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China's Climate Action Brief: Methane

Summary

Reducing the emission of methane, a short-lived climate pollutant, is critical to slowing climate change impacts in the near term. As a large methane emitter, China has been reducing emissions from its energy, agriculture, and waste sectors, and recently released its eagerly anticipated first methane reduction action plan in November 2023. Notably, methane was highlighted as a promising area for technical cooperation under the new U.S.-China Sunnylands Statement on Enhancing Cooperation to Address the Climate Crisis, inked between China and the United States earlier that month.

However, China still faces many challenges, including data shortages, a lack of comprehensive policy frameworks, and technological limits.

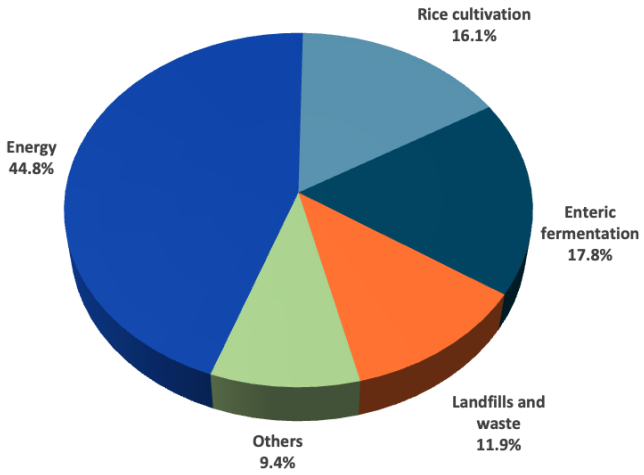
Moving forward, China should further prioritize and incorporate methane mitigation into its 2060 carbon neutrality roadmap through actions such as phasing out coal, waste reduction, and market incentives. International collaboration (such as collaboration under the Joint Glasgow Declaration and the Sunnylands Statement) can also contribute to China's methane mitigation efforts, as there are good practices in other countries, such as the United States.

Why Methane?

Methane is a short-lived greenhouse gas (GHG) with more than 80 times the global warming impact of carbon dioxide over a 20-year timeframe. Therefore, reducing methane emissions is key to slowing climate change impacts in the near term.[1] China's methane emissions totaled 55.29 million tonnes(with Land Use, Land-Use Change, and Forestry) (or 1161 million tonnes of carbon dioxide equivalent (CO_2e), based on 100-year global warming potential (GWP)) in 2014, representing an 11% increase compared to 2005. In 2014, methane accounted for 10.4% of national GHG emissions in China. The energy sector, dominated by coal mining, contributes 44.8% of total methane emissions, while agriculture accounts for another 40.2% share (Figure 1).[2]

[1] Zhu, Khanna, Gordon, Dai, et al., 2023
[2] Ministry of Ecology and Environment, 2018

Figure 1. China's Methane Emissions by Source (2014)



Data source: The People's Republic of China Second Biennial Update Report on Climate Change[3]

China's Methane Mitigation Actions

In November 2023, China released its long-awaited methane mitigation action plan, which is China's first comprehensive and specialized policy document on methane emissions control. This plan will serve as the top-level design of China's methane control in the near future. This action plan sets qualitative methane control targets for the 14th (2021 - 2025) and 15th (2026 - 2030) Five-Year Plan periods and outlines specific actions for methane inventory establishment as well as sectoral reductions. This plan also included high-level actions to control methane and other pollutants simultaneously, improve technology innovation and methane monitoring, refine technical standards for different methane sources, and incorporate methane mitigation projects into the carbon market.[4] It is estimated that the full implementation of this plan could reduce methane by 5 million metric tons by 2030.[5] However, it should be noted that this action plan does not include actions to mitigate methane from abandoned coal mines, an important source of methane in China, the number of which is expected to rise in the future as China transitions away from coal.[6] The contents of this action plan are summarized in the table below.[7]

