

中国水泥行业绿色低碳相关政策 和技术进展

Progress of green and low-carbon policies and
technologies in China's cement industry



中国建筑材料联合会（CBMF）是中国建材行业唯一的全国性、综合性权威社团组织，现有会员1500多家，是“AAAAA级全国性社会团体”，负责水泥、玻璃、建筑卫生陶瓷、石灰等30多个行业的发展规划、产业政策研究，先进技术装备的推广，以及标准制修订、国际交流与合作等工作。



中国建筑材料联合会
China Building Materials Federation

The China Building Materials Federation(CBMF) is the only national, comprehensive, and authoritative association in China's building materials industry. With over 1,500 members, it is recognized as a "5A-level National Association." Under the leadership of the Chinese government, it is responsible for the development planning, industrial policy research, the development and promotion of advanced technologies and equipment, and the formulation and revision of standards, as well as international exchanges and cooperation in over 30 sectors, including cement, glass, sanitary ceramics, and lime.



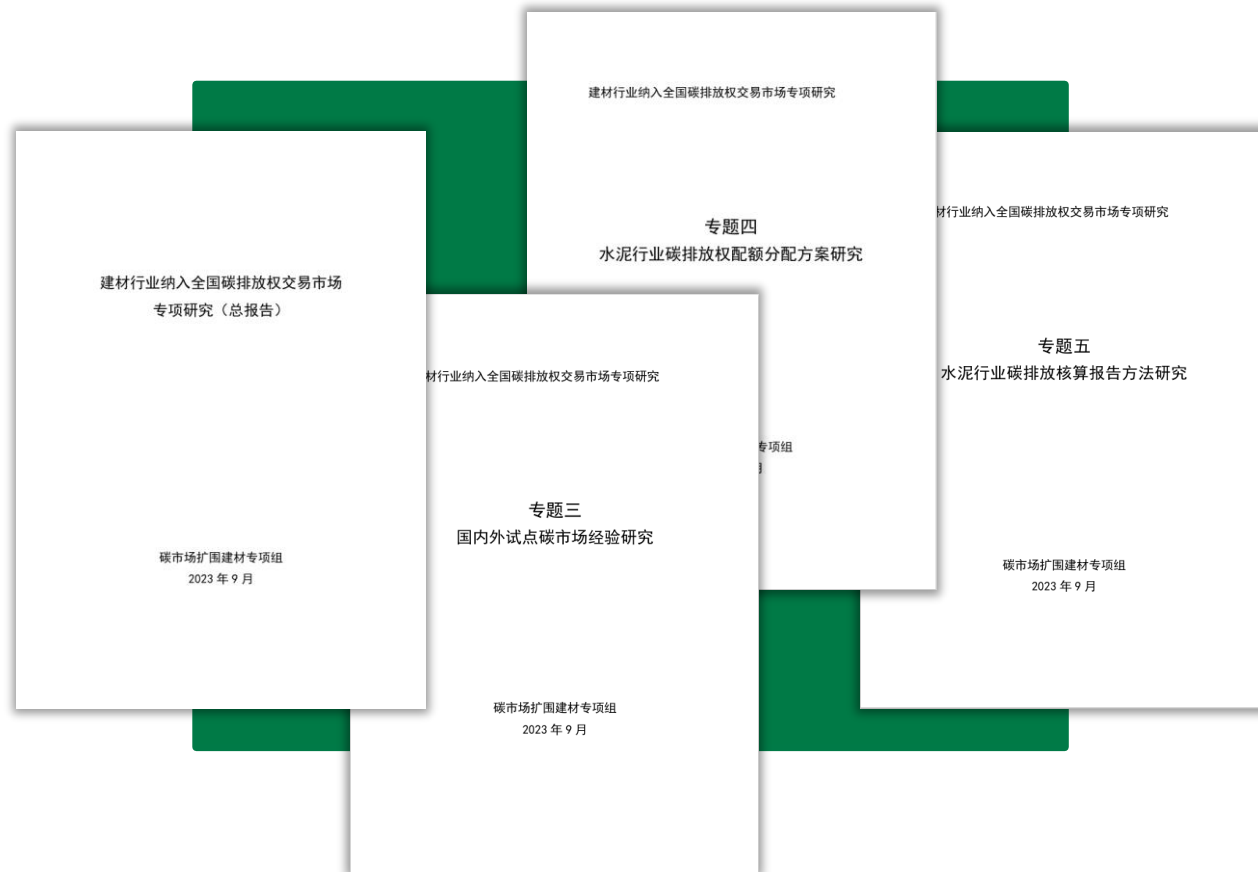
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中国建筑材料联合会是中国碳排放统计核算工作组、中国碳达峰碳中和标准化总体组成员单位。

