Energy Technology Perspectives 2012

Pathways to a Clean Energy System

Stockholm, June 21 2012

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Head of Energy Supply Unit

International Energy Agency

ETP 2012 – Choice of 3 Futures

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2DS

a vision of a **sustainable** energy system of reduced Greenhouse Gas (GHG) and CO_2 emissions

The 2°C Scenario

4DS

reflecting pledges by countries to cut emissions and boost energy efficiency

The 4°C Scenario

6DS

where the world is now heading with potentially **devastating** results

The 6°C Scenario

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A smart, sustainable energy system

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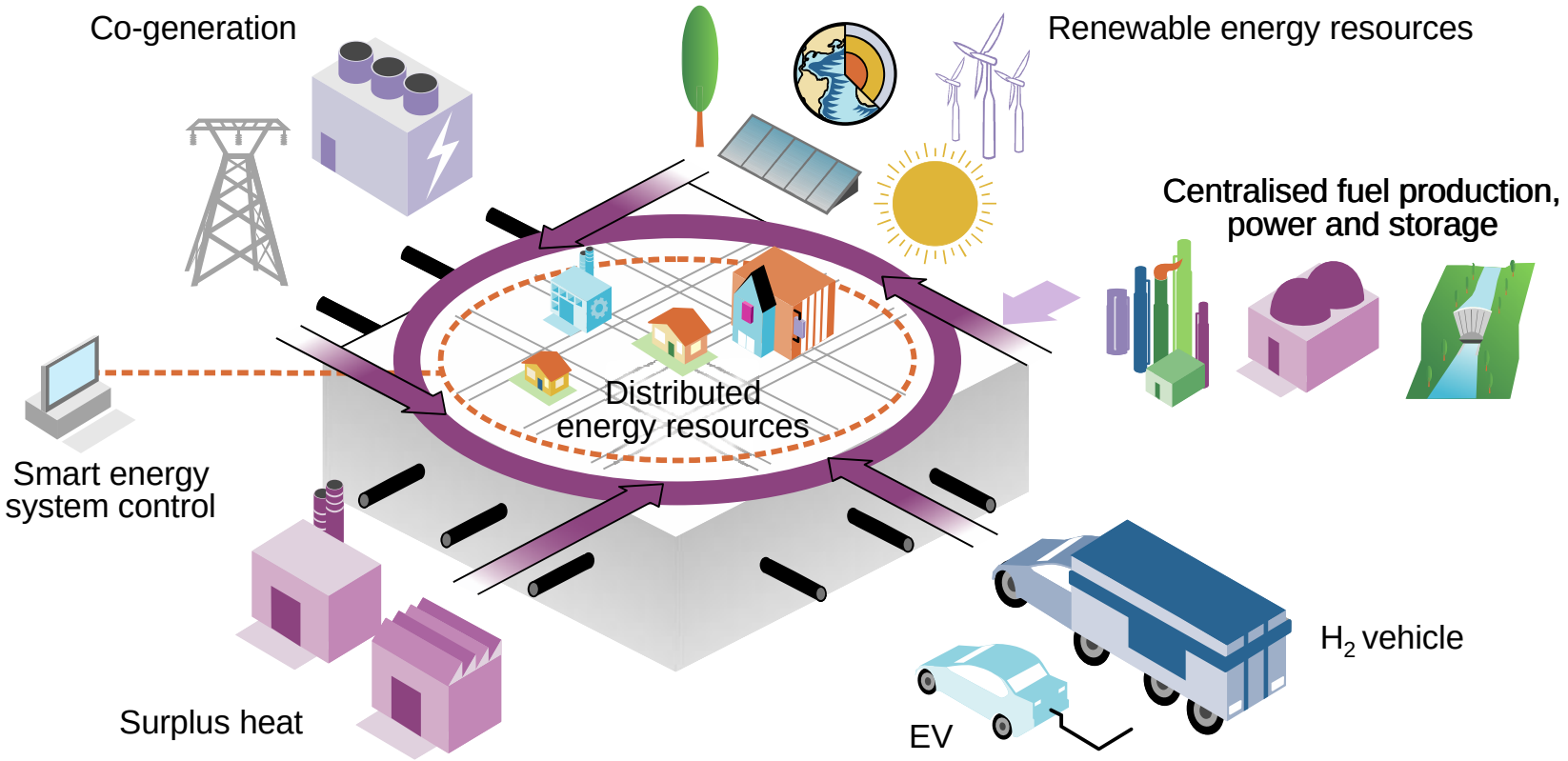

A sustainable energy system is a smarter, more unified and integrated energy system

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Low-carbon electricity: a clean core

