Digitalization & Energy
数字化与能源

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Economists Dialogue on China's Economic Stimulus and the 14th Five-Year Plan

中国经济刺激计划和“十四五”规划经济学家对话

IEA国际能源署

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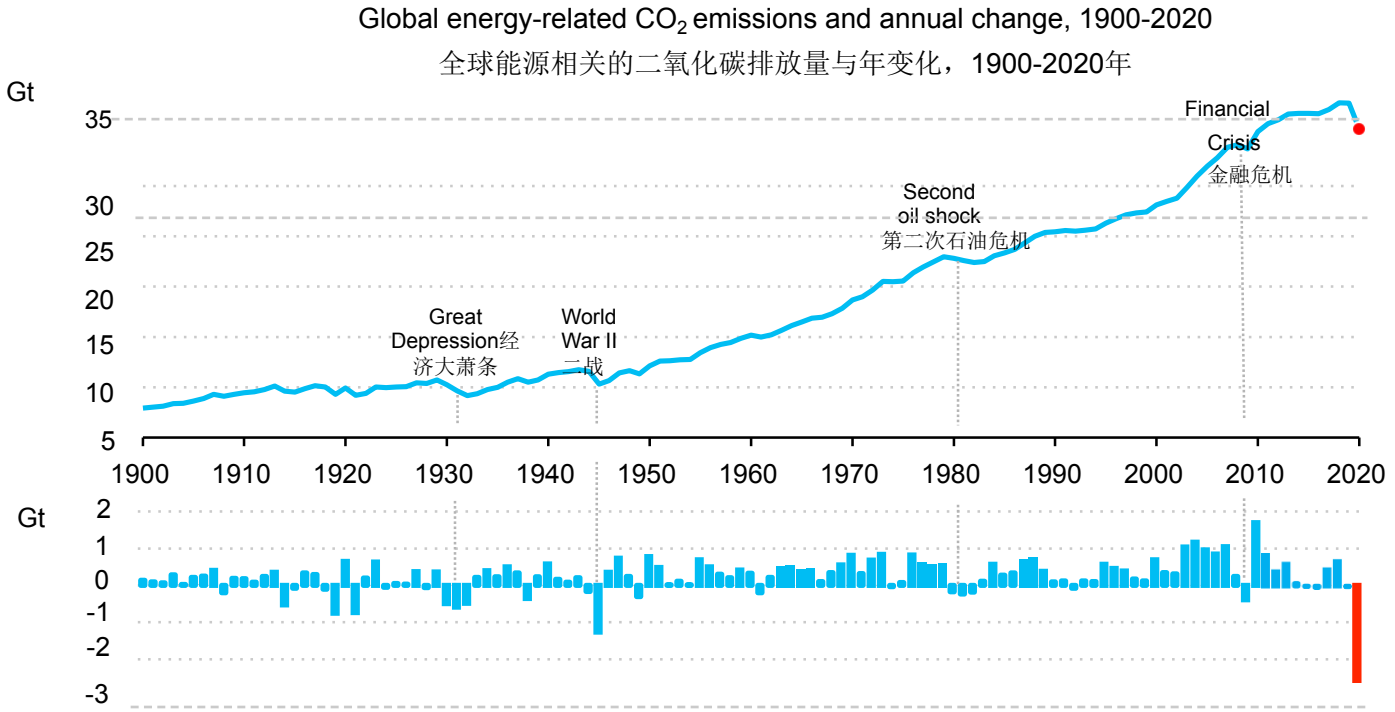
CO_2 emissions drop the most ever due to the COVID-19 crisis
由于新冠肺炎疫情危机，二氧化碳排放出现最大幅度的下降



Global energy-related CO_2 emissions are set to fall nearly 8% in 2020 to their lowest level in a decade. Reduced coal use contributes the most. Experience suggests that a large rebound is likely post crisis.

