potential to coordinate with the BRI," says Dr Aksornsri Phanishsarn, an expert on Thai-Chinese relations at Thammasat University's Faculty of Economics.

There are geographical synergies too with one of the BRI's six "new Silk Road" economic corridors, the China-Indochina Peninsula Economic Corridor. China identifies Thailand as "the most significant and fundamentally robust country in this peninsula," says Aksornsri.

Further similarities exist between Thailand's EEC and

China's "Made in China 2025" strategy. China is seeking to upgrade existing hi-tech industries through digitisation and the EEC plan strives to attract those same industries, especially aviation and robotics. Coordination within the BRI framework could strengthen Thai-Chinese supply chain networks and expand export markets.

"However, Thailand must be cautious," says Aksornsri, adding, "China seems to use unilateral decision making in dealing with its BRI counterparts and there's also a lack of transparency and good governance under BRI projects".

Transport infrastructure

Along with attracting new investors, there are key EEC infrastructure goals for a "seamless" transportation network between Bangkok and eastern Thailand, and an overland route to transport Thai goods to southern China via Laos that connects Thailand into the BRI.

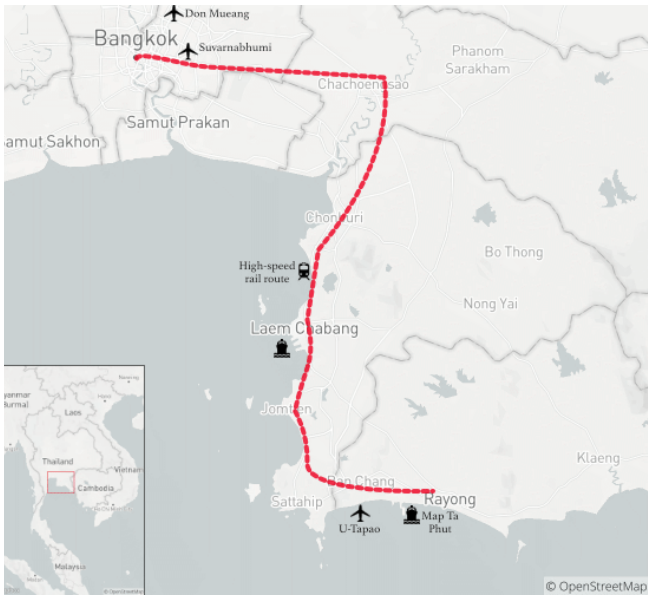
China is currently developing dual-railway tracks linking Bangkok to Nakhon Ratchasima, a major city in northeastern Thailand, which are likely to be extended to the Thai-Laos border town of Nong Khai in future. The rail route will connect to the EEC via another 225-billion-baht (US$7 billion) high-speed rail project linking Bangkok's two international airports, Don Mueang and Suvarnabhumi with U-Tapao airport in eastern Rayong province.

On the maritime route, the Thai government plans to expand the capacity of two deep seaports in the eastern region that are also align with the BRI – Laem Chabang Port phase three in Chonburi, Map Ta Phut Industrial Port phase three in Rayong.

Both ports are listed in the four EEC infrastructure projects, along with high-speed rail and U-Tapao International Airport in Rayong, which the Thai government recently asked private firms to tender for.

The government expects EEC projects to generate total investment of 500 billion baht (US$1.5 billion), and be built by public-private partnerships, entities with durations of 30 to 50 years.

Thailand's Eastern Economic Corridor



Winners and losers

On 12 November, the EEC Office revealed bidders for the high-speed rail project linking the three airports. The Thai conglomerate Charoen Pokphand Group has formed a consortium that includes China Railway Construction Corp Ltd, Italian-Thai Development PCL, and CH Karnchang PCL.

Another bidder is Thailand's BRS Joint Venture, comprising of BTS Group Holdings, Sino-Thai Engineering and Construction and Ratchaburi Electricity Generating Holding.

"China is likely to get shares in most of the infrastructure projects," says Somnuck Jongmeewasin, an independent community researcher based in eastern Thailand.

According to Somnuck, China's rising influence in the EEC is partly because other foreign companies are reluctant to make new investments given the ongoing unrest in Thai politics under the military government and potential for local opposition

"China has no concern for Thai dictators, who can fast-track procedures and environment impact assessments and award privileges for investors without consulting local opinion," says Somnuck.

Even though the EEC promises over 100-billion-baht annual investment in return, the big question is how it will distribute benefits to everyone from local to national level.

Beyond Thailand's major conglomerates, local businesses are as much in the dark as the farmers. They are short of information about the exact locations of industrial zones or railways, detailed project timeframes or when agriculture land-use zoning will be legally fixed to permit industrial development.

Overall, the EEC will boost the Thai economy says Meesak Chunharuckchote, chief executive of Chonburi Real Estate Association. "But the problem is, there is no clarity on EEC processes on the ground. There are some local investors who want to invest in the EEC but they don't see how they can engage with it at the moment."

After parliament passed the EEC legislation in mid-2018, the real estate industry was among the first to feel the impact with a wave of speculative land purchases. "Land prices are double," says Meesak, who cautions new developments will take many years.

In rural Chachoengsao, home to rice farmer Prakob's family, land prices have soared this year as buyers bet on the planned smart-city of two million people with new universities, a digital educational centre, and good transport links, confirms Jompong Chutabtim, secretary-general of Chachoengsao Chamber of Commerce.

He worries about whether there will be a well-balanced development that serves people's needs, especially given the lack of consultation: "Through the EEC, the government is selling dream to local people. We welcome the changes but they must be for the better, not for the worse," says Jompong.

Paritta Wangkiat is a Bangkok-base independent journalist covering human rights, development and environment issues.

肯尼亚：中国进口鱼产品激辩

廉价进口冷冻鱼对肯尼亚渔业影响几何？

□ 麦纳·瓦卢鲁

从中国进口的罗非鱼是肯尼亚最受欢迎的鱼类品种，每公斤售价2美元左右，而肯尼亚当地鱼类售价为每公斤3美元

杰弗里·奥巴迪·奥索洛的正式工作是肯尼亚首都内罗毕肯雅塔国立医院的会计。另外，他还开了三家鱼类批发店，两家在城里，另外一家在肯尼亚西部城镇埃尔多雷特。

他一般一天能卖出1000公斤鱼，但是去年销量却下降到每天600公斤左右，减少了40%。他认为，问题就在于来自中国的进口鱼。

他告诉我们，从中国进口的罗非鱼是肯尼亚最受欢迎的鱼类品种，每公斤售价2美元左右，而肯尼亚当地鱼类售价为每公斤3美元。来自肯尼亚国家统计局的数据显示，肯尼亚从2013年开始从中国进口罗非鱼，2016年的规模达到1亿美元，远高于2015年的6240万美元。

他补充道："进口鱼个头更小、价格也更便宜，批发价最低一公斤仅卖1美元，而当地湖鱼的最低价则要1.5美元。"

肯尼亚国家统计局的数据显示，2017年肯尼亚渔业进口总额达

到 1200 万美元，高于去年的 1000 万美元。

保卫地方渔业

手工渔民、批发商和加工商是当地渔业价值链的主力军，进口鱼让他们叫苦不迭，因为廉价进口产品导致本土产品在价格上慢慢失去优势。而此类指控也成为了中肯两国关系紧张的主要原因。

2018 年 10 月 15 日，在一场在内罗毕召开的中小企业家会议上，当地贸易商抗议中国进口产品扼杀当地企业活力。迫于压力，肯尼亚总统乌胡鲁 · 肯雅塔不得不临时宣布禁止进口中国鱼类产品。

总统表示：“尽管我们与中国保持着良好的贸易关系，但是我们也要保护本国民众的利益。如果的确是中国进口鱼导致我们的渔民陷入困境，那么我们将会出台一些进口条件阻止中国产品出口，保护地方渔业。”

虽然总统禁令还未正式成为法律，但是据当地媒体报道，中国驻肯尼亚临时代办李旭航警告称，这一禁令很可能会引发两国之间的“贸易战”。而这也会影响乌干达与肯尼亚印度洋口岸蒙巴萨港之间现代化标准铁路的二期工程融资。

目前，蒙巴萨与内罗毕之间铁路的一期工程已经完工，而另外 60 公里的西延线路正在建设之中，项目资金中有 1.5 亿美元来自中国。

肯尼亚海洋与渔业研究所高级研究员麦基冼德克 · 奥索尔指出，渔业进口有望继续填补该国每年 80 万吨的渔业资源缺口。

奥索尔援引 2016 年联合国粮农组织（FAO）的数据称，除了对进口产品进行合理监管，肯尼亚还要在现有 20.3 万吨的产能基础上继续扩大渔业产能，保证满足肯尼亚国内人均每年 4.5 公斤的渔业产品消费量。而这个数字平均下来，也就是人均每天消耗不到 3 克的渔业产品。

他指出：“我们需要进口鱼类来弥补缺口，但是也要通过合理监管平衡进口与本国产能，明确应该进口的产品。”

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维多利亚湖属于肯尼亚、乌干达和坦桑尼亚共享的湖泊。渔民艾萨克 · 奥蒂埃诺在捕捞之前准备好他的渔网，湖中的鱼类数量有所下降，导致鱼类进口量增加

他补充道："当前的首要任务是提高产能，然后再规范进口。"

积极发展地方渔业

科学家表示，由于民众对鱼类营养价值的认知度提高、人口不断增长、以及储存条件改善使得浪费减少，近年来肯尼亚鱼类消费实现了持续增长。

奥索尔指出，鱼类产品的巨大供需差距主要在于鱼类投资偏低，和过时的地方渔业捕捞技术。

奥索尔认为："其他可能的因素还包括高昂的生产成本，当然这还要看鱼类是人工养殖的还是野生捕捞的，如果是后者的话，那么当地鱼类产品反而更有竞争力。"

他说，要想满足市场需求，肯尼亚必须大力投资水产养殖，加强湖泊、河流和海洋的水产养殖及其可持续性，保护海洋生态系统。

除了上述观点外，奥索洛还指出，肯尼亚鱼类进口的混乱状况还要归咎于该国贸易与农业部门以及海关当局的腐败。

他表示，肯尼亚的渔业进口企业都必须掌握在政界或商界有影响力的人手中，因为只有他们能够在没有政府监管的情况下大肆进口鱼类产品。

不仅像奥索洛这样的贸易商受到渔业进口的影响，古德勒克·姆巴格这样的渔民也不例外。姆巴格住在肯尼亚印度洋沿海基利菲（Kilifi）地区的维平勾海滩，靠着一艘传统的单桅帆船打渔为生。

古德勒克没有任何的现代捕鱼设备，仅靠三位雇员和这艘小船进行捕捞，如今每天只能捕到20公斤金枪鱼。

他以每公斤3到4美元的价格将渔获出售给当地商人，大约每天平均进账60美元。然后还要用这笔钱支付雇员工资、自家收入和渔船损耗维修。

不公平的竞争

姆巴格说，情况并非总是这样糟糕，并指出过去六年多当地渔业交易量下降了近七成。他指责称外国捕捞船的出现，以及执法不严，允许船只进入繁殖区进行捕捞是造成目前状况的原因。

他表示，"我们捕的鱼之所以还能卖出去，就是因为新鲜，而进口产品可能已经在冰柜里储存了五个多月了。"

他指责本国监管部门的腐败导致外国渔船在肯尼亚水域非法捕鱼，因为每次外国船只被捕后不久就被释放了。同时，这些大型船只还捕光了本来小渔民可以捕捞的鱼类。

肯尼亚国家统计局2018年报告显示，肯尼亚水域的总捕捞量已经从2016年的14.7万吨下降到2017年的13.5万吨。与此同时，肯尼亚公共政策与分析研究所（KIPPRA）称，非法捕捞每年给肯尼亚带来的损失高达1亿美元。

姆巴格感觉自己的单桅帆船根本无法与国际捕捞船竞争，因为他的船最远只能驶到距离岸边两公里的海域进行捕捞，那里虽然海面平静，但鱼类数量也很少。

他说："我们只能在沿岸地区进行捕捞，劣势非常明显。"

在内罗毕的城市市场，酒店服务员艾琳·瓦伏拉承认，由于当地鱼类供应不足而进口产品价格"实惠"，所以饭店不得不用进口鱼为顾客烹制菜肴。

她不希望顾客知道自己买到的是中国进口鱼，因为有些当地人认为这种进口鱼质量不好甚至可能还受到过污染。

她说，"其实这些鱼质量很好，但是由于是从中国进口的，所以有些人会认为这些产品可能质量不行或者不卫生，因为'中国制造'质量堪忧的看法传播的太广了。"

麦纳·瓦卢鲁，自由撰稿人，常住肯尼亚内罗毕，拥有超过20年的在科学与发展、环境、气候、能源和健康方面的写作经验

China-Kenya tensions over fish as traders cry foul

Cheap imports of tilapia are undercutting the local fishing sector

□ Maina Waruru

Besides his regular job as an accountant at Kenyatta National Hospital in Kenya's capital Nairobi, Geoffrey Ombati Osoro owns two fish distribution stores in the city, and another in the western town of Eldoret.

He typically sold up to 1,000 kilogrammes of fish a day, but last year sales fell to around 600 kilogrammes, a 40% drop. Growing imports of fish from China are to blame, he says.

Chinese imports of tilapia – the most popular fish in Kenya – sell for around US$2 per kilogramme, compared with US$3 per kilogramme for local fish, he explains.

Fishermen weigh their catch at a cooling facility at Vipingo, Kilifi county, along Kenya's Indian Ocean coast. The fishermen complain that catches are declining and they must contend with competition from foreign vessels

Imports date back to around 2013 and reached a value of US$100 million in 2016, up from US$62.4 million in 2015, according to the Kenya National Bureau of Statistics.

"The imported fish are cheaper and smaller, so you can get fish at wholesale prices of as low as US$1 per kilogramme as opposed to fish from the local lake, for which the very lowest price you can pay is US$1.50 per kilogramme," he adds.

In 2017, Kenya imported fish worth US$12 million, up from US$10 million the previous year, according to figures from the National Bureau of Statistics.

Safeguarding local industry

Artisanal fishermen, wholesalers and processors are crying foul over the imports, claiming they are undercutting Kenya's indigenous sector on price. The allegations have become a major source of tension between the two countries.

President Uhuru Kenyatta banned the import of Chinese fish on 15 October in a declaration at a conference on small and medium enterprises in Nairobi. He was under pressure from traders at the event protesting against the strangulation of local businesses.

"While we have good trade relations with China, we must act to protect the interests of our people. If it is fish from China that is causing misery to our fishermen we

will creatively impose conditions to stop the exports to safeguard the local industry," the president said.

