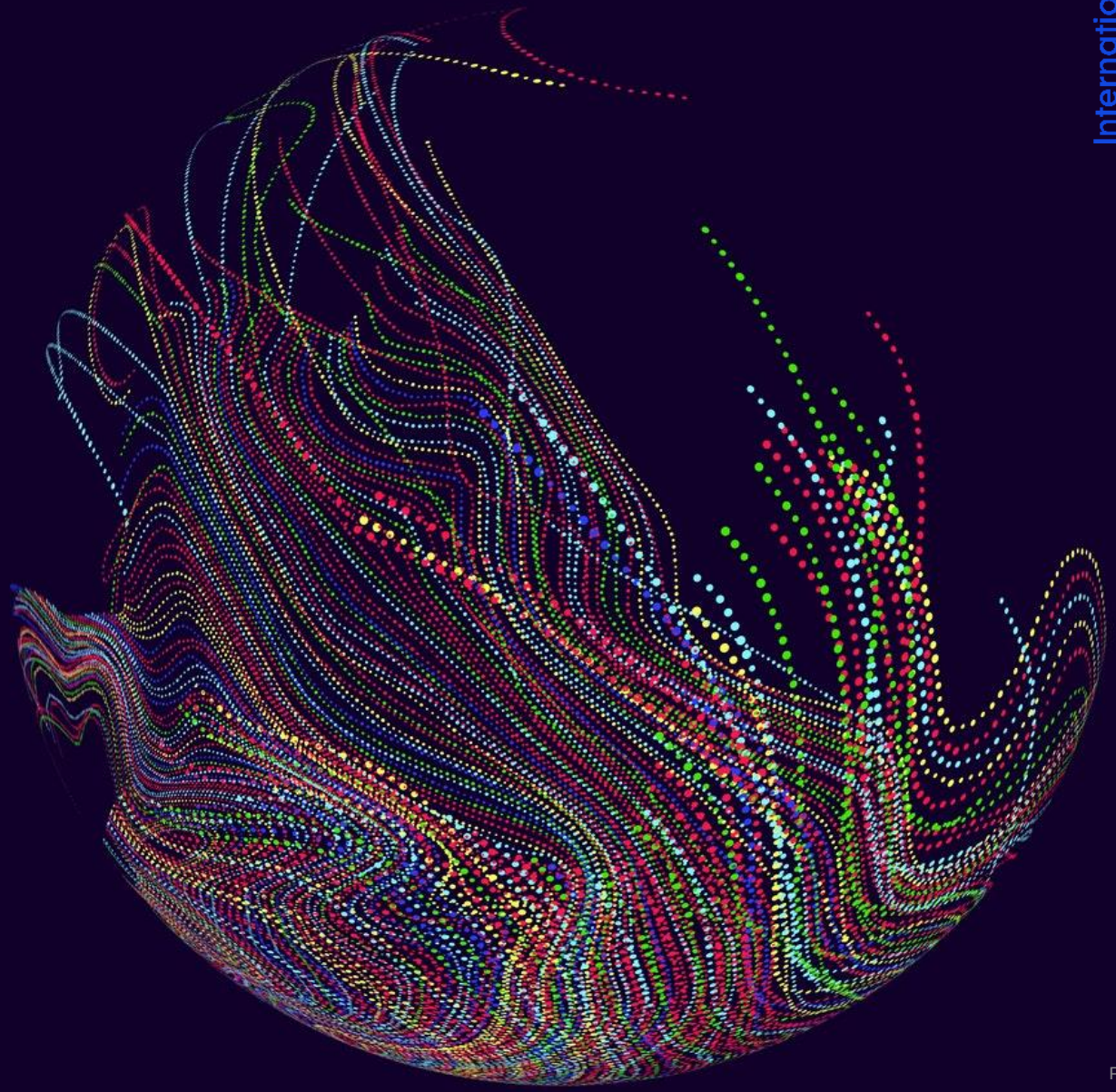
Energy Technology Perspectives 2020

A path for the decarbonisation of the buildings sector

14 December 2020



International Energy Agency

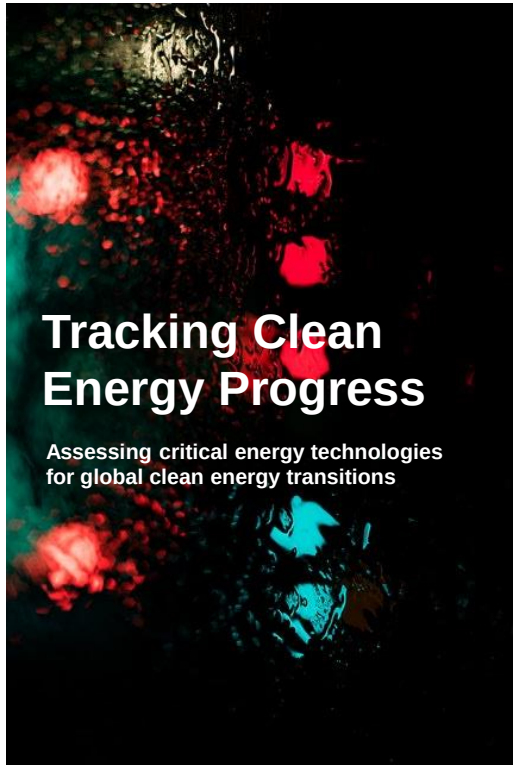
Opening remarks

Timur Gül

Head, Energy Technology Policy Division, International Energy Agency (IEA)

