



Energy Technology Perspectives 2017

Catalysing Energy Technology Transformations

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The Canon Institute for Global Studies, Tokyo, 20 July 2017

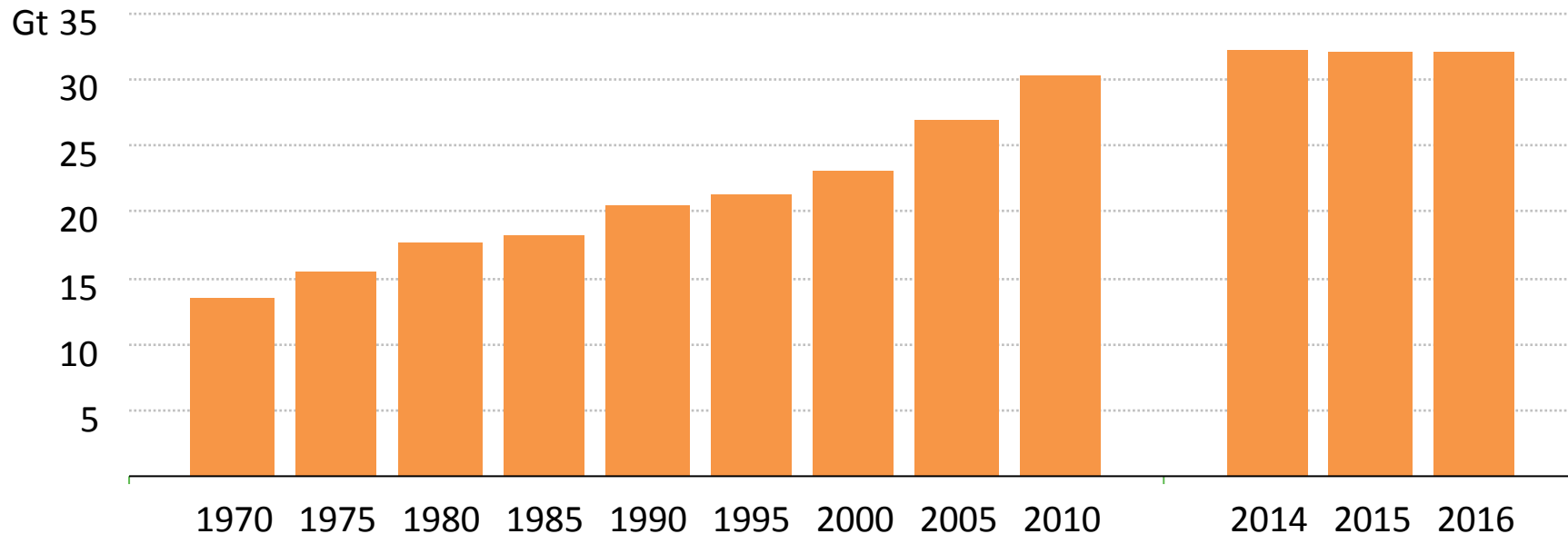


- Global energy markets are changing rapidly
 - *Renewables supplied half of global electricity demand growth in 2016, and increase in nuclear capacity reached highest level since 1993*
 - *Global energy intensity improved by 2.1% in 2016*
 - *Electric car sales were up 40% in 2016, a new record year*
- The energy sector remains key to sustainable economic growth
 - *1.2B people lack access to electricity; 2.7B people lack access to clean cooking*
 - *Largest source of GHG emissions today, around two-thirds of global total*
 - *Largest source of air pollution, linked to 6.5 million premature deaths per year*
- There is no single story about the future of global energy
 - *Fast-paced technological progress and changing energy business models*

Global CO₂ emissions flat for 3 years – an emerging trend?



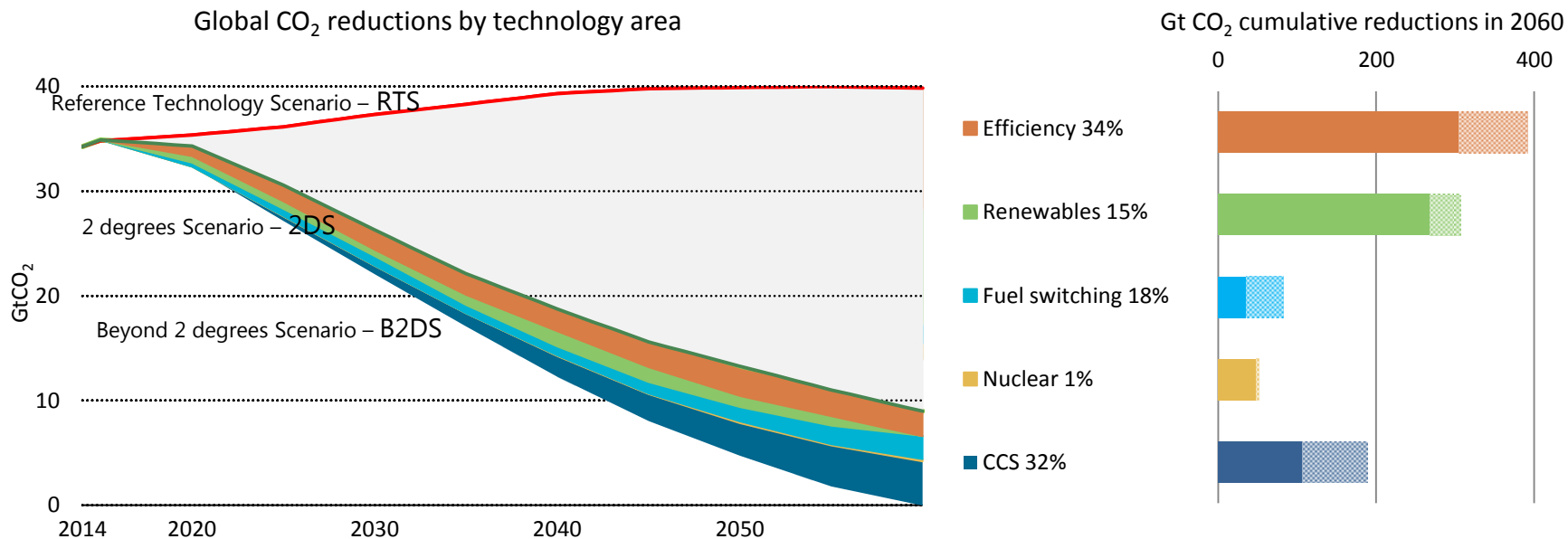
Global energy-related CO₂ emissions



IEA analysis shows that global CO₂ emissions remained flat in 2016 for the third year in a row, even though the global economy grew, led by emission declines in the US and China