While the presidential "ban" has not been made into law, China's chargé d'affaires to Kenya, Li Xuhang, was quoted in local media warning that the ban would amount to a "trade war" between the countries. This would put at risk funding of phase two of the so-called Standard Gauge Railway, a modern line that is supposed to link Uganda to Kenya's Indian Ocean port of Mombasa.

While the first phase of the line between Mombasa and Nairobi has been completed, an additional 60 kilometres extending it to the west of the country is under construction, partially funded by US$150 million from China.

According to Melchzedeck Osore, a senior researcher at the Kenya Marine and Fisheries Research Institute, fish imports were likely to continue to meet the country's annual fish deficit of about 800,000 tonnes.

Proper regulation was required for imports while the country sought to grow local production to meet annual per capita consumption of 4.5 kilogrammes, against an annual production of 203,000 tonnes, Osore says quoting 2016 Food and Agriculture Organisation (FAO) figures. This supports less than 0.3 kilogrammes a day per person according to the researcher.

"We need imports to take care of the fish deficit, but we also need proper regulation for balancing imports and production, and for determining which products should be imported," he says.

"The first priority is to increase production and afterwards regulate importations," he adds.

Developing local fishing

Consumption of fish in Kenya has been growing due to rising awareness of its nutritional value, population growth, and improvements in storage which have reduced waste, the scientist says.

Part of the reason for the huge gap between production and demand is low investment in fisheries, and near obsolete technologies deployed by local fishermen, Osore says.

"Other factors that come into play include the high cost of production – this needs to be addressed whether the fish is from aquaculture or wild capture and this will make local fish more competitive against imports," Osore believes.

Kenya could only meet its demand for fish by investing in aquaculture, better and sustainable fishing practices on its lakes, rivers and seas, as well as conservation of marine ecosystems, he says.

Farmer at fish cage in Lake Victoria, fish cage farming is a growing concept in Kenya's water bodies being practiced in a bid to increase production.

Osoro shares these views. Corruption in Kenya's trade and agriculture ministries, and within customs authorities, were to blame for unregulated importation, he believes.

Companies that import fish must be owned by influential people in Kenya's political and business spheres for them to be able to bring in huge volumes without government regulation, he claims.

It is not only traders like Osoro who are hurting from effects of the trade. Goodluck Mbaga, is a fisherman based at Vipingo beach in Kenya's Indian Ocean coastal region of Kilifi, where he operates a dhow, a traditional type of boat.

Without any modern equipment and wholly dependent on three men he employs to operate the boat, catch has been dropping to as low as 20 kilogrammes of tuna a day.

After selling his catch to local traders at between US$3-US$4 a kilogramme, he earns an average of US$60 a day. He then shares this between his fishermen, himself and the boat – with the boat's share saved for future maintenance costs.

Unfair competition

Mbaga says that the situation was not always this bad, noting that business has gone down by 70% over the past six years or so. He blames the presence of foreign fishing vessels, and poor law enforcement that allowed vessels to fish in areas designated for breeding.

"The only reason why we have been able to sell our catch is because our fish is fresh when compared to imports which could have been stored in a freezer for up to five months," he says.

He blames corruption for illegal fishing by foreign ships in Kenyan waters, saying that when arrested the foreigners were quickly released. Meanwhile, their boats continue to deplete resources that small fishermen would otherwise catch.

The total catch from Kenyan waters dropped from 147,000 tonnes in 2016 to 135,000 tonnes in 2017 according to a report from the National Bureau of Statistics. Meanwhile, the Kenya Institute for Public Policy and Analysis (KIPPRA) estimates that the country loses fish worth US$100 million annually to illegal fishing.

Mbaga feels his dhow cannot compete with foreign vessels because it can only venture about two kilometres out to sea where waves are small but there are fewer fish.

"We can only fish close to the shore which puts us at a huge disadvantage," he says.

At Nairobi's City Market, hotel attendant Irene Wafula admits that a shortage of local fish and the lower cost of foreign produce has forced them to cook imported fish for customers.

She says she would not want her customers to know that she sells them the much talked about Chinese fish that some people deem to be of lower quality or contaminated.

"The fact is that the fish is as good as any, but there's a perception that coming from China, it could be of suspect quality or unsanitary, which is supported by the widespread belief that things made in China are of poor quality," she says.

Maina Waruru is a freelance journalist based in Nairobi, Kenya with over 20 years experience writing about science and development, environment, climate, energy, and health.

高科技助力野生动物保护

遍布全世界的技术开发者都已参与到打击非法猎杀和贩卖动物的斗争中来。

□ 凯瑟琳·厄尔利

一个开发高科技监视装置来打击野生动物偷猎和走私、监控动物种群的浪潮正在兴起。无人机、遥控相机、智能手机软件和人工智能都大显神威。这些都是急需的技术，因为濒危物种的非法交易都已转移到了线上，如社交媒体和暗网。

动物保护者与技术开发者之间通过合作生产出了针对性强、简单易用的工具。比如，Wildlabs.net 网络社区在谷歌公司和物联网企业 Arm 公司的资助下，与英国政府和伦敦动物学会（ZSL）合作，建起了一个机器学习创新中心，设计各种算法保护野生动物，防止跨境走私。上网在发展中国家的偏远地区常常是一大难题，但卫星技术和低成本的太阳能信号放大器（即移动中继站）提供了很好的解决方案。

中外对话采访了一系列战斗在打击野生动物犯罪一线的技术开发者。

SMART 软件为护林员指路

让有限的人力在广袤的国家公园和荒野中发挥最大作用至关重要，因为不论巡逻队多么训练有素、装备精良，如果离受威胁的动物很远的话，他们也无法制止偷猎者。

空间监测与报告工具（SMART）的设计能够解决这一问题。它在全球的 2000 个地点被用来监控大象、雪豹、犀牛和海豚的种群。这一工具是由世界自然基金会、伦敦和法兰克福动物园以及国际野生生物保护学会共同开发。

SMART 技术使保护团队可以收集、分析和传输有关野生动物、非法活动和保护巡逻队的数据，从而更有的放矢地利用资源、做出更加灵活的反应。这一系统能不断更新用户输入信息。比如，它可以利用保护团队收集的野生动物种群数量和状况的数据进行生物调查。

在肯尼亚的马赛马拉地区，SMART 已经使巡逻队的覆盖面积扩大了 3 倍，2017 年的偷猎下降 74%，毒害野生动物事件为零。

马赛族战士们还受到培训，通

安哥拉的野生动物保护人员学习使用SMART技术，来提高管理能力

过监测狮子的活动来保护牛群，因此2010年以来报复性猎杀狮子的现象减少了67%。

SMART是一个免费的开源技术，重要的是使用者还能选用当地语言。

AudioMoth — 倾听危险

声音监测可以成为探测动物和监听非法活动的有力工具。但是，大多数地面监测设备不仅又大又贵，而且效率低下，在查看较长的录音时十分耗费电池和人力。

AudioMoth解决了这些问题。它利用机器学习，“训练”设备能够挑出并记录有关的声音，比如特定动物的叫声、枪声或链锯的声音。

这一系统是由南安普顿和牛津大学的博士研究生们开发的。它可以大大节省电池电量、存储空间和回查音频文件所需的时间，比传统音频技术成本更低、用途更广。

在监测到枪声时，设备会向护林员站点发出警报，巡逻队就会马上出动。伯利兹政府已经利用AudioMoth来估算保护区内针对小型哺乳动物的偷猎水平，准确派出护林员巡逻队。

AudioMoth发布于2017年，是一项开源技术。

用得起的DNA检验技术制止野生动物走私

用血液和唾液样本的DNA分析来确定保护物种，在走私者企图将保护物种伪装成其他动物时尤为管用。执法官员们可能怀疑这是保护动物，但并没有足够的把握截留货物。此外，那些野生动物走私最猖獗的国家可能缺乏检验设备，只能把样本送到外国进行分析。

莱斯特大学的研究者们正在与牛津纳米孔公司合作。这家企业专门生产可以低价简便并在传统实验室环境之外对任何生物的DNA进行测序的产品。

该团队正在开发一种可以在码头、市场或海关现场尽快确定可疑样本的检验方法。这种方法既要简单到无需科学训练也能掌握，又要快捷到几个小时就能确定样本。这种检验方法将效果显著。

开发者们定于2019年初将该技术在国际刑警组织的实际执法活动中进行试验。

最终，他们希望这一技术可以让样本具有司法效力，以作为法庭证据。

用无人机保护印度犀牛

印度的卡齐兰加国家公园栖息着世界上三分之二的独角犀，由于犀角被中国和越南当作一种壮阳药，这种犀牛在上世纪90年代几近灭绝。

如今卡齐兰加公园用无人机来持续监控这些珍稀的犀牛、老虎、大象和其他野生动物。

卡齐兰加面积480平方公里，其中最濒危的物种在夜间最为活跃，因此无人机在捉捕偷猎者方面要比单靠巡逻队有效得多。无人机上带有热成像和测绘设备，再加上日夜两用型摄像机，其视频图像可以实现地面实时监控。

无人机图像还可以用来对偏远地区进行定期监测，包括野生动物普查和植被分析。印度政府已经将无人机纳入其14年野生动物规划。

印尼还用无人机对红毛猩猩栖息地进行调查，伯利兹则用它来监控非法捕捞。

人工智能对付洗钱

追踪犯罪资金与追踪偷猎者一样重要。位于新加坡的新兴公司RisikoTek开发出一种通过金融系统追踪来自“黑色交易”非法资金的软件。它利用复杂的数据分析和人工智能在数据中查找犯罪模式。算法将来自非政府组织、媒体报道、贸易和企业的数据联系在一起，帮助确定犯罪实体及其网络。银行利用这些信息，并加入自身的数据，然后追踪犯罪嫌疑人的资金走向。

RisikoTek公司已经对该技术进行测试，现在正寻找一家银行对其系统进行试验，并寻求更多愿意与一家私营新兴公司分享信息的非政府组织合作。

凯瑟琳·厄尔利，自由撰稿记者，《环境学家》前副主编

Five technologies to save wildlife from traffickers

Developers worldwide have joined the fight against the illegal killing and trade of animals

□ Catherine Early

India's Kaziranga National Park is using drones to monitor and help protect rhinos

A wave of high-tech surveillance devices is being developed to combat wildlife poachers and traffickers, and monitor animal populations. Drones, camera traps, smartphone apps and artificial intelligence (AI) all have a role to play. They're especially needed because trafficking in protected species has moved online, to social media, and the dark web.

Collaborations between conservationists and tech developers are producing targeted, straightforward to use tools. For instance, the Wildlabs.net community works with the UK government and the Zoological Society of London (ZSL), and is funded by Google and "Internet of Things" company Arm. It is launching a machine learning

innovation hub to design algorithms to protect animals in the wild, and prevent cross-border trafficking. Lack of internet access in remote areas of developing countries is often a challenge. However, satellite technology and low-cost solar-powered signal extenders known as mobile relays are showing promise.

chinadialogue spoke to a range of technology developers on the front line of combatting wildlife crime.

SMART software directs rangers

Making the most of limited manpower in vast national parks and wilderness areas is vital as even well-trained and equipped rangers cannot stop poachers if they are far from threatened animals.

The Spatial Monitoring and Reporting Tool (SMART) has been designed to solve this problem. It's being used at 2,000 sites globally to monitor populations of elephants, snow leopards, rhinos and dolphins. It was developed by WWF, the London and Frankfurt zoos, and the Wildlife Conservation Society.

SMART enables conservation teams to collect, analyse and transmit data on wildlife, illegal activities and protection patrols, leading to better targeted resources and more agile responses. The system is constantly updated with user input, for example, it can now carry out biological surveys, where conservation teams collect data on wildlife populations and condition.

In Kenya's Maasai Mara region, SMART has quadrupled the coverage by patrols, contributing to a 74% decline in poaching and zero wildlife poisonings in 2017.

Maasai warriors have also been trained to use it to protect their cattle by monitoring the movement of lions, leading to a 67% reduction in retaliatory lion hunts since 2010.

SMART is free, open-source and, crucially, available in locally relevant languages.

AudioMoth – always listening for danger

Monitoring sound can be a powerful tool to detect animals and eavesdrop on illegal activities. However, most ground-level monitoring equipment is too large, costly, and inefficient, consuming battery power and manpower on checking long recordings.

AudioMoth addresses these problems by using machine learning to "train" the equipment to pick out and record only relevant sounds – such as a particular animal call, gunshots or chainsaws.

The system, which is being developed by PhD students at the universities of Southampton and Oxford, brings huge savings in battery power, storage and time needed to review audio files. It is much cheaper and more versatile than traditional audio technologies.

In the case of gunshots, the equipment sends an alert to a ranger station so patrols can be sent out immediately. In Belize, the government has used AudioMoth to estimate poaching levels of small mammals in protected areas and target ranger patrols.

AudioMoth was released as open-source technology in 2017.

Affordable DNA tests to stop wildlife smuggling

DNA analysis of blood or saliva samples to identify protected wildlife is especially useful when traffickers are trying to pass off a protected species as another animal. Enforcement officials may suspect the animal is protected, yet not have sufficient confidence to block the shipment. What's more, countries where wildlife smuggling is most

Close-up of the MinION handheld DNA sequencer

acute may lack testing facilities and have to send samples abroad for analysis.

Leicester University researchers are working with Oxford Nanopore, a company specialising in products that analyse the DNA molecules of any living thing cheaply and simply, and outside the traditional laboratory environment.

The team is developing a test to allow a suspicious sample to be identified as quickly as possible at docksides, markets or customs posts. It needs to be simple enough to be used by someone with no scientific training and quick enough to identify samples within a couple of hours, so that it can have a direct impact.

They are due to pilot the technology in live enforcement operations with Interpol in early 2019.

Eventually, they hope the technology will allow samples to be forensically validated so they can be used as evidence in court.

Protecting India's rhinos with drones

India's Kaziranga National Park is home to two-thirds of the world's one-horned rhinos, which were nearly wiped out in the 1990s due to popular beliefs in China and Vietnam that rhino horn is a virility tonic.

Drones are now being used in Kaziranga park for continuous monitoring of the rare rhinos, tigers, elephants and other wildlife.

Kaziranga is 480 square kilometres and its most vulnerable species are most active at night, so drones are far more efficient at catching poachers than ranger patrols alone. Carrying thermal imaging and mapping equipment, plus day and night-capable cameras, their video images can be monitored on the ground in real time.