CBMF is a member of China's Carbon Emission Statistics and Accounting Working Group and the overall Standardization Group for Carbon Peaking and Carbon Neutrality.

中国建筑材料联合会是建材行业纳入全国碳排放权交易市场研究的主要支撑单位，承担建材行业碳排放统计核算、应对气候变化有关工作。

CBMF plays a key supporting role in research related to the inclusion of the building materials industry in the national carbon emission trading market and undertakes the industry's work on carbon emission statistics, accounting, and climate change response.



- 中国是全球水泥制造第一大国，近年来水泥产量一直稳步在20亿吨以上，占全球水泥产量的50%左右。水泥熟料生产线数量为1600余条。前10家大企业集团的水泥熟料产能占全国总产能的57.9%

China is the world's largest producer of cement, with annual output consistently above 2 billion tons in recent years, accounting for around 50% of the global total. There are over 1,600 cement clinker production lines. The cement clinker production capacity of the top 10 enterprise groups accounts for 57.9% of the national total.

2024年水泥熟料产能前10家企业 Top 10 cement clinker production capacity



中国建材股份有限公司
China National Building Material Company Limited

CONCH
海螺水泥

BBMG 金隅冀东水泥

华新水泥

华隅建材科技
CR BLDG MATERIALS TECH

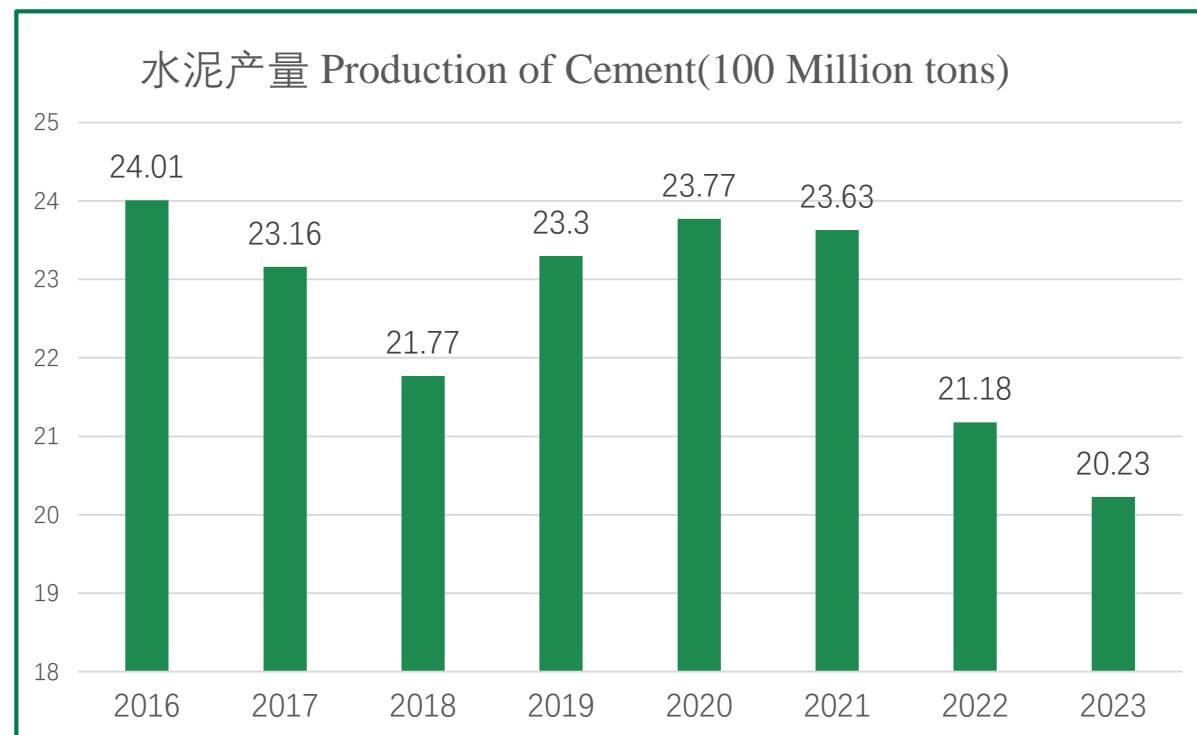
HONGSHI

天瑞
TIAN RUI

TCC
THE FUTURE IS WORTH IT

SUNNSY 山水集团
SUNNSY GROUP

亚洲水泥控股公司
Asia Cement (China) Holdings Corporation

