

绿色制冷与双碳战略

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国际气候创新大会
2023年12月22日 海口



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为论坛讨论提供背景信息

- 制冷与全球可持续发展
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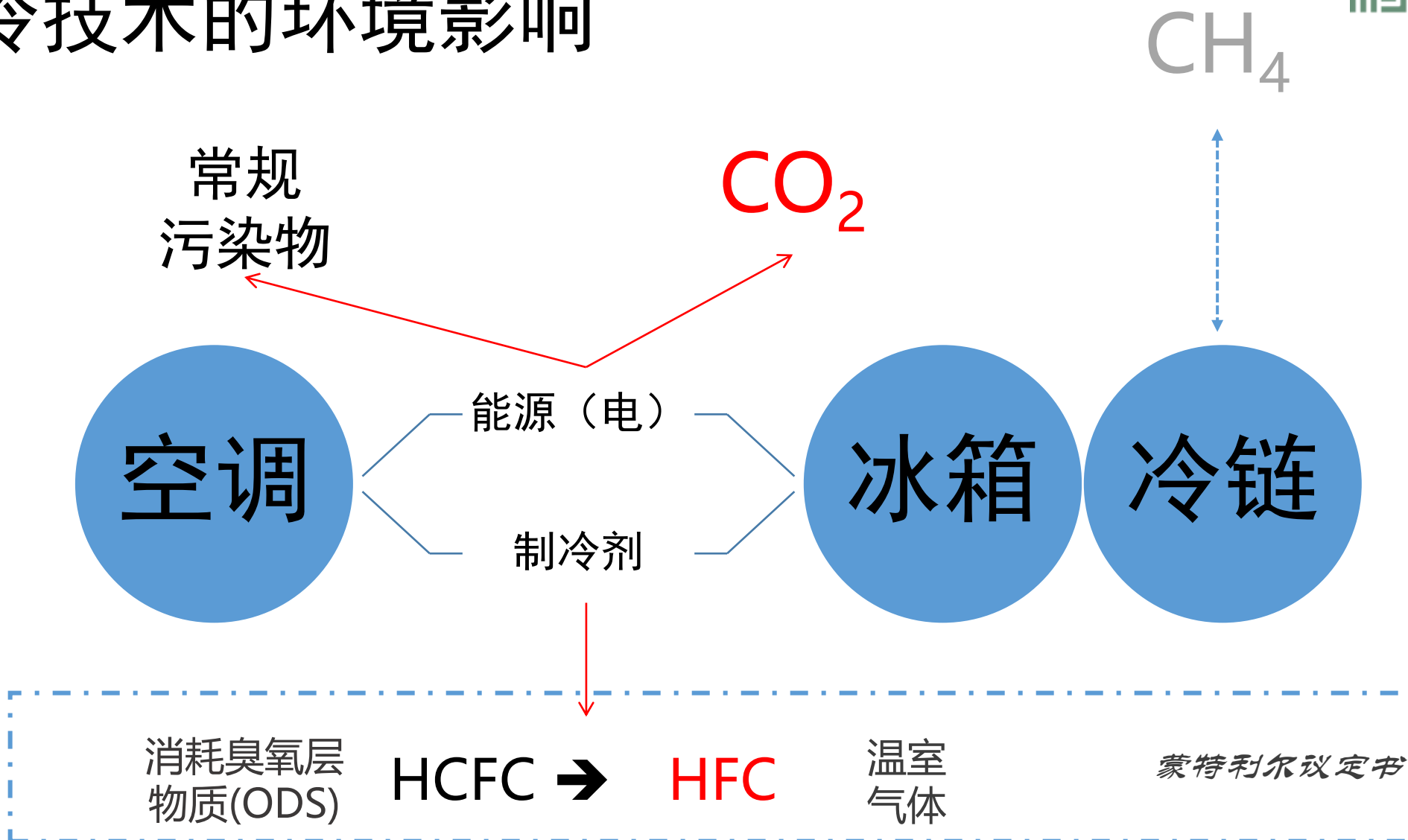
制冷绿色低碳转型与全球可持续发展