The IEA buildings technology work across four main deliverables

[Tracking clean energy progress]



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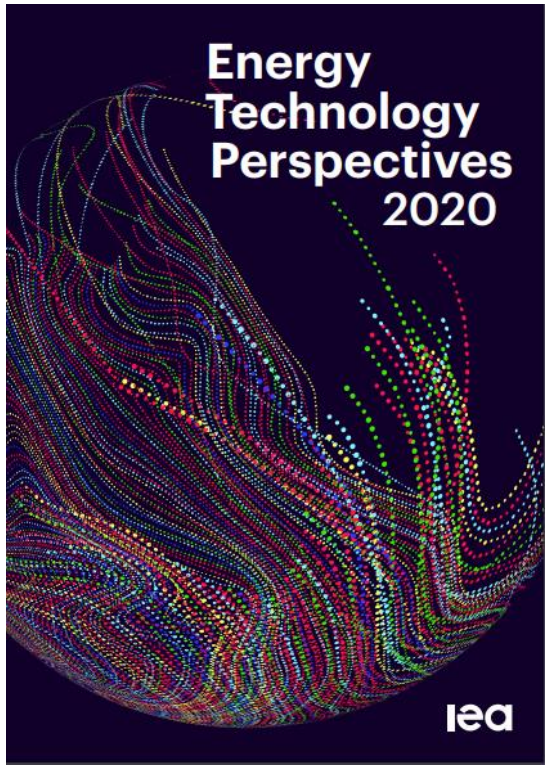
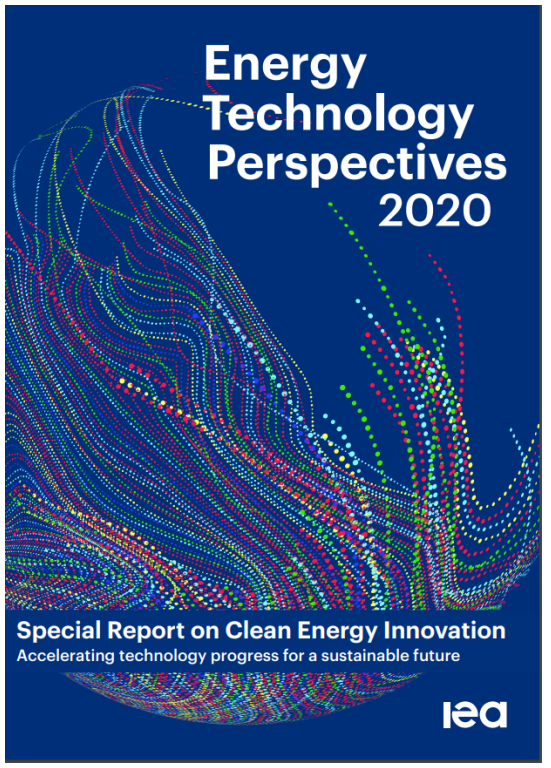
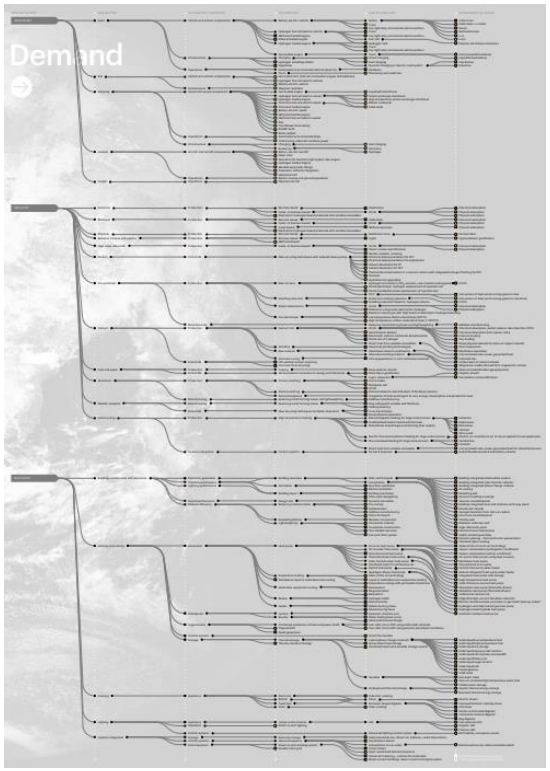