[3] Ministry of Ecology and Environment, 2018
[4] Ministry of Ecology and Environment, 2023a
[5] Ministry of Ecology and Environment, 2023b
[6] Zhong, 2023
[7] Ministry of Ecology and Environment, 2023a

Table 1. Summary of China's Latest Methane Control Action Plan

Item	Action
General Targets	2021 - 2025 • Gradually establish frameworks for methane mitigation policies, technologies, and standards • Strengthen methane inventory calculation and emission monitoring 2026 - 2030: • Establish comprehensive policy, technology, and standard frameworks • Significantly improve methane inventory calculation and emission monitoring
Methane Monitoring, Verification, and Reporting System	• Conduct methane monitoring pilot projects • Gradually establish methane monitoring systems consisting of ground-based, airborne, and satellite-based technologies • Establish methane monitoring, verification, and reporting systems • Promote regular methane emission reporting in coal mines, oil and gas fields, farms, landfills, and wastewater treatment facilities
Methane Mitigation in the Energy Sector	• Encourage oil and gas companies to recover and utilize methane from wells unless not economically viable • Improve the utilization of coal mine methane to reach 6 billion cubic meters by 2025 • Reduce methane leakage from oil and gas pipelines and the utilization of gas flares to destroy methane
Methane Mitigation in the Agriculture Sector	• Promote utilizing animal manure to produce fertilizer and natural gas to reach 80% by 2025 • Conduct research and pilot projects in mitigating methane emissions from enteric fermentation • Mitigate methane emissions from rice cultivation through water and fertilizer management, rice types selection, and aerobic rice cultivation
Methane Mitigation in the Waste Sector	• Implement waste source reduction, and establish waste recycling systems to reach about 60% by 2025 • Promote the construction of organic waste treatment facilities, and further utilize methane from landfills • Mitigate methane emissions from wastewater treatment to reach 90% by 2025
Coordinated Control of Methane and Other Pollutants	• Promote the simultaneous control of volatile organic compounds (VOCs), landfill odors, and methane • Enhance collaboration between industry and wastewater

	treatment facilities to reduce methane from wastewater
Technology Innovation and Policy Enforcement	• Conduct technical innovation and pilot projects • Further control methane emissions from coal mines, landfills, and wastewater treatment facilities through the enforcement of emission standards
Regulation Framework	• Refine current regulation and technical standard systems for coal mines, organic waste, and oil and gas • Formulate technical standards for agriculture methane mitigation • Drive more investment and subsidies to methane mitigation projects; incorporate methane mitigation projects in a voluntary carbon market
International Collaboration	• Participate in international methane mitigation dialogue and collaboration • Collaborate on methane mitigation technologies and standards

It should be noted that China was mitigating methane emissions before, even without a national-level plan specifically for methane. Since 2011, China's climate change policies have included some qualitative mentions of the need to control methane. The need to effectively control methane was part of the 12th, 13th, and 14th Five-Year Plans.[8] Some Chinese officials also confirmed that China's carbon neutrality by 2060 target includes methane, and its updated Nationally Determined Contribution (NDCs) in 2021 included actions to address methane emissions as well.[9] Some of China's methane mitigation policies are summarized below:

- **Inclusion of Methane in the "Dual Carbon" Goals Framework**:[10] In October 2021, China's State Council issued "Opinions on the Complete and Accurate Implementation of the New Development Concept of Carbon Peaking and Carbon Neutrality," emphasizing the importance of control measures for methane and other non-CO_2 GHGs.[11] This means that methane has become a priority of China's climate work.
- **Mitigate Methane from the Energy Sector**: Coal mining is the largest source of methane emissions in China.[12] The 13th Five-Year Plan on coal mine methane, issued in 2016, explicitly called for accelerated development and utilization of coal mine methane to reduce GHGs.[13] In 2020, China's government released a plan to encourage the utilization