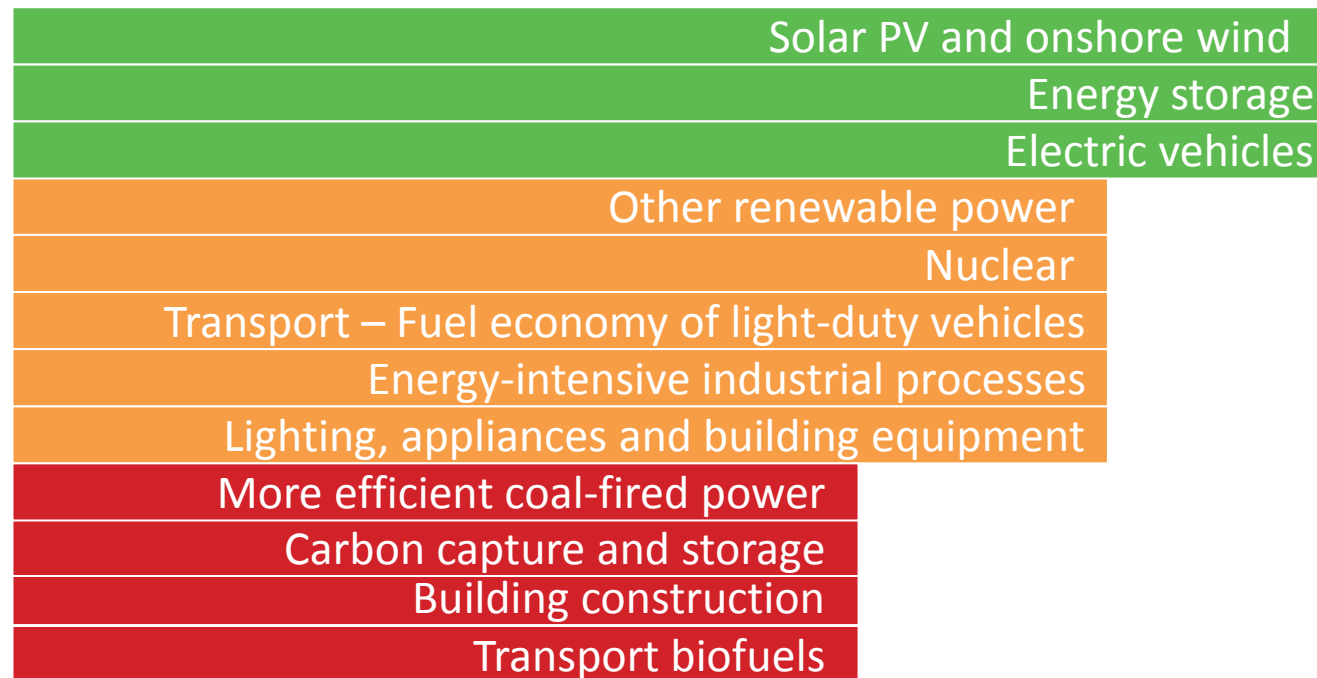
How far can technology take us?

Technology area contribution to global cumulative CO₂ reductions



Pushing energy technology to achieve carbon neutrality by 2060 could meet the mid-point of the range of ambitions expressed in Paris

The potential of clean energy technology remains under-utilised

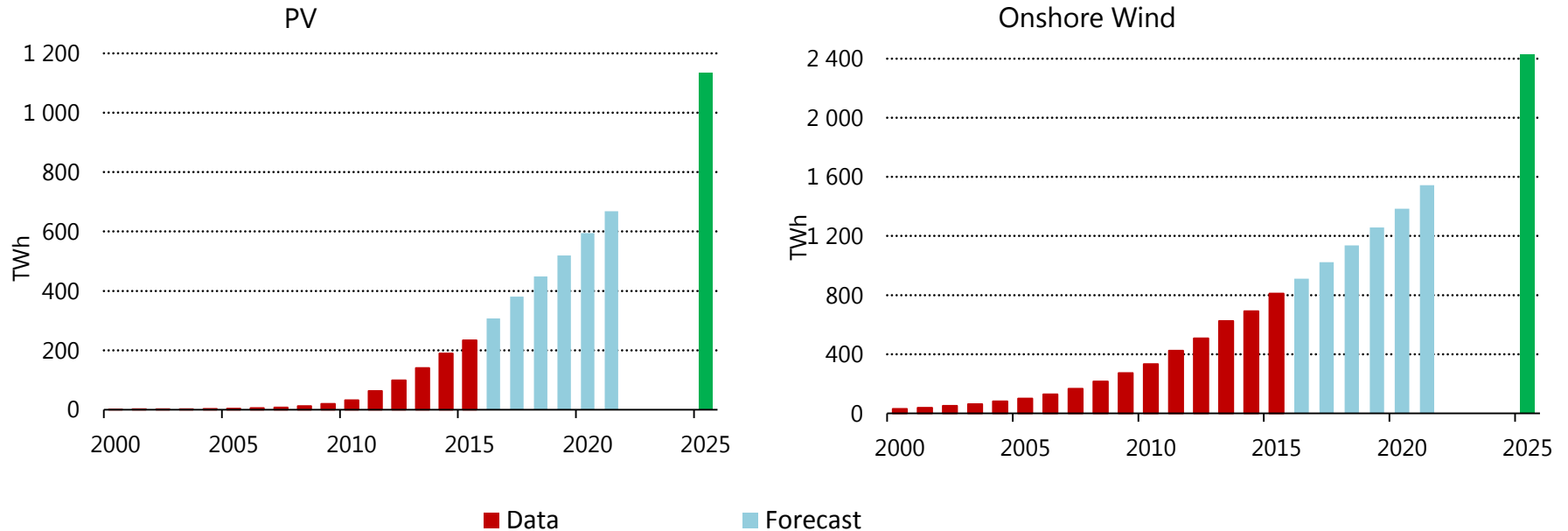


● Not on track ● Accelerated improvement needed ● On track

Recent progress in some clean energy areas is promising, but many technologies still need a strong push to achieve their full potential and deliver a sustainable energy future

Solar PV and Wind are still leading the transition...

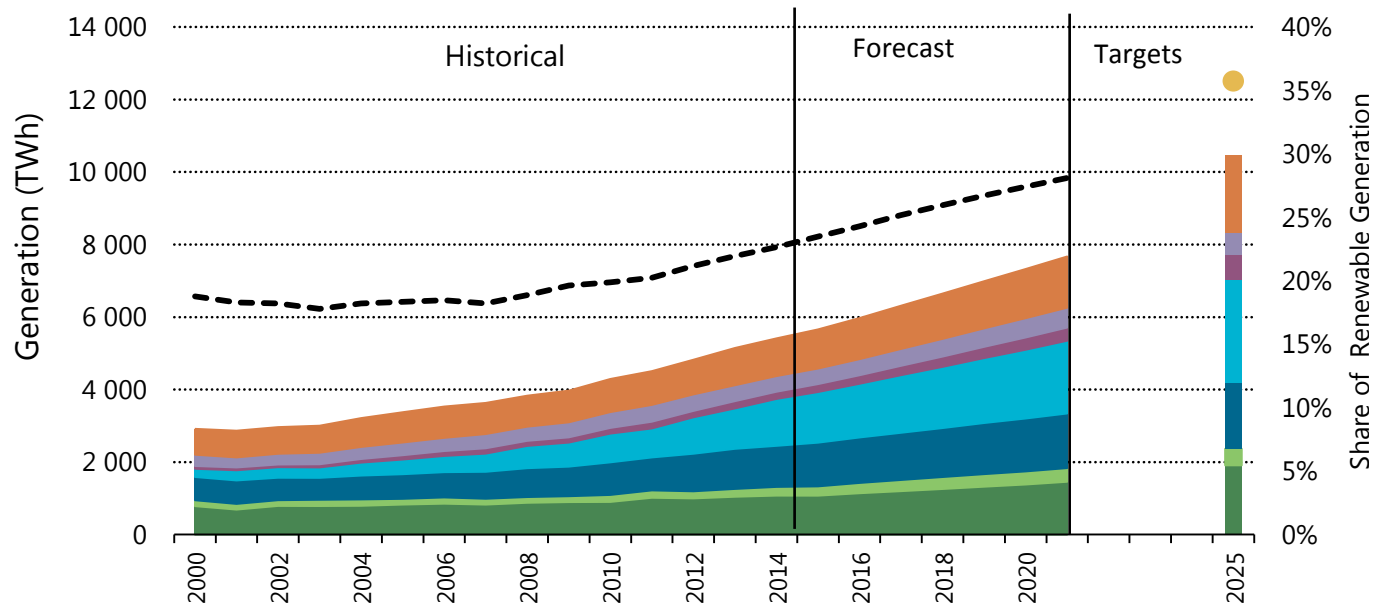
Electricity generation of selected renewable power generation technologies



Solar PV and onshore wind electricity generation are expected to grow by 2.5 times and by 1.7 times, respectively, over 2015-20.