Drone images can also be used to provide regular monitoring of remoter areas, including a wildlife census and vegetation analysis. India's government has written drones into its 14-year wildlife plan.

Drones are also being used in Indonesia to survey orangutan habitats, and in Belize to monitor illegal fishing.

AI taking on money launderers

Tracking criminal funds is as important as tracking poachers. Startup RisikoTek, based in Singapore, has developed software to trace illicit funds from trafficking through the financial system. It uses complex data analytics and AI to detect criminal patterns within the data. Algorithms link data from NGOs, media reports, trade and corporate sources to help identify criminal entities and their networks. The information can then be used by banks, who can add in their own data to track payments made by – or to – the suspected criminals.

RisikoTek has tested the technology and is now looking to trial its system with a bank and find more NGOs willing to share data with a private sector startup.

Catherine Early is a freelance journalist and the former deputy editor of the environmentalist.

虎骨决定影响中国的动物保育形象

中国需永久禁止老虎和犀牛所有身体器官的使用和销售。

□ 黛比·班克斯

11月12日，中国宣布将推迟执行“允许养殖虎骨和犀牛角入药”的规定，但并没有撤销这一决定

全亚洲野生老虎数量仅余不足4000只，而亚洲和非洲的犀牛数量大约也只有约3万头。面对这一现实，各国政府领导者必须竭尽全力结束偷猎和走私活动。

各国在加强合作、有效打击跨国非法贸易犯罪网络方面的努力仍有相当大的提升空间，但消费国最不应该做的就是允许在并行的合法市场上销售老虎和犀牛（包括人工养殖个体）的任何器官及其制品来刺激需求。

10月初，中国国务院做出了一项决定，允许养殖虎骨和犀牛角入药。

国务院随后于11月12日宣布，将推迟执行10月份出台的这份条例，但并没有撤销这一决定。并且该声明只出现在英文媒体上。这一决定的命运将影响中国作为动物保育领袖的声誉。

目前的局势仍掌握在少数靠囤积虎骨和犀牛角牟利的商人手中。

不平等的保护

2018 年 1 月中国禁止了国内的象牙贸易。这一决定认识到并行的合法象牙交易市场及其许可证制度不仅刺激了需求，而且为非法象牙洗白创造了条件。这一举动在全球广受赞誉，被认为是一个积极的进步，是中国愿意采取行动结束大象杀戮的一个信号。

濒危的亚洲老虎、犀牛以及非洲犀牛并没有得到同样的保护。1993 年，中国国务院认识到传统中医拿虎骨和犀牛角入药的需求正将这些物种推向灭绝，因此发布命令，禁止“使用、制造、销售、进口和出口一切含虎骨和犀牛角的药品及声称包含上述成分的产品”。

虎骨和犀牛角正式从中国的药典中删除。

然而，少数老虎养殖场所有者（其中两位得到了相当多的政府投资）不顾 1993 年的禁令，做出了继续养殖老虎的商业决定。到 2005 年，这些商人囤积了大量老虎尸体，并游说政府重新开放国内的老虎贸易。

有可能重开老虎贸易的前景引起了普遍的警觉。2007 年，存在老虎分布的国家呼吁全球再次努力，遏制对老虎器官及相关产品的需求。为了获得老虎的皮毛、骨骼、牙齿和爪子，这些国家的盗猎现象依然猖獗。在《濒危物种国际贸易公约》第 14 次缔约方会议上，各国政府决定不应以老虎器官及其制品贸易为目的繁殖老虎，并应逐步取缔老虎养殖场。

会议在撰写该决定的条文时，特别提到此背景下的贸易禁令同时适用于国内和国际贸易。

中国并未重视这项决定，反而建立了许可和标识制度，允许出售养殖老虎的皮毛；而老虎皮毛不在国务院 1993 年禁令限制的范围之内。就在养殖老虎的数量从 1987 年的 21 头增加到如今的超过 5000 头的同时，野生种群数量却在持续减少。到目前为止，中国国内的野生老虎种群仍未恢复，数量还不到 30 头。

2012 年，民间组织“环境调查署”记录了养殖虎皮通过何种方式销售给私人买家，持证上岗的剥制师则披露了他们如何利用制度漏洞洗白非法获得的老虎个体，将虎皮和虎骨送入市场。

大约在同一时间，虎骨酒经销商和厂家按照一份“内部通知”（2005 年发布），试点用圈养老虎的虎骨入药。一名经销商解释说，这份通知允许向专供医院的指定药品制造商出售圈养虎骨。

2013 年，中国记者曝光了剥制师行业的违规问题，并于 2014 年促使政府承认存在允许虎皮交易的情况，但仍否认允许使用虎骨。

为时未晚

解禁虎骨犀牛角贸易不仅会损害 CITES 呼吁停止老虎养殖和人工养殖虎贸易的决议和决定，还会破坏中国做出的尊重《生物多样性公约》（公约的下一次缔约方会议将于 2020 年在北京举行）中避免跨境损害原则的承诺，印度、尼泊尔、俄罗斯等周边国家的努力可能化为泡影。这不禁让人对中国在打击野生动物非法贸易伦敦国际会议（London Conference on Illegal Wildlife Trade）上做出的彻底取缔老虎、犀牛等物种市场的承诺产生了疑问。

不仅如此，解禁也会破坏中国传统医学界一直鼓励会员放弃使用虎骨及其他濒危物种入药的努力。在中国传统医学界的帮助下，中医的积极形象已经传播到了全球 50 多个国家。

现在行动还不晚，中国应确保国务院下达新的文件以取代 10 月 6 日的决定，永久禁止使用和销售老虎和犀牛（包括人工养殖个体）器官及其制品，从而重振中国作为新兴全球动物保育领导者的声誉。

黛比·班克斯，英国环境调查署打击老虎和野生动物犯罪项目负责人

China's conservation image tarnished by tiger bone decision

A permanent ban on the use and sale of all tiger and rhino parts is needed

□ Debbie Banks

Tiger bone products

With fewer than 4,000 wild tigers remaining across Asia and approximately 30,000 rhinos in Asia and Africa, government leaders must do everything possible to end poaching and trafficking.

There is room for considerable improvement to efforts to collaborate more effectively and disrupt the transnational criminal networks responsible for illegal trade. But the worst thing that consumer countries can do is stimulate demand by running parallel legal markets for parts and derivatives of tigers and rhinos, including from captive specimens.

Tragically, with one ill-advised decision by the State

Illegal wildlife property

Council in early October, endorsing the use of farmed tiger bone and rhino horn in medicine, China's reputation as a conservation leader was seriously tarnished.

A subsequent announcement on 12 November suggested a delay in the preparation of regulations to implement the October decision, but it does not reverse it. It is just a postponement, which only appears in English language media.

The current situation continues to play into the hands of a handful of businessmen who are stockpiling tiger and rhino parts for profit.

Unequal protections

China banned the domestic trade in ivory in January. This decision recognised that the parallel legal market for ivory and its licensing system was both perpetuating demand and creating a means to launder blood ivory. The move was hailed globally as a positive step and a sign that China was willing to act to end the slaughter of elephants.

Asia's endangered tigers and rhinos and Africa's rhinos are not being given the same protection. In 1993, recognising that demand for tiger bone and rhino horn used in traditional medicine was pushing these species towards extinction, China's State Council issued an order prohibiting the "the use, manufacture, sale, import and export of medicines derived from tiger bone and rhino horn and products claiming to contain these".

Tiger bone and rhino horn were officially removed from China's pharmacopoeia.

However, a small group of tiger farm owners, two of whom benefited from considerable government investment, made the business decision to continue breeding tigers despite the 1993 prohibition. By 2005, these businessmen were sitting on a stockpile of tiger carcasses and were lobbying the government to re-open domestic tiger trade.

There was widespread alarm at the prospect of that happening and in 2007 countries which still had tiger populations that were being poached for their skins, bones, teeth and claws led calls for renewed commitments to eliminate demand for tiger parts and products. At the 14th Conference of the Parties to the Convention on International Trade in Endangered Species (CITES),

governments decided that tigers should not be bred for trade in their parts and derivatives and that tiger farms should be phased out.

In adopting the language of the decision, they specifically voted for trade in this context to include domestic trade as well as international.

China has ignored this decision. Government officials in what was formerly the State Forest Administration were sympathetic to the tiger farm owners and established a licensing and marking system allowing the sale of farmed tiger skins; skins being exempt from the 1993 State Council order. As the number of tigers on farms grew in China from 21 in 1987 to more than 5,000 today, wild populations continued to decline and, to this day, China's own wild population has still not recovered, numbering fewer than 30 animals.

In 2012, the Environmental Investigation Agency (EIA) documented how farmed tiger skins were being offered commercially to private buyers and licensed taxidermists disclosed how they used loopholes in the system to launder illegally acquired specimens and move not just skins but also bones into the market.

Around the same time, tiger bone wine dealers and manufacturers referred to a "secret notification", also issued in 2005, piloting the use of captive-bred tiger bone for medicines. One dealer explained this notification allowed the sale of captive-bred tiger bone to designated medicinal manufacturers authorised to supply hospitals.

When EIA exposed the domestic trade in tiger parts in China in 2013, the government denied everything – but the cat was out of the bag and Chinese journalists were uncovering how unruly the taxidermy industry had become. In 2014, the government finally admitted that it allowed trade in skins but continued to deny any use of tiger bone.

Not too late

The October decision undermines CITES resolutions and decisions calling for an end to tiger farming and trade in captive tiger specimens. It also undermines China's commitment to the principles of avoiding transboundary harm enshrined in the Convention on Biological Diversity, the Conference of Parties which it will be host in 2020, putting at risk the efforts of neighbouring tiger range countries such as India, Nepal and Russia. It calls into question China's commitment to the London Conference on Illegal Wildlife Trade to eradicate markets for species such as tigers and rhinos.

At home, it undermines the efforts of the traditional medicine community who have urged members not to use tiger bone and other endangered species, a community which has helped spread the positive aspects of traditional Chinese medicine to more than 50 countries.

It is not too late for the Chinese leadership to ensure a new State Council order is issued to supersede the one of 6 October, permanently banning the use and sale of all tiger and rhino parts and derivatives, including from captive-bred specimens, and so reinstate China's reputation as an emerging global conservation leader.

Debbie Banks is the tigers and wildlife crime campaign leader at the Environmental Investigation Agency, UK

中国可助力遏制物种灭绝

世界能否拿出一份《巴黎协定》式的生物多样性保护协议，北京将发挥关键作用

□ 伊恩·凯斯

濒临灭绝的远东豹（又名阿穆尔豹），目前约有60只生存在野外，约有200只生活在全球各地的动物园里

如今，地球生物多样性正面临严重威胁。我们生活和对待其他动物的方式导致生态系统失去平衡，造成了严重的后果。科学家甚至警告称，到2020年，全球三分之二的野生动物都会消失。

我们不仅未能与自然和谐相处，反而还在逐步摧毁着维系所有生物（包括我们自己）生存的生命之网。要想避免生物多样性崩溃和人类自己的灭亡，各国政治领导人需要共同签署一份目标远大的生物多样性协议，就像2015年达成的有关气候变化的《巴黎协定》一样。

眼下，各国政要正汇聚埃及，共同参加在此召开的联合国生物多样性公约（UN Convention on Biodiversity，简称CBD）大会。来自全球各地的人们呼吁各国领导人在2020年下一次重要的生物多样性峰会上达成一个类似《巴黎气候协定》的协议文件。下届峰会将在北京召开，因此中国外交政策对于成功达成这样一份协议至关重要。

未来的目标

世界顶尖科学家们一致认为，要想避免生物多样性危机，我们必须在2050年前修复并保存一半的地球资源，同时对另外一半实行可持续化管理。当前，许多人认为这是可能达成的北京协议的一项核心要素。

这一目标虽然很高，但却是可行的：来自环境非政府组织RESOLVE的迪纳尔斯坦等人近日进行的一项调查显示，目前全世界大约有15.5%的土地受到某种形式的保护，另外31%则处于自然或半自然状态。这一目标也得到了广泛的支持：已经有超过170万人共同签署了一份网络请愿书，呼吁各国政府在2020年通过这一计划。

这个目标对于实现《巴黎协定》中控制全球升温不超过1.5摄氏度的关键目标也非常重要。如果我们现在不采取行动改变土地利用模式、恢复森林面积和森林碳汇，那么这个目标也就无法实现。

这样一份协定应当对生物多样性丰富但没有足够资源应对这一危机的贫穷国家提供支持。此外，这项协议必须保护受到生物多样性丧失和气候变化影响的原著居民和社区的权利，鼓励有野心、一致性、透明性的商业行动。这项协议还应激励政府采取措施，通过停止毁坏行为来重塑人与自然之间的生态平衡。至少，我们必须停止有害补贴，不再使用有毒农药，并积极实现零净砍伐的目标。

积极应对挑战

大自然正在敲响警钟，民众希望政府达成协定，而科学家也已经给出了解决这场危机的办法。现在，我们需要一个领导者将各国政界领袖团结起来，共同为了一个在2020能实现的远大目标而努力，并且推动政府、民众和企业采取行动，不仅要给我们的生态系统带来变化，同时也要在经济系统内带来变革。

这是一项艰巨的任务。过去几十年，生物多样性问题一直被忽视。相关的联合国会谈很少有环境部长参与，更别说各国政府首脑了。但是，北京大会之前这种趋势可能会有所改变。中国有望成为生物多样性政治的缔造者，而且中国这样做也在情理之中。

通过生态文明建设和生态红线网络，中国正在大力采取措施保护国内的自然资源。中国不仅是全球生物多样性最丰富的国家之一，同时也是利用尖端技术应对气候变化和环境问题的领先者。所以说，中国能够举起这把保护生态多样性的火炬，而其他国家也能够和愿意团结起来追随中国的脚步。

生物多样性危机是一场集体行动的失败，但《巴黎协定》证明，只要通过正确的外交手段，各国就能够团结起来，达成长期的宏伟改革目标。法国在促成《巴黎气候协定》的过程中，通过不懈努力，激励了各方的行动，吸引了全球的注意力，发挥了重要的领头羊的作用。

我们还有机会避免自然系统发生不可逆转的崩溃。在2020年制定一个北京自然协定，将成为全球生态文明走向繁荣的一个千载难逢的机遇，而中国将成为实现这一目标的关键。

伊恩·凯斯，Avaaz组织活动总监

China can help avert an extinction crisis

Beijing will be crucial to steering an ambitious Paris-style agreement to restore global biodiversity

□ Iain Keith

Earth's biodiversity is under dire threat. The way we live our lives and treat other animals has thrown ecosystems out of balance, creating a problem so severe that scientists warn two-thirds of wild animals will have vanished by 2020.