- 有助于实现大多数SDG目标
气候变化、基础设施、可持续城市、负责任消费、健康、脱贫、零饥饿等
- 既是气候减缓也是气候适应
- 提高福利水平、促进经济增长

SUSTAINABLE DEVELOPMENT GOALS

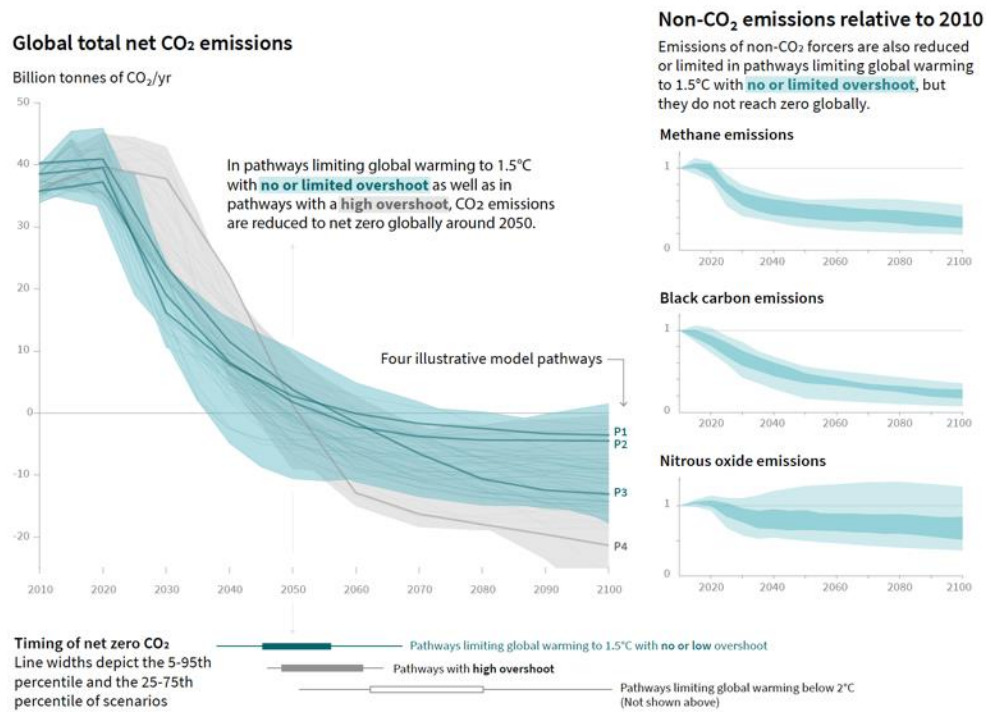


制冷技术的环境影响



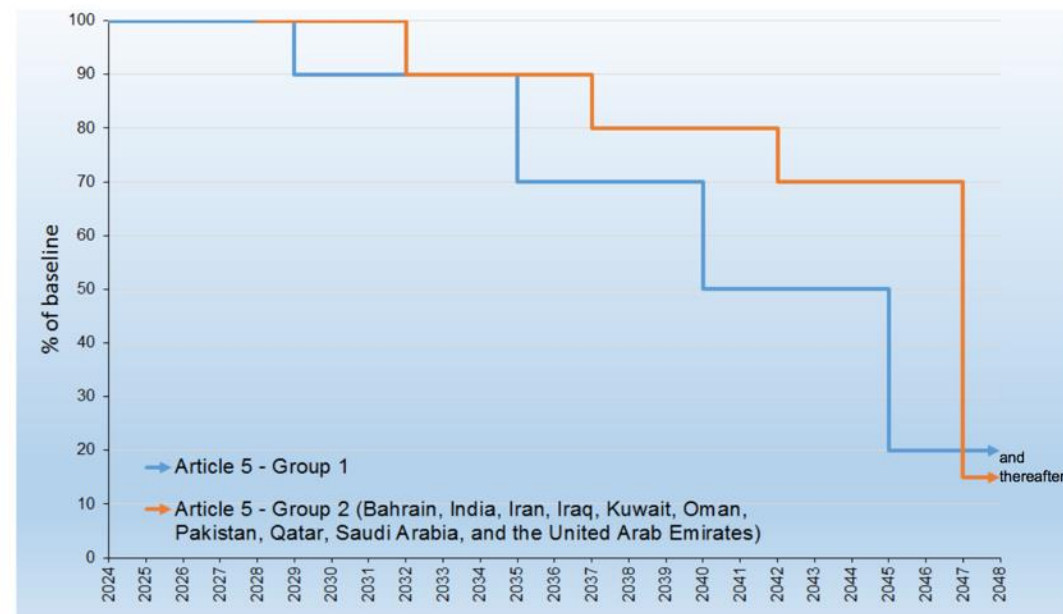
绿色高效制冷转型的国际制度框架

巴黎协定



蒙特利尔公约 - 基加利制冷修正案

Phase-down schedule



the Pledge is one of nine non-negotiated declarations, pledges, and charters at COP 28