... but can't make up for other low-carbon generation sources

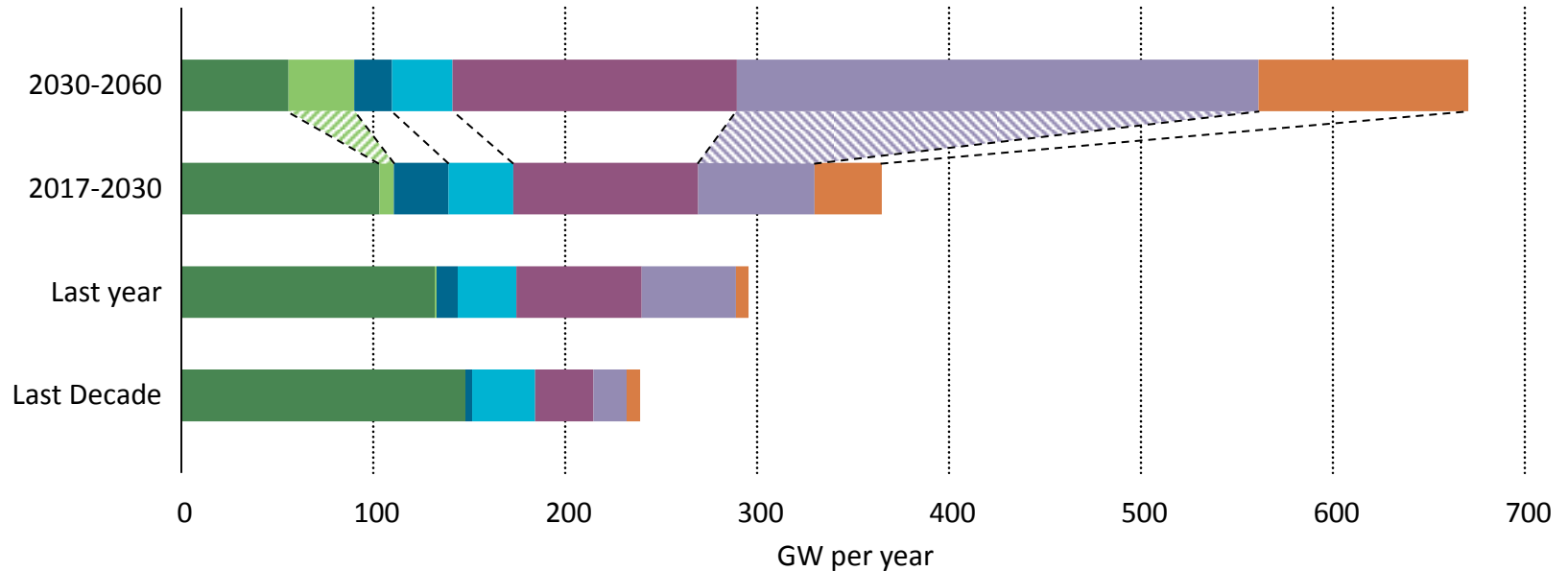
Total renewable power generation by region



While renewable power additions keep breaking records, they need to grow much faster to reach the 2DS electricity generation targets. Progress on early-stage technologies also needs to accelerate.

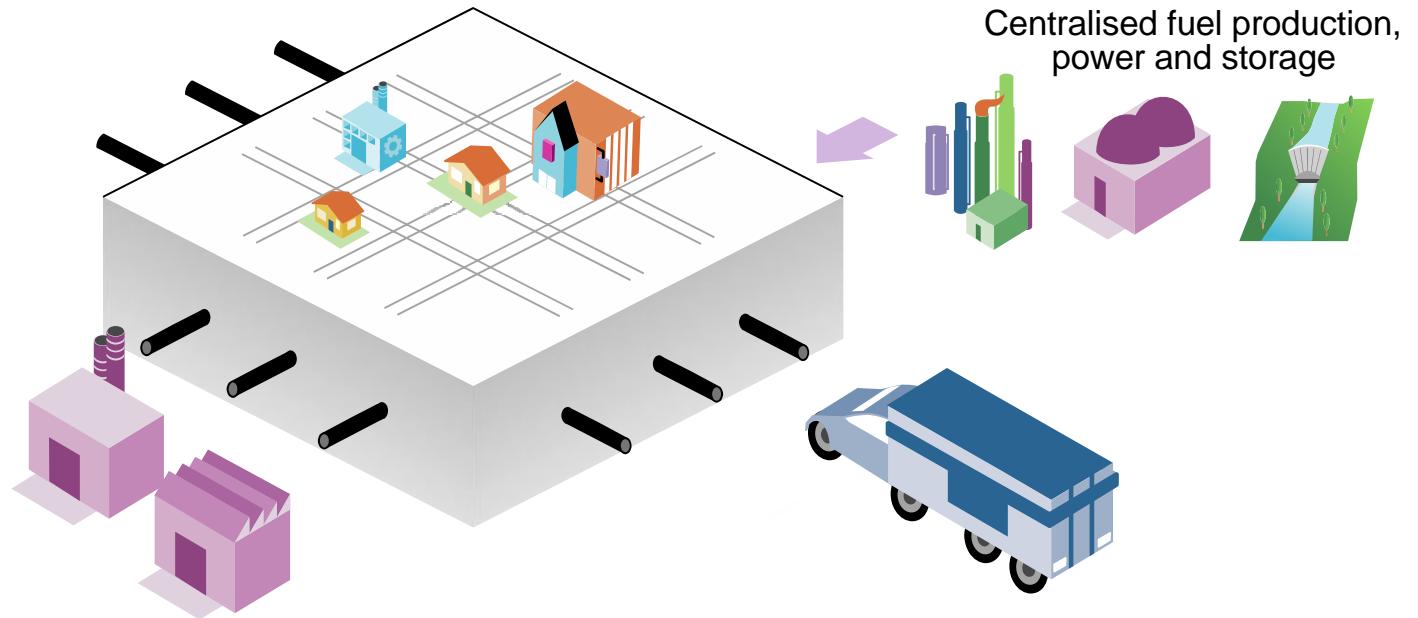
Can we push up the low-carbon power deployment pace?