[8] China's State Council, 2011, 2016; The National People's Congress of the People's Republic of China, 2021
[9] Lin et al., 2023
[10] "Dual Carbon" goals refer to China's two climate goals announced by President Xi Jinping at the 75th session of the United Nations General Assembly in September 2020. President Xi announced that China would reach its carbon emissions peak before 2030 and become "carbon neutral" before 2060 (People's Daily, 2022).
[11] Central Committee of the Chinese Communist Party & State's Council, 2021
[12] International Institute of Green Finance (IIGF) Central University of Finance and Economics, 2023
[13] National Energy Administration, 2016

of coal mine methane, especially low-concentration methane.[14] On another front, oil and gas companies have been actively promoting methane emissions reductions. In June 2020, PetroChina released the "Methane Emission Control Action Plan," outlining goals for methane emissions control. In May 2021, six oil and gas companies jointly established the China Oil and Gas Industry Methane Emission Control Alliance.[15]

- **Mitigate Agricultural Methane**: In January 2022, China's government released a policy and proposed to focus on ecological farms and explore low-carbon compensation policies for projects that reduce methane from rice paddies, animal digestive systems, and livestock and poultry manure.[16] In June 2022, two national departments jointly released a plan to mitigate GHG emissions in rural areas, which listed the reduction of methane emissions from rice paddies as one of the top ten major actions.[17]
- **Reduce Waste Methane**: The waste sector is the third largest source of methane emissions in China.[18] Methods adopted to reduce methane emissions from this sector include waste classification, recycling, and biogas recovery. China enacted a municipal solid waste (MSW) classification strategy in 2017,[19] and the latest 14th Five-Year Plan incorporates action to manage MSW and wastewater.[20] By 2022, MSW classification has been promoted in 297 cities.[21] Biogas recovery projects have been subsidized to utilize waste from the municipal area, agricultural lands, and industrial sewage.[22]
- **Utilize Green Finance to Support Methane Mitigation**: Existing policies support many types of methane mitigation projects through green loans or green bonds, such as collection of unorganized methane emissions from industrial production, coal mine methane utilization projects, methane leakage prevention, organic waste methane utilization, and manure methane mitigation.[23]

Furthermore, China also actively participates in international collaboration on methane mitigation. In the "U.S.-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s" that the United States (U.S.) and China announced at the 26th United Nations Climate Change Conference of the Parties (COP 26) in Glasgow, China expressed its intent to achieve a significant effect on methane emissions control and reductions in the 2020s.[24] In November 2023, China and the U.S. released the *Sunnylands Statement on Enhancing Cooperation to Address the Climate Crisis*, agreeing to work individually, jointly, and with other countries to mitigate methane. Moreover, both countries will "initiate technical working group cooperation on policy dialogue,

[14] National Energy Administration, 2020
[15] International Institute of Green Finance (IIGF) Central University of Finance and Economics, 2023
[16] Ministry of Agriculture and Rural Affairs, 2022a
[17] Ministry of Agriculture and Rural Affairs, 2022b
[18] Ministry of Ecology and Environment, 2018
[19] National Development and Reform Commission & Ministry of Housing and Urban-Rural Development, 2017
[20] The National People's Congress of the People's Republic of China, 2021
[21] Ministry of Ecology and Environment, 2022
[22] Zheng et al., 2020
[23] Hu et al., 2022
[24] United States Department of State, 2021

technical solutions exchanges, and capacity building," and include methane mitigation targets in their 2035 Nationally Determined Contributions (NDCs).[25] This is the first time China has made such a pledge.

Challenges and Opportunities

While China has made some progress in controlling methane emissions, there are still many challenges, including:

Lack of methane emission data and quantitative targets

There is a lack of complete emissions data and quantitative targets for controlling and reducing methane emissions in existing policies and programs. Most of the methane mitigation targets adopted so far are qualitative in nature, and there is no systematic tracking and evaluation. Even though there are some quantitative targets in China's latest methane reduction plan, they are copied from policies released before and focus more on energy source diversity and waste reuse, rather than on how much methane will be reduced.[26] The current data on methane emissions are also outdated and from the 2014 national GHG emissions inventory. The most important reason for the methane data shortage in China is that, unlike for CO_2, there is currently no robust methane monitoring, reporting, and policy evaluation system in place.

