



碳双控：促进水泥行业去产能、去产量

Dual Control of Carbon Emission: Promoting reduction of Cement capacity and output

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水泥行业碳配额分配方法

Allocation methods to distribute CO₂ allowances for cement industry

- **初始配额**: 政府发放的CO₂初始排放权, 主要由**熟料产量基准量**和**排放强度基准值**决定。

Initial allocation are essentially rights to emit GHG emissions equivalent to the global warming potential of 1 ton of CO₂ equivalent (tCO₂e), which is determined primarily by clinker yield benchmark and CO₂ emission intensity benchmark.

初始配额 = 熟料产量基准量 (t/a) x 排放强度基准值 (kg CO₂/tcl) x (1-下降系数(%))x 修正系数

Initial allocation = Clinker yield benchmark (t/a) x CO₂ emission intensity benchmark (kg CO₂/tcl) x (1- the linear reduction factor(%)) x correction factor

- **配额分配方式** *Allocation methods to distribute allowances:*



国内试点碳市场碳配额分配经验

Allocation methods to distribute CO₂ allowances in domestic ETS pilots

- 2013年，7个省市启动试点碳市场。截止2023年，湖北省覆盖全省50%约1.8亿吨/年的碳排放源，累计交易总量3.88亿吨CO₂，交易额95.75亿元；广东省覆盖40%约2.97亿吨/年的碳排放源，累计交易量约2.19亿吨CO₂，交易额58.52亿元。

Since 2013, 7 provinces and cities have launched ETS pilots. By 2023, in Hubei, ~0.18 billion CO₂/year, 50% of overall GHG emission is covered by ETS pilot, with a cumulative trading volume of 0.388 billion CO₂ and RMB 9.575 billion yuan. In Guangdong, ~0.297 billion CO₂/year, 40% of overall GHG emission is covered by ETS pilot, with a cumulative trading volume of 0.219 billion CO₂ and RMB 5.852 billion yuan.

- 国内试点碳市场水泥行业目前主要采用**基于强度控制的配额分配方法**。

Currently, the domestic ETS pilots mainly adopt the intensity-based allocation method in cement industry.

省市 Pilots	分配方法 Allocation method	配额分配量 Allowances distributed	基准值/标杆值 Benchmark (tCO ₂ /t clinker)	熟料产量 Clinker yield	配额总量调节 Correction of allowances
湖北省 Hubei Province	基于实际产量的基准法 Output-based benchmarked allocation, OBA	分配配额量=熟料产量×基准值× 市场调节因子 Distributed allowances= Clinker yield x CO ₂ emission intensity benchmark x market correction factor	0.8162 (2023年以第50%位熟 料生产线的排放强度为基准线) (In 2023, CO ₂ emission intensity benchmark was 50% quantile of clinker production lines)	取实际值 Output selected	市场调节因子=1-上年度市场 存量/当年配额总量 (0.97- 0.99) Market correction factor =1- Market stock of the previous year/total quota of the current year (ranging from 0.97-0.99).
广东省 Guangdong Province		熟料生产配额=熟料产量×同类型 生产线基准值×年度下降系数 Distributed allowances = Clinker yield x CO ₂ emission intensity benchmark for clinker line x linear reduction factor	4000t/d (含) 以上: 0.884 2000 (含) -4000t/d : 0.909 Above 4000t/d (including) : 0.884 2000 (including) -4000t/d: 0.909	取实际值，但设定熟 料产量上限为设计年 产能的1.2倍 Output selected, but capped by 1.2 times of the authorized capacity.	年度下降系数99% Linear reduction factor 99%

欧盟碳配额分配经验

Allocation methods to distribute CO₂ allowances in EU-ETS

第I II阶段
Phase I&II

历史法 Grandparenting

欧盟通过分配计划确定分配，因水泥产量大幅下降，导致大量盈余，碳价一度跌至零。The EU member acquire allowances through the distribution plan. Due to the cement production plummet, resulting in a large amount of allowances surplus, carbon prices once fell to zero.