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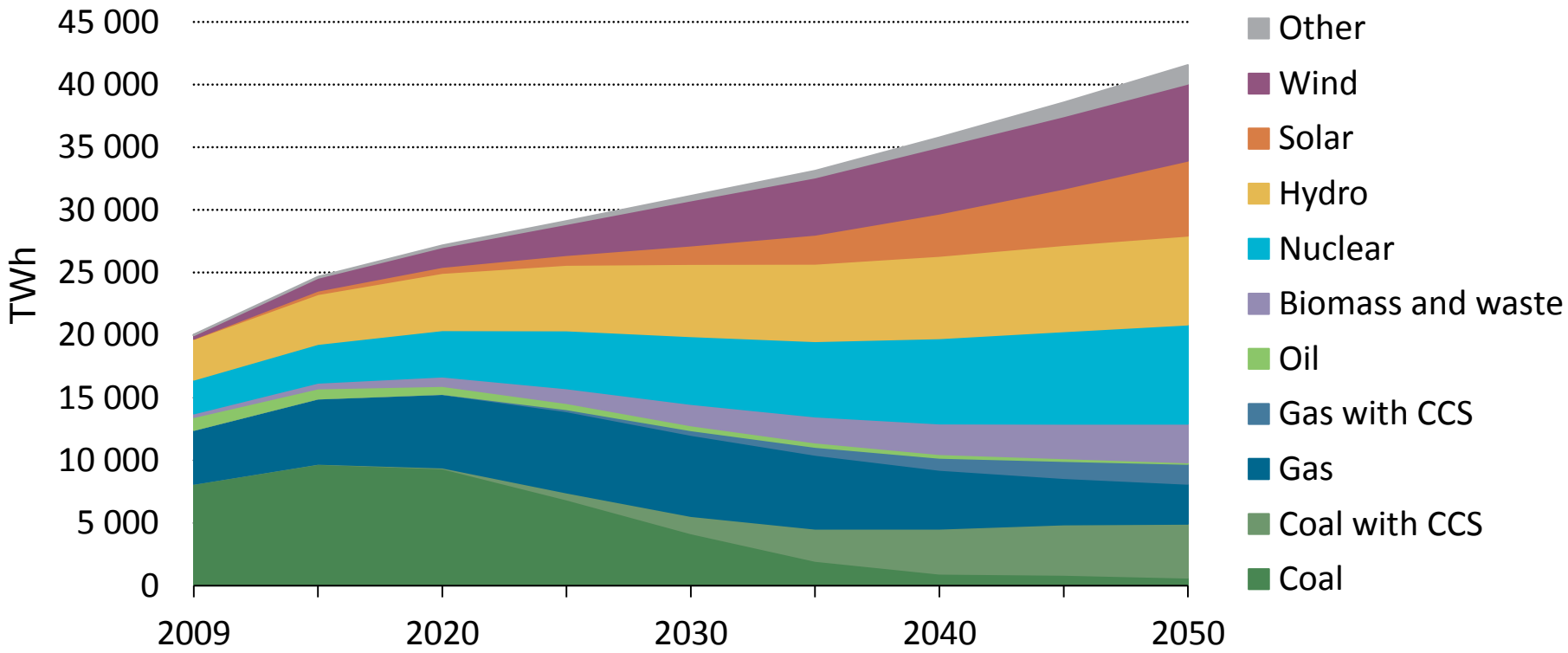

Renewables will generate more than half the world's electricity in the 2DS

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EU: Wind and solar must grow quickly

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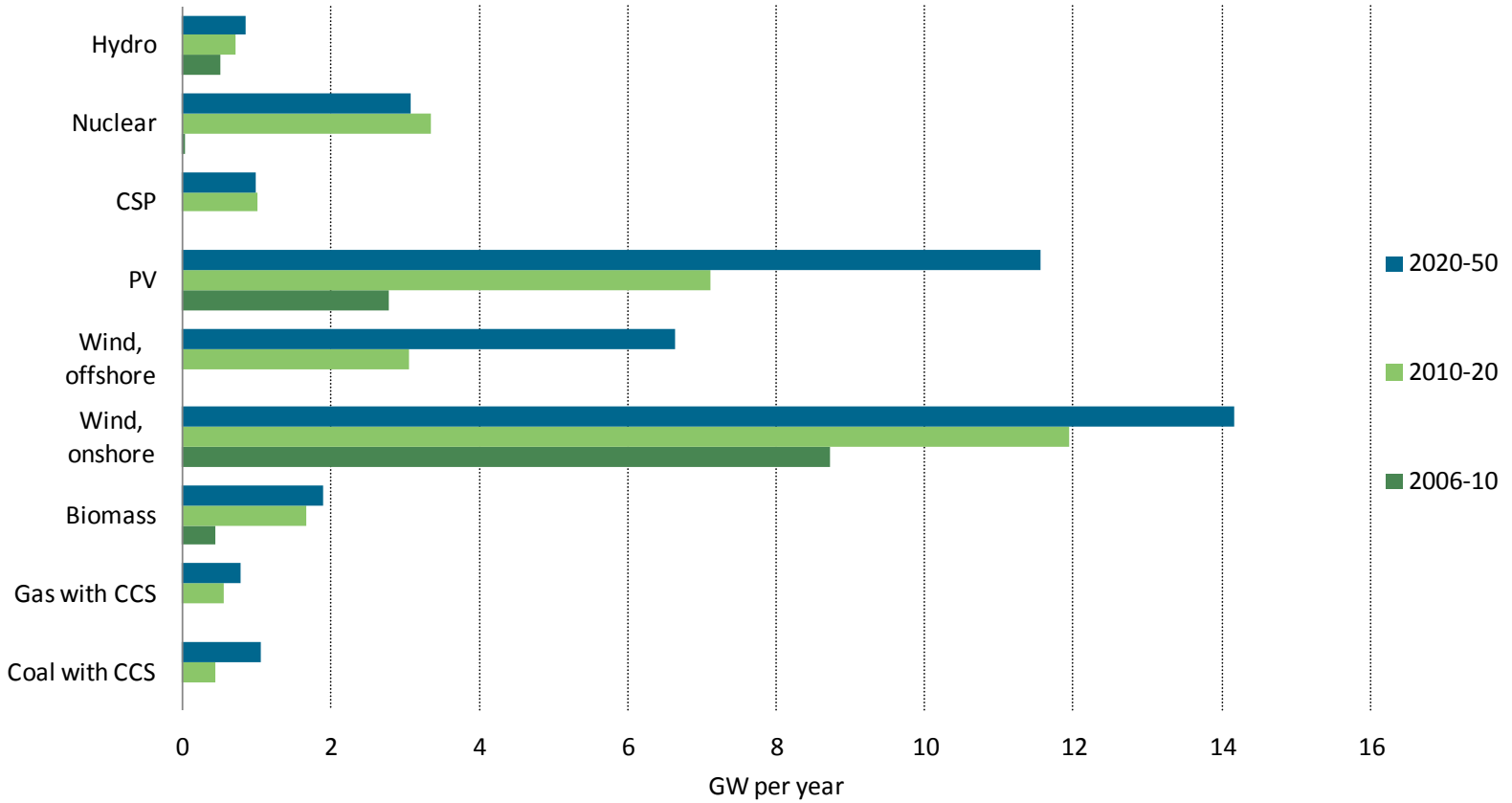

An additional USD 1.2 trillion are needed in the EU power sector, but fuel savings amount to USD 2.7 trillion

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Growth in renewable electricity in the 4DS

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2020

78%

2030

152%

Generation from renewable electricity will grow quickly even in the 4DS.