2020年，全球能源相关的二氧化碳排放量预计将下降近8%，降至十年以来的最低水平。其中，煤炭使用减量的贡献最大。但是经验表明，危机后可能出现大幅反弹。

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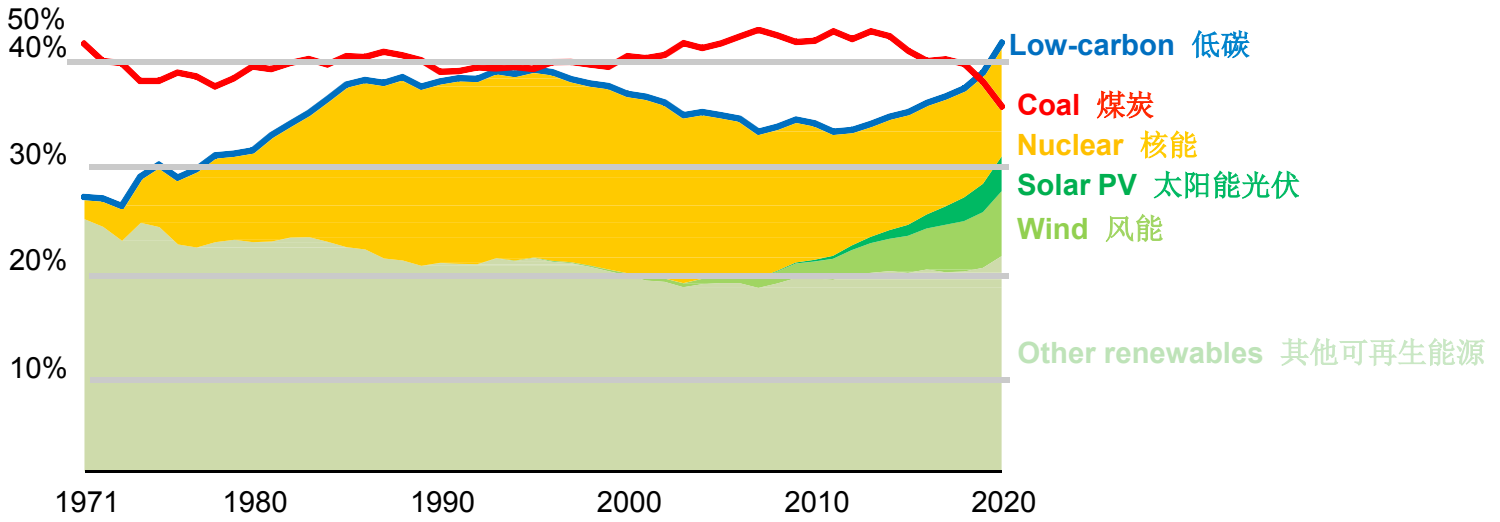
Low-carbon sources extend their lead in the power mix
低碳能源继续在电力结构中占据主导地位

Global generation shares from coal and low-carbon sources, 1971-2020
全球煤炭和低碳能源发电比例，1971-2020年



For the first time in 50 years, low carbon technologies overtook coal as the leading source of electricity in 2019, and they are moving further ahead in 2020.
2019年，低碳技术50年来首次超过煤炭成为主要电力来源，并在2020年实现进一步发展。

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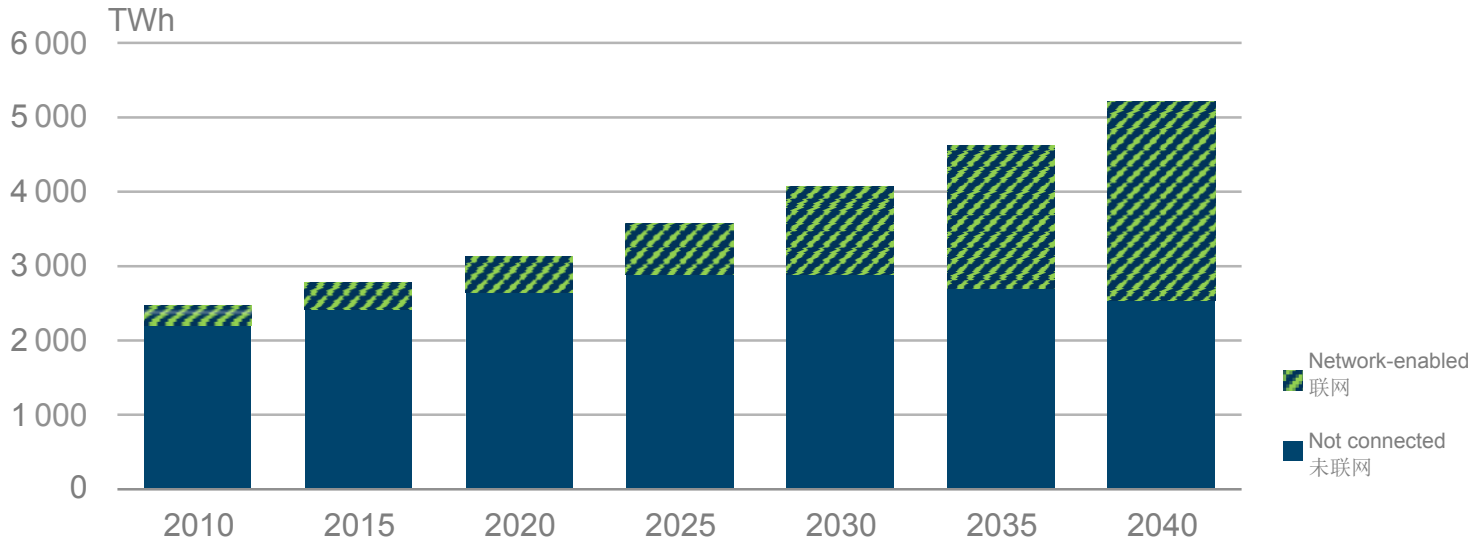
Growth of IoT and connected devices
物联网和互联设备的增长

