



# Building a unified national power market system in China 中国建设全国统一电力市场体系

## Pathways for spot power markets 电力现货市场路径

Key findings and recommendations 主要结论与建议

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# Background and motivation

## 背景与动机

### Main objectives of the report

#### 本报告的主要目标

- ❑ In line with Document 118 (NDRC, NEA, 2022), assess the **options for China to move ahead with a national market** and how to co-ordinate it with the existing markets 根据发改委及能源局2022年118号文，评估中国推进全国性市场的方案，以及如何与现有市场协调。
- ❑ Propose **transition pathways and recommendations** adapted to the Chinese context 提出适合中国国情的**转型路径和政策建议**
- ❑ Focus on **spot markets** as they have the potential to unlock the flexibility needed in light of renewables growth 在可再生能源增长背景之下关注可解锁灵活性潜力的**现货市场**。



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## 国家发展改革委 国家能源局关于 加快建设全国统一电力市场体系的指导意见

发改体改〔2022〕118号

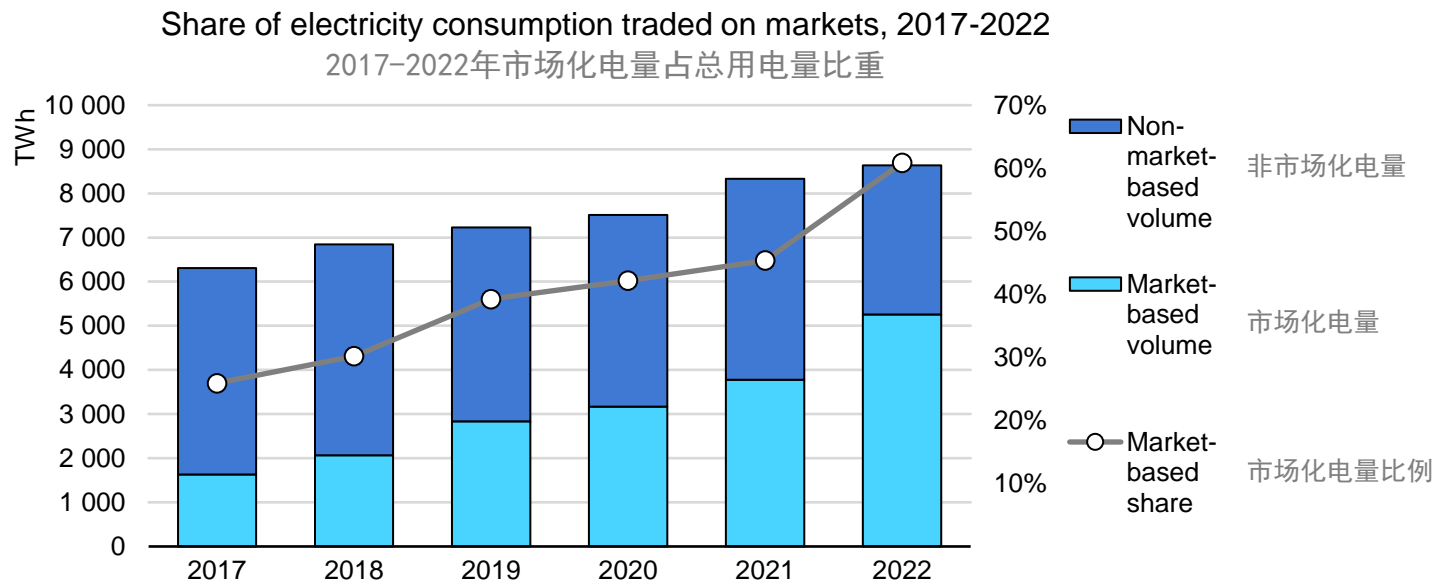
各省、自治区、直辖市人民政府，国务院各部委、各直属机构，国家电网有限公司、中国南方电网有限责任公司、内蒙古电力（集团）有限责任公司，中国核工业集团有限公司、中国华能集团有限公司、中国大唐集团有限公司、中国华电集团有限公司、国家电力投资集团有限公司、中国长江三峡集团有限公司、国家能源投资集团有限责任公司、国家开发投资集团有限公司、华润（集团）有限公司、中国广核集团有限公司：

