



International  
Energy Agency

Secure • Sustainable • Together

# Implications of the Paris Agreement for the energy sector and the IEA

**UNFCCC SB44 Bonn**  
**19 May 2016**

***Takashi Hattori***  
*Head, Environment and Climate Change Unit*  
*International Energy Agency*

[www.iea.org](http://www.iea.org)

- **Introduction**

Takashi Hattori, IEA

- **Implications for modeling and technology**

Eric Masanet, IEA

- **Implications for energy policy**

Christina Hood, IEA

- **Energy industry perspective**

Mandy Rambharos, Eskom

- **Country perspective**

Kay Harrison, New Zealand

# IEA key messages to COP21



## Energy Matters

How COP21 can shift the energy sector onto a low-carbon path that supports economic growth and energy access

- 1 Take five key actions, led by energy efficiency and renewables, to peak then reduce global energy emissions
- 2 Use the Paris agreement to drive short-term actions consistent with long-term emission goals
- 3 Accelerate energy technology innovation to make decarbonisation easier and even more affordable
- 4 Enhance energy security by making the energy sector more resilient to climate change impacts

## To shift the energy sector onto a low-carbon path that supports economic growth & energy access:

1. Take five key actions, led by energy efficiency & renewables, to peak then reduce global energy emissions
2. Use the Paris Agreement to drive short-term actions consistent with long-term emission goals
3. Accelerate energy technology innovation to make decarbonisation easier and even more affordable
4. Enhance energy security by making the energy sector more resilient to climate change impacts



Making the energy sector more resilient to climate change



Complementary measures for decarbonisation  
Looking beyond pricing and regulation to motivate private businesses and state-owned enterprises



Track the energy transition  
Where we are, how we got here, and where we need to be

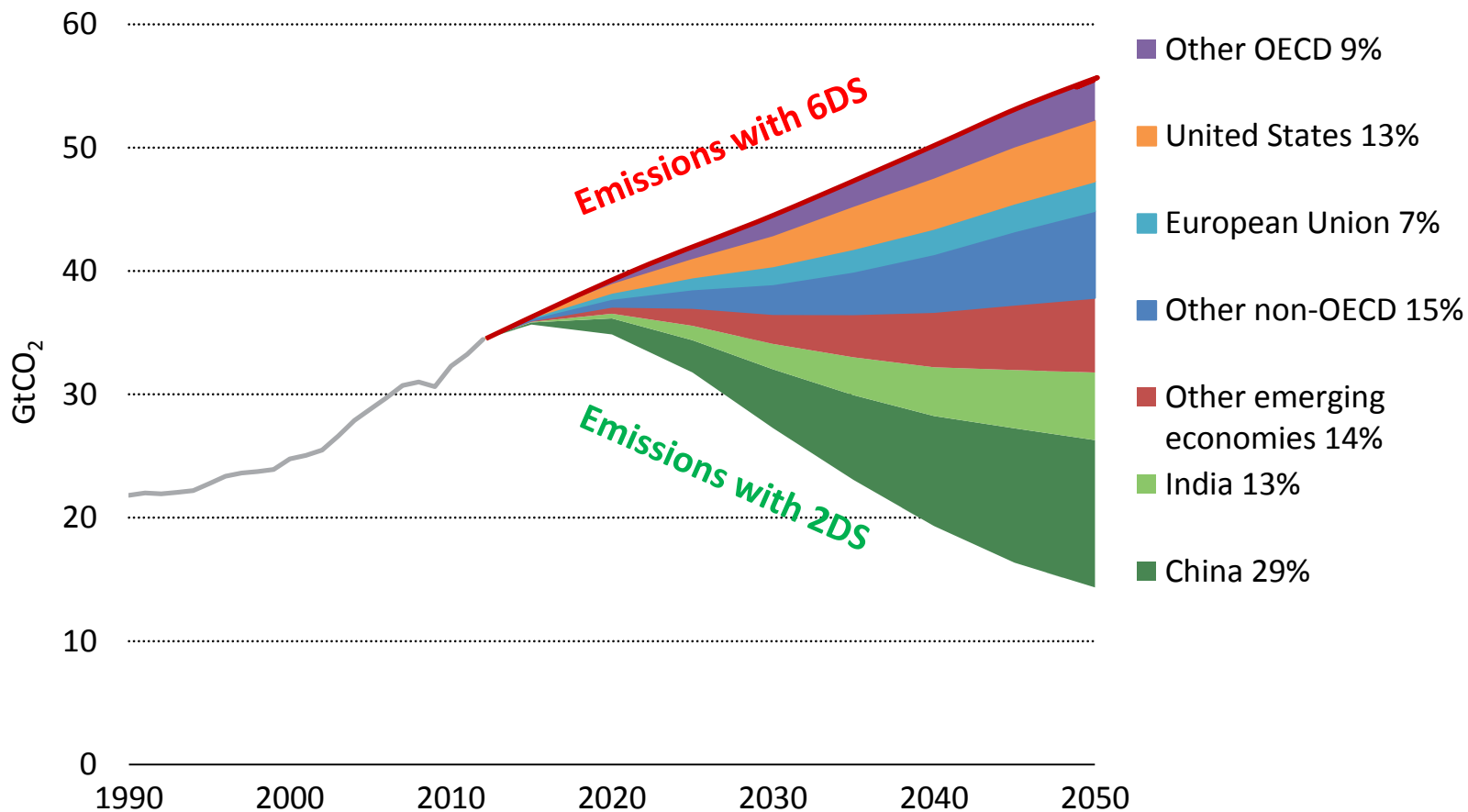
# Implications for the energy sector

- **The Agreement sends a clear signal** to government, business and investors and it will speed up the energy sector transformation by **accelerating investments in cleaner technologies and energy efficiency**.
- **Ambitious long-term targets imply that all low carbon technologies must be considered**, including CCS/BECCS.
- **Achieving 1.5 C is significantly more effort than 2 C.**

# Low-emissions development is key

[www.iea.org](http://www.iea.org)

Source: Energy Technology Perspectives 2015





■ Where do we need to go?

■ Where are we today?

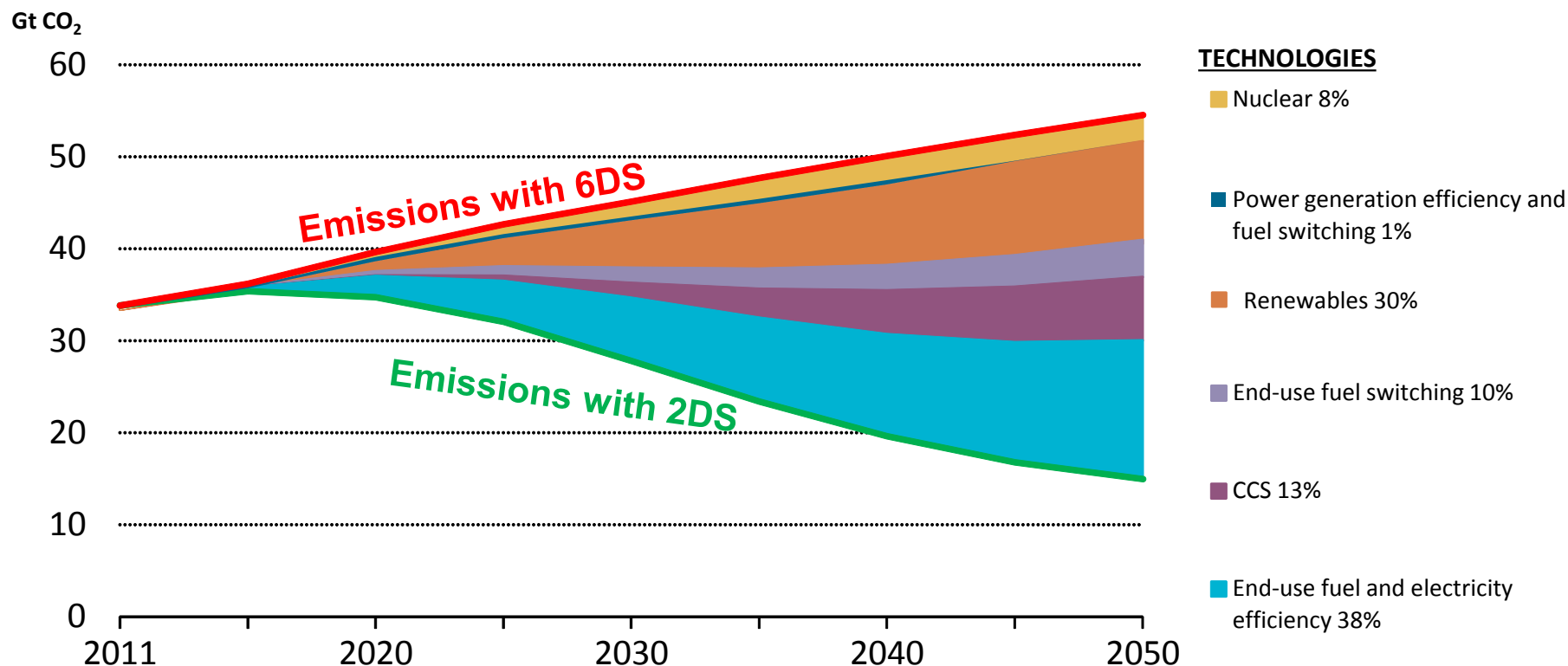
■ How do we get there?