Rather than living in harmony with nature, we are destroying the web of life that sustains all species, including our own. Preventing the collapse in biodiversity and our own extinction requires political leaders to deliver an ambitious agreement for biodiversity similar to the one agreed for climate change in 2015.

Governments are currently meeting at the UN Convention on Biodiversity (CBD) in Egypt. People from across the world are calling on their leaders to deliver a Paris climate style agreement for nature in time for the next major biodiversity summit in 2020. This will be held in Beijing, so Chinese diplomacy will be critical to guiding a successful outcome.

What to aim for

Top scientists agree that to avert the crisis in biodiversity we must restore and conserve half the earth by 2050, and sustainably manage the other half. Now, many are seeing this as a core element of any Beijing Nature Agreement.

The proposal is ambitious but viable; a recent study by Dinerstein et al. shows that roughly 15.5% of the world's lands are currently under some form of protection, and another 31% are in a natural or semi-natural state. It is also popular. Over 1.7 million people have signed an Avaaz petition calling on governments to agree to it in 2020.

The goal will also be crucial to meeting the Paris Agreement's high ambition target of staying below warming of 1.5 degrees Celsius. If we don't act on land use, and restore forests and carbon sinks now, we'll not meet it.

A Beijing Nature Agreement must offer support for countries rich in biodiversity but poor in the resources needed to respond to the crisis. The deal must protect the rights of indigenous groups and communities on the frontline of biodiversity loss and climate change, and engage businesses in ambitious, coherent and transparent actions. Finally, it must also incentivise governments to

There is still time to avoid an irreversible collapse of the natural world.

put in place policies that rebalance our relationship with nature by stopping destructive practices. At a minimum, there needs to be an end to harmful government subsidies and the use of toxic pesticides, and targets for zero net deforestation.

Rising to the challenge

Nature is sounding the alarm, people want to see an agreement, and scientists have offered a solution to this crisis. Now all that is needed is a torchbearer to rally political leaders for an ambitious 2020 outcome. One that can catalyse the actions from governments, citizens, and businesses that are needed to drive change not just in our ecosystems but our economic ones too.

It's a tall order. For decades biodiversity has been neglected. The UN talks have received minimal engagement from environment ministers, let alone heads of government. But the pathway to Beijing could reverse that trend. China can be the political rainmaker for biodiversity, and it makes sense for it to do so.

China is taking huge strides to protect large swathes of land across the country through its creation of an ecological civilisation and network of ecological red lines. China is both one of the most biodiverse countries on the planet and a leader in using cutting-edge technologies to address climate change and environmental issues. It has a torch to carry that others can, and will, rally around.

The crisis in biodiversity is a failure of collective action, but the Paris Agreement shows that with the right diplomacy, countries can come together and agree to ambitious long-term change. France was a crucial torchbearer for the Paris climate deal through its efforts to inspire action and capture the world's attention.

There is still time to avoid an irreversible collapse of the natural world. A 2020 Beijing Nature Agreement is a unique opportunity to provide a path for a global ecological civilisation to thrive, and China will be key to making it happen.

Iain Keith is a campaign director with Avaaz.org

化学品也需要《巴黎协定》式的全球公约

现有的国际化学品环境管理框架即将于2020年到期，新的全球化学品管理体系应该是何种形式？

□ 李 婧

由于降低化学品危害的全球政策框架即将于 2020 年到期，各国正在考虑建立一个能够接替它的“巴黎协定式”的协议。

2006 年通过的《国际化学品管理战略方针》（SAICM）属于非约束性的框架协定，旨在帮助各国在 2020 年前“以尽量减少对环境和人类健康造成重大不利影响的方式来生产和使用化学品”。

近日，在由瑞典驻华大使馆举办的一场圆桌会议上，联合国人权和有毒化学品问题特别报告员巴斯楚特 · 托卡克建议各国通过一个 2020 年后的全球框架。受关于气候变化的《巴黎协定》的启发，他认为这一框架应该是自愿和强制相结合的，包括一系列具有法律约束力的义务和可以定期审查的自愿措施。

托卡克表示，现有的国际化学品管理战略方针，“非常坦率地说，未能实现目标，部分原因在于国际层面缺乏对已有承诺的问责机制”。

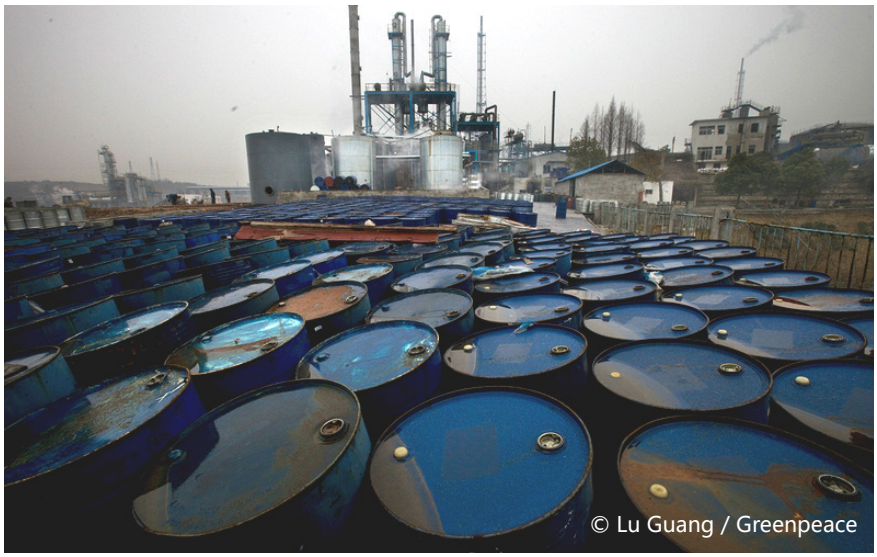
《巴黎协定》式的框架协议

根据瑞典化学品管理局（KEMI）高级顾问奥勒 · 约翰逊的介绍，全球化学品销售额预计将从 2016 年的 3.4 万亿欧元（3.8 万亿美元）增长到 2030 年的 6.3 万亿欧元（7.18 万亿美元）。

市场上流通着10万多种化学品。“没有人知道确切的数字，”约翰逊说。这些化学品中很多都会给环境和健康带来风险。

除 SAICM 外，还有一些规管化学品的国际公约，以保护环境和人类健康。例如，针对不易降解的危险化学品的《关于持久性有机污染物的斯德哥尔摩公约》。列入该公约全球淘汰黑名单中最出名的就是农药滴滴涕。

但专家认为，与问题的规模相



没有人确切地知道，有多少种化学品给环境和健康带来危害

比，此类条约的范围太过局限。经过近 17 年的发展，《斯德哥尔摩公约》仅仅对数十种化学品进行规管。而其他公约，如《关于汞的水俣公约》则针对的是非常具体的物质。

“2020 年后需要一个更强有力、更全面的全球化学品管理体系，”托卡克说，“我们现有的框架是由各个化学品公约拼凑而成的，依据的也是过时的定义”。

他认为未来国际化学品管理框架的核心组成部分应包括逐步淘汰有害化学品的机制以及对于通过国际供应链进行流通的化学品的考量。

约翰逊在其演讲中介绍，中国占全球化学品销售总量的 40%，并且这一数字到 2030 年预计将达到 50% 左右。因此，中国面临的挑战尤为紧迫。

托卡克提出的全球框架提议得到了瑞典驻中国大使林戴安的支持。她曾担任瑞典气候变化首席谈判代表。

林戴安认为，巴黎气候协定表明，自上而下和自下而上两种方法的结合可能是解决复杂环境问题的“最佳解决方案”。

“需要采取胡萝卜加大棒的策略，”林戴安称。 她解释说，与其让各国听命于外部的指挥，不如让他们拥有决策自主权，自行决定行动的步调，这样可以提高他们的主动性。不过，若该制度完全是自愿的，各国可能会逃避责任。

中国的差距

在圆桌会议上，中国专家普遍认为中国的化学品管理系统远远落后于国际先进水平。目前，安全生产和急性威胁被放在首位，而未考虑化学品对公共健康和环境的长期慢性威胁。

值得注意的是，中国目前的化学品管理体系缺乏对“现有化学物质”的有效监管。“现有化学物质”指的是中国在 2010 年《新化学物质环境管理办法》施行前就已存在的大量化学品。

2009 年，中国现有化学物质名录中共收录了 45000 多种化学物质，而其中受到法律法规监管的仅有不到 3000 种，而且大部分都是爆炸物、易燃物和急性有毒物质。

北京大学环境学院的刘建国副教授认为：“很多人类社会广泛使用的化学品一般都不具有显性的‘毒性’或‘危险性’，但是可以在很低的浓度水平对生态环境和人体健康产生长期潜在的危害性影响，”然而，目前尚无相应机制对这些化学物质进行系统的评估或规范。

随着危险化学品和相关产业逐步撤离发达国家而进入中国等发展中国家，缺乏健全的化学品管理系统增加了中国的健康和环境负担，从而带来巨大的经济和社会成本，并成为了“国家实现可持续发展的障碍。”刘建国表示。

民间组织磐之石环境与能源研究中心的联合创始人毛达认为，更严格的国际规则可以迫使参与生产和使用化学品的行业将环境和健康影响纳入其考量范围之中。

观点分歧

中国检验检疫科学研究院研究员陈会明表示，履行国际公约的义务是近年来中国建立和完善化学品管理体系的重要推动力。

不过，陈坦言，目前全球并未就化学品的环境和健康风险达成共识，建立一个具有法律约束力的全球框架为时尚早。

对此，中国纺织工业联合会可持续发展项目主任胡柯华表示赞同。他认为，即使政策制定者想要制定更严格的规则，中国的行业和市场也“还没准备好”接受一个新的国际化学品协定。

胡柯华拿中国应对气候变化的行动进行了对比。当空气污染和经济结构转型成为中国国内的重要议题后，中国才开始支持应对气候变化的全球行动。“我认为我们在化学品方面尚未达到那个阶段。”他说。

根据托卡克的说法，我们没必要在自愿和具有法律约束力的义务之间进行二元选择。“更多的是赋予各国明确的义务 ..... 同时让各国根据自己的需求制定政策，并按照自己的步调施行，但需要开展一些国际协商。”

随着 2020 年的迫近，制定接替 SAICM 的新框架的紧迫性与日俱增。今年 3 月，SAICM 的代表们未能制定出 2020 年后的框架草案。融资和问责是两个主要的分歧领域。SAICM 的下一次正式会议将于 2019 年 2 月举行。

“全球社会有能力提出比非约束性的 SAICM 更强有力的国际协定，我对此持乐观态度。”托卡克表示。

李婧，自由撰稿人，关注环境与气候议题

Experts call for Paris-style agreement on chemicals

A more comprehensive system is needed to manage the trade, production and use of chemicals after 2020

□ Li Jing

As the global policy framework to reduce chemical harm nears expiration in 2020, countries are considering whether it can be succeeded with a "Paris Agreement style" instrument.

The Strategic Approach to International Chemicals Management (SAICM) was created in 2006 as a non-binding framework to help countries produce and use chemicals by 2020 "in ways that minimise significant adverse impacts on the environment and human health".

At a roundtable organised by the Swedish Embassy and the Raoul Wallenberg Institute in Beijing, Baskut Tuncak, the United Nations' special rapporteur on human rights and toxics, suggested that countries adopt a post-2020 global framework. This should consist of a mix of legally-binding obligations and voluntary measures that could be reviewed periodically – a template inspired by the Paris Agreement on climate change.

Tuncak said that the process to achieve the 2020 chemical goal had "quite frankly, failed to be realised due in part to a lack of accountability at an international level for the commitments that had been made".

Paris-style framework

The sales of chemicals globally are projected to grow from 3.4 trillion euros (US$3.8 trillion) in 2016 to 6.3 trillion euros (US$7.18 trillion) in 2030, according to a presentation by Ule Johansson, senior advisor to the Swedish Chemicals Agency (KEMI).

Over 100,000 chemicals are circulating on the market. "No one really knows exactly how many," said Johansson. Many of these chemicals pose environmental and health risks.

Besides SAICM, there are international treaties that regulate chemicals with environmental and health concerns. The Stockholm Convention on Persistent Organic Pollutants, for instance, governs hazardous chemicals that do not easily degrade. The most notorious in the convention's blacklist for a global phase-out is the pesticide DDT.

But experts believe the scope of such treaties is too limited compared to the size of the problem. The Stockholm

" It's necessary to have a combination of carrots and sticks."
— Anna Lindstedt, Swedish ambassador to China

Convention, after almost 17 years in existence, only manages to regulate a few dozen chemicals. Other treaties, such as the Minamata Convention on Mercury, target very specific substances.

"A stronger, more comprehensive system of global chemicals management is needed after 2020," said Tuncak, "what we have today is a patchwork of treaties to manage chemicals of global concern, based on outdated definitions".

He argued that a mechanism to phase-out chemicals of global concern, taking into account the global movement of chemicals through international supply chains, should be a core component of the future framework

The challenge is particularly urgent for China, which accounts for 40% of global chemical sales, and is expected to take up almost a half of global sales by 2030, according to the presentation by Johansson.

Tuncak's proposal for a global framework was echoed by Anna Lindstedt, Swedish Ambassador to China, who previously served as Sweden's chief negotiator for climate change.

The Paris climate agreement shows that both top-down and bottom-up approaches could be the "best possible solution" for resolving complicated environmental issues, according to the ambassador.

"It's necessary to have a combination of carrots and sticks," said Lindstedt. Letting countries decide for themselves what to do and at what pace may bring more initiative than subjecting them to external finger pointing, she explained. Yet if the system is made completely voluntary, countries may shirk away from their responsibilities.

China's gap

At the roundtable event, Chinese experts agreed that the country's chemicals management system lags far behind international best practice. Currently, work safety and acute threats are seen as the priority, while long-term chemical risks to public health and the environment are largely unaccounted for.

The Tianjin chemical explosion in 2015 was the result of inadequate storage of highly reactive chemicals

Notably, there is an absence of regulation on "existing chemical substances", a legal term referring to the large number of chemicals in existence before China implemented measures for registering new chemical substances in 2010.

The 2009 inventory of China's existing chemical substances comprises more than 45,000 entries. Yet less than 3,000 substances are covered by regulations, the majority of which are explosives, flammables and acute toxics.

"Many commonly used chemicals are not obviously toxic or hazardous, yet can, at very low concentrations, present a chronic risk to health and the environment," said professor Liu Jianguo from Peking University's School of Environment. And yet there is no mechanism to assess or regulate them.

