Energy Technology Perspectives 2016

Energy Technology Perspectives: Towards Sustainable Urban Energy Systems

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International Energy Agency
Secure Sustainable Together

Context

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- First clear signs of decoupling of CO_2 emissions and GDP
  - *Global energy-related CO_2 emissions remained flat in 2015 for the second year in a row*

Global energy emissions - peaked?

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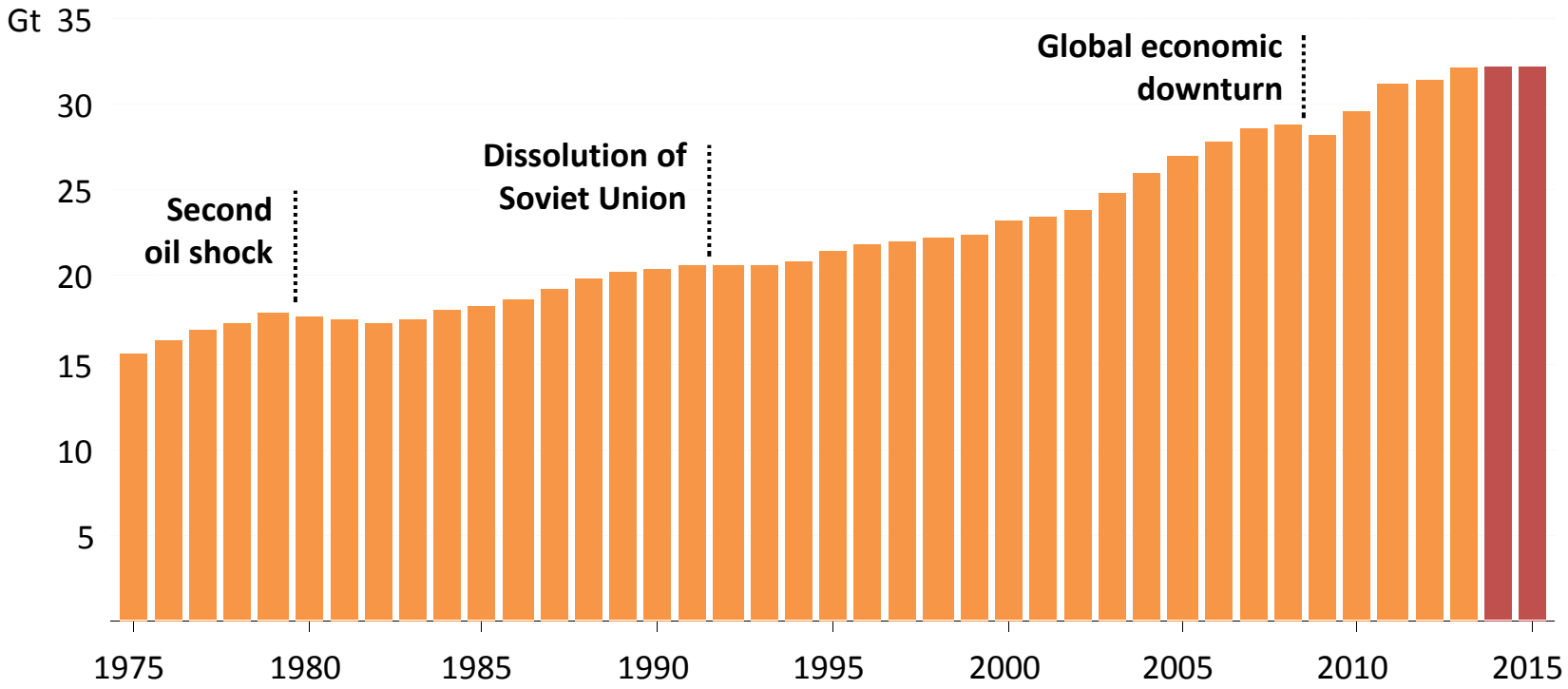
Global energy-related CO2 emissions



IEA analysis for 2015 shows renewables surge, led by wind, and improvements in energy efficiency were key to keeping emissions flat for a second year in a row

Context

ETP 2016

- First clear signs of decoupling of CO_2 emissions and GDP
  - *Global energy-related CO_2 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*

Renewable Energy deployment prospects improving around COP 21

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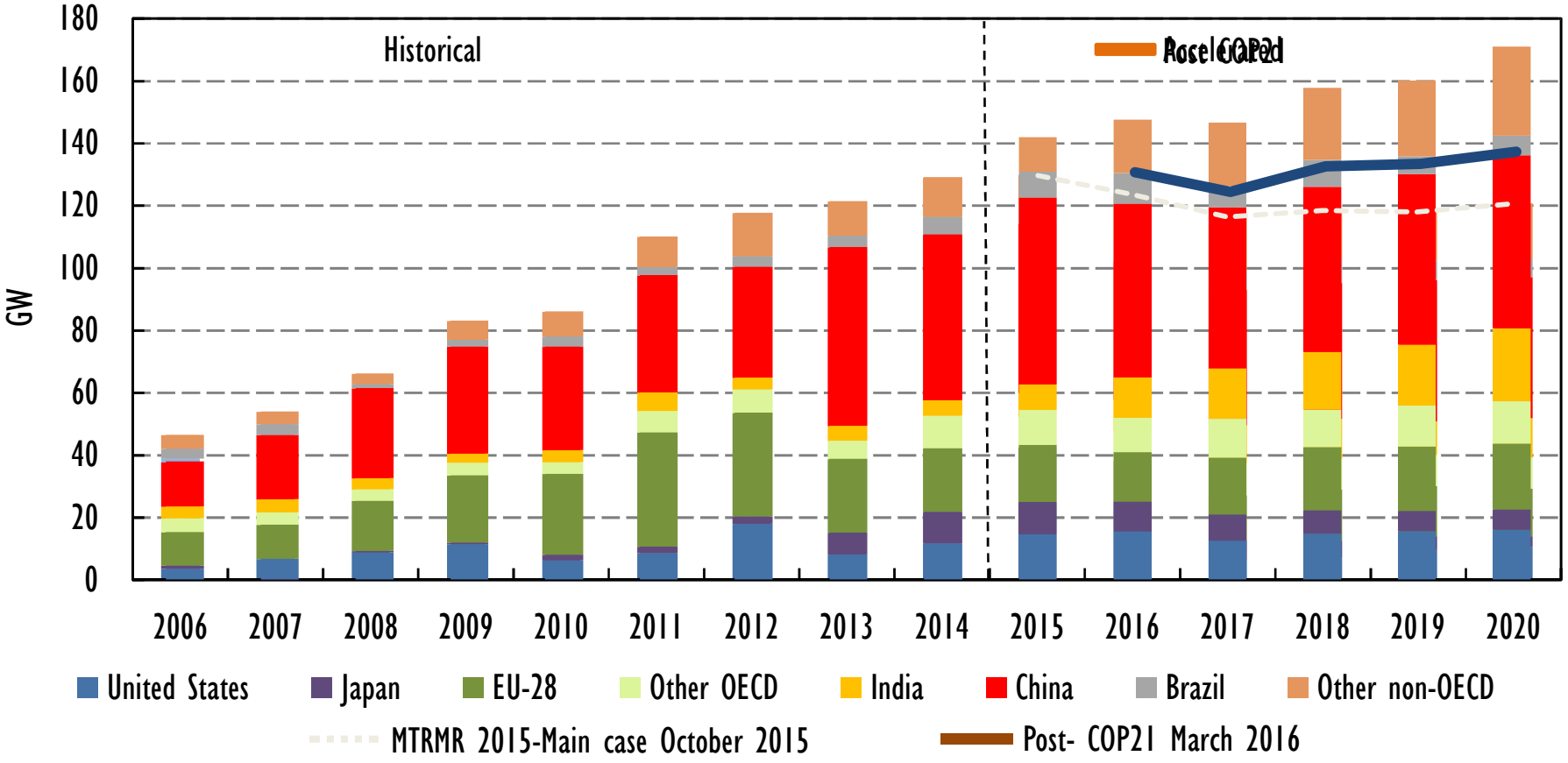
World renewable power annual capacity additions, *main* vs. *accelerated case*



With recent policy changes, 35% of gap between main and accelerated case is bridged