# Current status of power markets in China

## 中国电力市场现状

# Markets are taking a growing role in China's power system

市场在中国电力体系中的作用愈发重要



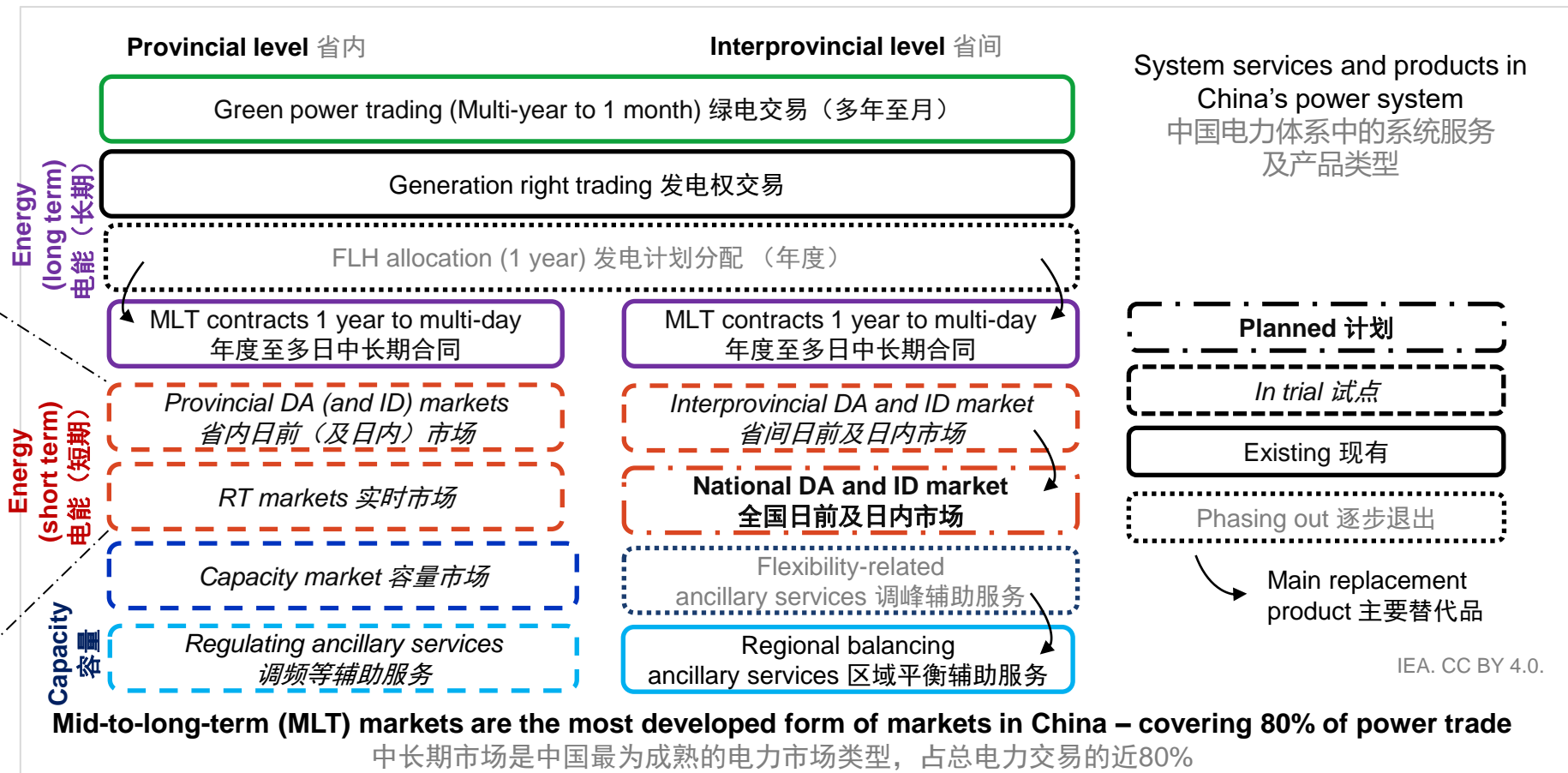
Source: IEA analysis from China Electricity Council data. IEA. CC BY 4.0.  
来源：IEA基于中电联数据的分析