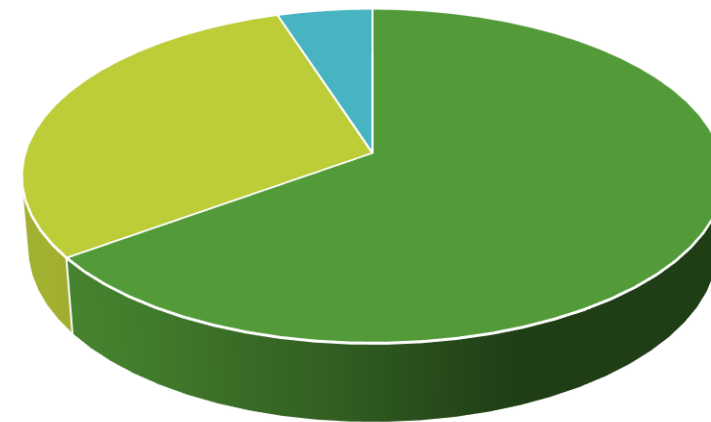


水泥行业碳排放量仅次于电力和钢铁行业，位于全国第三。2020年，水泥行业二氧化碳排放量13.2亿吨，其中，电力消耗二氧化碳排放量为0.9亿吨。

The cement industry has the second-largest carbon emissions in China, ranking third nationwide. In 2020, it emitted 132 million tons of carbon dioxide, of which 90 million tons were from power consumption.

水泥熟料直接排放占比约95%，其中煅烧工艺排放占比60%，主要为原料（碳酸钙）分解排放；燃料燃烧排放占比35%；电力产生的间接排放约占5%

Cement clinker direct emissions accounted for about 95%, of which calcination process emissions accounted for 60%, mainly raw material decomposition emissions; Fuel combustion emissions accounted for 35%; Indirect emissions from electricity account for about 5%



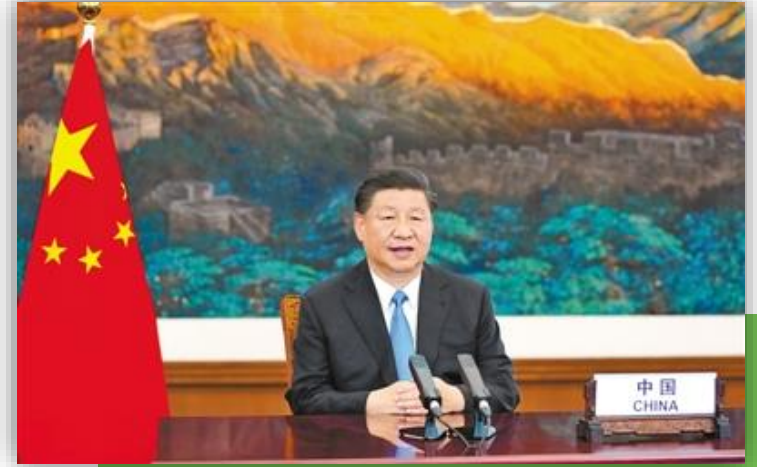
燃料燃烧排放
Fuel combustion emissions

电力排放
Emissions from electricity

原料分解排放 Emissions from
raw material decomposition

2020年9月22日，国家主席习近平在第七十五届联合国大会一般性辩论上向世界宣布了中国的碳达峰目标与碳中和愿景。中国将提高国家自主贡献力度，采取更加有力的政策和措施，**二氧化碳排放力争于2030年前达到峰值，努力争取2060年前实现碳中和。**

On September 22, 2020, Chinese President Xi Jinping announced at the 75th United Nations General Assembly that China will increase its nationally determined contributions, adopt more effective policies and measures, strive to peak carbon dioxide emissions before 2030, and strive to achieve carbon neutrality before 2060.



