

## Energy Technology Perspectives: Towards Sustainable Urban Energy Systems

*Highlights der Energieforschung 2016: Die Rolle der  
Wärmepumpe im zukünftigen Energiesystem*

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International Energy Agency*



International  
Energy Agency  
Secure  
Sustainable  
Together

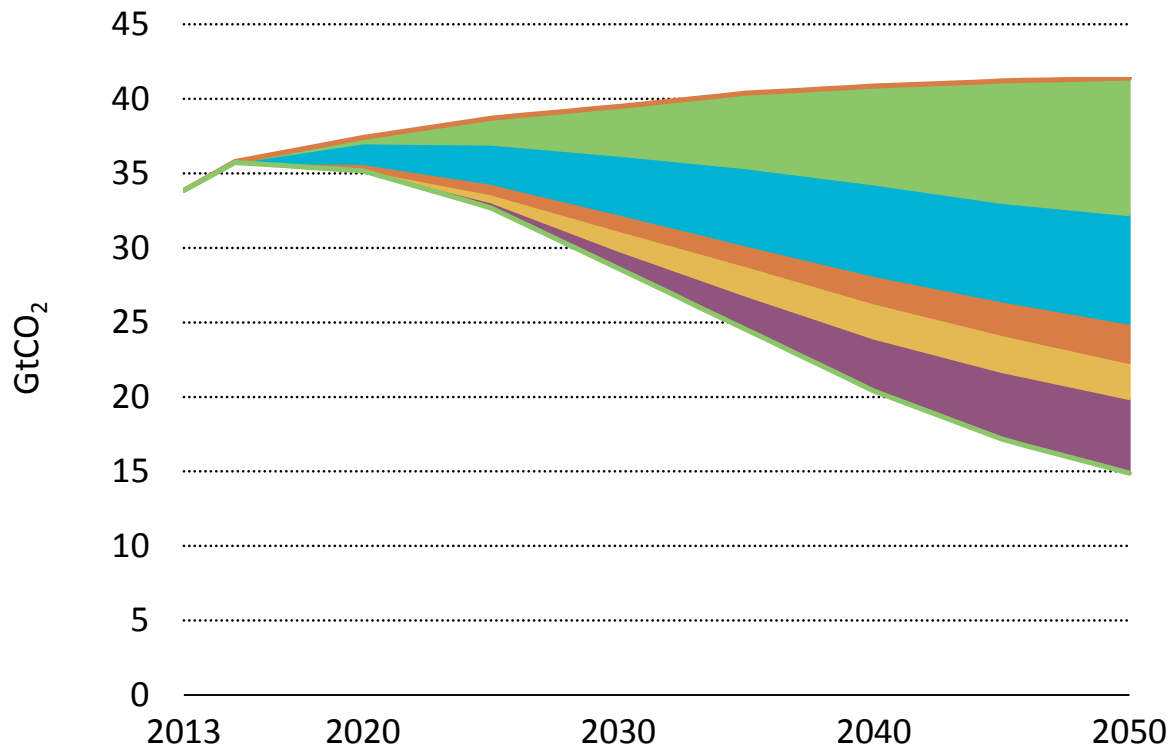


- First clear signs of decoupling of CO<sub>2</sub> emissions and GDP
  - *Global energy-related CO<sub>2</sub> emissions remained flat in 2015 for the second year in a row*
  - *Renewable power capacity at record high with over 150 GW installed in 2015*
- COP21 provided a historic push for clean energy
  - *Start of a new era of collaboration: Country-based approaches preferred to top-down regulation*
  - *New goals put forward – going beyond what everyone already considered challenging when our first ETP was released in 2006*
- Growing recognition that greater innovation is essential to meet ambitious climate goals