# COP21 provided strong momentum for clean technology innovation

www.iea.org

## Contribution of technology area to global cumulative CO<sub>2</sub> reductions



Energy innovation has already yielded solutions, but ETP needs support and guidance to deliver on its promises 2015

# But action needs to be drastically accelerated - building on recent progress

www.iea.org

## Technology/Status against 2DS targets in 2025

## Recent trends

Electric Vehicles	↗
Nuclear Power	↗
Renewable power	↗
Coal-fired power	~
Carbon Capture and Storage	↗
Biofuels	↗
Transport	~
Industry	~
Buildings	↗
Appliances and lighting	↗
Energy Storage	↗

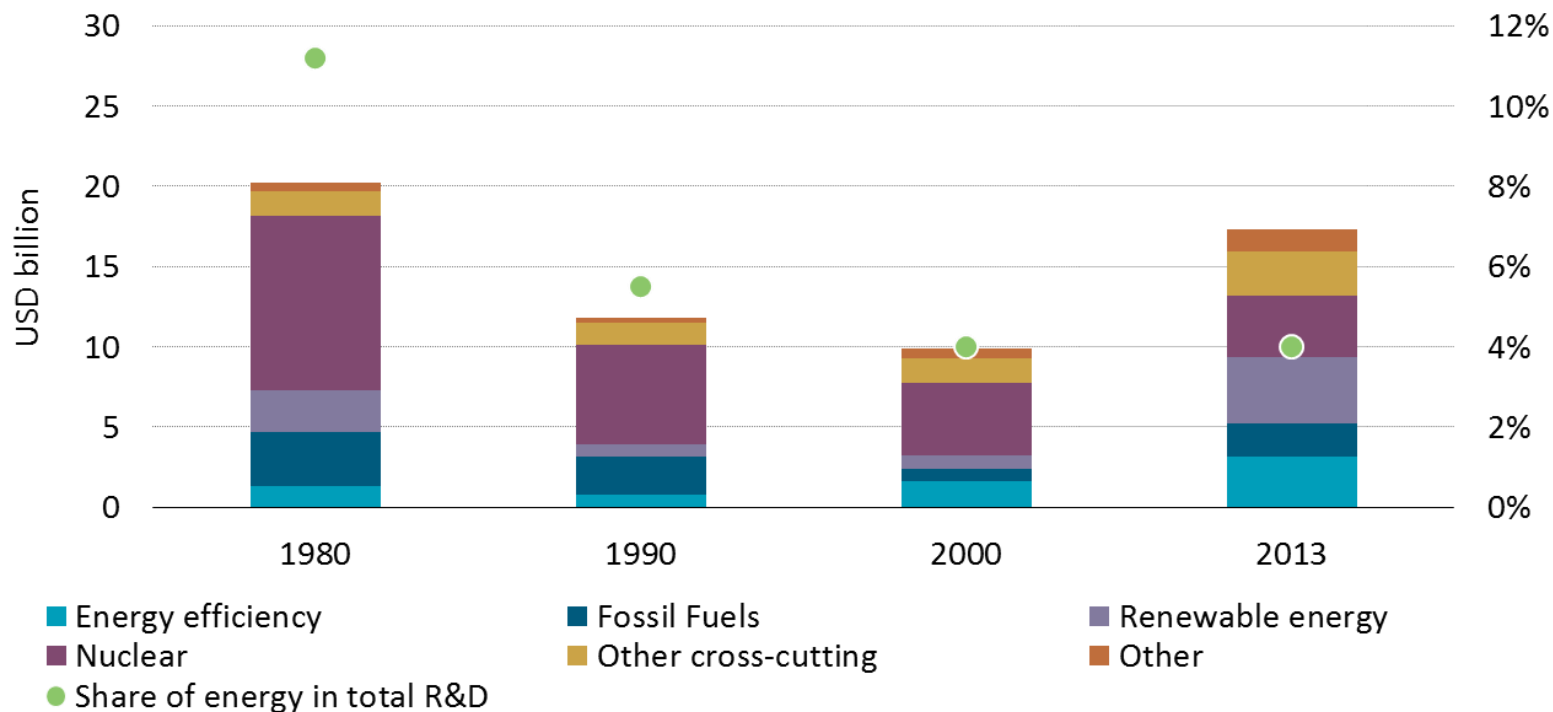
Clean energy deployment falls short of the 2DS opportunity ETP  
2015



# Energy RD&D funding now targets the right issues, but is not enough

www.iea.org

IEA government Energy RD&D expenditure

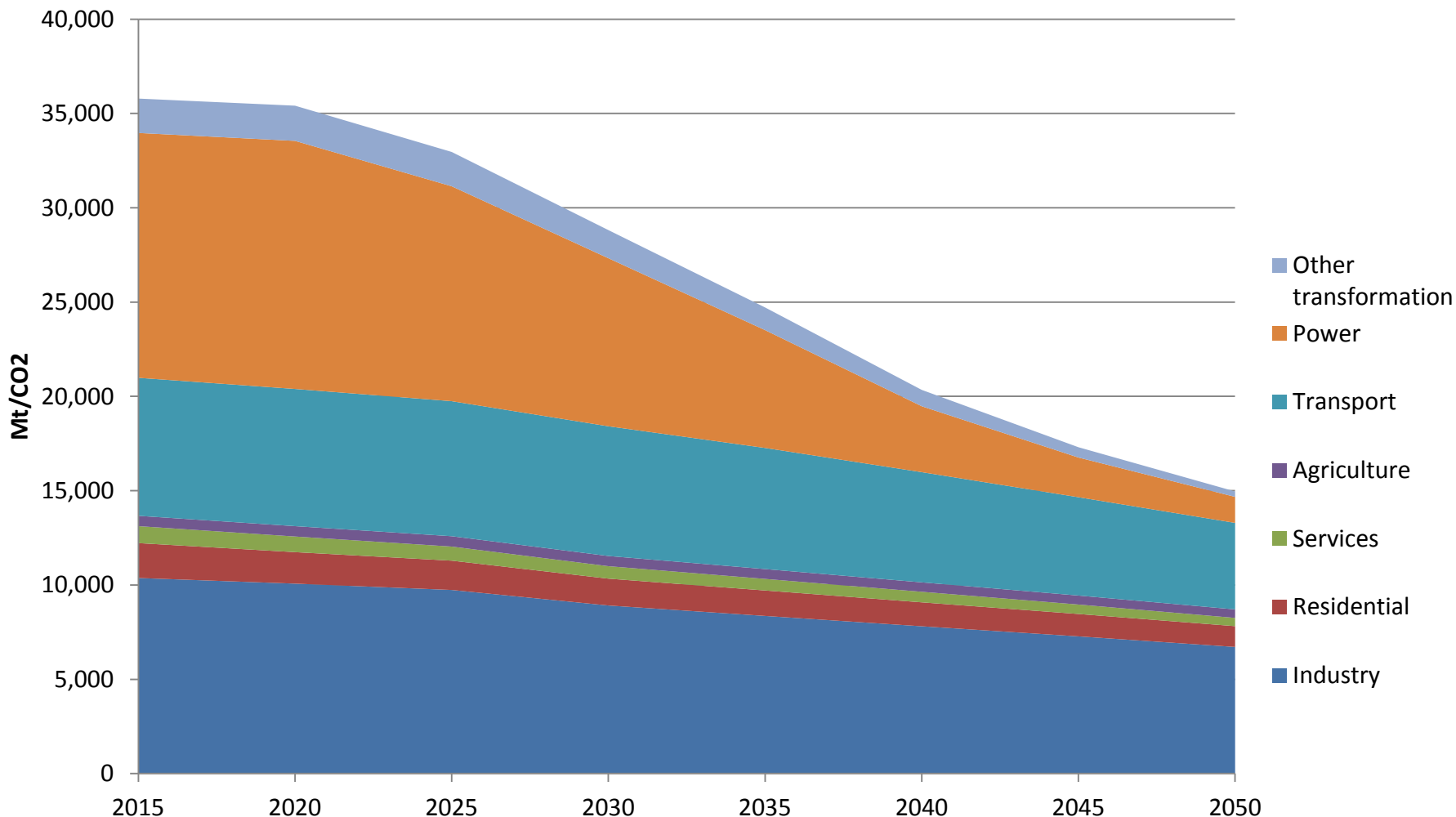


Energy RD&D spending should reflect the importance of energy technology in meeting climate objectives

