



# World Energy Investment 2017

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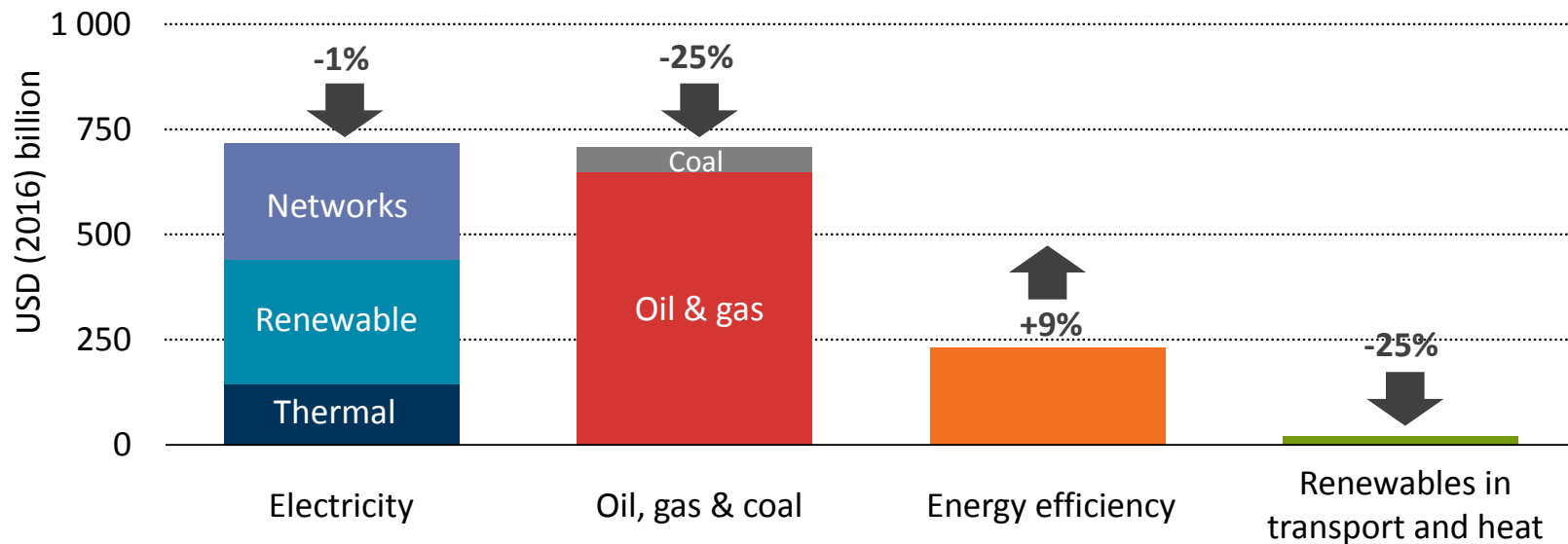
Economics and Investment Office



