Energy Technology Perspectives 2017:
Catalysing Energy Technology Transformations

Baltic Pathway towards Low-Carbon and Climate-Resilient Development

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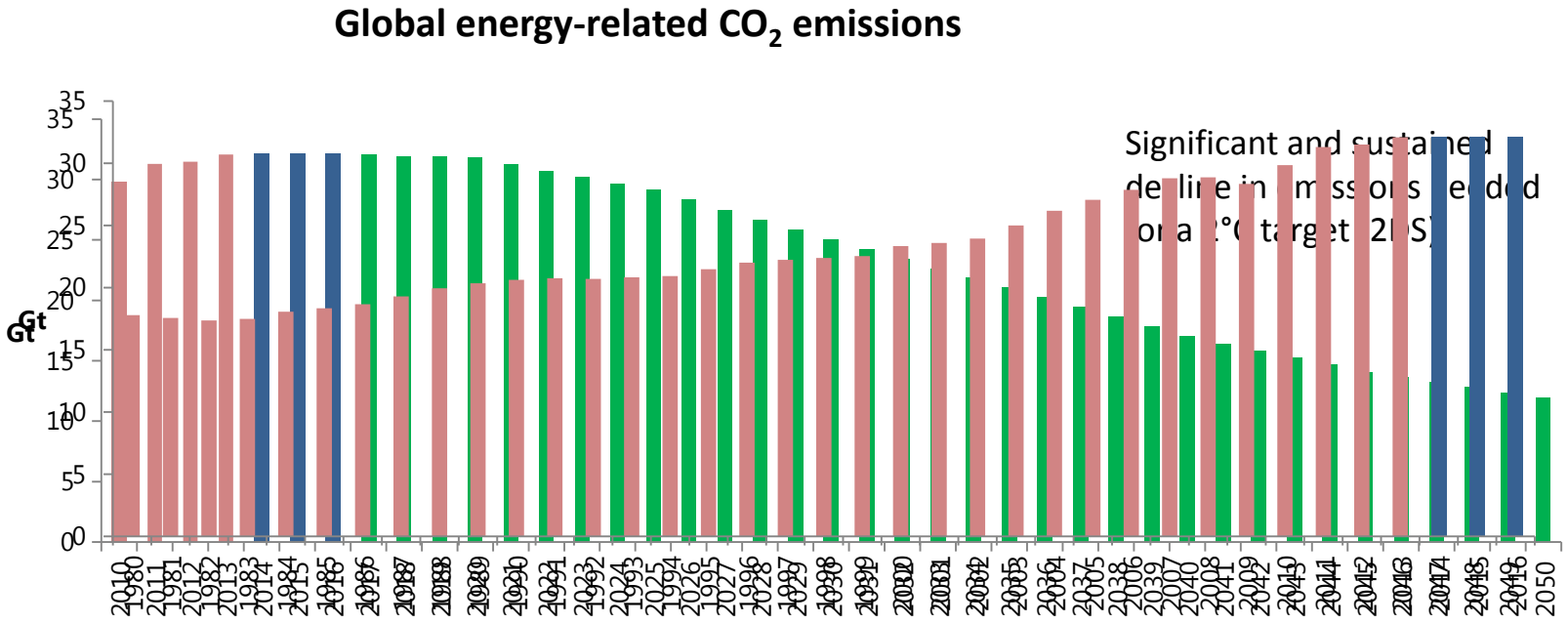
IEA

Key trends and starting points

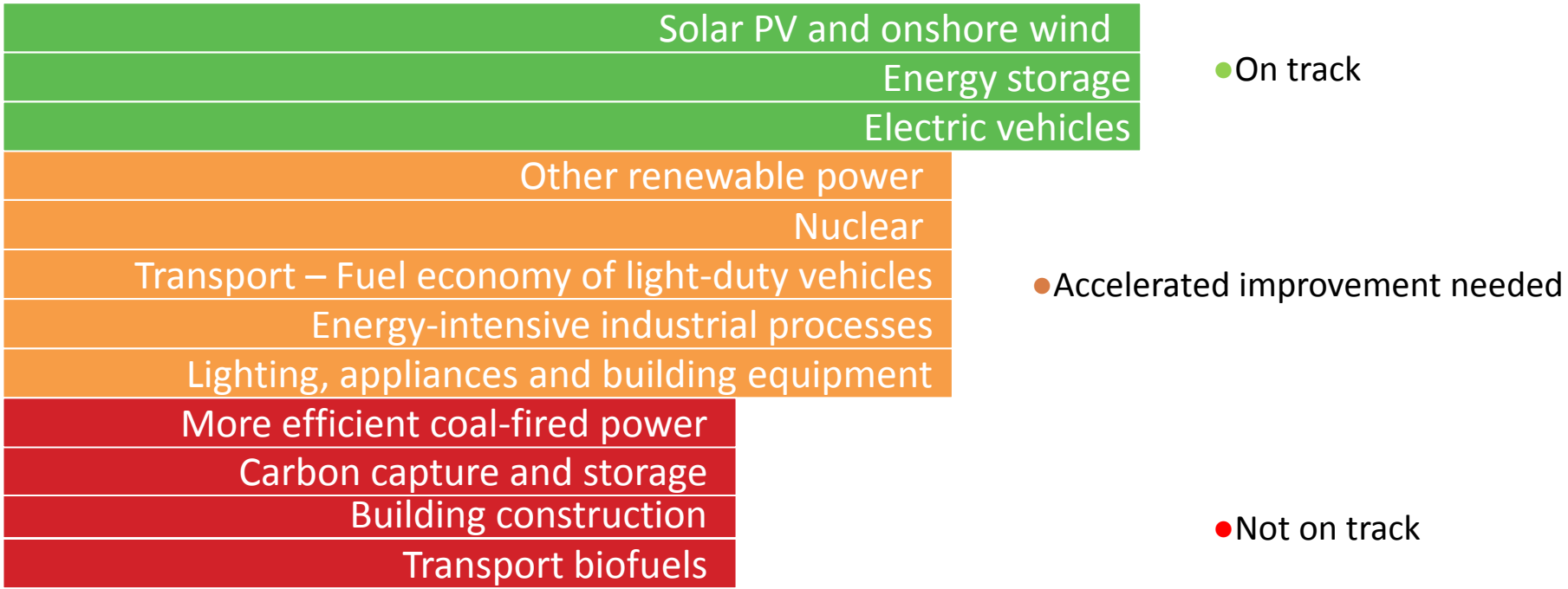
- Global energy markets are changing rapidly
  - *Renewables supplied half of global electricity demand growth in 2016, and increase in nuclear capacity reached highest level since 1993*
  - *Global energy intensity improved by 2.1% in 2016*
  - *Electric car sales were up 40% in 2016, a new record year*
- 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 CO_2 emissions flat for 3 years – an emerging trend?



