Energy Technology Perspectives 2014: Harnessing Electricity's potential

Joint IEA & EPRI Expert Workshop, IEA Headquarters

8 October2014

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Energy Technology Policy, IEA

International Energy Agency

The world faces a challenge

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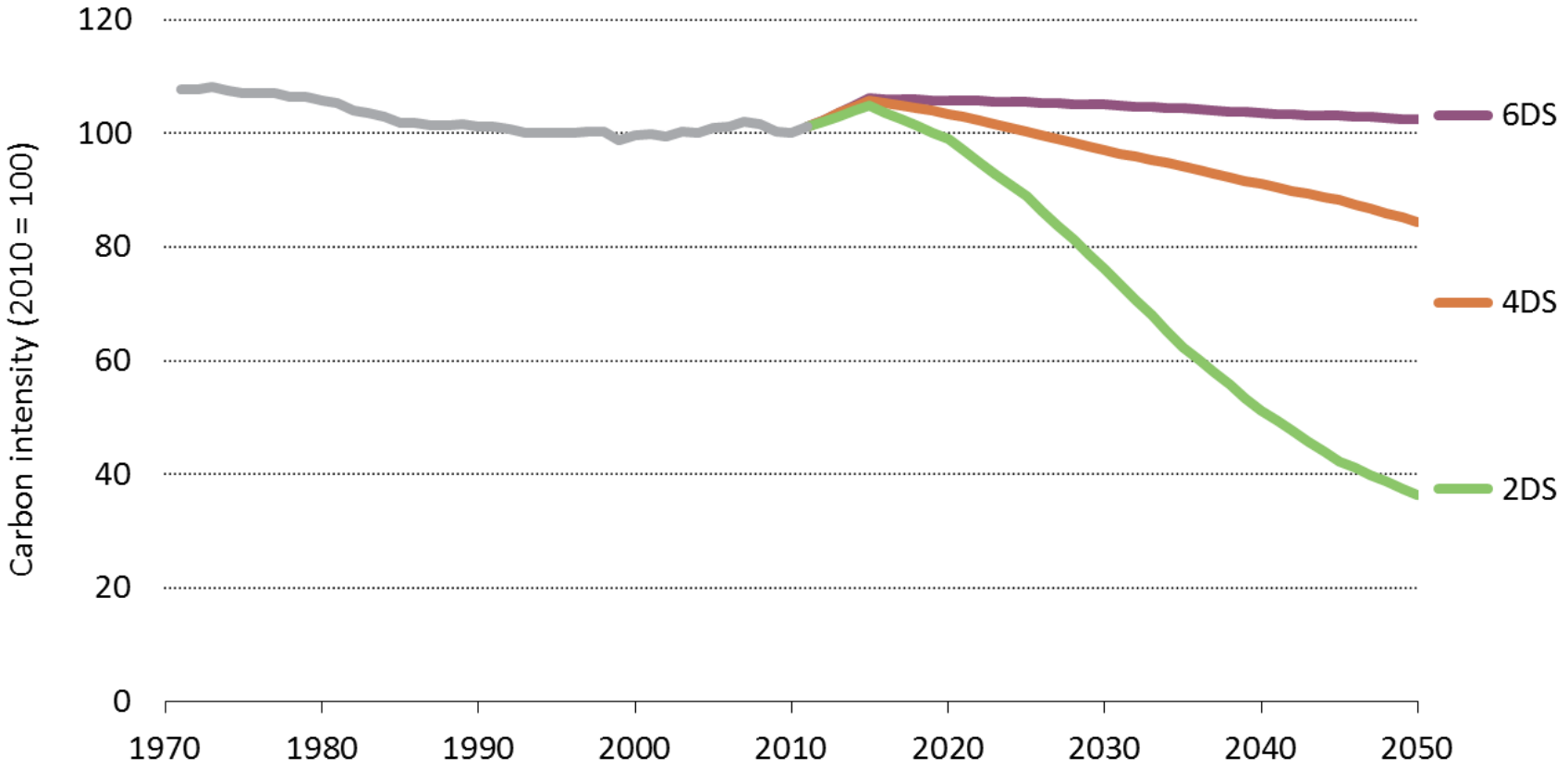

Energy's carbon intensity is stuck AND we need to decouple economic growth from energy use

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A transformation is needed…

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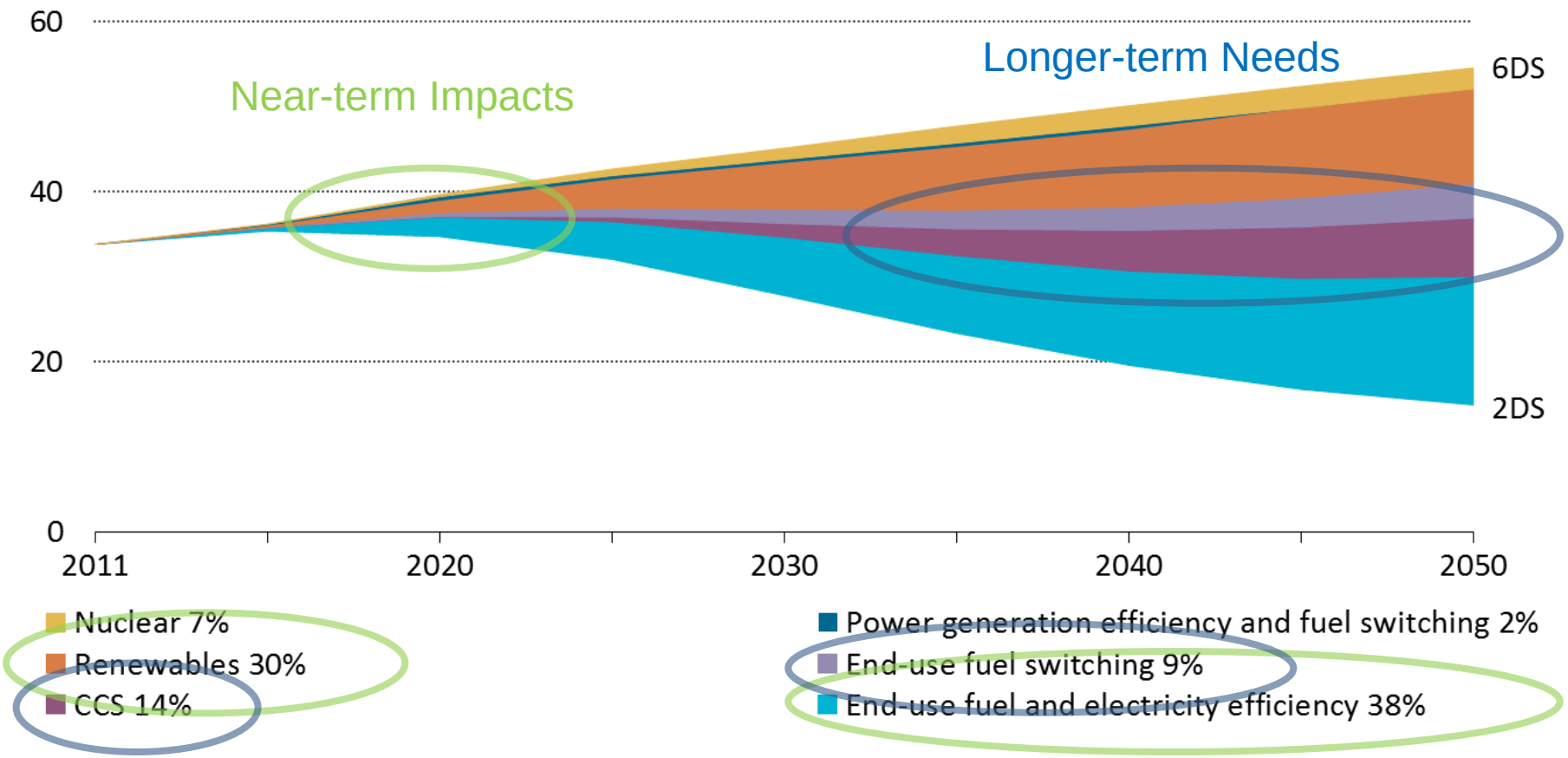

..and we to have the tools to develop a strategy and be proactive.

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Investment in our future pays off…

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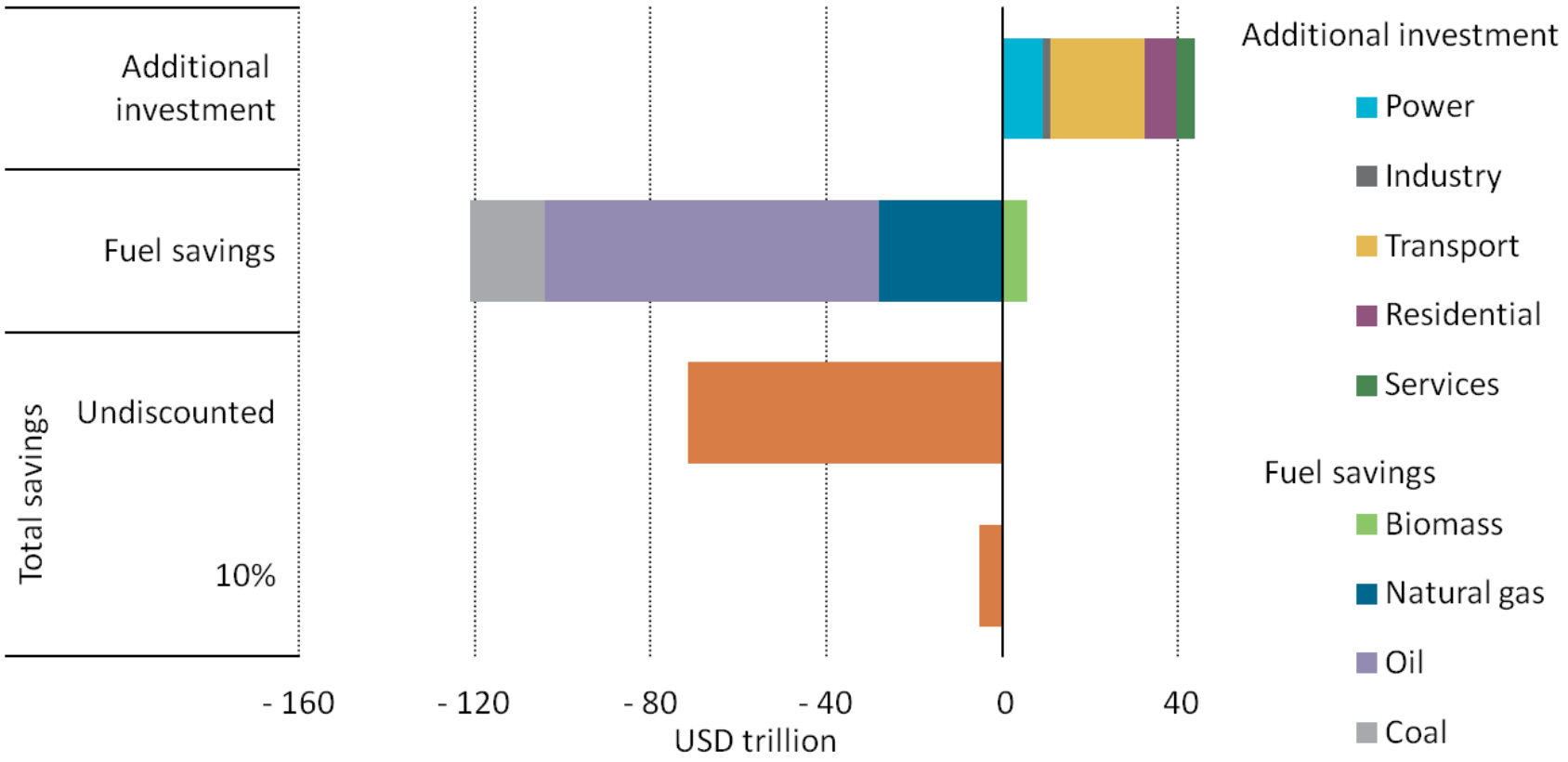