# Global energy investment fell 12% in 2016, a second consecutive year of decline

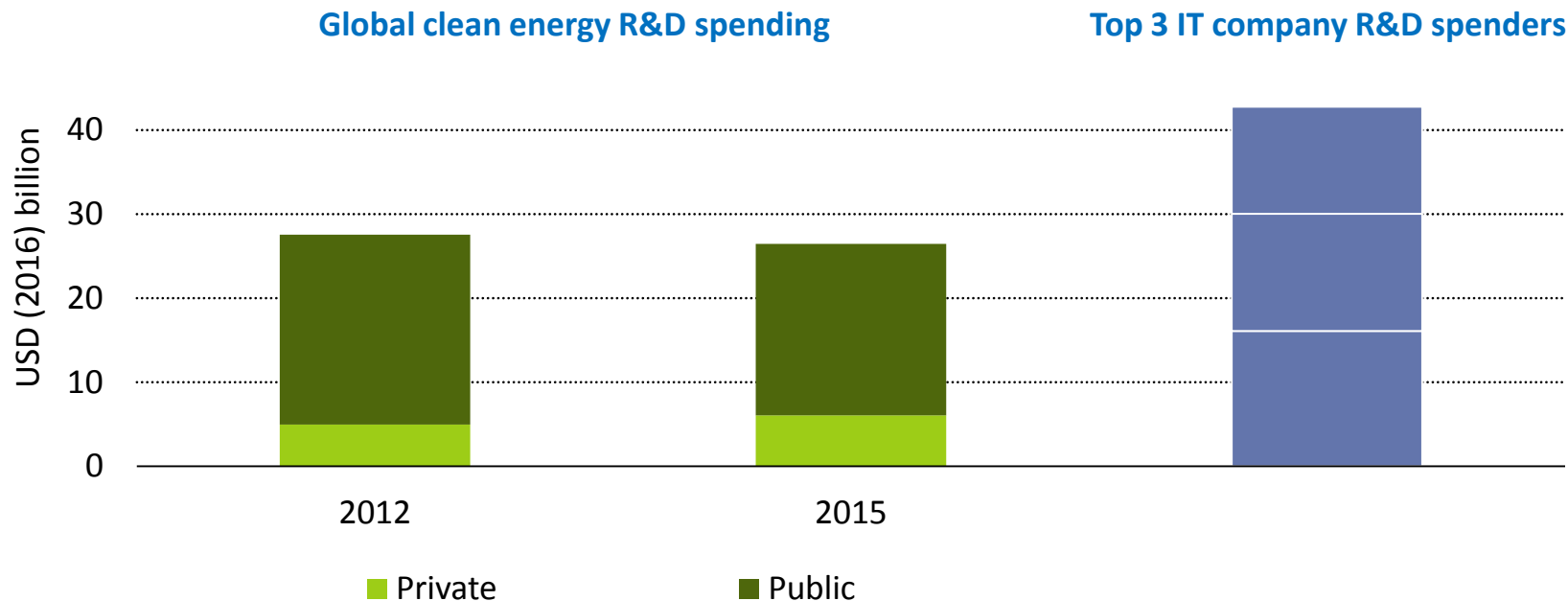


Global energy investment 2016



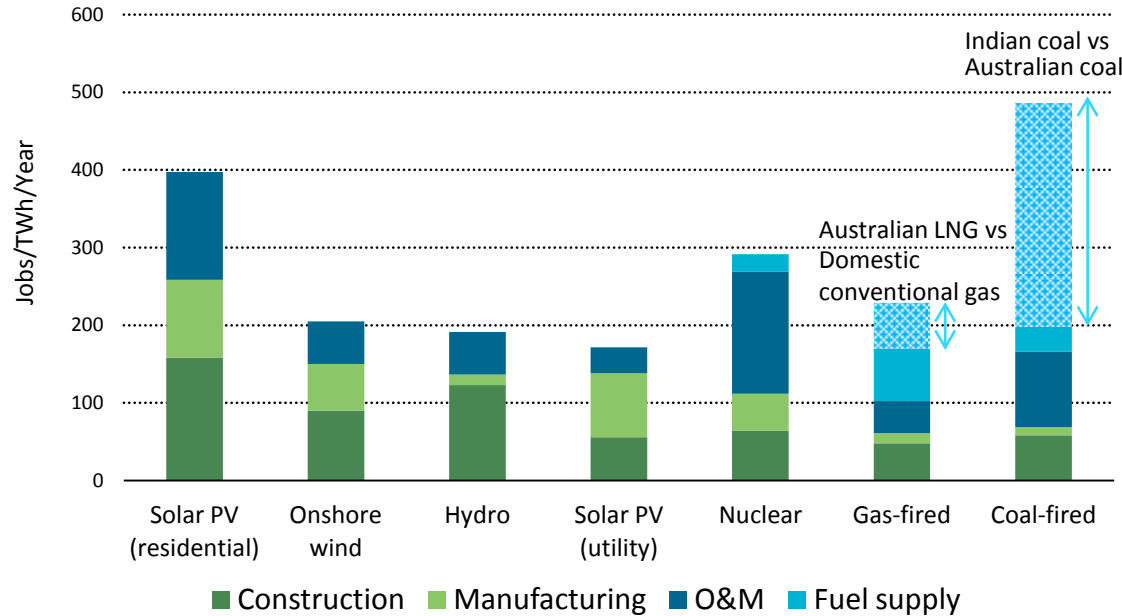
Electricity sector investment overtook oil and gas for the first time

# Global clean energy R&D funding needs a strong boost



**Global R&D spending on clean energy plateaued at \$26 billion/year, with much room for growth from the private sector. As a share of GDP, China's leads spending on energy R&D, after overtaking Japan**

## Employment associated with 1TWh of new generation in 2016



**Residential solar PV and coal-fired generation are most labour-intensive while regional differences can be significant.**

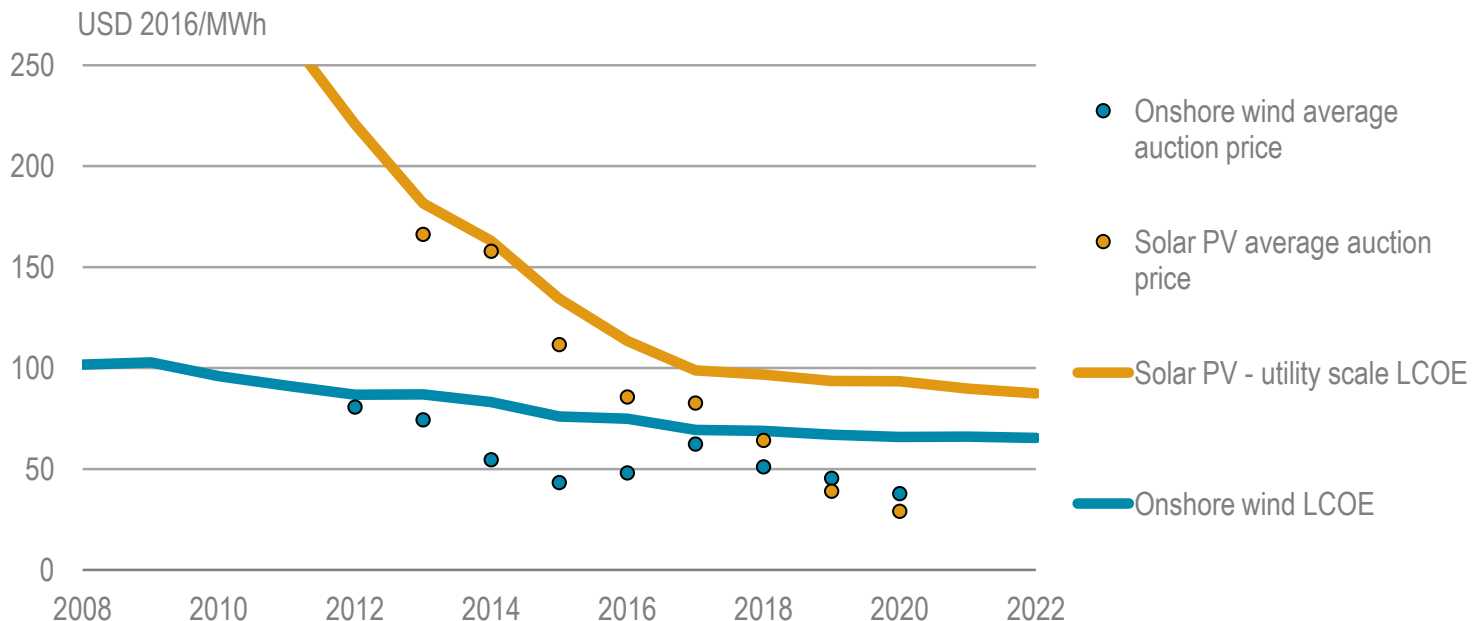
# Appliance standards lock in electricity end use efficiency