ETP  
2015

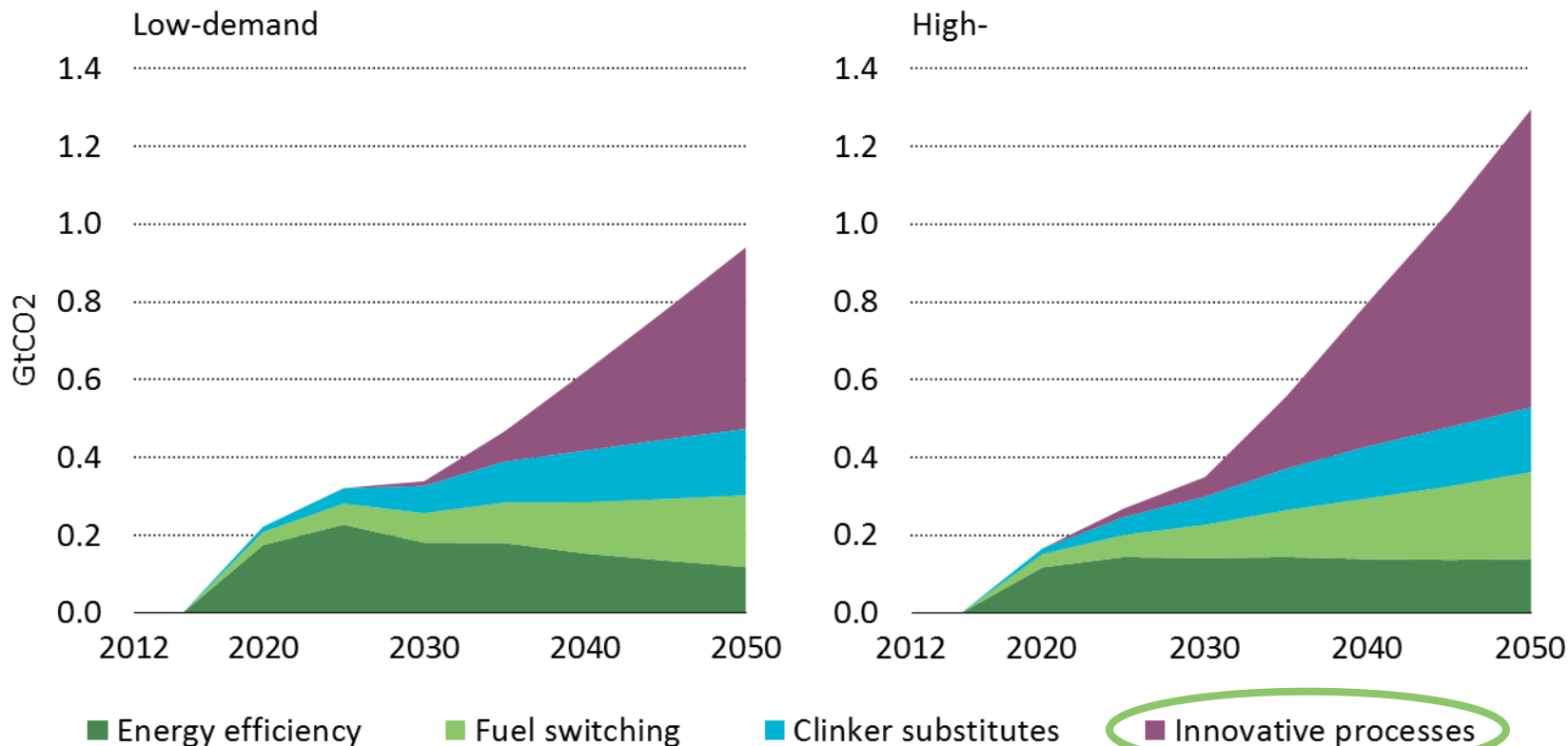
# From 2 . . . to 'well below 2'

## Direct CO2 Emissions in the 2DS



# Understanding and fostering innovation is critical

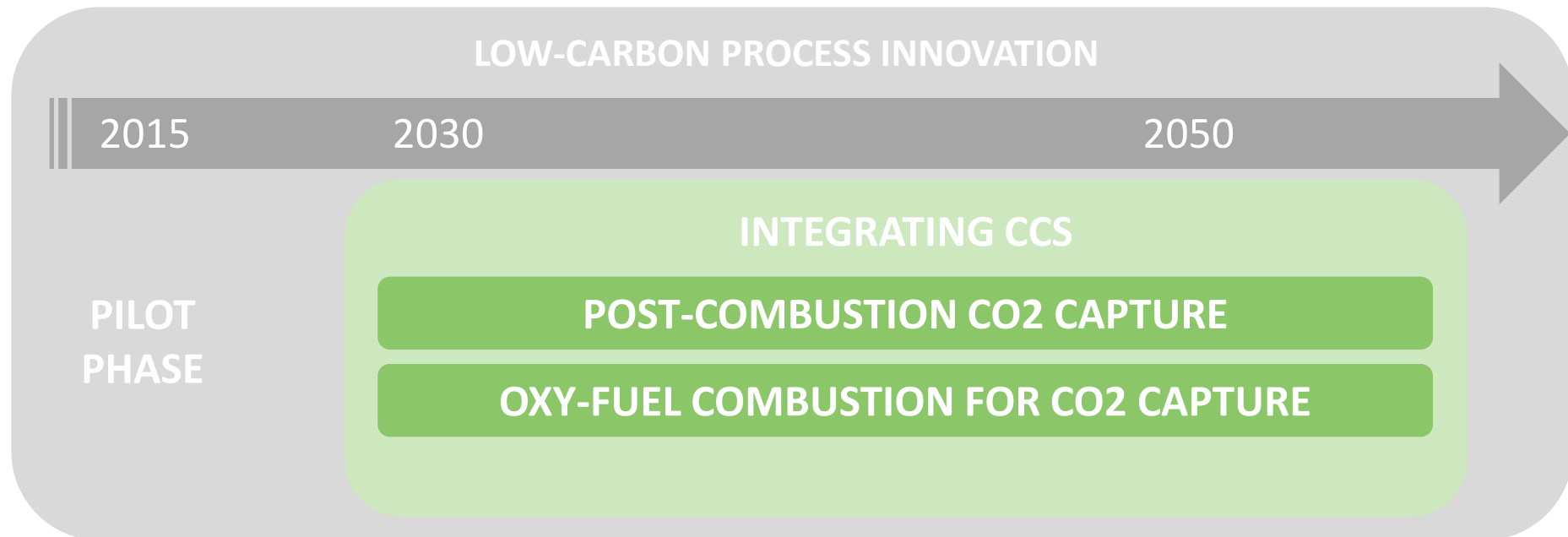
## Cement direct CO<sub>2</sub> emissions reductions 6DS vs 2DS by technology



- Between 50% and 60% of required CO<sub>2</sub> emissions reduction in the cement sector in 2DS in 2050 relies on deployment of innovative processes.

# Cement main innovative low-carbon options

www.iea.org



**Note:** This slide is not intended to provide an exhaustive list. Sketch is not at scale and time milestones are just illustrative.