…and it is cost effective to make the transition

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We are not on track

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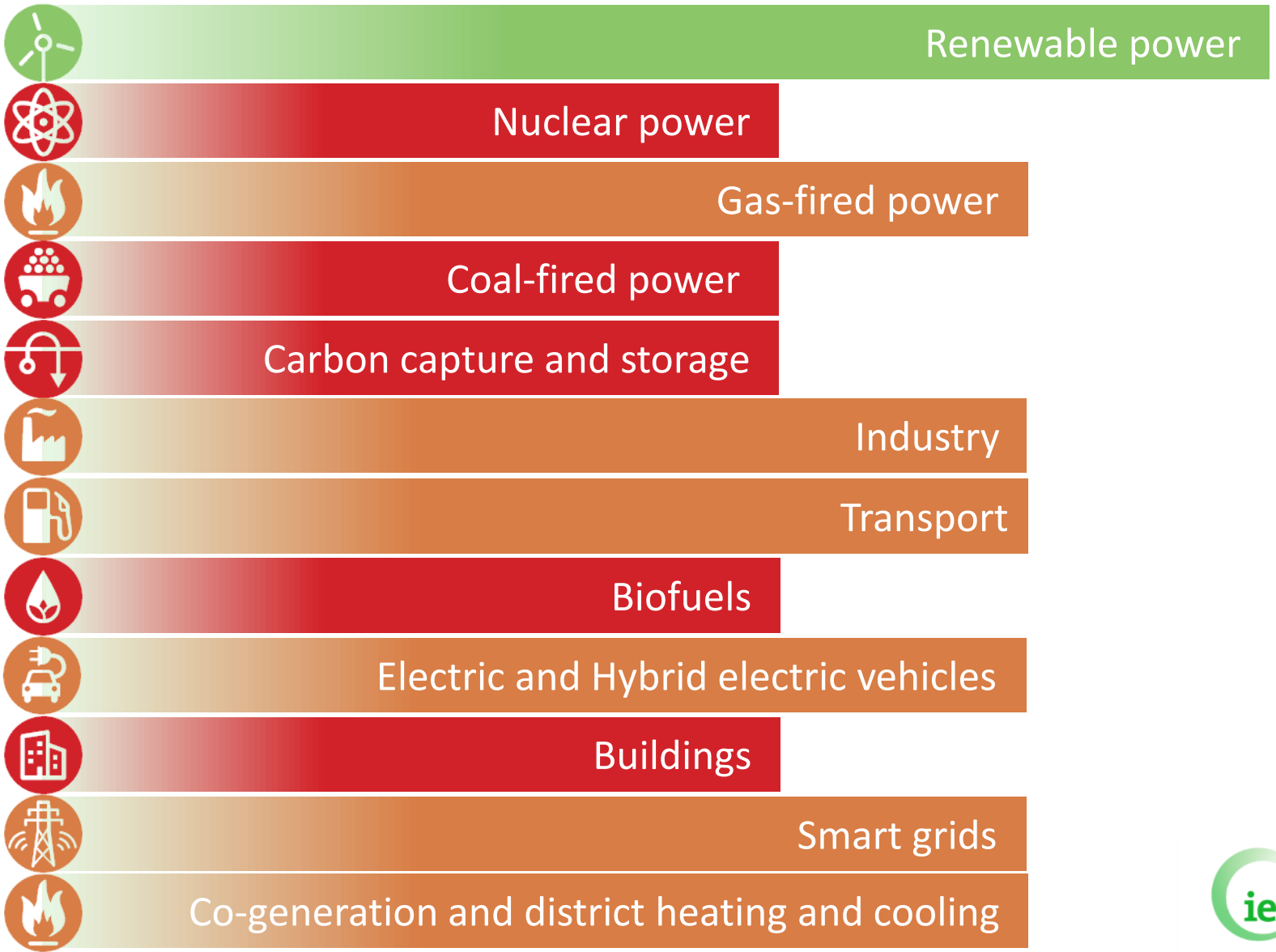

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Harnessing Electricity's Potential

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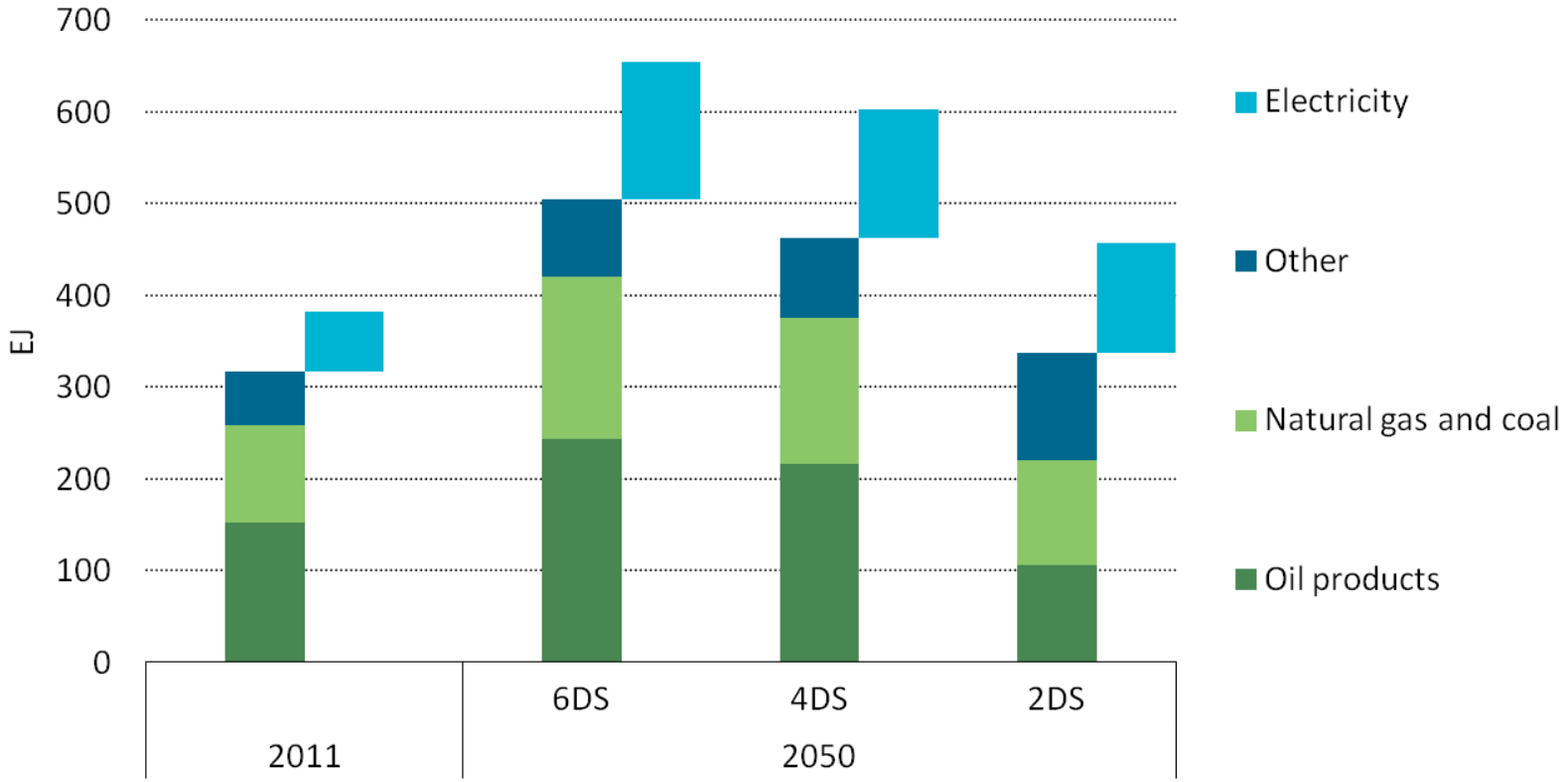
Global energy demand



*Increasing electricity consumption and share of overall energy usage– for **ALL** forward looking scenarios*

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Electricity can power sustainable growth

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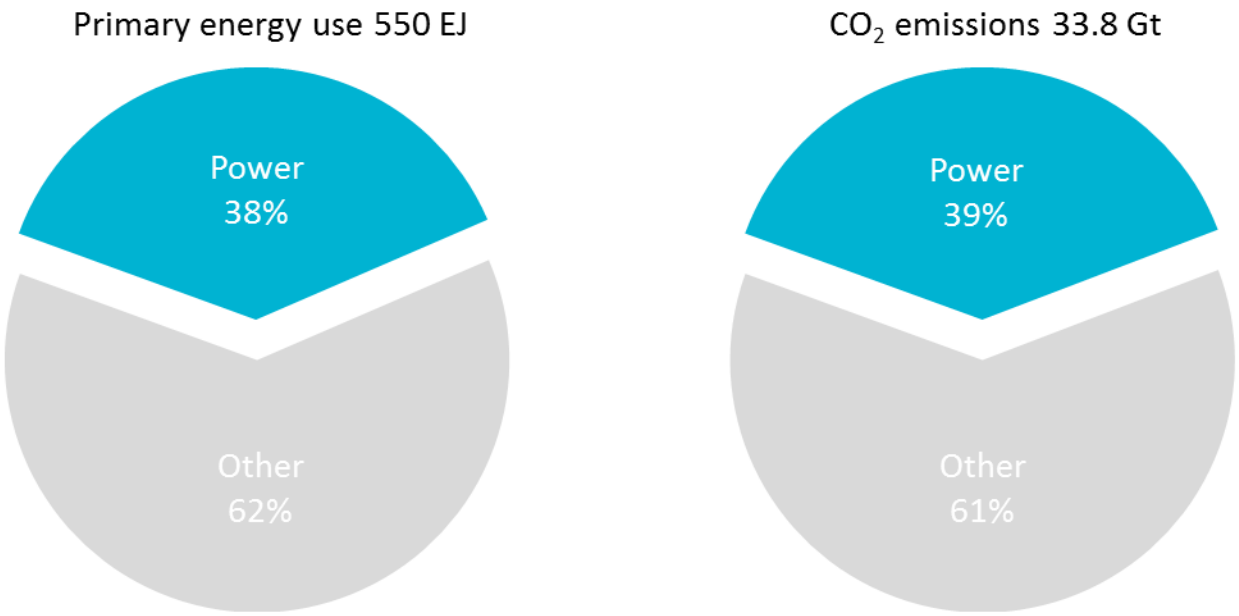
2011



But the source of electricity is of utmost importance

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Electricity can power sustainable growth

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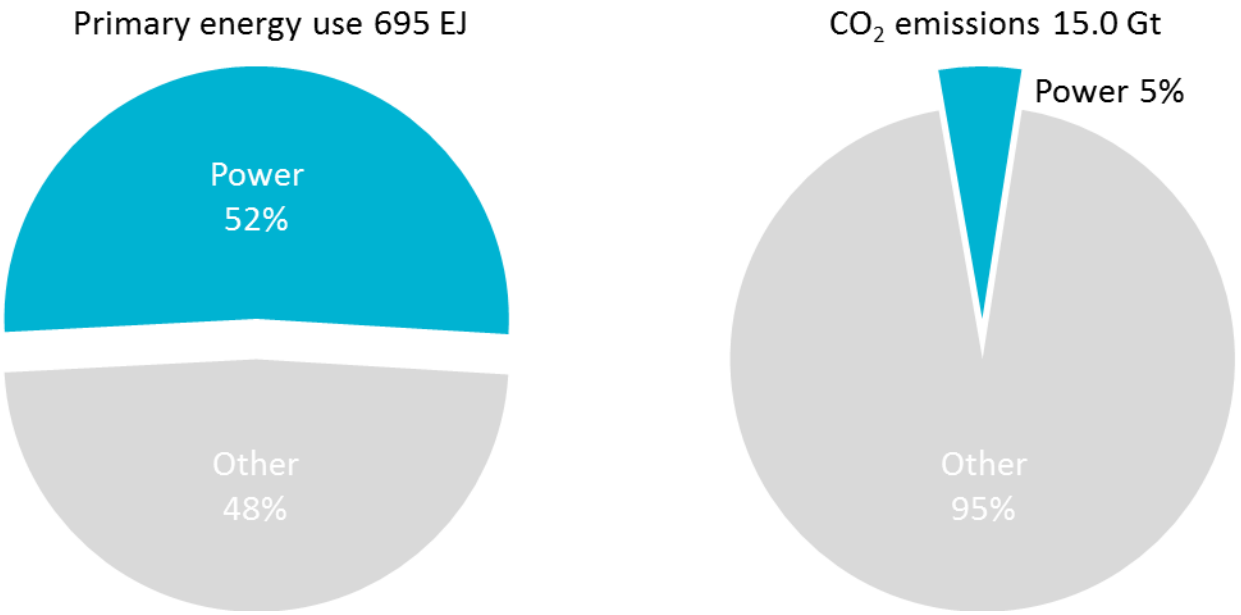
2050 2DS