[Special Report on Innovation]



[Clean Technology guide]



The IEA is unfolding a series of resources setting an ambitious pathway to reach the Paris Agreement and other Sustainable Development goals.

Opening remarks

Roland Hunziker

Director, Sustainable Buildings and Cities, World Business Council for Sustainable Development (WBCSD)

Energy Technology Perspectives 2020 presentation

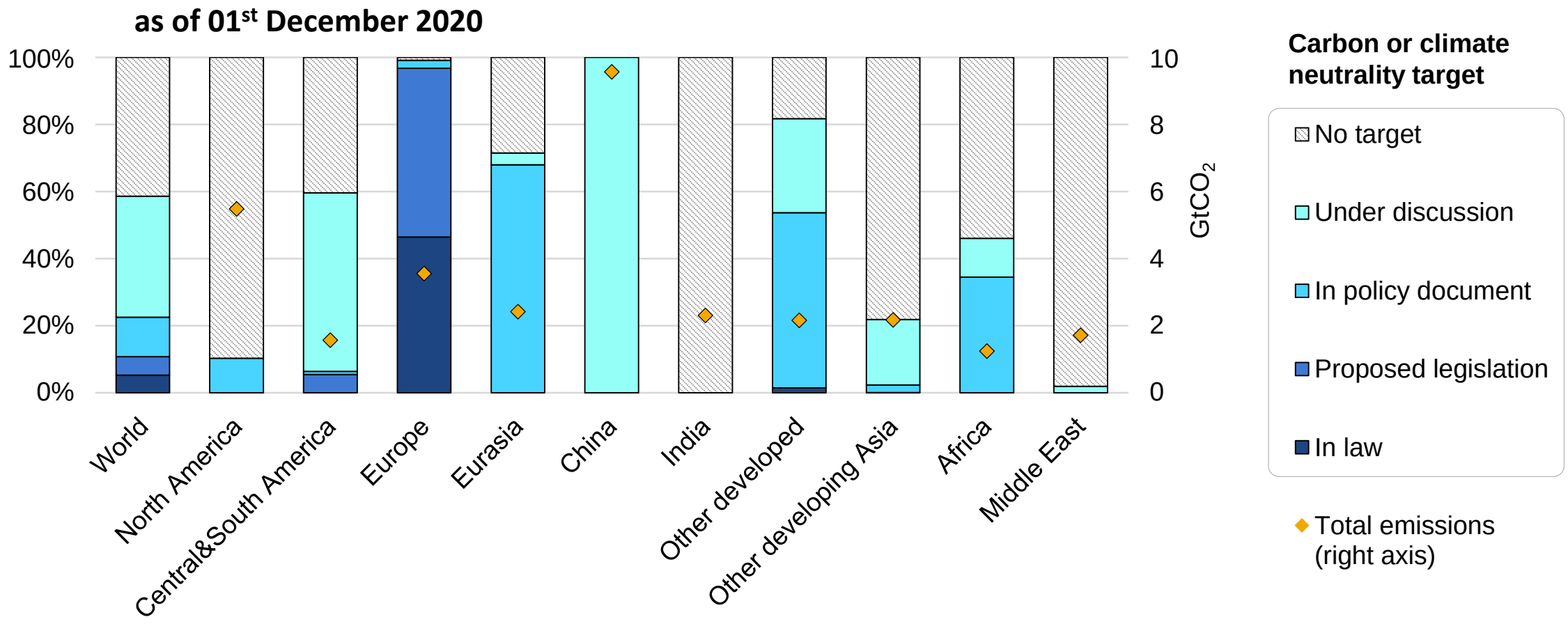
Thibaut ABERGEL

Chiara DELMASTRO