# IEA Technology Roadmaps

## Mapping where we need to go...

www.iea.org

2009

2010

2011

2012

2013

2014

2015



2016

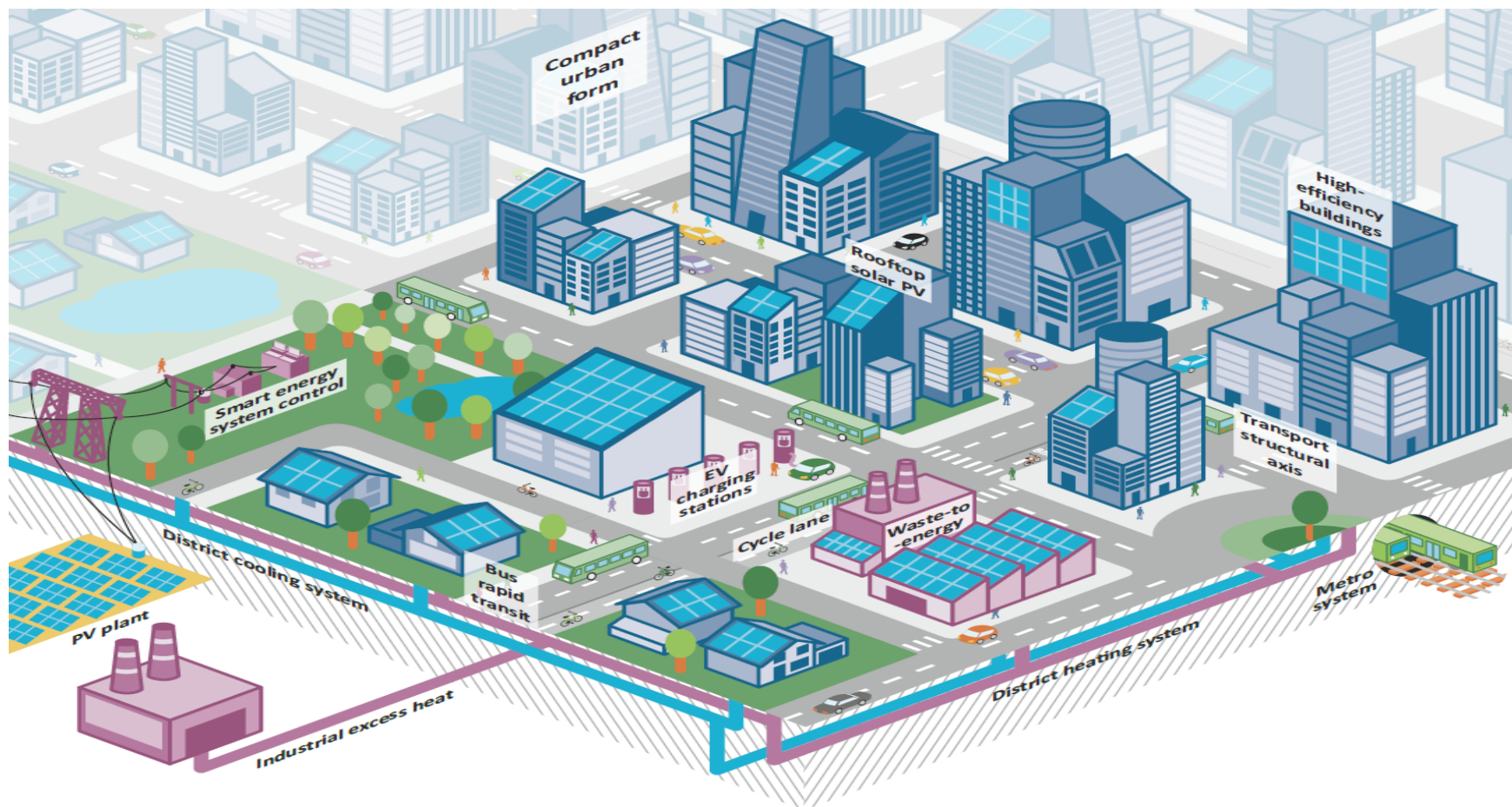
**Smart Grids  
Update**

<https://www.iea.org/roadmaps/>

Low-Carbon Technology Roadmaps



# The critical role of cities and urban-scale decisions

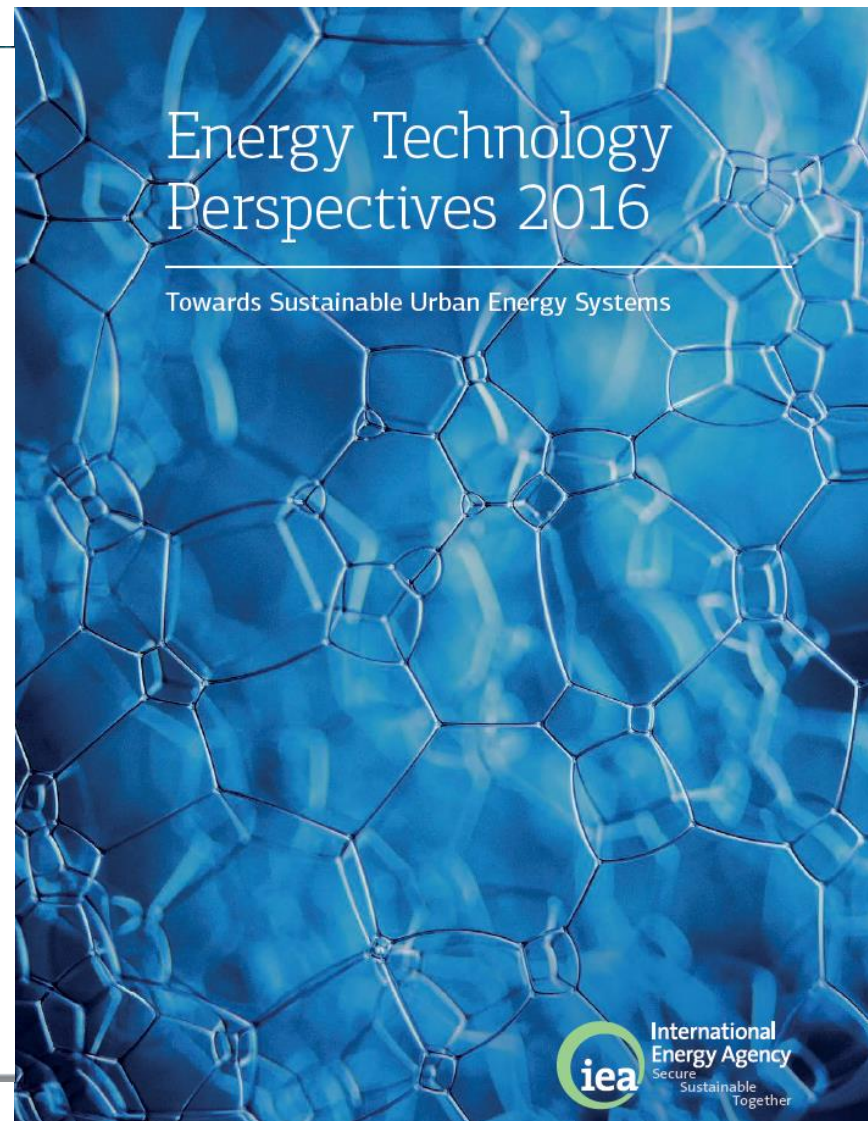


*Urban forms can lock-in the energy system of cities in either inefficient or sustainable energy use patterns for decades.*

# ETP 2016: Towards Sustainable Urban Energy Systems

[www.iea.org](http://www.iea.org)

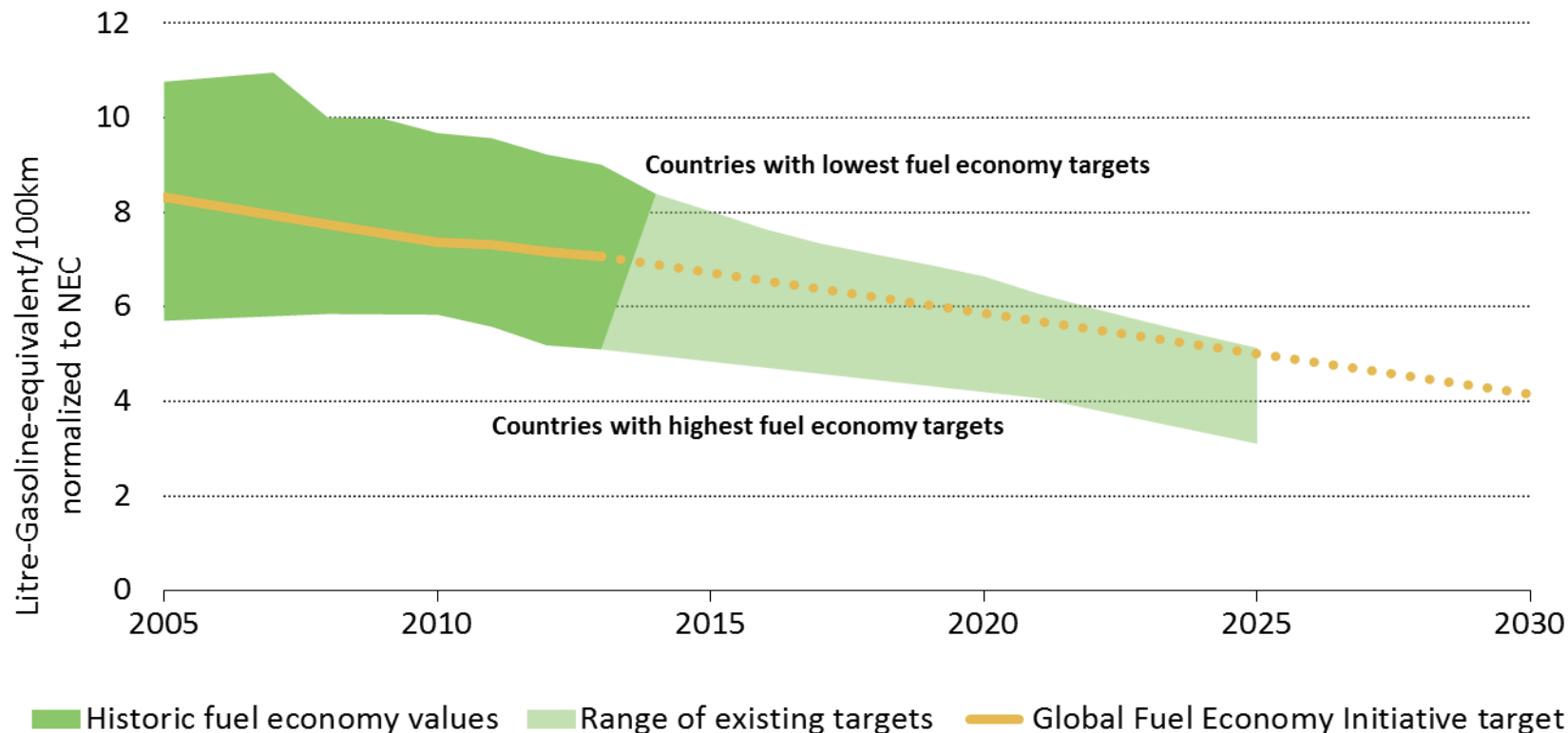
- Part 1: Setting the Scene
  - Global Outlook
  - Tracking Clean Energy Progress
- Part 2: Towards Sustainable Urban Energy Systems
  - The Urban Energy Challenge
  - Energy-efficient Buildings in the Urban Environment
  - Sustainable Urban Transport
  - Energy Supply in Cities
  - Policy and Finance Mechanisms for Sustainable Urban Energy Systems
  - Mexico's Sustainable Energy Transition: What Role for Cities?