Electricity demand shows similar stagnation in the US and Europe despite very different end user prices

# Wind and solar costs continue to plummet

Wind and solar PV average LCOEs and auction results by commissioning date



**Competitive auctions combine technology incentives with ultra low cost of capital**

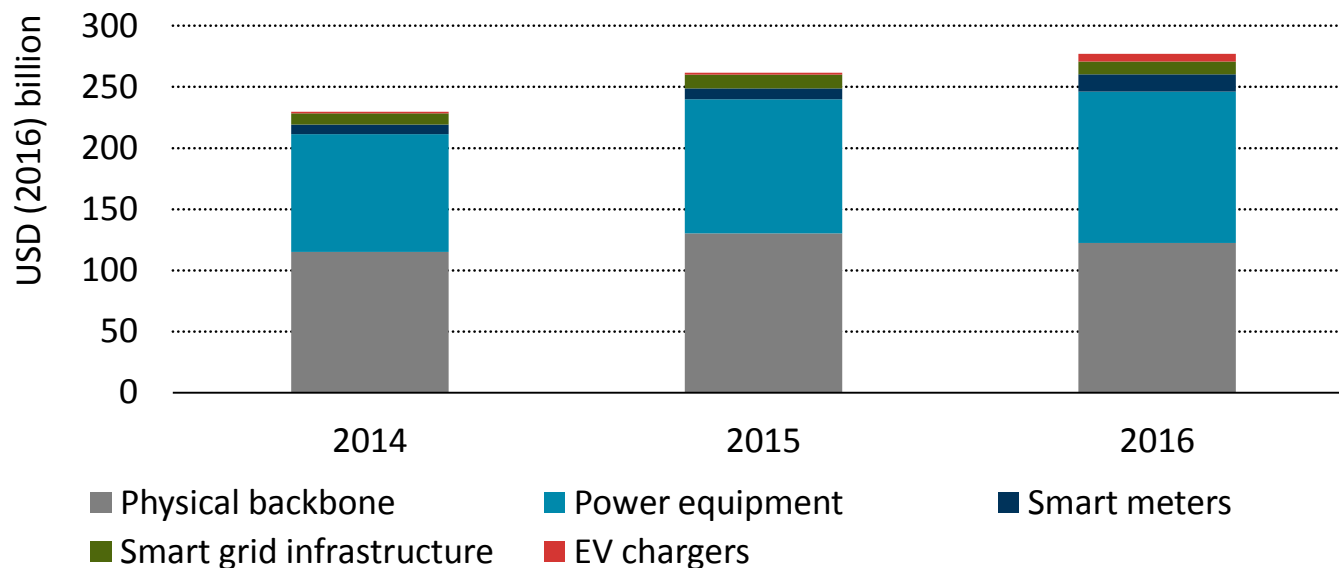
# The so called “decentralised” renewables



All of wind and the large majority of solar deployment relies on an interconnected network

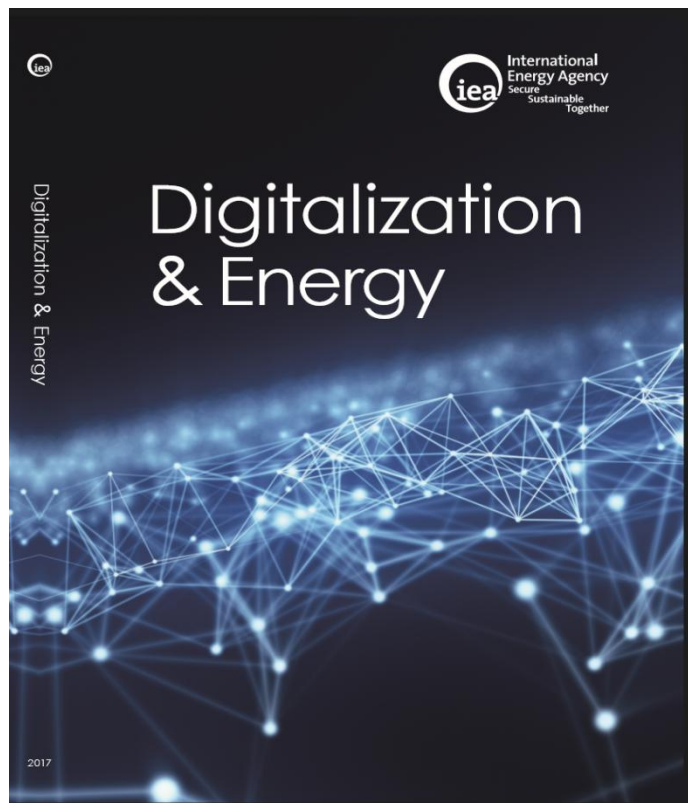
# Smarter networks are the key to address flexibility gaps