**China has made significant progress in developing its power markets; market-based electricity represented 61% of the national electricity consumption in 2022**

中国在发展电力市场方面取得了显著成效；市场化电量2022年占全国总用电量的61%。

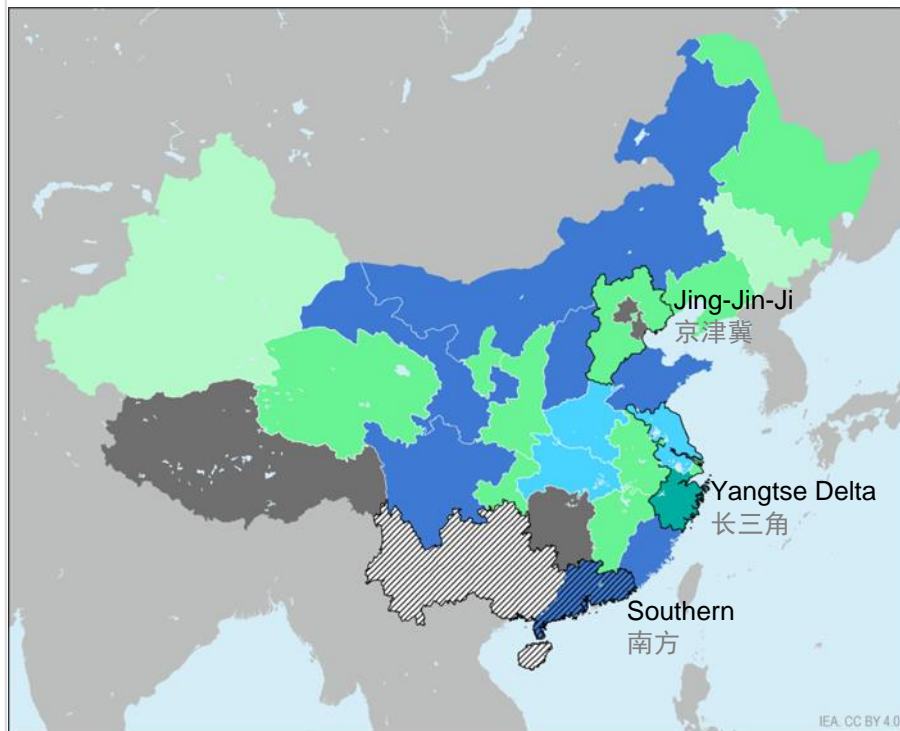
# Power sector reforms seek to balance transition with security of supply

## 电力体制改革寻求能源转型与供应安全之间的平衡



# Several provinces run continuously operational spot pilot markets

数个省份已经开展了连续运行的现货电力市场试点



## Status of China's spot power market trials

中国电力现货市场试点现状

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>Long-term continuous operational test</li><li>Long-term operational test</li><li>Operational test</li><li>Simulation test</li><li>Announced plans</li></ul> | <ul style="list-style-type: none"><li>Southern regional spot provinces</li><li>Regional markets in Document No. 129 (2022)</li><li>No plan</li></ul> |
|---|--|

