International Energy Agency

Meeting power system flexibility needs in China by 2030

A market-based policy toolkit for the 15th Five-Year Plan

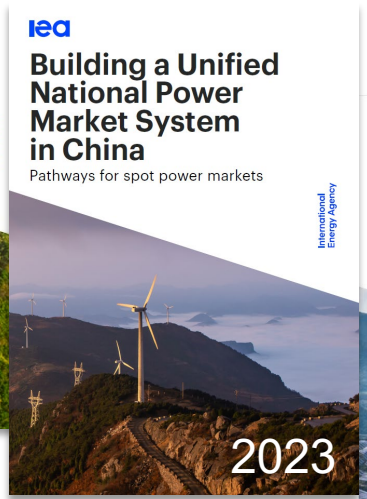
满足2030年中国电力系统灵活性需求：“十五五”规划电力市场政策工具箱

Report Launch

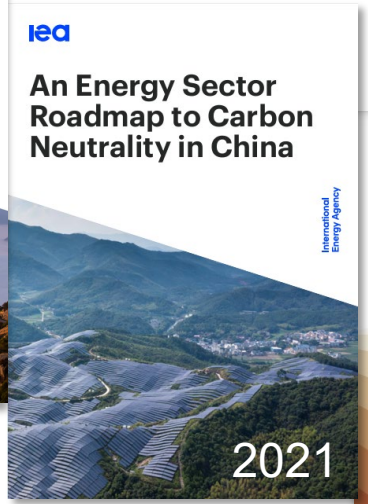
28 November 2024

The IEA has been supporting China's power sector reforms and energy transition for many years
国际能源署已致力于中国电力系统转型研究多年