Context

ETP 2016

- First clear signs of decoupling of CO_2 emissions and GDP
  - *Global energy-related CO_2 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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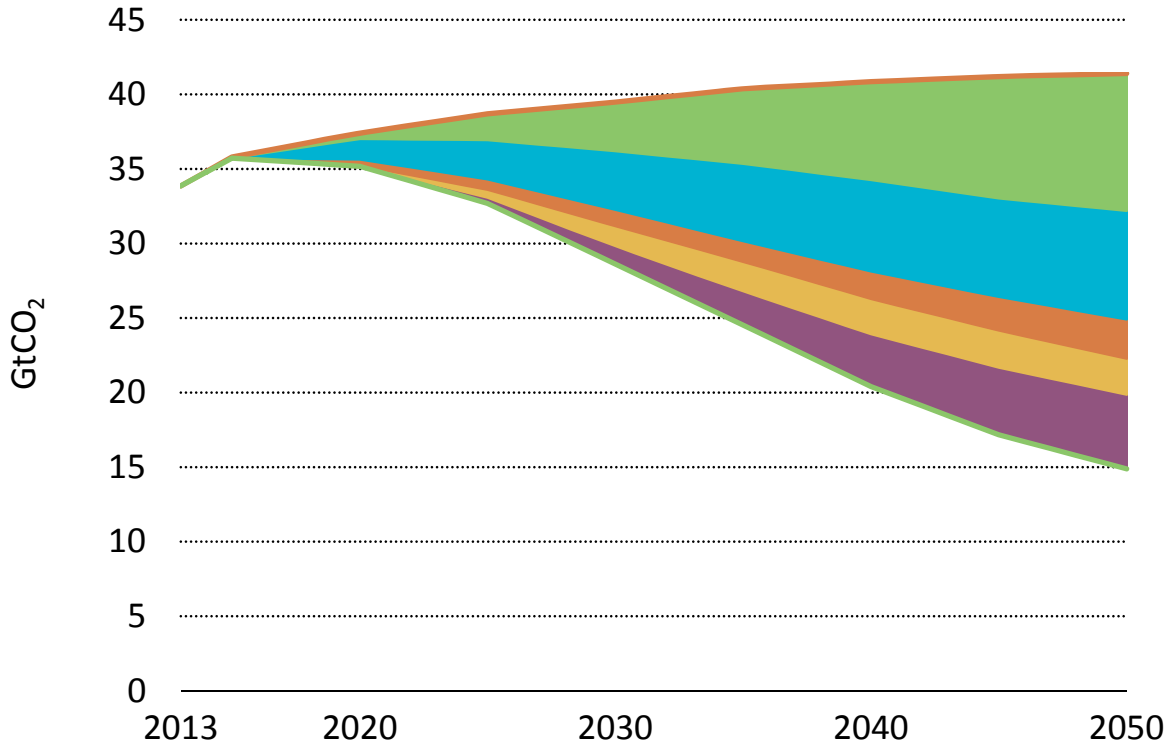
Contribution of technology area to global cumulative CO_2 reductions



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

Pre-COP21: Pathway to 2 Degree

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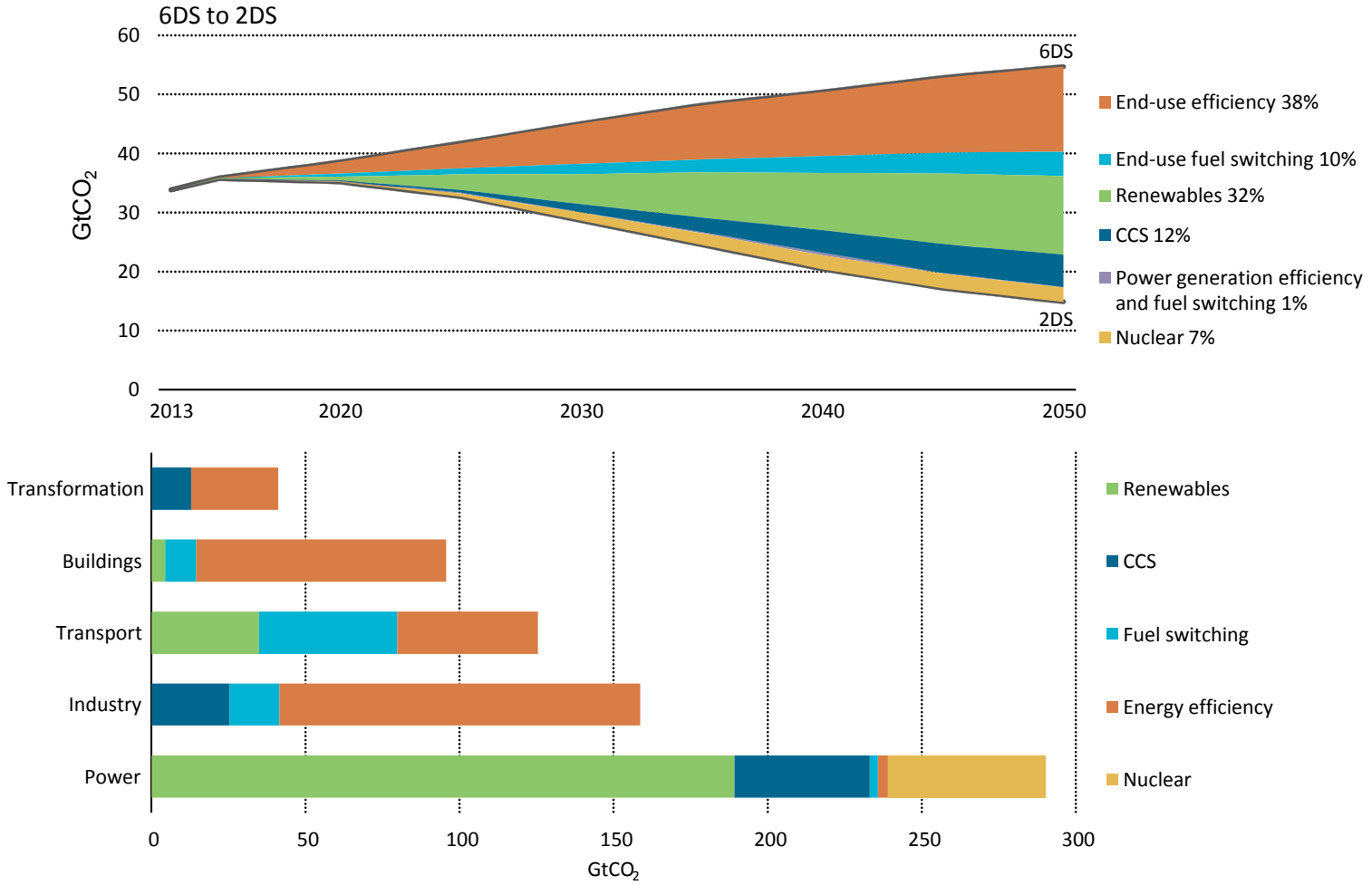
Contribution of technology area and sector to global cumulative CO_2 reductions



All sectors are needed

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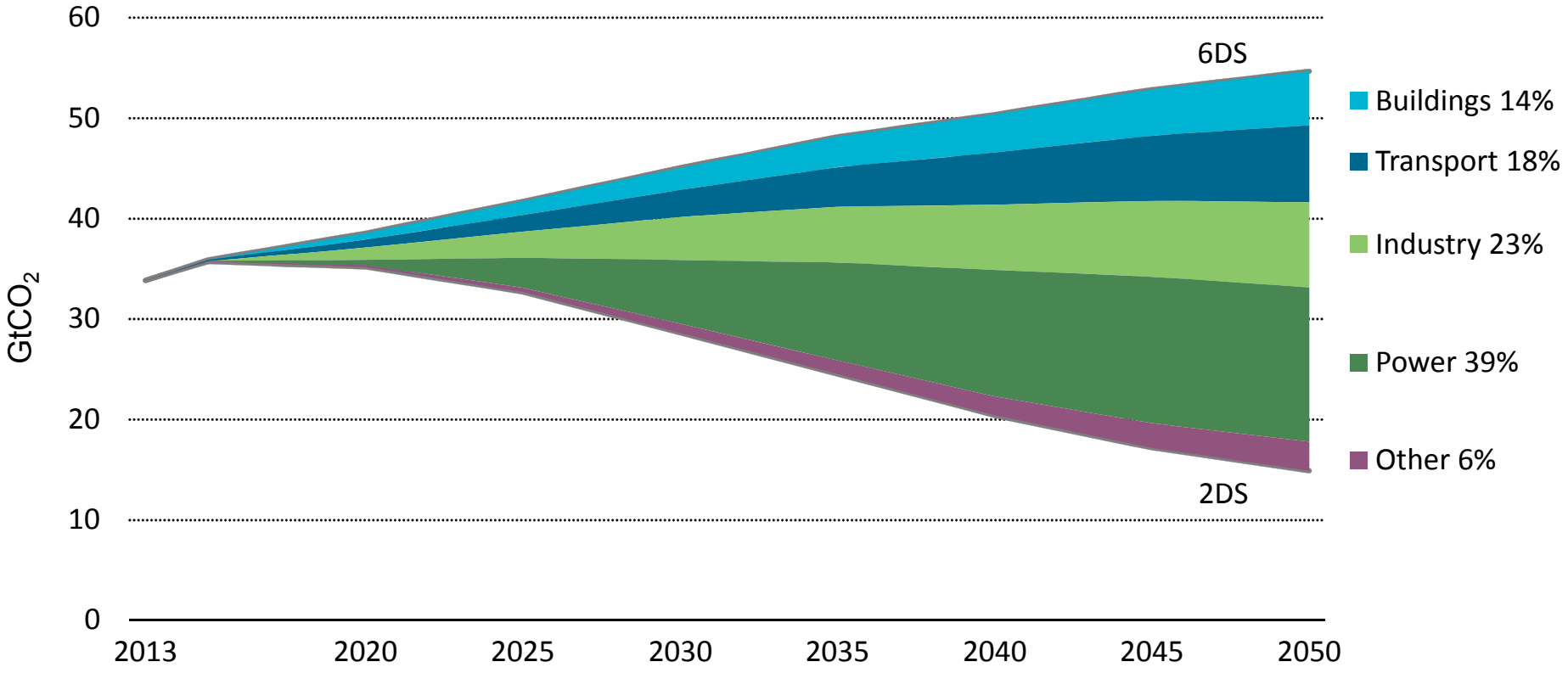

End-use sectors and supply-side sectors provide each around half of the cumulative reductions between the 6DS and 2DS.