Average capacity additions in different periods in the B2DS



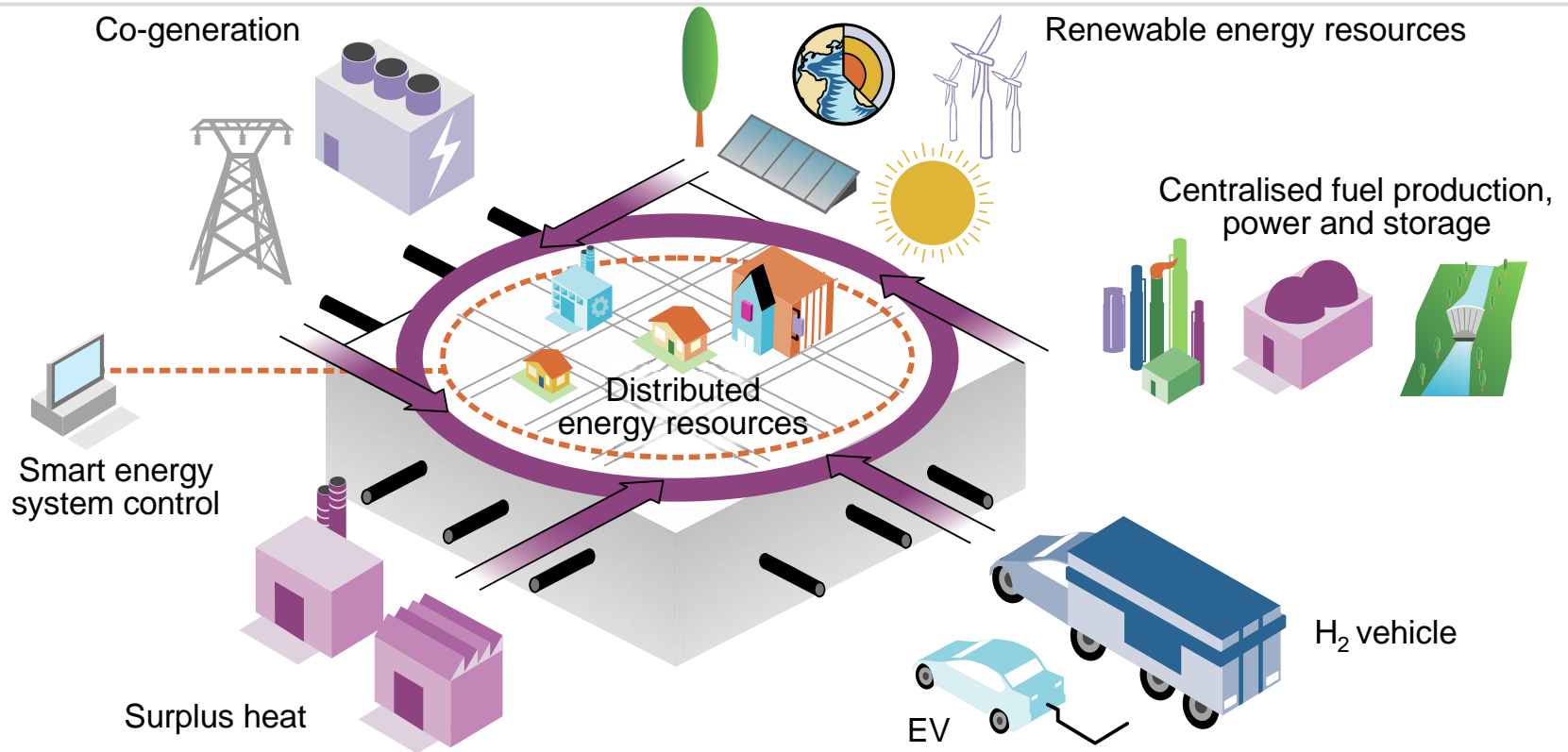
Recent successes in solar and wind will have to be extended to all low-carbon solutions, and brought to a scale never experienced before

Systems Integration is essential for a sustainable energy future



We need to move away from a one-directional energy delivery philosophy

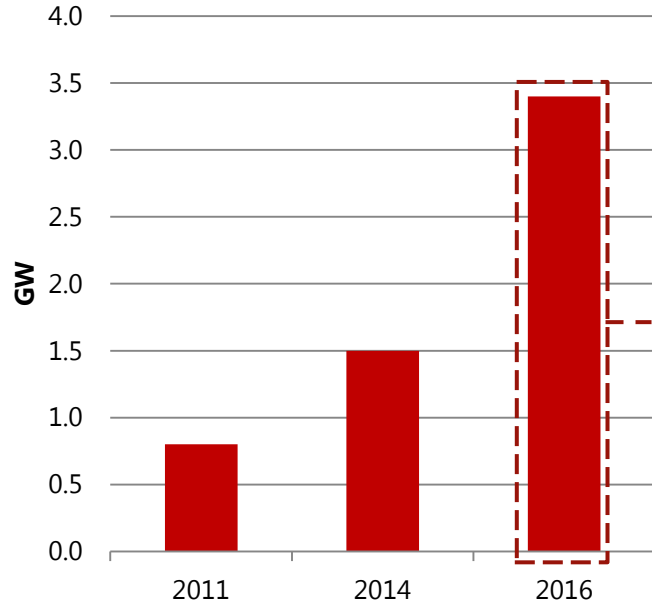
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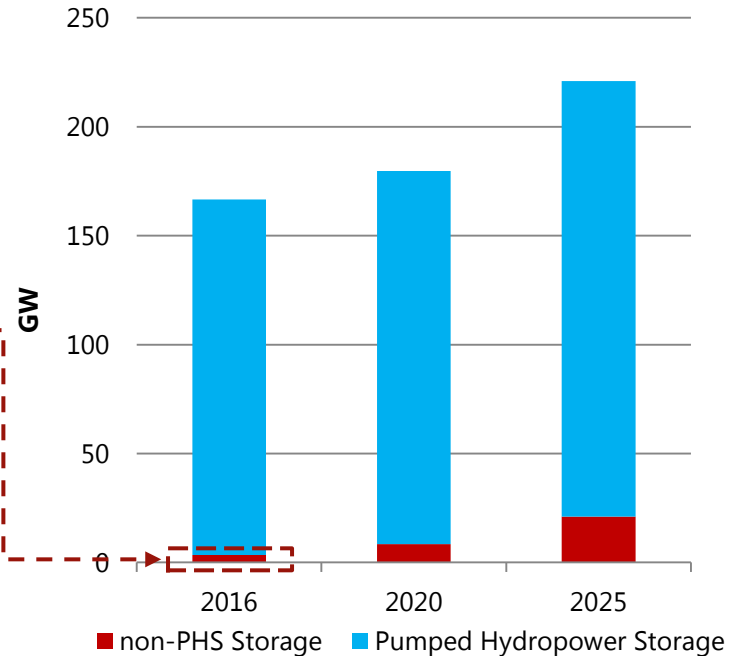
We need to move away from a one-directional energy delivery philosophy to a digitally-enhanced, multidirectional and integrated system that requires long-term planning for services delivery

The value of storage is starting to drive new solutions

Globally installed non-pumped hydro electricity storage (GW)