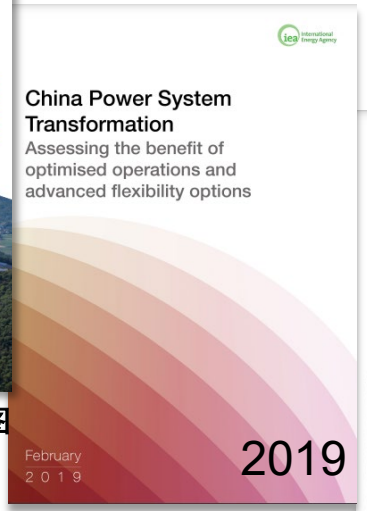
满足2030年中国电力系统灵活性需求



建立全国统一的电力市场



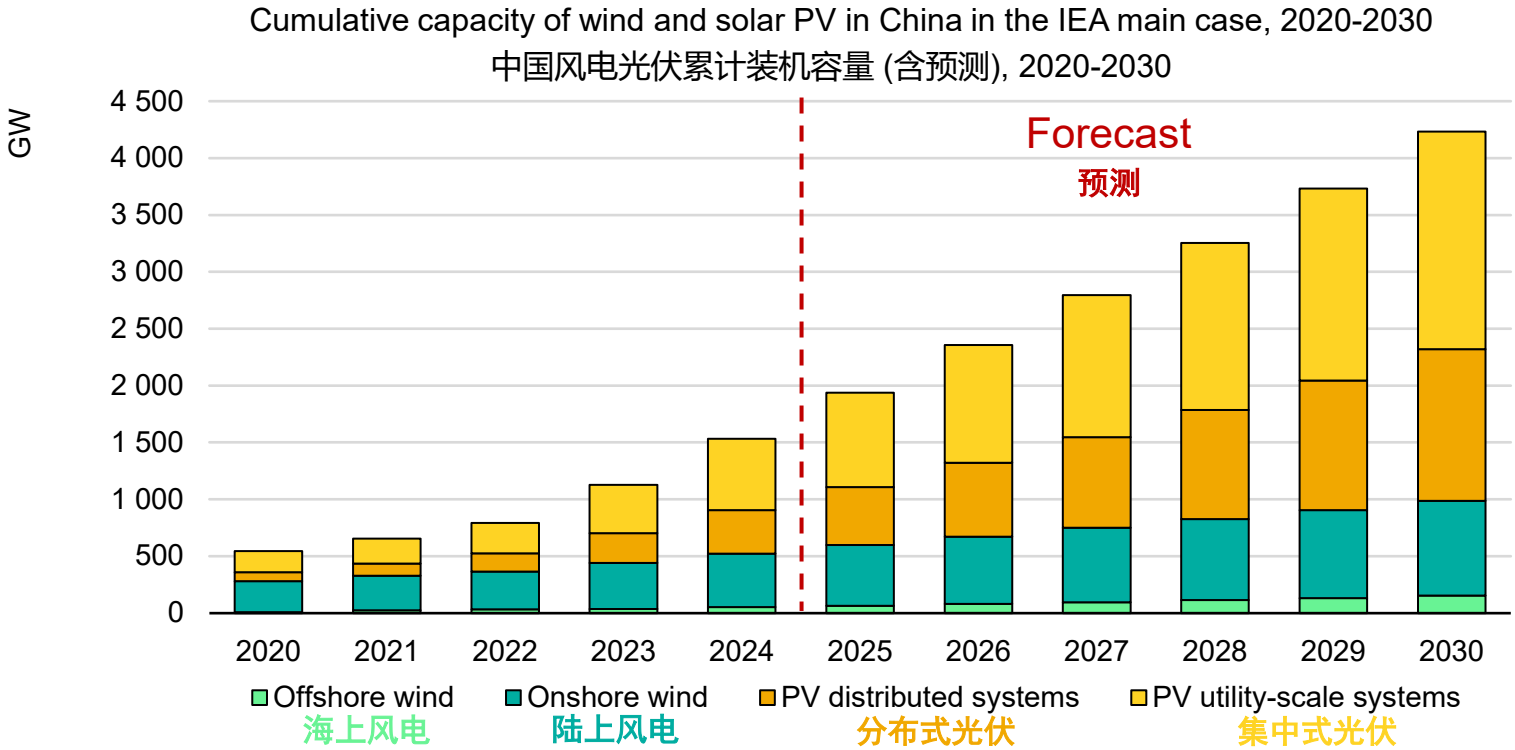
中国能源体系碳中和路线图



中国电力系统转型

国际视角下的中国电力系统转型

China has seen unprecedentedly fast development of wind and solar PV
中国飞速发展的风电、光伏装机

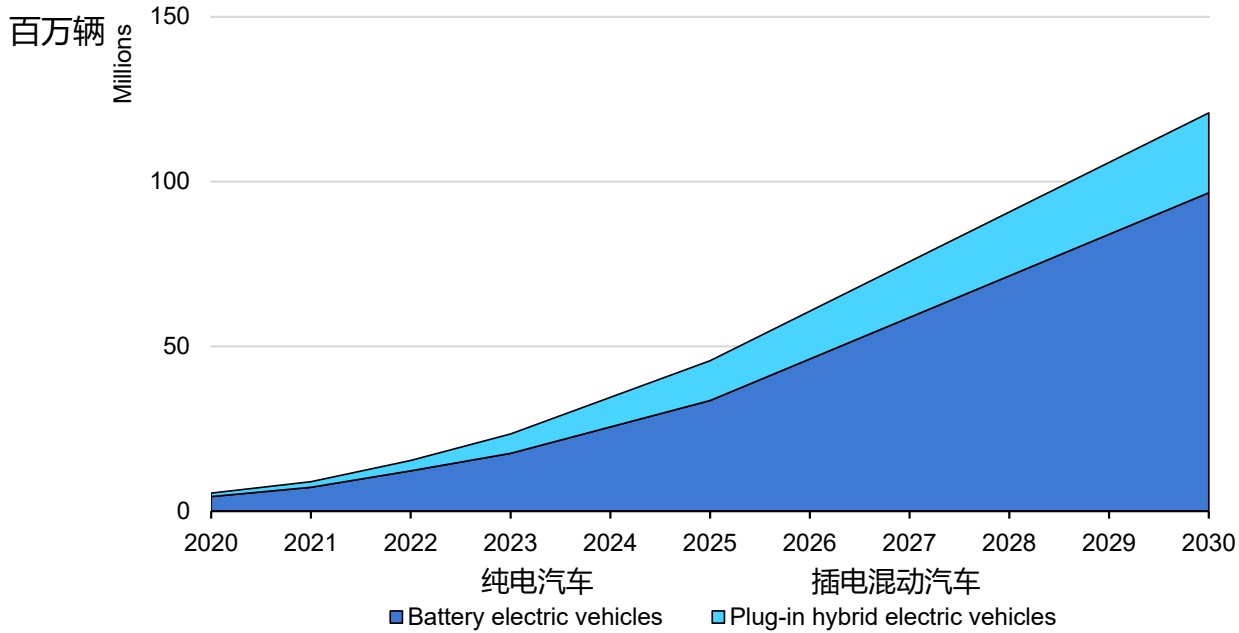


In 2024, China achieved 1200 GW of wind and solar PV capacity - six years ahead of the government target. This fast uptake comes with integration challenges in several provinces