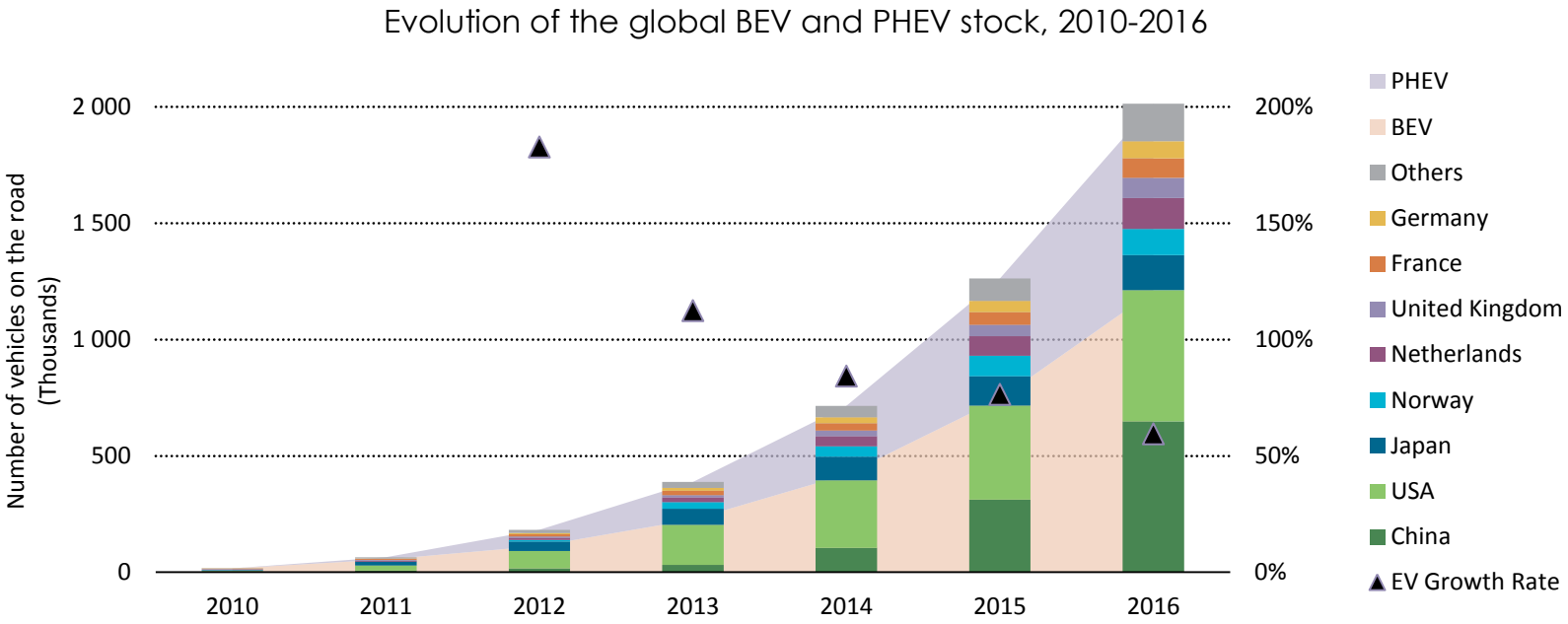
IEA analysis shows that global CO_2 emissions remained flat in 2016 for the third year in a row, but a significant effort required to achieve a 2°C target

The potential of clean energy technology remains underutilised



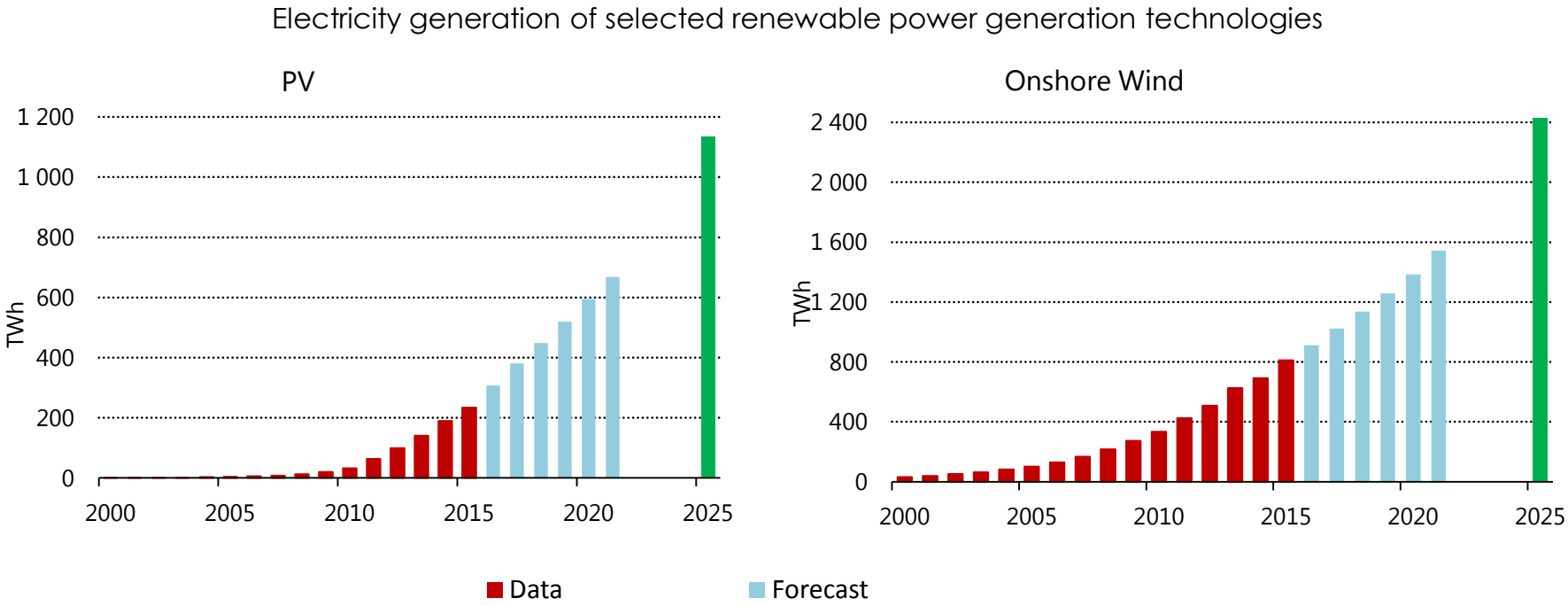
Recent progress in some clean energy areas is promising, but many technologies still need a strong push to achieve their full potential and deliver a sustainable energy future.

EVs are still on track, but need continued support



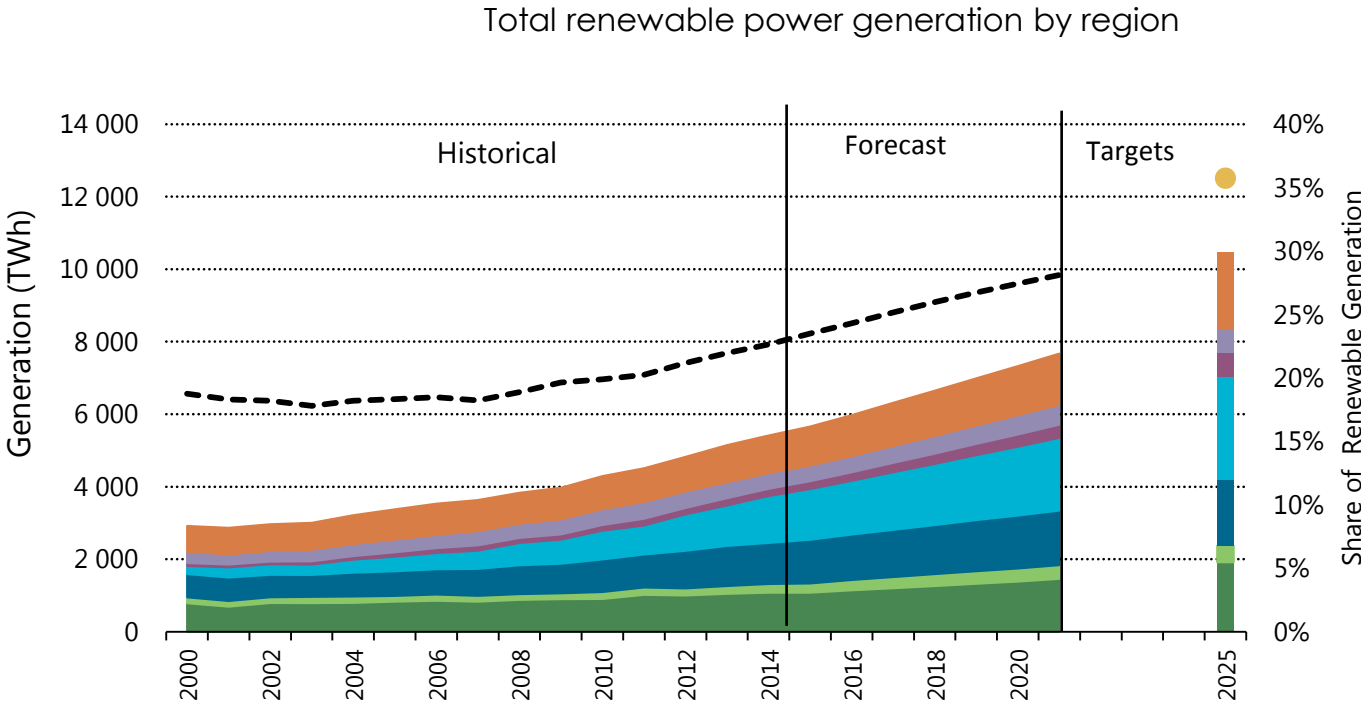
The global PEV car stock has reached 2 million units in circulation last year, but sales growth went from 70% last year to 40% this year, suggesting an increasing risk to start diverging from a 2DS trajectory.