The 2DS pathway disconnects primary energy used in generation from emissions

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Electricity Generation: a share reversal

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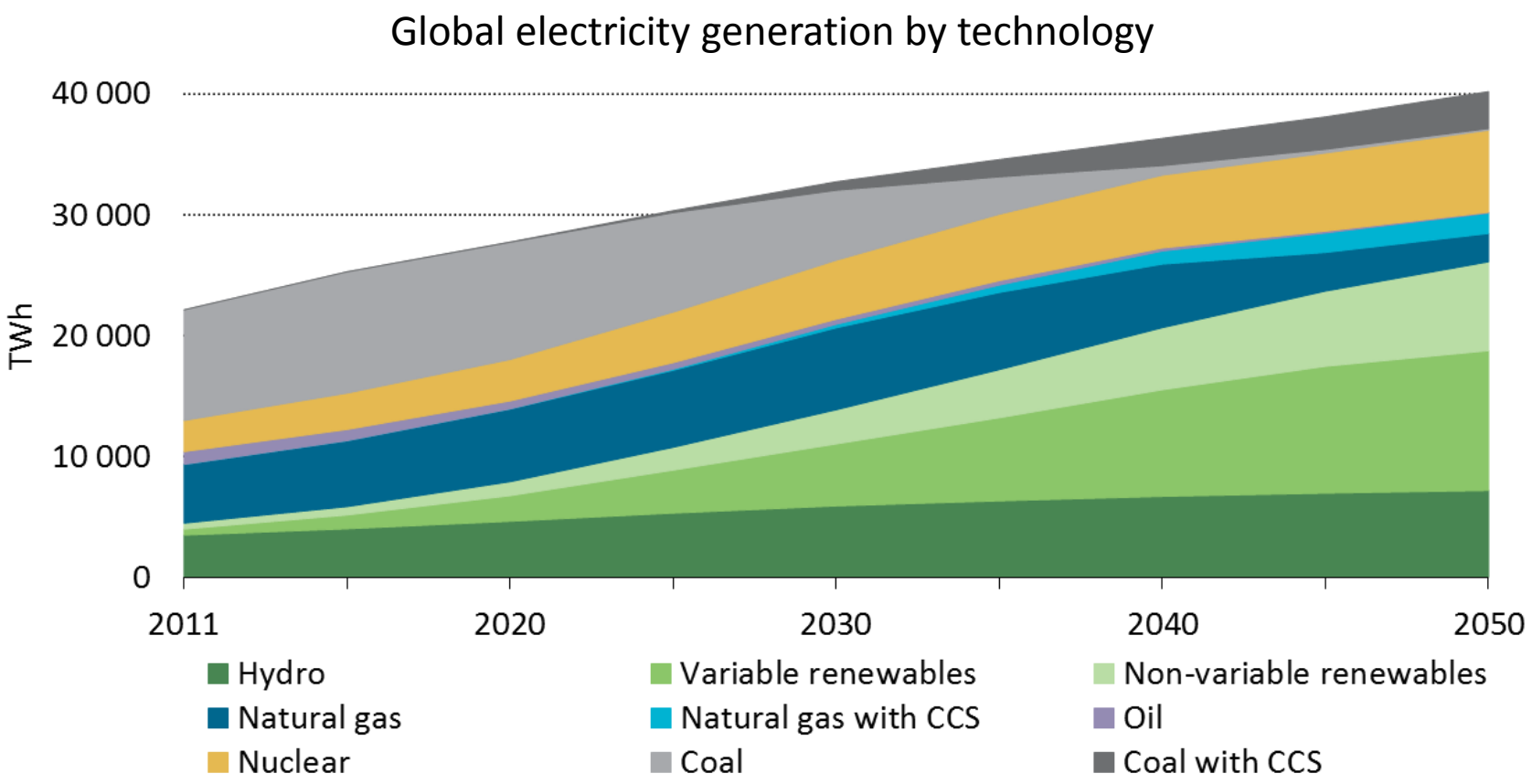

- Generation today:
  - Fossil fuels: 68%
  - Renewables: 20%
- Generation 2DS 2050:
  - Renewables: 65%
  - Fossil fuels: 20%

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Global climate-friendly electricity mix by 2050

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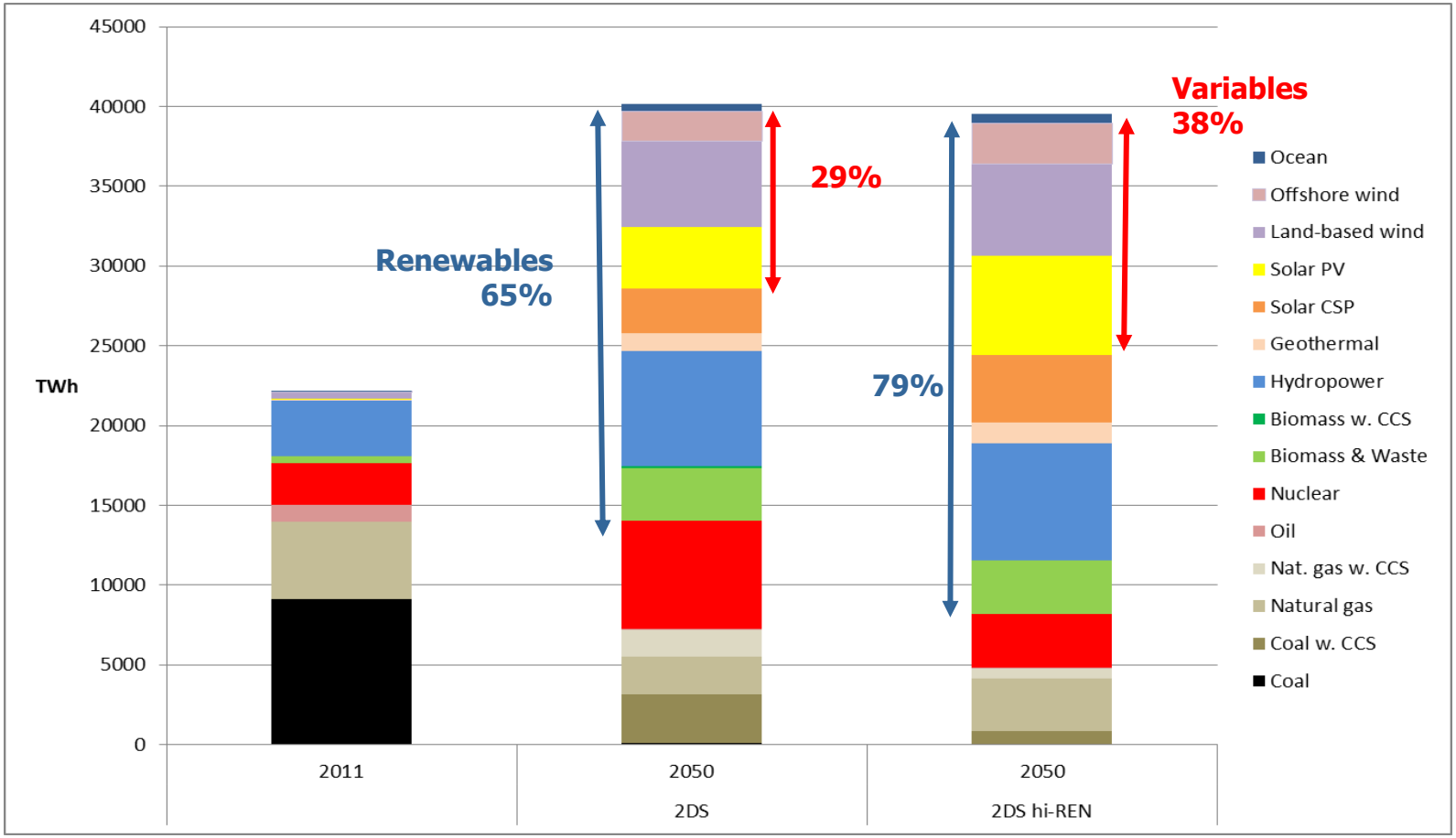

*Renewables to provide 65 to 79% of World's electricity by 2050 in 2 degree scenarios - **VRE 29 to 38%***

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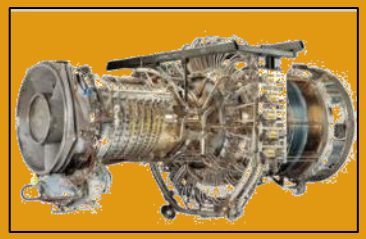
Reaching high VRE shares: three pillars of system transformation