## Investment in digital grid infrastructure and total electricity networks spending



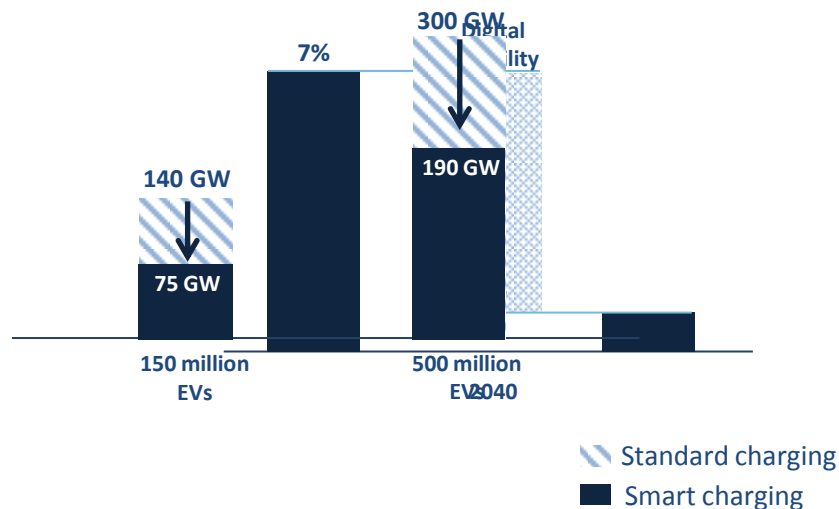
**Networks spending is dominated by lines and power equipment, but digital grid infrastructure now accounts for over 10% of networks investment.**