Solar PV and Wind are still leading the transition…



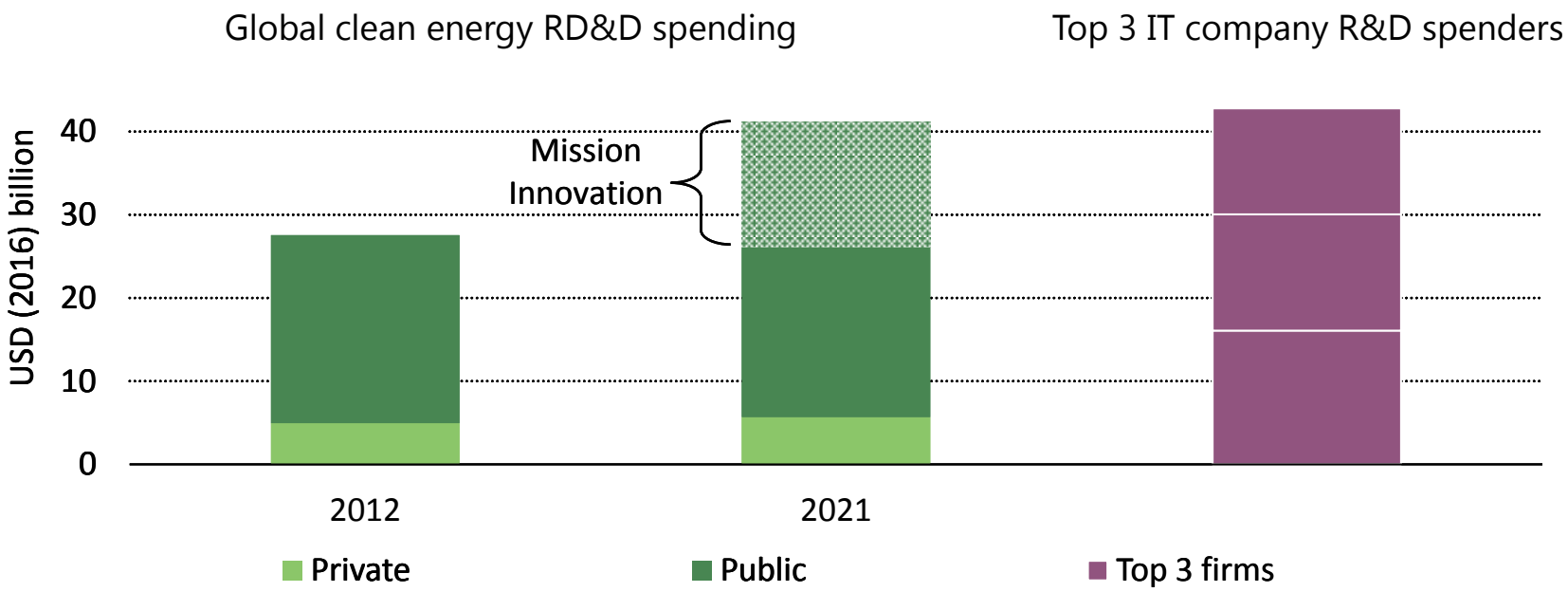
Solar PV and onshore wind electricity generation are expected to grow by 2.5 times and by 1.7 times, respectively, over 2015-20.

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



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.

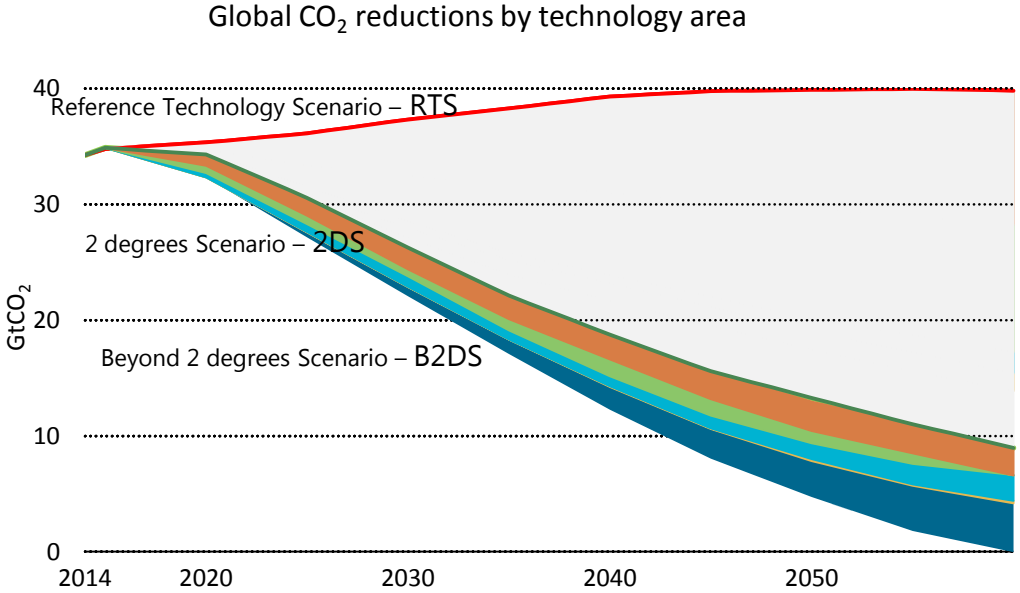
Global clean energy RD&D spending needs a strong boost

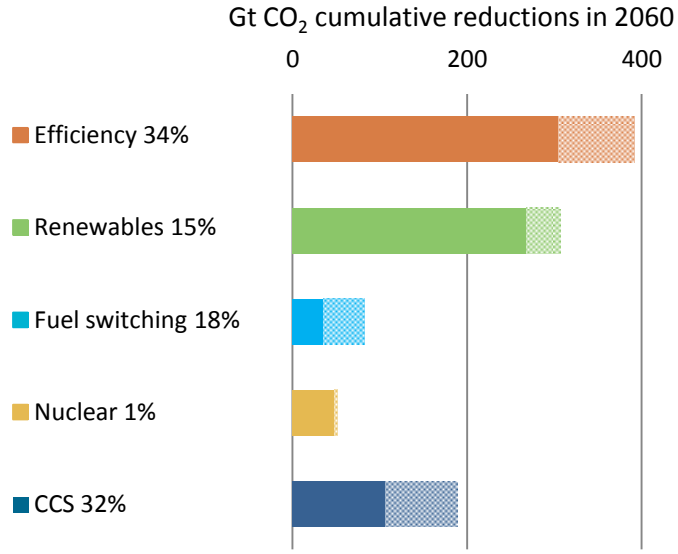


Global RD&D spending in efficiency, renewables, nuclear and CCS plateaued at $26 billion annually, coming mostly from governments.
Mission Innovation could provide a much needed boost.