- |   |   |
|---|---|
| <ul style="list-style-type: none"><li>长周期连续试运行</li><li>长周期试运行</li><li>结算试运行</li><li>调电试运行</li><li>已宣布试点计划</li></ul> | <ul style="list-style-type: none"><li>南方区域电力现货市场省份</li><li>2022年129号文提及的区域市场</li><li>尚无计划</li></ul> |
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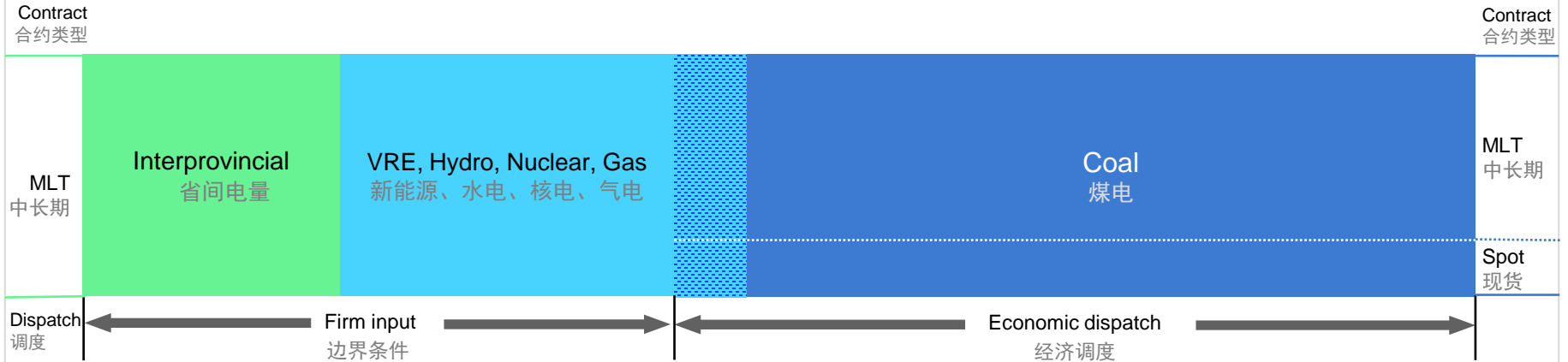
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**Short-term markets were launched from 2018 and are yet to achieve their full potential to unlock system flexibility**

短期市场自2018年启动，尚未能完全释放其提升系统灵活性的潜力

# Reforms are making cautious steps towards a market-driven dispatch of resources 目前的改革正在谨慎地向市场驱动的资源调度转型

Power dispatch model and contract type in spot pilots in China  
中国现货试点地区的电力调度模式与合约类型



IEA. CC BY 4.0.

Notes: This only represents gross pool model markets (the majority of pilots). Lengths of the bars are not proportional to dispatched/contract volumes.  
备注：本图仅代表集中式现货市场（主要试点模式）的情况，各条块长度与实际调度/合约量不成比例。

**Spot market development and financial MLT contracts have made dispatch more market-based in pilot provinces, with growing shares of participants in the market on the supply and demand side**  
现货市场的运行及金融中长期合同使得试点省区的调度决策更加基于市场，且供需双方的市场参与度都在上升



# Key findings

## 主要结论

# Overview of the 3 models explored for a national power market in China

## 中国全国电力市场的3个模式概述

	Surplus market model 余量市场模式	China Energy Transition outlook (CETO) market model 中国能源转型展望 (CETO)模式	Primary market model 一级市场模式
<b>Rationale in a nutshell</b> 原理概述	<p>Increase RE resource utilisation while maintaining differentiated local markets</p> <p>提高新能源消纳并保留不同省级市场设计</p> <p>(e.g. SIEPAC in Central America, SAPP in Southern Africa)</p> <p>(如：中美洲SIEPAC，南非SAPP)</p>	<p>Improve interconnection use while allowing local autonomy for price formation and dispatch</p> <p>提高跨省区输电通道利用率，并保留各地价格形成及电力调度的自主权</p>	<p>Interconnection-wide competition and integration</p> <p>跨省区规模的市场竞争和整合</p> <p>(e.g. EU internal electricity market, PJM in the USA)</p> <p>(如：欧盟内部电力市场，美国PJM市场)</p>

### Secondary market models

#### 两级市场模式

**Secondary market models where local markets co-exist with a higher level (national) market allow to increase resource sharing across provinces, while maintaining provincial autonomy in market design and dispatch decision**