Lack of comprehensive regulatory and management frameworks

There is a lack of comprehensive regulatory and management frameworks on methane emissions. Certain sectoral standards and policies, such as the 2008 Standard on Coal Mine Methane Emissions, have been adopted, but due to a lack of monitoring and policy indicators tracking, it is sometimes unclear how effective these standards are. Moreover, so far there have been no methane control standards for the agriculture and waste sectors. There is also a lack of capacity-building activities and cross-department collaboration at all levels of government to raise awareness of methane problems, establish methane reduction plans, and support methane mitigation efforts. China needs to further incorporate methane reduction in its carbon neutrality policies to make methane reduction a priority in the government's working agenda and drive full enforcement of methane-related regulations and standards.

Lack of available technologies

In China, there is a lack of available technologies for methane mitigation, especially for low-concentration coal mine methane recovery, abandoned coal mine methane utilization, and agricultural methane mitigation. The insufficient foundational research on science, technology, and policies causes this problem. As the U.S. and Europe have conducted various technical and economic analyses for methane mitigation measures, China should learn from these regions and launch more local research to develop technologies and standards adapted to China.

Despite challenges, there are also many opportunities for China to further mitigate methane emissions, including through:

Energy structure transformation and methane mitigation

[25] United States Department of State, 2023
[26] Ministry of Ecology and Environment, 2023a

Methane emissions from coal mines are the most significant source of methane emissions in China, and reducing emissions in this sector is critical. As long as China keeps reducing the share of coal in its energy portfolio according to its 14th Five-Year Plan and carbon neutrality roadmap, methane from coal mining will decrease. In other words, coal reduction and methane mitigation can be achieved simultaneously. China should also provide technical and financial support in utilizing methane as an energy source. By recovering and utilizing methane from sources such as coal mines, wastewater treatment facilities, landfills, and manure treatment facilities, China can not only reduce methane emissions but also diversify its energy portfolio and ensure energy security.

Waste methane reduction

The potential for methane mitigation from solid waste and wastewater is great in China. With rapid urbanization and industrialization, the generation of municipal solid waste and wastewater is expected to increase. China has implemented various policy measures in waste management, including establishing a waste sorting system, encouraging re-utilization of solid waste and wastewater, increasing the capacity of waste incineration, and constructing "zero-waste cities." Fully implementing these policy actions will contribute to methane emissions reduction, extract the economic values of waste, and support the practice of the "cycling economy" at all levels of government.

Chinese Certified Emission Reduction (CCER) framework

Market-based mechanisms such as the voluntary carbon market also contribute to the development and exploration of methane emissions reduction technologies. In July 2021, China's national carbon trading market commenced operations, and the CCER framework, which had been suspended for five years, restarted in 2022. CCER can be used not only in the mandatory national carbon market but also in voluntary carbon markets. Through market-based means, CCER enhances the economic viability of methane recovery and utilization projects.

International collaboration

As China and the U.S. released the *Sunnylands Statement on Enhancing Cooperation to Address the Climate Crisis*, and the two countries will continue to meet and cooperate in the UN Climate Change Conference in Dubai this year,[27] the U.S. could be an important collaborator for China on methane mitigation. Collaboration between these two countries is possible in the following areas:

1. National-level collaboration on devising policy instruments, such as monitoring frameworks, financial incentives, and quantitative methane reduction targets, and conducting technical research in reducing methane from hard-to-mitigate sources, such as rice cultivation, livestock enteric fermentation, and abandoned coal mines.
2. Subnational collaboration on conducting pilot projects in reducing methane emissions in waste, energy, and agricultural sectors, and developing policies to promote the implementation of mitigation measures and protocols, such as the oil and gas protocols in New Mexico, Colorado, and California, and agricultural methane reduction measures adopted in California.