第III阶段
Phase III

基于历史产量的基准值法 Fixed historical benchmarked allocation

初始免费配额 = 2005-2008年产量中位数 × 灰水泥熟料碳排放基准值 × (1 - 年均下降系数 1.74%) × (1 - 跨行业修正系数 5.7%)
Initial free allocation = median clinker output of 2005-2008 × CO₂ emission intensity benchmark for grey clinker × (1 - LRF 1.74%) × (1 - CSCF 5.7%)

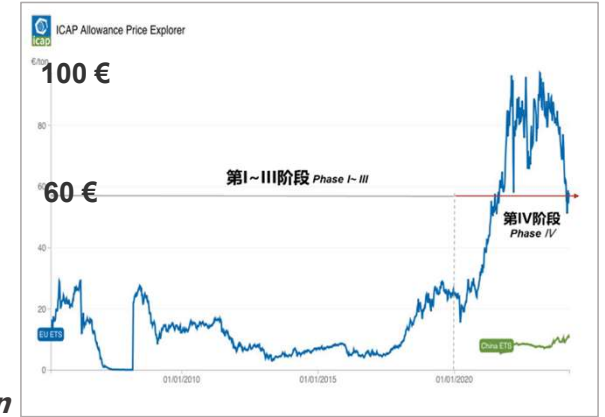
第IV阶段
Phase IV

基于历史产量的基准值法 Fixed historical benchmarked allocation

初始免费配额 (2021-2025) = 2014-2018年平均熟料产量 × 灰水泥熟料碳排放基准值 × (1 - 年均下降系数) × 跨行业修正系数 (取值为1)
Initial free allocation (2021-2025) = avg. clinker output of 2014-2018 × CO₂ emission intensity benchmark for grey clinker × (1 - LRF %) × (CSCF 1)
LRF : year 2021-2023 was 2.2%; year 2024-2027 is 4.3%, year 2028-2030 is 4.4%.

- 基准值由具体行业内 **10% 最高效率装置的平均排放强度** 确定。

The CO₂ emission intensity benchmark value is the average of the top 10% level efficient installation in the industry.



碳配额分配的经验启示

Inspiration from Allocation methods to distribute CO₂ allowances

统一性 Coordination & unification

国内试点 Domestic pilots

试点独立运行，2021年7月启动的全国碳市场仅包含火电行业。

Operating independently. The national ETS launched in July 2021, covers only the power sector.

欧盟碳市场 EU-ETS

建立协调统一碳市场，包含电力、工业、航空、CCUS设施等。形成欧盟范围内自上而下统一的配额分配、MRVA规则等。

Establish coordinated & unified carbon trading market, which including power, industrial, aviation, CCUS facilities, etc. Form a top-down uniform allocation method and MRVA rules within the EU.

总量控制 Absolute emission control

国内试点 Domestic pilots

基于强度控制。
Intensity-based control.

欧盟碳市场 EU-ETS

基于总量控制的配额分配方法实现了碳排放强度和总量的逐年下降。

The allocation method based on absolute emission control has achieved a decrease in carbon emission intensity and total volume year over year.

配额减少? Reduction of free allowances?

国内试点 Domestic pilots

初始分配的大多为免费配额。
Initial allocation are mainly free allowances.

欧盟碳市场 EU-ETS

碳边境调节机制 (CBAM) 的逐步推进，免费配额逐年减少。

The implementation of the CBAM and the gradual reduction of free allowances.

补偿性 Compensatory

国内试点 Domestic pilots

基于强度控制，对减产没有补偿。间接鼓励超量生产，成本影响小。

Intensity-based control, no compensation for capacity cutting. It encourages over-production indirectly and has merely a little impact on cost.

欧盟碳市场 EU-ETS

熟料产量降低、熟料产能退出通过碳市场获得了一定补偿。

Through the EU-ETS, cement plants which reduced clinker output or withdrawal of clinker capacity were compensated to some extent.

年份 Year	排放强度 (t CO ₂ /t clinker)	排放总量 Absolute emission (10 ⁸ tCO ₂)
2007	0.766 (前10%水平的平均值) (average of the top 10% level)	/
2016	0.722 (前10%水平的平均值) (average of the top 10% level)	1.053
2021	0.693 (推算基准值) (calculated benchmark)	0.901 EUA

水泥行业进入全国碳市场的思考

Thoughts on cement sector into China national ETS

- 当前水泥行业面临产能严重过剩、超批复产能生产、利润断崖式下滑。
At present, the cement industry is facing serious overcapacity, over-approved capacity production, and the actual problems of falling profits.
- 温室气体排放是典型的负外部问题，**碳市场如何与水泥行业现状结合，推动健康发展？**
GHG emission is a typical negative external problem. **How to combine the ETS with the status quo of cement industry, and promote its healthy development?**



企业主动降碳
Enterprises motivated to reduce carbon emission

激励机制
Incentive mechanism



公地悲剧
Tragedy of the Common



科斯理论 Ronald Coase

约束机制
Constraint mechanism



淘汰低效产能、约束产量发挥、降低能耗、CO₂和污染物排放

Eliminate inefficient production capacity, curb output. Reduce energy consumption, CO₂ and pollutant emissions (Scale: intensity and absolute volume balance)