Technology spread

Geographic spread

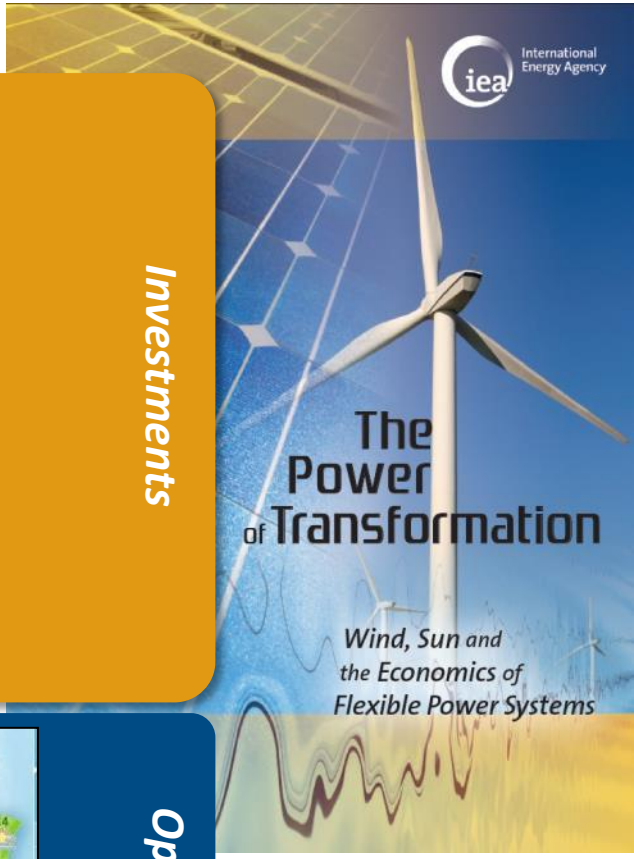
Design of power plants

System friendly VRE



Investments

Operations



Various technology choices lead to various flexibility capacity

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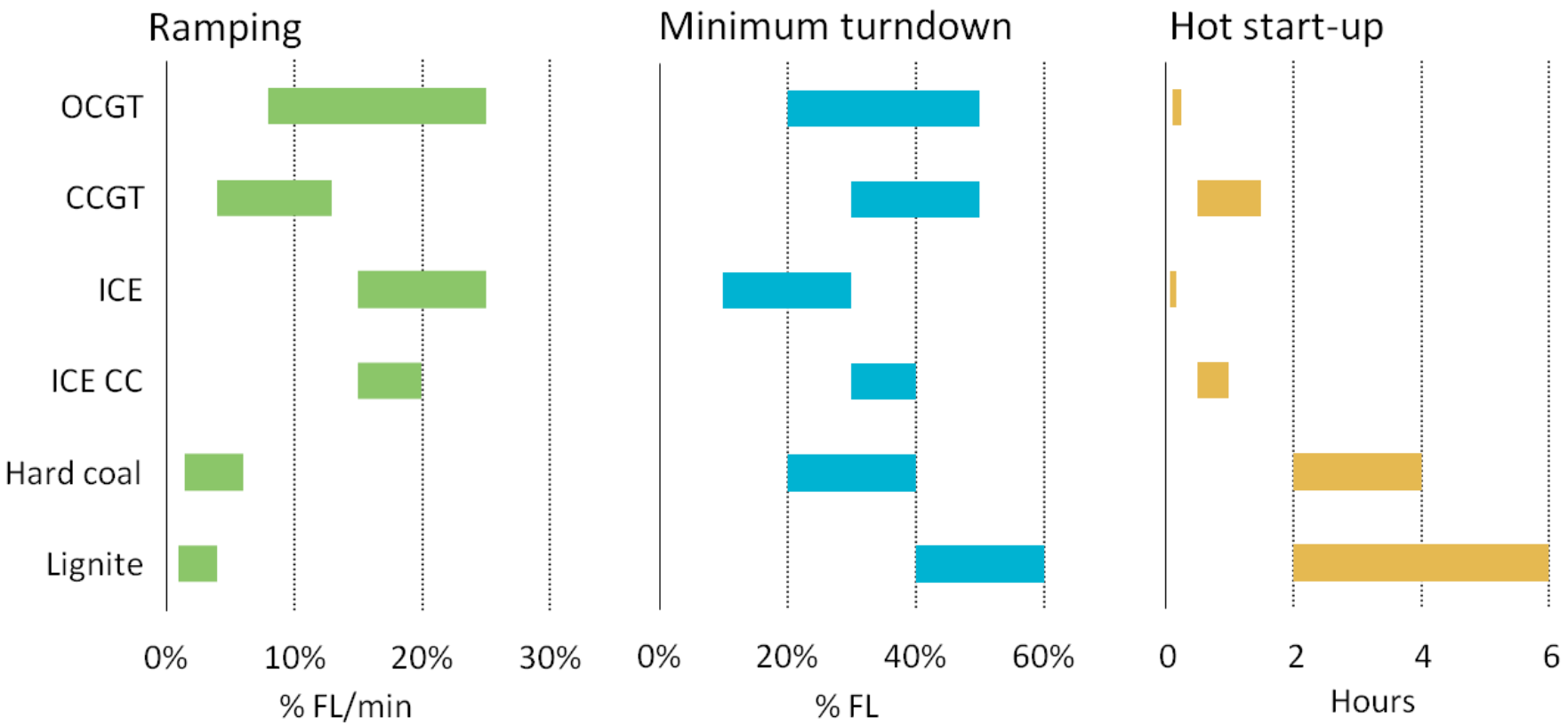

Among thermal generation plants, gas-fired plants perform better than coal-fired plants for flexibility parameters

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Stacking the benefits through demand-side integration

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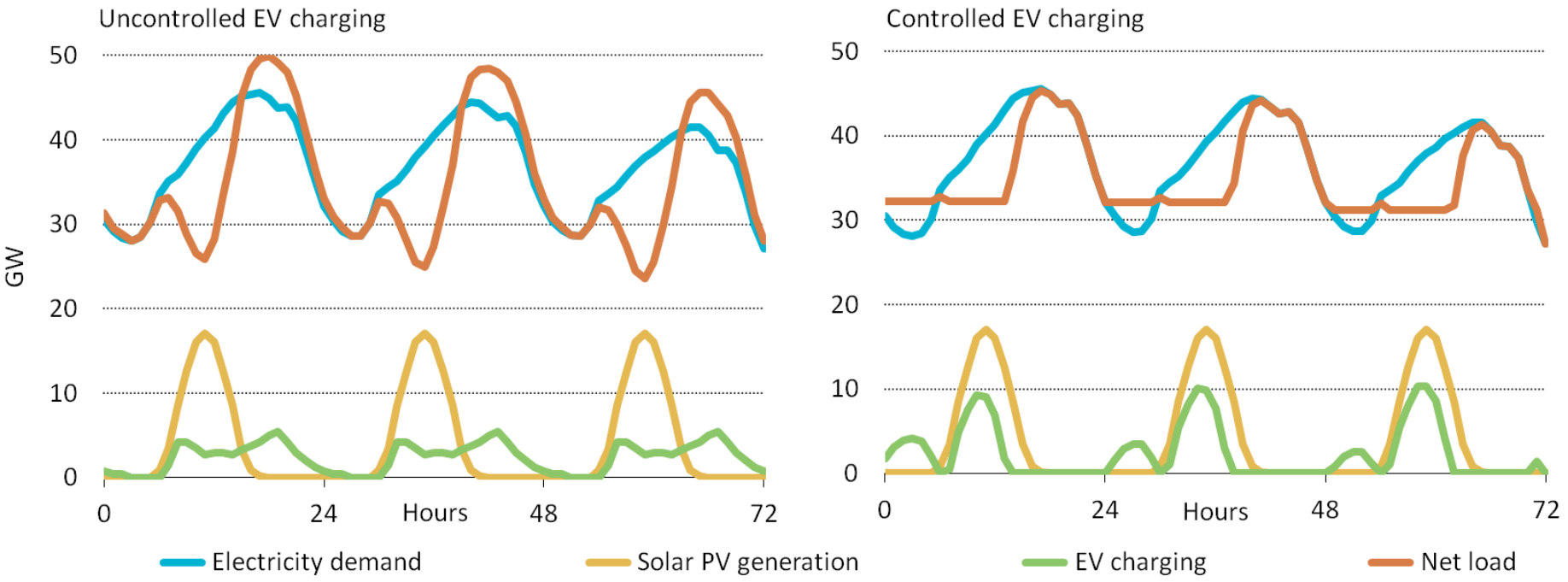
Controlled versus uncontrolled EV charging effects on load net of PV



Controlled charging of electric vehicles could facilitate the integration of solar PV

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Electricity Storage: still an essential part, but no need for game changers!

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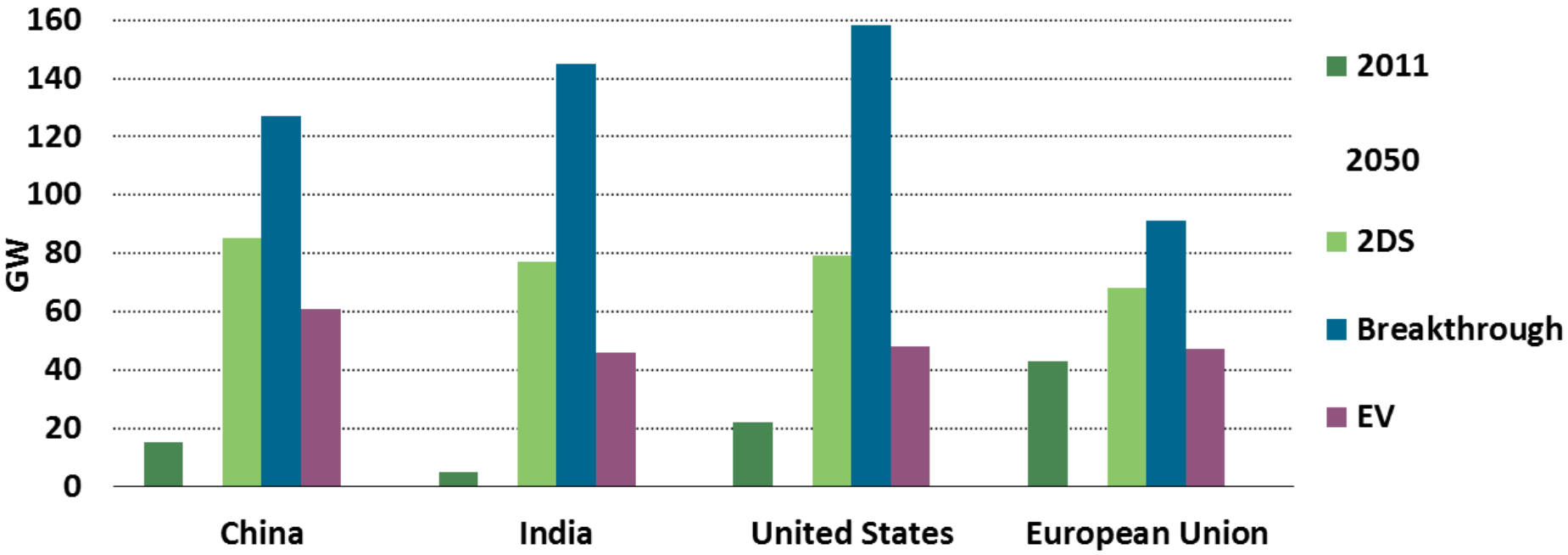
Potential for storage in key regions under various scenarios



Attractiveness of storage is highly context-specific, but increases greatly across all scenarios

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Storage is but one of a suite of options for providing flexibility

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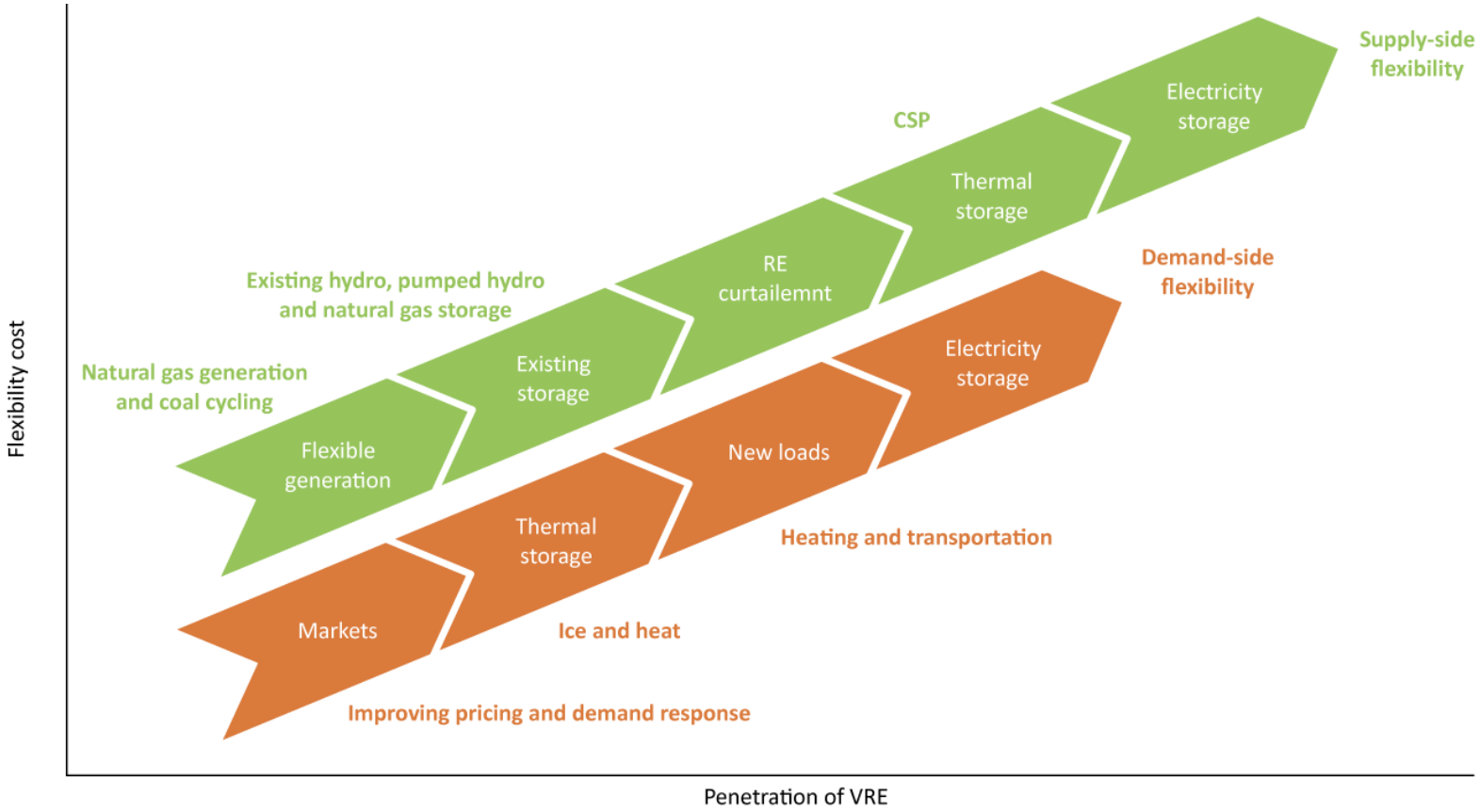