# The scale of the challenge

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

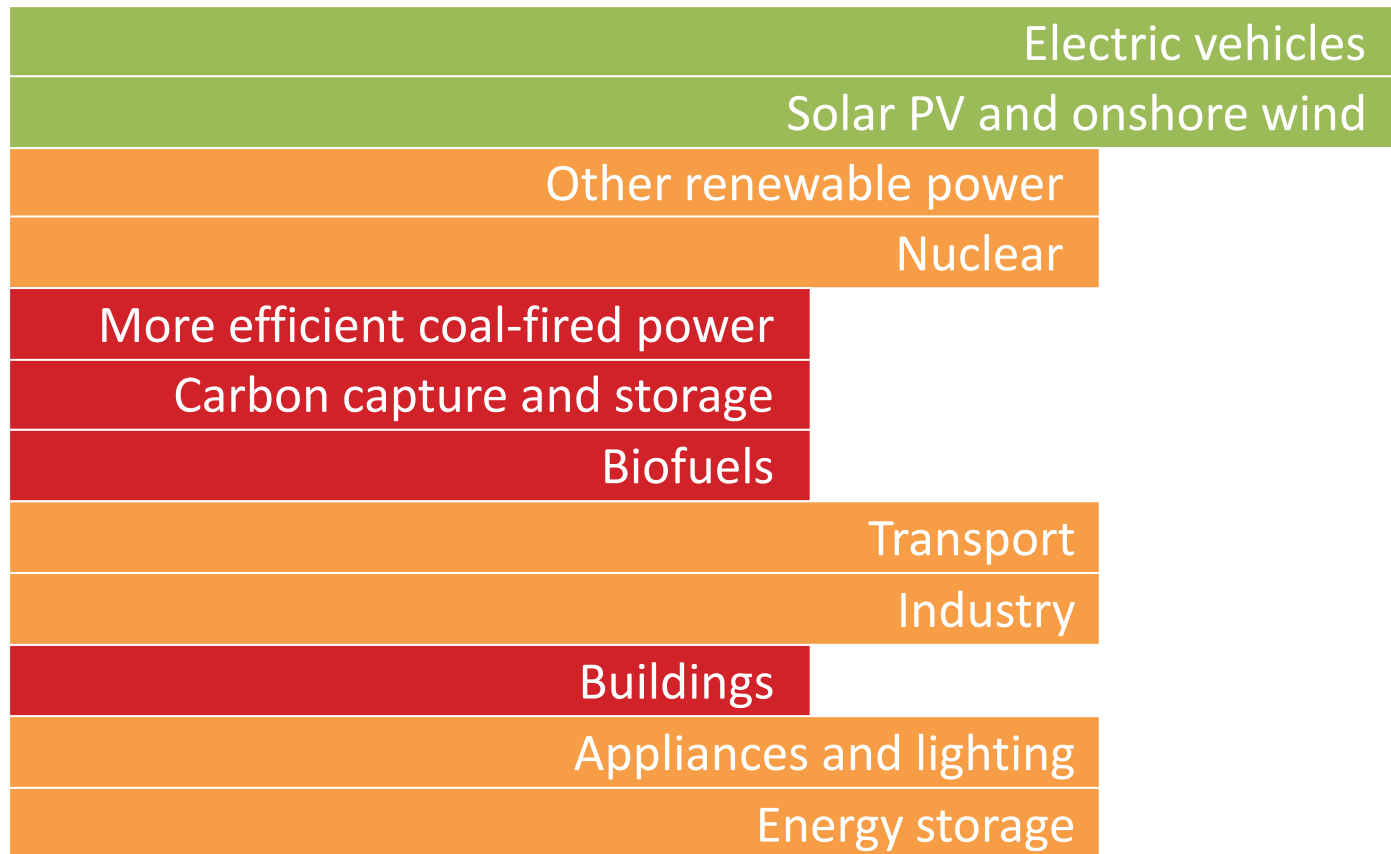


*The carbon intensity of the global economy can be cut by two-thirds through a diversified energy technology mix*

# Progress in clean energy needs to accelerate

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Technology Status today against 2DS targets



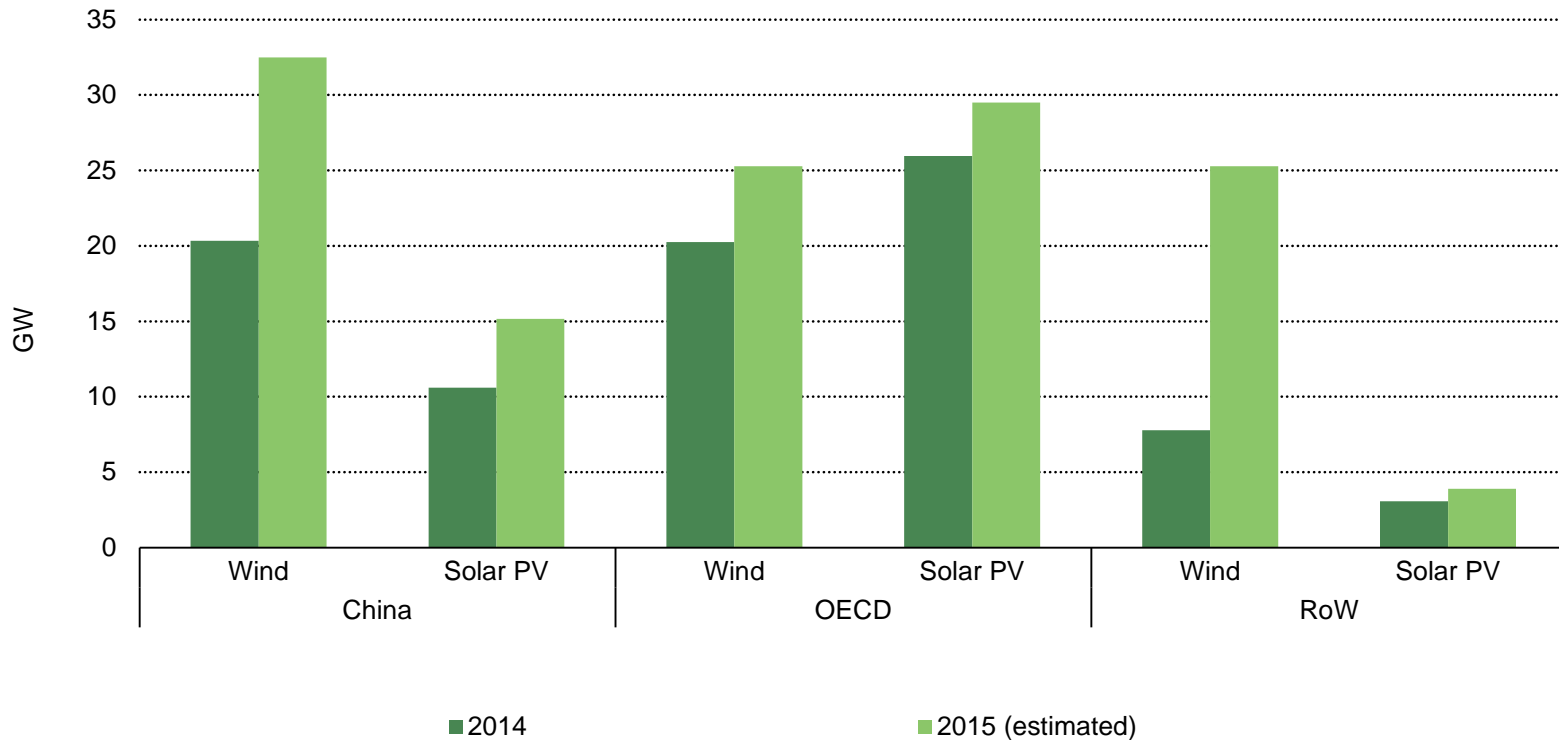
● Not on track   ● Accelerated improvement needed   ● On track

*Clean energy deployment is still overall behind what is required to meet the 2°C goal, but recent progress on electric vehicles, solar PV and wind is promising*

# RE Policies must keep up the good work

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## Select renewable power capacity additions (2014-2015)