Co-leads, Buildings Energy Technology, Energy Technology Policy Division, International Energy Agency (IEA)

Commitment to net-zero emissions is globalising

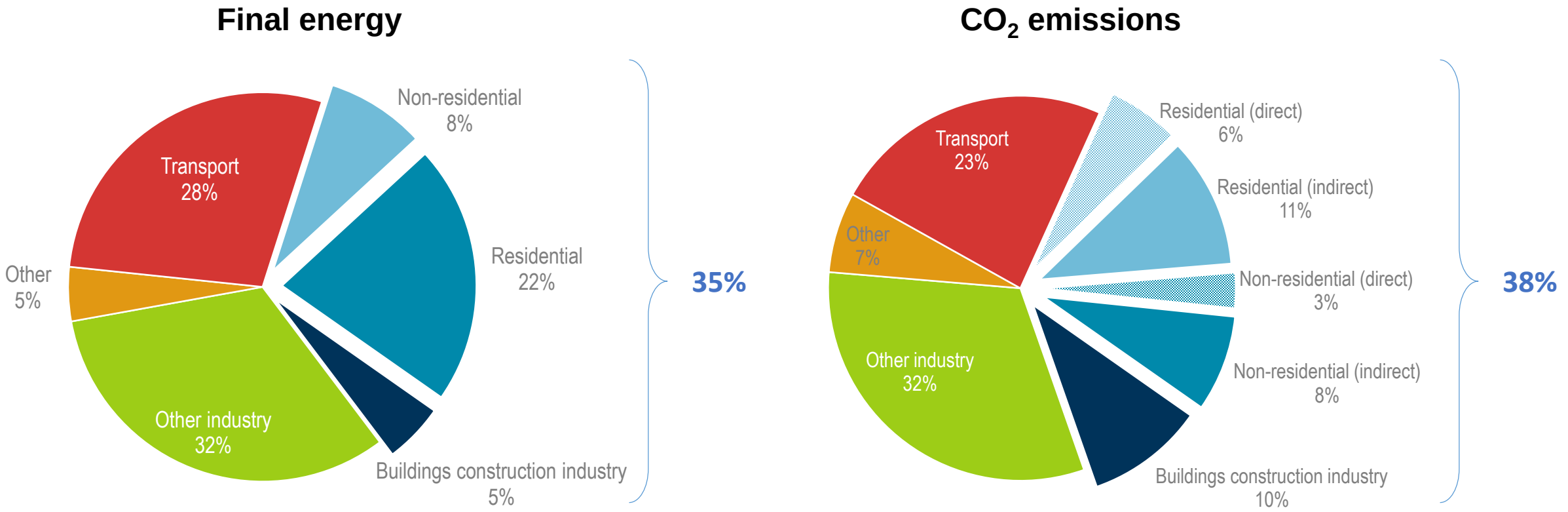
Share of energy-related CO_2 emissions covered by national and supra-national public net-zero emissions targets



Countries responsible for around 60% of global energy-related CO_2 emissions have formulated net-zero emissions ambitions in laws, legislation, policy documents or official discussions.