The lack of a robust chemicals management system increases the health and environmental burden on China, as hazardous chemicals and related industries, phased-out in developed countries, move into the country. This results in hefty economic and social costs, according to Liu, and creates a "significant barrier to the national strategy for sustainable development".

Mao Da, co-founder of Rock Environment and Energy Institute, a Chinese NGO, believed tighter international rules could force industries involved in producing and using chemicals to factor in the environmental and health impact into their businesses.

Different priorities

Obligations under global treaties have been important driving forces for China in establishing and upgrading its own chemicals management system in recent years, said Chen Huiming, a chemical policy researcher with the Chinese Academy of Inspection and Quarantine.

Yet Chen also admitted that a legally-binding, global framework seems out of reach without a global consensus on tackling the environmental and health risks of chemicals.

Hu Kehua, head of sustainable development at the China National Textile and Apparel Council, agreed. He said businesses in China are simply "not ready" for an international chemical treaty even if policy makers want to put more stringent regulations in place.

Hu made a comparison with the country's efforts to tackle climate change. The Chinese government only became a supporter of global action to reduce fossil fuels after its air pollution crisis and economic restructuring made it a domestic priority. "I don't think we've arrived at that stage yet on chemicals," he said.

According to Tuncak, a binary choice between voluntary and legally binding obligations is unnecessary. "It's more about giving countries clear obligations … while letting countries design their own system based on their needs and move at their own pace, but subject to some sort of international discussions."

The urgency of creating a successor to SAICM will only increase as 2020 nears. In March, delegates of SAICM failed to produce a draft post-2020 framework. Financing and accountability were two major areas of disagreement. The next formal meeting of SAICM will take place in February 2019.

"I'm optimistic that the global community will come up with something that is more robust than the non-binding SAICM," said Tuncak.

Li Jing is a freelance writer covering environmental and climate issues.

“去毒”之路：纺织行业在中国的绿色挑战

纺织行业消除有毒化学品的行动在中国已进行 7 年，成果如何？

□ 武毅秀

21世纪的纺织业可谓赶上了一个好时代。从 2000 年到 2017 年间，全球服装年产量翻了一番，并在 2014 年产量首次超过 1000 亿件，相当于地球上的每个人都分摊到了 14 件单品。Zara、H&M、Nike 和 Adidas 等品牌在全球迅速扩张，并带动其身后的产业链快速发展。

作为全球纺织服装最大的生产国和出口国，中国在全球纺织业产业链上一直占据着举足轻重的地位。但随着带有“中国制造”标牌的纺织服装产品销往世界各地，与生产这些产品相伴的污染却留在了中国。

过去数年，中国纺织业的上下游正静悄悄地开展一场“去毒”运动。这场运动的成果与困惑，显示了中国作为“世界工厂”在绿色产业升级中面临的机遇和挑战。

民间组织推动的“去毒”

纺织行业在生产过程中使用和排放的大量具有潜在危害的化学品，是其供应链环境足迹的很重要一部分。

全球生产的化学品约有 25% 用于纺织业。联合国环境署《全球化学品展望》报告曾指出，中国纺织行业消耗了全世界 42% 的纺织化学品。纺织品生产工艺中需要使用大量的化学产品作为染色剂，助剂、稳定剂等对布料进行处理。这些化学品很多会随纺织印染废水进入环境中。

2011 年，国际环保组织绿色和平发布了“时尚之毒”报告，开始了全球范围内动员消费者要求纺织行业为时尚去毒的运动。报告显示在中国广东、浙江的纺织工业园区的污水中均含有具有生殖毒性和致癌性的多种有毒有害物质。 而供应链证据将这些工厂的货品指向了包括 Adidas、Nike 以及 H&M、Zara 等在内的全球知名服装品牌。

浙江绍兴的一家印染厂，大量染色剂、助剂、稳定剂随着印染过程产生的废水进入到环境中

仅仅几个月后，包括公众环境研究中心（IPE）、自然之友在内的多家中国民间环保组织共同发布“为时尚清污”报告，再次将矛头对准纺织行业巨头，指责其“在华供应链存在严重环境违规，对中国的水环境造成严重影响。”

压力下，多家纺织服装业的领导品牌，包括 Inditex（ZARA 母公司）, H&M 等快时尚品牌和 Puma，Nike，Adidas 等运动品牌，均加入了承诺到 2020 年实现供应链内有毒有害物质零排放的厂商行列。为此，这些品牌甚至还成立了一个 ZDHC（Zero Discharge of Hazardous Chemicals）基金会，作为行业合作促进机构，对“去毒”的要求作出回应。

纺织行业“去毒”承诺的核心元素包括：对供应链进行化学品管理、信息公开透明（通过网络平台公布纺织废水和污泥的检测结果，并公布供应商清单）、有毒化学品的替代和淘汰。

如今，七年过去，距离 2020 年“无毒时尚”目标也只有不到 2 年时间了。供应链去毒的进展如何？

“去毒”之路

民间组织的“去毒”呼吁，给行业带来了震动。

中国纺织工业联合会（CNTAC）可持续发展项目主任胡柯华这样评价：“在绿色和平的报告之前，纺织业界关注的都是终端产品里的化学品，关注的是产品质量的合规，对于生产过程中的化学品到底是怎样的情况，是不太在意的。所以报告出来时，业界一方面是震惊，一方面也不太理解这个问题，有些业界人士甚至感觉很无辜。”

据绿色和平统计，截至目前全球已有 80 家纺织品牌和供应商作出了“去毒”承诺，这些品牌的销量占全球纺织业市场份额的 15%。“这些品牌都在实现无毒供应链的道路上取得了长足的进步”。如今，绿色和平在最新一期的《为时尚去毒》(Destination Zero) 进展报告里这样评价品牌们的表现：“品牌为时尚去毒的行动，已经帮助将纺织行业的化学品管理工作推向一个不可逆转的新的趋势。”

加入“去毒”承诺的公司要做的第一件事，就是建立一个生产禁用物质清单（MRSL, Manufacturing Restricted Substances List），俗称为“有害物质黑名单”。名单中的化学品将在生产全过程的各个环节被禁用。品牌也会公布淘汰这些化学物质的时间表。

H&M 全球可持续项目经理 Veera Sinnemaki 是这样介绍 H&M 的供应链“去毒”之路的：“在 2012 年，公司要做的第一件事，就是对现有供应商使用的化学品进行全面的筛查和信息登记，然后对化学物质毒性进行筛检（screening）。”

2012 年，H&M 发布了 MRSL，同时也发布了面向其供应商的正面产品清单，并针对 H&M 的供应商做了培训。

“通过 MRSL 的发布，我们的供应商就会知道有哪些产品他们是需要替代的。之后，H&M 通过正面清单告诉厂家哪些产品可以用在我们的生产线上。这整个过程，需要每个供应商提供他们的化学品使用清单，然后与我们的清单进行比对。”Sinnemaki 解释说，“今天，制定化学品清单和采购政策已是我们所有供应商的最低要求。”

在 2018 年 9 月更新发布的“H&M 正面清单”里，列出了数千种允许使用的纺织化学品，详细列出了每一种产品的名称、种类、用途、供应商等信息。

Sinnemaki 说：“最大的挑战是供应商对化学品问题的意识。应该说，当时来自民间组织的宣传和报告有助于这一问题的传播。在当时，我们没有别的选择，只能就决定这样开始了。”

针对供应商的能力建设是品牌需要啃下的第二块“硬骨头”。供应链的化学品管理涉及到供应链环节的多个层级的供应商，不仅仅是“第一级”的成衣供应商那么简单。而在污染最多、化学物质使用最多的湿法处理（wet processing）环节，也是化学品管理知识、能力和意识极为匮乏的环节。大多数品牌需要提供培训、技术支持，从零开始为供应链中的厂家提供能力建设。

与之相辅相成的是供应链的信息透明。加入“去毒”承诺的品牌，需要公开他们的执行进展，保证越来越多的供应商公布他们的废水检测结果。如今，很多品牌已经将这一信息公开扩大到了二、三级的供应商，甚至有一些品牌开始上溯到纤维制造阶段。

“全面的公布我们的一级供应商和二级供应商的名单，会使他们接受到各个方面的更加密切的关注和监督，并不仅仅局限在化学品上。当他们看到自己的名字公开的时候，对他们是更好的监督。”Sinnemaki 表示。

挑战重重

对供应链化学品的管理，最终需要落实到有害化学品的替代。出于成本和成熟替代品的可获得性等原因，有害化学品的替代一向被认为是“去毒”过程中最困难的一步。 在实践中，达成“替代”这个共识，甚至要比寻找替代品本身难度更大。

“这是一个先有鸡还是先有蛋的问题。 供应链的厂商往往希望品牌能够先采取行动，而品牌寄希望于上游行业能够先提供替代品。”ZDHC 基金会东亚区总监林立在介绍化学品替代项目时这样说。

林立以二甲基甲酰胺（DMF）的淘汰为例，说明行业共识对替代的推动作用。DMF - 二甲基甲酰胺，是皮革和纺织品生产中用途很广的一种溶剂，因其健康风险而被欧盟列为“高关注物质”(SVHC)。在品牌们调研 DMF 的替代品时，发现上游的合成革行业已有解决方案。由此，几个大的品牌率先提出要在 2020 年或 2025 年淘汰 DMF。“通过越来越多的品牌加入，在行业的合作和对话之下，从 2015 年到今年五月，中国的无 DMF 替代品——水性合成革产量增长了 120%，无溶剂合成革增长了 40%。我们预计到今年年底，DMF 替代品的产量还会持续增加。”林立表示。

对此，绿色和平“为时尚去毒”的项目官员 Yannick Vicaire 很有感触地认为，替代的成本和难度，并没有想象的那么高。“在过去几年，我们看到全氟化合物（PFC，一种具有潜在危害的化学品）的市场已经产生了巨大的变化。从 PFC 的替代历史我们可以看出，其中花费最多的时间，是品牌‘抗拒’的时间。一旦品牌公司同意，某种化学品需要被替代，市场就会紧跟上。”

上游厂商和政策支持成瓶颈

尽管到目前为止，大部分的大型纺织品牌已经悉数展开了供应链去毒的行动，但绿色和平的 Vicaire 仍然认为距离全行业的真正“去毒”还很远。

“我认为我们还没有实现‘无毒’供应链。尽管现在已经有 80 家纺织品牌加入了去毒的承诺，我们需要这个理念尽快被政府所采纳和推行。因为尽管大品牌可以加大对供应链的管理，但是这个行业其余的品牌还没有加入进来。”

纺织服装行业高度分散的属性增加了问题解决的难度。80 家国际大型的服装零售公司和纺织供应商，其体量也仅占全球行业的 15%。世界范围内，电商和网购的兴起使得纺织品牌更加多元。在中国，更多的工厂服务于二、三线、甚至没有品牌标签的低廉服装品牌。这意味着纺织业供应链的大部分还没有被置于严格的化学品监管之下。中外对话访问的业内人士均认为，来自上游化学品厂商的深度参与和政策的引导，对于下一步的行动至关重要。

H&M 的 Sinnemaki 认为，政策的进步会降低品牌推进工作的难度。”我们希望政策能够最终让源头的化学品公司负起责任。如果生产这些化学品的公司能够淘汰这些有毒化学品的话，那么对于纺织品的供应商和品牌来说，管控化学品将会变得非常容易。”

此外，如何发挥和调动起中国供应商的主动性，在上游行业内实现更有效的联动，也是中国纺织产业面临的问题。 今年 4 月，中国的一些大型纺织染料、助剂、化学品公司，发出了“行业自愿行动”的倡议，承诺制订上游行业的 MRSL，以便更好地整合目前的多个标准和行业要求。胡柯华认为,“中国的化学品供应商占据了全球 60% 以上的体量，所以说在全球的纺织品化学品管理里，他们才是真正的主角。”

“没有其他利益相关方在去除有害化学品上的推动，我们对于供应商的推动是有限的。”林立这样总结,“政策推动和市场推动两条腿的方向一致的话，供应链去毒的步伐会更快。”

武毅秀，中外对话气候传播项目负责人

Textile industry under pressure to detox fashion

Leading brands are removing toxic chemicals from their Chinese supply chains, but they can't do it alone

□ Wu Yixiu

The 21st century has been good to the textile industry. Global clothing production doubled between 2000 and 2017 to surpass 100 billion items annually for the first time in 2014 – that's equivalent to 14 new items for every person on the planet. Leading brands such as Zara, H&M, Nike and Adidas have expanded their supply chains to keep up with demand.

China is the world's largest producer and exporter of textiles and clothing, but while "Made in China" products are sold around the world, the pollution from their manufacture doesn't leave the country.

The call to clean up

Textile manufacturing uses enormous quantities of potentially harmful chemicals. Large quantities of dyes, additives and stabilisers are used to treat textiles, which then enter the environment through wastewater.

> Eighty fashion brands and suppliers, accounting for 15% of the global clothing market, have agreed to "detox".

According to the Chinese Textile Industry Association, 25% of global chemical output is used in the textile industry. The United Nations Environment Programme's Global Chemicals Outlook report points out that 42% of that usage is in China.

In 2011 Greenpeace published Dirty Laundry, a report that called on consumers worldwide to demand change in the fashion industry. The report showed wastewater in textile industry zones in Guangdong and Zhejiang contained chemicals that cause cancer or are harmful to reproduction. Supply chain investigations linked the products from those factories with global brands, including Adidas, Nike, H&M and Zara.

Just several months later a number of Chinese non-governmental organisations, including the Institute for Environmental and Public Affairs and Friends of Nature, published a report on fashion's polluting practices, again taking aim at global mega-brands and warning of "severe breaches of regulation in their Chinese supply chains, with a grave impact on China's water environment".

Leading brands, including fast fashion companies Inditex (Zara's owner) and H&M, along with Puma, Nike and Adidas, committed to ending the release of harmful substances from their supply chains by 2020. A Zero Discharge of Hazardous Chemicals Foundation (ZDHC)

A textiles factory discharge pipe in China

was set up to encourage and guide change in the sector.

The key elements of that commitment include management of chemicals used in the supply chain, information transparency (wastewater data monitoring and supplier lists) and the replacement of harmful chemicals with alternatives.

Seven years have passed and the 2020 target is nearing, so what progress has been made?

Reforming the industry

Before the Greenpeace report, the textile industry was focused on product quality and chemicals in end products, said Hu Kehua, head of sustainable development at the China National Textile and Apparel Council. "The use of chemicals in the manufacturing process wasn't of much concern so the report shook the industry, but also we didn't really understand the issue and some people felt they were being wrongfully accused," he said.