Household electricity consumption of appliances and other small plug loads
家用电器和其他小插头负载的家庭用电量



The growth in network-enabled devices presents opportunities for smart demand response but also increases needs for standby power

联网设备的增长为智能需求响应提供了机会，但同时也增加了对备用电力的需求

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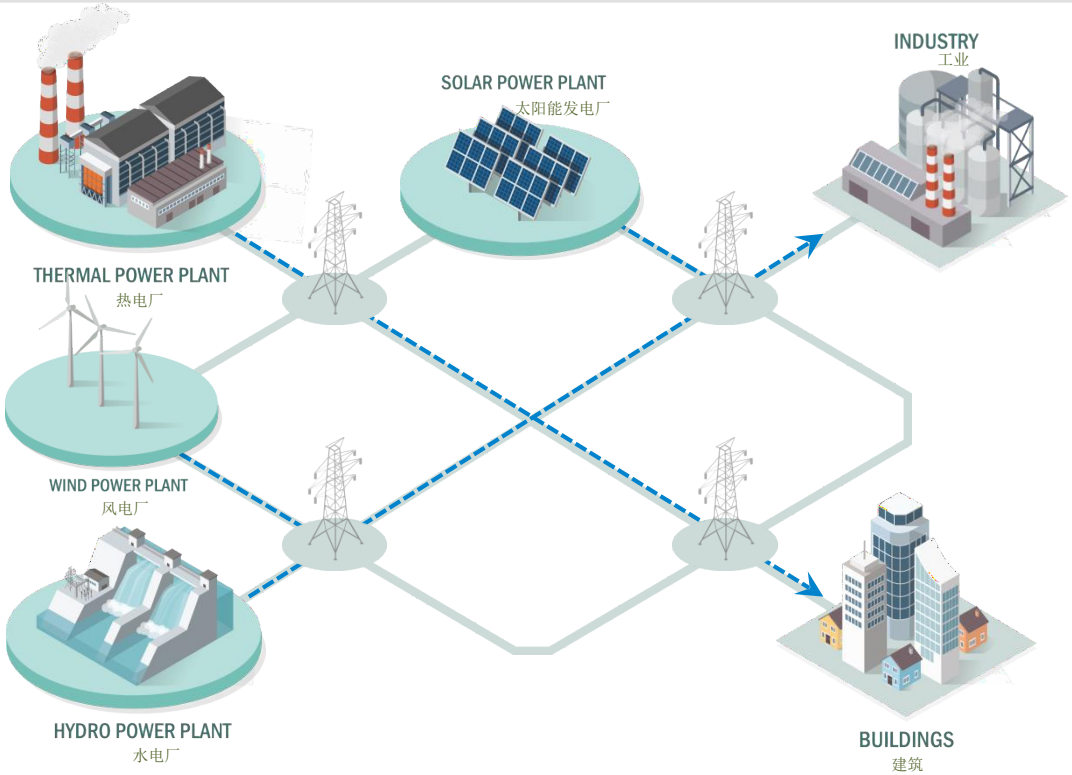
The digital transformation of the energy system
能源系统的数字转型



Pre-digital energy systems are defined by unidirectional flows and distinct roles
前数字能源系统表现为单向流，扮演不同角色