Depending on the system, flexibility from demand response could provide greater returns

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Evaluating how systems behave : (I) Long-term planning model

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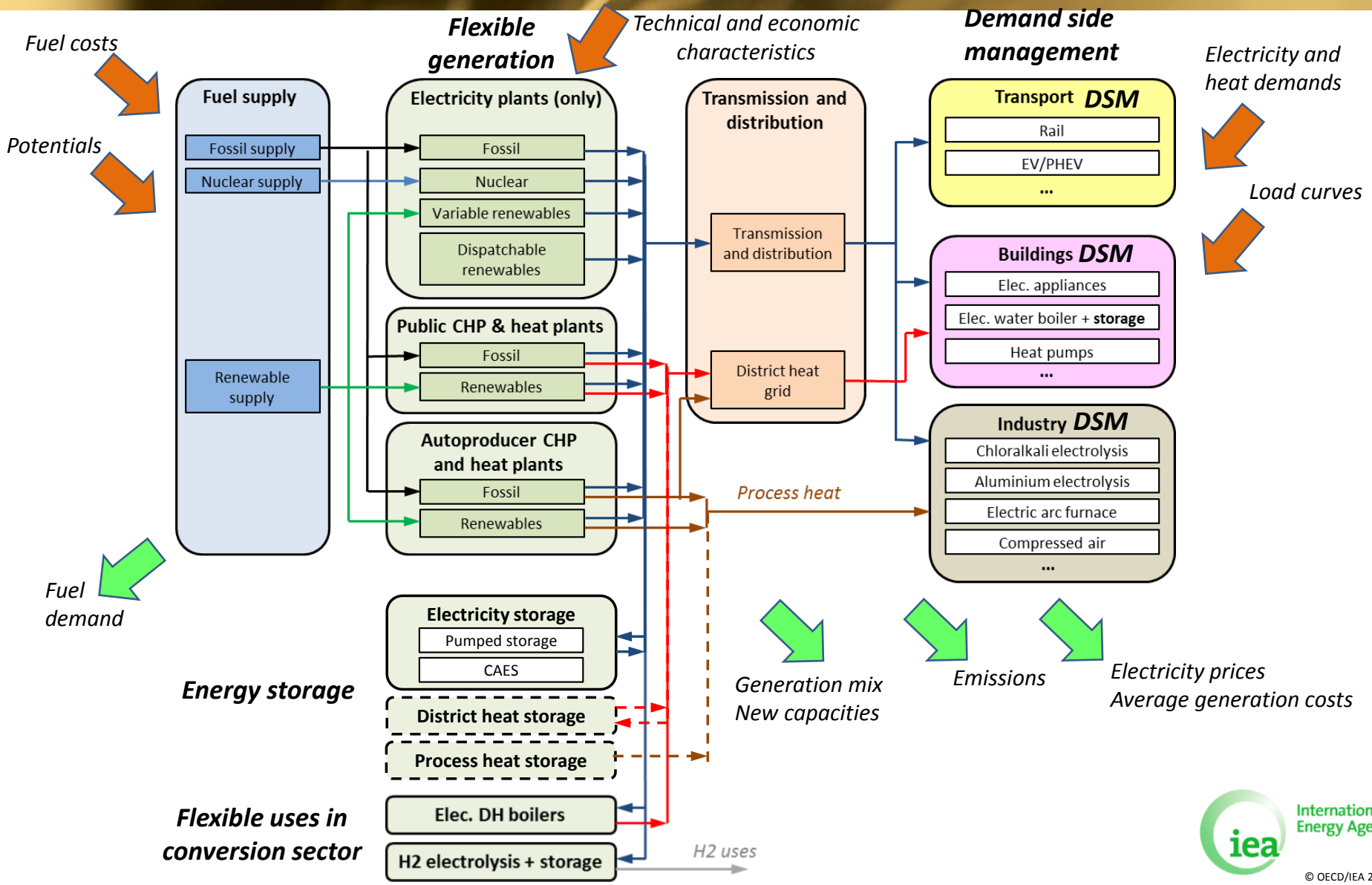

(II) Optimal dispatch analysis of ETP long-term decarbonisation scenarios

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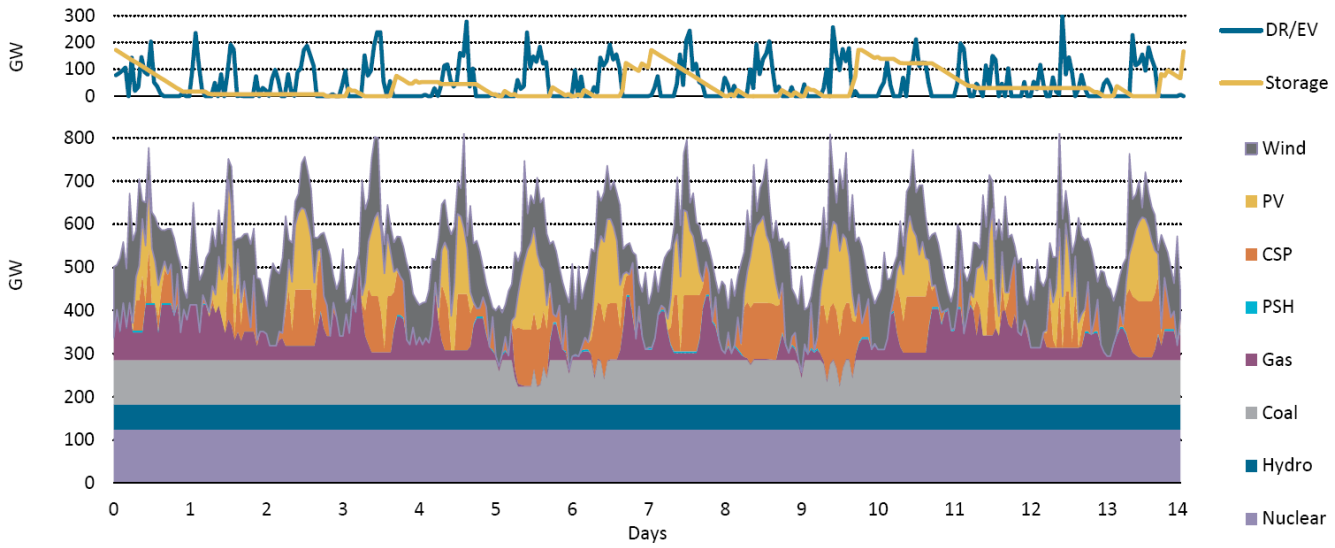

- **Storage modelled for:**
- Load following
- Arbitrage/load-levelling
- Seasonal storage

a range of plants:

mation

Storage

Re-optimising plant mix for vRE

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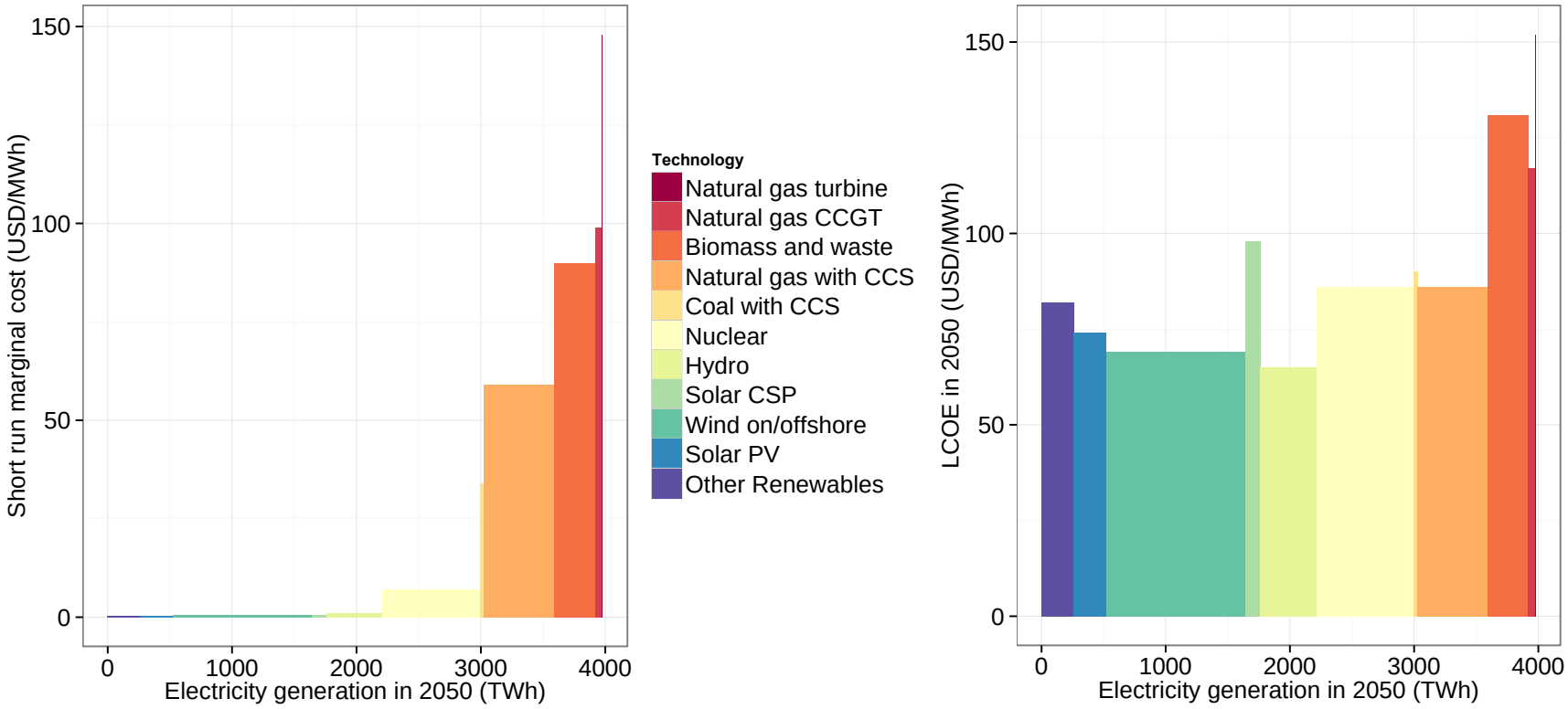

Short run marginal cost in 2050

LCOE in 2050

Capital costs a much higher share of total costs – fuels/commodities give way to capital investment

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Key changes in wholesale price duration curve