地方市场与全国市场并存的两级市场模式，可以促进各省的资源共享，同时保持各省在市场设计和调度决策方面的自主权。

# Overview of the 3 models explored for a national power market in China

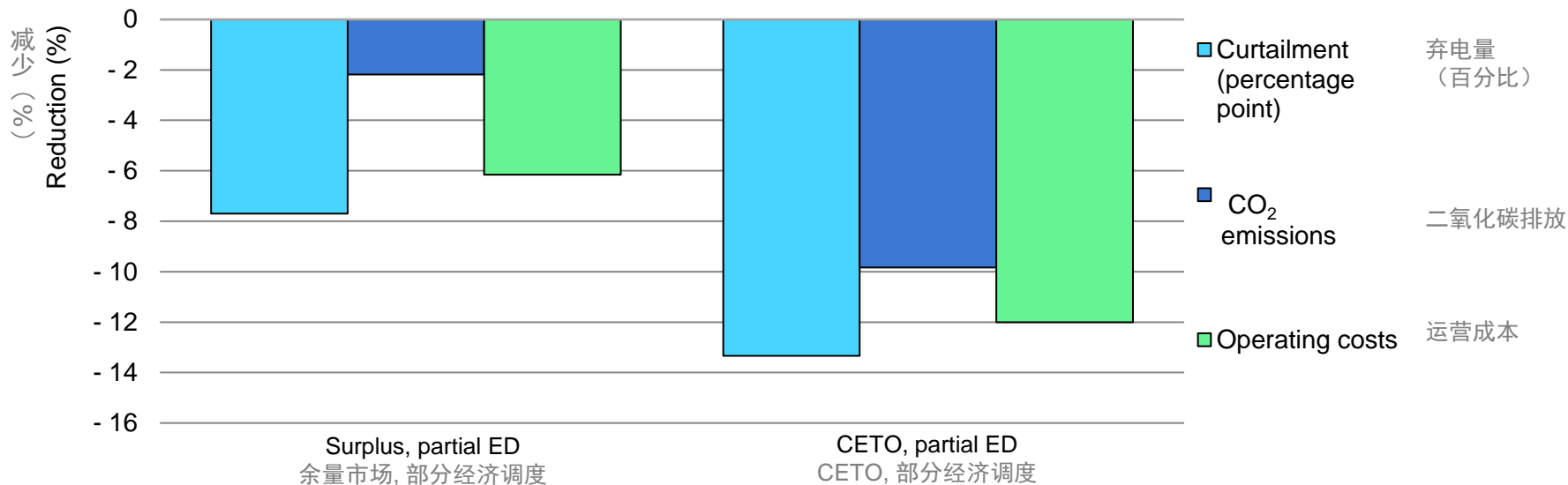
## 中国全国电力市场的3个模式概述

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	<ul style="list-style-type: none"> <li>Existing SGCC interprovincial spot market 可利用现有国网省间现货市场</li> </ul>	<ul style="list-style-type: none"> <li>Interconnectors flows optimised 优化输电通道利用</li> <li>Volume coupling easier and faster to implement than price coupling 容量耦合较价格耦合实施更为简单迅速</li> </ul>	<ul style="list-style-type: none"> <li>Social welfare maximised 最大化社会福利</li> </ul>
	<ul style="list-style-type: none"> <li>Limited amounts of interprovincial trading 省间交易有限</li> </ul>	<ul style="list-style-type: none"> <li>More complex to implement 实施更为复杂</li> </ul>	<ul style="list-style-type: none"> <li>Implementation time 落地时间久</li> </ul>

# Increased regional coordination can improve system operations under current dispatching rules 在现有的电力调度规则下，加强区域协调可以改善系统运作

Reductions in operating costs, CO<sub>2</sub> emissions and curtailment using economic dispatch under different models for regional co-ordination in China in the Announced Pledges Scenario, 2035