According to Greenpeace, 80 fashion brands and suppliers, accounting for 15% of the global clothing market, have agreed to "detox".

"Committed brands and companies are delivering on the rigorous management of hazardous chemicals collectively," wrote Greenpeace in Destination Zero, a recent progress report, "and they have reached a critical point where there's no going back".

The first step companies are asked to take is to set up a Manufacturing Restricted Substances List (MRSL), which is often described as a harmful substances blacklist that can guide the elimination of harmful chemicals from the manufacturing process.

Veera Sinnemaki, chemicals programme manager with H&M, explained: "The first thing we did in 2012 was to look into chemicals in the supply chain. Together with the facilities, we conducted a chemical inventory, then we analysed the hazards of each incoming chemical."

In 2012, H&M published its MRSL along with a list of endorsed alternative chemicals. It then started training its suppliers.

"Once the MRSL was released our suppliers would immediately know which chemical products they needed to replace," said Sinnemaki. "We then provided the positive

list, which is the chemical products that we endorse so that they know which chemicals are allowed to be used in our supply chain."

One challenge was helping suppliers understand why the changes were necessary, added Sinnemaki. Another was working to build capacity with them. Management of chemicals involves the entire supply chain so it's not just a matter of working with the top tier suppliers of finished clothing items; the use of chemicals is greatest at the wet processing stage, where knowledge and abilities are most lacking so companies have had to provide training and technical support to build these capacities from scratch.

Supply chain transparency can help this process if companies publicise their progress and ensure that more suppliers make wastewater monitoring data public. Many companies have extended this to second and third tier suppliers, with some having also reached textile manufacturers.

"By releasing the list of the first and second tier suppliers they will be scrutinised more," said Sinnemaki.

Finding alternatives

Ultimately, the chemicals that cause harm need replacing, but cost and availability of alternatives means this is seen as the toughest part of the process.

"The manufacturers in the supply chain always want to see the fashion firms take action first, while the fashion firms want their suppliers to provide alternatives," said Lin Li, East Asia director of the ZHDC Foundation.

The replacement of dimethyl fumarate (DMF) is a good example of the role industry consensus can play, said Lin. DMF is a widely used solvent in the textile and leather industry, but it has proven hazardous to health so was listed by the EU as a Substance of Very High Concern (SVHC). When fashion brands searched for an alternative they found a solution with their suppliers of synthetic leather, and so several major firms required the removal of DMF from their supply chains, with deadlines ranging from 2020 to 2025.

"With more companies getting involved, and with cooperation and dialogue within the sector, production of

In 2012, Greenpeace activists installed a group of mannequins around a large wastewater discharge pipe belonging to the Linjiang Waste Water Treatment Plant, in Xiaoshan District, Hangzhou

DMF-free alternatives, such as water-based synthetic leather and solvent-free synthetic leather, grew by 120% and 40% respectively from 2015 by May this year. We expect that to continue to increase by year's end," said Lin.

Yannick Vicaire, campaign strategist for Greenpeace's DetoxMyFashion project, said the costs and difficulties should not be overstated. "Once companies agree that chemicals should be substituted, the market follows."

Engaging all suppliers

Although the majority of major fashion brands have started to take action, Vicaire thinks there is still a long way to go. "Even though 80 brands have adopted the zero discharge of hazardous chemicals goal we are not there yet. We need these dynamics to be adopted by all governments because though big brands lead the trend, the rest of the industry have not followed," he said.

Spurred by the emergence of online shopping and e-commerce, the textile and clothing industry is dominated by small firms, which makes change more difficult. In China many factories supply lesser-known brands, or produce cheap unbranded clothing. This means the bulk of the clothing supply chain is not subject to strict chemicals management. Industry figures interviewed by chinadialogue said that chemical suppliers and policy-makers will be crucial to supporting the sector's next steps.

H&M's Veera Sinnemaki agreed that government policy is needed to get the industry to change. "If there are policies holding chemical companies accountable, chemical management work will be much easier for both brands and suppliers," she said, referring to the upstream chemical companies that provide chemical agents to the textile industry.

There is some movement among chemical suppliers on this issue. In April, a number of large Chinese suppliers of dyes, additives and chemicals to the clothing sector launched a voluntary initiative to produce a Manufacturing Restricted Substances List that applies to their own sector. This would integrate several existing industry standards.

Hu Kehua thinks that China will be key to making this work. "China's chemical manufacturers account for 60% of global output, so have a real role to play in chemical management in the clothing sector," he said.

"Without help from other stakeholders to eliminate harmful chemicals, there are limits to what we can do in the supply chain," concluded Lin Li. "Detoxification of supply chains would happen quickly if both policy and the market moved in the same direction."

Wu Yixiu is team leader of Chinadialogue's Strategic Climate Communication Initiatives.

世贸组织渔业补贴改革恐破坏其声誉

每年约有350亿美元补贴投入海洋渔业，对海洋生态系统造成了破坏性影响。

□ 麦纳·瓦卢鲁

今年谈判重点是在遏制破坏性的渔业补贴问题上达成国际协议

国际贸易官员表示，世界贸易组织须在全球渔业补贴改革方面取得切实进展，以拯救海洋及挽回自身声誉。

11 月在内罗毕召开的蓝色经济峰会上，与会官员表示，在明年 1 月世贸组织部长级首脑会议前，各成员国必须将重心放在保护世界海洋和内陆水域的未来上，而不应该继续增加渔业产量。

世界贸易组织规则谈判组主席罗伯托·萨帕塔·巴拉达斯（Roberto Zapata Barradas）说：“在磋商中，我们应该把维系全球渔业生存当作首要任务。我们应在过程中考虑到渔民和传统捕鱼社区的利益，解决有争议的补贴问题。”

今年谈判重点是在遏制破坏性的渔业补贴问题上达成国际协议。这些不合理的补贴包括导致全球产能过剩、过度捕捞和非法捕捞（IUU）的政府支出或税收减免政策。

世贸组织的 164 个成员国将致力于达成具有约束力的协议，来取消此类补贴，关于取消此类补贴的探讨已持续了二十余年。强有力的新承诺将有助于达成这项紧迫的协议。

总部位于日内瓦的国际贸易与可持续发展中心（ICTSD）首席执行官里卡多·梅林德（Ricardo

Menendez-Ortizo）表示，一些渔业公司在进行非法、未报告和无管制（IUU）捕捞的同时仍享有政府补贴，这“令人费解”。

他说，谈判代表有责任提出经得起时间考验、具有约束力的承诺。

发言人表示，国家间的会谈必须本着诚信、透明、包容和政治互信的原则。达成的成果应“切实可行”。

全球渔业补贴每年近 350 亿美元（2320 亿元人民币）。据欧洲议会渔业委员会称，其中以提高产能为名提供给大型捕捞船队的补贴高达 200 亿美元（1320 亿元人民币），例如燃料补贴和税收减免计划。

据联合国粮食及农业组织 2016 年发布的 SOFIA 报告称，在被评估的全球鱼类资源中，完全开发的约占 60%，过度开发的占 30%。补贴导致捕鱼船队扩张，因此对补贴加以控制或有助解决问题。

皮尤慈善信托基金会的渔业专家埃内斯托 · 费尔南德斯 · 蒙赫（Ernesto Fernandez-Mong）表示，渔业补贴法的改革势在必行。他表示，研究表明补贴会威胁世界鱼类资源的健康发展。

“规范捕捞活动很重要，[但] 我们必须注意保护工作。要知道，有鱼的地方就会有人在。”加拿大世贸组织特使斯蒂芬 · 德波尔（Stephen De Boer）说道。

据比利时非洲加勒比和太平洋（ACP）秘书处渔业专家彼得 · 韦克萨（Peter Wekesa）表示，许多发展中国家政府缺乏打击其海域内不良捕捞作业的执法能力。因此，许多发展中国家的沿海社区仍在遭受 IUU 的影响。

他说，这些国家的渔业部门发展不够成熟，会从 WTO 谈判所制定的规则中得到好处。

“2019 年对于世界渔业的未来至关重要，必须达成协议，”他指出。“世贸组织谈判必须汇聚专家和谈判代表，以提升其影响力，并对补贴问题进行探讨，来拯救我们的鱼类资源。”乔治敦大学法学教授埃内斯托 · 费尔南德斯 - 蒙格（Ernesto Fernandez-Monge）说。

2001 年在多哈举行的世贸组织渔业部长级会议首次提出补贴改革的承诺。

明年 1 月份会谈的目的是“阐明和改进”2005 年香港部长级会议上制定的捕鱼补贴的现行规则，其中包括禁止导致“产能过剩和过度捕捞”的补贴。

2017 年在阿根廷布宜诺斯艾利斯举行了类似的会议。在这次会议上，部长们达成一致，将在 2019 年的部长级会议上完成谈判。

麦纳 · 瓦卢鲁，自由撰稿人，常住肯尼亚内罗毕，拥有超过20年在科学与发展、环境、气候、能源和健康方面的写作经验

WTO risks reputation on subsidies reform

Around US$35 billion per year is paid to the fishing industry, with devastating consequences for marine life

□ Maina Waruru

The World Trade Organisation must make progress on reforming global fishing subsidies to save the ocean and its own reputation, say international trade officials.

Ahead of the WTO ministerial summit in January next year, member states must focus on safeguarding the future of the world's seas and inland water, rather than increasing production, said officials at the Blue Economy Summit in Nairobi in November.

"We must approach these talks with sustenance of world fisheries as a priority," said Roberto Zapata Barradas, chair of WTO's Negotiating Group on Rules. "The process should address the controversial question of subsidies, taking into account the interests of fish farmers and traditional fishing communities."

Central to this year's talks will be an international deal to curb harmful fishing subsidies. These are government payments or tax breaks that contribute to overcapacity, overfishing and illegal fishing (IUU) globally.

> " The year 2019 is pivotal for the future of fisheries in the world. An agreement must be secured. "
>
> — Peter Wekesa

The 164 member countries of the trade body will aim for a binding agreement to eliminate these subsidies, an issue that has been under discussion for more than two decades. A strong, renewed commitment will help to achieve an urgently-needed deal.

It is "unfathomable" that some fishing companies are still engaged in IUU fishing while enjoying subsidies from their own governments, said Ricardo Menendez-Ortizo, chief executive of International Centre for Trade and Sustainable Development (ICTSD), based in Geneva.

Negotiators have a duty to come up with binding commitments that will stand the test of time, he said.

The talks must be conducted between countries in good faith, with transparency, inclusivity and free of political mistrust, said speakers. The outcomes should be "enforceable".

Subsidies paid to the fishing industry amount to around US$35 billion per year (232 billion yuan), globally. Of this, US$20 billion (132 billion yuan) is given in forms that enhance the capacity of large fishing fleets, such as fuel subsidies and tax exemption programmes, according to the European Parliament's Committee on Fisheries.

Around 60% of the world's assessed fish stocks are fully exploited and 30% are already overexploited, according to the 2016 SOFIA report, published by the United Nation's

Food and Agriculture Organisation. Curbing subsidies that underpin fleet expansion can address this.

There is a need for urgent reforms on subsidies law governing fisheries, according to Ernesto Fernandez-Monge, fisheries expert at the Pew Charitable Trust. He said research shows that subsidies are harmful to the health of the world's fish stocks.

"Regulating fishing activity is important, [but] we must take care to protect jobs and know that people go wherever fish go," said Stephen De Boer, Canada's envoy to WTO.

Many governments in the developing world lack the capacity to enforce laws to prevent harmful fishing activities in their own waters, according to Peter Wekesa, fisheries expert at the African Caribbean and Pacific (ACP) secretariat in Belgium. As a result, many coastal communities in developing countries continued to suffer from IUU fishing activities.

He said these countries often have undeveloped fishing sectors that would benefit from protection of rules reached at the WTO talks.

"The year 2019 is pivotal for the future of fisheries in the world, an agreement must be secured," he noted. "WTO talks must bring together experts and negotiators to raise the profile and discuss the issue of subsidies to save our fish stocks," said Ernesto Fernandez-Monge a law professor at Georgetown University.

A commitment to reform subsidies was first made in 2011 at a WTO ministerial Conference on Fisheries in Doha.

The aim of the January talks will be to "clarify and improve" existing rules on fishing subsidies, set at the 2005 Hong Kong ministerial conference, including a call to prohibit subsidies that contribute to "overcapacity and overfishing".

A similar meeting was convened in 2017 in Buenos Aires, Argentina where ministers agreed on a programme to conclude the negotiation at a ministerial conference in 2019.

Maina Waruru is a freelance journalist based in Nairobi, Kenya with over 20 years experience writing about science and development, environment, climate, energy, and health.