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Natural Gas: a transitional fuel

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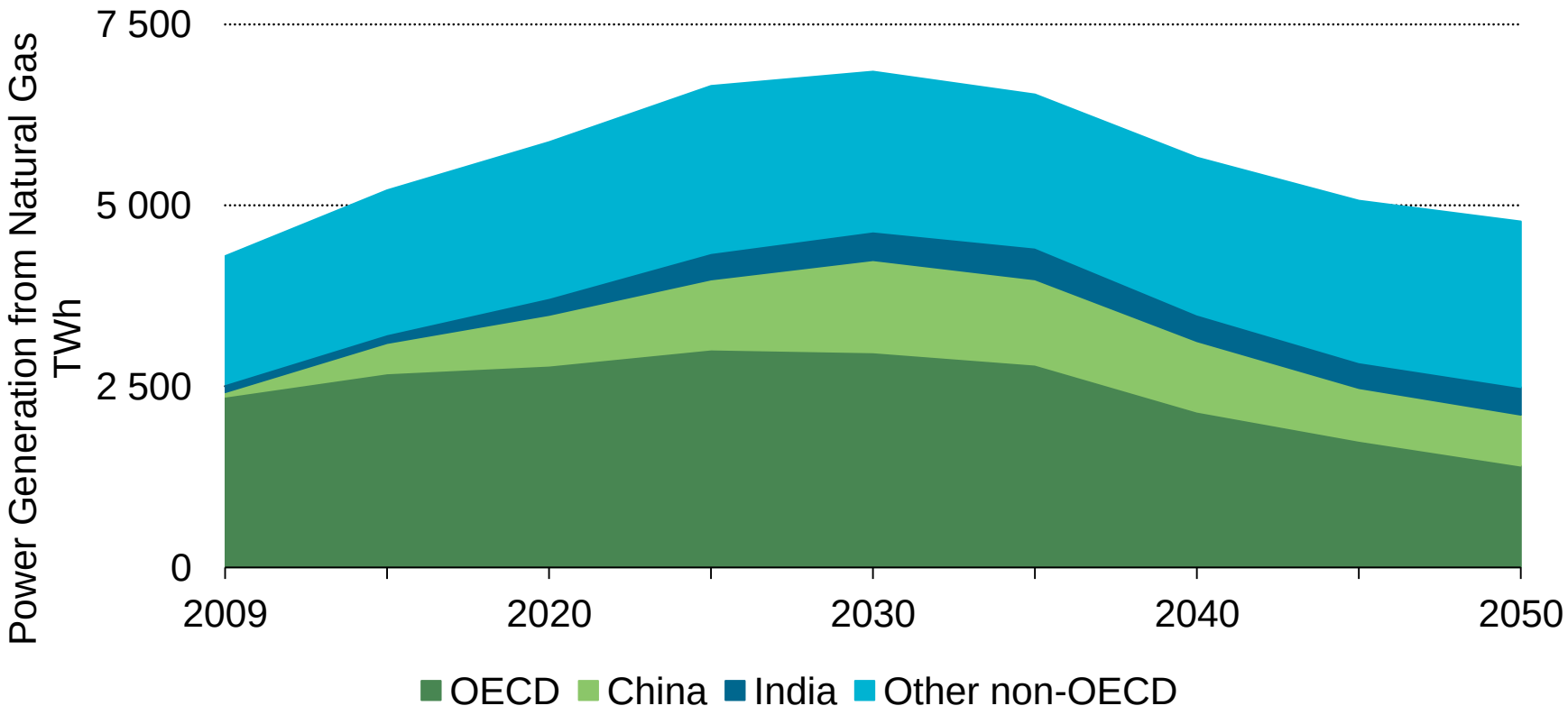

Around 2030, natural gas becomes 'high carbon'

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Electric vehicles need to come of age

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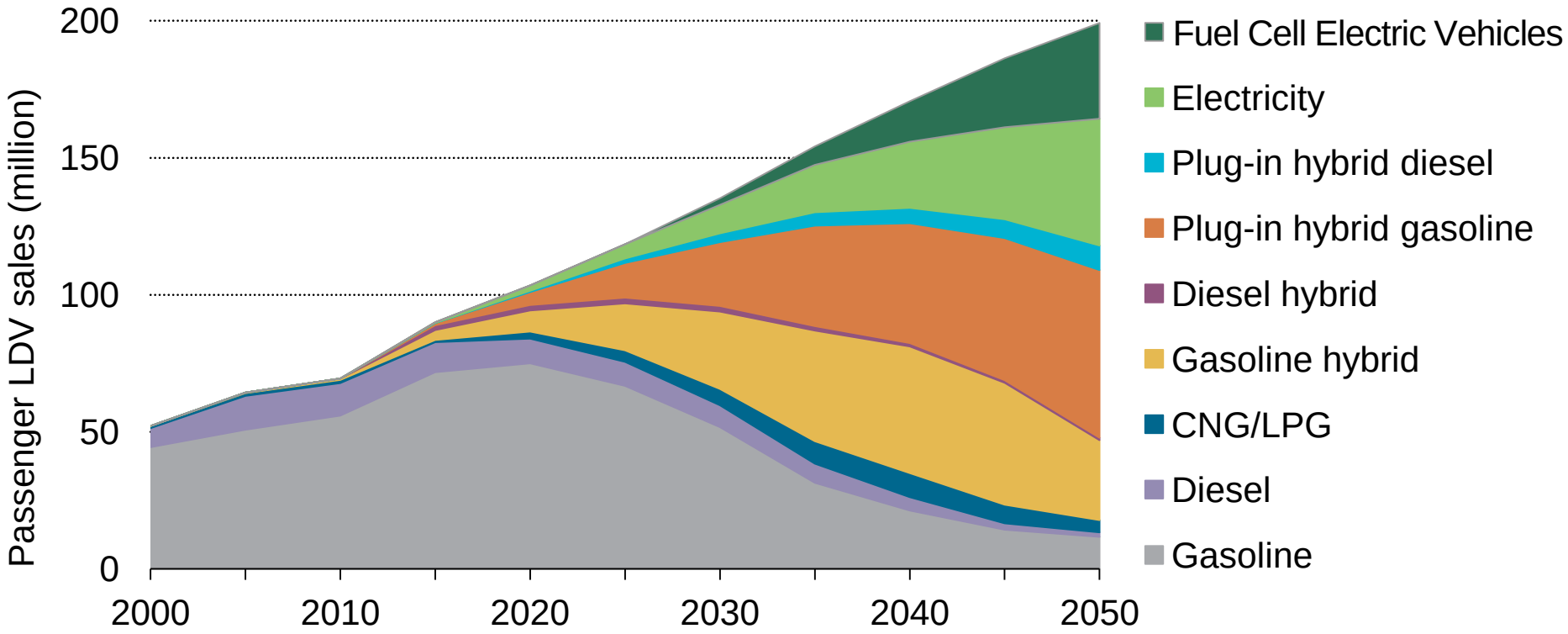