[27] Cornwell, 2023

Existing Best Practices

United States

The U.S. is one of the most advanced countries in methane mitigation and has been reducing methane from different sources for decades. There are some good practices of methane mitigation in the U.S. that can provide examples of how China should further implement methane policies. Two examples are California's actions to mitigate landfill methane and the U.S. actions to mitigate methane from abandoned coal mines.

California's Actions to Mitigate Landfill Methane[28]

California stands out as the first state to develop comprehensive reduction strategies for solid waste methane. California first introduced its Landfill Methane Regulation in 2010. Since then, several policies and programs have been developed and implemented. Policies and programs have focused on two main approaches to reducing methane emissions from municipal solid waste landfills: (1) diverting organic waste from landfills, and (2) reducing methane emissions from existing landfills.

Diverting organic waste from landfills is a strategy California has implemented to avoid and reduce landfill methane generation at its onset. California's regulations on organic waste diversion started with mandatory municipal solid waste recycling as early as 2008, followed by mandatory recycling of organic waste beginning in 2014. In September 2016, California passed Senate Bill 1383, which aimed to reduce the disposal of organic waste in landfills by 50% of 2014 levels in 2020 and by 75% in 2025 and to recover at least 20% of disposed edible food by 2025. With this important legislation, California established a comprehensive regulatory system with clear targets supported by various financial approaches, including procurement programs, fees, credits, and market expansion, to reduce the disposal of organic waste.

Reducing methane emissions from existing landfills is also important since landfill methane will escape and become fugitive emissions if not effectively controlled. Since the Landfill Methane Regulation was issued in 2010, California has developed a holistic policy framework for reducing methane emissions from existing municipal solid waste landfills. Three types of measures (regulations, financial mechanisms, and methane emission quantifying) are adopted to reduce methane from landfills.

[28] Zhu, Khanna, Gordon, Huo, et al., 2023

U.S. Actions to Mitigate Methane from Abandoned Coal Mines[29]

The U.S. has been at the forefront of efforts to mitigate and utilize abandoned mine methane. In scaling up its efforts to reduce and utilize abandoned mine methane, the U.S. has adopted three key approaches:

1. **Accurate modeling and monitoring**. This is important for identifying abandoned mine methane emission sources and ensuring effective mitigation of climate impacts. The U.S. has modeled abandoned mine methane emissions for over two decades and designed a modeling methodology for its own national greenhouse gas inventory as well as international climate guidelines. Although national monitoring programs for abandoned mine methane are lacking, certain states conduct monitoring to quantify emissions reductions from mitigation and utilization projects.
2. **Implementing mitigation and utilization projects**. Beyond reducing greenhouse gas emissions, utilizing abandoned mine methane as a clean energy source can stimulate economic development in communities affected by coal mine closures. In the U.S., financial incentives, including government investments and market-based mechanisms, significantly drive these projects. Regulatory incentives, such as recognizing abandoned mine methane as a renewable energy source and clarifying property rights, also facilitate project development.
3. **Fostering effective collaboration among government agencies, industry stakeholders, and local communities**. This is essential for providing local communities with tailored solutions to mitigate and utilize abandoned mine methane. A notable example is the U.S. EPA's Coalbed Methane Outreach Program, which promotes abandoned mine methane recovery through industry collaboration. Collaborative initiatives, such as the Energy Communities Interagency Working Group, also engage stakeholders nationwide and support community-focused projects in different states.

[29] Zhu, Khanna, Gordon, Dai, et al., 2023

China

In China, many provinces and cities are also following national policies to mitigate methane and have already implemented projects and made progress. Guangdong and Shanghai are two great examples, whose actions should be considered in other jurisdictions in China as well.