承诺目标情景中不同区域协调及经济调度等级下运营成本，二氧化碳排放量及弃电量的减少量，2035年



Note: ED = economic dispatch. Reductions are calculated relative to a low-co-ordination baseline scenario with interregional exchanges based on historical levels and dispatch reflecting current progress towards markets with economic dispatch in some regions and full load hour allocations taking place in the remainder

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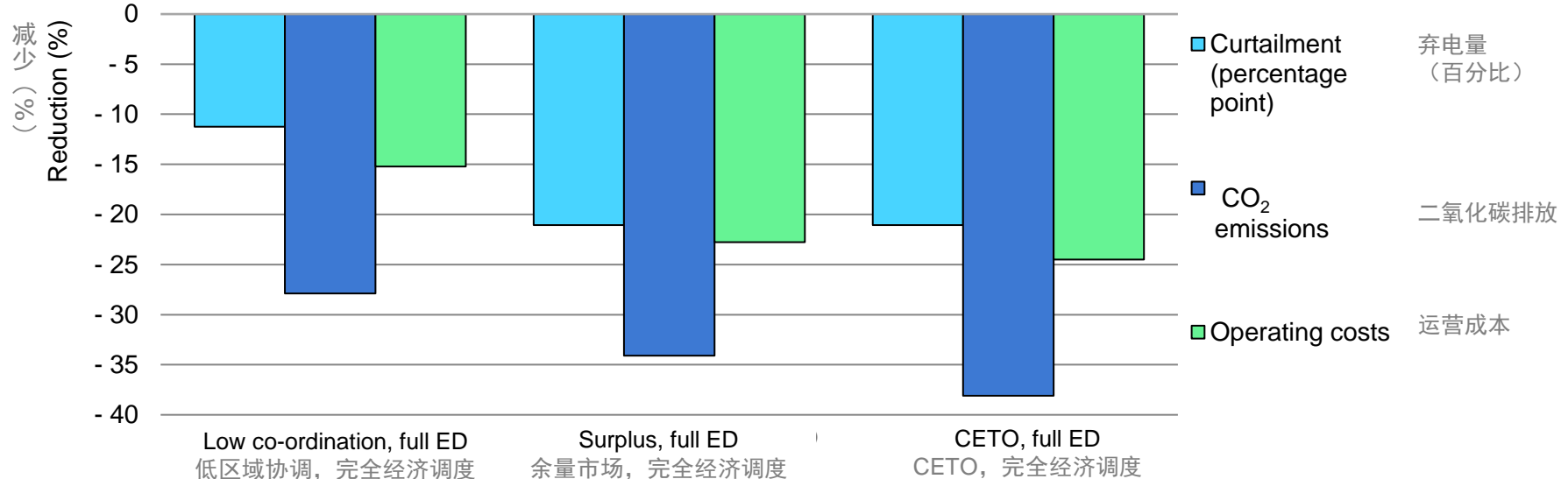
**Regional trade co-ordination improves resources sharing across larger areas, delivering efficiency benefits and increased resilience** 区域交易调度可在更大空间尺度上促进资源共享，并提供效率及韧性增益

# Full implementation of economic dispatch delivers significant benefits

## 完全实施经济调度将带来显著收益

Reductions in operating costs, CO<sub>2</sub> emissions and curtailment using economic dispatch under different models for regional co-ordination in China in the Announced Pledges Scenario, 2035