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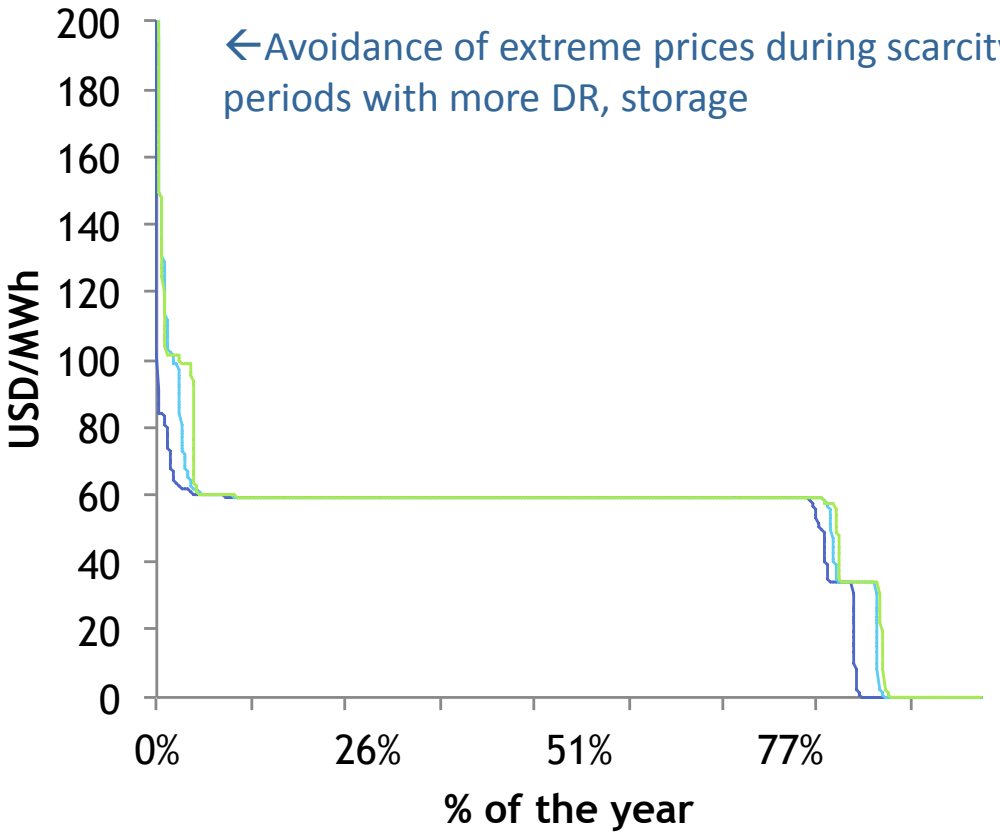

←Avoidance of extreme prices during scarcity periods with more DR, storage

2DS
DR
Full DR+Storage

←Reduced curtailment, other technologies setting price during periods where low SRMC was price setter

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Increased pressure on some generators to recover costs

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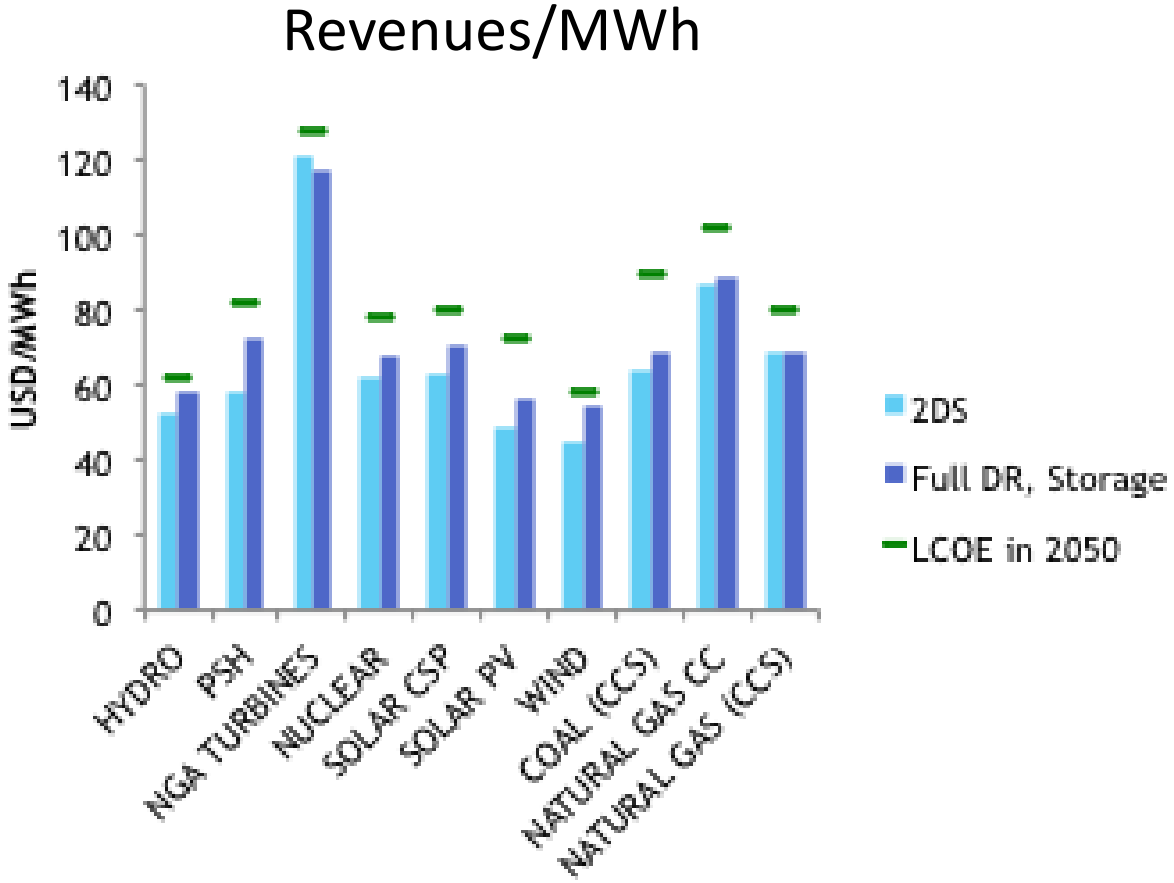

Across all scenarios, high carbon price ≠ good market position for low SRMC generators; missing money

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Risks affecting the cash flows of low-carbon power plants

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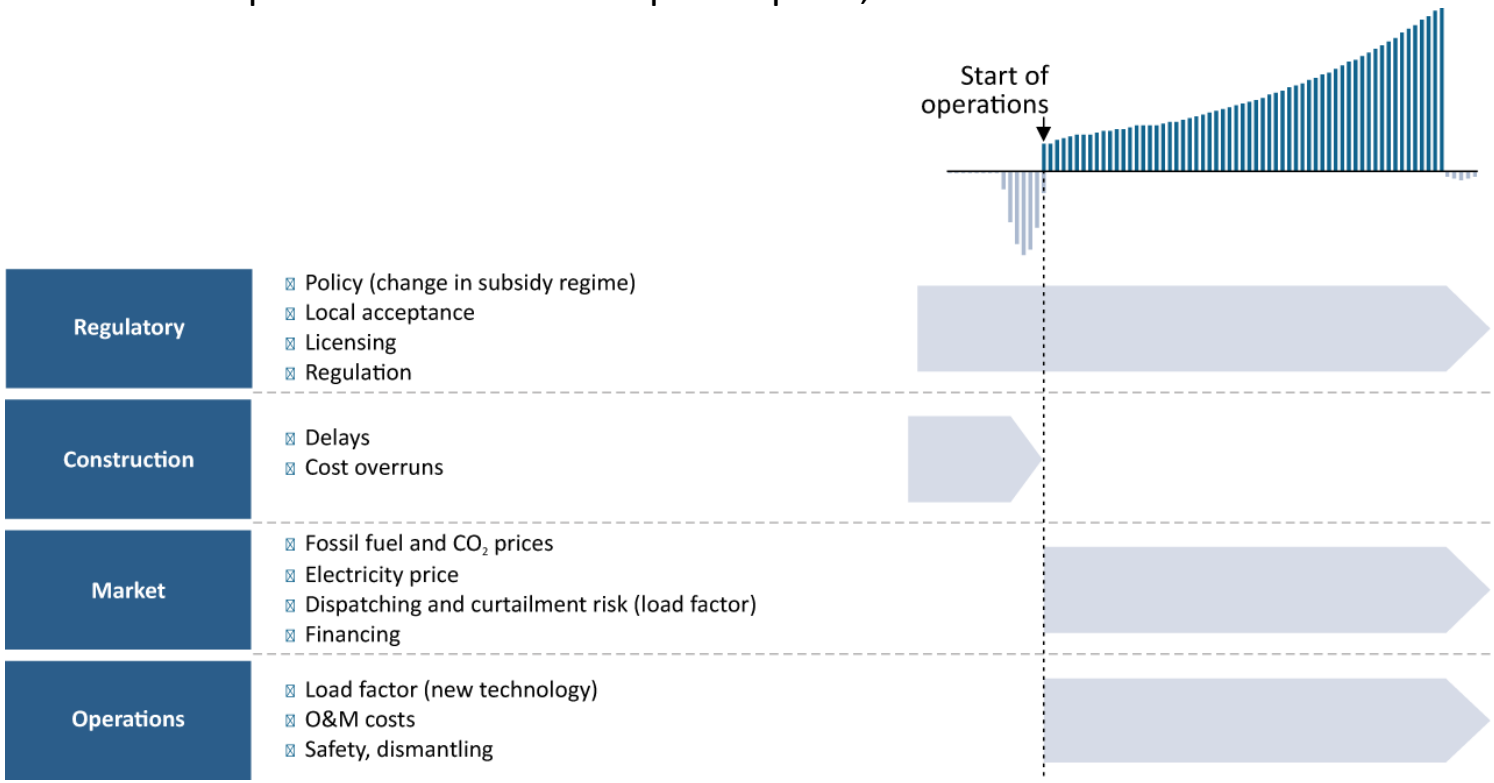
Cash flow profile of a low carbon power plant, and associated risks



The value of low-carbon investment projects is exposed to regulatory, construction, market and operations risks

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Improving the low-carbon business case

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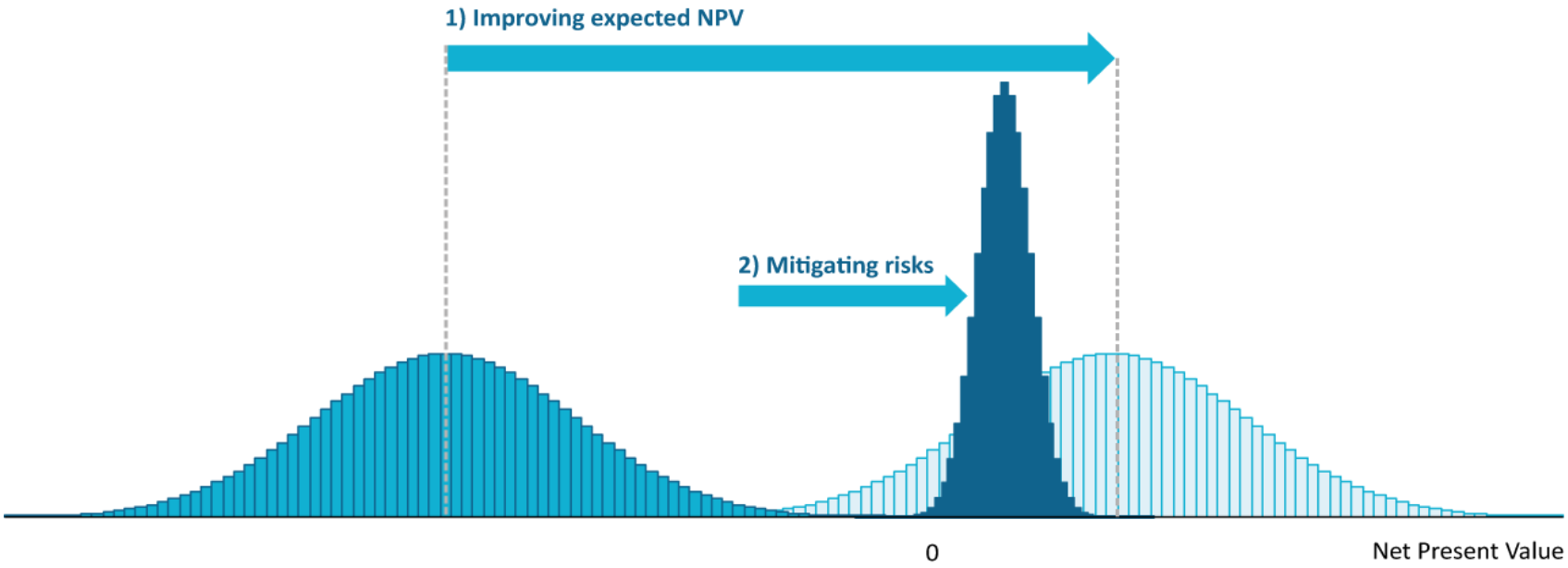