应对“鬼网”，各显神通

残留在海中的“幽灵渔具”是巨大的生态环境隐患，世界各地的机构与个人都在想办法解决这个问题。

□ 张 春

在各种最终落脚海洋的塑料垃圾中，各类废弃渔具可能要占近一半。

这些因捕鱼或养殖而被制造出来的渔具在废弃后不仅成为污染海洋环境的垃圾，也成了威胁海洋生物的“杀手”，从珊瑚礁到鲸鱼，甚至潜水员，无不笼罩在这些“幽灵”阴影之下。

全球范围内，对“幽灵渔具”（或称“鬼网”）的关注正在增加。在中国深圳，巴基斯坦卡拉奇，地中海等地，都有潜水员组织将清理当地海中的废弃渔网作为一项公益活动坚持下来。与此同时，一些机构和企业也在为收集上来的废弃渔具寻找出路，并寻找减少塑料入海的解决方案。

目前数十个遍布世界各地的机构，在进行海底渔网清理、废弃渔网回收再利用，以及利用废弃渔网发电等

废弃渔网粗加工

自从2017年底参与救助了一只被困在废弃渔网中的抹香鲸之后，“潜爱大鹏”(DiveforLove)的潜水志愿者们，就开始不定期地潜入深圳大鹏湾的水下打捞各种海底垃圾，特别是遗弃海底的渔网。

他们特意邀请当地的老渔民来传授渔网编织方法，将打捞上来的废网线编成可重复利用的网兜，便于潜水员下海时装垃圾。同时，也让渔民们认识到“随意丢弃的渔网已经成为新的麻烦”。

不过，从海底打捞的渔网一般都有很大的结且手感粗糙，无法生产更高价值的消费品。“潜爱大鹏”也在尝试用一种手感平滑、网眼细密的养殖渔网制作潜水袋。不过由于需要人工从回收站的各种垃圾中找出这种渔网并清洗干净，成本大大提高，暂时难以市场化生产。

为了实现废弃渔网的可持续利用，“潜爱大鹏”秘书长夏嘉祥带队探访了一些塑料回收厂，了解到大

部分进入回收体系的塑料渔网都会被加工成塑料颗粒以便再次加工利用。这给了他们启发。目前，他们还在寻求让这些塑料回到环境友好产品中的路径。

废弃渔具深加工

与简单的废弃渔网再利用相比，将废弃渔网“回炉”再造为再生塑料颗粒用来制造更多消费产品，可以消化更多回收来的渔具。美国加利福尼亚州注册的Bureo公司做的正是这项工作。

这个公司是由三个热爱冲浪但对海洋垃圾深感焦虑的年轻人发起的，第一笔资金来自众筹。Bureo的产品也主要是与户外相关，冲浪板、滑板、太阳眼镜、玩具等。

Bureo并不完全自己生产产品，而是尝试将回收生成的塑料原料颗粒推介给其他公司，在其产品中掺入部分渔网回收塑料。如HumanScale公司生产的一种办公椅，每把椅子中就有近2磅（约1公斤）的渔网材料；而Bureo和Jenga公司合作生产的一款积木类玩具产品就完全用回收渔网材料做成。

该公司在智利各地设置了回收点，由渔民自行投放废弃渔具，最后再统一回收处置。目前已有26个智利渔民社区加入了这一行动，从2013年至今共搜集处理了超过185吨废旧渔网。目前，Bureo已与WWF合作将工作扩展到秘鲁。他们将与秘鲁渔业部门联合寻求综合解决方案，试图将每年的渔网回收量提高到1000吨以上。

从渔网到织品

同样是用废弃渔具回收再利用，有50年历史的尼龙生产企业Aquail将其用于生产纺织品。

渔港作为渔船出入最频繁的地方，常常堆积大量的废弃渔网；而养殖场为了防止鱼儿逃脱，也会使用大量网眼极小的渔网做围栏。因此Aquail和许多港口以及养殖场直接合作，现在每个月从港口、养殖场和部分海底清理而来的渔网总量可达400-500吨。

尼龙重新加工后，用于生产地毯等纺织品。现在，渔网可以占到Aquail回收品的四分之一。

替代材料

将已经废弃的渔具进行回收和再利用是一项艰巨的工作。从源头减少渔具和塑料部件入海对于海洋环境保护更为关键。

泡沫塑料在养殖业十分常用。但这种塑料正常只有一年寿命。它们很容易遇外力破损，如果遭遇台风或其他事故，破损的泡沫塑料极易变成海洋垃圾和微塑料。

在中国山东潍坊的一个海水养殖场，泡沫塑料浮排被替换成了一种硬质塑料球。每个浮球下是一串价值五六百元的牡蛎，因此这种比一般泡沫塑料更耐久的浮球，不仅可以减少进入海洋的塑料碎片，而且可以更好地保护牡蛎。

养殖场董事长陈维江介绍，他们根据可持续认证的要求，会定期对球进行巡视以防止脱落。

据SCS可持续水产养殖认证项目中国区代表李海峰介绍，这种浮球添加了橡胶成分，具有一定弹性，故不易撞碎。不过，一个普通养殖场近20亩水面要使用约2000个浮球，因其更不容易降解，一旦遗落海洋，也可能成为海洋新的麻烦。

消灭“鬼网”

减少“幽灵渔具”，仅靠志愿者的回收和有限的替代远远不够。让渔民社群参与到问题的解决中，将极大地增加各种海洋塑料的回收率。在苏格兰，已有机构将渔民组织起来，把捞到的垃圾收集带回陆地。

最重要的一点是如何从源头减少渔具入海。除了给渔网编号追踪渔具行踪，通过经济回馈鼓励渔民回收，替代渔具的开发和应用也需要尽快提上议事日程。最重要的是，要让更多的渔民意识到，如果他们持续往海里丢弃不可降解的渔具，这场与“鬼网”的战争永远没有胜利的一方。

张春，中外对话高级研究员

Five ways to tackle ghost fishing gear

Abandoned gear is a huge threat to the environment but there are lots of ways to fix the problem

□ Zhang Chun

Fishing gear that's lost or dumped in the ocean may account for almost one half of all the plastic waste that ends up there. But this equipment, which is manufactured for fishing or aquaculture, isn't ordinary waste because it continues to do what it was designed for – trapping marine life, with devastating consequences.

Global awareness of the issue is growing though. In Shenzhen, Karachi and the Mediterranean, for example, diving organisations are removing nets from the marine environment, while numerous companies and organisations have sprung up to find ways of reusing the waste.

No dumping

Before getting to the alternative uses for old fishing gear, it's worth remembering that relying on volunteers to recycle ghost nets will never fix the problem. Fishermen must also get involved to increase recycling of marine plastics. In Scotland, one organisation is doing this, bringing waste collected at sea back to land.

But most important is stopping fishing gear from being lost to the ocean at all. Alongside tracking fishing gear and offering financial incentives for recycling, the development and use of alternatives needs to be accelerated. Most important is making fishermen aware that if non-biodegradable fishing gear continues to be dumped at sea, nobody will win the battle against ghost nets.

Basic processing of abandoned nets

Since helping to rescue a sperm whale trapped in abandoned fishing nets in 2017, the volunteers with

Sea lion, with nylon strings and piece of fishing net wrapped around his neck that caused him a deep wound.

Diveforlove have been recycling old nets into bags.

Shenzhen diving organisation Diveforlove have been removing marine litter, and fishing nets in particular, from the seabed of nearby Dapeng Bay.

They consulted with the fishermen living locally to learn how fishing nets are made, and now recycle the old nets into bags, which they use to store rubbish collected when diving. This also made the fishermen aware of how their abandoned nets were causing problems.

But the nets tend to be coarse and knotted and cannot be used to make more valuable consumer goods. Diveforlove is trying to make similar bags out of finer nets used in aquaculture, but these need to be scavenged at the recycling centre and then cleaned, which makes the process more expensive and harder to commercialise.

In their search for a sustainable way of reusing fishing nets, Diveforlove head Xia Jiaxiang and the team visited plastics recyclers, learning that most recycled plastic nets are turned into plastic pellets before being reused. This provided some inspiration and they are now looking for ways to ensure the plastic is used in environmentally friendly products.

Deeper processing of recycled nets

A lot of recycled fishing gear can be melted down into plastic pellets that can be used to make new consumer products. Bureo, a California-registered company, is currently working on such a project.

Bureo was founded by three young surfers deeply concerned about marine litter, and was initially financed via crowdfunding. Its products are mostly outdoor goods: surfboard, skateboards, sunglasses and toys.

The company does not just make its own products – it also provides its pellets to other companies, which use them in their own goods. For example, a company called HumanScale makes an office chair containing about one kilogram of Bureo's plastic sourced from fishing nets. Bureo also works with Jenga to make a version of the popular game featuring blocks made entirely out of recycled fishing nets.

The company has recycling stations throughout Chile, where fishermen can deposit waste nets. Currently 26 fishing communities are involved, and since 2013, 185 tonnes of waste nets have been collected. Bureo is now working with WWF to expand to Peru, where they are working with the fishery authorities to increase the quantity of nets recycled every year to over 1,000 tonnes.

From fishing nets to textiles

Nylon manufacturer Aquail, which has been in business for 50 years, is recycling old fishing nets to make textiles. Piles of old nets often accumulate in fishing ports, and fish

The port of Steveston, British Columbia, one of Aquail's partners in trials of fishing net recycling

farms also use nets with a smaller mesh size to stop young fish escaping. Every month Aquail acquires 400-500 tonnes of nets from the ports, fish farms, and also from seabed clean-up efforts.

After processing, the material is used to make carpets and other textiles. Nets now account for one quarter of Aquail's recycled material.

Alternative materials

Foamed plastics are often used in fish farming, but usually only last a year typically. They are easily damaged and break down in storms to become marine litter and microplastics.

In one ocean fish farm in Weihai, Shandong, foamed plastic floats have been replaced with an alternative made of tougher plastic. Each float supports a string of oysters worth 500-600 yuan, and so the improved floats reduce the amount of plastic entering the ocean and also protect the oysters.

Chen Weijiang, chairman of the company, explained that their sustainability certification requires regular patrols to check that no floats have come adrift. Li Haifeng, regional representative for SCS Global Services, a sustainability certification provider, says rubber is added to the floats to provide more elasticity and reduce the chances of breakage. An average fish farm requires 2,000 floats but as the newer alternatives don't degrade, they could also cause problems if they get loose.

Zhang Chun is a senior researcher at chinadialogue.

珊瑚修复利弊几何?

关于什么是珊瑚种植的最佳实践，生态保护人士之间存在不同看法。

□ 李 婧

中国清环保人士对修复珊瑚礁的热情日益高涨，但在最佳修复方法上存在的分歧也日益突出。

7 月，广东海洋大学深圳研究院的一个环保小组在香港以北的大鹏湾海底种植了3 万盆珊瑚苗（占海底面积17 亩，约 1.1 万平方米），此次活动受到了公众的高度关注。

几天后，参与该地区珊瑚修复工作的当地团体潜爱（DiveforLove）开始质疑大规模的珊瑚种植活动造成的影响。该团体发现，种植珊瑚的架子中有些并非直接位于海床之上，而是放在了健康的珊瑚上。潜爱还发现水底散落着数十个本该用来固定珊瑚盆的塑料螺丝。

广东海洋大学深圳研究院专家廖宝林不认同这一批评。他否认团队有采集野生珊瑚或使用塑料的行为，并指出大部分支架是由陶瓷或玻璃材料制成。他同时指出，30000 盆对于海洋来说远算不上“大规模”，且项目珊瑚的成活率达到85%。

“潜爱大鹏”秘书长夏嘉祥表示，珊瑚种植项目对于资助方和政府管理部门来说都很难监测，这使得评估它们的真正成效变得很困难。在他们的早期工作中，也曾经进行过大规模的珊瑚培育，不过后期转向了拯救受损的珊瑚碎片。

“珊瑚生态系统是非常复杂的。我们很多年后才意识到在陆地上大范围种植单一树种对生物多样性的影响。不希望看到这样的情况在海底重演。”夏嘉祥说。

7月下旬，在与深圳大鹏官方的一次会议中，中国太平洋学会珊瑚分会以对生态的负面影响为由，提议暂停大规模珊瑚种植活动。廖表示，他的团队没有后续的珊瑚种植计划。

珊瑚正面临威胁

全球变暖正严重威胁着全世界的珊瑚礁。政府间气候变化专门委员会（IPCC）在其最新的报告中发出了可怕的警告。即便各国能够把全球气温上升控制在 1.5℃以内，全球仍将失去约 70% 到 90% 现有的珊瑚礁。据IPCC 估计，若升温达到 2℃，所有的珊瑚礁都将不复存在。

全球温度已经比工业化前上升了 1℃。IPCC 预测，按照当前的趋势，全球最早将在 2030 年突破 1.5℃的升温限值。

珊瑚礁承受着巨大的压力，并面临退化和前所未有的白化威胁。所谓的珊瑚白化，即海水温度过高时，珊瑚礁组织内的共生藻类（黄藻）便会离开或死亡，从而导致珊瑚变成白色。珊瑚礁白化并不一定意味着死亡，但却会面临更大的生存压力，从而面临死亡的威胁。

据国际自然保护联盟统计，至少有 5 亿人依靠珊瑚礁支持的生态系统获得食物、海岸保护和生计。

“渔民和旅游业者知道（失去珊瑚礁的）后果，因为他们看到自己的收入受到了影响。”香港大学生物科学学院助理教授大卫 · 贝克说。

“但从全社会的角度来说，对于（珊瑚礁保护重要性）的认识还很难和一些其它的环境议题相比。”

中国的珊瑚礁约占全球总量的13.5%，它们面临着工业污水排放、过度捕捞和几十年来沿海土地复垦带来的海洋污染的挑战，这些都造成了严重的损失。

但由于尚未进行全面调查，中国珊瑚礁的退化程度还不清楚。中

海底的珊瑚苗圃

科院的科学家们希望建立统一的监测网络，并在今年晚些时候公布对中国珊瑚礁的评估情况。

拯救珊瑚

随着中国不断强调环保的重要性，更多研究机构和民间环保团体开始参与修复珊瑚礁。

这顺应了利用人为手段帮助珊瑚适应海洋变暖的全球趋势，但一些科学家对此持保留意见，认为这种做法是在浪费时间和资源。

贝克不同意这一说法："在我看来，我们不应该放过任何可能有用的工具或机会。"他说。

贝克认为，这个"工具包"既包括修补珊瑚的基因组让它们变得更强大这样的激进想法，也包括珊瑚礁修复这种不那么"高科技"的做法。

全球范围内，珊瑚修复的速度在过去 15 年间加快不少。据加州大学的研究人员介绍，仅加勒比地区就开展了 150 多次培育珊瑚苗，并将幼苗移植到已经退化的珊瑚礁上的行动。

精工细作

好的意愿并不总能得到科学认识的强有力的支持，贝克说。

环保人士需要以科学为基础，确定应该对哪些种类的珊瑚进行切分和培育，以及如何移植。这么做的目的是保持遗传多样性，同时避免浪费。另外由于一些珊瑚物种具有攻击性，一些则对某些疾病特别敏感，这么做还能避免对水下生态造成意想不到的影响。

"我们能保护一些现有的珊瑚礁。"贝克说，"还能加强一些地方（珊瑚）的多样性……我们可以帮助它们迁移。"

贝克相信中国可以成为全球珊瑚修复的领军者。

"也许我们可以从海南省的一些珊瑚开始，帮助它们在其他沿海地区扎根，然后增强它们应对气候变化的能力。"

这对中国而言尤其重要，因为如果珊瑚有机会随着海水变暖向北迁移，中国南部将成为接纳北上珊瑚的第一线。

潜水员加入救援

香港珊瑚礁普查基金会执行董事基思·凯认为，让休闲潜水团体参与珊瑚修复项目有助于壮大珊瑚修复队伍。

"经过适当的培训，潜水员可以在短时间内学会这些操作——这将大大提高效率。"凯说。

但潜爱的秘书长夏嘉祥担心，为了达到大规模移植珊瑚的目的，潜水员可能会在无意间破坏野生的健康珊瑚。

"我个人认为，保护珊瑚礁最好的办法就是不要打扰它们……"他说。

李婧，自由撰稿人，关注环境与气候议题

Conservationists clash over coral reefs

Shenzhen divers spark row over the role of human intervention in reef protection

□ Li Jing

Coservationists are enthusiastically trying to rehabilitate China's coral reefs but there is disagreement over how best to do so. Some prefer large-scale nursery planting, others believe that human intervention should be limited.