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The digital transformation of the energy system
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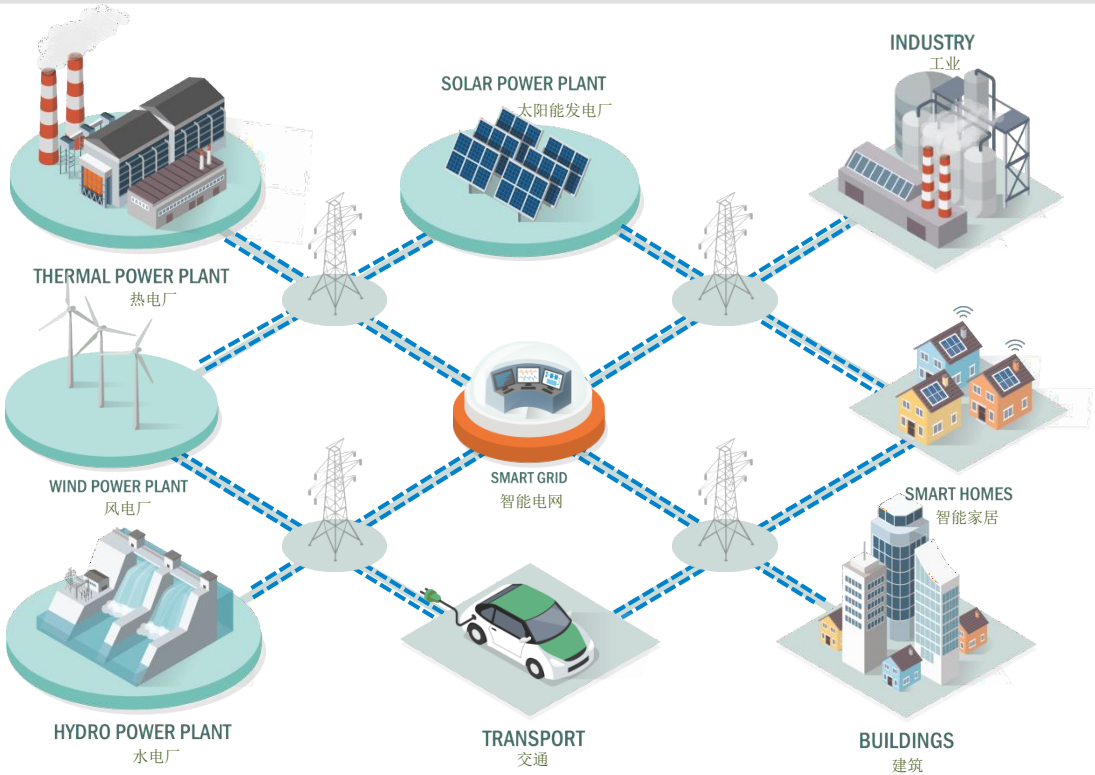

Pre-digital energy systems are defined by unidirectional flows and distinct roles, digital technologies enable a multi-directional and highly integrated energy system

前数字能源系统表现为单向流，扮演不同角色，数字技术实现了多方向、高度集成的能源系统

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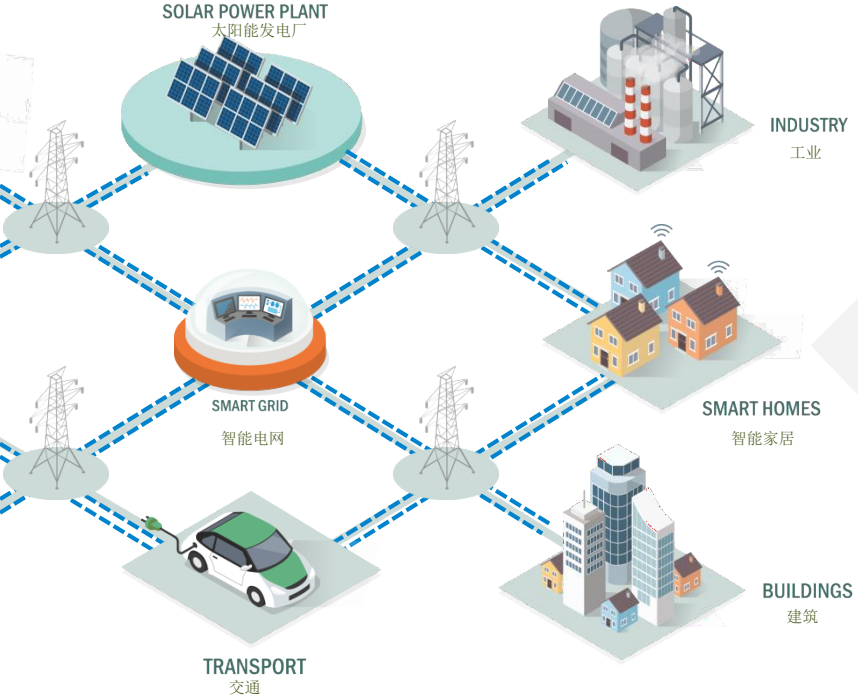
Smart demand response
智能需求响应