How far can technology take us?

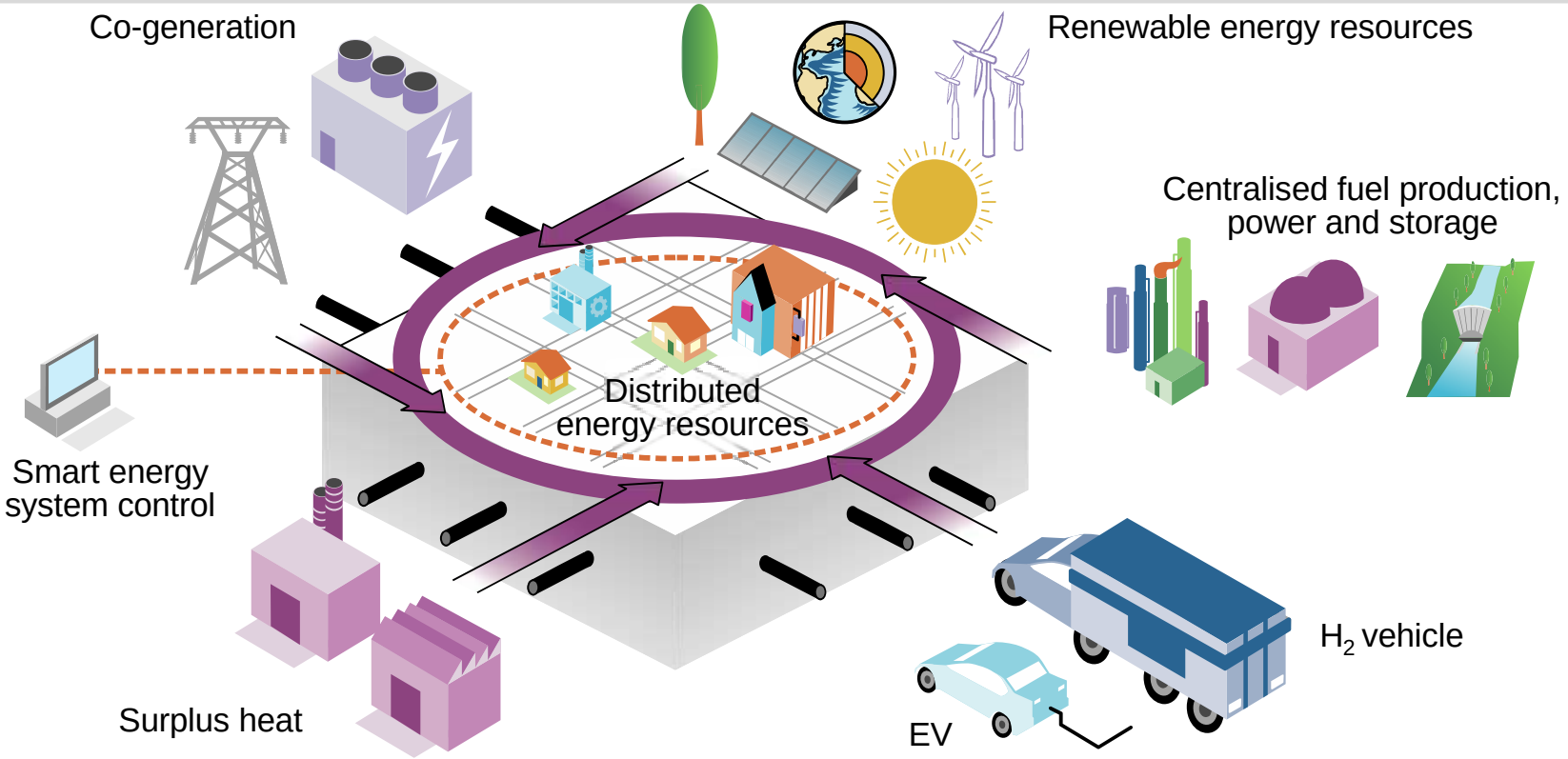
Technology area contribution to global cumulative CO_2 reductions





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

Systems Integration is essential for a sustainable energy future



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.