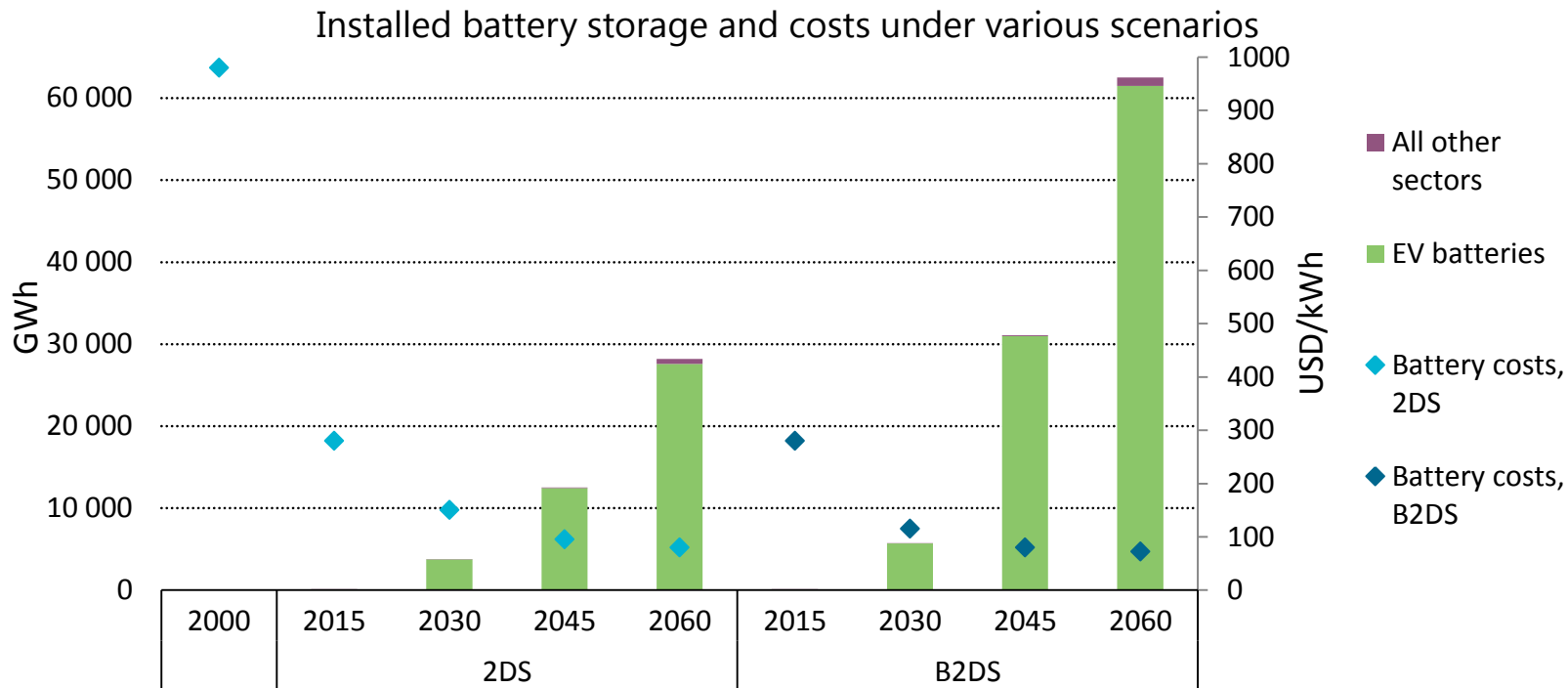


Globally installed electricity storage (GW)



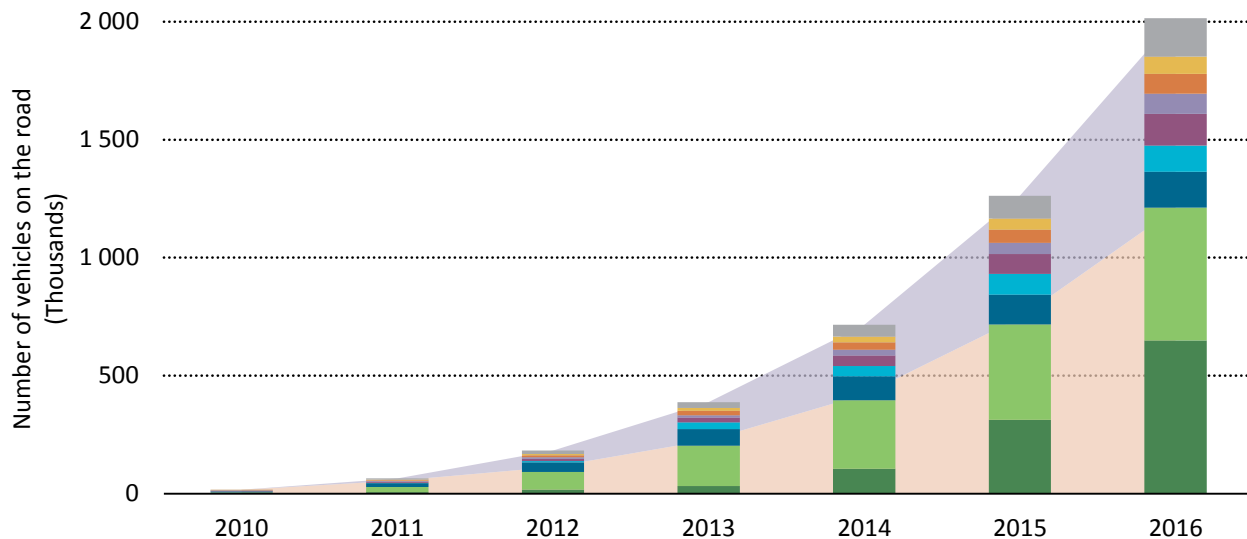
Positive market and policy trends supported a year-on-year growth of over 50% for non-pumped hydro storage
But near-term storage needs will remain largely answered by existing or planned pumped hydro capacity

Can we enact a storage revolution



Batteries experience a huge scale-up in the B2DS, with EV battery markets leading other sectors in size

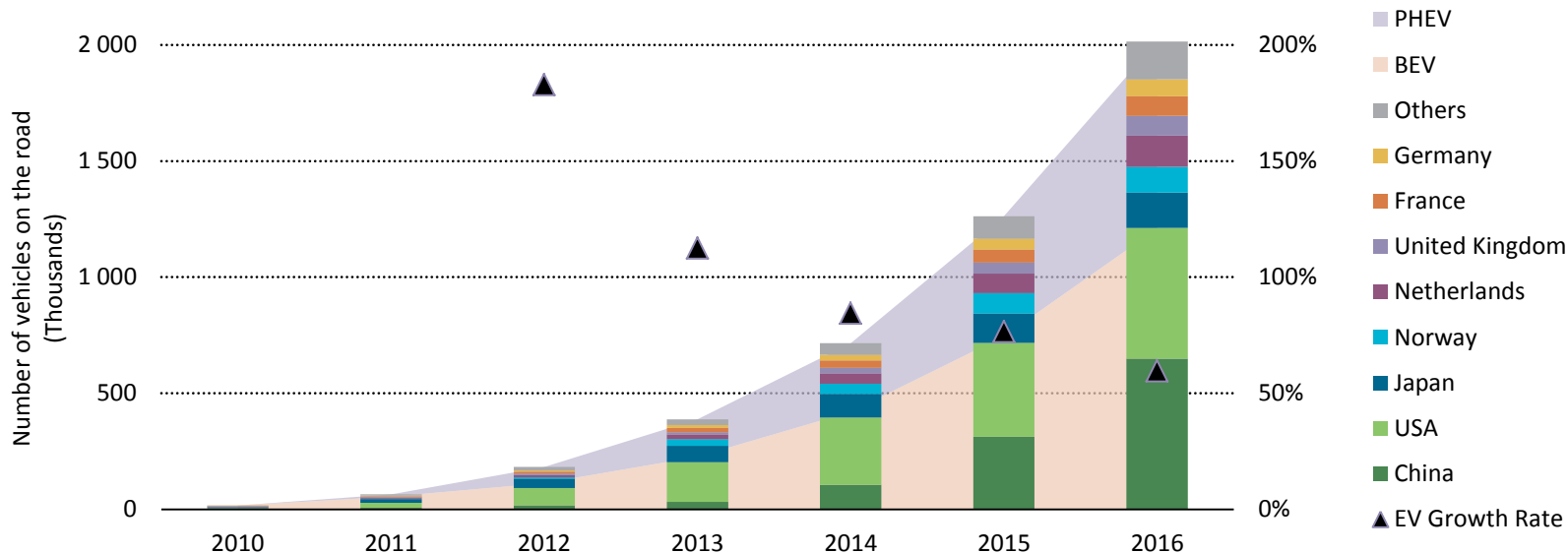
Evolution of the global BEV and PHEV stock, 2010-2016