reduce cooling related emissions by 68% from today by 2050,

significantly increase access to sustainable cooling by 2030, and

increase the global average efficiency of new air conditioners by 50%

60+ Parties Signed



Global Cooling Pledge

- 2050年前将制冷相关排放降到零，对实现全球2度目标和1.5度愿景至关重要
- coordinated international action on sustainable cooling can save **78 billion tonnes CO₂e** between now-2050 (UNEP 2023)
- sustainable cooling practices include safely transitioning to environmentally-friendly low-GWP refrigerants, including through implementation of the Kigali Amendment to the Montreal Protocol for the phasedown of hydrofluorocarbons (HFCs), to prevent up to **an estimated 0.5°C of warming by 2100** and that coordinated action to improve cooling efficiency alongside the phase-down of HFCs could more than **double those climate benefits** (IEA-UNEP 2020);
- **heat-related deaths increased 68%** between 2000-04 and 2017-21 (Romanello et al. 2022);
- over **1.1 billion people lack access to sustainable cooling** and a further **2.9 billion** have inefficient cooling, and that disproportionately women and girls are affected (SEforALL 2023);
- increased heat stress is projected to **reduce total working hours worldwide by 2.2%** and global GDP by US\$2.4 trillion in 2030 (ILO 2019);
- the lack of sustainable cold chains results in the loss of 526 million tons of **food production, or 12% of the total**, and contributes to a significant reduction in smallholder farmers' income (UNEP-FAO 2022);
- **mechanical cooling accounts for 20% of global electricity consumption (UNEP 2023)** and is a top driver of global electricity demand and of generation capacity additions to meet peak power demand;
- a growing number of **renewables-based cooling technologies** are technically viable, economically feasible and quickly deployable at scale in rural, remote and off-grid locations (IRENA 2022);

制冷是减缓也是适应

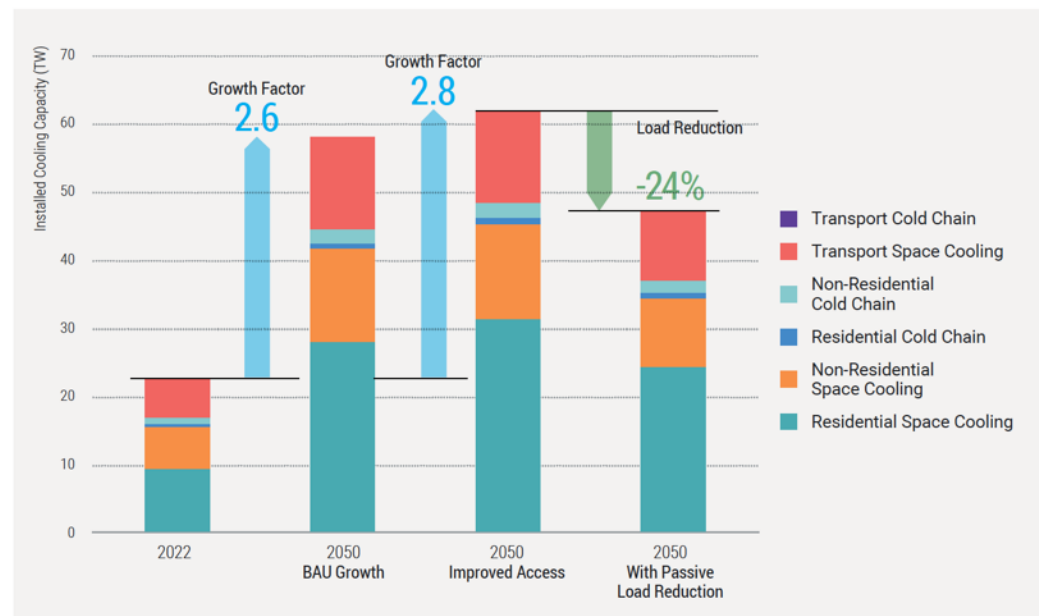
How to Meet Cooling Demand While Cut Emissions