More than 90% of new light duty vehicles need to be propelled by an electric motor in 2050

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Translating targets into action

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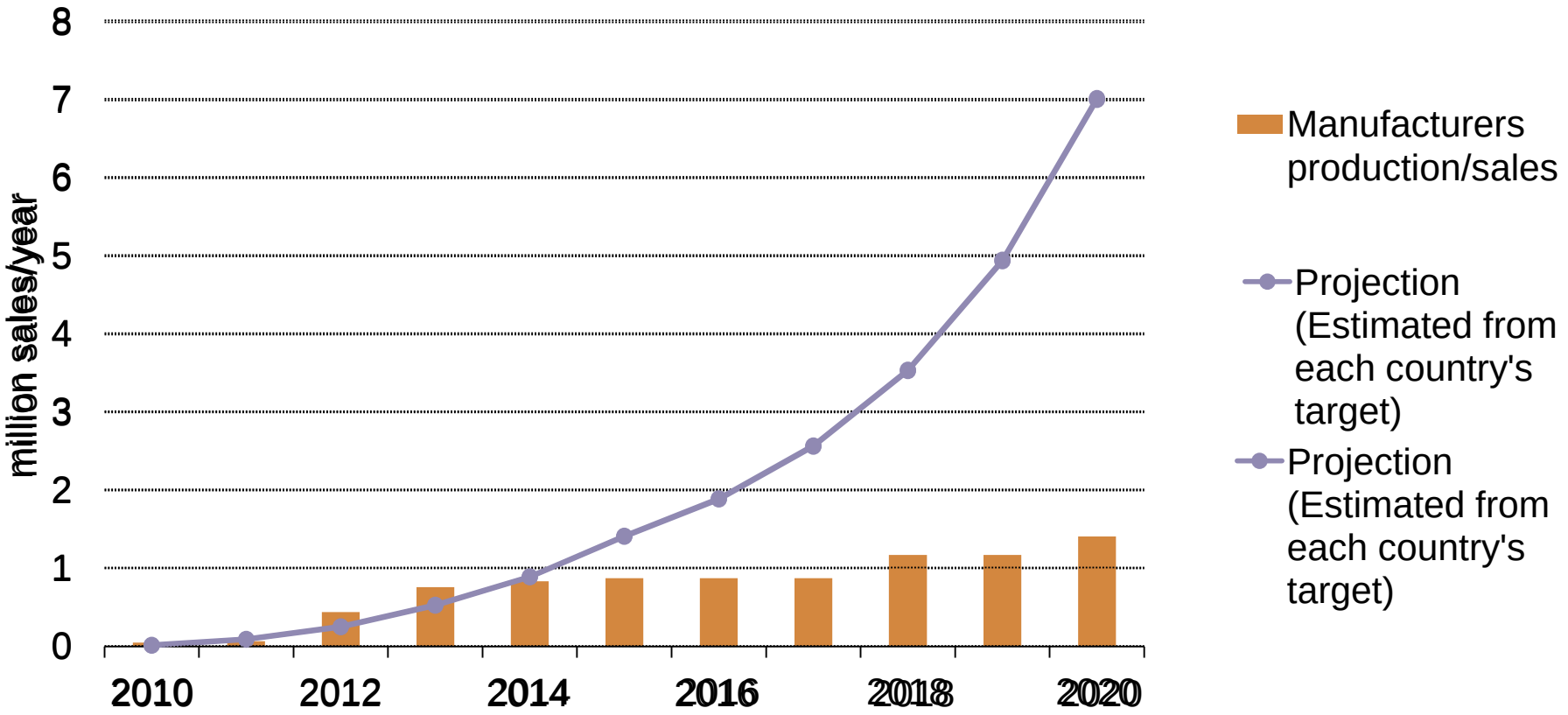

Government targets need to be backed by policy action

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What about the money?

The sums are large

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Total

140

2DS Additional

36

Trillion USD in investment required under the 2DS.

Note: Numbers for total invetments are more uncertain than additional, and do not include baselines investment in buildings

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Power generation: annual investments 2DS

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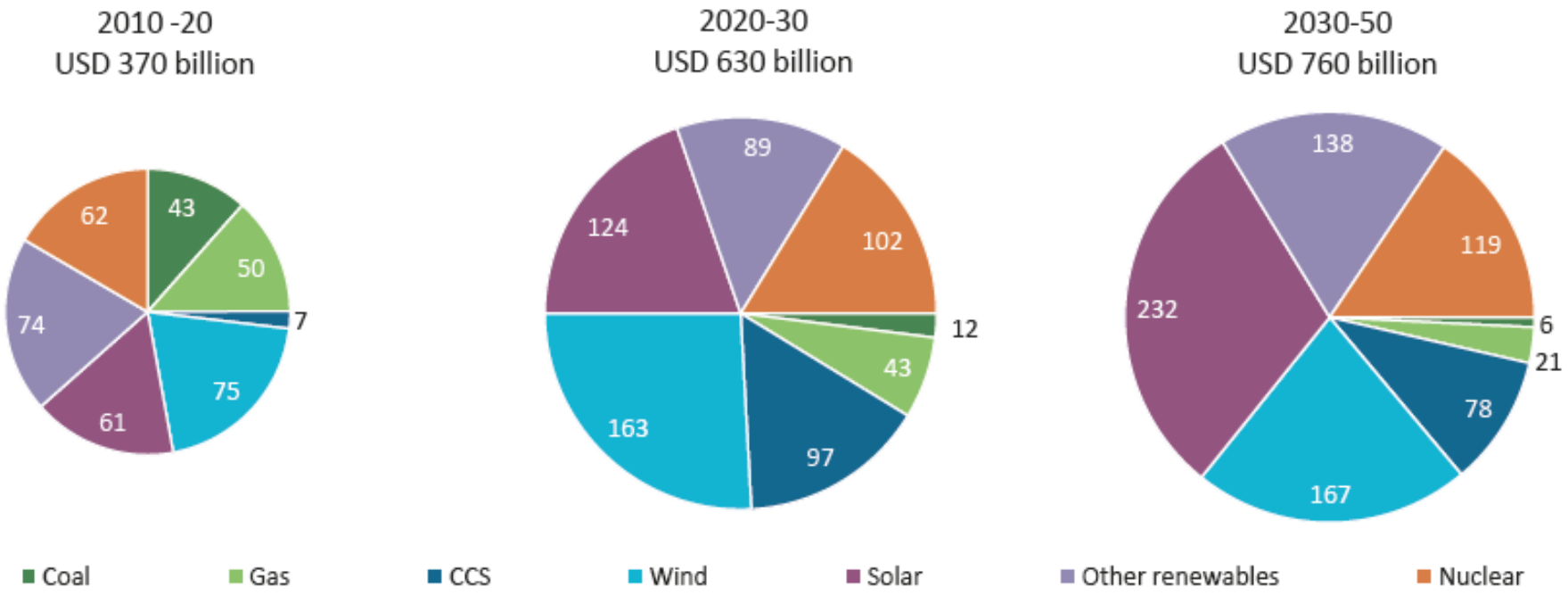