2021年1月中国建材联合会发出倡议：我国建筑材料行业要在2025年前全面实现碳达峰，水泥等行业要在2023年前率先实现碳达峰。**从目前来看，水泥行业提前实现碳达峰已经成为现实。**

In January 2021, the China Building Materials Federation issued an initiative: China's building materials industry should fully achieve carbon peak before 2025, and the cement industry should take the lead in achieving carbon peak before 2023. **From the current perspective, achieving carbon peak ahead of schedule in the cement industry has become a reality.**

■ 《建材行业碳达峰实施方案》-2022.11

"Action Initiative for Promoting Carbon Peaking and Carbon Neutrality in the Building Materials Industry"

“十四五”期间，水泥熟料单位产品综合能耗水平降低3%以上

During the “14th Five-Year Plan (2021-2025)” period, the comprehensive energy consumption of cement clinker per unit product was reduced by more than 3%

✓ 加快退出低效产能

Accelerate the withdrawal of inefficient capacity.

✓ 加快清洁绿色能源应用

Accelerate the application of clean and green energy.

✓ 加快研发重大关键低碳技术

Accelerate the development of major key low-carbon technologies.

✓ 加快推广节能降碳技术装备

Accelerate the promotion of energy-saving and carbon-reducing technologies and equipment.

■ 《关于严格能效约束推动重点领域节能降碳的若干意见》-2021.10

Several opinions on strict energy efficiency constraints to promote energy conservation and carbon reduction in key areas

■ 《工业重点领域能效标杆水平和基准水平（2023年版）》-2023.6

Leading level and benchmark level of energy efficiency in key industrial areas

序号	产品名称	指标名称	指标单位	基准水平	标杆水平
4	水泥熟料	可比熟料 综合能耗	千克标准 煤/吨	117	100

水泥熟料单位产品综合能耗标杆水平是100千克标准煤/吨，基准水平是117千克标准煤/吨

The leading level of comprehensive energy consumption per unit product of cement clinker is 100 kilograms of standard coal per ton, and the reference level is 117 kilograms of standard coal per ton.

到2025年，水泥熟料达到标杆水平的产能比例超过30%，低于基准水平的产能将淘汰退出

By 2025, the proportion of cement clinker production capacity reaching the leading level will exceed 30%, and capacity below the benchmark level will be phased out.

目前，全国水泥熟料产能达到或优于标杆水平的占比超过15%，仍有约16%产能的能效达不到基准水平。这意味着，水泥行业仍有约2-3亿吨熟料产能的能效达不到基准水平，若这部分产能不在规定时限通过技术改造升级达到基准水平，将面临关停和淘汰。

Currently, the proportion of cement clinker capacity in the country that meets or exceeds the leading level is over 15%, while about 16% of the capacity has an energy efficiency that does not meet the benchmark level. This means that there is still **about 20-30 million tons** of clinker capacity with an energy efficiency that does not meet the benchmark level in the cement industry. If this part of the capacity does not meet the benchmark level within the specified time limit through technological upgrading and transformation, **it will face closure and elimination.**

■ 《关于推进实施水泥行业超低排放的意见》-2024.1

Opinions on promoting the implementation of ultra-low emission in the cement industry

- 2025年底，重点区域力争50%水泥熟料产能完成改造，区域内大型国有企业集团基本完成有组织、无组织超低排放改造；到2028年底，重点区域水泥熟料企业基本完成改造，全国力争80%水泥熟料产能完成改造。

By the end of 2025, 50% of the cement clinker capacity in the key areas is expected to be transformed; By the end of 2028, the cement clinker enterprises in the key areas will have basically completed the transformation, and nationwide, 80% of the cement clinker capacity is expected to be transformed.