Guangdong's Actions to Mitigate Methane

There are some actions taking place in Guangdong to mitigate methane. For example, to reduce methane emissions from the waste sector, Guangzhou built a sanitary landfill in the Xingfeng village, which effectively reduces the amount of emissions from waste decomposition.[30] Guangdong also doubled its waste incineration capacity during the 13th Five-Year Plan period (2016 - 2020) to reduce the amount of organic waste in landfills as well as landfill methane emissions.[31] In 2017, the Guangdong carbon trading market stipulated that the China Certified Emission Reductions (CCER) used by enterprises to offset carbon emissions should "mainly come from carbon dioxide and methane reduction projects," which significantly encouraged the mitigation of methane.[32]

Guangdong plans to mitigate methane from oil and gas systems, waste treatment, and agriculture during the 14th Five-Year Plan period (2021 - 2025). Unlike China's latest methane reduction plan, Guangdong does have a quantitative target for methane mitigation in the oil and gas industry. Major methane policies are as follows:[33]

- The methane emission intensity per unit production of oil and gas equivalent in the oil and gas industry should be reduced by more than 40%.
- The province's utilization rate of livestock and poultry manure will reach more than 80%.
- The utilization rate of major crop fertilizers and pesticides will be more than 43%.
- The utilization rate of straw will be more than 86%.
- The province's municipal solid waste recycling rate will reach more than 35%, and the harmless treatment rate of urban solid waste will not be lower than 99%.

[30] Z. Li & Chen, 2023
[31] Department of Housing and Urban Rural Development of Guangdong Province, 2021
[32] Guangdong Development and Reform Committee, 2018
[33] Guangdong Department of Ecology and Environment, 2022

Shanghai's Actions to Mitigate Methane

Shanghai has adopted multiple measures to mitigate methane. For example, to reduce methane emissions from the agriculture sector, Shanghai has been conducting carbon neutrality pilot projects in Chongming Island and utilizing water-saving and drought-resistant rice to reduce methane from rice cultivation.[34] It is estimated that this transition from traditional rice could lower methane emissions from rice paddies by 97%.[35] Furthermore, to reduce waste methane, Shanghai started implementing mandatory waste sorting in 2019 - the first in China- significantly reducing methane emissions from waste landfills.[36] Moreover, Shanghai signed a MOU in October 2023 to further the collaboration on methane and other climate topics with California.[37]

Shanghai has proposed an ambitious plan to mitigate methane from waste treatment and agriculture in the next few years:[38]

- By 2025, establish a comprehensive and long-term mechanism for municipal solid waste sorting, collection, and processing. The compliance rate for waste sorting and the recycling rate will reach over 95% and 45%, respectively.
- By 2025, Shanghai will eliminate household waste landfills. The city's daily waste incineration capacity will be stabilized at 28,000 metric tons, and the wet waste treatment capacity will reach 11,000 tonnes per day.
- By 2025, the comprehensive utilization rate of crop straw will reach approximately 98%. The newly added wastewater sludge treatment capacity will total approximately 105,000 tonnes per year, and no sludge from wastewater treatment plants will be landfilled.
- Promote technology innovation in waste landfill methane and rice paddies methane mitigation and recovery.

[34] Li Y. & Song, 2021
[35] Shi, 2021
[36] Wang, 2023
[37] California Office of Governor, 2023
[38] Shanghai Government, 2023