Investment needs grow; wind, solar, CCS and nuclear dominate in power sector

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Investment needs shift over time

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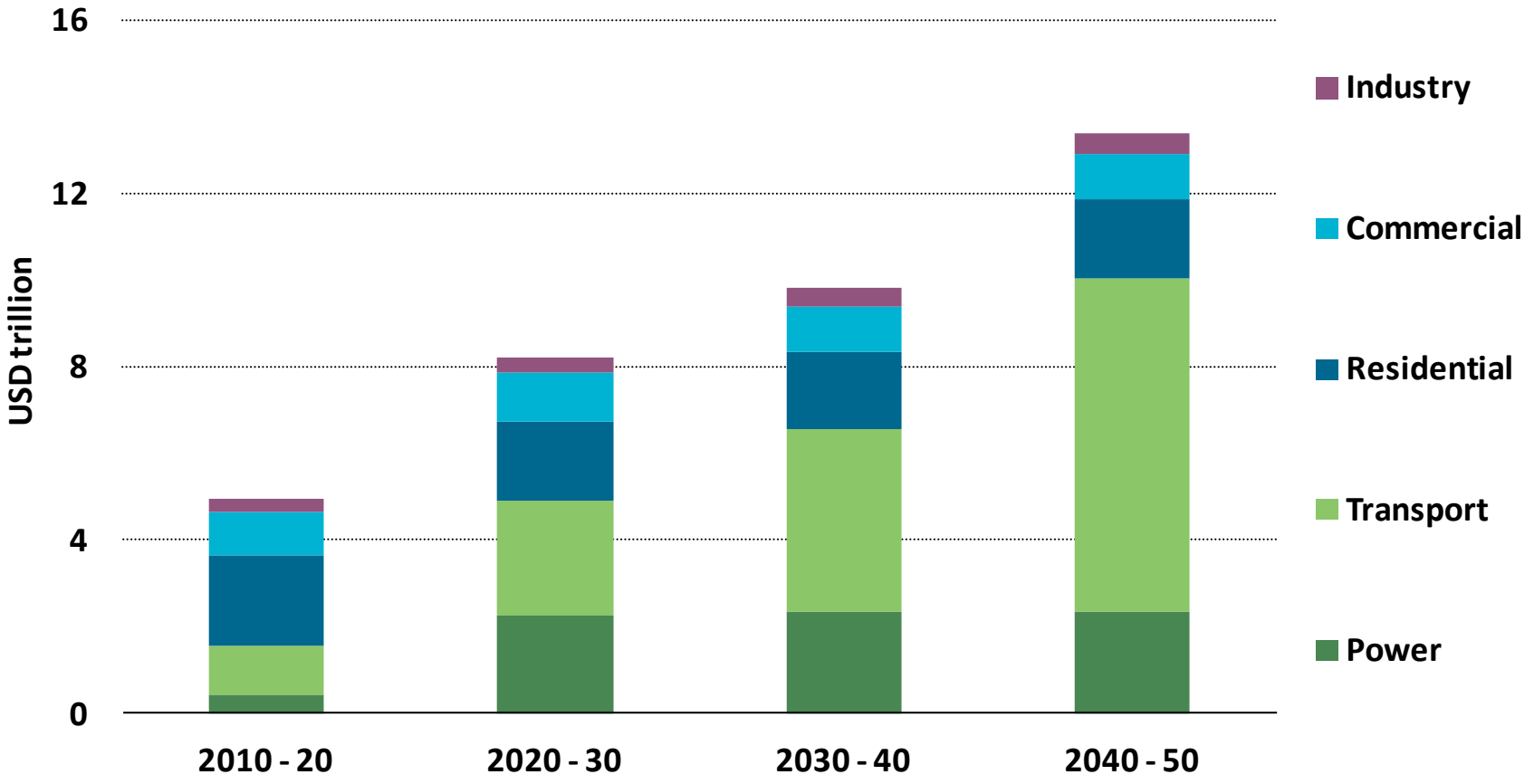

To 2020, investments in buildings sector dominates in all regions, highlighting importance of energy efficiency

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Infrastructure needs upgrading