Explore the data behind *ETP*

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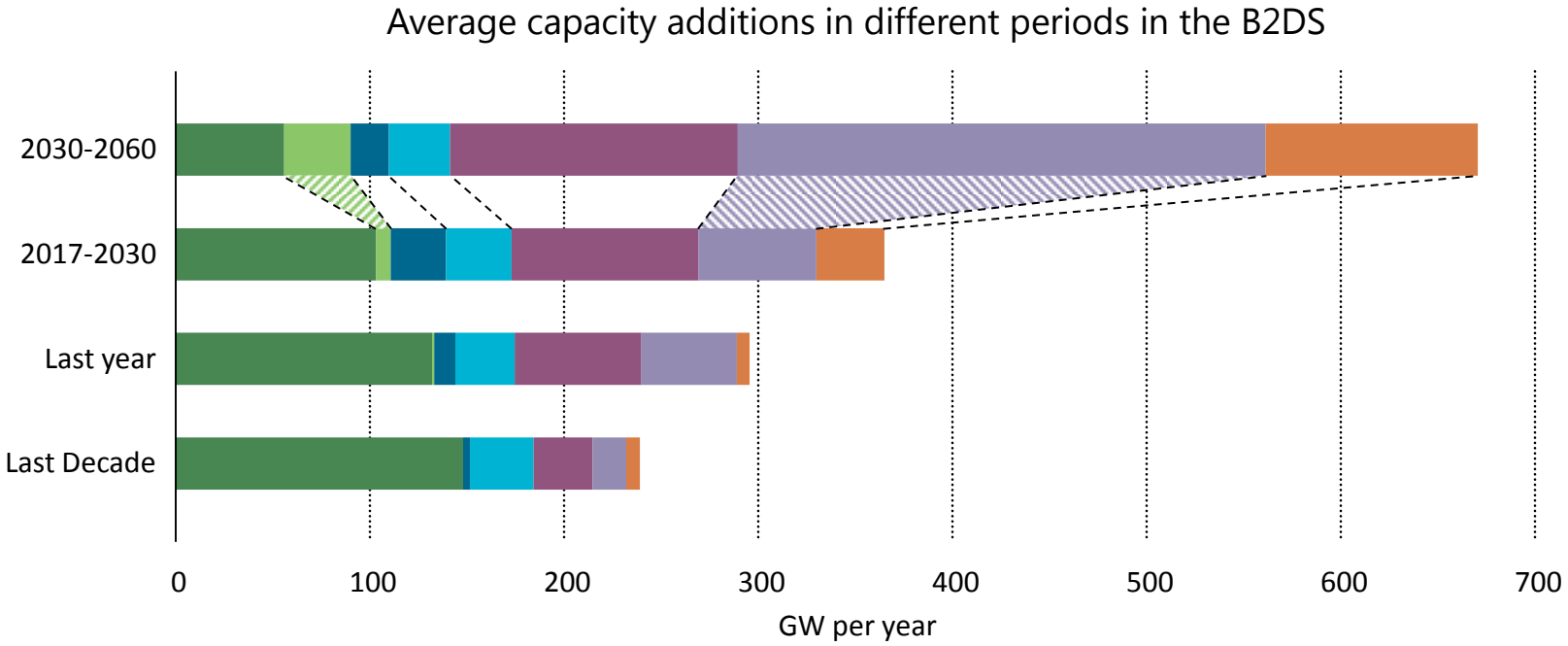
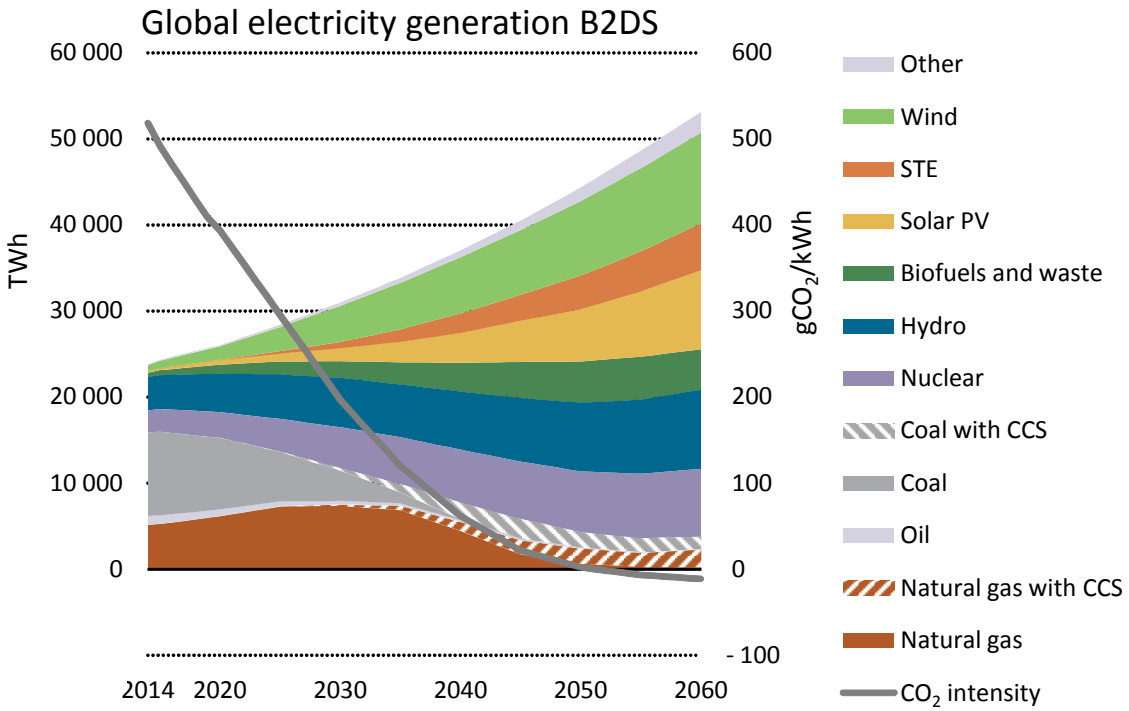
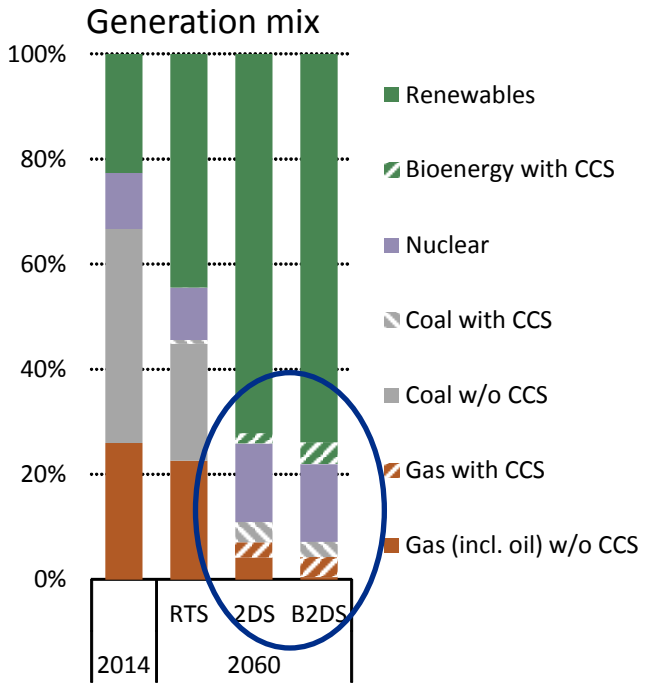
Can we push up the low-carbon power deployment pace?