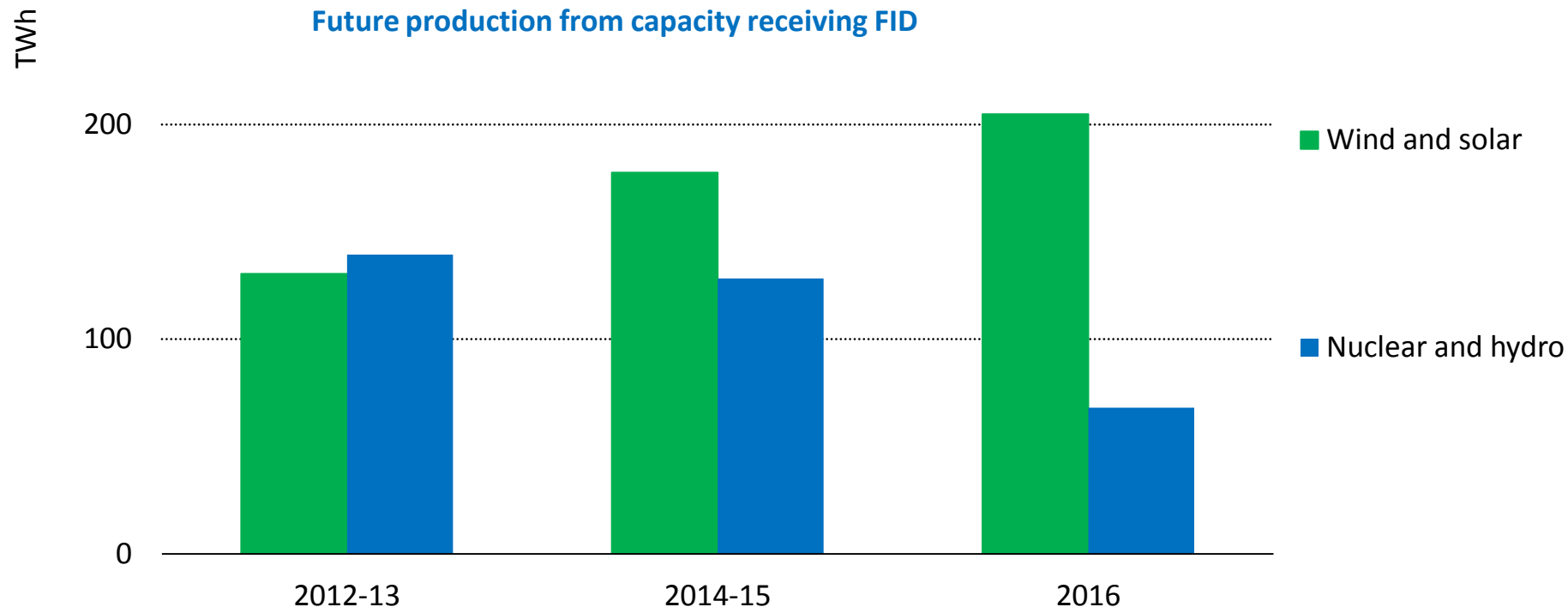
## EVs standard vs smart charging

Containment of solar PV and wind



**Digitalization unlocks flexibility to facilitate renewable integration and turn EVs into flexible grid assets**

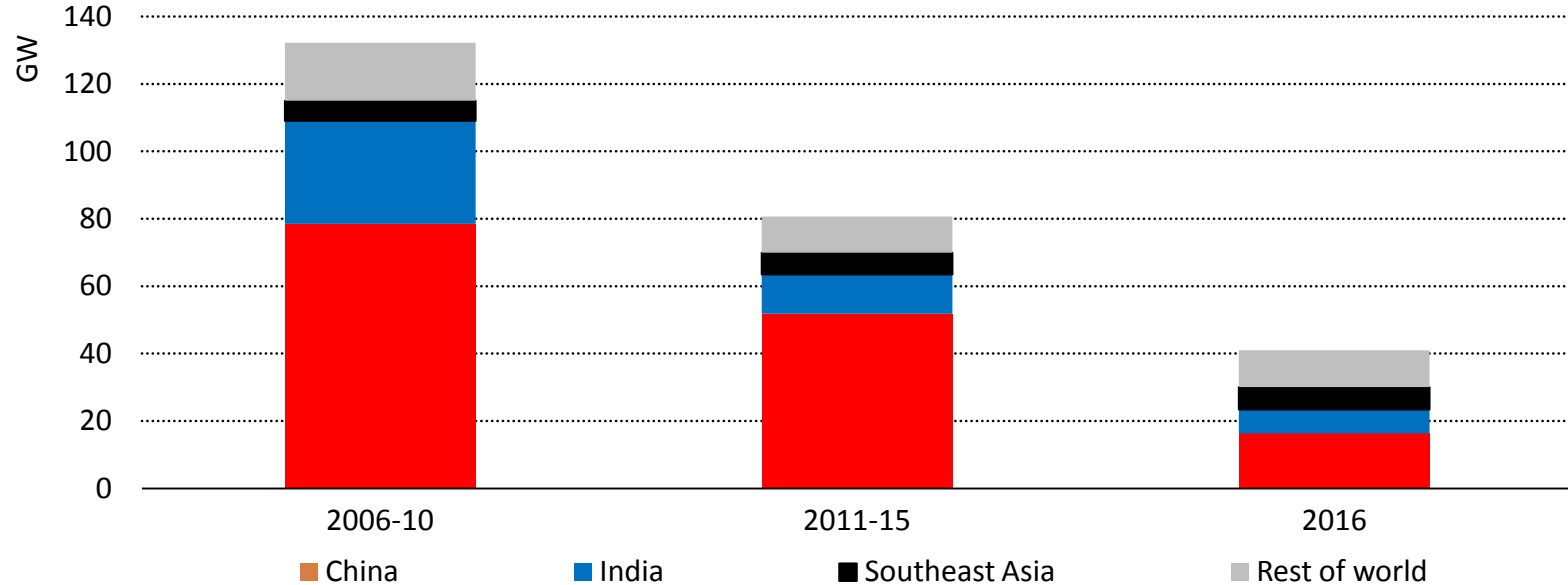
# The headwind of the hydro and nuclear slowdown



**New low carbon investment covers only around half of the global electricity demand increase**

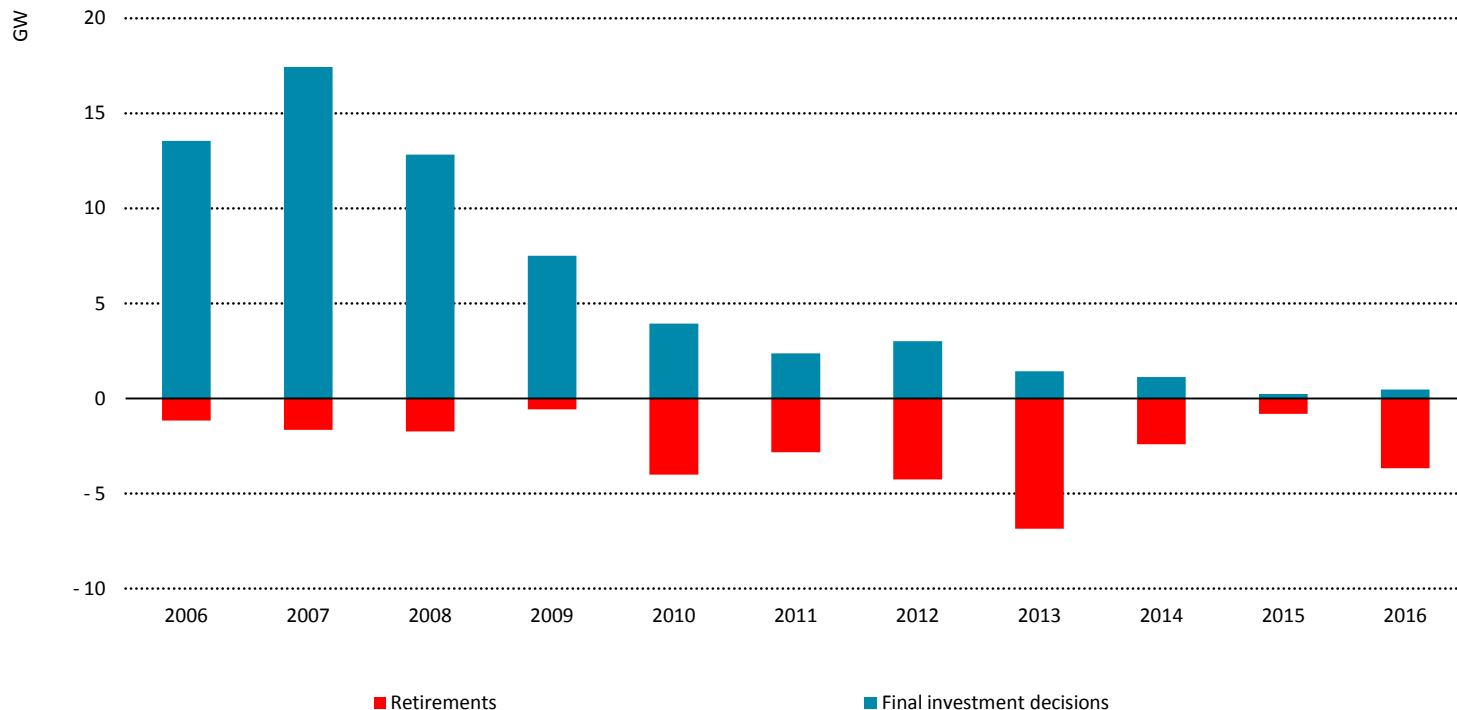
# A wave of coal power investment is coming to a pause