# Energy efficient technologies are constantly improving

www.iea.org

Average new Light-duty vehicle fuel economy evolution by country, 2005 to 2013

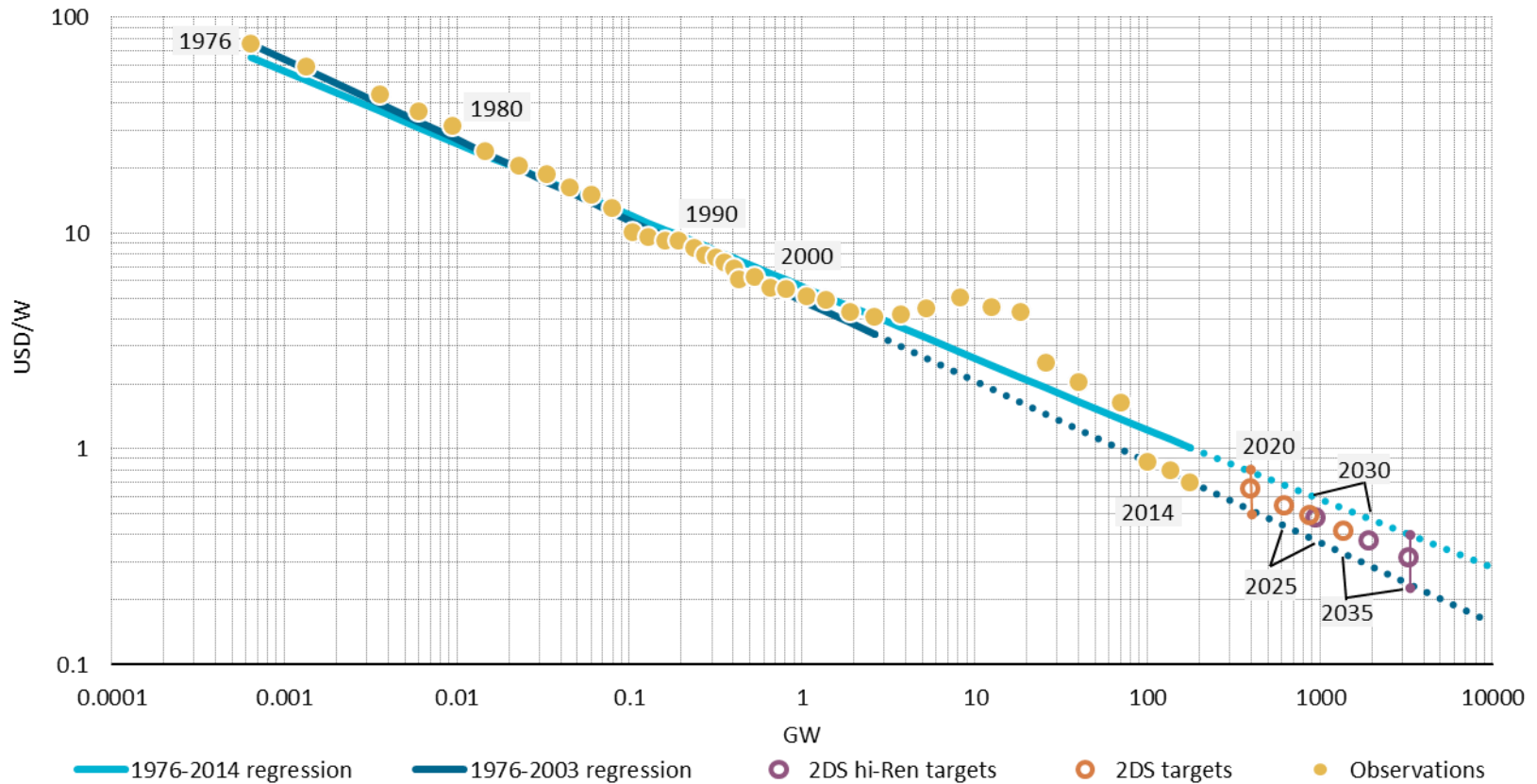


***Fuel economy is improving as policy increasingly drives the deployment of more efficient vehicle technologies***



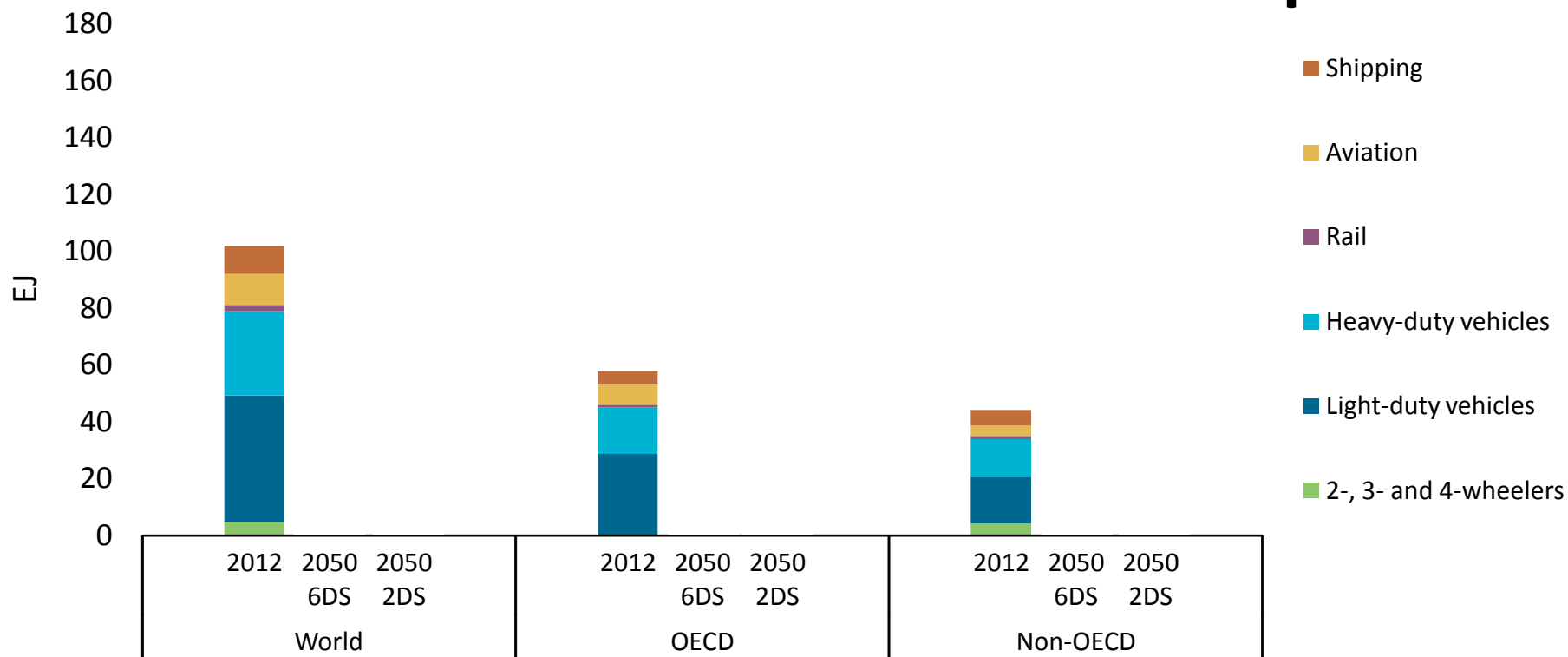
# Innovation already plays a role:

## Solar PV



*Nearly 40 years of data demonstrates a determined effort to reduce Solar PV Module Costs*

## Avoid, shift and improve strategies in transport...

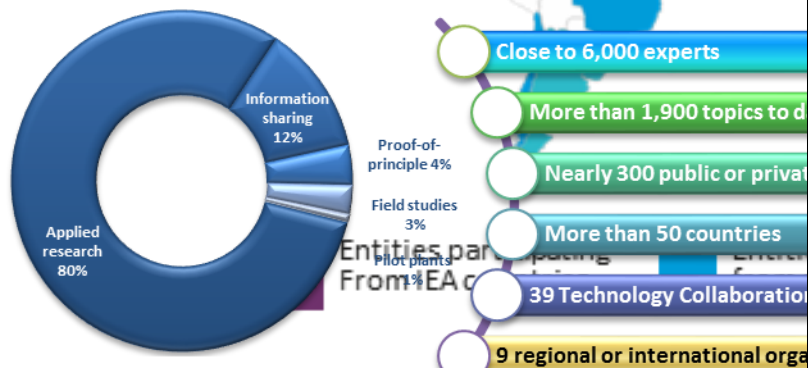


*...help to keep energy use in 2050 in the 2DS at today's level.*

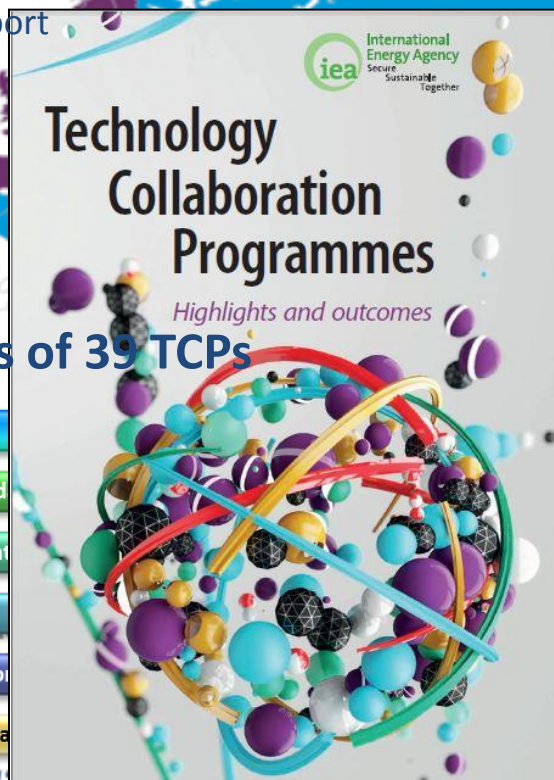


# Technology Collaboration Programmes: Highlights and outcomes

- **Broad membership**
  - Government, industry and research
- **Wide range of activities**
  - Energy efficiency
    - Buildings, electricity, industry, transport
  - Fossil fuels
  - Fusion power
  - Renewable energy and hydrogen
  - Cross-cutting
    - Technology transfer and modelling
- **Most significant recent outcomes of 39 TCPs**



- Close to 6,000 experts
- More than 1,900 topics to discuss
- Nearly 300 public or private entities participating
- More than 50 countries
- 39 Technology Collaboration Programmes
- 9 regional or international organisations



Watch the introductory video  
<http://bit.ly/TCPvideo>



The above map is without prejudice to the status of territories and to the sovereignty of sovereign states, as well as to the principle of territorial integrity of all states. Experts from countries shown above participate in activities of the Technology Collaboration Programmes.

- **COP21 momentum for accelerating clean energy technology investment, innovation, and deployment should be seized**
- **New challenges arise for long-term scenario modeling, data, and knowledge generation in a “well below 2 degree” world**
- **Understanding the roles of innovation, technological change, spatial scales, and behavior are particularly acute challenges for the modeling/analysis community**
- **Higher levels of data gathering, knowledge sharing, and cross-sectoral technology collaborations are required**

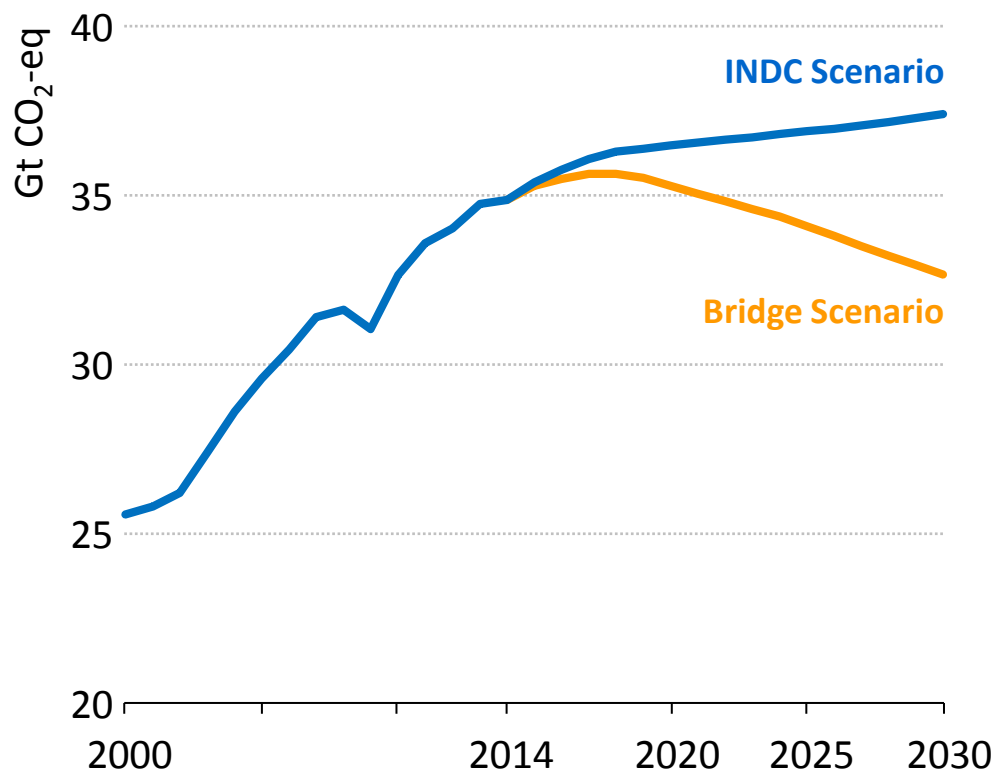
# Some post-Paris policy challenges

## ➤ Options to peak emissions rapidly

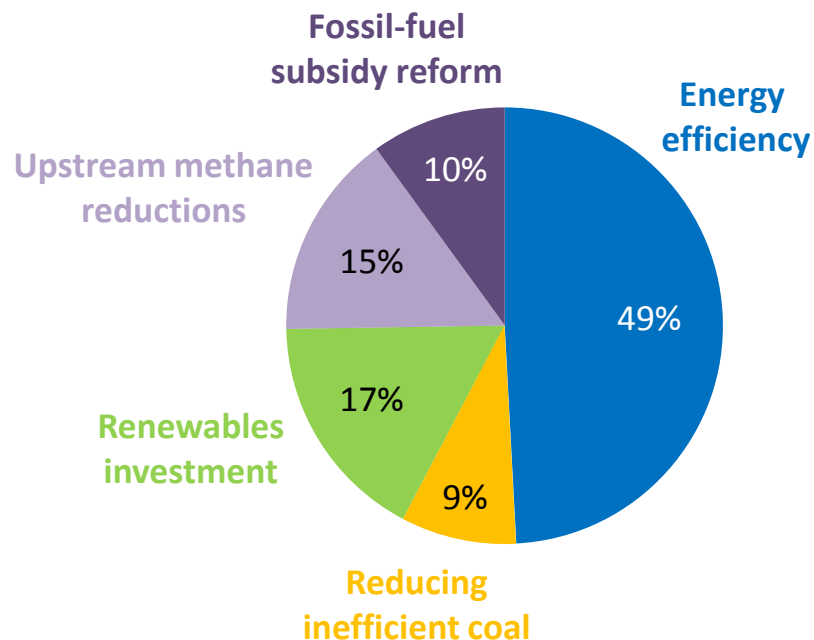
# *Peak in emissions:* IEA strategy to raise climate ambition