《水泥行业节能降碳专项行动计划》-2024.5

Cement Industry Energy Saving and Carbon Reduction Action Plan

到2025年底 By the end of 2025

➤ **全国水泥熟料产能控制在18亿吨左右**

The national cement clinker production capacity is controlled at around 1.8 billion tons.

➤ **通过节能降碳改造和用能设备更新形成节能量约500万吨标准煤、减排二氧化碳约1300万吨**

Save 50 million tons of standard coal in energy consumption and reduce carbon dioxide emissions by 13 million tons.

➤ **水泥窑使用替代燃料技术生产线比例达到30%，水泥行业替代燃料消费比例力争达到10%**

The proportion of cement kilns using alternative fuel technology in production lines is expected to reach 30%, and the proportion of alternative fuel consumption in the cement industry is expected to reach 10%.

《水泥行业节能降碳专项行动计划》-2024.5

Cement Industry Energy Saving and Carbon Reduction Action Plan

到2025年底 By the end of 2025

➤ **大气污染防治重点区域50%左右水泥熟料产能完成超低排放改造**

About 50% of the cement clinker production capacity in the key areas for atmospheric pollution control have completed the transformation to ultra-low emissions.

➤ **水泥行业综合利用废弃物总量达到8亿吨**

The total utilization of waste materials has reached 800 million tons.

➤ **关键工序数控化率达到70%，智能制造示范工厂力争达到25家**

The proportion of key processes controlled by numerical control reaches 70%, and the number of smart manufacturing demonstration factories is aimed at 25

国际能源署：2050年水泥行业低碳转型技术路线图

IEA: Technology Roadmap - Low-Carbon Transition in the Cement Industry (By 2050)

□ 提高水泥生产效率和能耗效能，减碳约3%；

Improving energy efficiency, provide 3% of the cumulative CO2 emissions savings by 2050

□ 替代燃料技术（协同处置等），减碳约12%；

Switching to alternative fuels that are less carbon intensive than conventional fuels delivers 12% of the cumulative CO2 emissions savings by 2050

□ 降低熟料系数（混合材替代熟料），减碳约37%；

Reducing the clinker to cement ratio delivers 37% of the cumulative CO2 emissions savings by 2050

□ 采用新兴和创新的节能降碳技术，减碳48%

Emerging and innovative technologies provide 48% of the cumulative CO2 emissions savings by 2050

✓ 余热发电 Excess Heat Recovery (EHR) for power generation

✓ 可再生能源发电 Renewable power generation

✓ CCUS



中国建筑材料联合会组织实施的建材行业重大科技攻关“揭榜挂帅”项目中，榜单设立了“绿色氢能煅烧水泥熟料关键技术”“水泥窑炉烟气碳捕集新工艺流程再造及示范”“新型固碳胶凝材料制备及工业窑炉尾气CO₂材料化利用关键技术”等研发方向，行业内龙头企业以及知名院所、高校积极主动“揭榜”攻关，目前部分单位已取得阶段性成果。



In the major scientific and technological research projects organized by the China Building Materials Federation under the “Open Competition Mechanism”, the focus has been on areas such as the “**Key Technologies for Green Hydrogen-Based Calcination of Cement Clinker**” “**Reconstruction and Demonstration of New Process Flow for CO₂ Capture from Cement Kiln Flue Gas**” and “**Preparation of New Carbon-Sequestering Cementitious Materials and Material Utilization of Industrial Kiln Flue Gas CO₂.**” Leading enterprises in the industry, renowned research institutes, and universities have actively engaged in these projects, and some units have already achieved phased results.