Average annual final investment decisions for new coal-fired power capacity



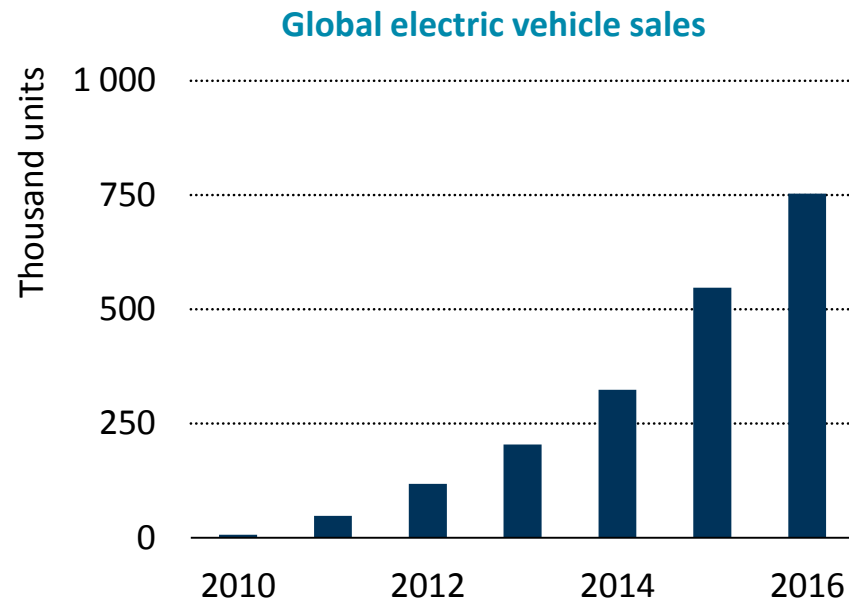
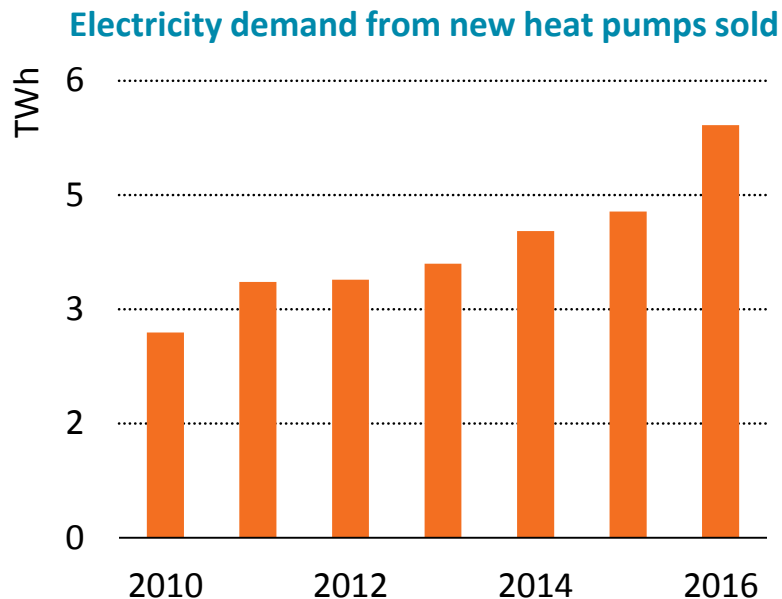
In 2016 the sanctioning of new coal power fell to the lowest level in nearly 15 years, hampered by competition from renewables and environmental challenges. Gas power FIDs surpassed coal for only the second time in the past decade.

# Gas capacity: coming back from the brink?



**Compressed load factors, low wholesale prices and market design uncertainty disrupted the investment model of gas plants**

# Electrification of transport and heat is progressing



**Electric vehicle (EV) sales grew 38% in 2016 and, at \$6 billion, now represent 10% of all transport efficiency spending. Another \$6 billion was spent globally on EV charging stations.**

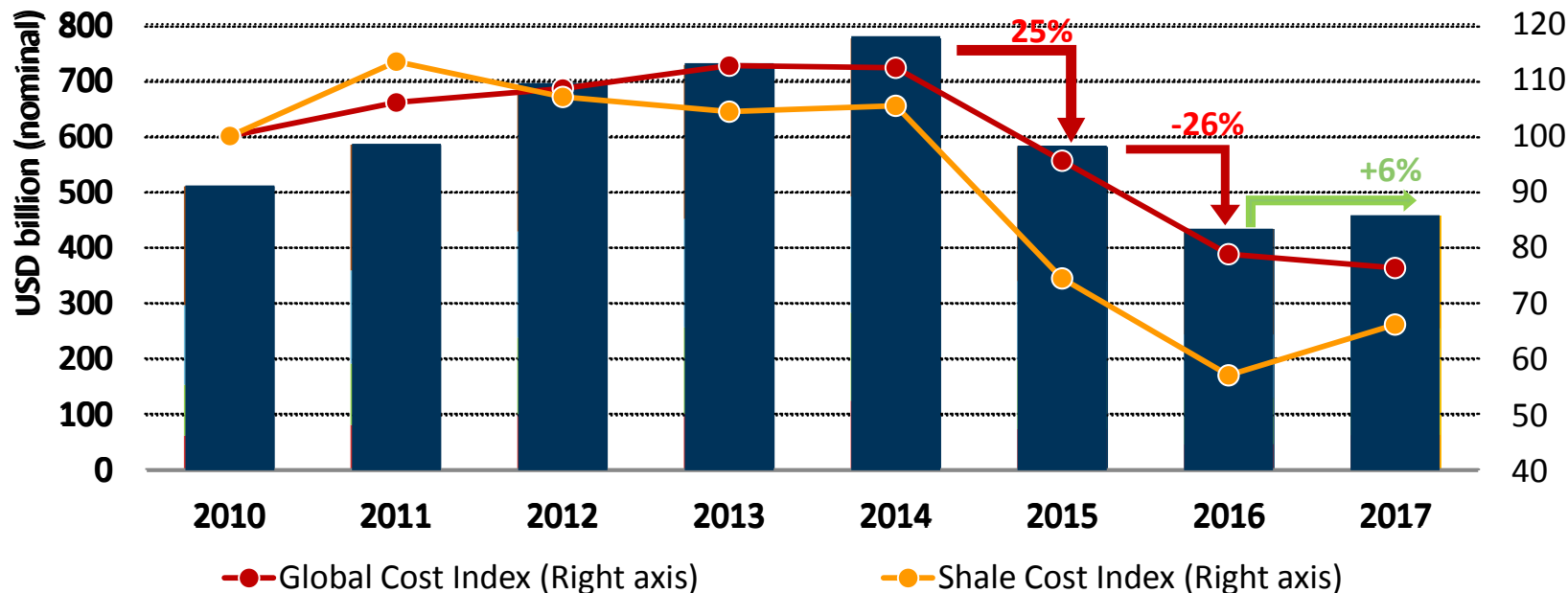
# Cheap oil shifts consumer preferences towards big cars