2024年中国提前6年完成了风光装机12亿的目标，这种飞速增长给多个省份的电力系统带来了挑战

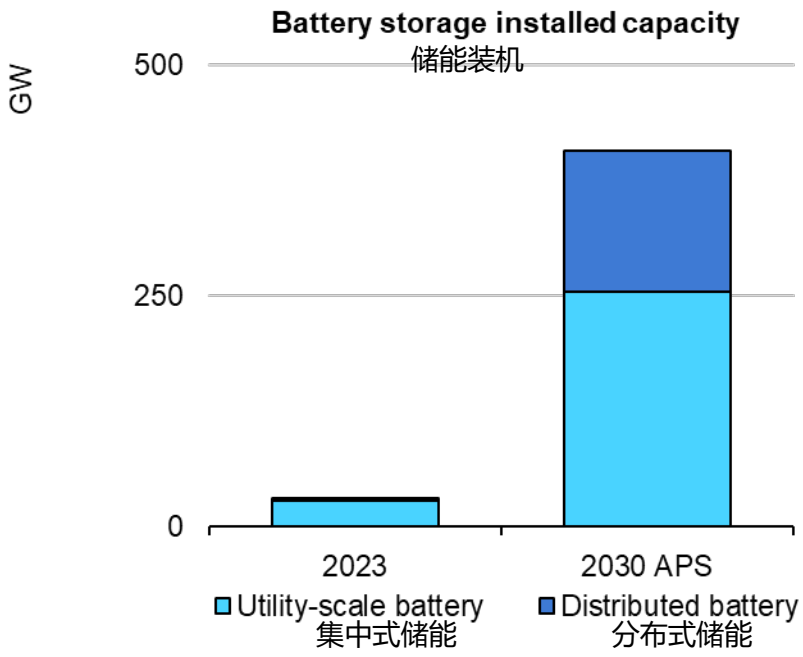
The demand-side is also transforming, with new electric loads…
需求侧也正在经历巨大变革

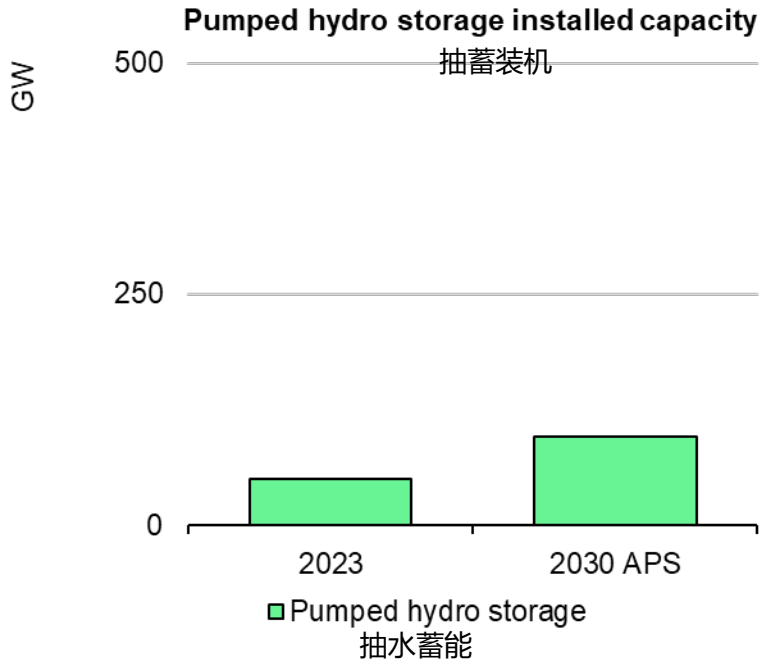
Electric vehicles stock in China under the Announced Pledges Scenario, 2020-2030
在承诺情景(APS)下，2020-2030年电动汽车数量变化



In a context of booming EV deployment, managed EV charging offers a yet-to-be flexibility resource
电动汽车保有量大幅上升，智能化充电管理成为了重要的灵活性来源