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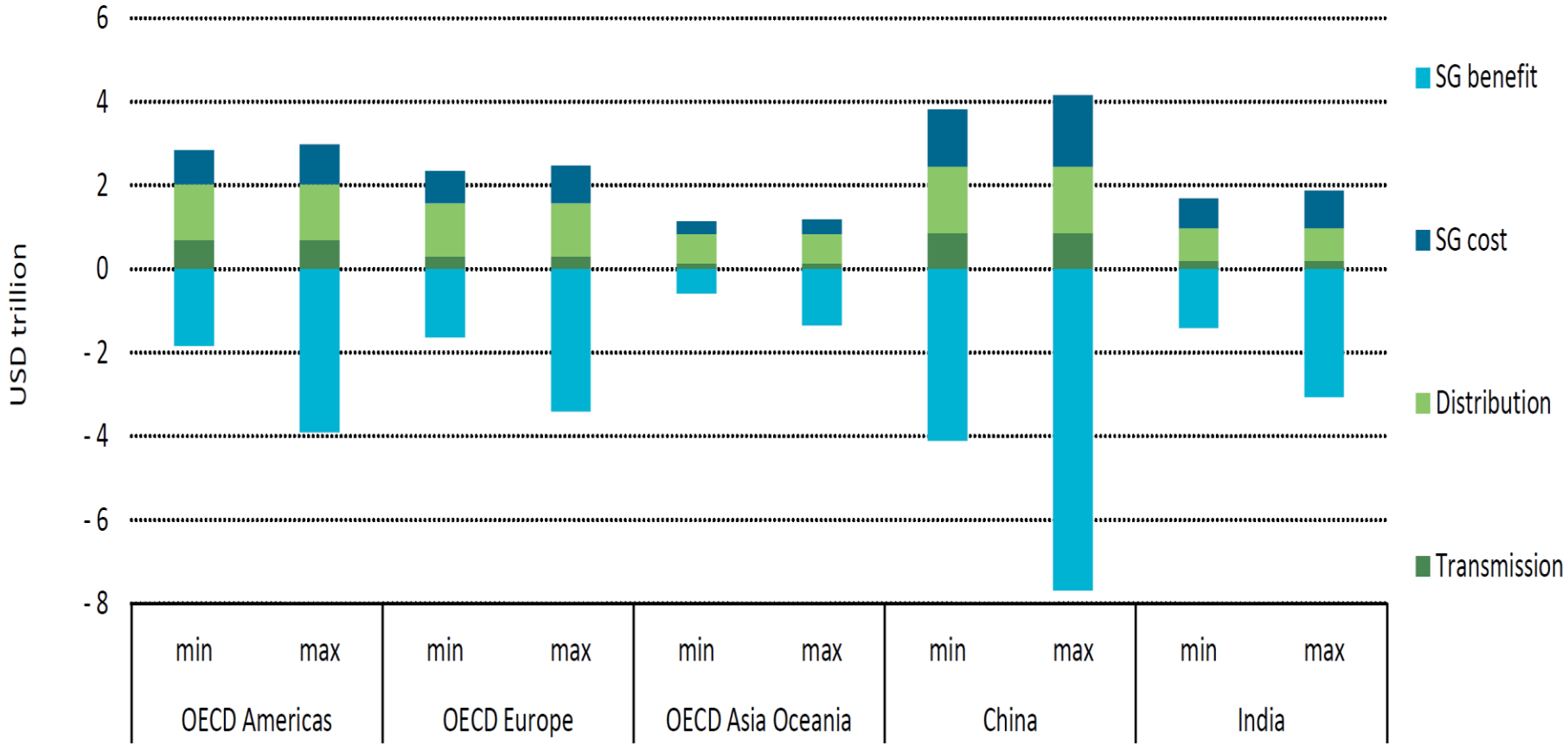

Total benefits of smart-grid investments outweigh costs – but direct benefits of investment may be found in other sectors.

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Size and time matter

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- Low carbon technologies often capital intensive
- Low carbon technologies come at very different sizes

5 kW solar PV rooftop	500 MW wind off-shore	10 GW large hydro
€10 k	€1.75 bl	€15-20 bl

- Lead times for project construction also differ widely
- Investors range form home owners to very large consortia.

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Cost of capital is critical

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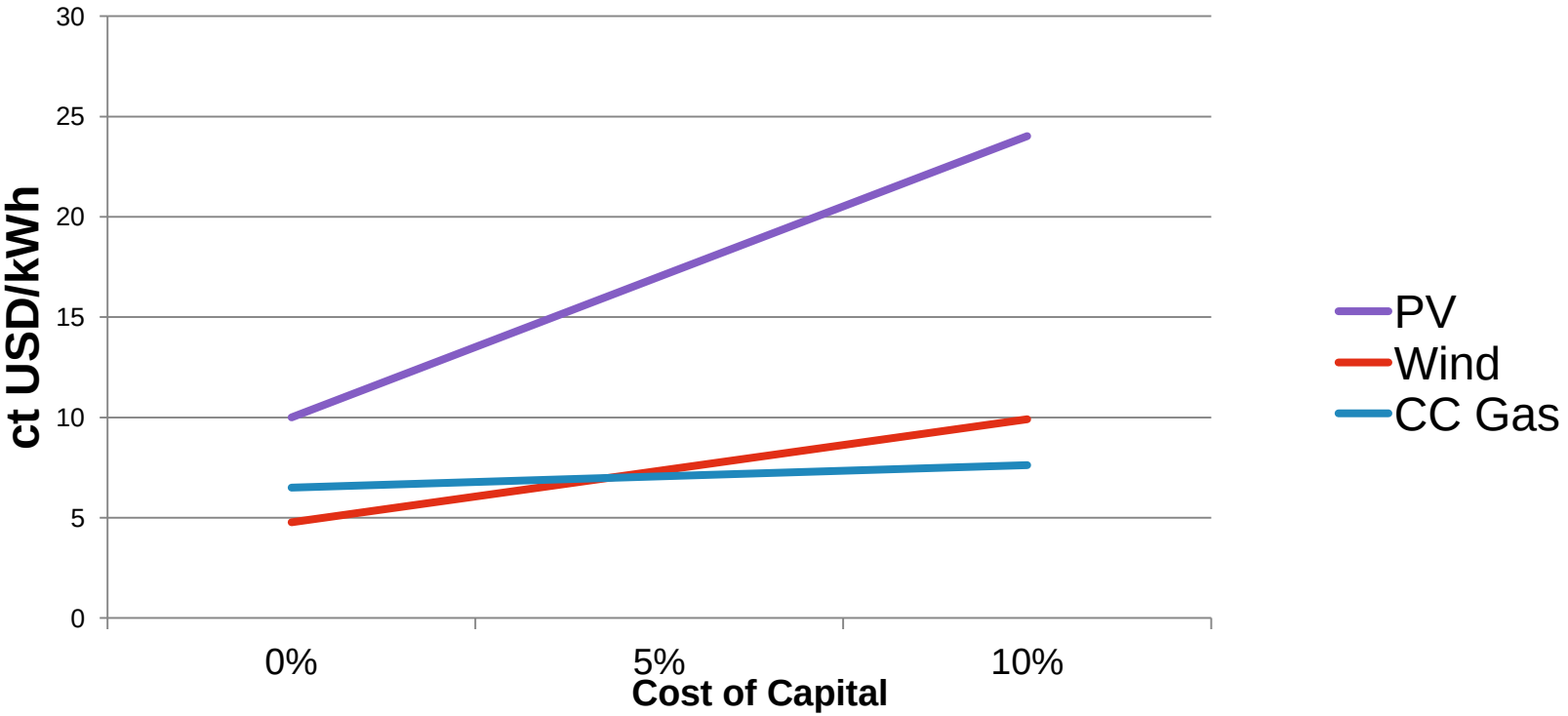