## *The three best selling vehicles in North America*



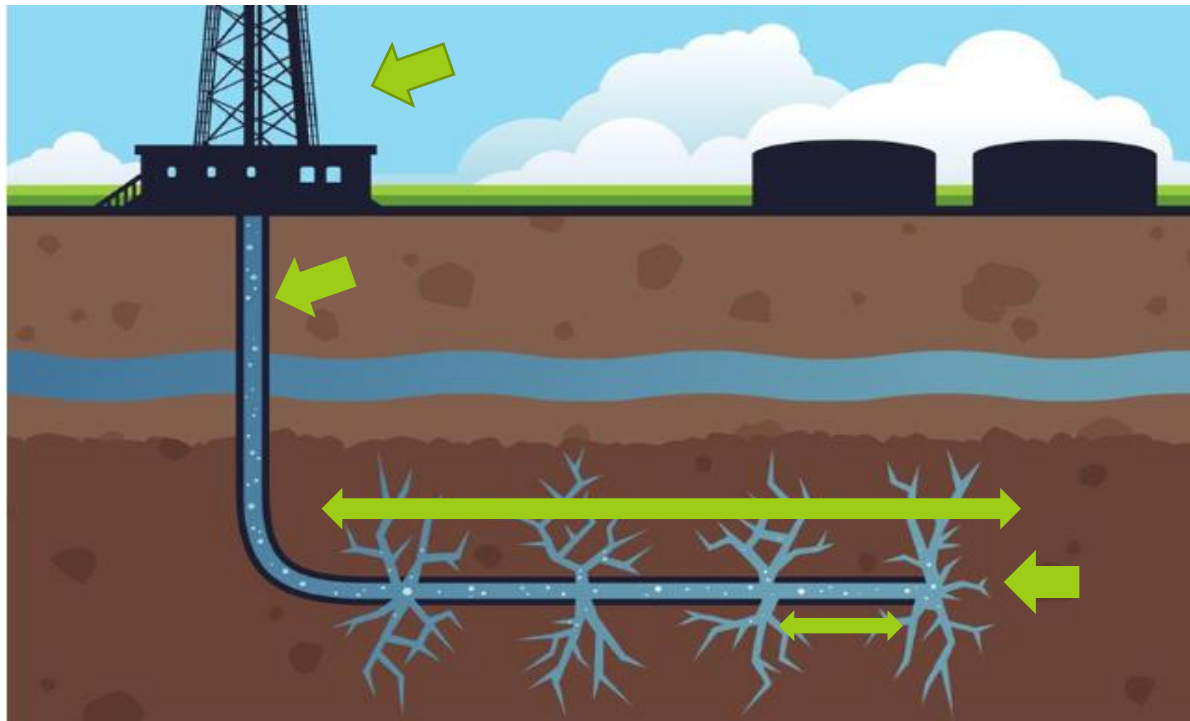
# Global upstream investment rebounds modestly in 2017

Global oil and gas upstream capital spending 2010-2017



Ramp up of activities leads to cost inflation in US tight oil but elsewhere upstream costs decline further. NOC' share in total investment reaches another record high.

# US shale: a digitalization and technology success



3D seismic data for geologic modelling

Multi-well pad drilling

Walking rig

New chemical agents to reduce the use of sand

Longer lateral

Tighter spacing

Fracture design and evaluation software

Improved robotics

Sources: original image from the Texas Tribune





West Siberia brownfield: domestic service capabilities, costs are in rouble



Power of Siberia: Strong project management expertise with pipelines, Made in Russia components