www.iea.org

Global energy-related GHG emissions



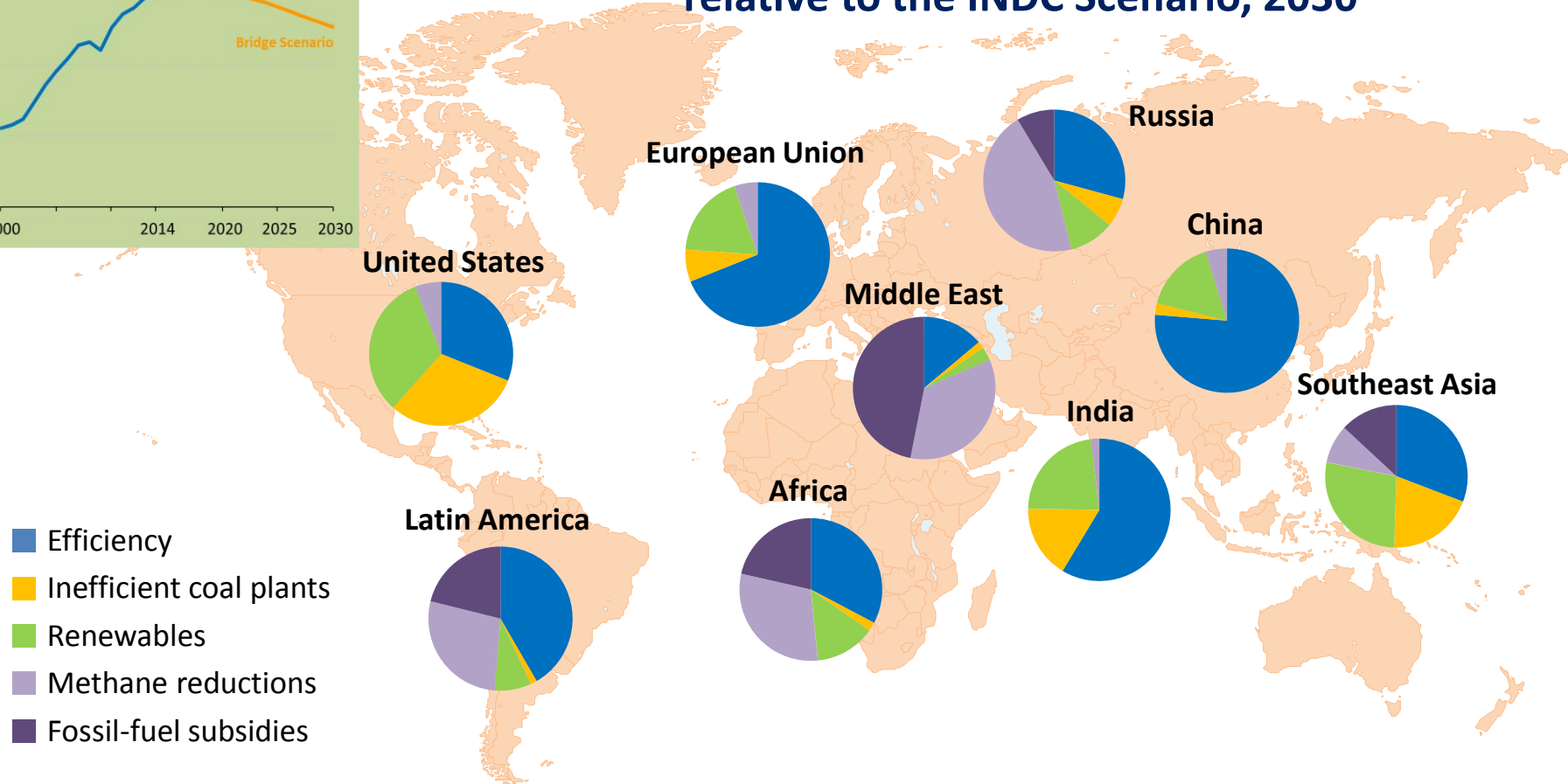
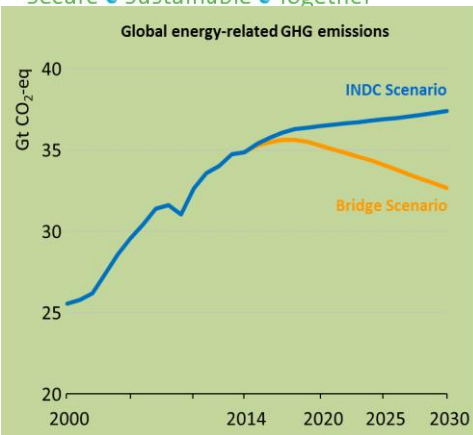
Savings by measure, 2030



**Five measures – shown in a “Bridge Scenario” – achieve a peak in emissions around 2020, using only proven technologies & without harming economic growth**

# Peaking emissions around 2020: Bridging strategy varies across regions

**GHG emissions reduction by measure in the Bridge Scenario, relative to the INDC Scenario, 2030**



***The measures in the Bridge Scenario apply flexibly across regions, with energy efficiency & renewables as key measures worldwide***



# Some post-Paris policy challenges

- **Options to peak emissions rapidly**
- **“Real-world” policy implementation**
  - **mobilising non-climate levers**

# WEO-2016 Special Report on Energy and Air Pollution

World  
Energy  
Outlook  
2016

- **The role of energy in air quality today – a global assessment by sector, region and pollutant**
- **Pollutants & their impacts – an Outlook to 2040 on the basis of existing and planned energy and environmental policies**
- **A Clean Air Scenario:**
  - *Short- and long-term solutions by region*
  - *The costs of solving air pollution*
  - *A quantification of the benefits*
- **A deep dive into cities – governance, technologies and policies**
- **From analysis to recommendations – an IEA view on how best to address energy-related air pollution**

# Some post-Paris policy challenges

- **Options to peak emissions rapidly**
- **“Real-world” policy implementation**
  - **mobilising non-climate levers**
  - **suboptimal carbon prices**

# “Un-locking”: Policies exist

Unlocking action	Policy Options		
	Direct regulations	Supply/demand balances	Price
<b>Retirement of coal/gas plant</b>	<ul style="list-style-type: none"> <li>- ownership decision</li> <li>- lifetime limits</li> <li>- phase-out</li> </ul>	<ul style="list-style-type: none"> <li>- fleet-wide emissions performance standard</li> <li>- Renewables regulation</li> <li>- demand reductions</li> </ul>	<ul style="list-style-type: none"> <li>- fuel tax changes</li> <li>- carbon pricing</li> <li>- preferential renewables tariffs</li> </ul>
<b>Change dispatch of existing power plant fleet</b>	<ul style="list-style-type: none"> <li>- “clean-first” dispatch</li> <li>- priority dispatch of renewables</li> </ul>	<ul style="list-style-type: none"> <li>- fleet-wide emissions performance standard</li> </ul>	<ul style="list-style-type: none"> <li>- fuel tax changes</li> <li>- carbon pricing</li> <li>- removal of fossil fuel subsidies</li> </ul>
<b>Efficiency retrofit of coal plant</b>	<ul style="list-style-type: none"> <li>- targets for plant retrofit rates</li> </ul>	<ul style="list-style-type: none"> <li>- fleet-wide emissions performance standard</li> </ul>	<ul style="list-style-type: none"> <li>- carbon pricing</li> <li>- removal of fossil fuel subsidies</li> </ul>
<b>Retrofit of coal or gas plant</b>	<ul style="list-style-type: none"> <li>- regulated lifetime limits</li> <li>- CCS mandates</li> </ul>	<ul style="list-style-type: none"> <li>- CCS trading schemes</li> <li>- fleet-wide emissions performance standard</li> </ul>	<ul style="list-style-type: none"> <li>- carbon pricing</li> <li>- preferential tariffs for CCS generation</li> </ul>

# Some post-Paris policy challenges

- **Options to peak emissions rapidly**
- **“Real-world” policy implementation**
  - **mobilising non-climate levers**
  - **suboptimal carbon prices**
  - **electricity market design**