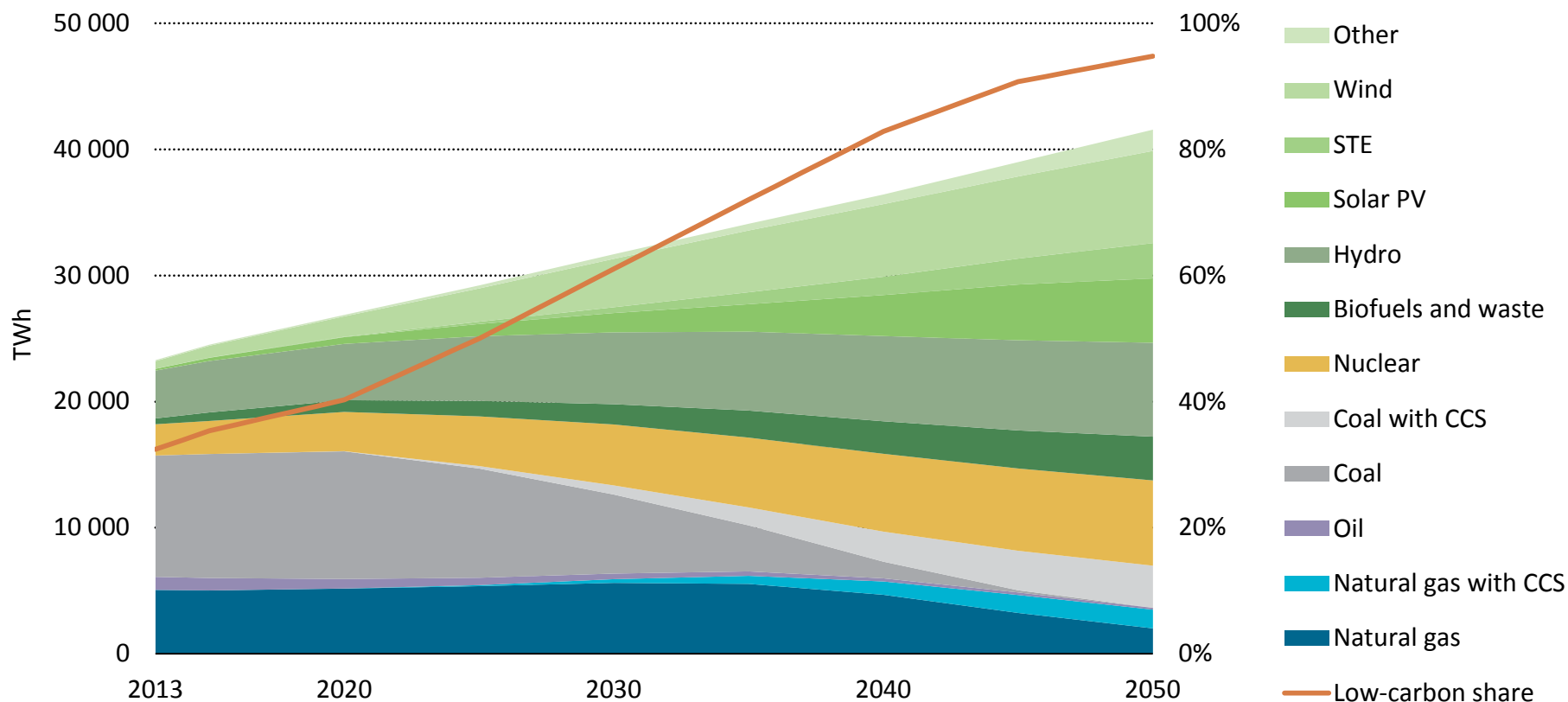


*Cost improvements are making Solar and Wind cost-competitive with fossil alternatives, provided proper market and regulatory conditions*



# Decarbonising global electricity supply in the 2DS

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## ■ Generation today:

- Fossil fuels: 68%
- Renewables: 22%

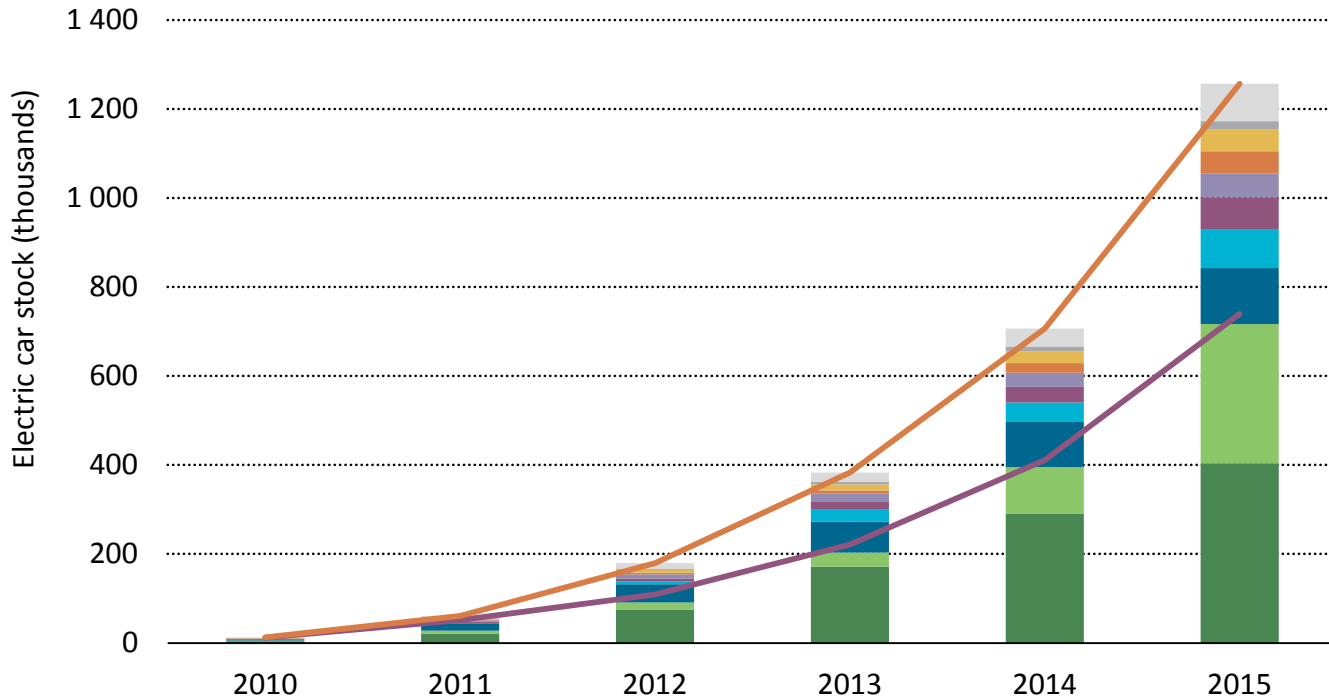
## ■ Generation 2DS 2050:

- Renewables: 67%
- Fossil fuels: 17%

# Crossing the 1 million EVs threshold

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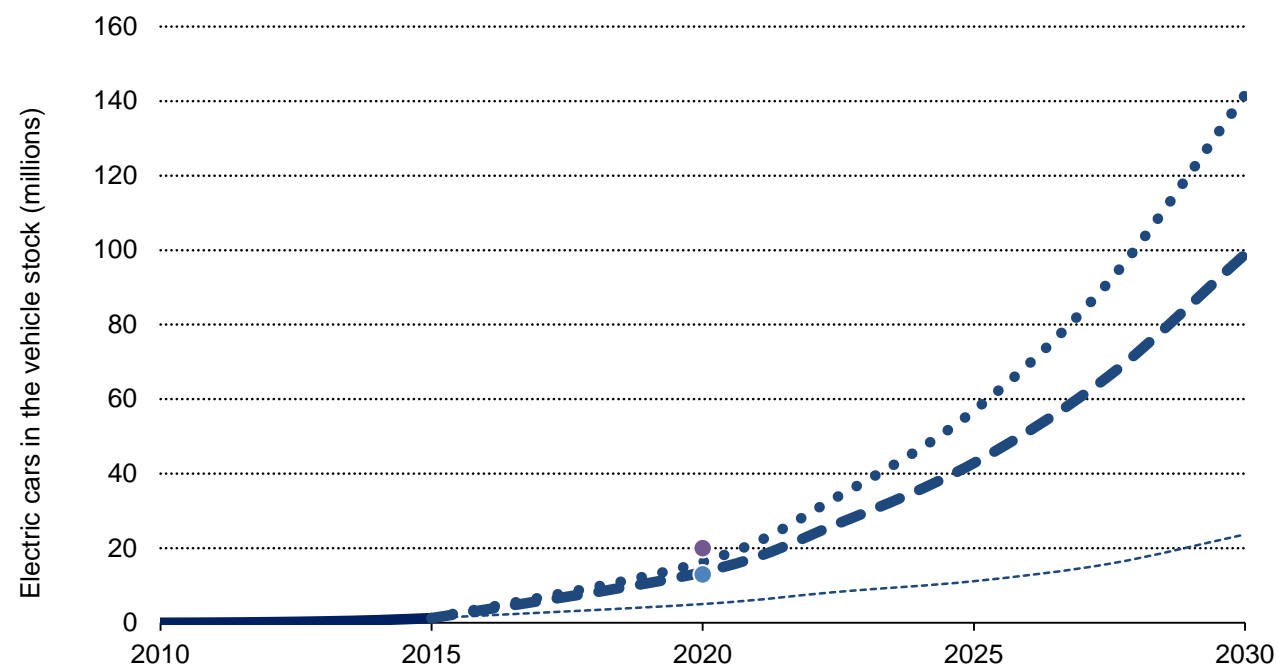
Evolution of the global BEV and PHEV stock, 2010-2015



*Annual EV sales grew by 70% over 2014, catching up to rates needed to meet the 2DS target.*

# Must sustain pace to reach 1 bn in 2050

Evolution of the global BEV and PHEV stock, 2010-2015



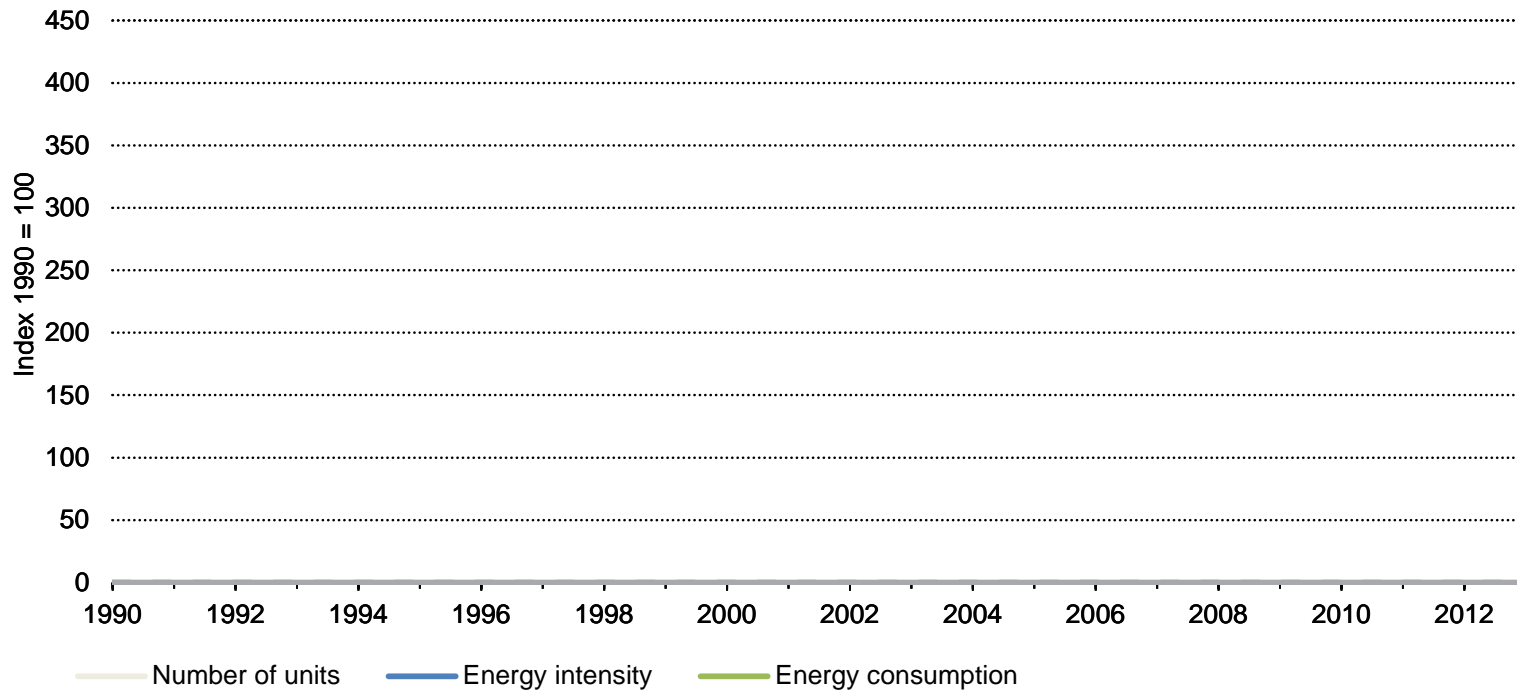
*Policy support needs to be continued to reach the very ambitious targets of 30% of sales by 2030 set during COP 21*



# Efficiency Standards pay off

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## World refrigerator and television energy use