This debate was highlighted recently following a high-profile campaign by conservationists affiliated with the Shenzhen Institute of Guangdong Ocean University who installed 30,000 coral pots in Dapeng Bay in July. They covered a combined seabed area north of Hong Kong of over 11,000 square metres. The restoration project was sponsored by a liquefied natural gas terminal operated by CNOOC, a major national oil company.

Days after the pots were laid, DiveforLove, a local environmental group involved in coral restoration work in the area, expressed doubts over the campaign's impact. Divers from the group discovered that shelves that provided a fixing point for the coral pots had been placed on top of healthy coral, instead of directly onto the seabed. They also found dozens of plastic fixings scattered underwater that were used to connect the corals to the shelves.

Worse still, members of DiveforLove found fragile staghorn corals they had nursed in earlier years had been snapped off. There was no evidence that the missing parts were harvested for the sake of coral restoration. Still, they feared that the university team had used the healthy wild corals as "seedlings" for the 30,000 coral pots.

Liao Baolin, director of the coral rehabilitation centre at the university disputed the criticisms. He denied his team had harvested any wild corals or used plastics, saying the shelves were mostly made from pottery or tempered glass. He said that 30,000 pots was by no means "large-scale" for the ocean, and insisted the survival rate of the coral was 85%.

Coral rehabilitation projects are difficult for donors and government authorities to monitor, which makes their

How to plant a coral nursery

effectiveness hard to measure, according to Xia Jiaxiang, secretary general of DiveforLove. In the group's early years, it also pursued large-scale coral nurseries but later switched to saving damaged coral fragments.

"The coral ecosystem is very complicated. It took years for us to realise the country's massive, single-species tree-planting initiative had contributed to a loss of biodiversity. We don't want to see that happen again underwater," said Xia.

In late July, at a closed meeting with the Dapeng government, the coral reefs branch at Pacific Society, a Chinese research institute, suggested putting a pause on large-scale coral planting, citing the negative ecological impacts. Liao said his team have no current plans for further coral planting.

Corals under threat

Coral reefs worldwide are threatened by global warming. In its latest report, the Intergovernmental Panel on Climate Change (IPCC) warned that 70-90% of existing coral reefs will be lost even if countries manage to limit the global temperature rise to 1.5C. At 2C, all coral reefs will cease to exist, according to the IPCC's assessment.

The world has warmed by 1C since pre-industrial times and the IPCC predicts that if current trends continue, the 1.5C threshold will be passed as early as 2030.

Coral reefs are already subject to substantial stress, degradation and unprecedented bleaching. The latter occurs when water is too warm and corals expel algae (zooxanthellae) living in their tissues, causing them to turn white. While corals can survive a bleaching event, they take time to recover.

According to IUCN, at least 500 million people rely on the ecosystems supported by coral reefs for food, coastal protection and their livelihoods.

"Fishermen and tourism operators know the consequences [of losing coral reefs] because they see their income being affected," said David Baker, an assistant professor at the University of Hong Kong's School of Biological Sciences. "But as a society, humanity still lacks the awareness that we might have for other environmental issues that we can see."

Coral reefs in China account for around 13.5% of global coverage, but they have been damaged by the discharge of sewage from industry, excessive fishing and decades of land reclamation along the coastline.

Just how degraded the corals are is unknown as there is yet to be a full survey. Scientists from the Chinese Academy of Sciences hope to set up a unified monitoring network and release an evaluation of the country's coral reefs this year.

Save the corals

As China improves its coastal protections, more research institutes and grassroots conservation groups are getting involved in coral reef restoration. At least four different teams are involved along the country's southern coast. However, some scientists argue that attempts to help coral adapt to warmer seas using artificial reefs are a waste of time and resources.

Coral restoration is a labour intensive practice and cannot be done easily across large areas, according to Baker. And as a result are less supported by scientists in Australia, home to the massive Great Barrier Reef.

Baker advocated for experimenting with an array of tools and approaches, including radical changes such as tinkering

How to transplant coral

with corals' genomes to make them more resilient, as well as simpler practices such as restoration.

A job well done

Globally, coral restoration has expanded over the past 15 years. Researchers at the University of California have counted more than 150 operations transplanting nursery-raised corals to degraded reefs in the Caribbean, for example.

But good intentions are not always backed up with a strong scientific understanding, said Baker.

Given the labour-intensive nature of restoration work, Keith Kei, executive director of the Hong Kong Reef Check Foundation, believes that involving recreational diving groups could help scale up efforts.

"With proper training, divers could learn the practices in a short time – that will greatly enhance the efficiency," said Kei.

Conservationists need to make science-backed decisions about which species of corals should be fragmented and farmed, and how they should be transplanted. The aim is to maintain genetic diversity while avoiding waste or unintended consequences for the underwater environment because some species of corals are aggressive, while others are particularly sensitive to certain diseases.

"We can protect what we have," said Baker. "We can also enhance the diversity [of corals] in some sites… We can assist their migration."

Baker thinks China can become a world leader in coral restoration.

"Maybe we could start with the species in Hainan province, helping them to get a foothold at other locations along the coastline," he said.

It's important that China prepares because the southern part of the country will be at the frontline for coral migration northwards as the ocean warms.

But Xia Jiaxiang is concerned that divers could still unintentionally damage wild and healthy corals to meet large coral transplant targets. "For me, the best way to protect the coral reefs is to leave them undisturbed."

Li Jing is a freelance writer covering environmental and climate issues.

蔚蓝的呼唤：镜头中脆弱的海洋生命

这是一位摄影师谱写的海洋颂歌，以提醒我们所有这些美好即将逝去。

□ 贝丝·沃尔克

潜水员在一个“饵球”旁边工作

摄影师兼海洋保护活动家菲利普·汉密尔顿耗时五年成书《蔚蓝的呼唤》，目的是在其消失之前，用镜头捕捉到海洋的瑰丽与多样。这本画册中的照片令人称奇。很多把自己的一生都献给了海洋研究和保护工作的著名科学家和海洋“卫士”都贡献了自己的佳作。

汉密尔顿的目的是让大家看到海洋的脆弱性：

“很多年前我开始水下摄影的时候，目的是和朋友分享并弄些漂亮的照片贴在墙上。不幸的是，鉴于我过去三十年中在海里看到的情形，我觉得自己不能仅仅分享这些可爱的照片而不提出警醒。我们必须改变向外传达的信息，而且必须让更多的、不受限定的、遍布全球的受众都接收到这个信息。只有这样，我们才能得到与这个问题的严重性相匹配的关注。”

他希望自己的照片能对全球的决策者产生影响，就像前辈摄影师和探险家们在 1872 年通过摄影影响美国政府建立黄石公园和其他国家公园那样。

在这本书中，“海洋卫士”和专家们描述了过度捕捞、污染、温度上升和酸化带给海洋不断增加的压力。

过去 50 年中，我们失去了全世界 50% 的珊瑚和 95% 最大的鱼类，很多物种都处于崩溃的边缘。

如果不做出巨大的改变，到 2100 年，世界一半以上的海洋物种将面临灭绝。

海洋是我们主要的生命来源。这里生活着世界 90% 的物种，产生了 60% 的氧气，吸收了地球大部分的热量和二氧化碳，并养育了全世界三分之一的人口。

这本书带给读者一线希望。海洋是有韧性的，如果得到保护将会恢复生机。目前世界上得到保护的海洋面积仅有 8%，汉密尔顿认为我们必须马上扩大保护范围。

让思维从这些美丽的图片跳出来去联想海洋面临的威胁，这有一定难度。这些图片可能会让读者在浏览的过程中只沉醉于书中海洋生命的光辉，却忘掉这本书本来想传达的让人做出行动的信息。

汉密尔顿辩解道：“只放入美好的照片，并不是要自欺欺人、掩盖问题、粉饰太平。我只是为了避免传达那种毫无希望的，无人问津的信息。”

无论你是否认同这种观点，你必须承认这些照片都很美丽。

贝丝·沃尔克，中外对话文化频道编辑，同时也是第三极项目编辑

Call of the Blue: the fragility of marine life – in photos

A photographer's ode to the ocean aims to raise the alarm on all we are about to lose

□ Beth Walker

Photographer and ocean conservationist Philip Hamilton's latest book "Call of the Blue" is the culmination of a five-year project to capture the magnificence and diversity of the ocean before it is lost. This breath-taking book combines photos with contributions from acclaimed scientists and ocean "guardians", who have dedicated their lives to understanding and preserving the ocean.

Hamilton aims to bear witness to the fragility of the ocean:

"When I started underwater photography many years back my intention was to share it with friends and hang some beautiful pictures on a wall. Unfortunately, given what I have witnessed over the last 30 years at sea, I find I can't share the lovely photos without raising the alarm. The message had to change and the audience had to be greater, unlimited, and global, matching the size of the problem."

He hopes his photography will influence global policy makers in the same way pioneer photographers and explorers managed to influence the US government in 1872 to create Yellowstone Park and many subsequent national parks.

Featured "ocean guardians" and experts describe the mounting pressures from overfishing, pollution, rising temperatures and acidification.

Over the past 50 years we've lost 50% of the world's coral reefs and 95% of the largest fish. Many species are on the brink of collapse.

Without significant changes, more than half of the world's marine species could face extinction by 2100.

The ocean is our main source of life. It is home to 90% of the world's species, generates 60% of all oxygen and absorbs most of the planet's heat and carbon dioxide. The ocean feeds a third of the world's population.

The book offers some hope. The ocean is resilient and will recover if given protection. The world currently protects just 8% of the ocean. There is an urgent need to expand this, Hamilton argues.

There is a big disjunction between the beautiful photos and the spectre of threats that imperil the ocean. This may lead readers to forget the book's call to action as they flick through the teeming glory of ocean life in its pages.

Hamilton justifies this: "By presenting only the beautiful pictures I'm not trying to deceive myself, hiding the problems and pretending that everything is prefect. I'm just avoiding passing on a message with no hope that will get no audience."

Whether or not you agree with his approach, these are beautiful photos.

Beth Walker is chinadialogue's culture editor.

1.印度洋—太平洋土生的蓑鲉是一个贪婪的猎手，其猎杀范围从海岸红树林直到300米的深海。它们先喷出一股水柱将其他鱼击昏，然后再整个吞下

2.小丑鱼（海葵鱼）在它们海葵家园的触须“护栏”中游弋

3.双髻鲨群

4.抹香鲸在海面社交，但要潜入1000米以下的深海捕捉乌贼为食

5.草海龙是伪装最华丽的海洋生物之一，模拟周围的海草惟妙惟肖。它是海马家族中最大的一种，可以长到45厘米

1.Native to the Indo-Pacific, lionfish are voracious hunters that feed on other fish from coastal mangroves down to a depth of 300 metres. They disorientate their prey by blowing a jet of water at them before swallowing them whole.

2. Anemone fish among the protective tentacles of their anemone home.

3.The great hammerhead is the largest of the hammerhead sharks, reaching over 6 metres in length. Its head contains sensory organs that it uses to sweep for prey.

4.Sperm whales socialise on the surface, but dive to depths of over 1,000 metres in search of squid to feed on.

5.Weedy seadragons are one of the most ornately camouflaged sea creatures and resemble the seaweed in which they live. Larger than any seahorse species, they can measure up to 45cm long.

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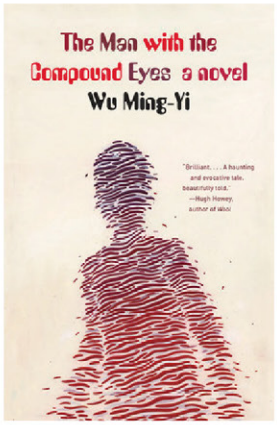

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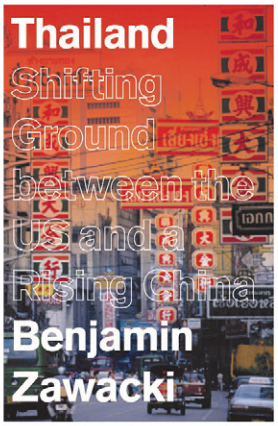

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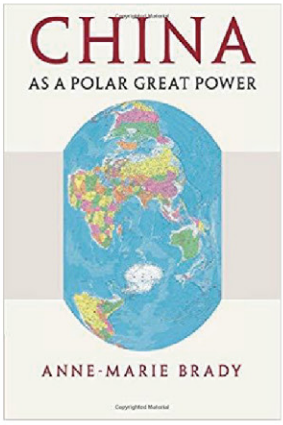

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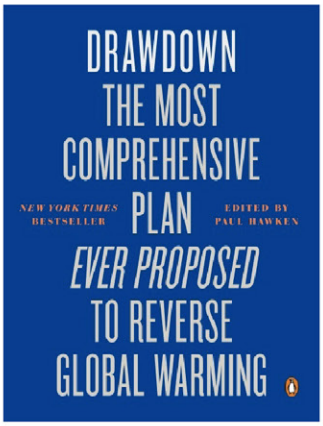

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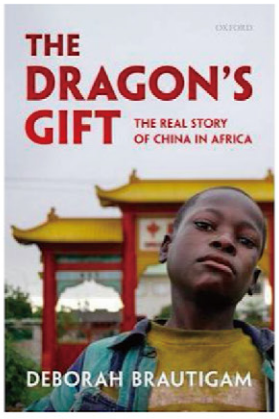

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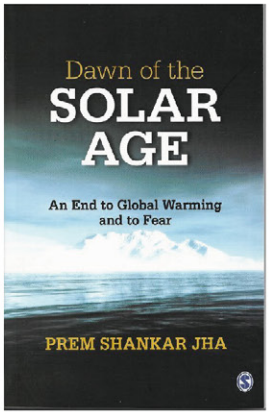

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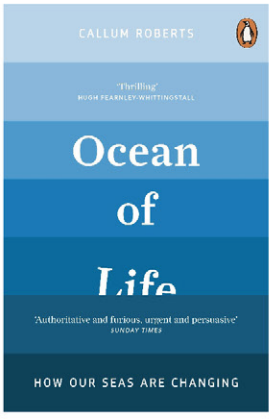

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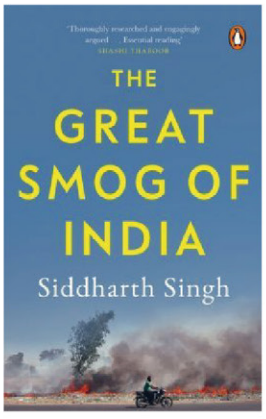

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