The global PEV car stock has reached 2 million units in circulation last year,

EVs are still on track, but need continued support

Evolution of the global BEV and PHEV stock, 2010-2016

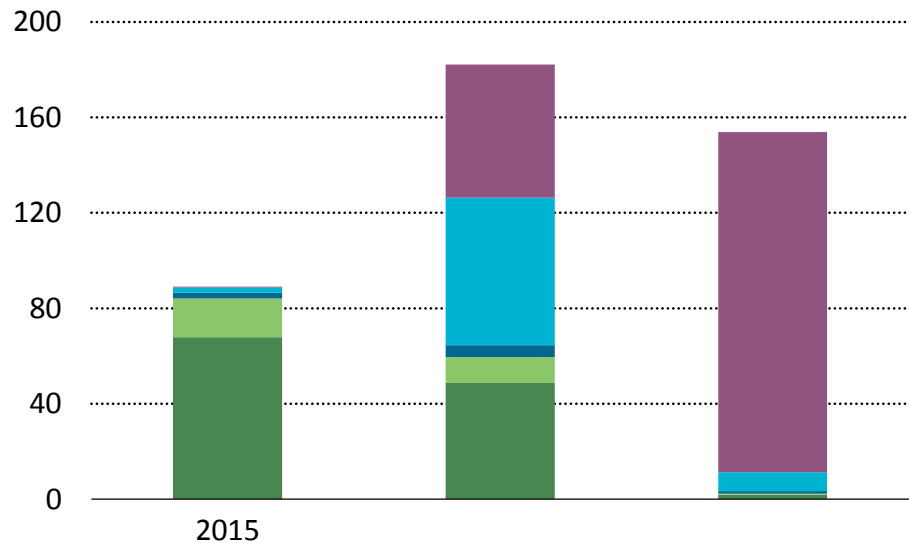


The global PEV car stock has reached 2 million units in circulation last year, but sales growth went from 70% last year to 40% this year, suggesting an increasing risk to start diverging from a 2DS trajectory.

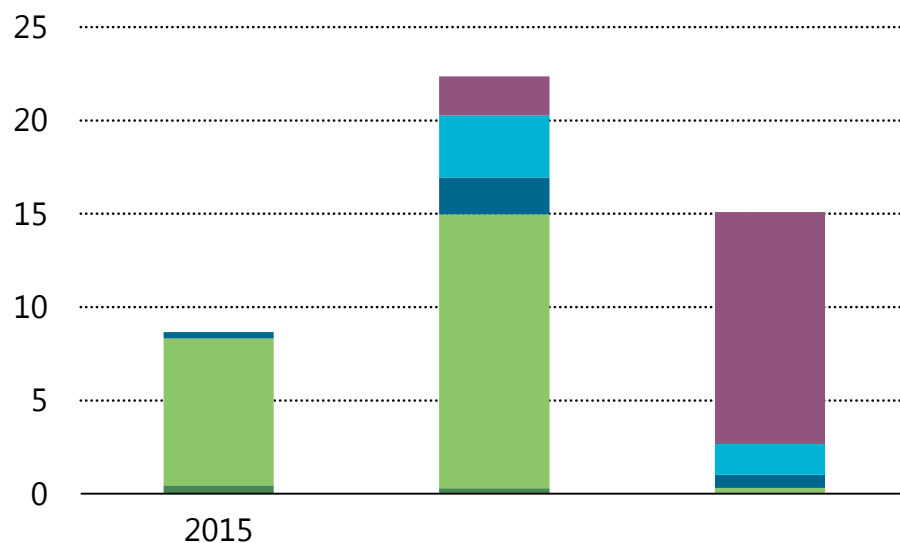
Can we change the landscape of transport ?

Vehicle sales and technology shares under different scenarios

Light-duty Vehicles (millions)



Heavy-Duty Vehicles (millions)



■ Gasoline ICE

■ Diesel ICE

■ CNG/LPG

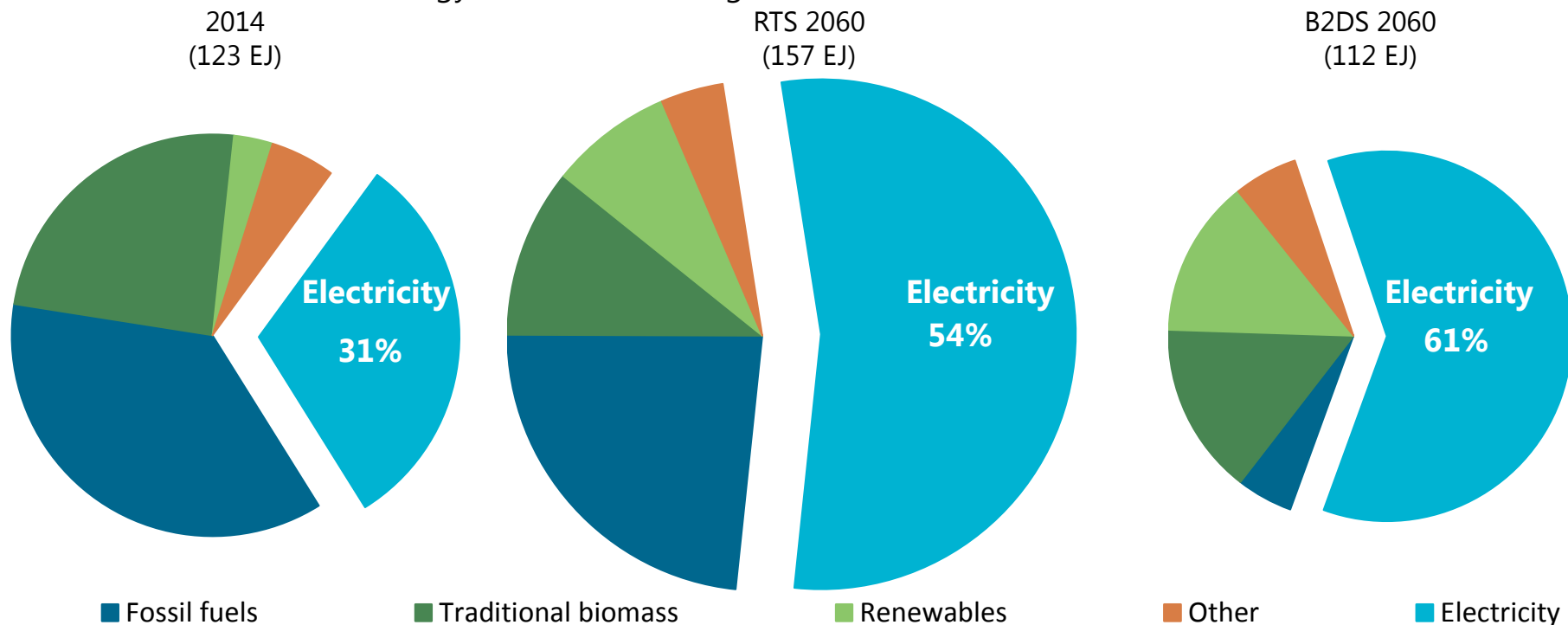
■ Hybrids

■ Electric & FCV

The transportation sector already experiences technological change, but won't shed its oil dependency without assertive policies