The transition to a 2-Degree world requires an exceptional effort

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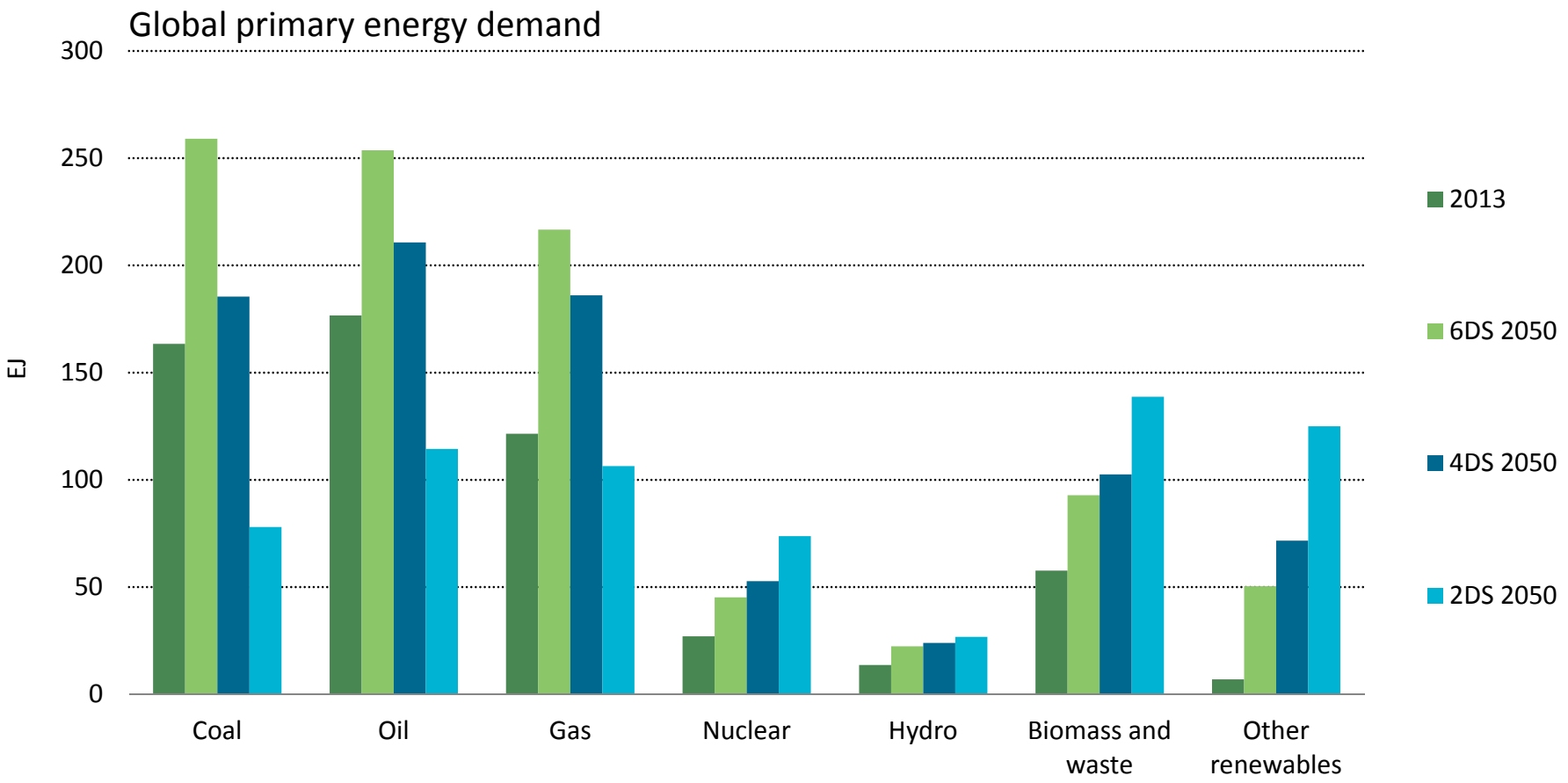

Share of fossil fuels in primary energy is in the 2DS with 45% almost halved by 2050 compared to today (81%), biomass becomes the largest energy source in 2050 in the 2DS.

Progress in clean energy needs to accelerate

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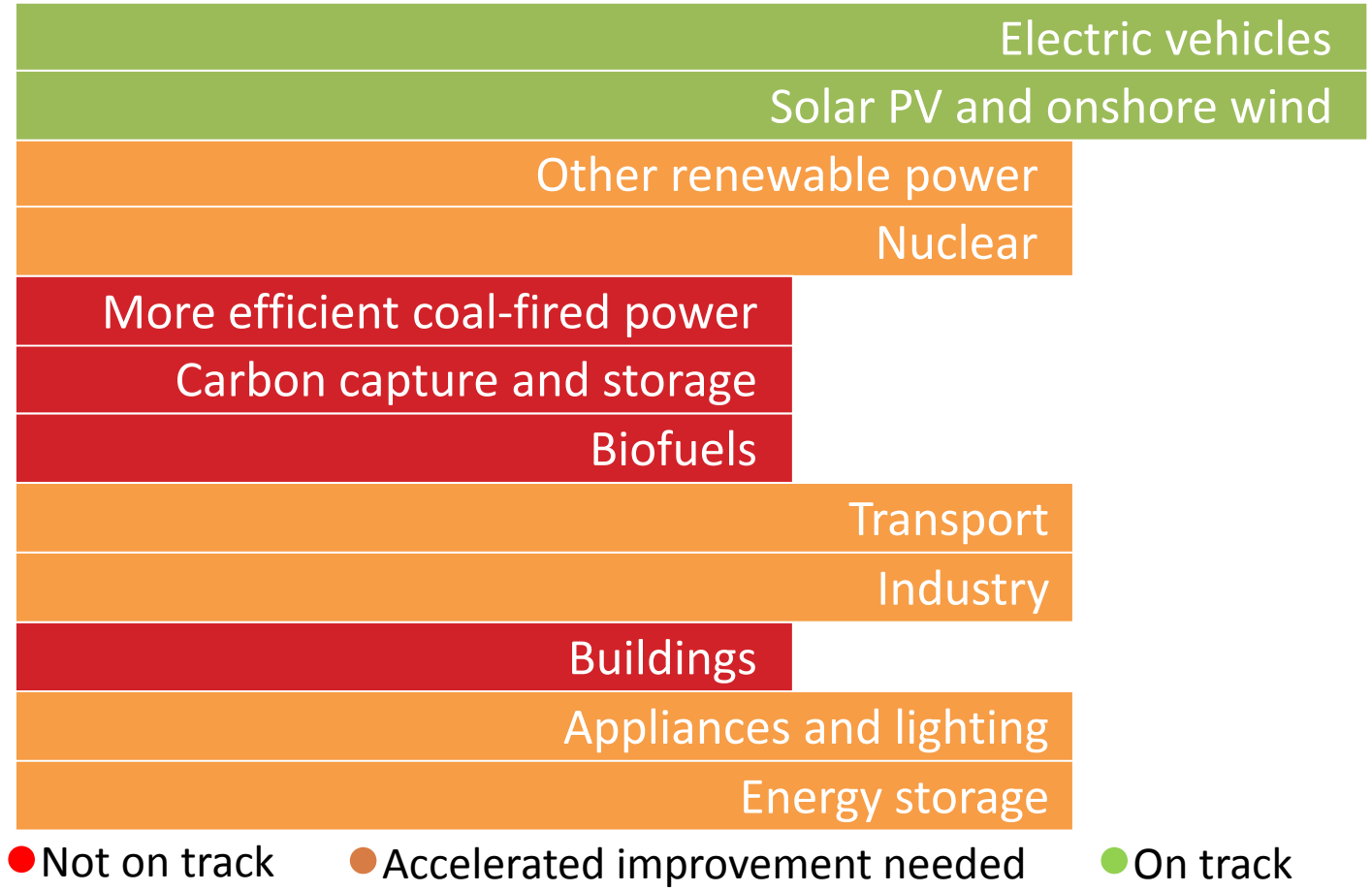
Technology Status today against 2DS targets