全球因缺少制冷服务而面临生命、健康、生计冲击的“高风险弱势群体”在扩大

全球制冷需求将增加2.6倍以上，相关温室气体排放有可能从2022年到2050年升高一倍以上(发展中国家增加二倍以上)

RISK SPECTRUM	HIGH RISK	
	<ul style="list-style-type: none"> • No access to electricity • Income below poverty line • Poor ventilation and construction • No access to refrigeration for food • Farmers lack access to cold chains • Vaccines exposed to high temperatures 	
RISK POPULATIONS	RURAL POOR	URBAN POOR
RISK INDICATORS	<ul style="list-style-type: none"> • Lack of access to energy • Population living in rural areas on less than \$1.90/day 	<ul style="list-style-type: none"> • Lack of access to energy • Population living in urban slums on less than \$1.90/day
2022 ACCESS GAP	376.6 MILLION	821.5 MILLION
2021 ACCESS GAP	372.7 MILLION	796.7 MILLION
CHANGE	+3.9 MILLION	+24.8 MILLION

Figure 2-1: Global cooling capacity in 2022 and under three scenarios for growth to 2050



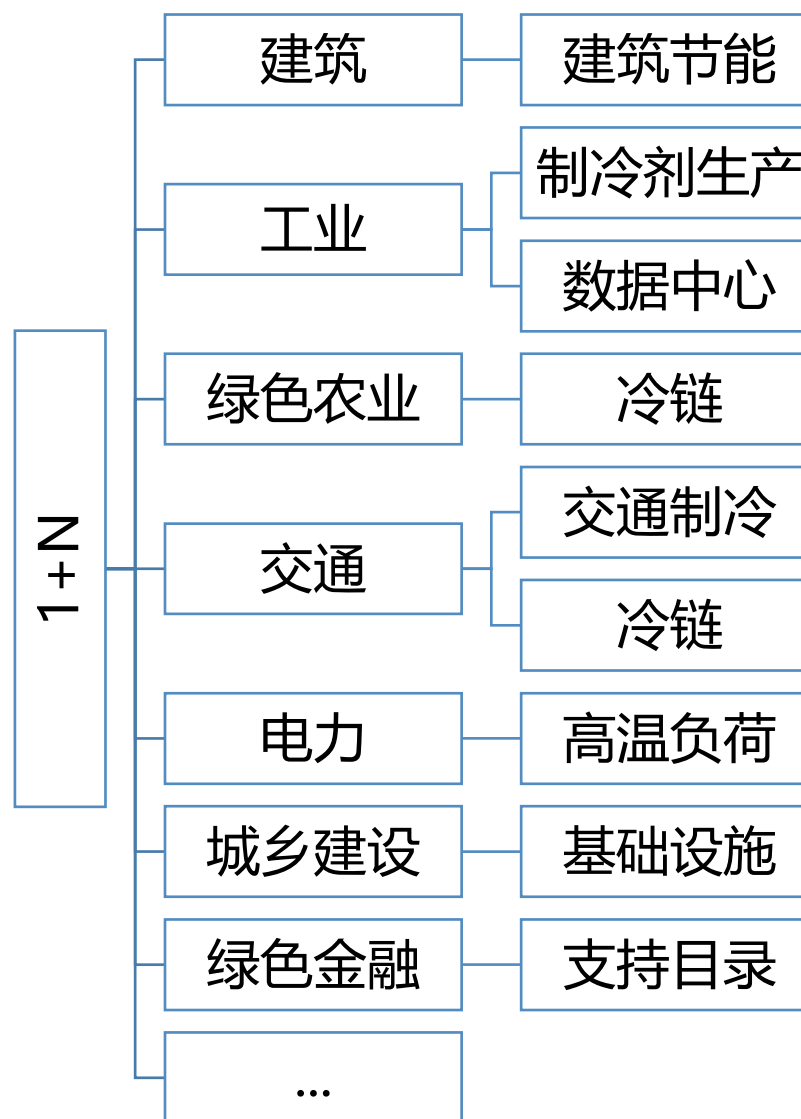
Source: Global Cooling Emissions Model

Sources: SE4ALL, Chill Prospect: Access to Cooling Report 2023

Sources: UNEP, Keeping it chill, How to meet cooling demand, while cutting emissions 2023