Attracting financing must consider two dimensions: improving the expected NPV and mitigating risks

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Spillover effect of decarbonising electricity in the 2DS

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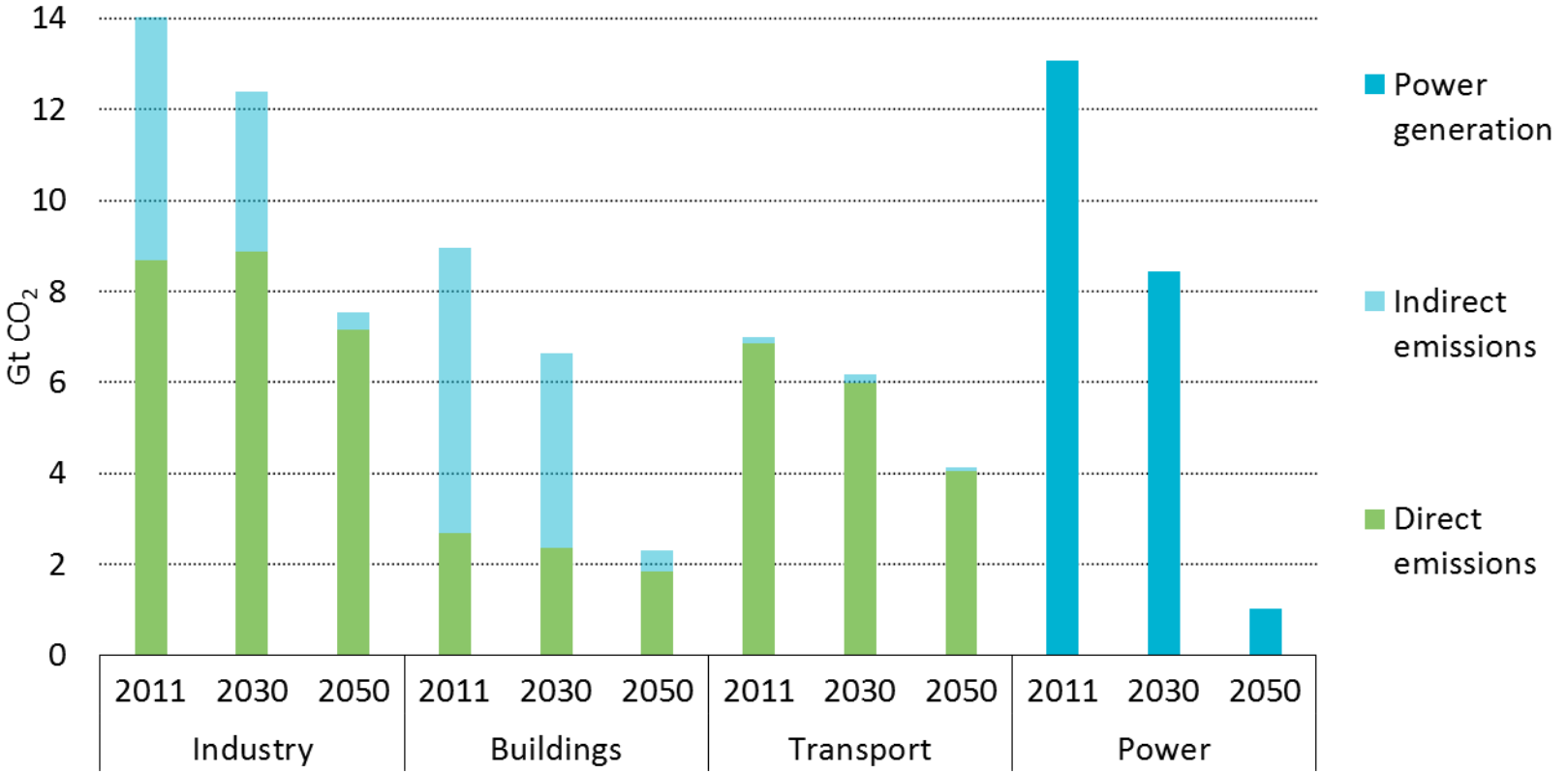

Electricity decarbonisation reduces emissions from sectors already electrified, without the need for further end-use investments.

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Building sector benefits most from decarbonisation of power generation

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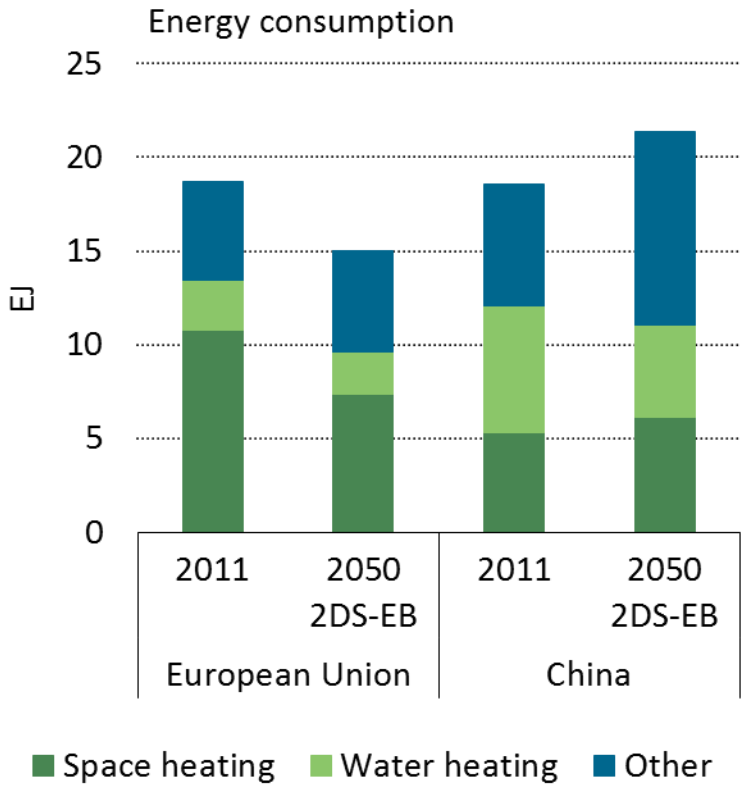

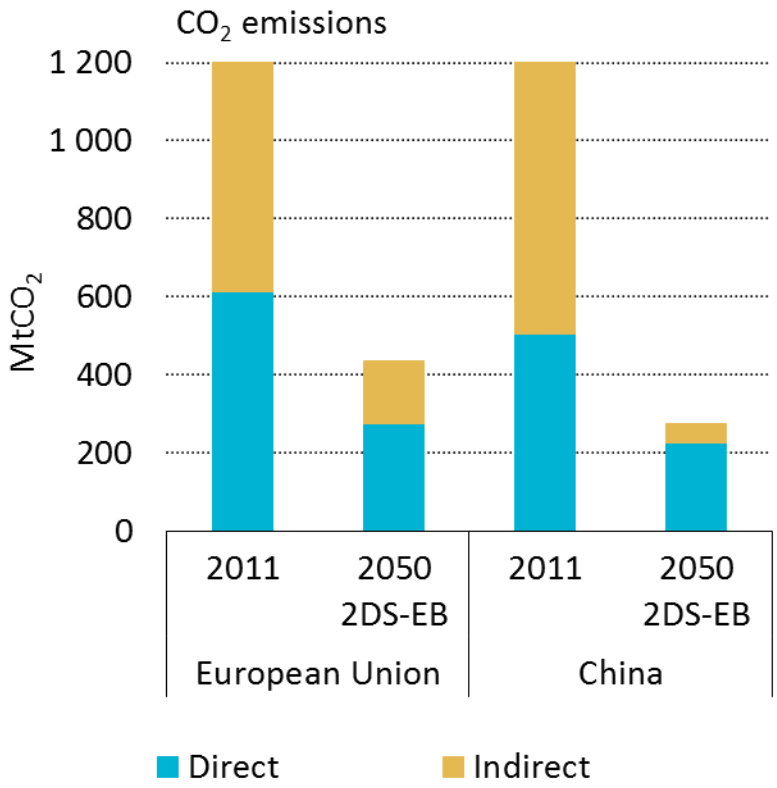

Increasing electricity use also helps to reduce natural gas demand in buildings

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Systems thinking and integration

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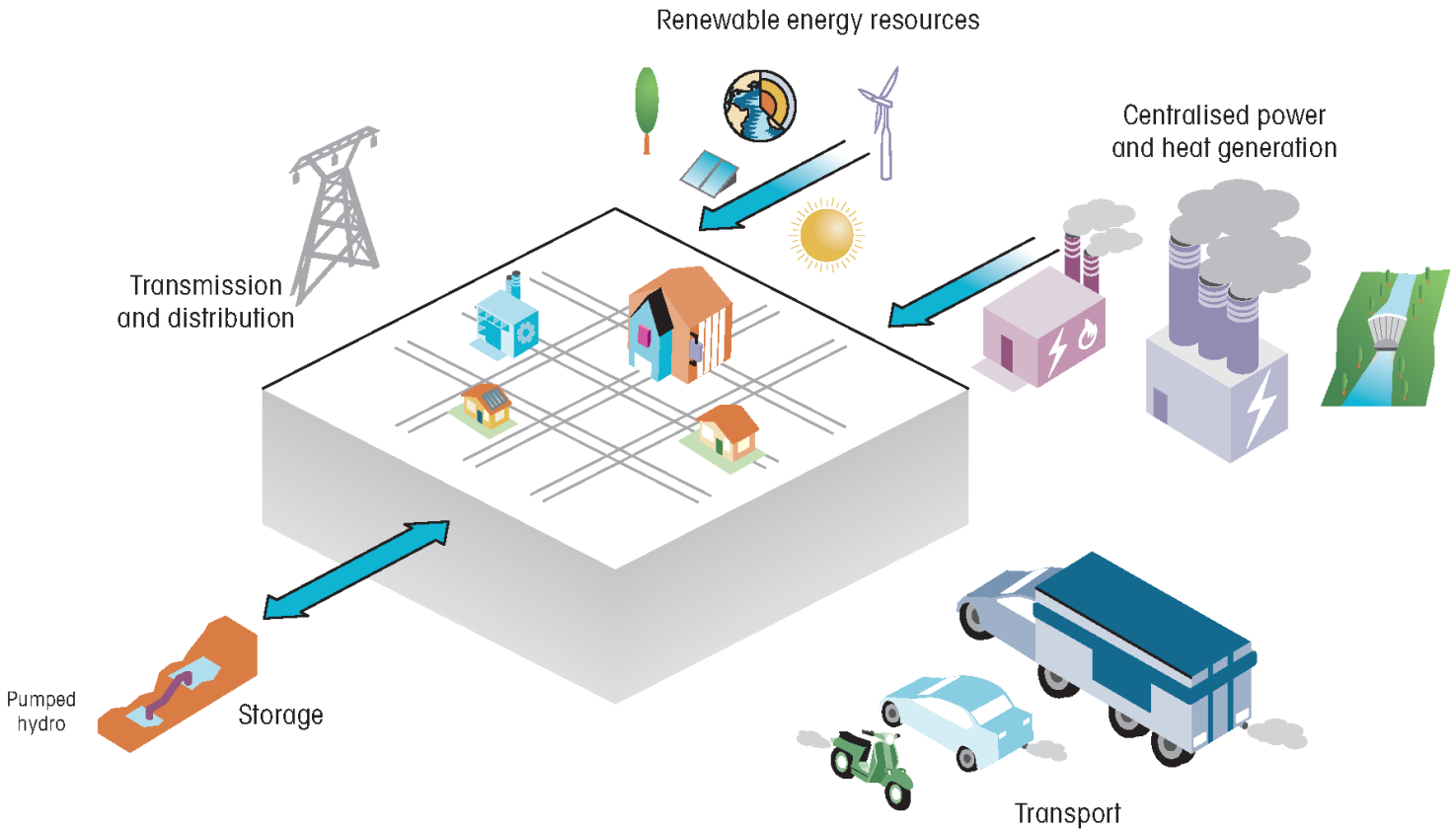