… while storage capacity is expanding
储能和抽蓄装机容量飞速上升





APS = Announced Pledges Scenario

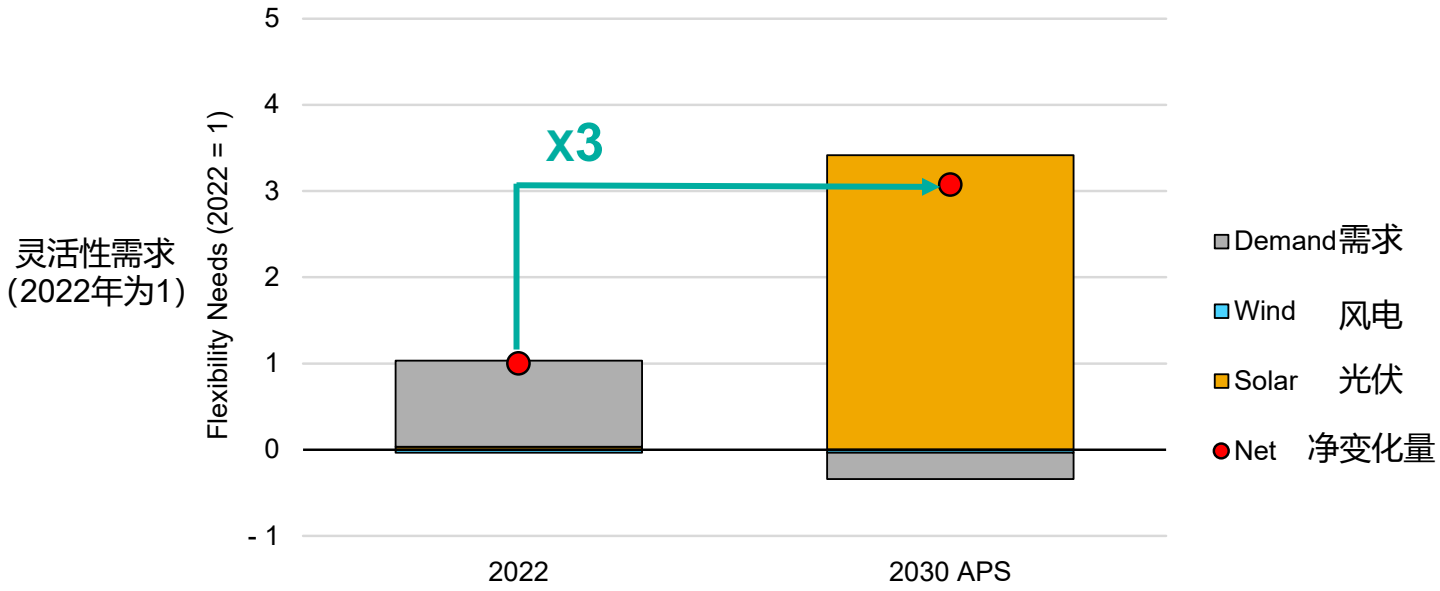
Battery storage's fast uptake will be a game changer for short-term flexibility provision, balancing variability of VRE output over a few hours - with much shorter lead times than pumped hydro storage

储能系统以其比抽水蓄能更快速的响应速度成为了能够提供短期灵活性的重要资源

As flexibility requirements for daily operations will triple by 2030, power markets need to evolve
2030年系统的灵活性需求是2022年的3倍以上，所以市场建设也应该与时俱进

Short-term flexibility needs in 2030 as a proportion of 2022, in the IEA's Announced Pledges Scenario

在承诺情景(APS)下，2030年短期灵活性需求相对于2022年的变化



Note: Flexibility needs for 2030 are calculated based on hourly changes in net load (total load minus wind and solar PV generation).