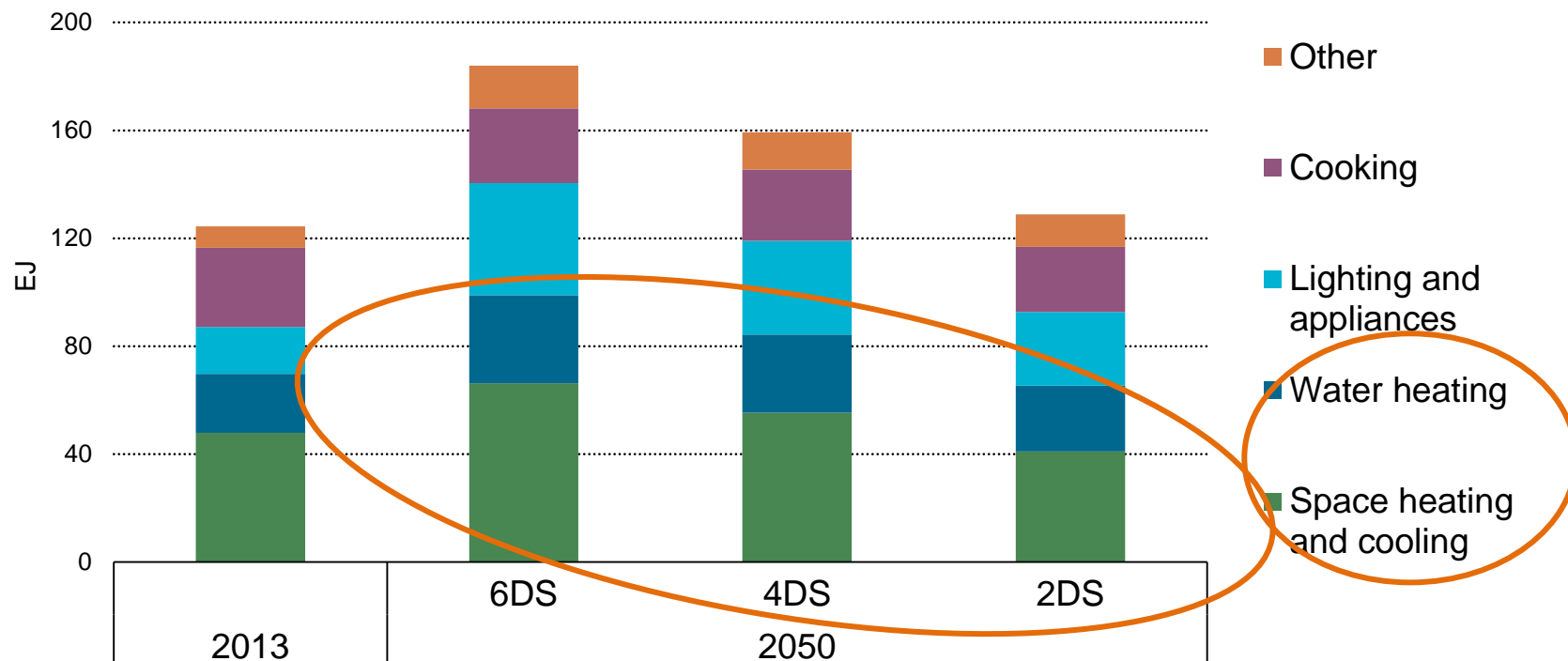


*Energy efficiency standards and labelling (EESL) programmes should expand across more countries and product categories*

# Buildings efficiency must be ramped up

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Building energy consumption by end use to 2050



*Building energy use could increase 50% without strong action to improve energy efficiency.*

# Collaboration: the New Modus Operandi to meet sustainability goals

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- COP 21 invited Non-State Actors to actively contribute to the climate solution
  - *Increased participation from Business, NGOs and Local Governments*
  - *“Paris Pledge for Action” support to ensuring that the level of ambition set by the Paris Agreement is met or exceeded*
- Urban areas will shape the energy future
  - *They currently account for 80% of global GDP, 65% of energy demand and 70% of energy-related CO<sub>2</sub> emissions*
  - *Current urban development trends in Developing Asia would eat up half of the world’s CO<sub>2</sub> budget of the 2DS by 2050*
  - *Sustainable urban energy planning could save 1900 Mtoe and save 50 trillion USD in energy bills to urban customers by 2050*



# Cities in emerging/developing economies will be critical

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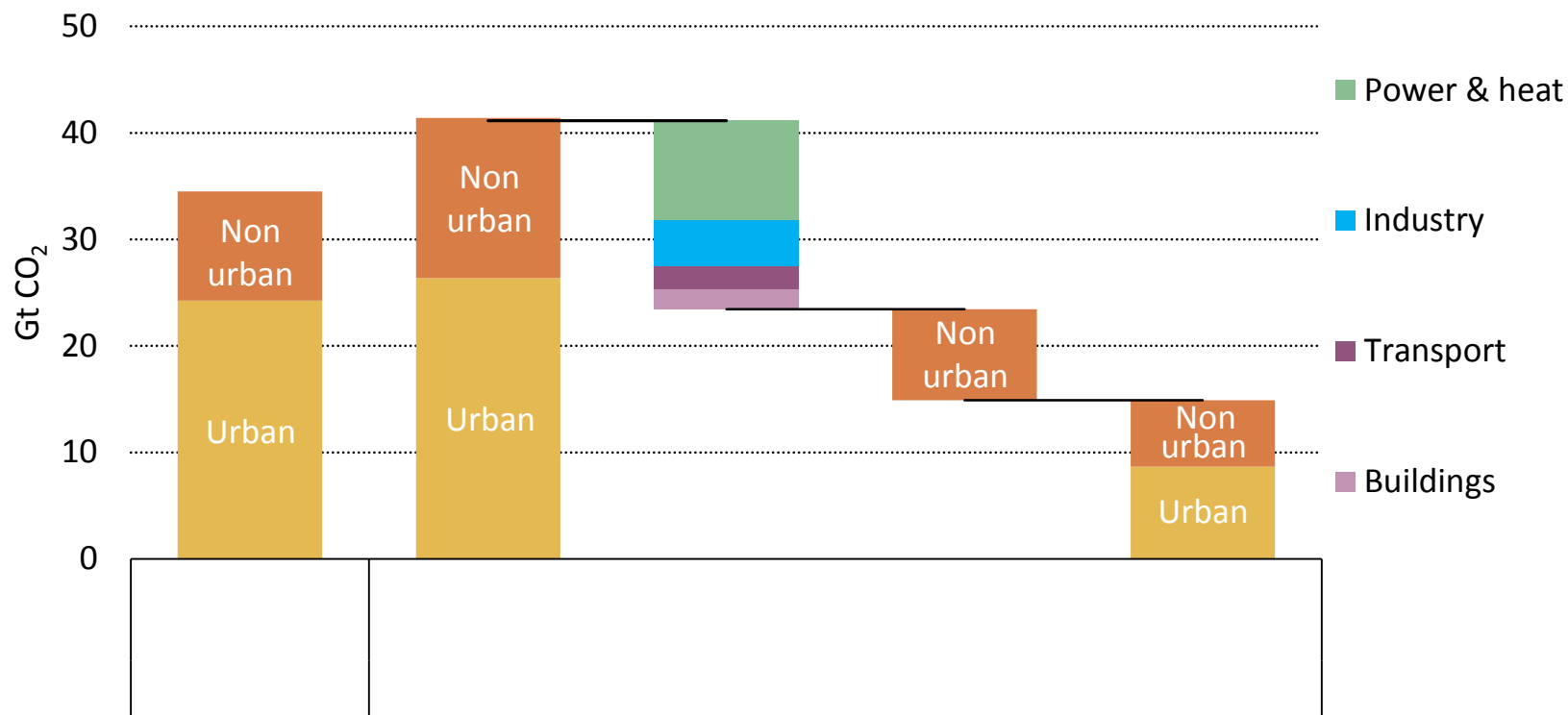
Final energy demand in the 4DS