The heavy direct and indirect buildings carbon footprint

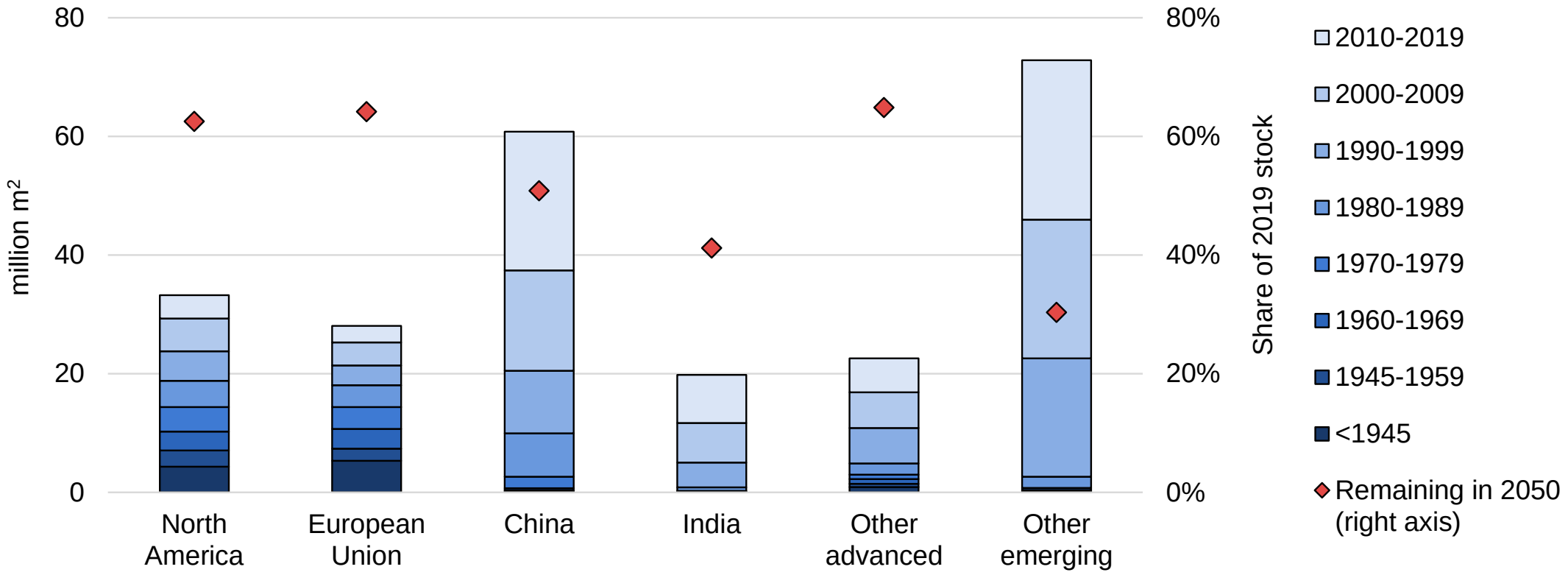
Global share of buildings and construction final energy and emissions, 2019



The buildings sector is responsible for 35% of global final energy consumption and 38% of global CO_2 emissions, when both operational and construction phases are accounted for.

Around half of today's buildings stock is likely still in use in 2050

Building stock by year of construction and share of stock that remains in 2050



…but floor area is expected to increase more than twofold in the period to 2070, which is equivalent to adding a city the size of Paris to the world every week.

What do net-zero ambitions mean for buildings and construction?

- **Deployment of early adoption technologies**

Heat pumps, district energy, LEDs, rooftop PV, solar thermal and other technologies can not only deliver on emissions reductions but also on job creation and energy expenditure savings in the COVID19 recovery context.

- **Buildings integration in the energy system**

Buildings need to support the transition of the power and industry sectors. In 2019, electricity use in buildings accounted for nearly 19% of global CO_2 emissions, and material use for construction and renovation accounted for another 10%