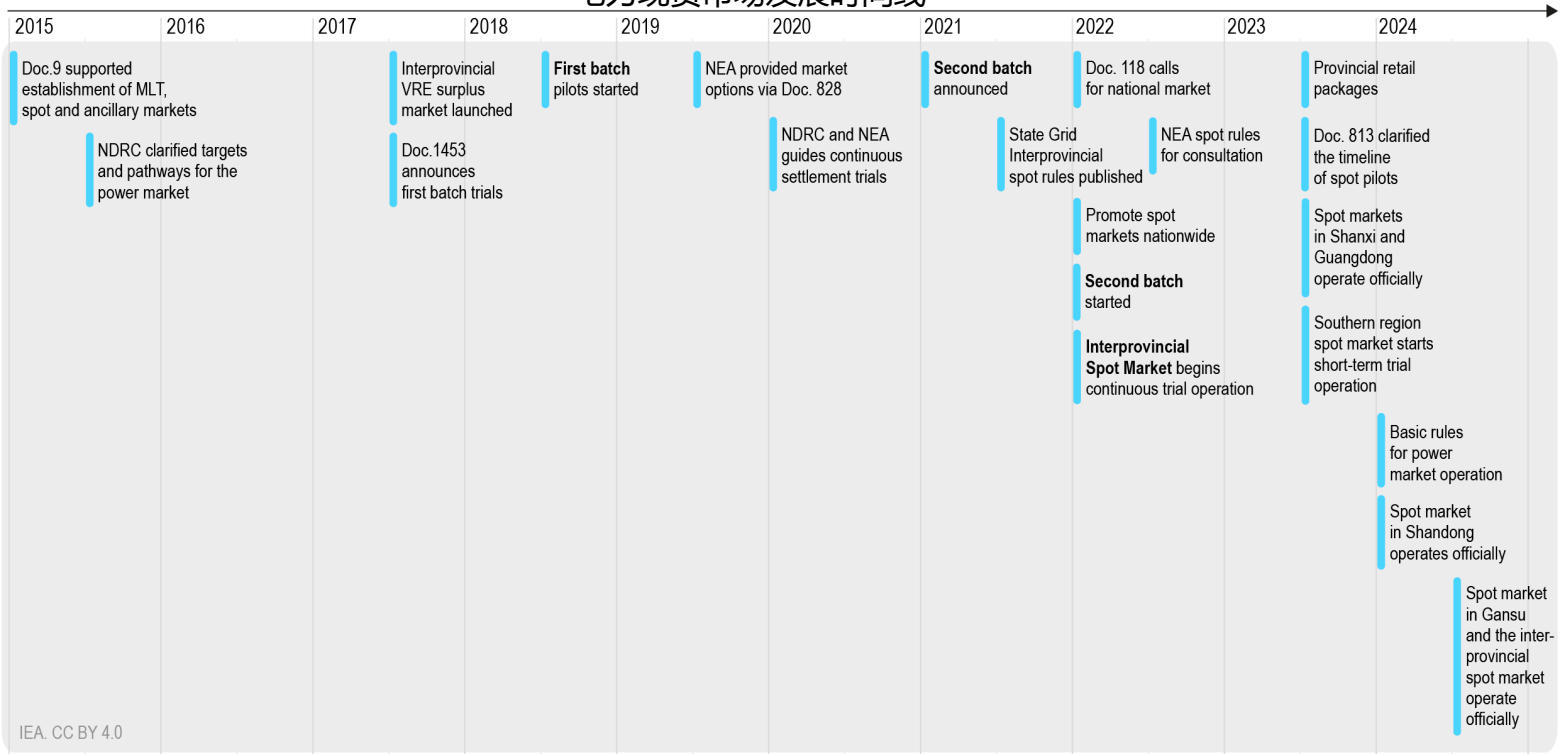
注：系统灵活性需求基于净负荷的小时级变化计算得到

Solar PV is main driver of the need for short-term ramping capability, with daily ramps around the midday peak

灵活性需求的增加主要是由于光伏的大面积并网以及其"昼发夜停"的特性

Spot markets' rollout is progressing, central to China's efforts to enhance system flexibility
现货市场正在飞速发展，这是中国增强系统灵活性的核心

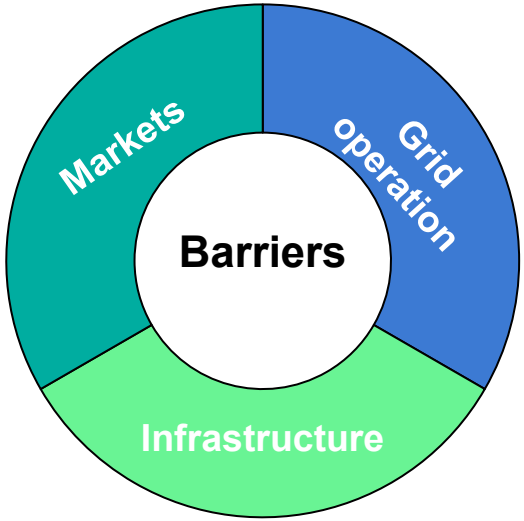
Timeline for the introduction of spot markets in China, 2015-2024
电力现货市场发展时间线



Currently, 4 provincial spot markets and the interprovincial market are officially operational, with 22 pilots underway
目前4个省级现货市场以及省间现货市场已正式运行，其余22个省级现货市场正在快速发展

Despite progress, several barriers continue to limit China's ability to unlock full flexibility
进一步激发灵活性现存障碍