Residential sector
住宅部门

1 billion households and **11 billion smart appliances** could actively participate in interconnected electricity systems

10亿家庭和**110亿智能家电**积极参与互联电力系统

Demand response programs – in buildings, industry and transport - could provide 185 GW of flexibility, and avoid USD 270 billion of investment in new electricity infrastructure

建筑、工业和交通领域的需求响应计划可以提供185 GW的电力弹性，帮助避免2700亿美元的新电力基础设施投资

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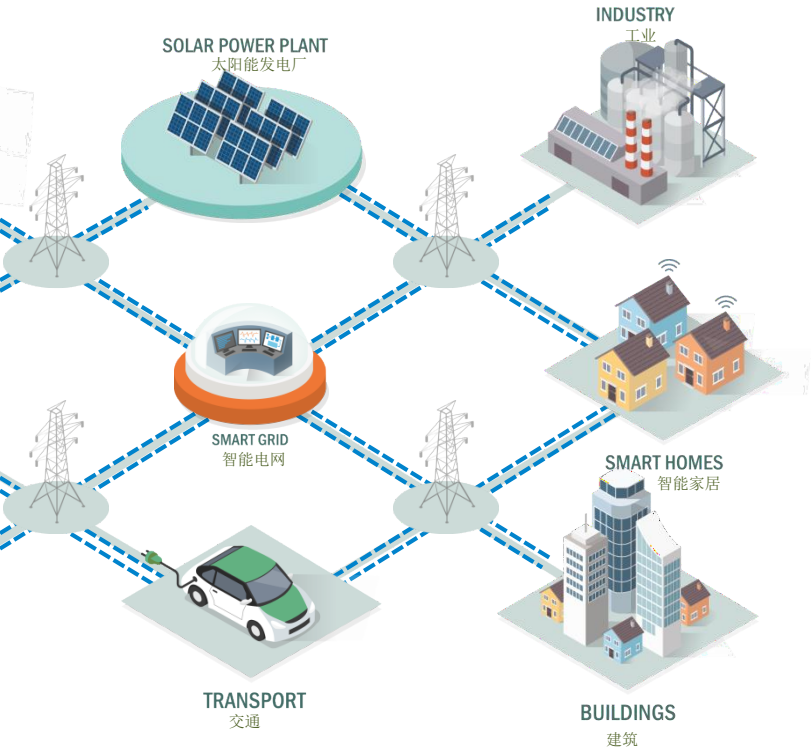
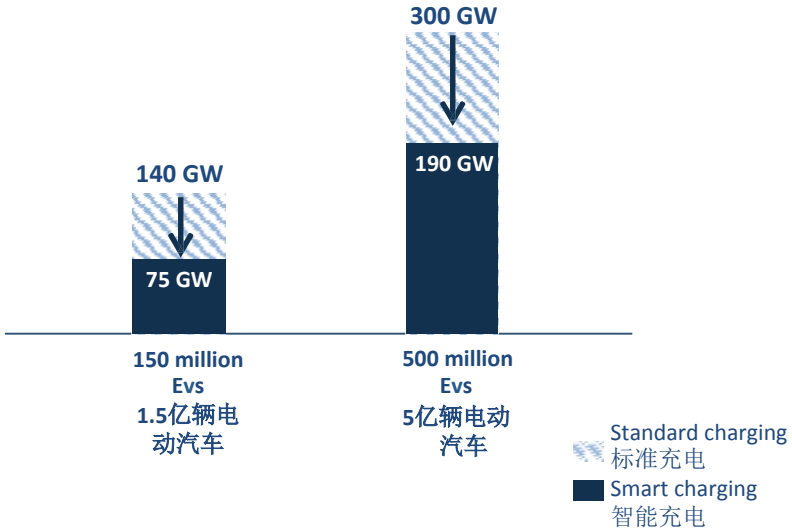
Smart charging of electric vehicles
电动汽车智能充电