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

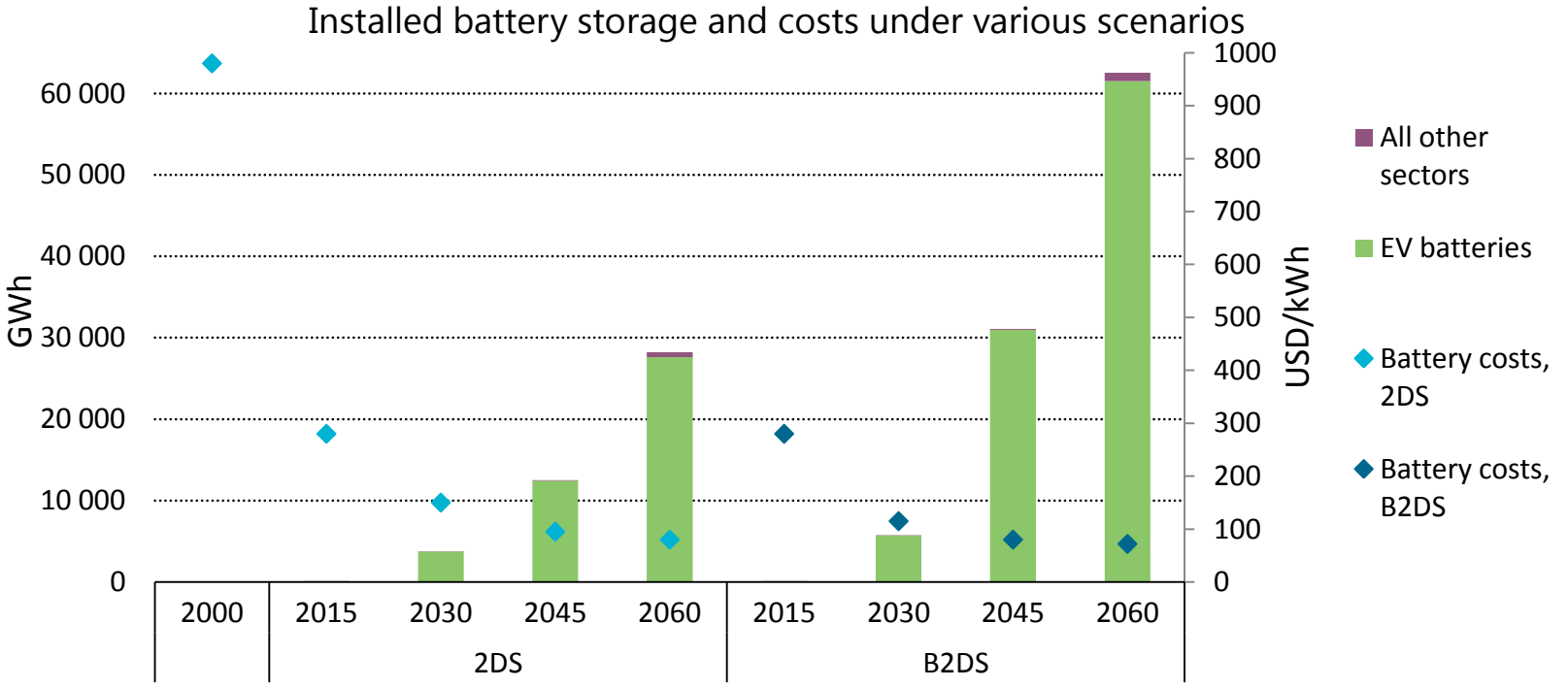
Decarbonising electricity





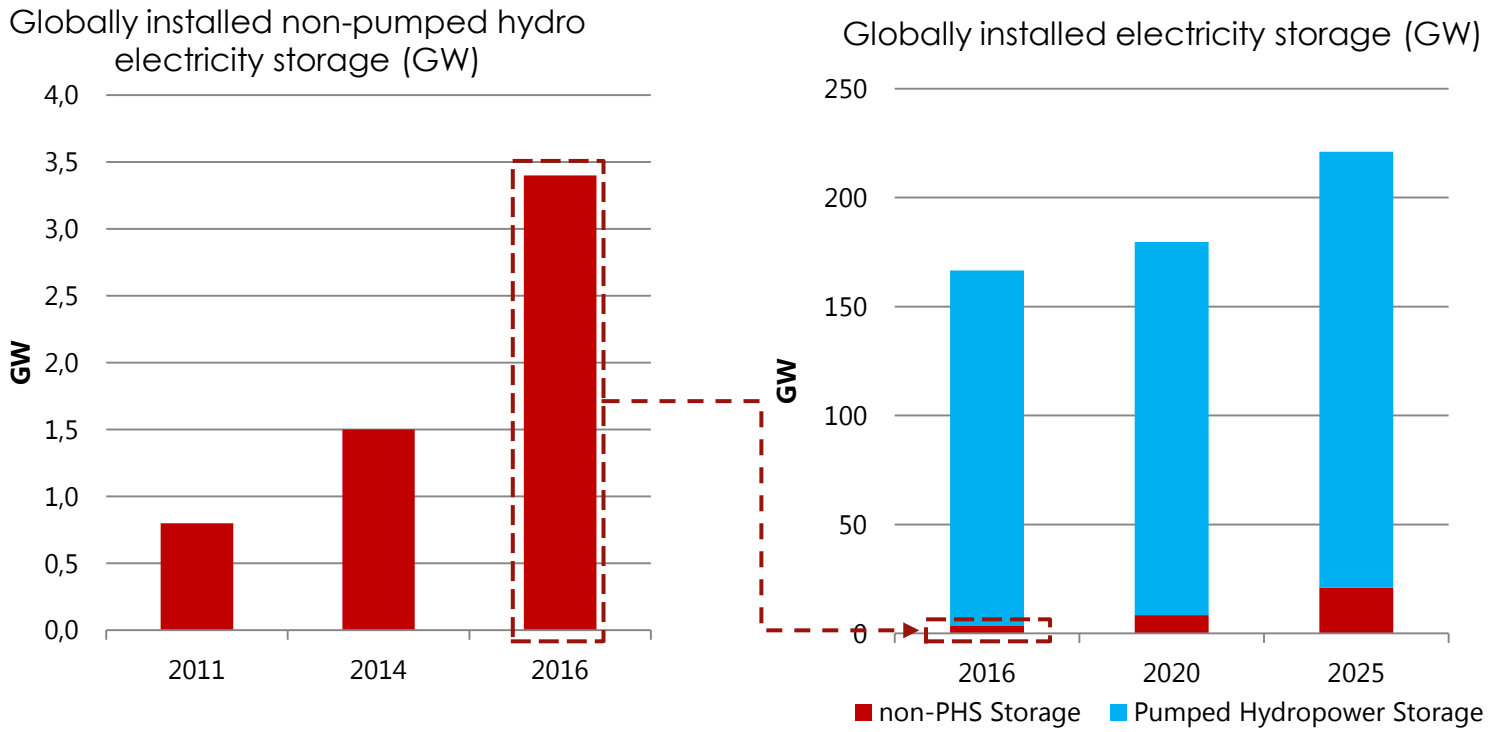
Renewables dominate electricity generation in the 2DS and B2DS. Thanks to bioenergy with CCS, the average global CO_2 intensity falls below zero after 2050.

Infrastructure becomes more distributed



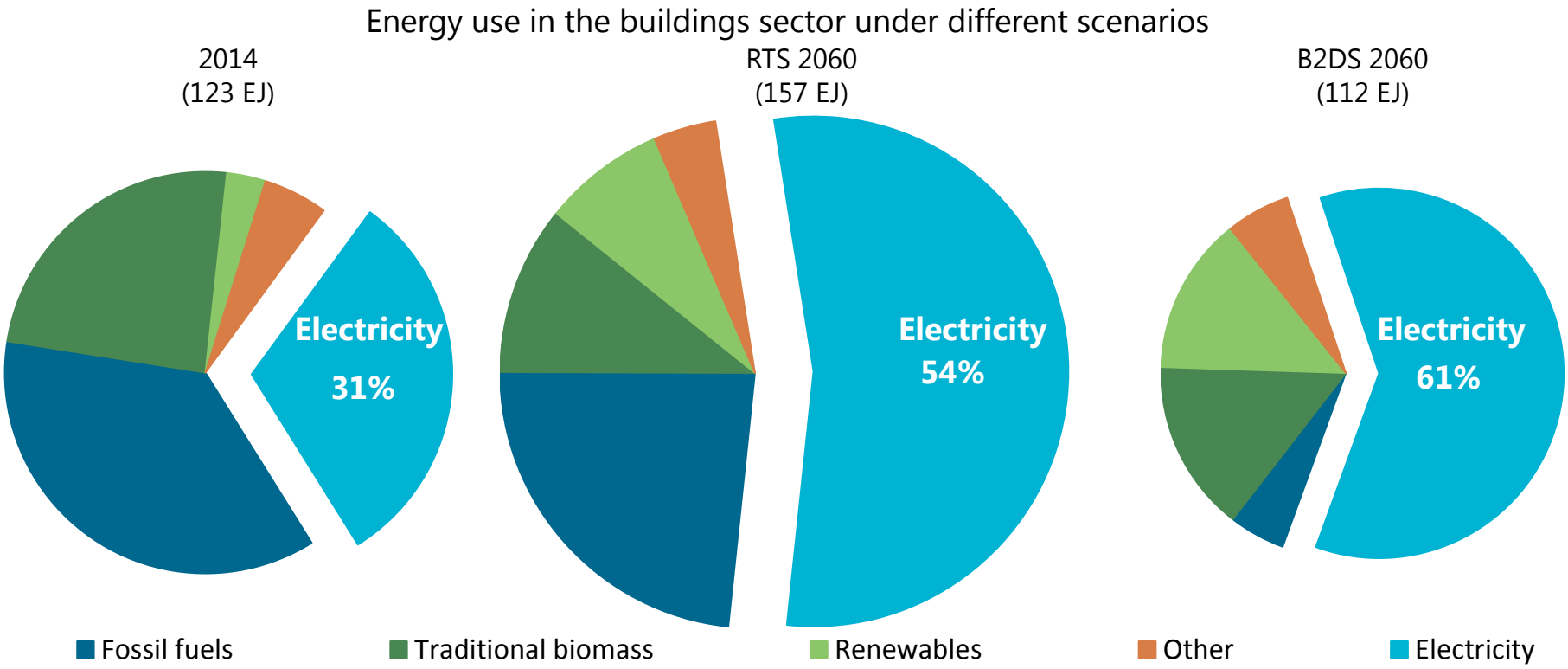
Batteries experience a huge scale-up in the B2DS, with EV battery markets leading other sectors in size