探讨：基于碳双控（强度和总量）的水泥行业配额分配方法

Exploration: Allocation method based CO₂ dual control (intensity and absolute volume) in cement industry

1. 初始配额的确定 *Determination of initial allocation*

初始配额=熟料产量基准量×排放强度基准值 *Initial allocation = Clinker yield benchmark x CO₂ emission intensity benchmark.*

熟料产量基准量A=初始年前两年平均熟料产量 *Clinker yield benchmark A= Average of pervious 2 years of clinker output.*

熟料产量基准量B=批复产能（吨/天）×1.1倍×310天 *Clinker yield benchmark B= Authorized clinker capacity (ton /day) x 1.1 x 310 days.*

A与B二者取小值，作为该企业初始年熟料产量基准量。排放强度基准值为初始年前两年行业中前10%水平的平均值。

The smaller value is chosen between A and B, as the Clinker yield benchmark for the initial year. The CO₂ emission intensity benchmark value is the average of the top 10% level in the industry in the previous 2 years.

2. 第2年起配额在以下两种方式中选择，但不超过C：

Allocation from the second year forward is chosen between the following, should be less than C:

1) 本年度配额=上年度配额×(1-D)×(1-E) *1) Allocation of the current year = Allocation from the previous year x (1- D) x (1- E)*

2) 本年度配额=过去两年平均产量×排放强度基准值×(1-D)×(1-E)

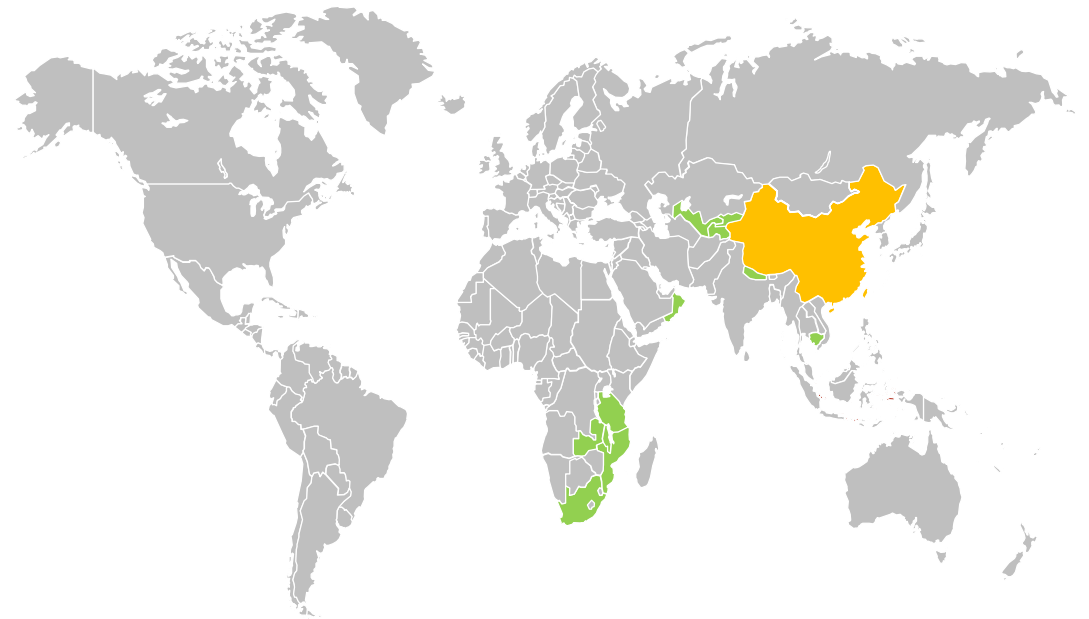
2) Allocation of the current year = Average of pervious 2 years of clinker output x CO₂ emission intensity benchmark x (1- D) x (1- E)

其中：C=B×排放强度基准值；D为碳配额线性下降系数，基于国家碳减排总体目标确定；E为行业修正系数

Where: C=B x CO₂ emission intensity benchmark; D is the linear reduction factor of carbon allocation, which is determined based on the overall national carbon emission reduction target; E is the industry correction factor.

第3年配额分配计算方法同第2年，以此类推。 *Allocation of the third year is calculated in the same way as the second year, and so forth.*

Thanks!



诚信 Integrity

奉献 Dedication

求实 Pragmatism

创新 Innovation