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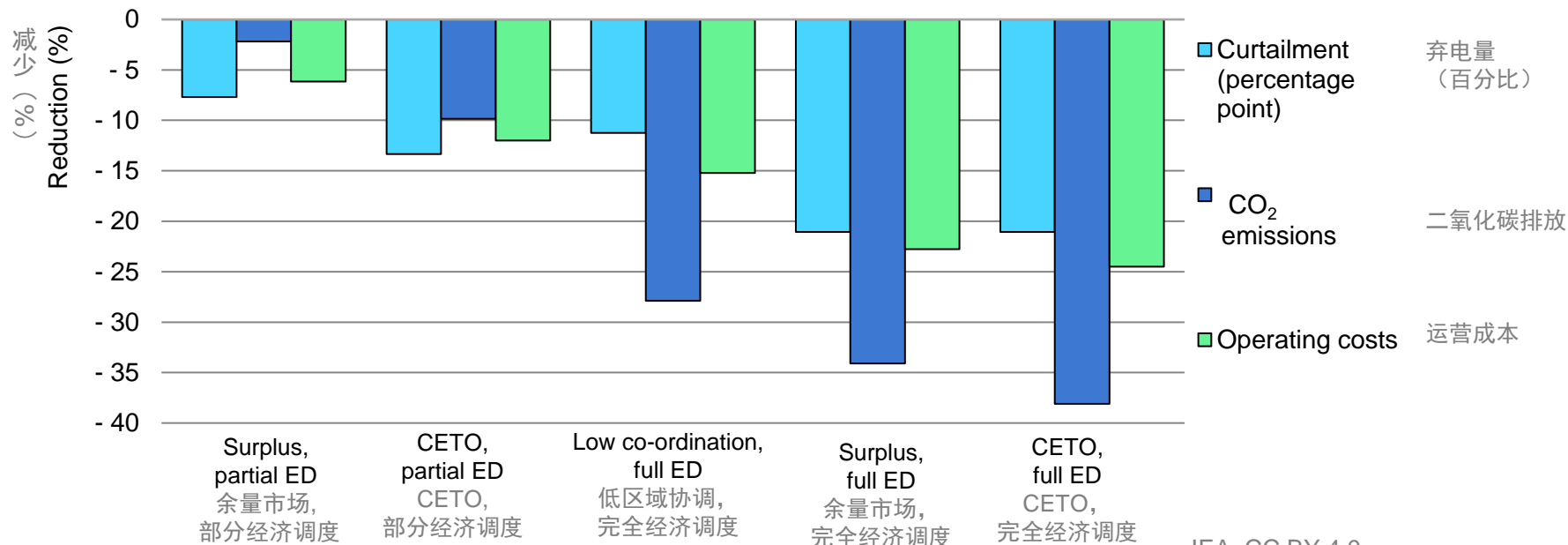
**Realising the full benefits of a national market requires implementing economic dispatch at the provincial level. Secondary markets have the advantage of enabling provinces to advance in parallel with regional co-ordination.**

若要充分实现全国市场的增益，则需要由省一级实施经济调度。两级市场模式可使省级与区域级协调同时开展

# Extended application of economic dispatch will deliver enhanced benefits under all co-ordination models 进一步应用经济调度在各协调情景下均有益处

Reductions in operating costs, CO<sub>2</sub> emissions and curtailment using economic dispatch under different models for regional co-ordination in China in the Announced Pledges Scenario, 2035