*Two-thirds of the growth in global energy demand to 2050 comes from cities in emerging and developing economies*

# Cities are key to carbon abatement

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Impacts to global cumulative CO<sub>2</sub> reductions

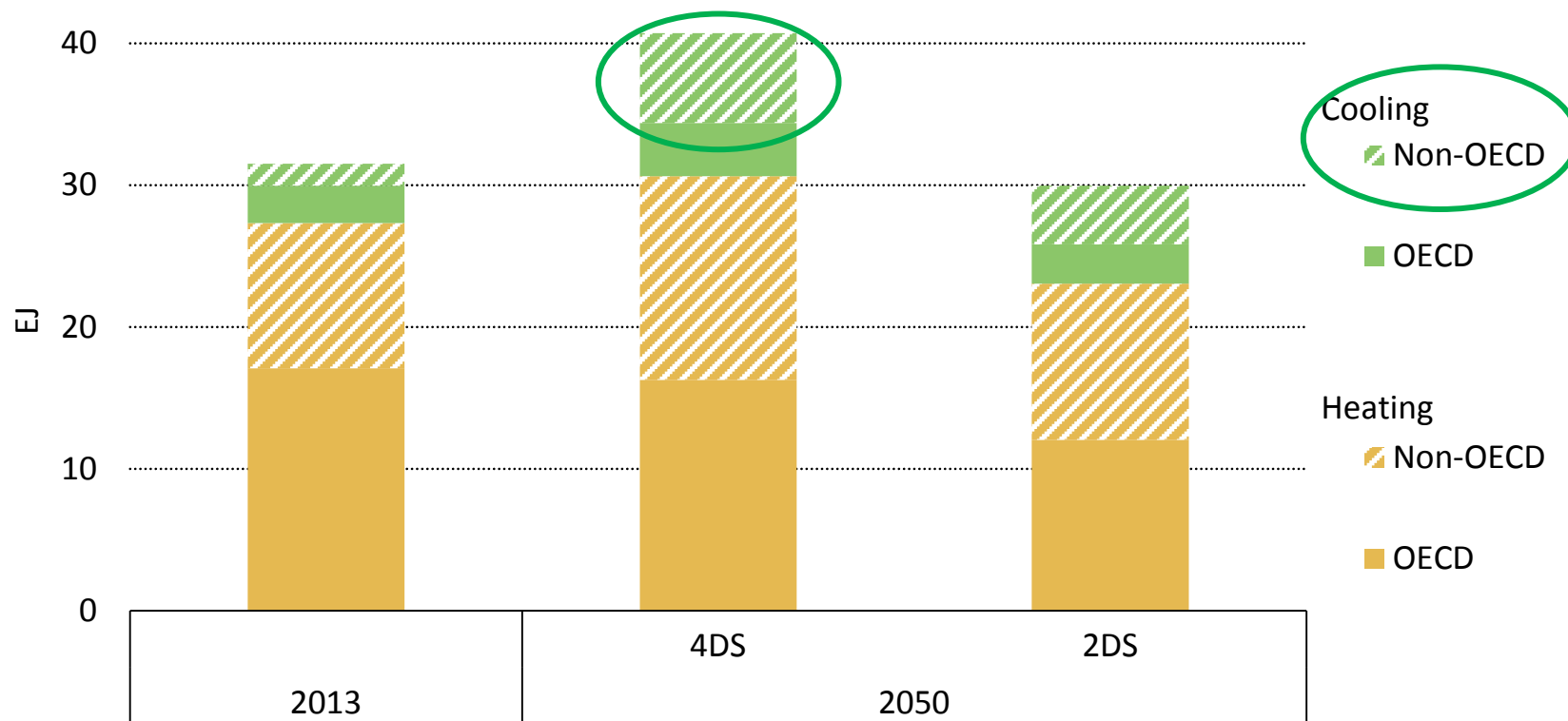


*Cities represent 70% of the cost-effective CO<sub>2</sub> abatement potential by 2050*

# Heating and cooling: the elephant in the room

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Global urban heating and cooling demand



*Heating and cooling energy demand in cities can be reduced by 25% without compromising thermal comfort, particularly cooling in emerging economies*



## Global Objective: (Near) Zero-Energy Buildings

Inefficient, still-common and old stock	Typical building code in advanced regions	Zero- and low-energy buildings
<ul style="list-style-type: none"><li>• Single pane windows</li><li>• No insulation</li><li>• High air leakage</li> <li>• Inefficient gas, oil and coal boilers</li><li>• Electric resistance heaters</li><li>• Conventional biomass burning</li></ul>	<ul style="list-style-type: none"><li>• Low-e double glazed windows</li><li>• High levels of insulation</li><li>• Low air leakage</li> <li>• Condensing gas boilers</li><li>• Electric heat pumps</li><li>• Modern district heat and biofuels</li></ul>	<ul style="list-style-type: none"><li>• Highly insulating and variable solar windows</li><li>• Optimised building design and orientations</li><li>• Natural ventilation and daylighting</li> <li>• Water heating, cold-climate and gas-thermal heat pumps</li><li>• Solar thermal with energy storage</li><li>• Advanced district heat and micro-CHP</li></ul>