References

1. California Office of Governor. (2023, October 29). *Governor Newsom's Last Day in China Advances New Climate Partnership with Shanghai*. https://www.gov.ca.gov/2023/10/29/governor-newsoms-last-day-in-china-advances-new-climate-partnership-with-shanghai/
2. Central Committee of the Chinese Communist Party & State's Council. (2021). 中共中央 国务院关于完整准确全面贯彻新发展理念做好碳达峰碳中和工作的意见. http://www.gov.cn/zhengce/2021-10/24/content_5644613.htm
3. China's State Council. (2011). 国务院关于印发"十二五"控制温室气体排放工作方案的通知. https://www.gov.cn/zwgk/2012-01/13/content_2043645.htm
4. China's State Council. (2016). 国务院关于印发"十三五"控制温室气体排放工作方案的通知. https://www.gov.cn/zhengce/content/2016-11/04/content_5128619.htm
5. Cornwell, A. (2023, November 29). U.S., China to work together at COP28 summit, Kerry says. *Reuters*. https://www.reuters.com/sustainability/climate-energy/us-climate-envoy-urges-wider-support-phasing-out-unabated-fossil-fuels-2023-11-29/
6. Department of Housing and Urban Rural Development of Guangdong Province. (2021). *广东省生活垃圾处理"十四五"规划*. https://zfcxjst.gd.gov.cn/attachment/0/478/478389/3740318.pdf
7. Guangdong Department of Ecology and Environment. (2022). *广东省应对气候变化"十四五"专项规划*. https://gdee.gd.gov.cn/attachment/0/494/494368/3977041.pdf
8. Guangdong Development and Reform Committee. (2018). *广东省控排企业使用国家核证自愿减排量（CCER）或省级碳普惠核证减排量（PHCER）抵消2017年度实际碳排放的工作指引*. http://www.tanjiaoyi.com/article-23859-1.html
9. Hu, M., Liang, H., Chen, M., Wu, W., & Geng, H. (2022). *甲烷减排：碳中和新焦点*. http://www.igdp.cn/wp-content/uploads/2022/07/甲烷减排：碳中和新焦点.pdf
10. International Institute of Green Finance (IIGF) Central University of Finance and Economics. (2023). 浅析我国甲烷减排进展及政策建议. https://iigf.cufe.edu.cn/info/1012/6553.htm
11. Li Y., & Song K. (2021, January 19). 农业甲烷排放：中国隐性的气候风险. 中外对话. https://chinadialogue.net/zh/3/69673/
12. Li, Z., & Chen, J. (2023). 从白云兴丰村之变，看广州"垃圾围城"破解之路. https://m.mp.oeeee.com/a/BAAFRD000020230628813154.html
13. Lin, J., Dai, F., Zheng, N. K., Zhu, R., & Hultman, N. (2023). *Reducing Methane Emissions in the U.S. and China*. https://ccci.berkeley.edu/sites/default/files/02_Reducing%2520Methane%2520Emissions%2520in%2520the%2520U.S.%2520and%2520China_English.pdf
14. Ministry of Agriculture and Rural Affairs. (2022a). 农业农村部办公厅关于印发《推进生态农场建设的指导意见》的通知. https://www.gov.cn/zhengce/zhengceku/2022-02/10/content_5672847.htm
15. Ministry of Agriculture and Rural Affairs. (2022b). 农业农村部、国家发展改革委联合印发《农业农村减排固碳实施方案》. http://www.moa.gov.cn/xw/zwdt/202206/t20220630_6403822.htm
16. Ministry of Ecology and Environment. (2018). *中华人民共和国气候变化第二次两年更新报告*. https://www.mee.gov.cn/ywgz/ydqhbh/wsqtkz/201907/P020190701765971866571.pdf
17. Ministry of Ecology and Environment. (2022). *中国应对气候变化的政策与行动2022年度报*