- **Clean energy innovation**

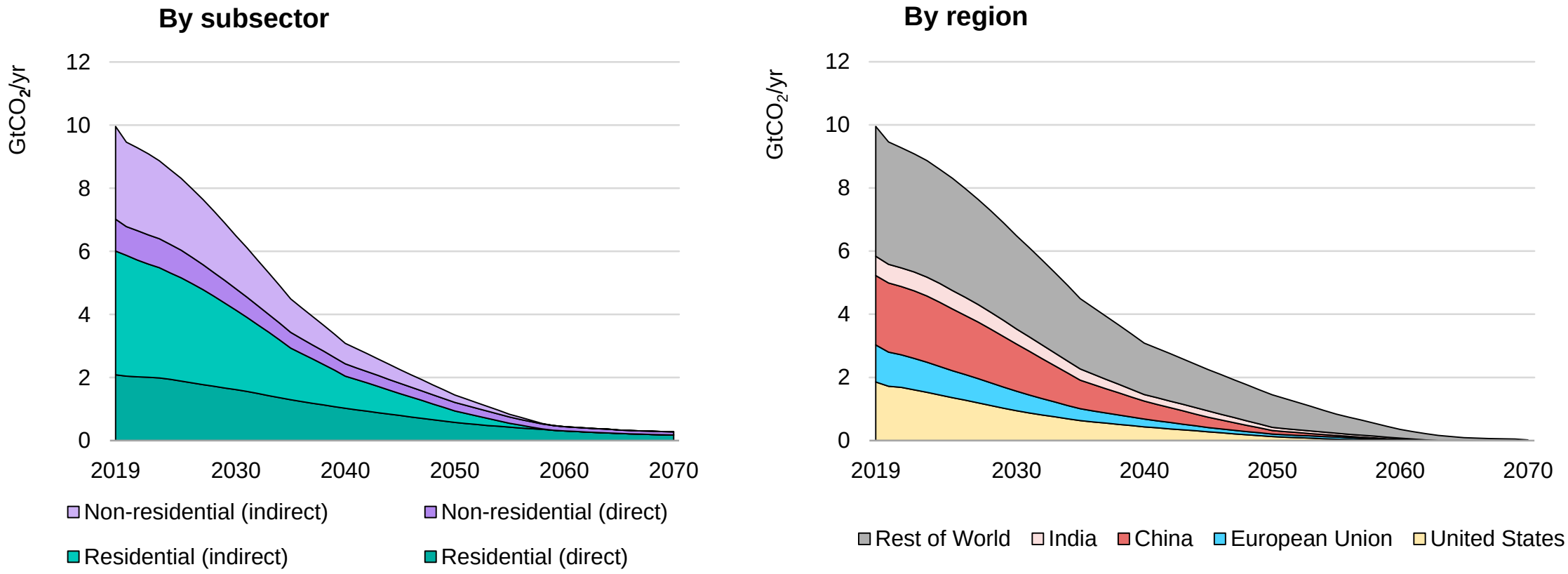
Despite a number of technologies being available on markets today, R&D needs to further enhance technology performance, deliver on new services (e.g. demand response) and foster the development of new technologies (e.g. advanced cooling).

1.

Clean energy technology deployment

Reaching net-zero requires a rapid decline of building emissions

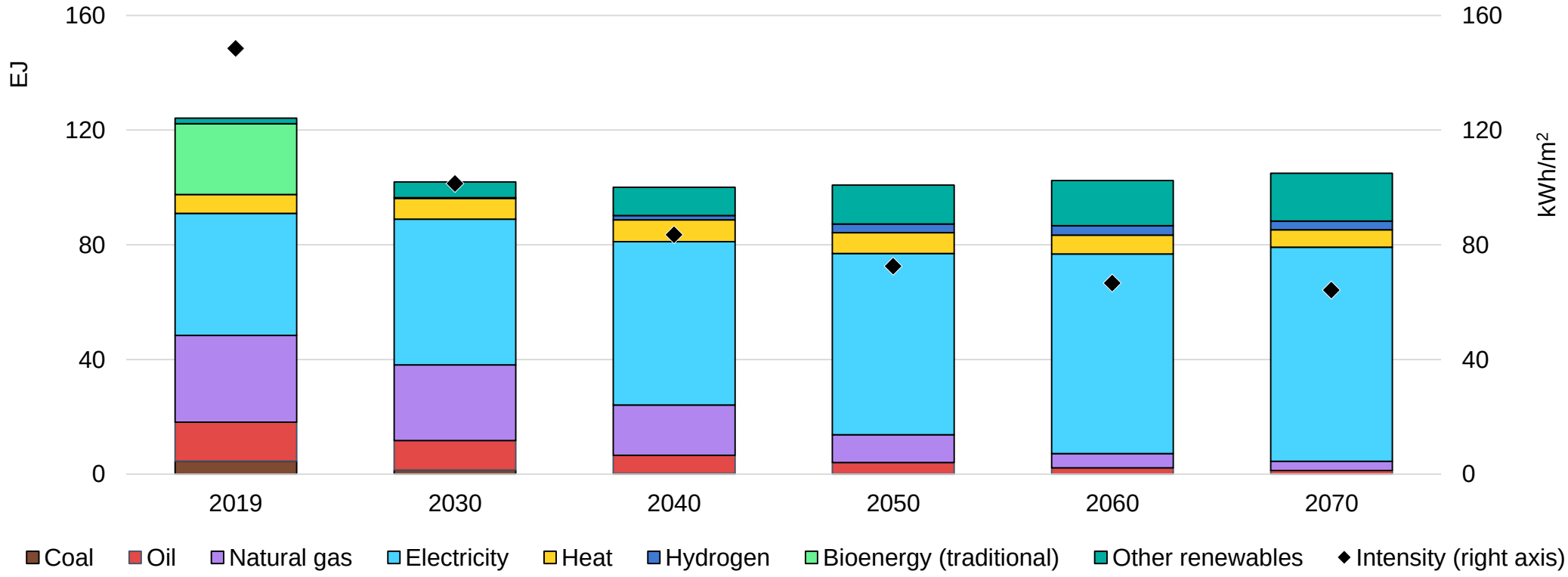
CO_2 emissions from the use phase of buildings in the Sustainable Development Scenario, 2019-2070