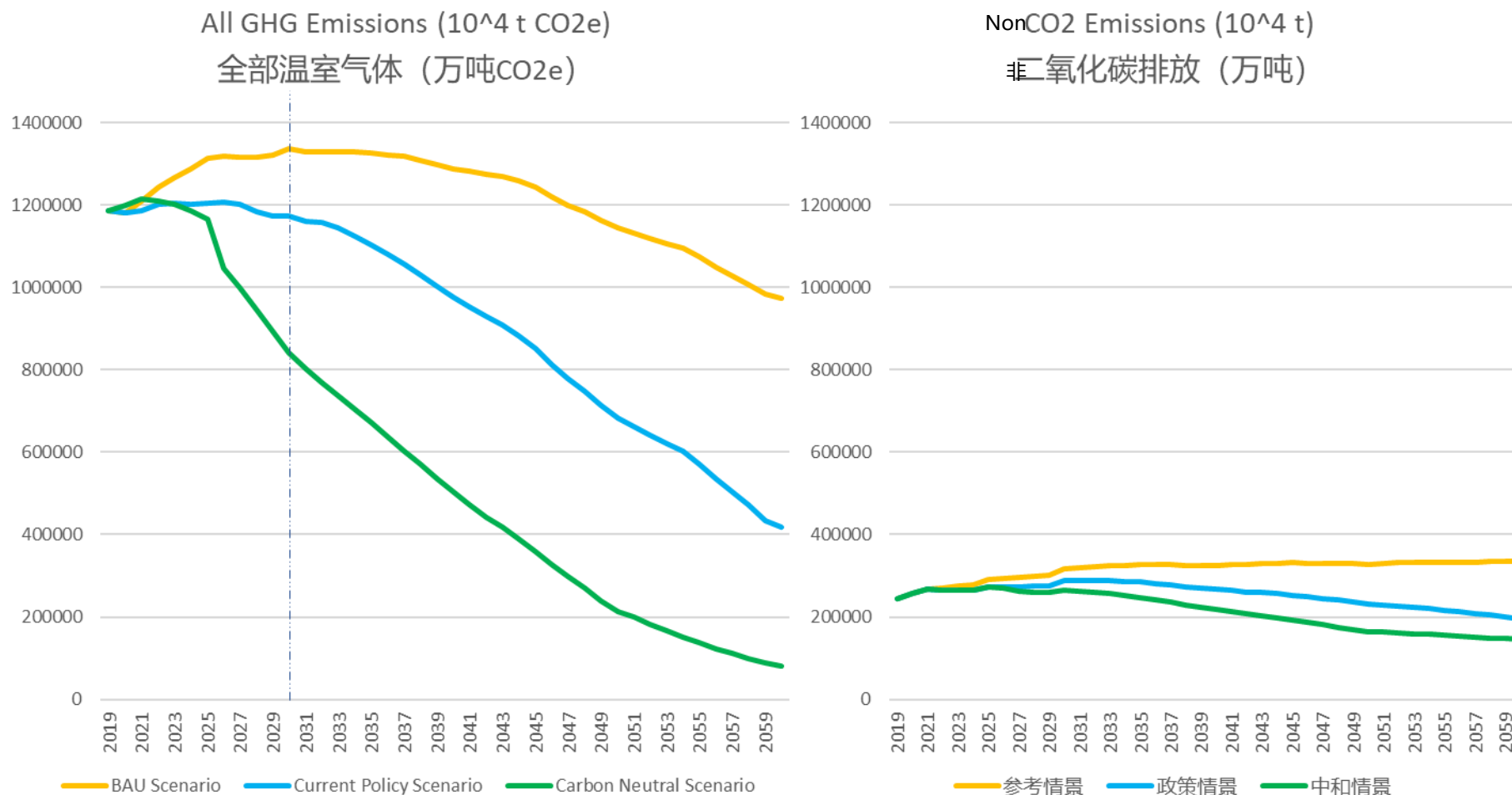
制冷与我国双碳战略

- 《绿色高效制冷行动方案》(2019)
- 《2024年度氢氟碳化物配额总量设定与分配方案》



Current policies would lead to early CO2 peaking around 2025 and lower the CO2 peak emissions by 917 MMT (8%)