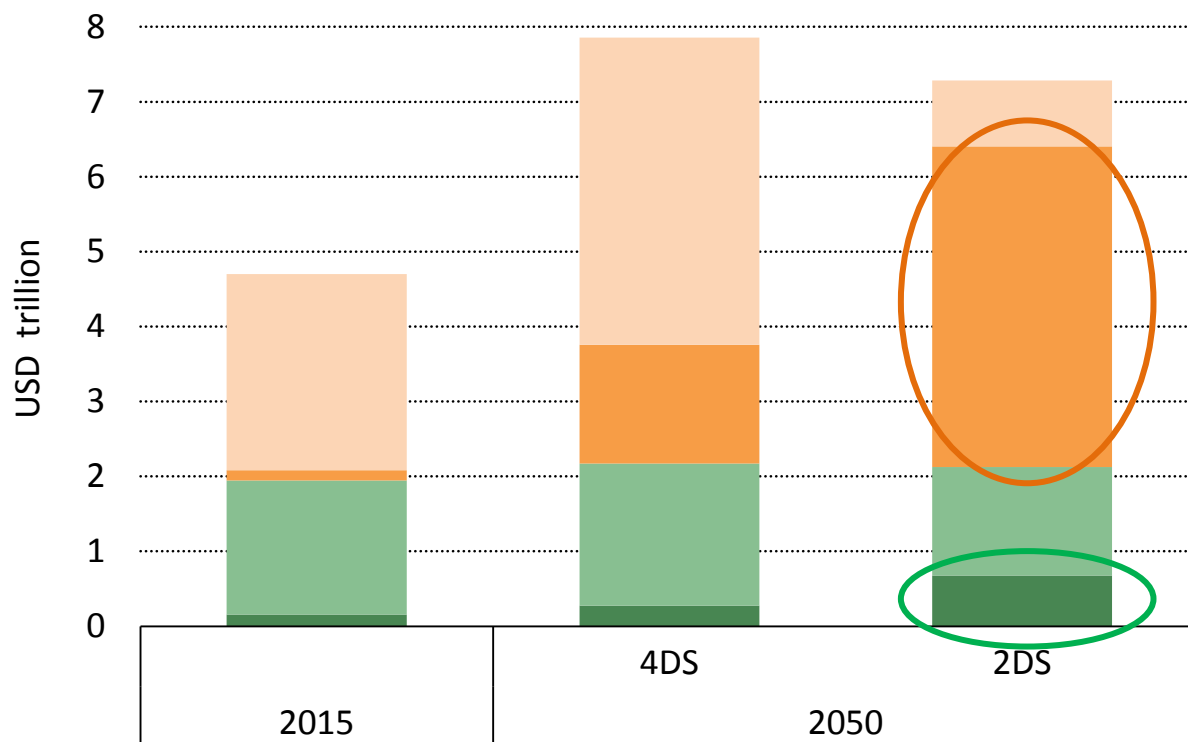
Source: IEA Technology Roadmap: Energy Efficient Building Envelopes, 2013

*First step: reduce need for heating and cooling!!*  
*Then: provide heat in a more efficient way*

# Sustainable transport systems: a cheaper way to provide service

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### Urban transport investments

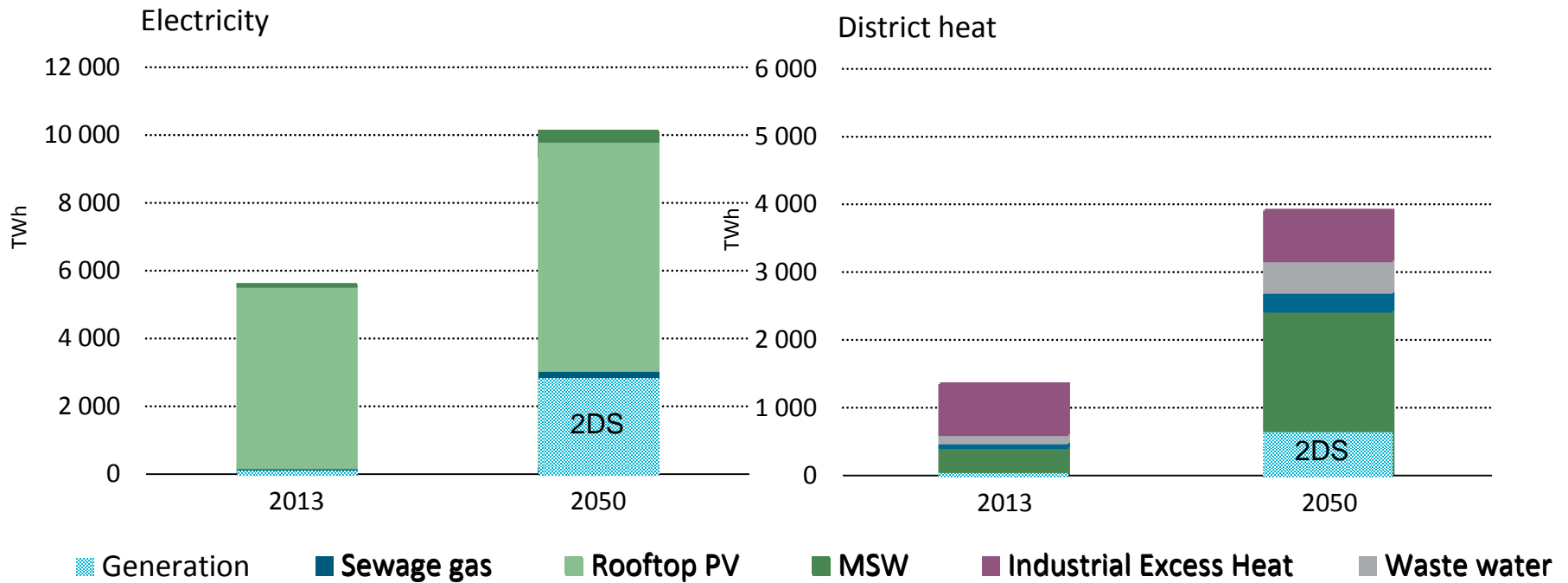


*In the 2DS, by 2050 one billion cars are electric vehicles while public transport travel activity more than doubles*

# Systems integration: utilising wastes and local resources

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Electricity and heat from urban energy sources in the 2DS  
Technical potentials