Note: Simplified calculation for illustration. Assumptions:
Gas: 800 USD/kW; annual O&M: 2.5% of capex; FLH: 5000 h/y; 8 USD/Mbtu; 50% thermal efficiency
Wind: 2200 USD/kW; 2.5% O&M; 3000 h/y
PV: 3000 USD/kW; 1% O&M, 1500 h/y

The financing regime is key for RE economics

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Clean energy investment pays off

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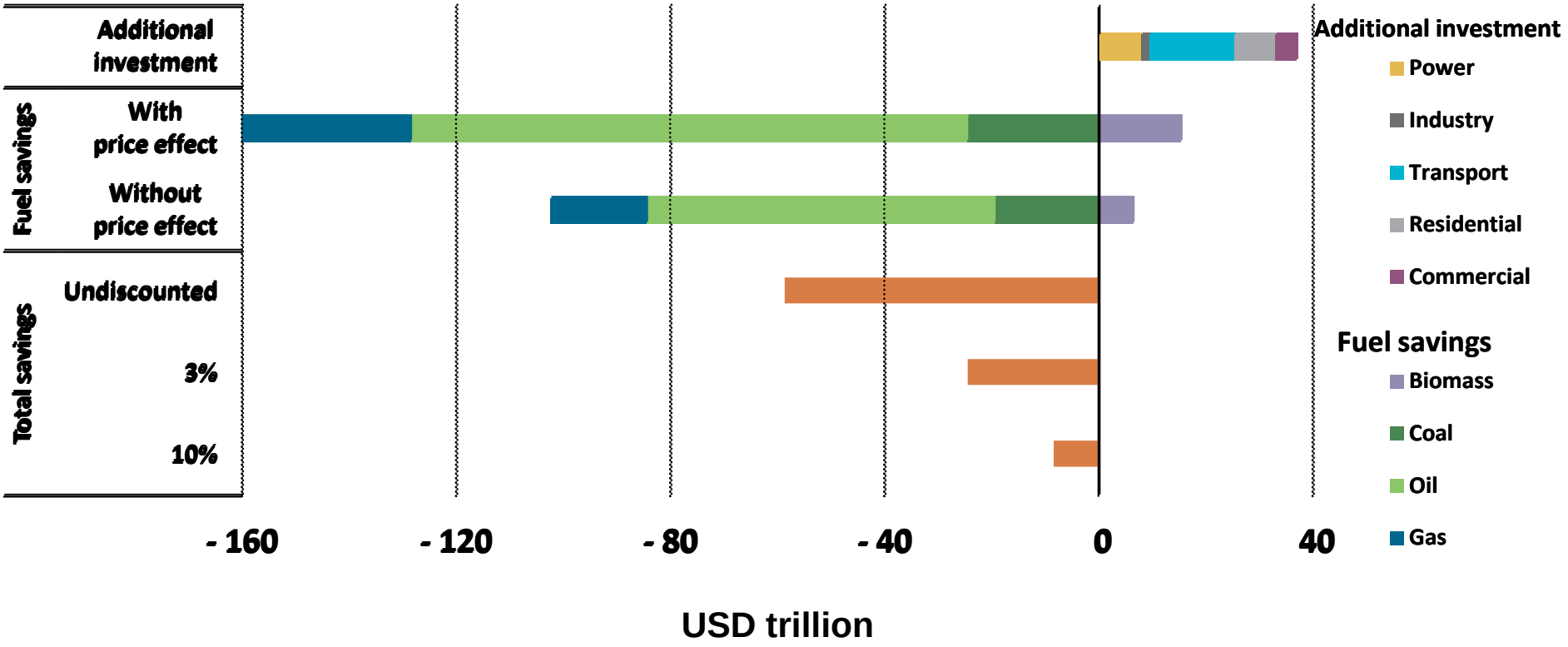

Every additional dollar invested in clean energy can generate 3 dollars in return.

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Clouds on the horizon?