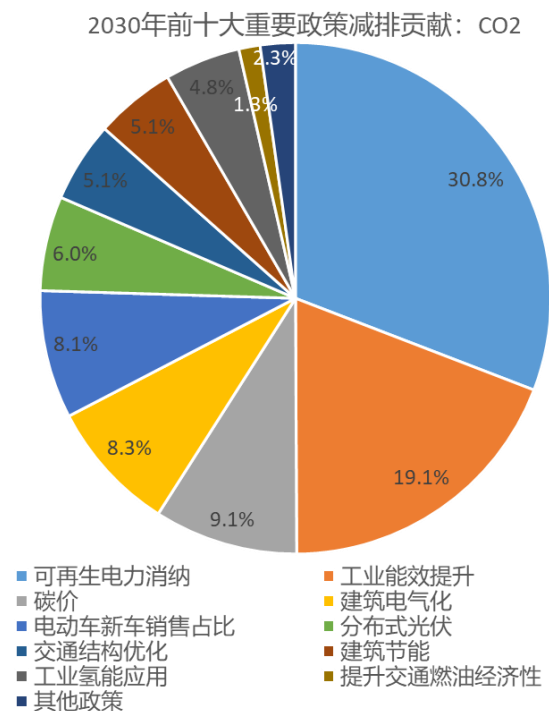
现有政策可以达到2025前后二氧化碳提前达峰，峰值减少约9亿吨



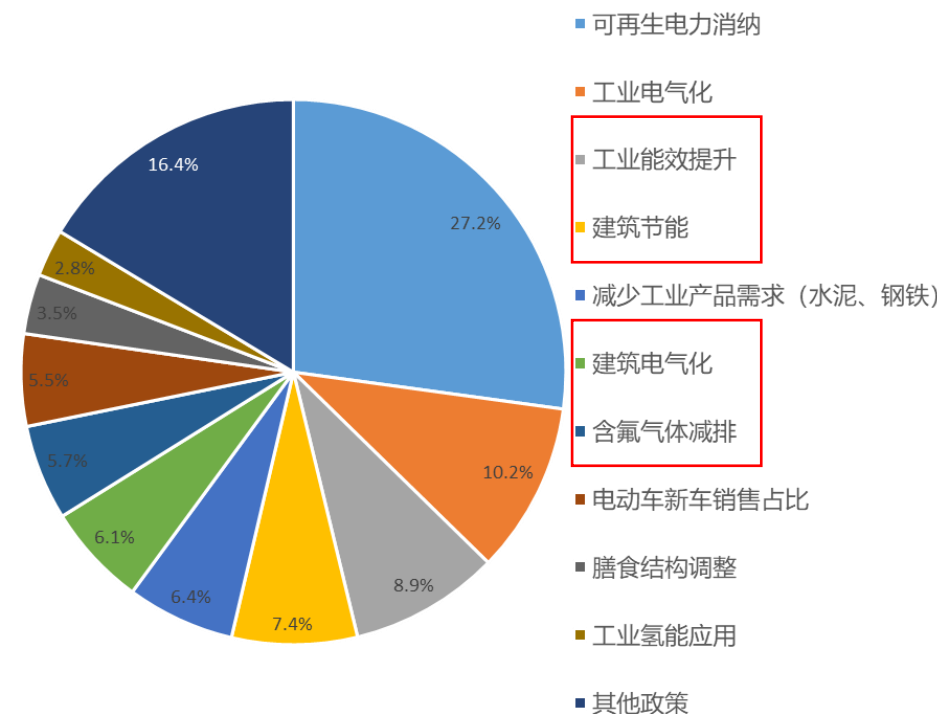
- CO2 Emissions only reduced by 1% (BAU) and 6% (CP) in 2035 compared to 2030, unable to fulfill the promise to "significantly reduce emissions after carbon peak"
- 2035年CO2排放相较2030年仅减少1% (BAU) 和6% (1+N)，不符合“达峰后显著下降”的承诺
- Policy enhancements are necessary to reach carbon neutrality by 2060.
- 达到2060碳中和需要加强政策措施