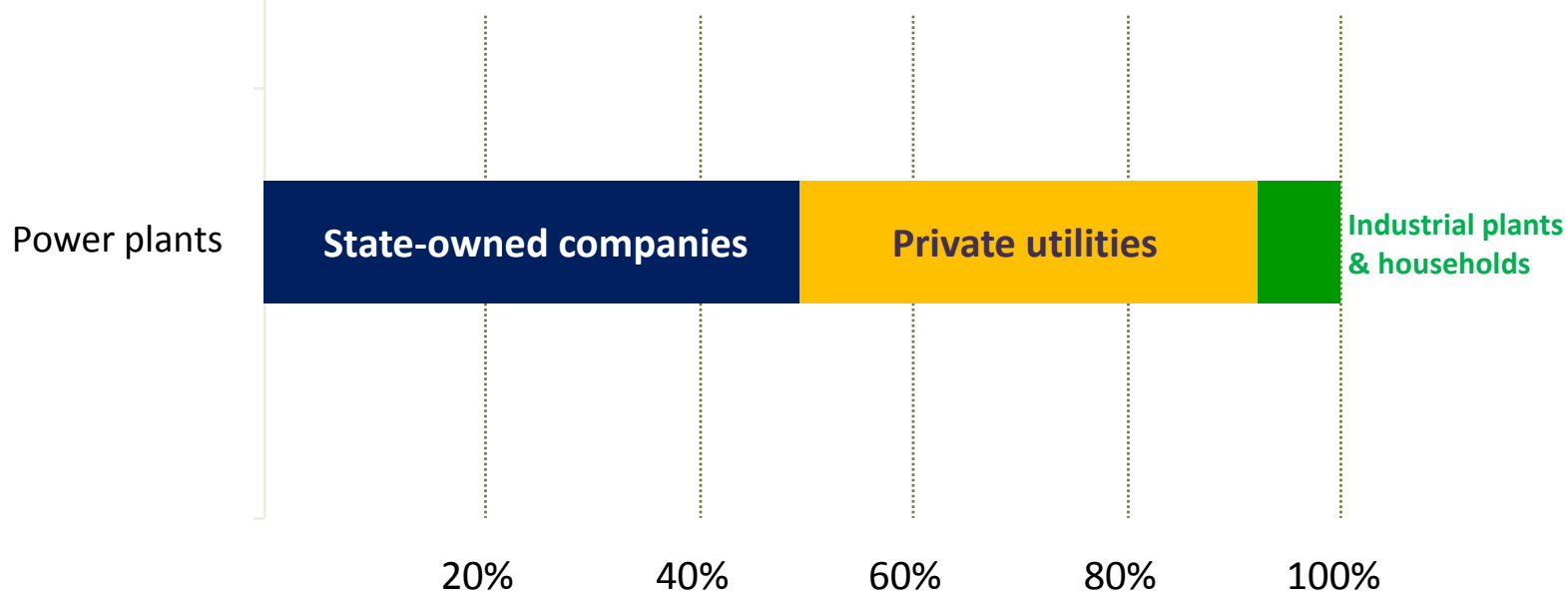


# Some post-Paris policy challenges

- **Options to peak emissions rapidly**
- **“Real-world” policy implementation**
  - **mobilising non-climate levers**
  - **suboptimal carbon prices**
  - **electricity market design**
  - **state-owned companies**

# States hold many of the cards

## Ownership of worldwide power generation capacity – about half with Governments

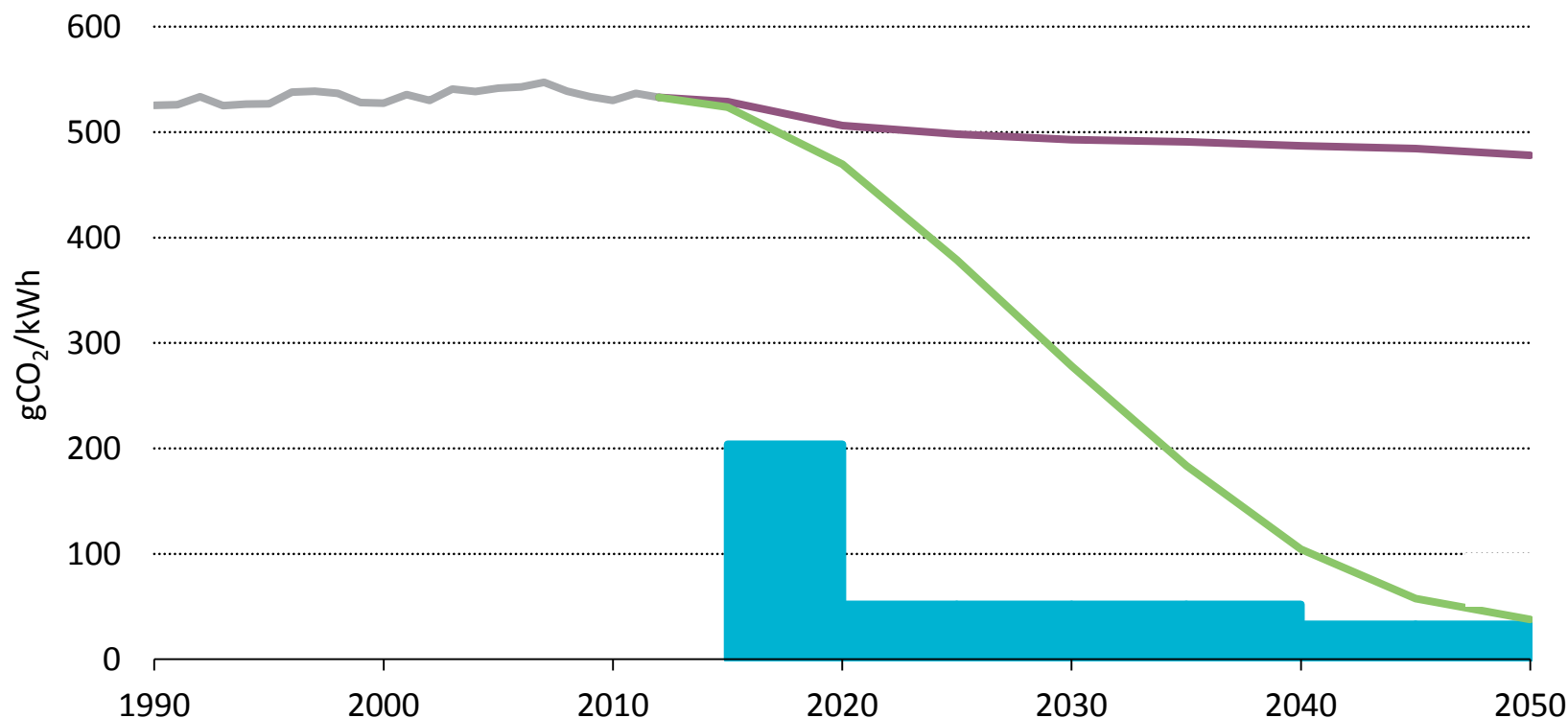


***Understanding and adjusting to the objectives, corporate culture & financing of state-owned enterprises are critical to promoting the energy transition***

# Some post-Paris policy challenges

- **Options to peak emissions rapidly**
- **“real-world” policy implementation**
  - **mobilising non-climate levers**
  - **suboptimal carbon prices**
  - **electricity market design**
  - **state-owned companies**
- **Tracking the transition**

## Global fleet average and new-build plants emissions intensity of power generation in IEA scenarios



**The right metrics can help drive the right action:  
looking beyond emissions**

# ***Energy, Climate Change and Environment: 2016 insights***

- **Policy and data compendium covering many of these topics**
- **Publication fall 2016**



# Thank you

## THE WAY FORWARD

FIVE KEY ACTIONS TO ACHIEVE A  
LOW-CARBON ENERGY SECTOR

40  
International  
Energy Agency  
1974-2014  
Action • Innovation • Progress

01 Seize the benefits of immediate action to bend the global emissions curve. To 2020, bridging 80% of the gap to an optimal 2°C path with no extra GDP cost.



03 Reshape investment and innovation now in low-carbon. Multilateral collaboration, development and tailor-made appropriate technology.

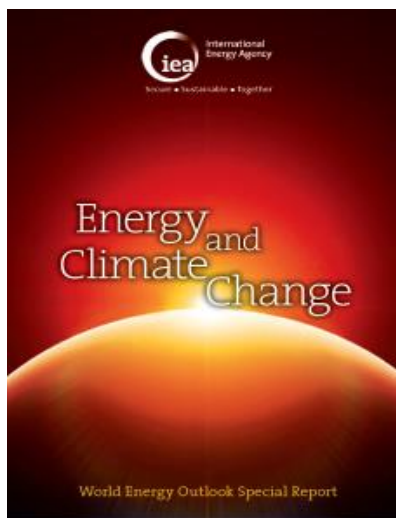
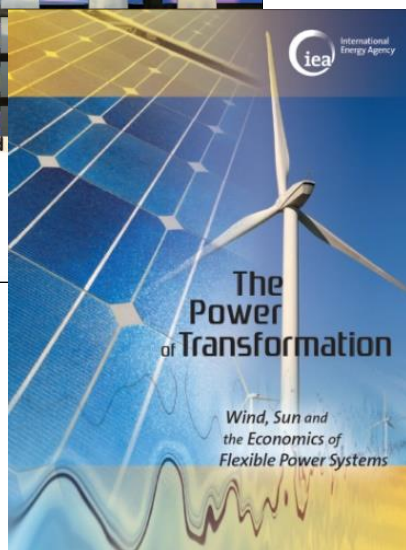
04 Mobilise resources to promote a decarbonised energy sector also drive energy security.



## ENERGY EFFICIENCY Market Report 2015



Market Trends and



Explore the data behind ETP