Today's energy system paradigm is based on a unidirectional energy delivery philosophy

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Systems thinking and integration

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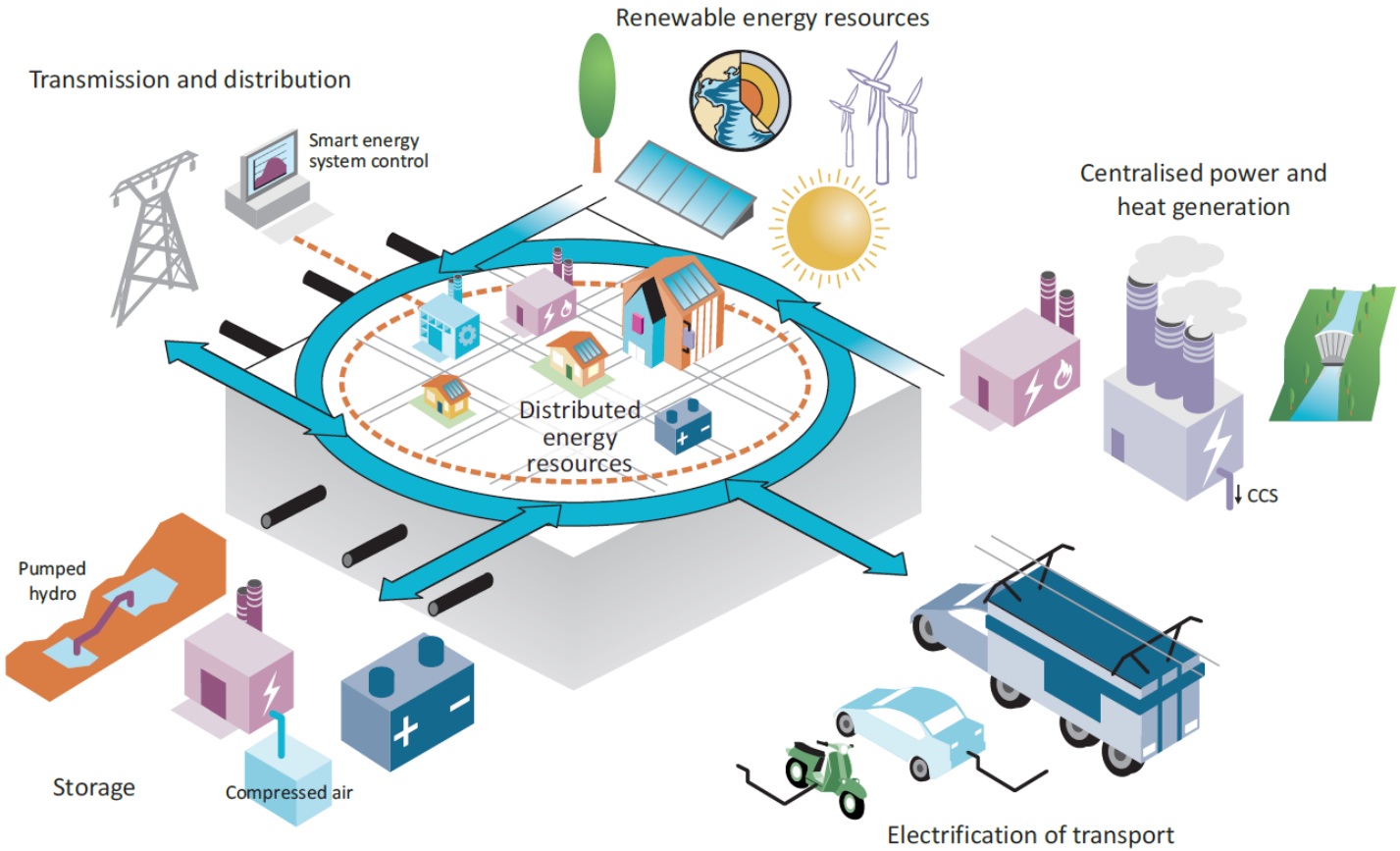

A sustainable electricity system is a smarter, multidirectional and integrated energy system that requires long-term planning for services delivery

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Ongoing work on cross-sectoral integration

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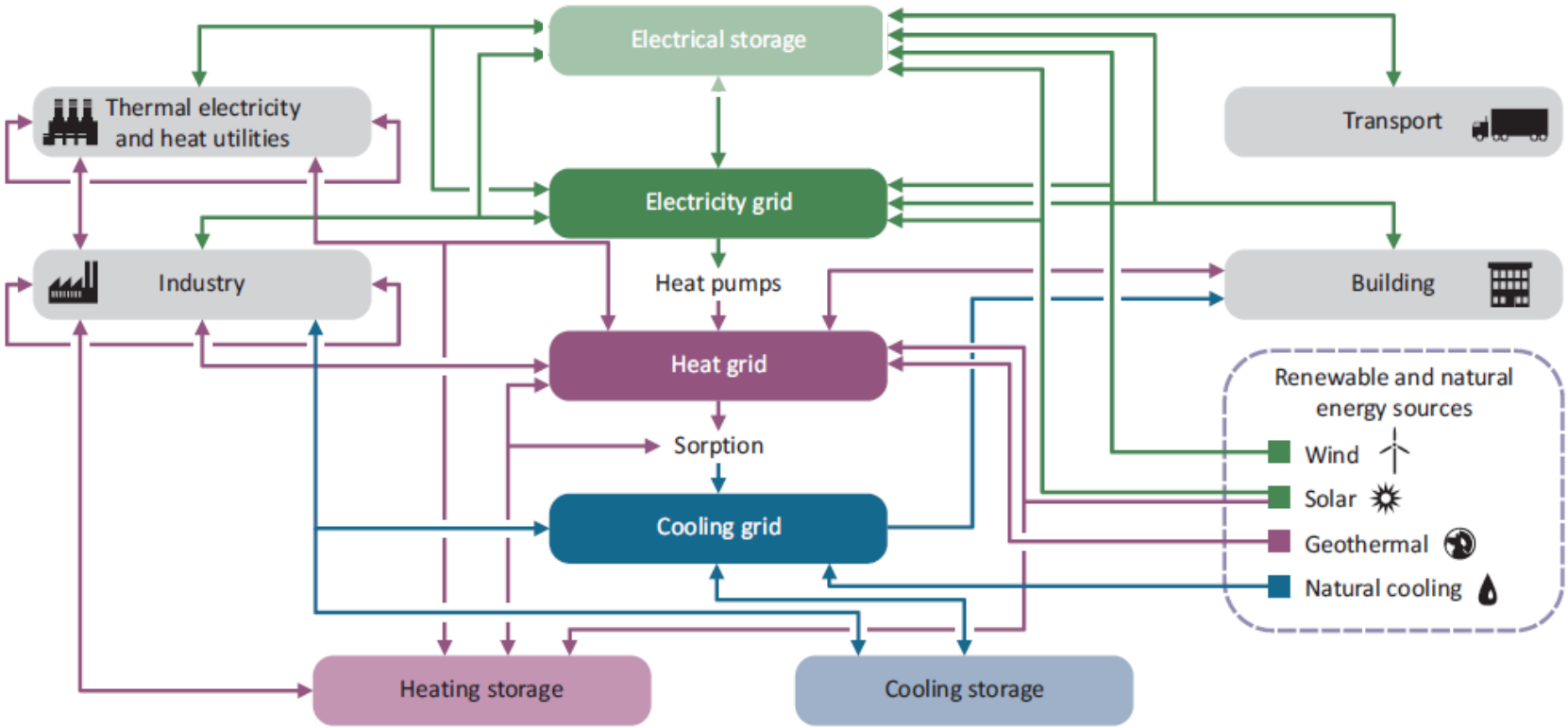
Linking heat and electricity systems: Co-generation and DHC solutions for a clean energy future. IEA, 2014.



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Thank you

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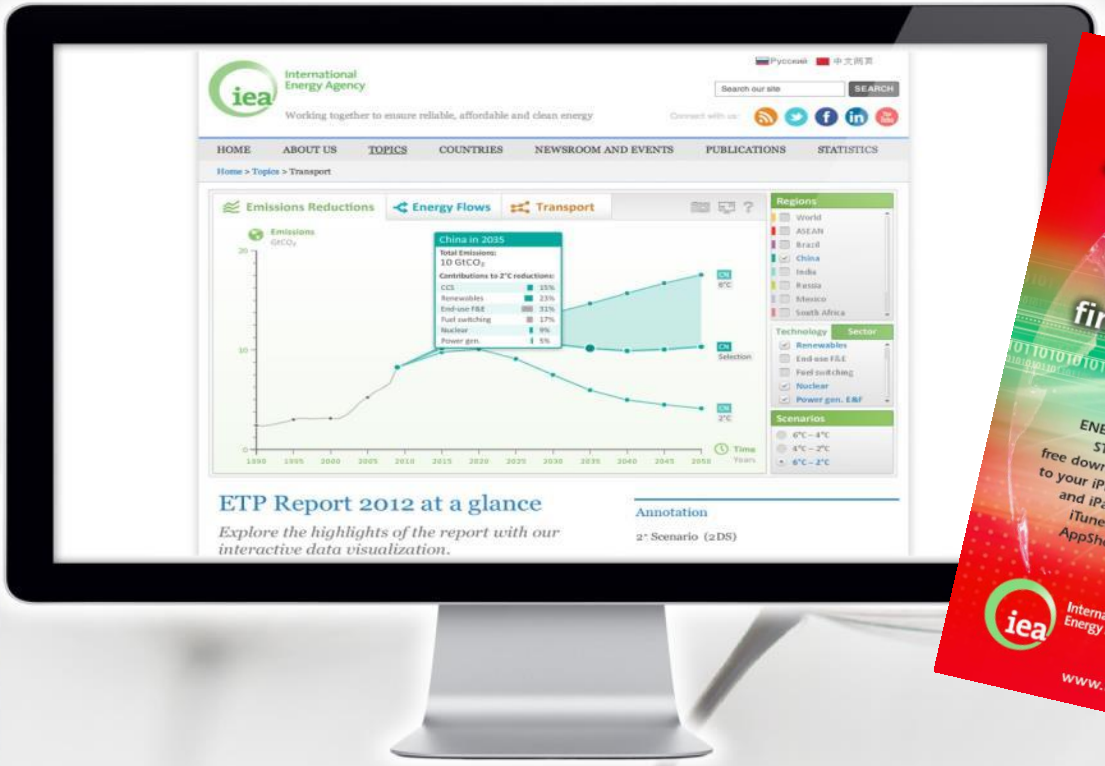
Explore the data behind *ETP*



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