EVs standard *vs* smart charging
电动汽车标准与智能充电

Capacity requirement
容量需求



EVs smart charging would provide further flexibility to the grid saving between USD 100-280 billion investment in new electricity infrastructure
电动汽车智能充电将为电网提供更大的弹性，帮助节约1000-2800亿美元的新电力基础设施投资

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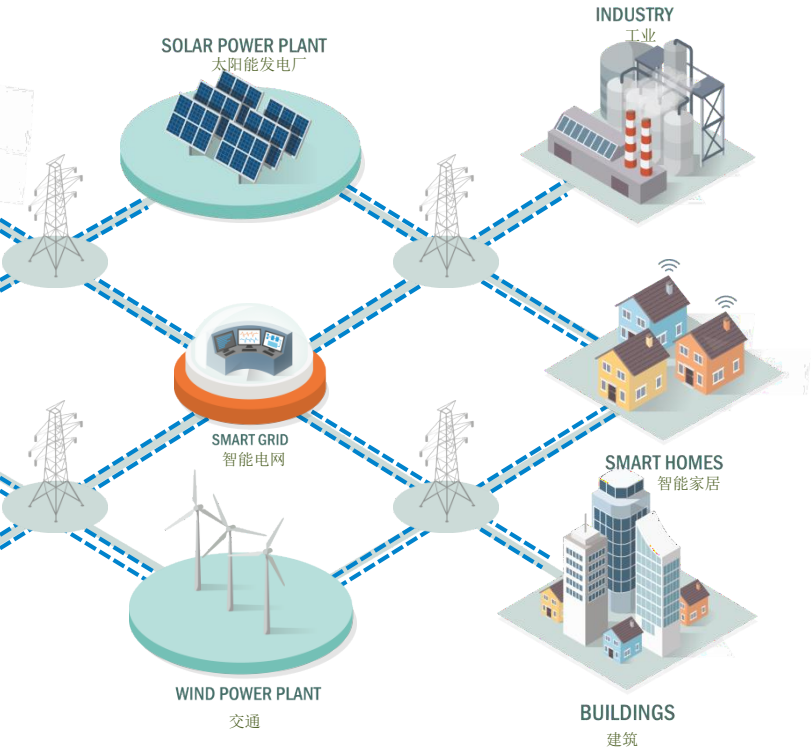
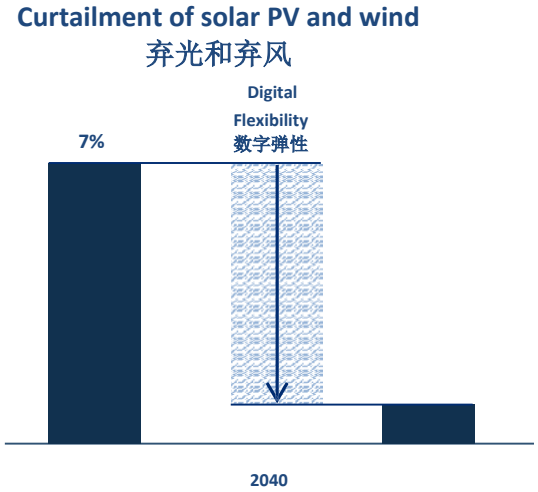
Integration of variable renewables
多变可再生能源集成





Digitalization can help integrate variable renewables by enabling grids to better match energy demand to times when the sun is shining and the wind is blowing.

数字化可通过使电网更好地匹配能源需求与日照风吹时间，从而帮助集成多变的可再生能源。

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Building digital resilience
建立数字弹性

- To date, cyber disruptions to energy have been small
  迄今为止，网络对能源的扰动很小
- But cyber-attacks are become easier and cheaper – malware, ransomware, phishing / whaling, botnets
  但是网络攻击变得更加容易，成本也更加低廉-恶意软件、勒索软件、网络钓鱼/捕鲸、僵尸网络
- Digitalization also increases the “cyber attack surface” of energy systems
  数字化也增加了能源系统的“网络攻击面”
- Full prevention is impossible, but impact can be limited:
  无法实现全面预防，但可以限制影响范围：
  - Raised awareness, cyber hygiene, standard setting and staff training
    意识提高、网络卫生、标准制定和员工培训
  - Coordinated and proactive preparation by companies and governments
    企业和政府采取协调和积极主动的防范措施
  - Design digital resilience in technologies and systems
    设计技术和系统的数字弹性
- International efforts can help raise awareness and share best practices
  国际社会可帮助提高意识，分享最佳做法

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