承诺目标情景中不同区域协调及经济调度等级下运营成本，二氧化碳排放量及弃电量的减少量，2035年



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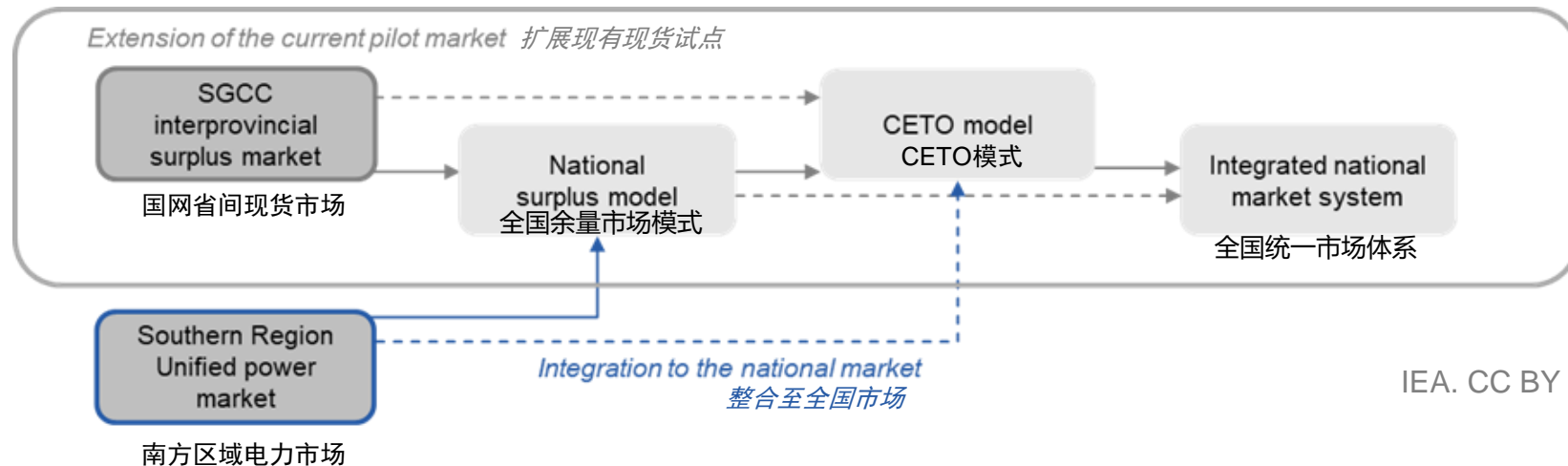
**Implementing economic dispatch alongside market reform provides more than double the benefit of regional co-ordination alone** 在市场改革的同时推进经济调度可进一步带来好处，其增益可达仅协调区域交易情景的一倍以上。

# Policy recommendations

## 政策建议

# Recommendations: National co-ordination of the power sector

政策建议：国家对电力部门的整体协调



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**A national surplus market built on the foundation of the existing interprovincial spot market can be a no-regret move enabling later further integration**

基于现有省间现货市场的全国余量市场对未来市场进一步整合有利无弊



Reinforce the role of national institutions implementing reforms  
强化国家机构在实施改革中的作用

- A strong national regulatory body is needed to supervise the implementation of national markets  
确保部署全国市场的中央监管部门发挥强有力的作用

Lift barriers to interprovincial trade  
消除省间壁垒

- Increase flexibility of trading arrangements, enabling trade closer to real time  
交易安排可更加灵活并允许更接近实时的合约调整
- Improve and harmonise transmission charges to avoid “tariff pancaking” and promote interprovincial trading  
改进并协调输电价格机制以促进省间交易，避免输电费用“摊大饼”

Further articulate planning and operations around markets  
进一步明确市场相关规划

- Further co-ordinate nation-wide plans and operational protocols  
进一步协调国家计划和运行规定
- Think of power sector planning as a framework under which markets operate to support policy goals  
在电力行业整体规划的框架下，确保有明确的市场设计以支持政策目标的实现

Increase economic dispatch within provinces  
提高省级市场经济调度

- Maximise participation in provincial spot markets, from both supply and demand sides  
最大限度地提高电力供需双方对省级现货市场的参与度
- Complement spot markets with ancillary services and real-time markets based on merit-order  
以辅助服务市场和基于优先顺序排序的实时市场补充现货市场

Continue the move towards liquid, competitive MLT market with financial contracts  
持续提高中长期市场流动性、竞争性及金融合约比例

- (where they persist) increase time granularity of physical contracts but expand the use of financial contracts  
缩短现有实物合约的时间尺度，尽量扩展金融合约的使用
- Gradually increase the range of price fluctuation of MLT contracts to enable MLT prices to gradually converge towards long-term trends of spot prices  
逐步扩大中长期合同的价格浮动范围，以使中长期价格逐渐向现货价格长期趋势靠拢

Compensate available kW without distorting markets nor contravening climate goals  
在不扰乱市场或影响气候目标的前提下补偿现有容量

- Carefully design capacity remuneration mechanism to target assets required for system security and compatible with decarbonisation goals; base remuneration on actual performance  
认真设计容量补偿机制，以确保仅针对对系统安全所需且与脱碳目标相兼容的机组，基于实际产出计算补偿
- Prefer market-based mechanism to select these assets and encourage flexibility  
倾向于市场化的机制选择以上机组并鼓励灵活性



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