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

Wind and PV
Downward price trends continuing rapidly

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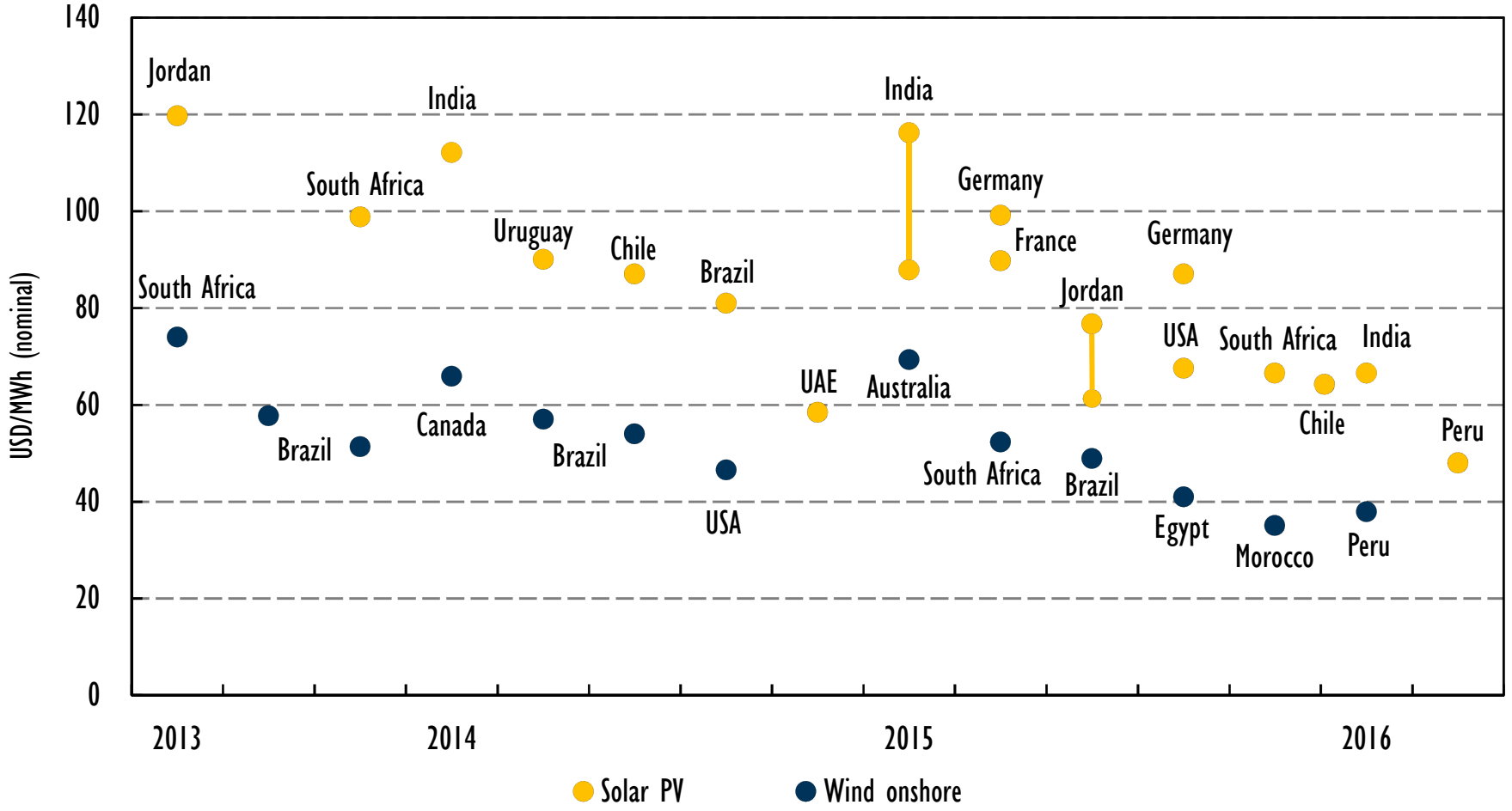
Recent announced long-term contract prices for new renewable power to be commissioned over 2016-2019



Best results occur where price competition, long-term contracts and good resource availability are combined

The world's population is becoming increasingly urbanized

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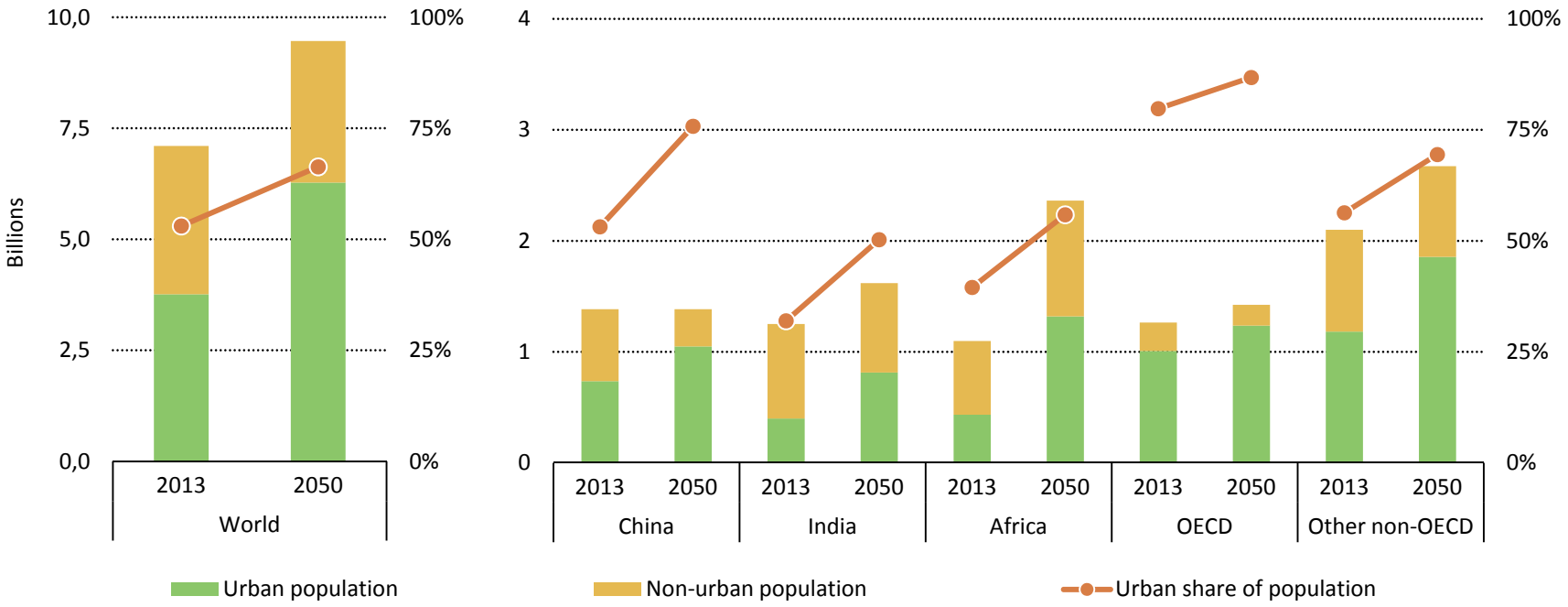

By 2050, two-thirds of the world's population will live in urban areas, with the greatest growth in China, India, Africa and non-OECD economies in other regions

Urban areas dominate global energy and CO_2 emissions

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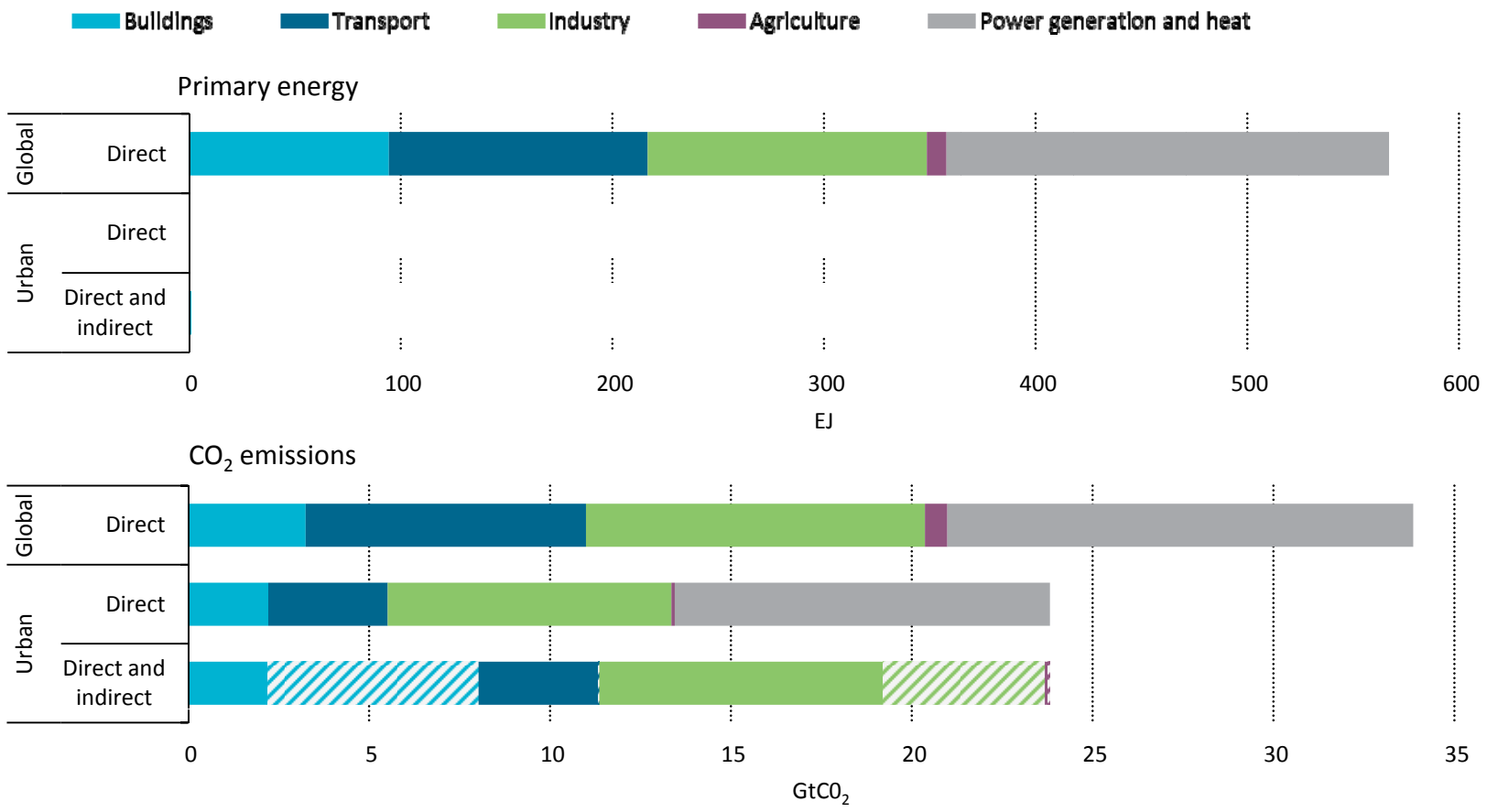