The phase-out of fossil fuel, the deployment of high-efficiency electric equipment and the decarbonisation of the heat and power sectors together drive buildings-sector CO_2 emissions to net-zero by 2070.

Electrification and energy efficiency are key

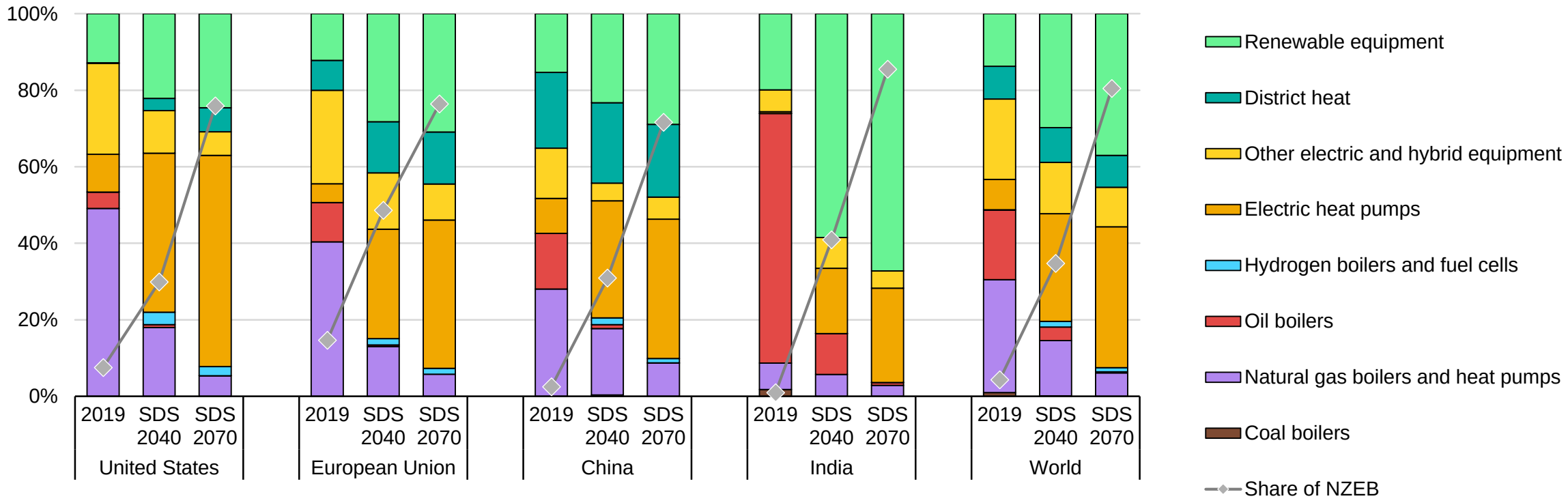
Buildings energy use and intensity in the Sustainable Development Scenario, 2019-2070



The share of electricity in final energy use grows to nearly 70% at net zero emissions, while the average buildings intensity is more than halved.