制冷绿色低碳转型助力实现碳达峰碳中和

2030年前主要减排措施



2050年前主要减排措施



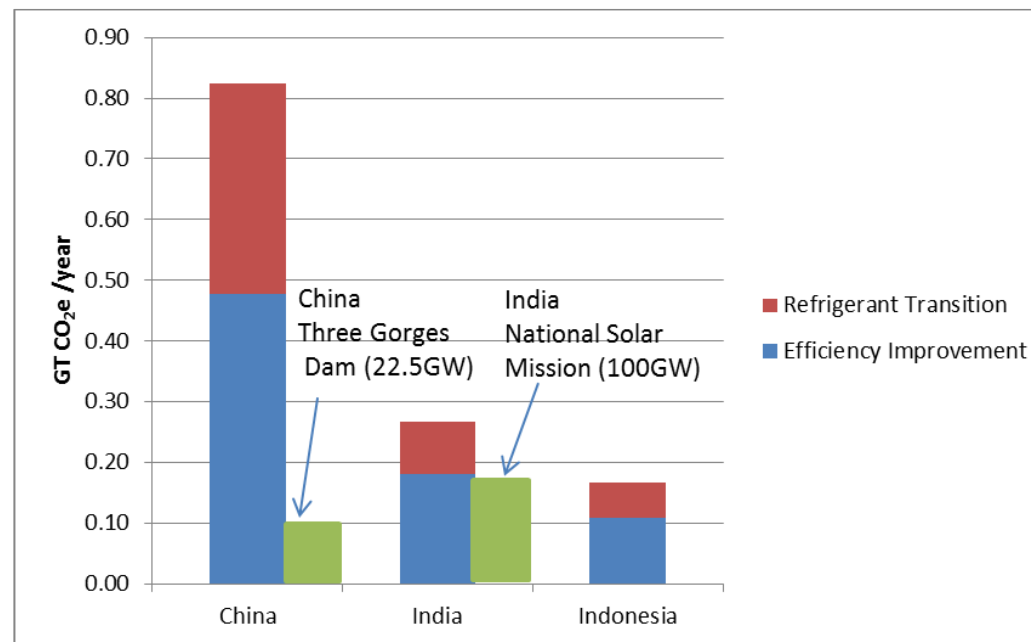
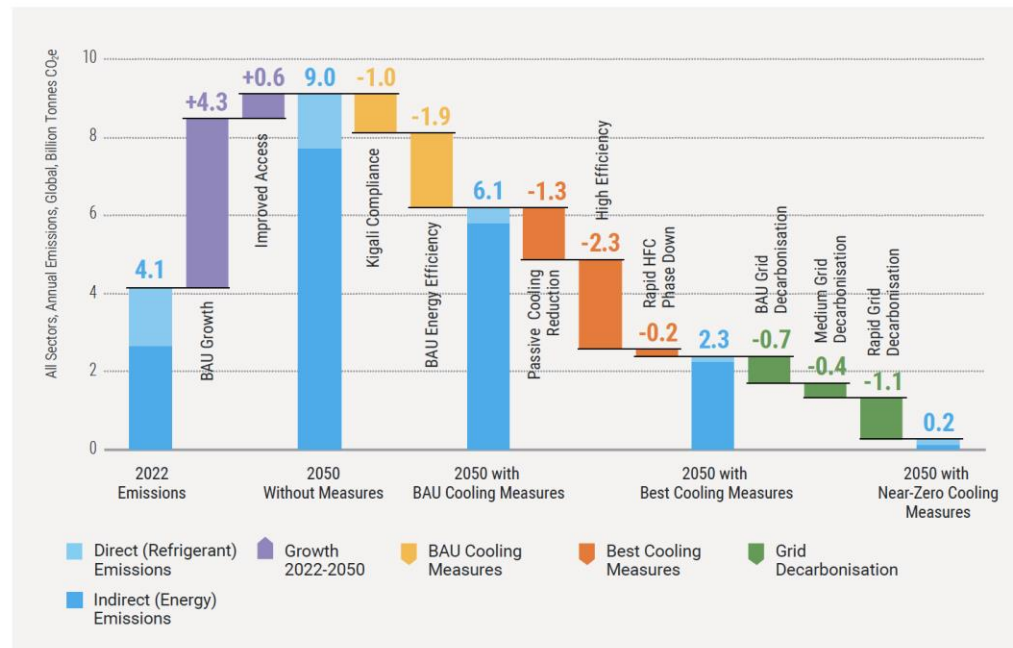
来源: iGDP, Modeling 1+N Policies Using China Energy Policy Simulator, 2021

能效提升和制冷剂替代协同增效

零碳途径：提高能效（? %）、制冷剂替代、被动制冷（减少制冷需求）、电网低碳化

发展超高效绿色低碳空调、协同控制带来的温室气体减排，约占实现中国2030年峰值目标所需减排量的10-15%

Figure ES-1: Global pathway and key steps to achieve near-zero GHG emissions from cooling, 2022-2050