Enhanced buildings efficiency could also improve system flexibility

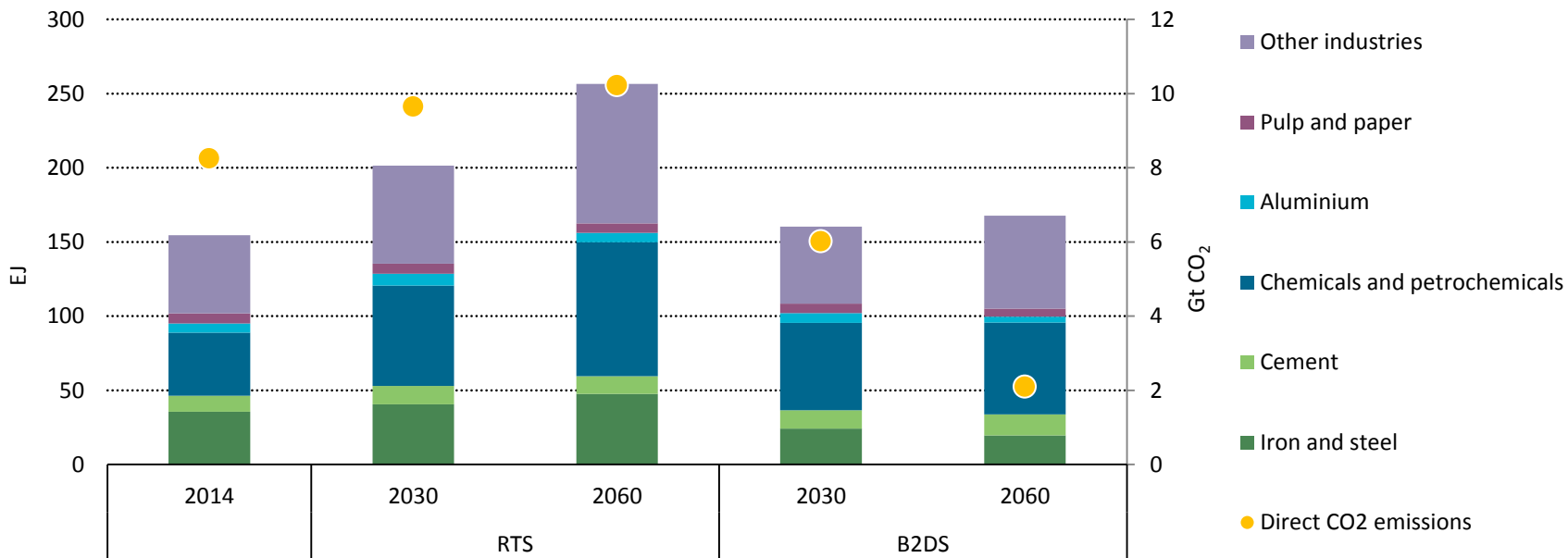
Energy use in the buildings sector under different scenarios



Efficiency technologies can provide the same level of comfort while reducing energy demand despite doubling floor area

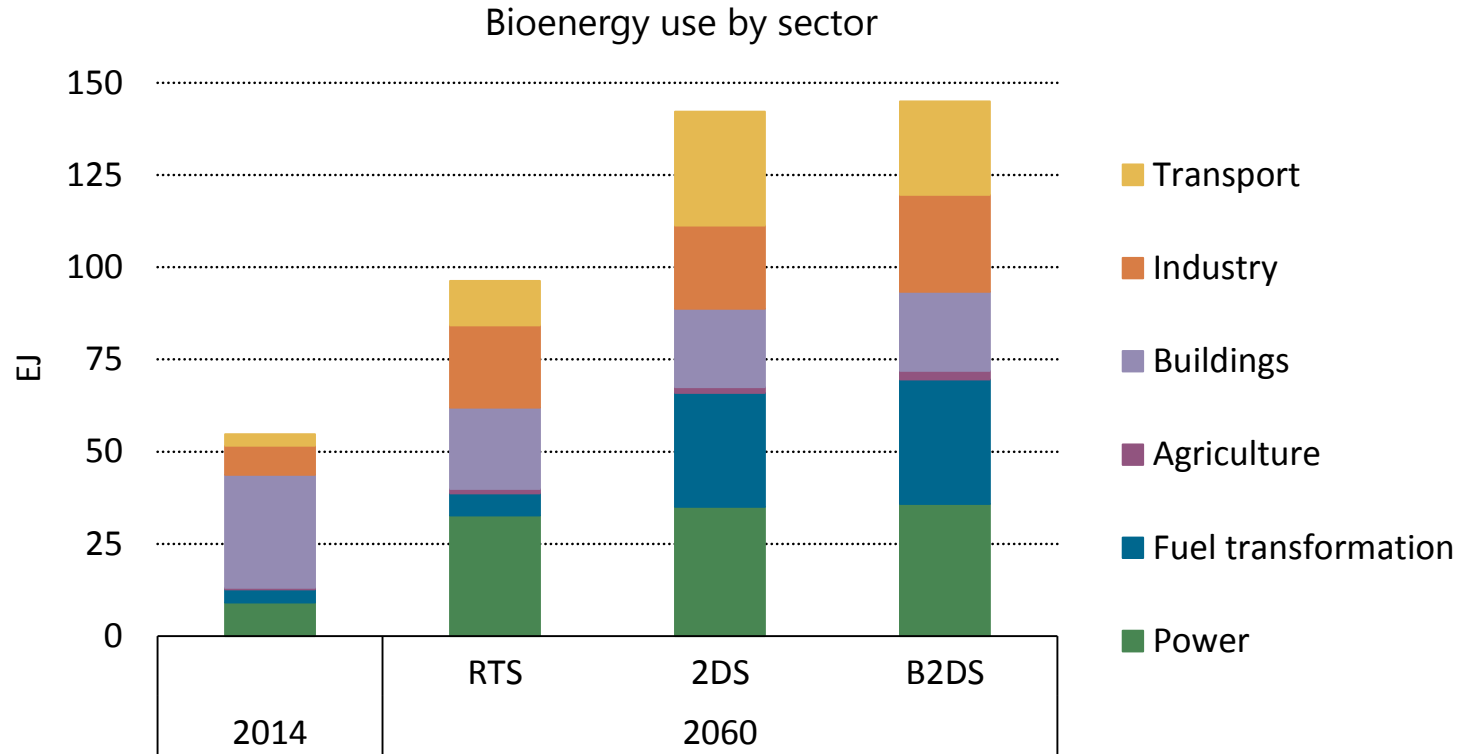
Can we produce materials more sustainably ?