Barriers to maximising system flexibility in China
进一步激发系统灵活性现存障碍

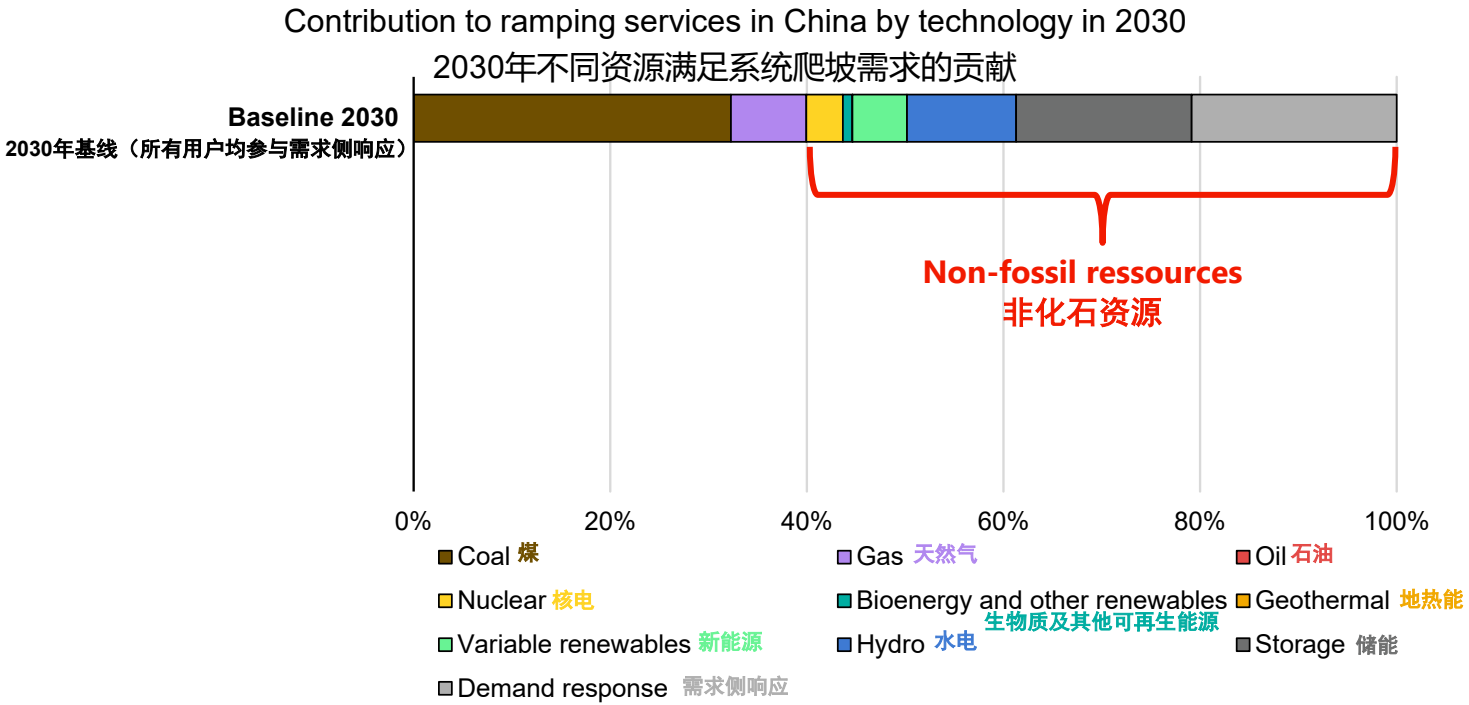


- **Lack of effective market mechanisms and price signals**
  缺乏有效的电力市场与价格信号
- **Restrictive market access for new players**
  对新兴市场主体过高的市场门槛
- **Fragmented policy framework**
  各省政策不统一
- **Local protectionism**
  本地保护

- **Inflexible interprovincial contracts**
  省间输电合同灵活性不高
- **Limited co-ordination across regions and grid operators**
  区域间电网运行协调程度不足
- **Lack of real-time, transparent data and advanced forecasting tools**
  实时、透明和先进的预测工具缺失

- **Lack of energy storage capacity**
  储能容量不足
- **Insufficient rollout of digital infrastructure and smart grids**
  电网数字化、智能化程度不足
- **Lagging interprovincial grid development and distribution grid upgrades** 省间输电线路发展滞后，配电网亟需升级

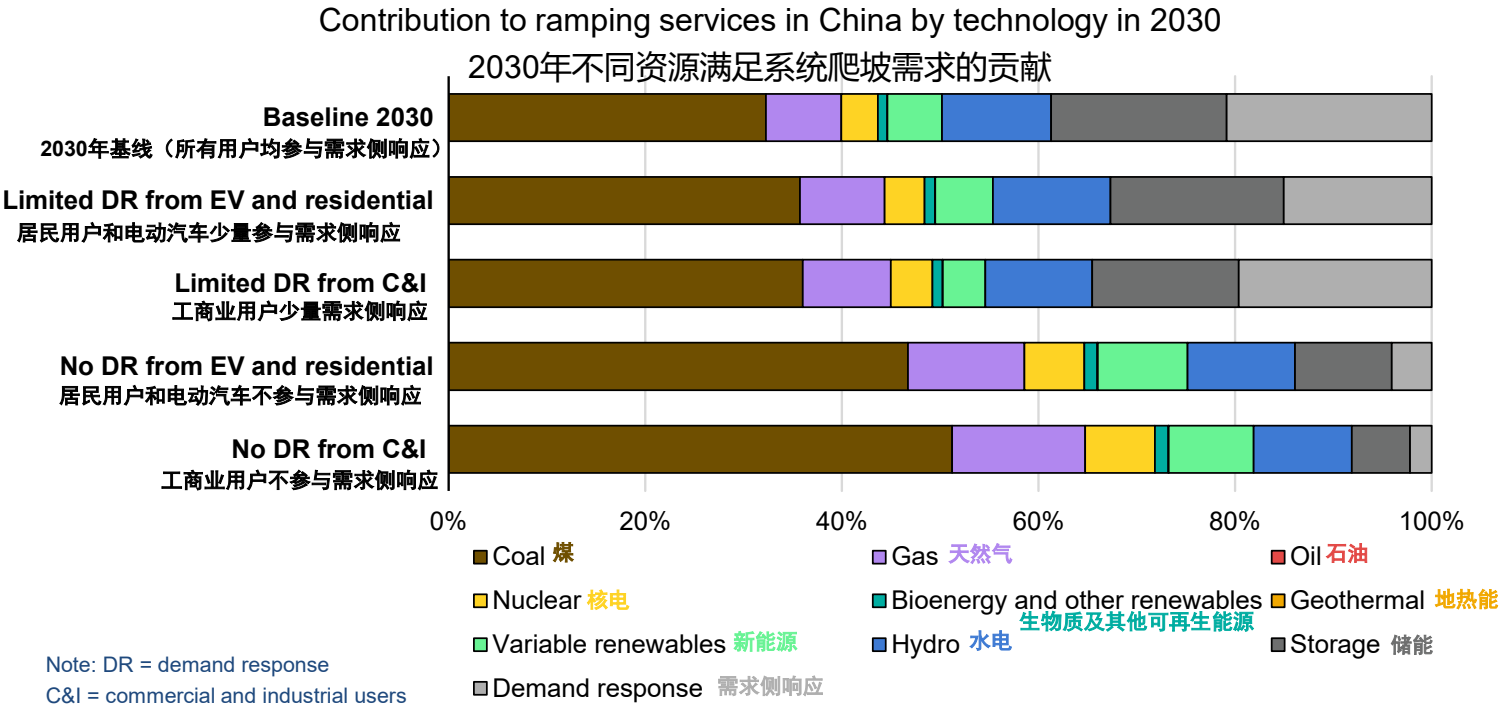
Non-fossil resources could fulfil nearly 60% of the short-term flexibility needs in 2030
2030年中国60%的短时灵活性需求可由非化石资源所满足