While the impact of storage could be disruptive, it remains highly uncertain



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

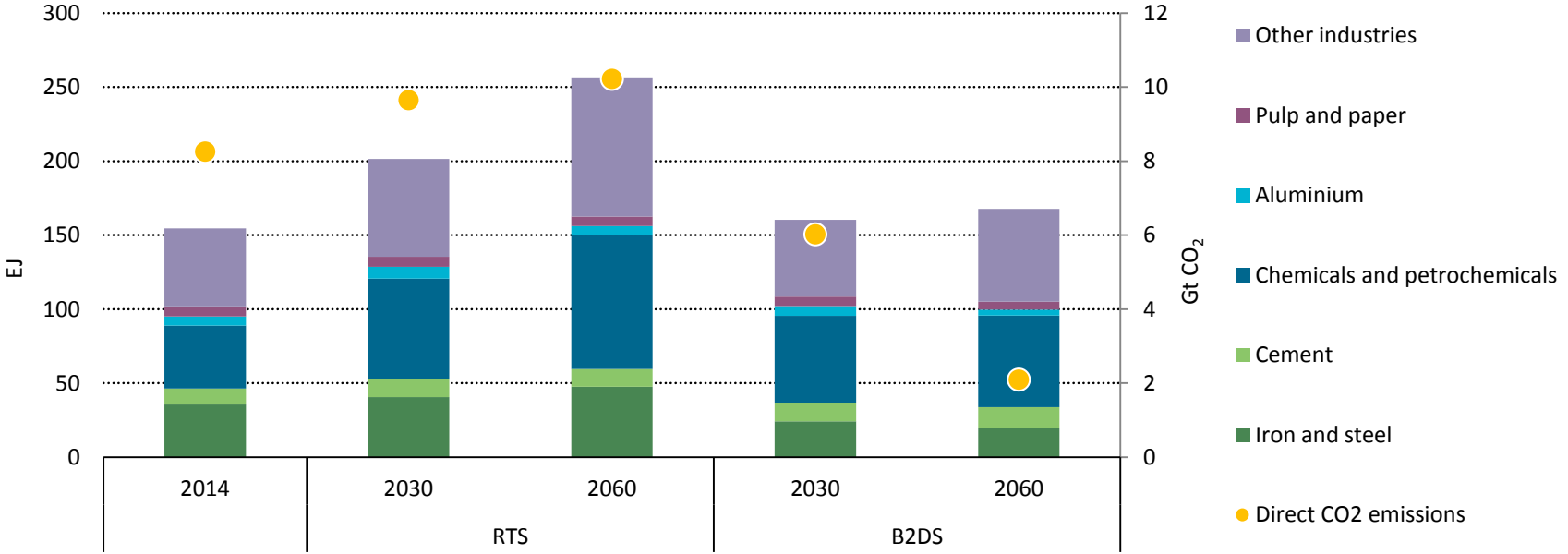
Enhanced energy efficiency in buildings



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

Can we produce materials more sustainably ?

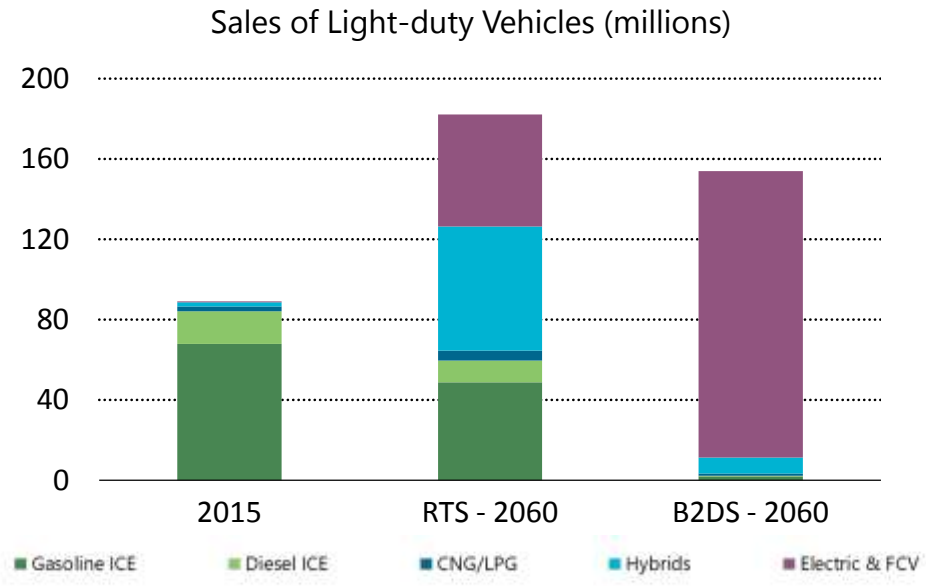
Energy use and direct CO_2 emissions in various industrial sectors under different scenarios

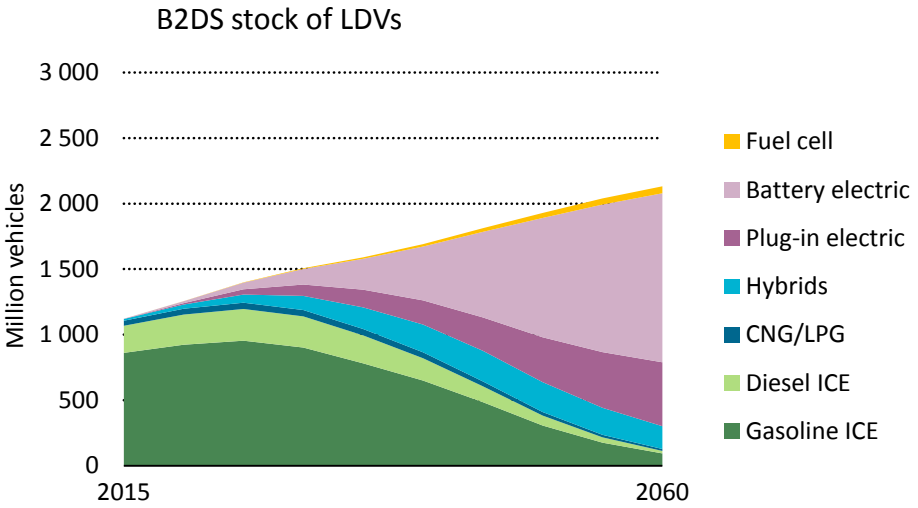


Effective policies and public-private collaboration are needed to enable an extensive roll out of energy and material efficiency strategies as well as a suite of innovative technologies.

Can we change the landscape of transport ?