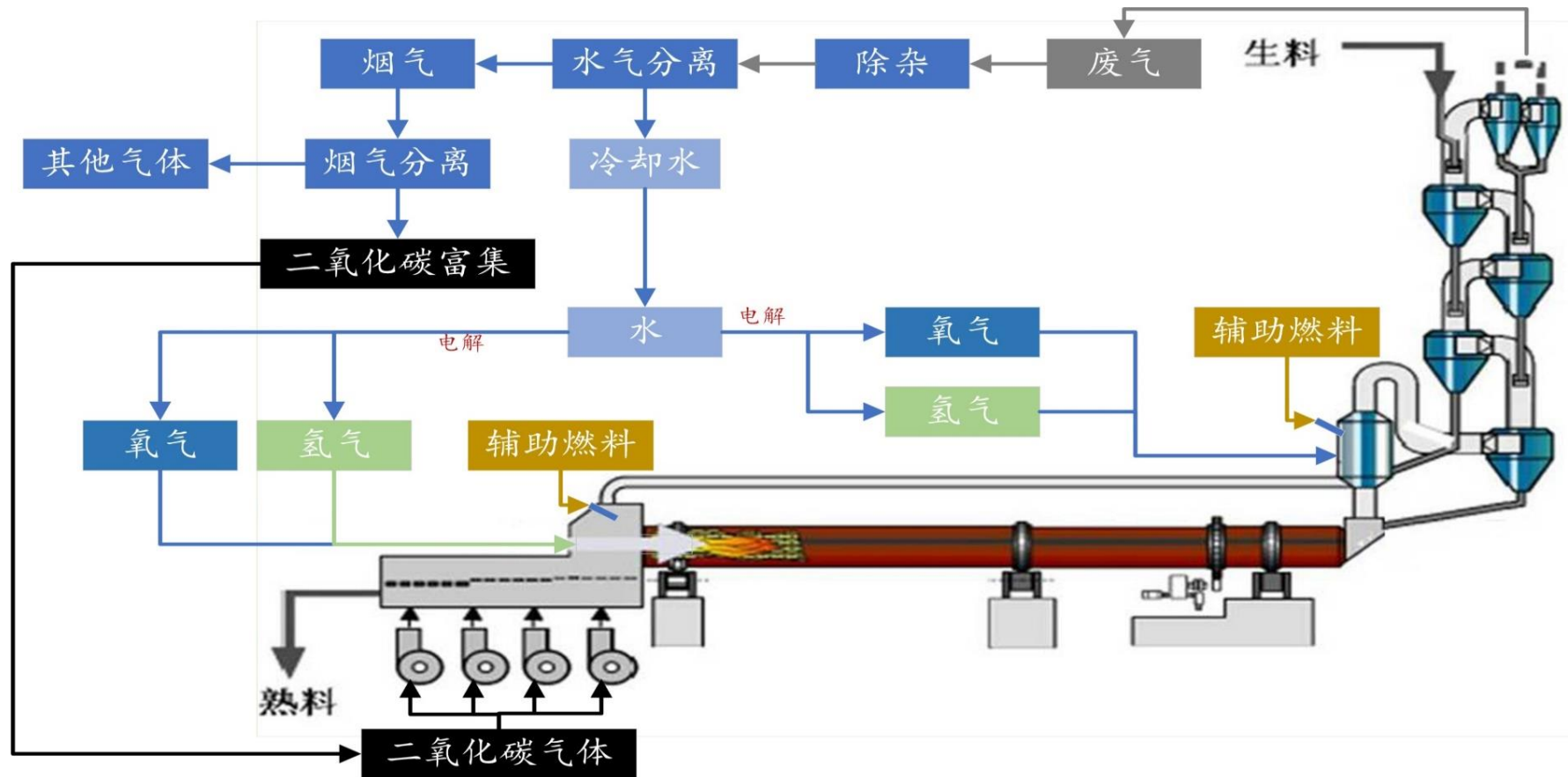
■ 降低燃煤消耗、提高替代燃料的使用比例，是水泥生产实现减少直接排放的重要技术。
Reducing coal consumption and increasing the proportion of usage of alternative fuels are important methodologies for cement production to reduce direct emissions.