In 2013, the world's urban areas accounted for the majority of primary energy use (64%) and energy-related CO_2 emissions (70%)

Cities in emerging/developing economies will be critical

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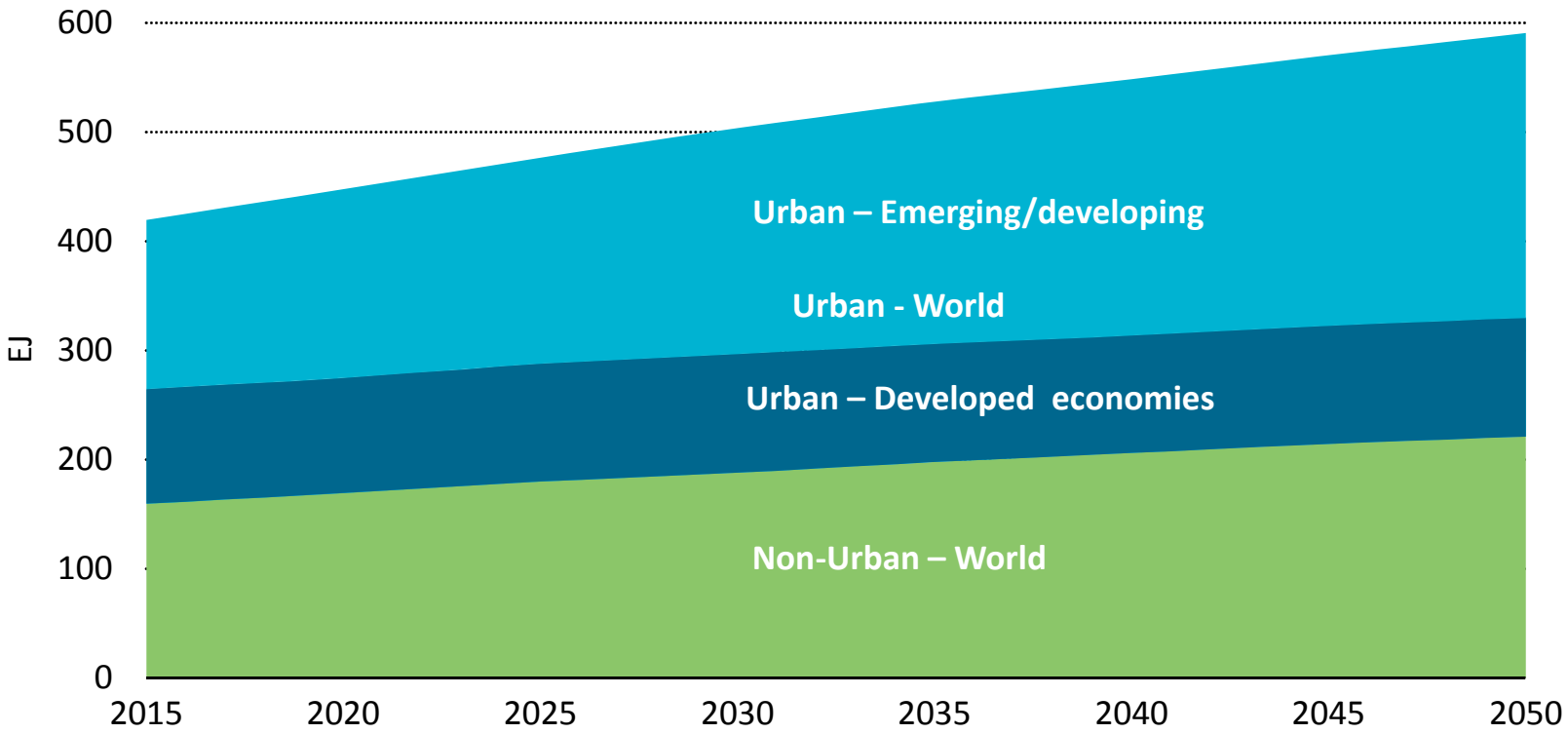
Final energy demand in the 4DS



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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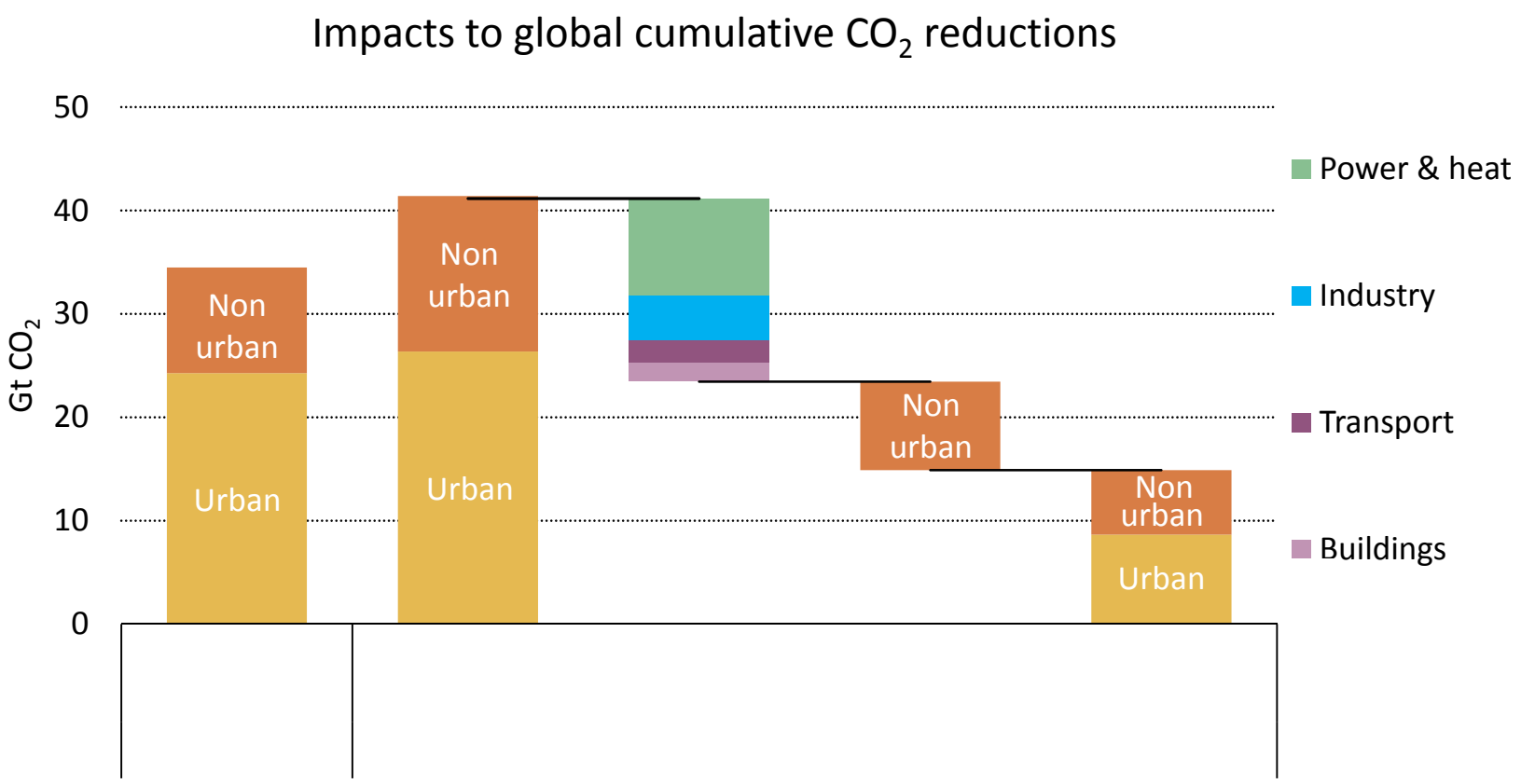