In a baseline scenario where China is to meet its 2030 carbon peaking goal, well-functioning power markets are key enablers to maximise the flexibility from non-fossil resources

中国2030完成碳达峰被设定成基线，成熟且有效的电力市场对于挖掘非化石资源的灵活性是至关重要的

But delays in markets implementation and expansion could prolong reliance on thermal plants
但是市场的缓慢发展可能会延缓替代火电的步伐



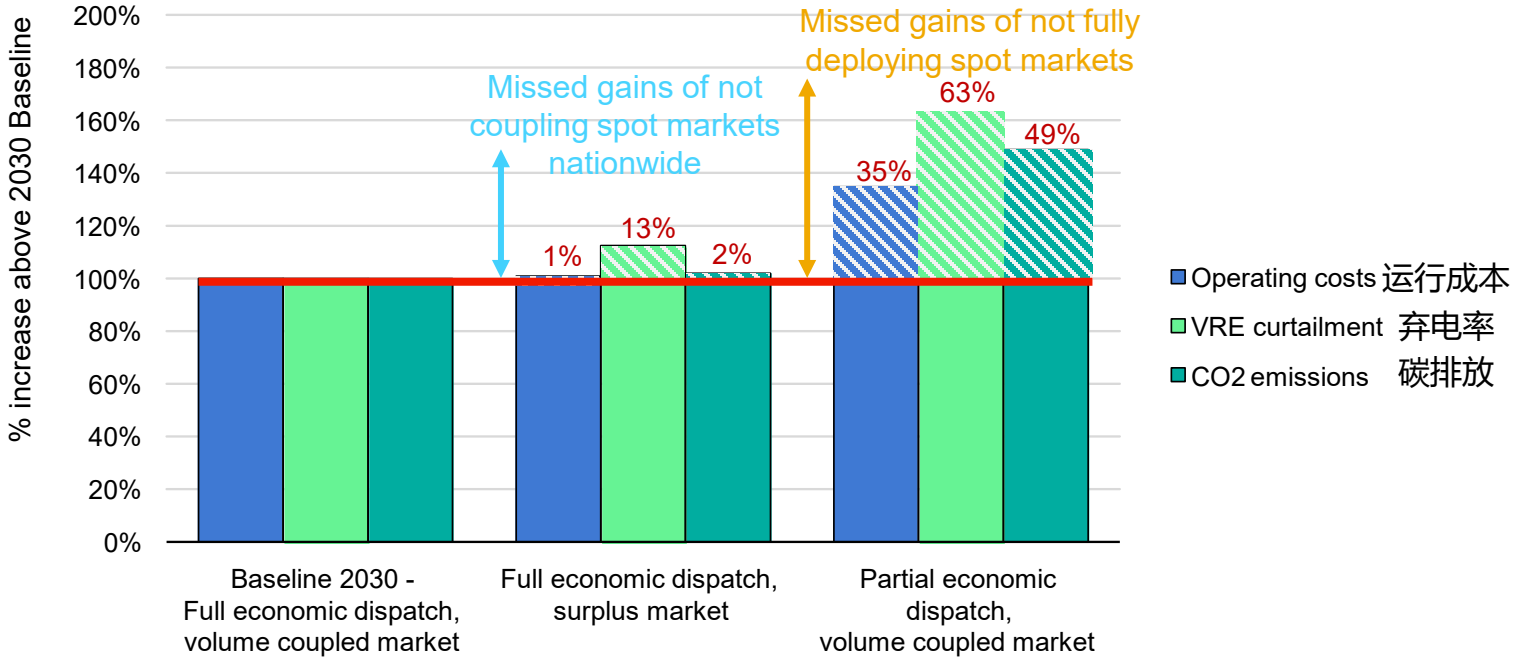
Note: DR = demand response
C&I = commercial and industrial users