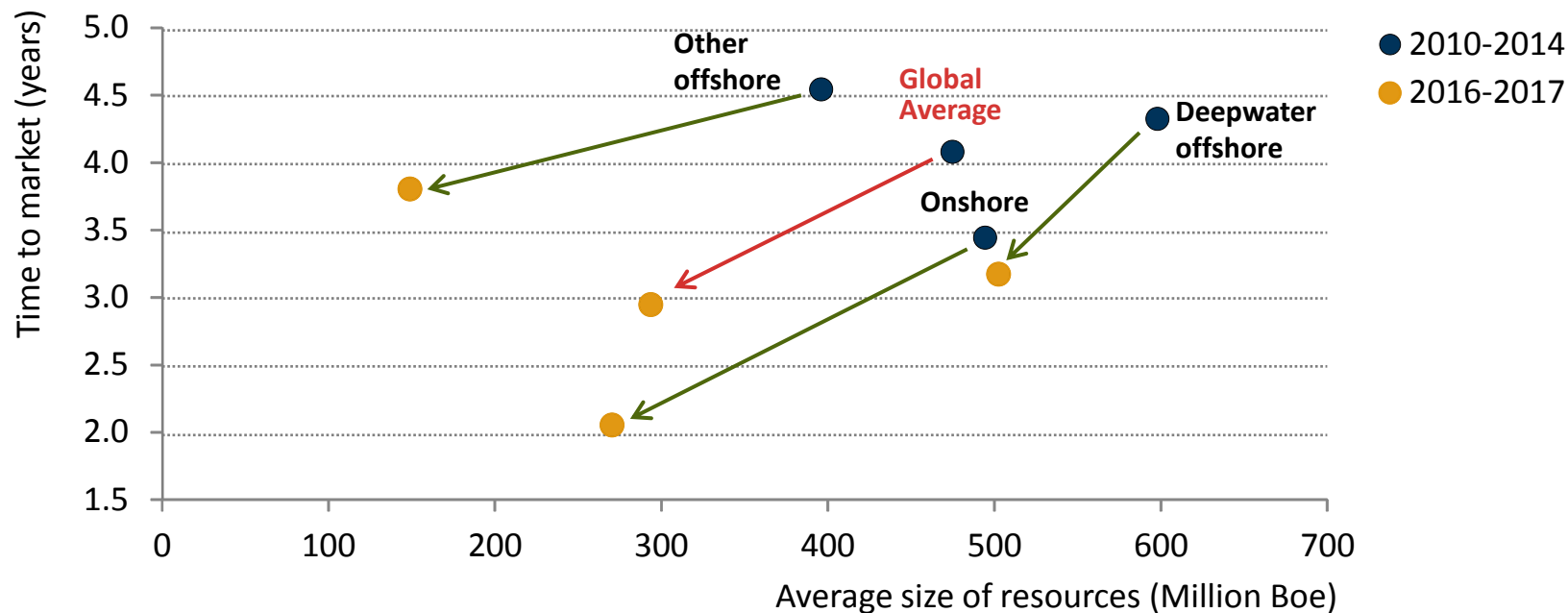


Yamal LNG: Chinese equity and project finance, EU and Japanese technology providers

**Russian oil production stabilized at a level 0.6 mB/day higher than 2014 expectations**

# Conventional oil and gas projects becoming faster and smaller

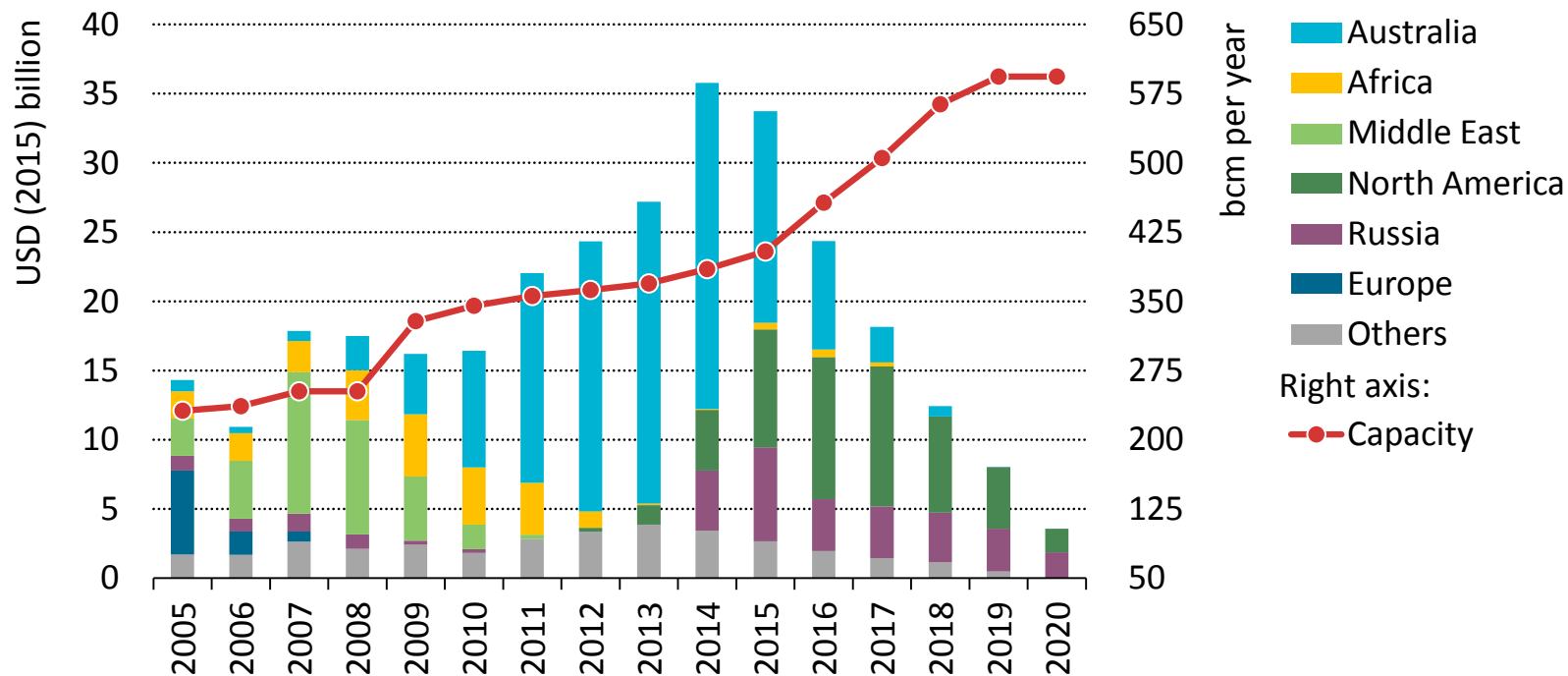
Average size of conventional resources sanctioned and time-to-market



**A shift in company strategies and technology developments leads to shorter project cycles across all the oil and gas industry**

# LNG investment: past the peak?

## Investment into LNG export facilities



Lack of FIDs since 2015 indicate a rapid decline of investment