Cities represent 70% of the cost-effective CO_2 abatement potential by 2050

Passenger transport activity in 2015

Mode matters

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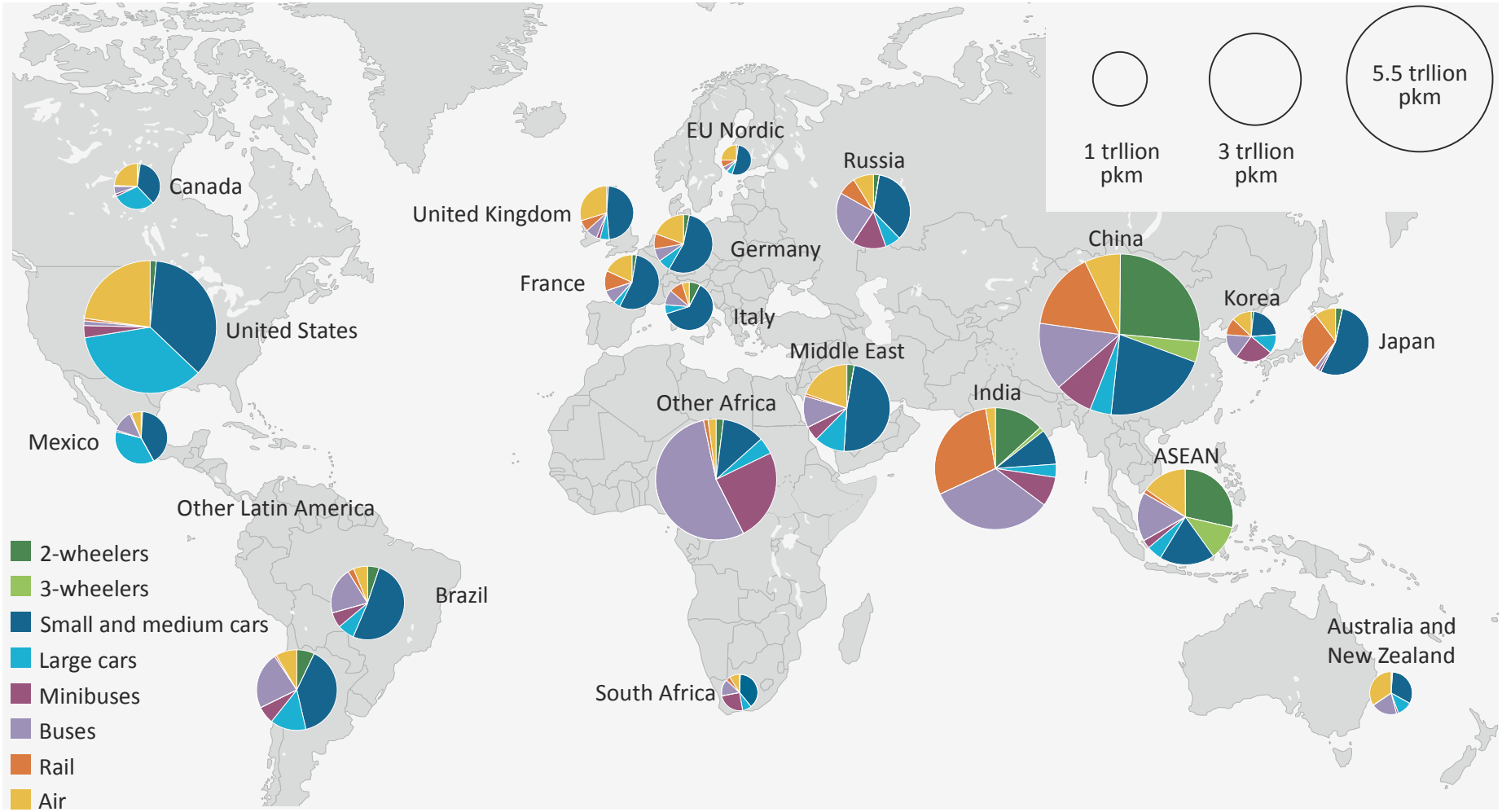
National Passenger transport activity (pkm) in 2015, by mode



Sustainable urban energy systems can improve air quality

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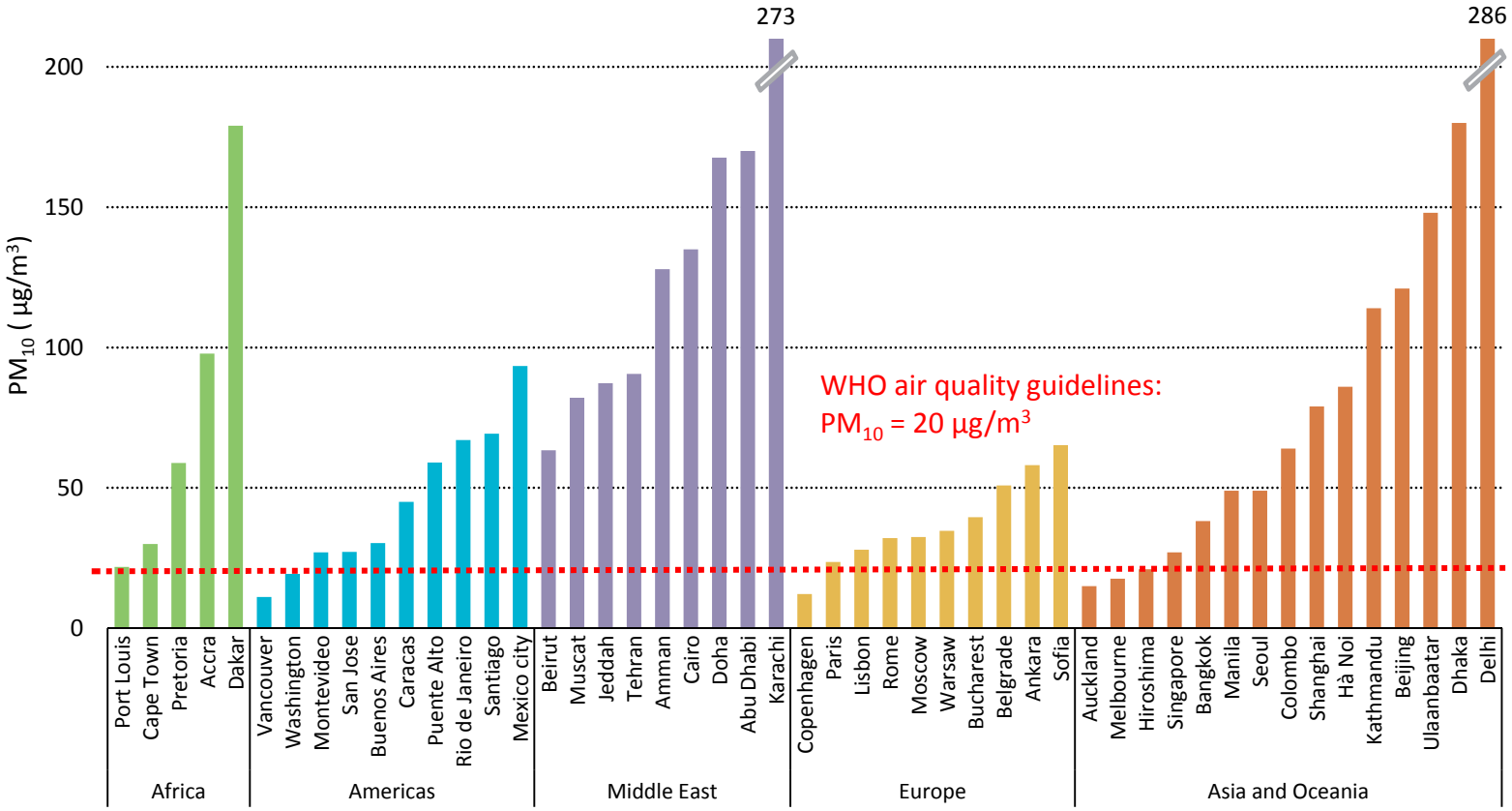
PM_{10} levels for selected cities by region, 2008-12



In many cities, air pollution levels significantly exceed World Health Organization air quality guidelines

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High risk air pollution areas

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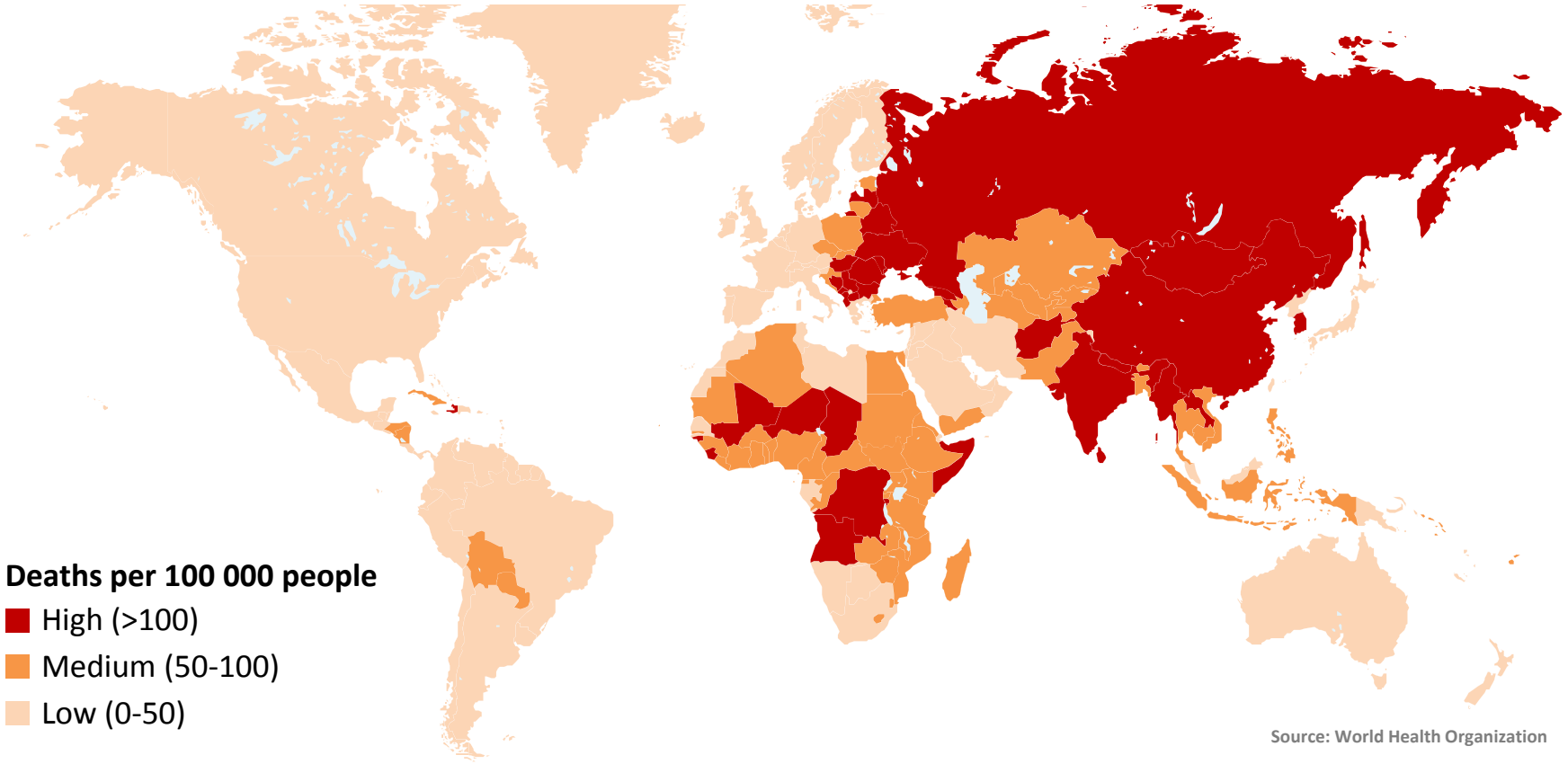
Mortality rate due to air pollution, 2012