Vehicle sales and technology shares under different scenarios





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

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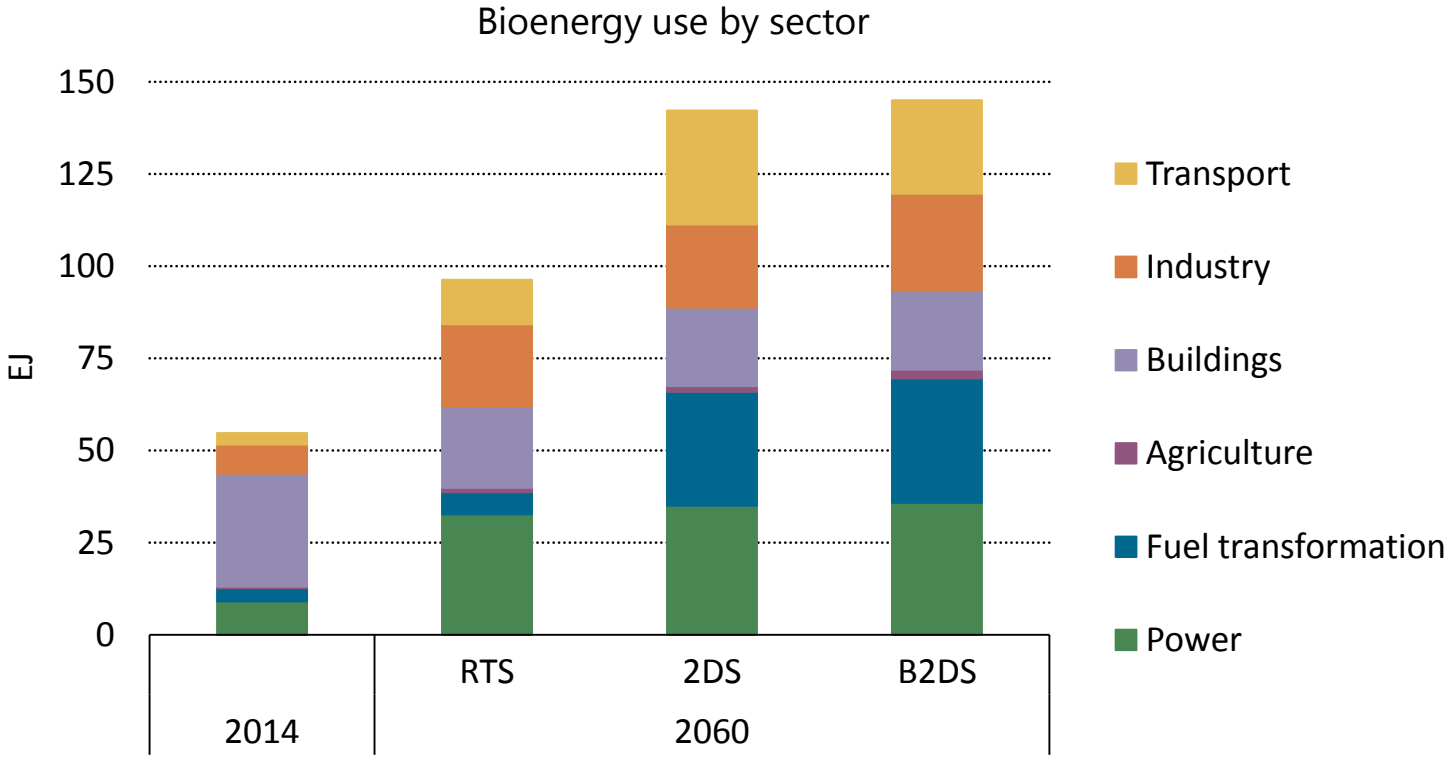
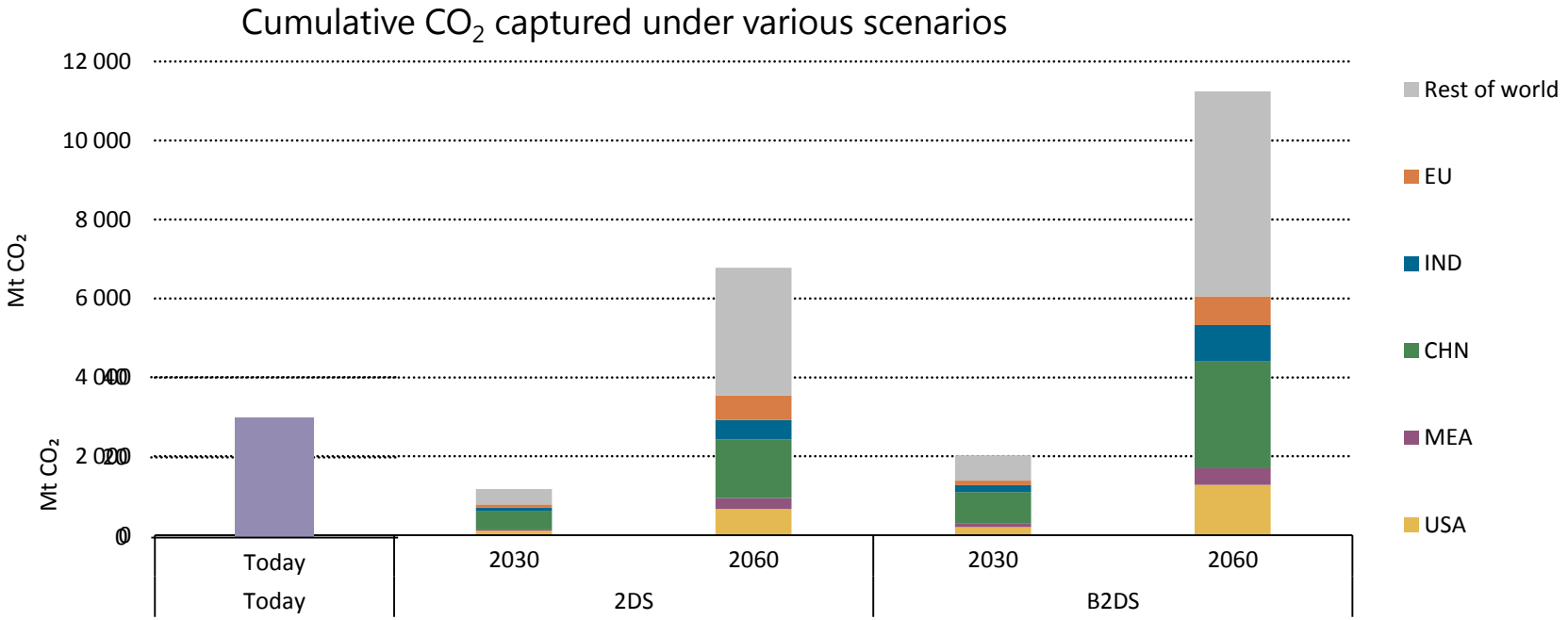
Can we produce enough sustainable biomass ?



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 significant scale-up of CCS efforts will be required globally



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

Conclusions

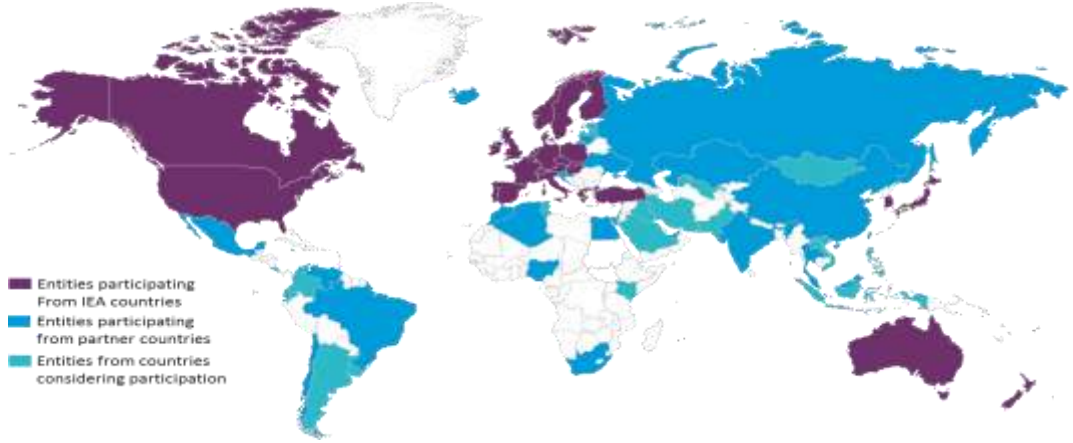
- Early signs point to changes in energy trajectories, helped by policies and technologies, but progress is too slow
- An integrated systems approach considering all technology options must be implemented now to accelerate progress
- Each country should define its own transition path and scale-up its 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

IEA Technology Collaboration Programmes (TCPs)

- **38 TCPs, five groups:**
  - Cross-cutting activities (2)
  - End use and energy efficiency (14)
  - Fossil fuels (5)
  - Fusion power (8)
  - Renewable energy and hydrogen (9)

Estonia, Latvia and Lithuania participate in two TCPs:

- Hydrogen TCP
- Bioenergy TCP



- Close to 6,000 experts
- More than 2,000 topics to date
- Nearly 300 public or private organisations
- 52 countries
- 38 Technology Collaboration Programmes
- 4 intergovernmental organisations

This map is without prejudice to the status of sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area. Experts from countries shown above participate in activities of the Technology Collaboration Programmes.

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