Unlocking demand-side flexibility involves lifting existing market barriers such as restricted access from aggregators and limited exposure from large consumers to spot market prices

释放需求侧灵活性需要消除现有的市场障碍，例如降低聚合商的准入限制以及使大用户充分暴露在现货市场价格下

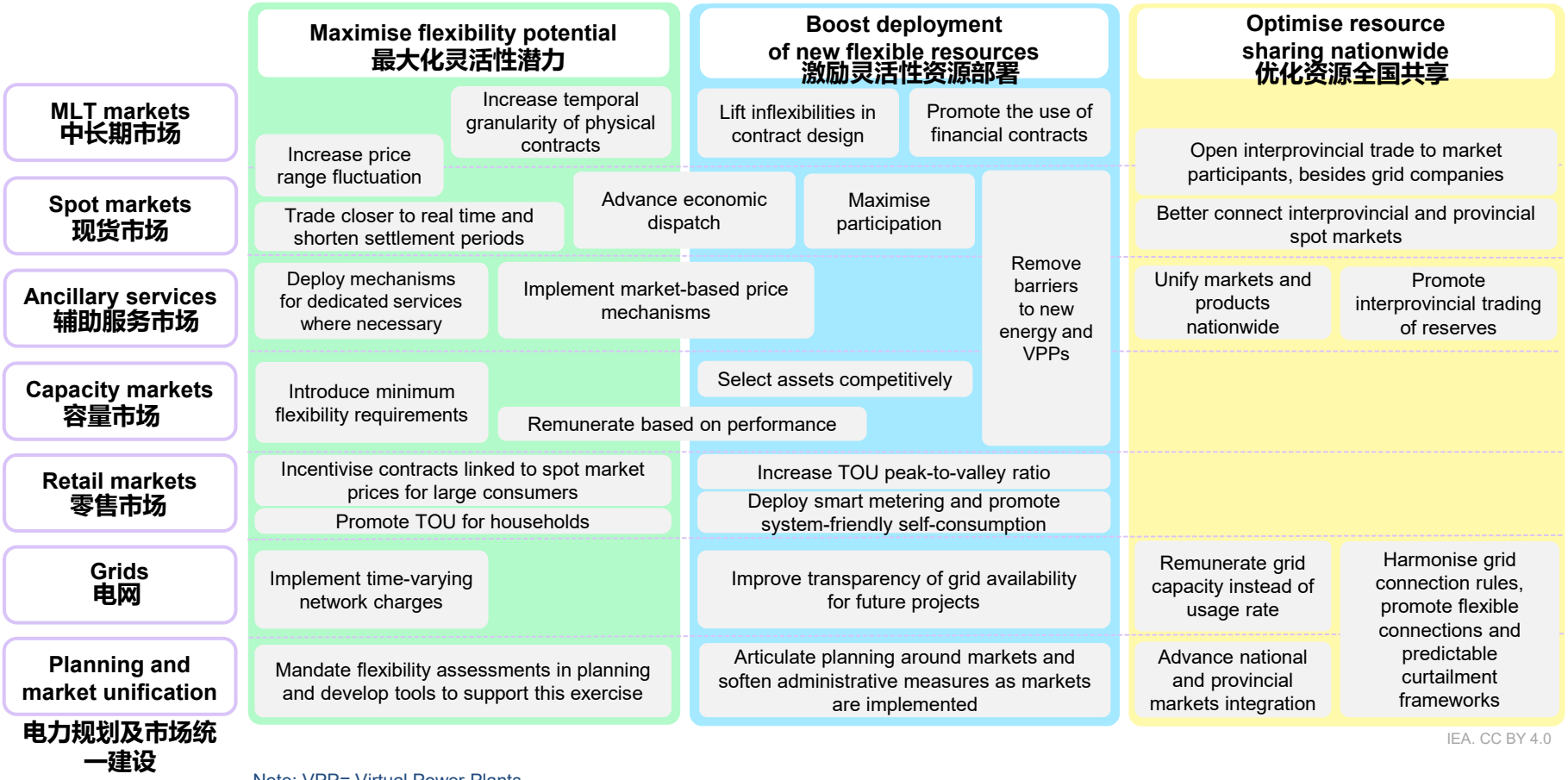
Most of the needed flexibility can be unlocked through improvements to dispatching practices
通过改变调度方式可以满足绝大多数的灵活性需求

Impacts of scenarios with barriers to spot markets development , against the 2030 Announced Pledges Scenario
不同调度及市场耦合方式对系统运行成本、弃电率及碳排放产生的影响



…however, it is essential that spot markets are deployed in a co-ordinated way with other market segments, and that their design prioritise flexibility
然而，他们必须与市场统筹协调发展并且将激发系统灵活性作为优先考虑的对象

A policy toolkit for the 15th Five-Year Plan to unlock flexibility through power markets
通过电力市场激发系统灵活性“十五五”规划政策工具箱



Note: VPP= Virtual Power Plants

Thank you!

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