告. https://www.mee.gov.cn/ywdt/xwfb/202210/t20221027_998171.shtml
18. Ministry of Ecology and Environment. (2023a). *甲烷排放控制行动方案*. https://www.mee.gov.cn/xxgk2018/xxgk/xxgk03/202311/W020231107750707766959.pdf
19. Ministry of Ecology and Environment. (2023b). 专家解读 | 推动我国甲烷排放控制迈上新台阶. https://www.mee.gov.cn/zcwj/zcjd/202311/t20231110_1055711.shtml
20. National Development and Reform Commission & Ministry of Housing and Urban-Rural Development. (2017). 生活垃圾分类制度实施方案. https://www.gov.cn/zhengce/content/2017-03/30/content_5182124.htm
21. National Energy Administration. (2016). 能源局关于印发煤层气（煤矿瓦斯）开发利用"十三五"规划的通知. https://www.gov.cn/xinwen/2016-12/04/content_5142853.htm
22. National Energy Administration. (2020). 关于对《关于推进关闭煤矿瓦斯综合治理与利用的指导意见（征求意见稿）》公开征求意见的公告. https://www.nea.gov.cn/2020-05/15/c_139059509.htm
23. People's Daily. (2022). 习近平：实现"双碳"目标，不是别人让我们做，而是我们自己必须要做. http://politics.people.com.cn/n1/2022/0523/c1001-32428031.html
24. Shanghai Government. (2023). 上海市人民政府办公厅关于印发《上海市"无废城市"建设工作方案》的通知. http://www1.shanghaiinvest.com/cn/viewfile.php?id=18356
25. Shi, J. (2021). *上海原创的节水抗旱稻，比一般水稻少排9成温室气体，助力碳中和*. http://61.129.0.66/c/2021-05-20/527311.shtml
26. The National People's Congress of the People's Republic of China. (2021). *中华人民共和国国民经济和社会发展第十四个五年规划和2035年远景目标纲要*. http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm
27. United States Department of State. (2021). *U.S.-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s*. https://www.state.gov/u-s-china-joint-glasgow-declaration-on-enhancing-climate-action-in-the-2020s/
28. United States Department of State. (2023). *Sunnylands Statement on Enhancing Cooperation to Address the Climate Crisis*. https://www.state.gov/sunnylands-statement-on-enhancing-cooperation-to-address-the-climate-crisis/
29. Wang, C. (2023). 推进无废城市建设，上海垃圾分类引领生活"新时尚." http://www.stdaily.com/index/kejixinwen/202305/acb9c363fe1847da9ed232a5961721ae.shtml
30. Zheng, L., Chen, J., Zhao, M., Cheng, S., Wang, L.-P., Mang, H.-P., & Li, Z. (2020). What Could China Give to and Take from Other Countries in Terms of the Development of the Biogas Industry? *Sustainability*, *12*(4), Article 4. https://doi.org/10.3390/su12041490
31. Zhong, R. (2023). 煤矿甲烷减排引发关注. http://paper.people.com.cn/zgnyb/html/2023-07/24/content_26008638.htm
32. Zhu, R., Khanna, N., Gordon, J., Dai, F., & Lin, J. (2023). *Abandoned Coal Mine Methane Reduction: Lessons from the United States*. https://ccci.berkeley.edu/sites/default/files/Abandonded%20Coal%20Mines_Final%20%28EN%29.pdf
33. Zhu, R., Khanna, N., Gordon, J., Huo, K., Dai, F., & Lin, J. (2023). *Reducing Methane Emissions from the Solid Waste Sector: Lessons from California's Experiences*. https://ccci.berkeley.edu/sites/default/files/Reducing%20Methane%20Emissions%20from%20the%20Solid%20Waste%20Sector%20Lessons%20from%20Californias%20Experience_March%202023.pdf

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About the California-China Climate Institute

The California-China Climate Institute was launched in September 2019 and is a University of Californiawide initiative housed jointly at UC Berkeley's School of Law (through its Center for Law, Energy, and the Environment) and the Rausser College of Natural Resources. It is Chaired by Jerry Brown, former Governor of the State of California, and Vice-Chaired by the former Chair of the California Air Resources Board Mary Nichols. The Institute also works closely with other University of California campuses, departments, and leaders. Through joint research, training, and dialogue in and between California and China, this Institute aims to inform policymakers, foster cooperation and partnership and drive climate solutions at all levels.