		
NCV [kcal/kg] 秸秆 3200 kCal/kg	RDF 5000 kCal/kg	市政污泥 3000 kCal/kg
		
NCV [kcal/kg] 废旧轮胎 7000 kCal/kg	木料 4000 kCal/kg	SRF 4000 kCal/kg



华新水泥在水泥窑大比例替代燃料技术领域取得突破，实现了燃料替代率稳定在60%以上，水泥熟料综合能耗低于50千克标准煤/吨。

Huaxin Cement has made a breakthrough in the field of large-scale substitution of fuels in cement kilns, achieving a stable fuel substitution rate of over 60% and a comprehensive energy consumption of cement clinker below 50 kg standard coal per ton.

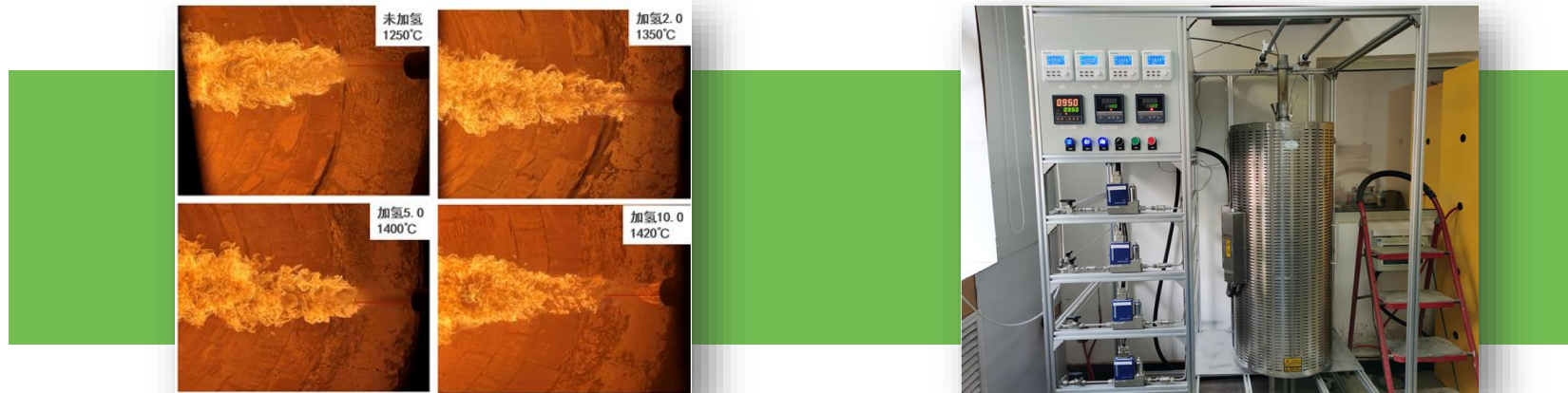


- 采用氢能烧成技术，CO₂降低约32%，窑尾废气CO₂浓度可提高至95%

Using hydrogen energy combustion technology, CO₂ is reduced by about 32%, and the CO₂ concentration of kiln exhaust gas can be increased to 95%.

- 天津水泥工业设计研究院搭建了氢能悬浮煅烧实验平台，完成氢能煅烧水泥熟料的中试试验，氢能替代化石燃料比例可达到20%。

Tianjin Cement Industry Design & Research Institute has set up a hydrogen-powered suspension calcination experimental platform and completed a pilot test for hydrogen calcination of cement clinker, with the proportion of hydrogen replacing fossil fuels reaching 20%.