Energy use and direct CO₂ emissions in various industrial sectors under different scenarios



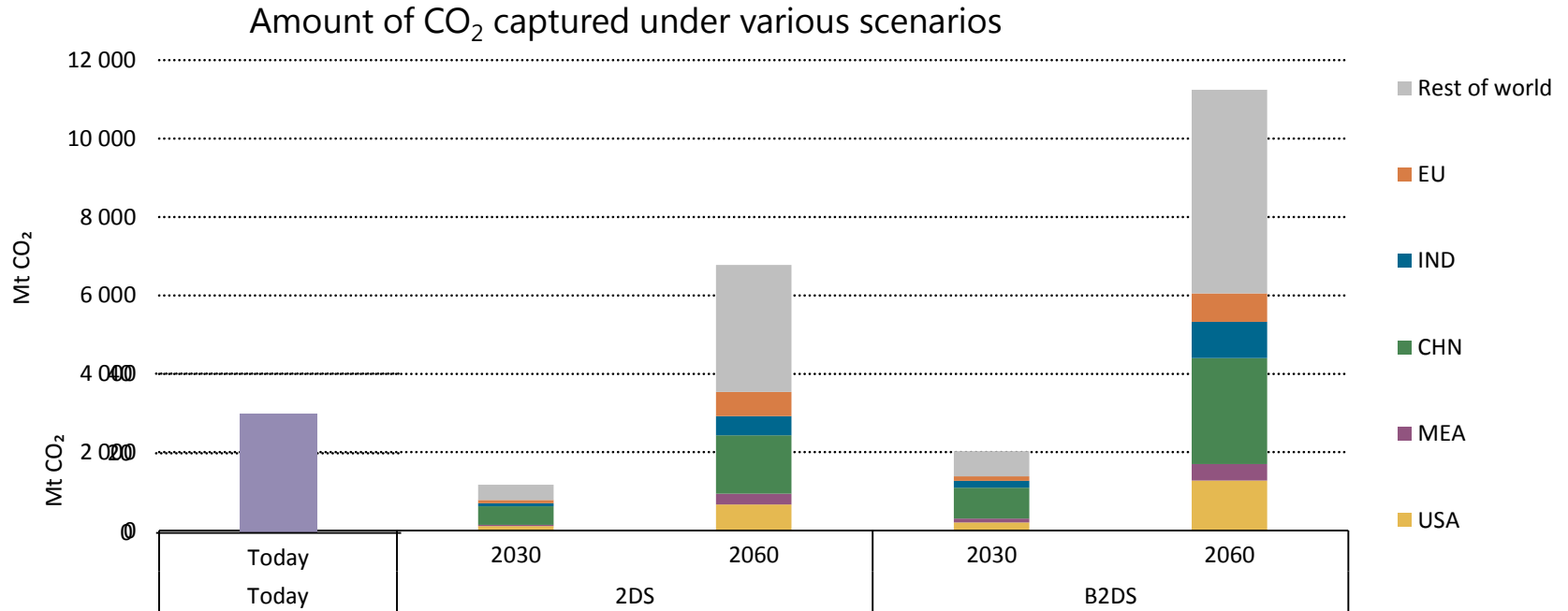
Effective policies and public-private collaboration are needed to enable an extensive roll out of energy and material efficiency strategies as well as a suite of innovative technologies

Can we produce enough sustainable biomass ?

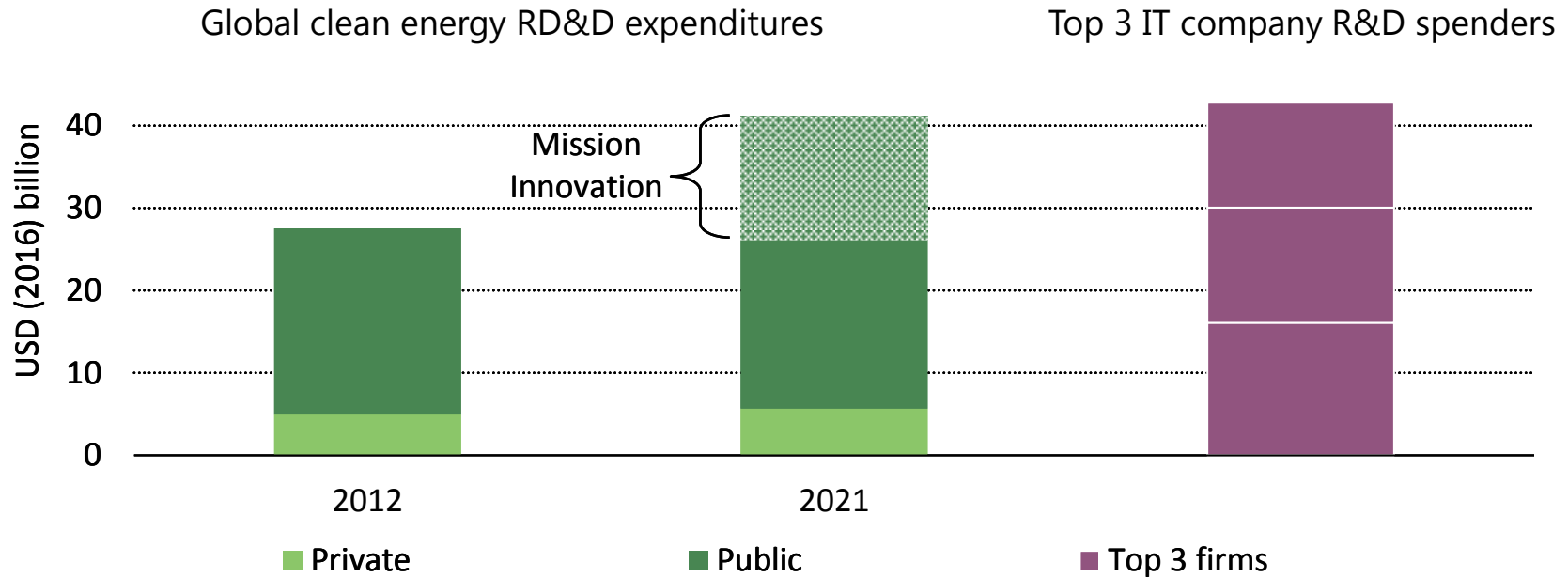


Around 145 EJ of sustainable bioenergy is available by 2060 in all our decarbonisation scenarios, but gets used differently between the 2DS and the B2DS.

A challenging task ahead for CCS



CCS is happening today, but needs to be ramped up hundreds of times to achieve long-term goals
The role for CCS varies based on local circumstances



RD&D investments in efficiency, renewables, nuclear and CCS is around \$26 billion annually, mostly government-related. This pales in comparison with IT sector.

- Early signs point to changes in energy trajectories, helped by policies and technologies, but progress is too slow
- An integrated systems approach considering all technology options must be implemented now to accelerate progress
- Each country should define its own transition path and scale-up its RD&D and deployment support accordingly
- Achieving carbon neutrality by 2060 would require unprecedented technology policies and investments
- Innovation can deliver, but policies must consider the full technology cycle, and collaborative approaches can help

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