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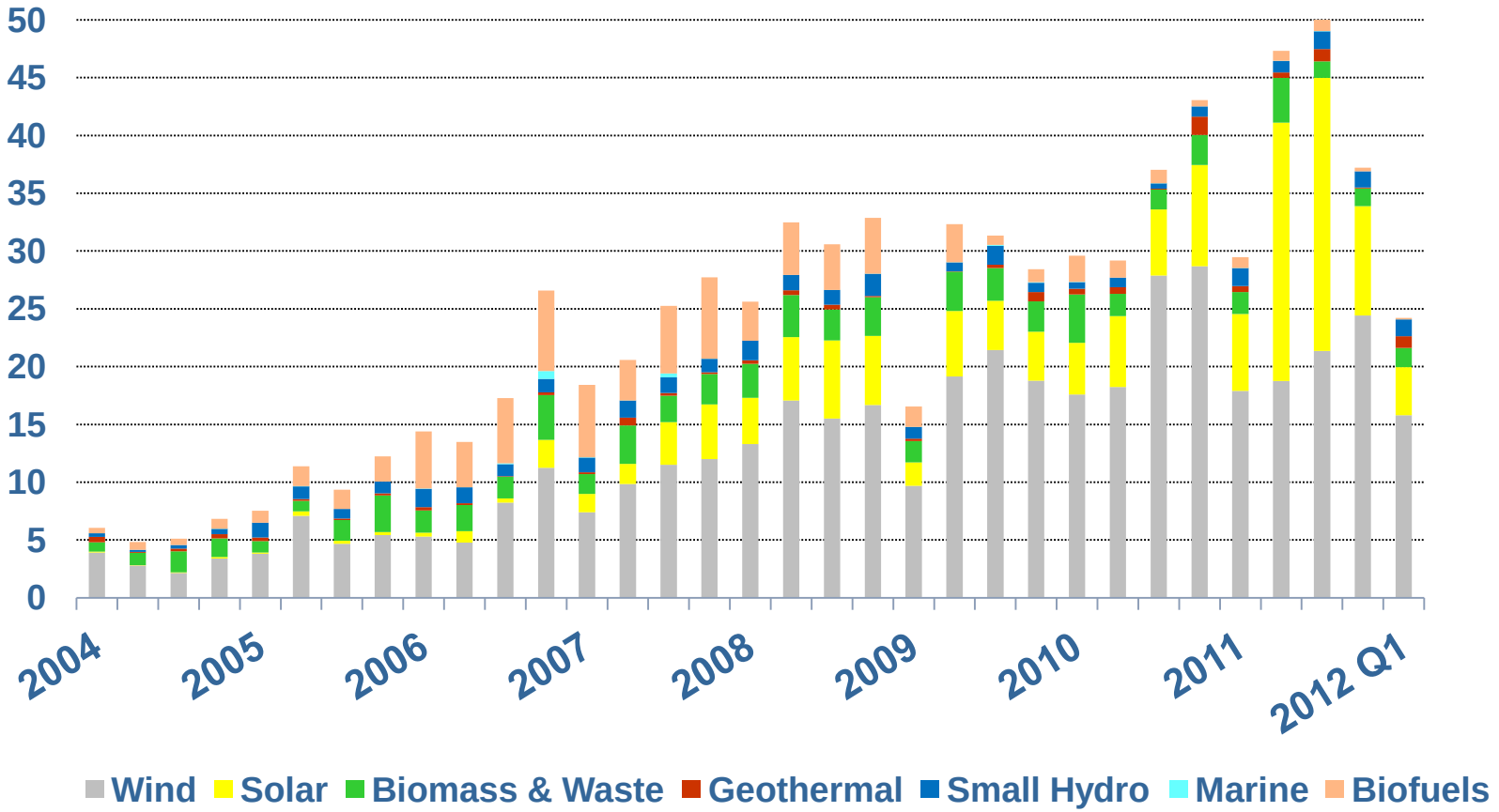

Source:
BNEF, 2012

Signs of slowing investment, but numbers should be interpreted with caution

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To take home...

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- Investment in low carbon technologies need to double current levels by 2020, reaching USD 500 bn annually
- Balance between ensuring investors confidence and controlling total policy costs
- Low carbon technologies often capital intensive
- Risk profile different compared to conventional technologies

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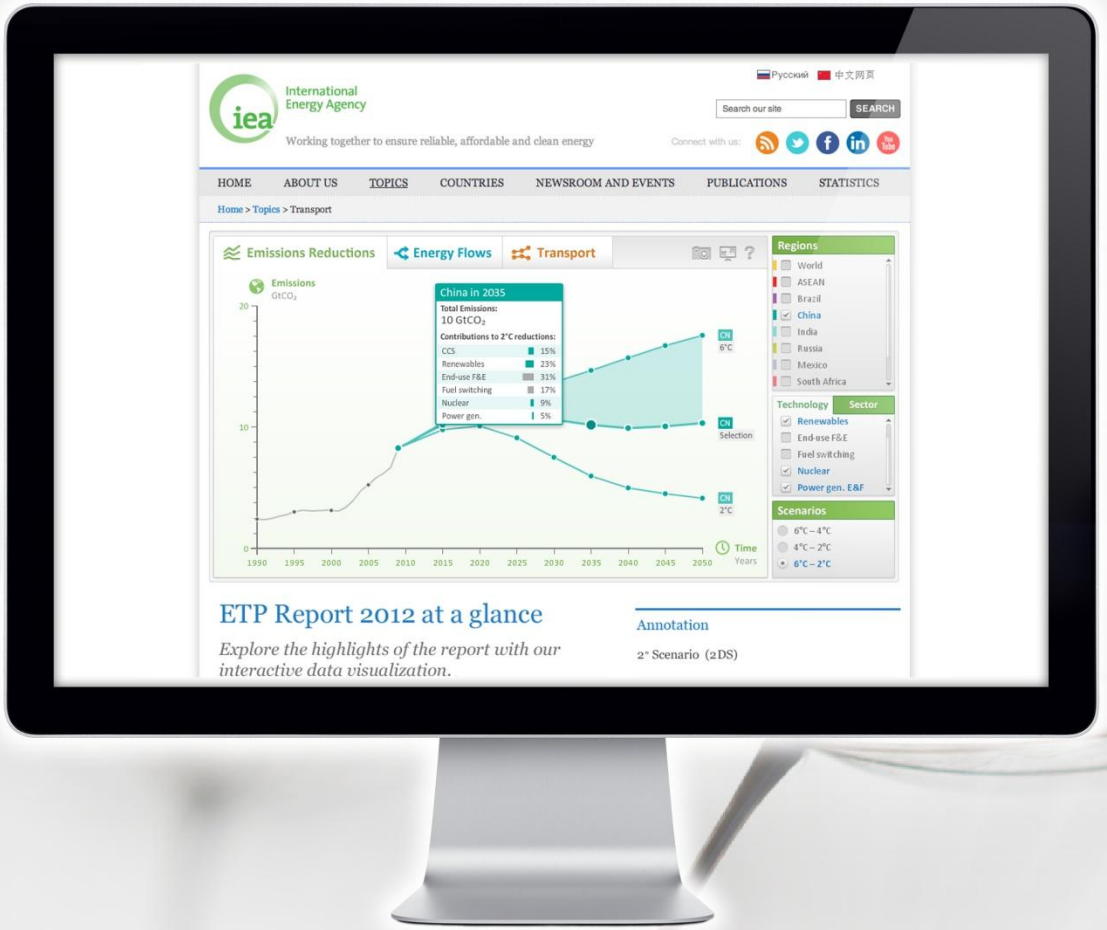
Explore the data behind *ETP*



www.iea.org/etp