- 中国科学院大连化学物理研究所通过绿电或低谷电力实现电解水制氢；开发的电解水制氢工艺技术装备制氢量可达150kg/h, 电能转化效率大于65%。

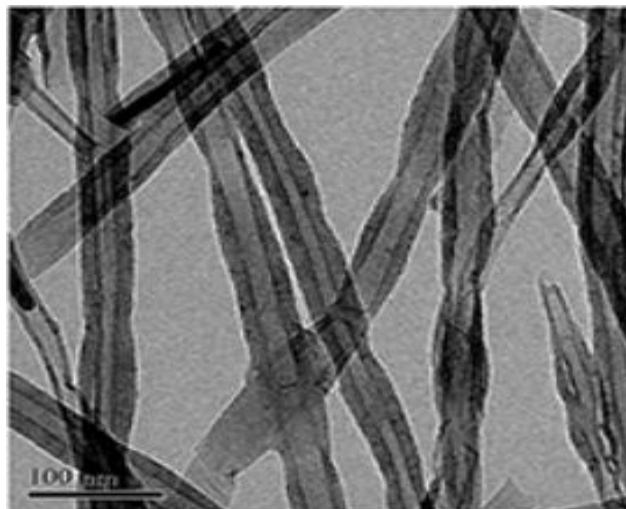
Dalian Institute of Chemical Physics, Chinese Academy of Sciences has achieved electrolysis of water to produce hydrogen by using green electricity or low-valley electricity. The electrolysis equipment developed by the institute can produce up to 150 kg of hydrogen per hour, with an electricity conversion efficiency of over 65%.

水泥种类 Type of cement	熟料占比 Proportion of clinker/ %	其他材料占比 Proportion of others/%
普通水泥 Ordinary cement	65-70	30-35
低熟料水泥 Low clinker cement	40-60	40-60

- 提高混合材活性，降低水泥中熟料掺量，吨水泥碳排放可降低约 26%。
- Improving the activity of mixed materials can reduce the amount of clinker in cement, reducing carbon emissions per ton of cement by about 26%

- 掺加纳米改性材料，提高混凝土性能，降低熟料用量。

Adding nano-modified materials can improve the performance of concrete and reduce the amount of clinker in it



■ 余热发电 Excess Heat Recovery (EHR) for power generation

- 95%以上的水泥熟料生产线安装了余热发电设施

More than 95% of cement clinker production lines are equipped with EHR for power generation facilities.

- 建材工业年余热发电量超过400亿千瓦时。

The building materials industry generates over 40 billion kilowatt-hours of EHR for power generation .

■ 可再生能源发电 Renewable power generation

- 济宁海螺水泥生产用电的绿色低碳电力占比已超过全年用电量的80%

The green and low-carbon electricity used by Jining Conch Cement for production has exceeded 80% of its total electricity consumption for the year.



□ 海螺水泥2019年建成世界首条年产5万吨二氧化碳捕集的生产线;

In 2019, Conch Cement built the world's first production line capable of capturing 50,000 tons of CO₂ per year.



□ 海螺集团在白马山水泥厂干冰生产线和智慧农业温室项目，实现二氧化碳资源化利用

China Resources Building Materials Technology is building two CCUS production lines with capacities of 100,000 tons and 200,000 tons.

中国建材集团牵头2024年1月建成当前全球水泥领域首个、最大的全氧燃烧耦合碳捕集攻关项目进行调试生产，CO₂ 捕集浓度、捕集能耗等指标已初步达到预期攻关目标；

China National Building Material Group, leading a project, completed the world's first and largest oxyfuel combustion coupled carbon capture project in the cement sector in January 2024, with performance indicators such as CO₂ capture concentration and energy consumption meeting initial targets.



■ **金隅冀东在北京正在建设年产10万吨二氧化碳捕集的生产线，已投产；**

BBMG Jidong is constructing a CO₂ capture production line with an annual capacity of 100,000 tons in Beijing.

■ **华润建材科技正在建设10万吨、20万吨两条CCUS生产线；**

China Resources Building Materials Technology is building two CCUS production lines with capacities of 100,000 tons and 200,000 tons.

■ **凯盛科技集团在2022年9月建成世界首套玻璃熔窑5万吨二氧化碳捕集与提纯示范项目**

In September 2022, Triumph Technology Group completed the world's first demonstration project for CO₂ capture and purification from glass furnaces with an annual capacity of 50,000 tons.



我们期待通过技术交流与合作，加速新技术的落地和应用，共同推动建材行业的绿色低碳发展。在此，我代表中国建材联合会，对各位的参与和支持表示衷心的感谢，并期待会后我们能够进一步探讨合作的可能性。谢谢大家！

We look forward to accelerating the implementation and application of new technologies through technical exchanges and cooperation, and jointly promoting the green and low-carbon development of the building materials industry. On behalf of the China Building Materials Federation, I would like to express our heartfelt thanks for your participation and support, and look forward to further exploring possibilities for cooperation after the conference. Thank you !



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