Source: World Health Organization

Countries with the largest death toll are China and India, but on a per capita basis many countries across Africa, Asia and Eastern Europe are affected

Technologies

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Technologies capable of delivering the changes required by the 2DS scenario can be categorized as follows:

- Technologies allowing to manage travel demand (avoiding travel needs and shifting mobility to the most efficient modes) - closely linked to the deployment of information and communication technologies (ICT)
- Technologies improving the energy efficiency of vehicles
- Technologies reducing the carbon intensity of fuels

Policy recommendations
Use a coherent portfolio of instruments

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National/Supra-national policies

- Fuel taxes
- Removal of fuel subsidies
- Introduction of CO_2 taxation on fuels
- Fuel economy standards
- Vehicle taxes, including feebates/bonus-malus schemes
- RD&D support

Local measures

- Compact city (e.g. densification, integrating land use and transport planning, promotion of brownfield development and TOD)
- Pricing (congestion charges, tolls parking fees)
- Regulatory (access & parking restrictions, low emission zones)
- Public transport investments (e.g. network development, subsidies

Local policies

Examples of measures already in use

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Pricing	Regulatory instruments	Public transport and walking and cycling support
Congestion charging, cordon pricing, tolls (e.g. London, Milan, Singapore, Stockholm).	Access restrictions (e.g. "yellow label" restrictions in Chinese cities).	Shared bicycle systems and bicycle parking (e.g. *Vélib'* in Paris, Citi Bike in New York).
Parking pricing (widespread in North American, European and Japanese cities, most prevalent in the central business districts of densely populated cities).	Low-emission zones (e.g. time-of-day restricted access for freight trucks, as in many European cities).	Investments in cycling and walking paths, and sidewalks.
	Registration caps (e.g. in Singapore, Shanghai and other Chinese cities).	Transit infrastructure projects/ extensions (e.g. the Paris *Métro*; Bogotá's *Transmilenio*).
	Parking restrictions/reductions in parking supply (e.g. progressive elimination of off-street parking in Copenhagen, Paris and other European cities).	Transit fare subsidies (e.g. local, regional and federal subsidies pay for roughly half of fares on systems in many European and Chinese cities).

- Front runners exist amongst cities
- Effects observed in these cities were instrumental to assess the impact of these policies and generalize it in our projections

Sustainable transport systems: a cheaper way to provide service

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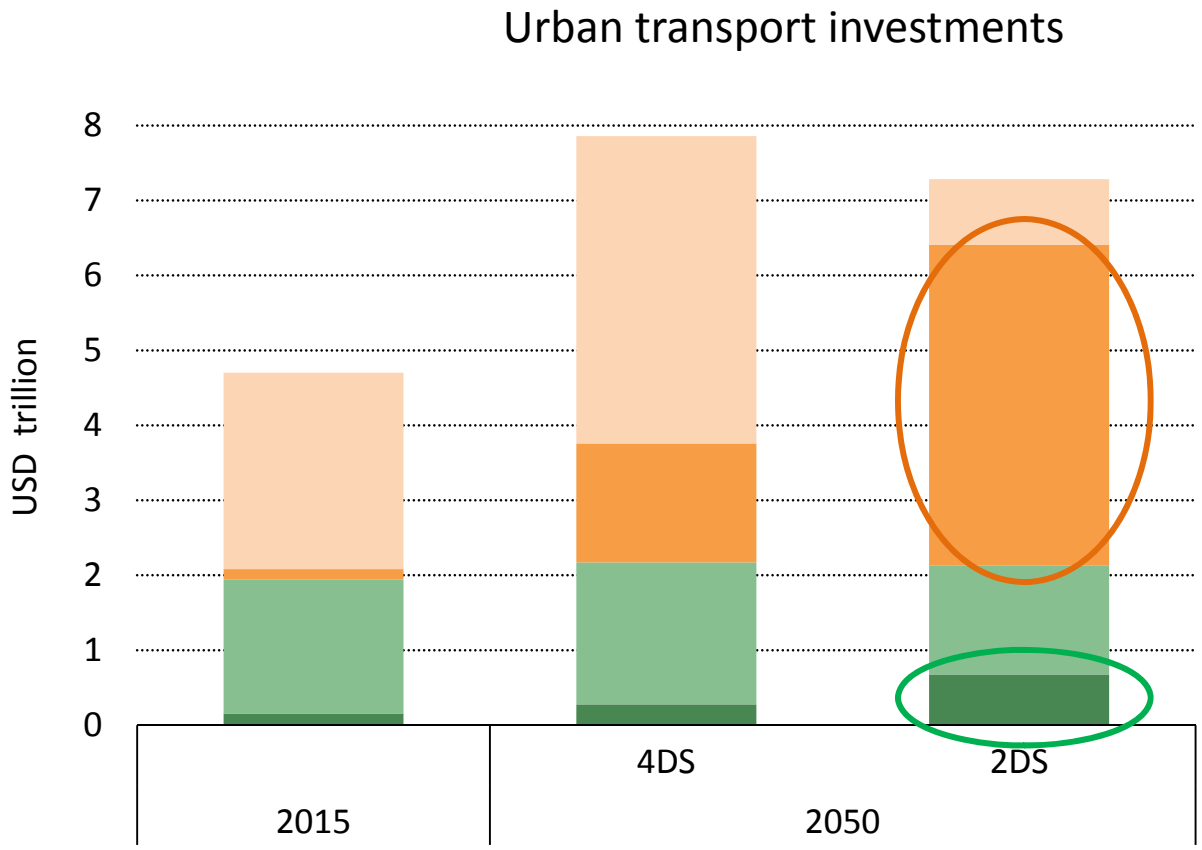

In the 2DS, by 2050 one billion cars are electric vehicles while public transport travel activity more than doubles

Heating and cooling: the elephant in the room

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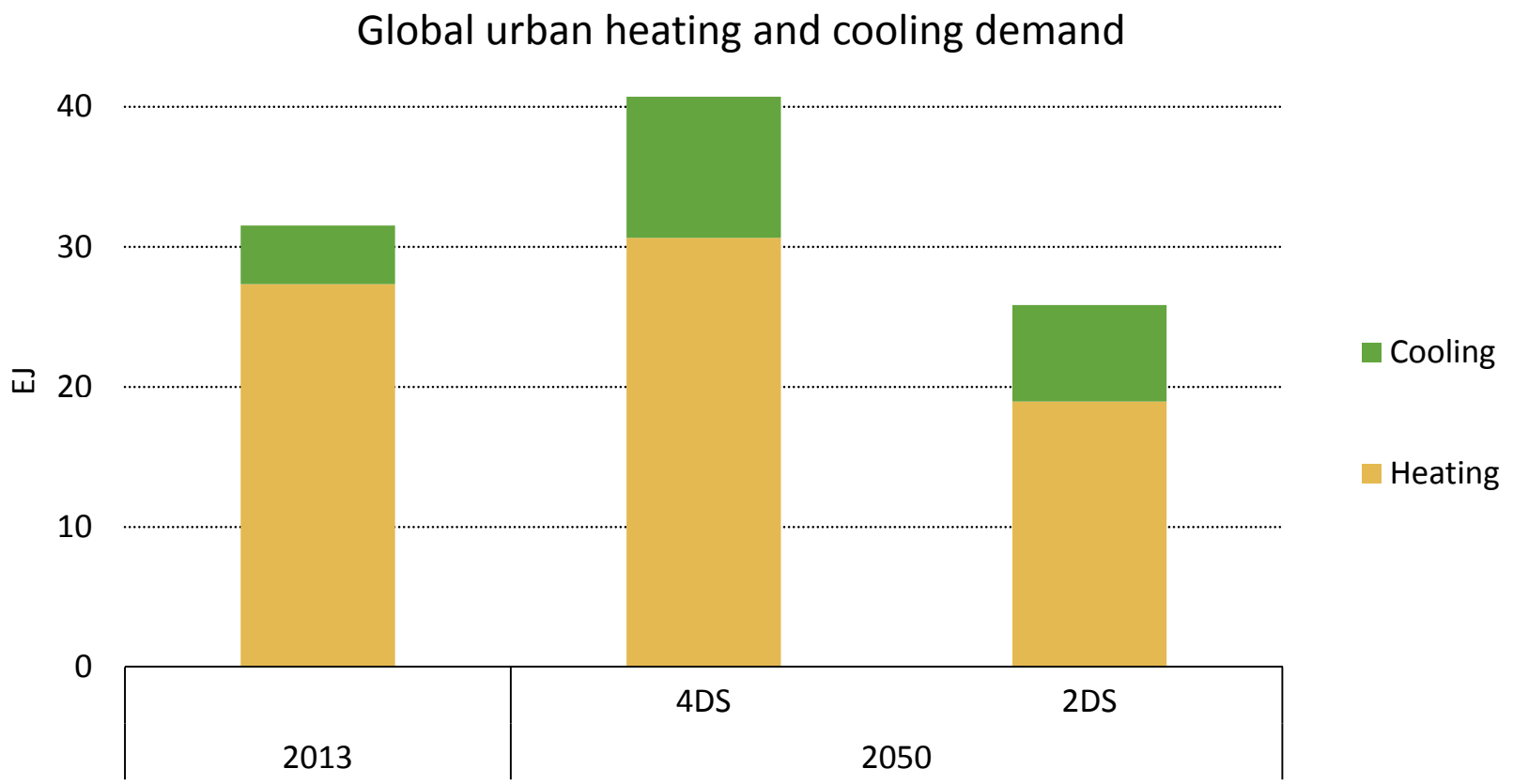