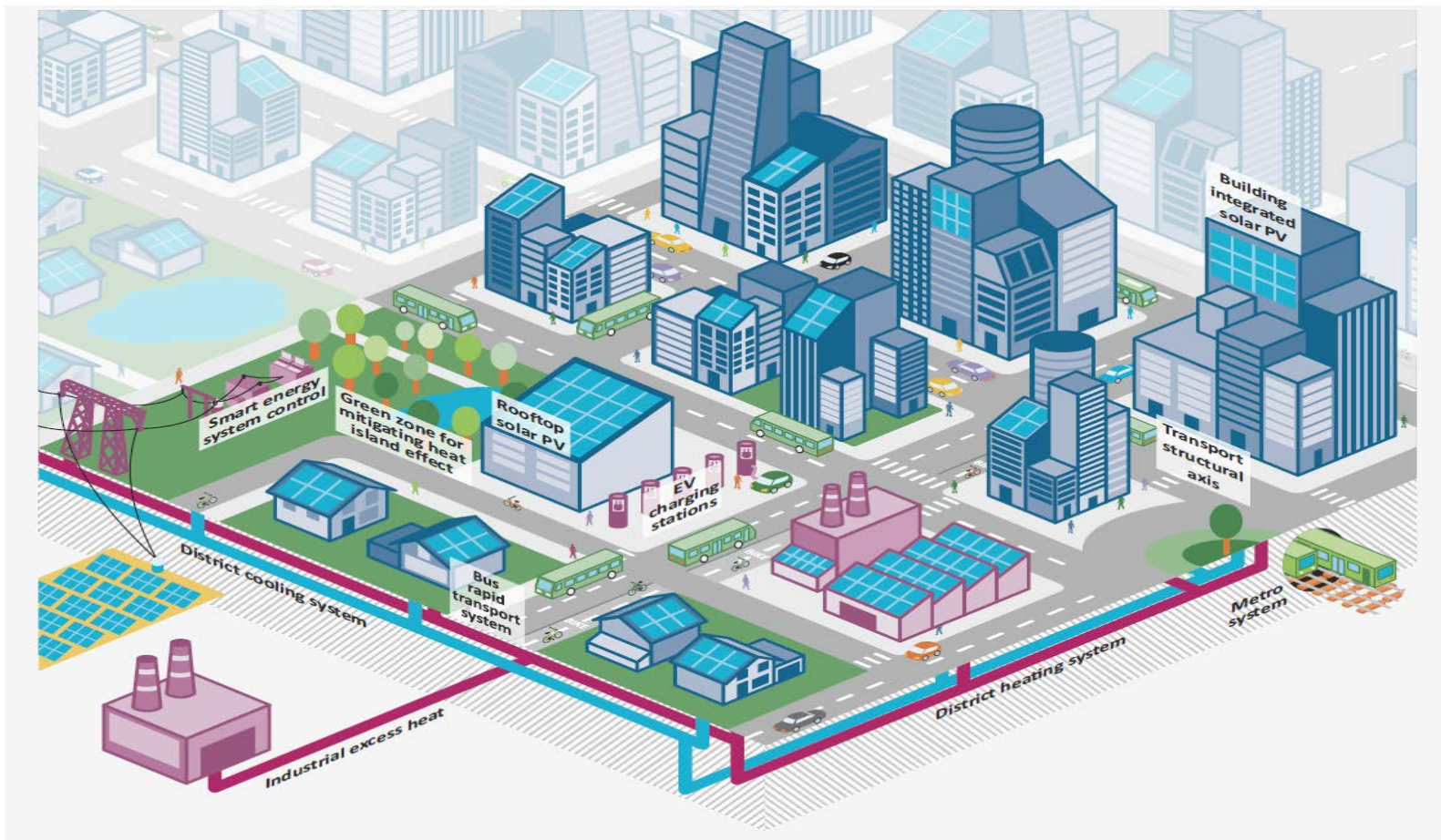


*Local and National authorities each have a role to play to ensure the urban potential for sustainable energy supply is tapped*



# Locking-in sustainable new urban infrastructure, unlocking existing assets

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

# Local and national policies at the core of ETP the urban low-carbon transition

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## POLICY RECOMMENDATIONS

### LOCAL POLICY MAKERS

Integrated Land Use and Transport planning

Education and Awareness Campaigns

Enforcement of Building Codes

Increased Investments in Public Transport

Sustainability-oriented municipal utilities

Green municipal buildings and transport fleets

### NATIONAL POLICY MAKERS

Capacity-building programmes  
for local planners

Enabling national legislative  
frameworks

Funding mechanisms for  
investments in sustainable  
energy infrastructure

Alignment of regulatory  
frameworks with  
technological innovation

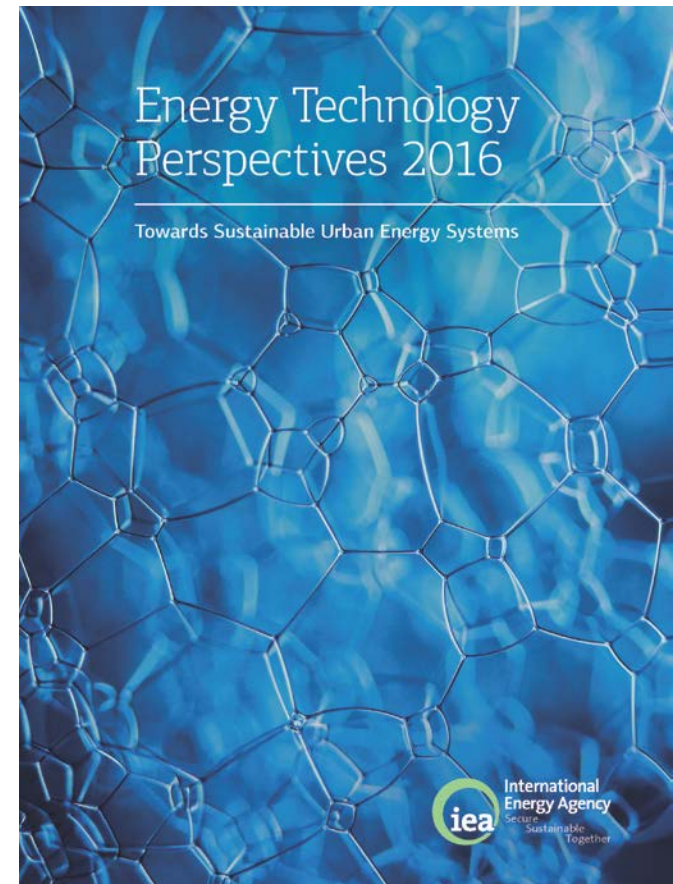
*Leveraging all solutions to urban energy sustainability requires strong  
policy action both at local and national level*



# ETP2016: Towards Sustainable Urban Energy Systems

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- 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 Urban Areas
  - Mexico's Sustainable Energy Transition: The Role of Cities?





- COP21 was historic and a catalyst for more innovation, research and investment in clean energy technologies
- 2015 saw progress in Solar PV, wind and electric vehicles, but others areas such as CCS and biofuels are lagging behind
- Cities in emerging and developing economies can lead the low-carbon transition while reaping many benefits
- Efficient heating & cooling systems, better public transport and electric vehicles will be critical to decarbonise cities
- Acting together with industry, national and local governments can drive innovation through international co-operation

# Thank you

# ETP 2016

## Explore the data behind *ETP*



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