Note: Blue bars show emissions in 2022 and 2050. Purple bars indicate growth. Yellow bars indicate BAU Cooling Measure emission reductions. Orange

Sources: UNEP, Keeping it chill, How to meet cooling demand, while cutting emissions 2023

Sources: Shah LBNL, Benefits of Leapfrog to High-EE and Low GWP Refrigerant in Room Air Conditioning

几点建议

制定城市制冷（降温）方案

制冷（降温）行动方案

1. 开展全方位城市高温风险评估
2. 强化高温预测预警与信息网络
3. 改善城市布局与基础设施，建设高温韧性城市
4. 推广绿色高效制冷技术和方式，降低能耗
5. 提升城市智慧管理能力，保护高危群体
6. 促进绿色消费

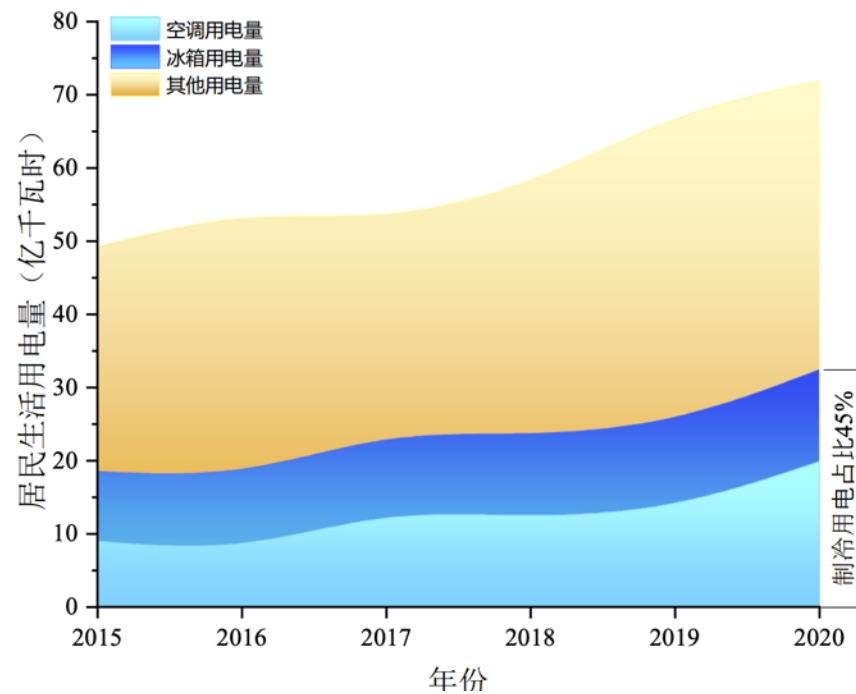


低成本/被动制冷技术



建议

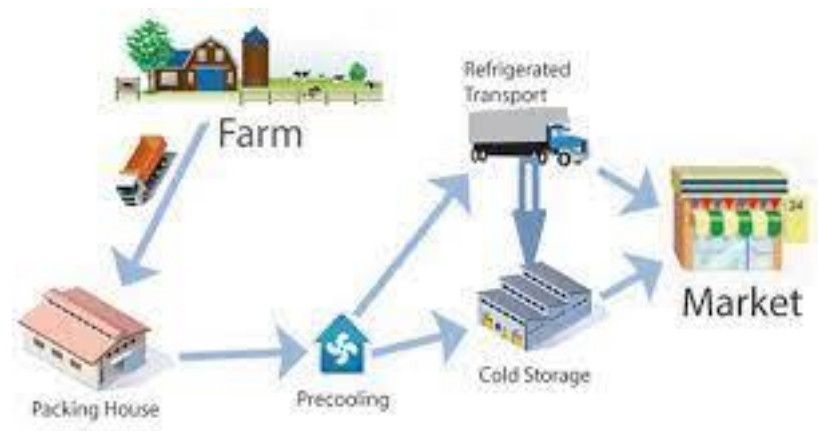
海南省绿色高效制冷方案



来源: 海南省环科院, 海南省绿色高效制冷行动方案研究 2022

建设自贸港农业零碳冷链体系

可再生能源 + 低碳冷库 + 电动车 + 零废弃



“节能一夏·低碳乐活”社区环保活动

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期待你们的反馈与交流

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