Global heating and cooling energy demand in cities can be reduced by 25% without compromising thermal comfort, particularly cooling in emerging economies

Systems integration: utilising wastes and local resources

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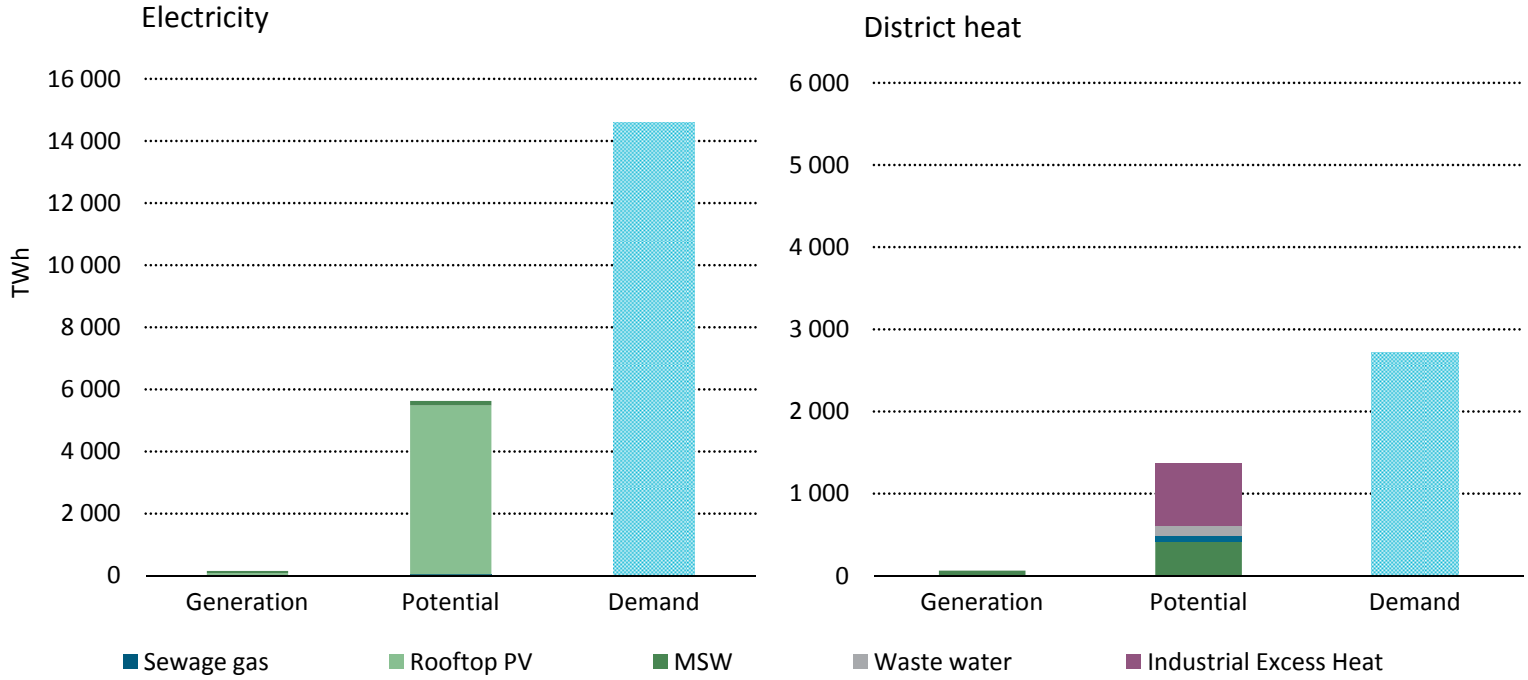
Generation and technical potentials for electricity and heat from urban energy sources in 2013



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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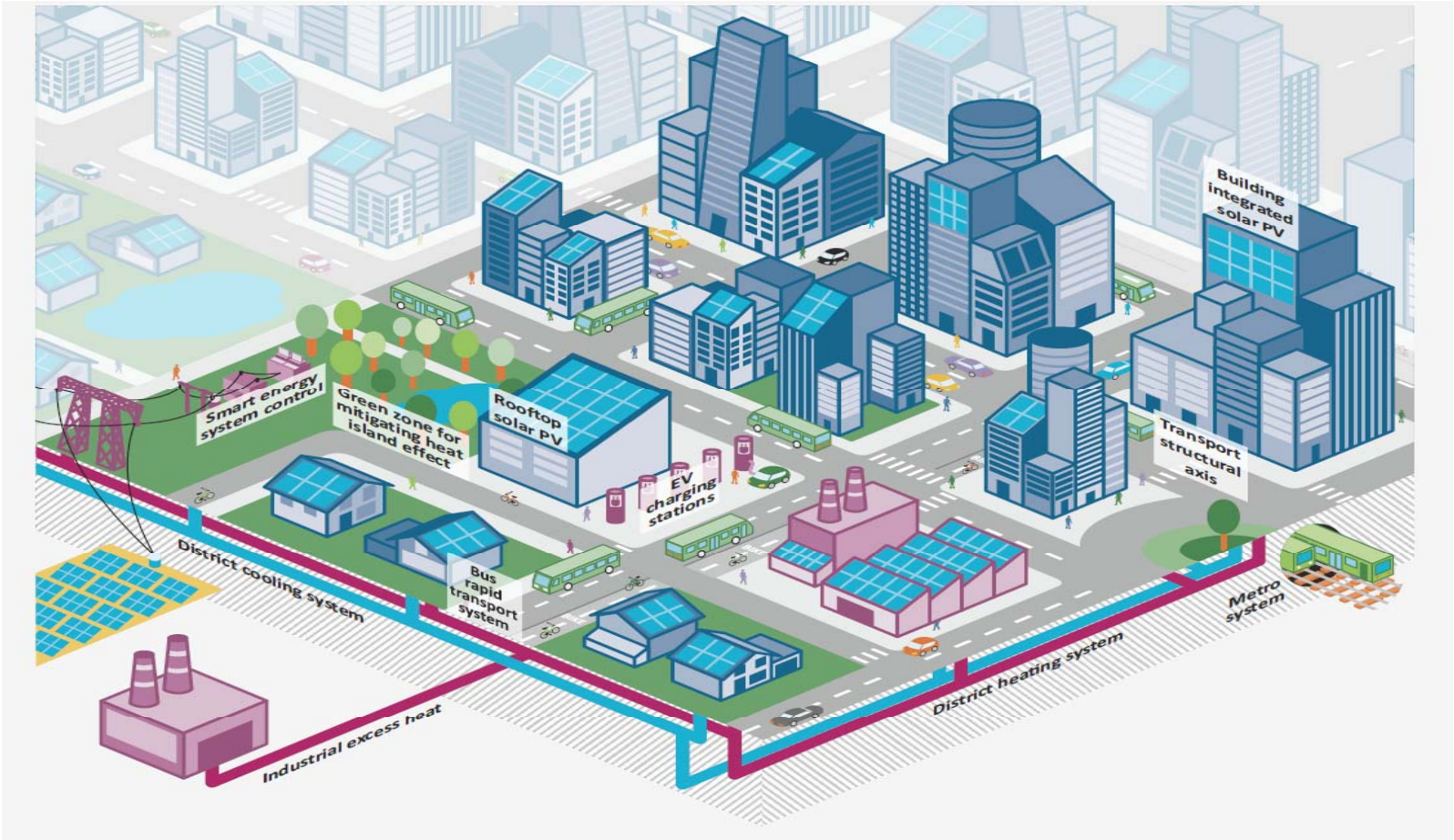

Urban forms can lock-in the energy system of cities in either inefficient or sustainable energy use patterns for decades.

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

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POLICY RECOMMENDATIONS

LOCAL POLICY MAKERS	NATIONAL POLICY MAKERS
Integrated Land Use and Transport planning	Capacity-building programmes for local planners
Education and Awareness Campaigns	Enabling national legislative frameworks
Enforcement of Building Codes	Funding mechanisms for investments in sustainable energy infrastructure
Increased Investments in Public Transport	Alignment of regulatory frameworks with technological innovation
Sustainability-oriented municipal utilities	
Green municipal buildings and transport fleets	

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

Conclusions

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- 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

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Explore the data behind *ETP*

www.iea.org/etp