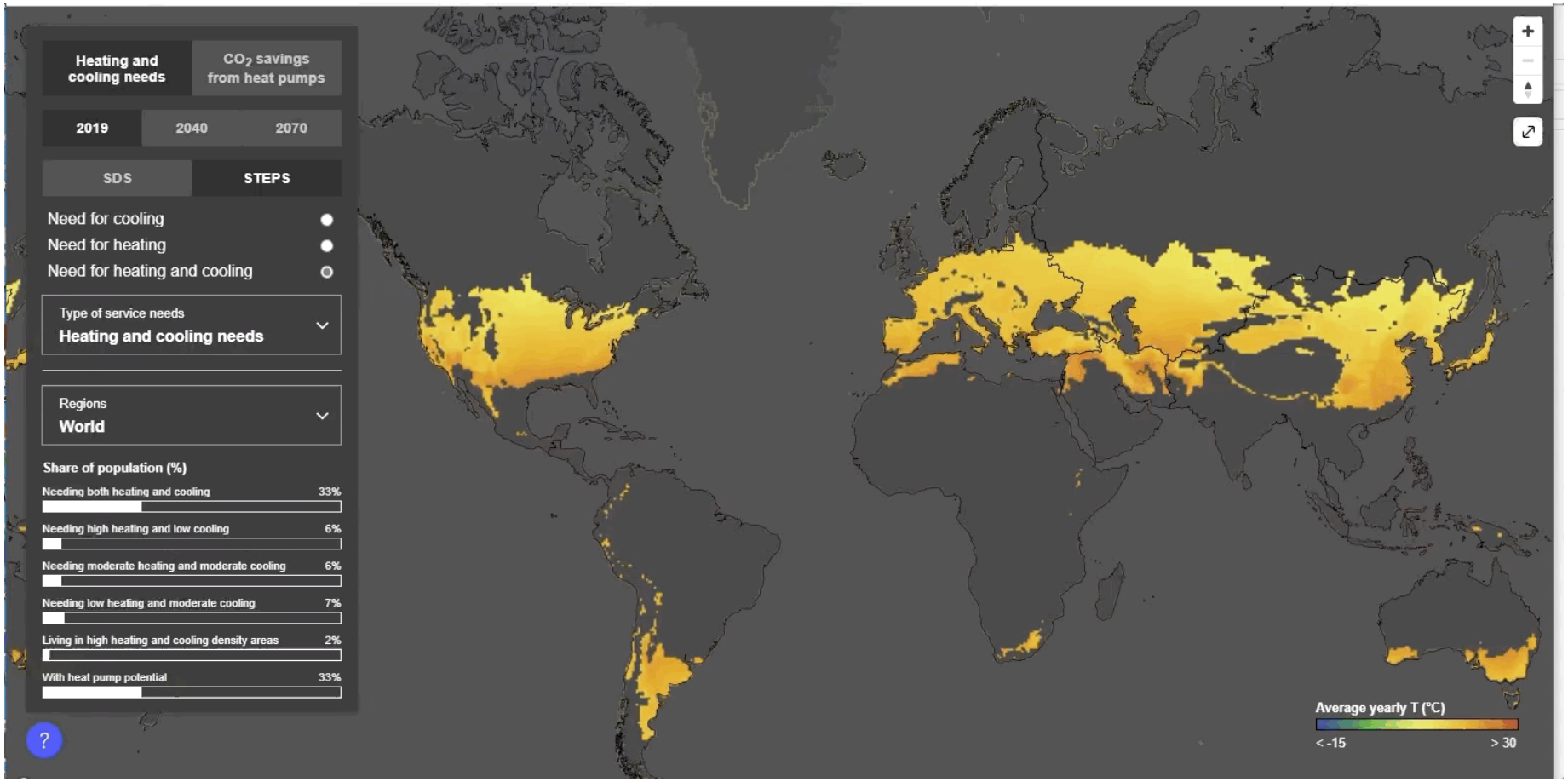
Technology shifts are necessary to decarbonise heat

Heating equipment sales share and share of NZEB in buildings stock by region in the Sustainable Development Scenario



Decarbonizing heat in buildings requires increased coordination of measures to improve the building envelope and to deploy clean and efficient heating technologies.

Decarbonisation strategies are highly geographically-dependent

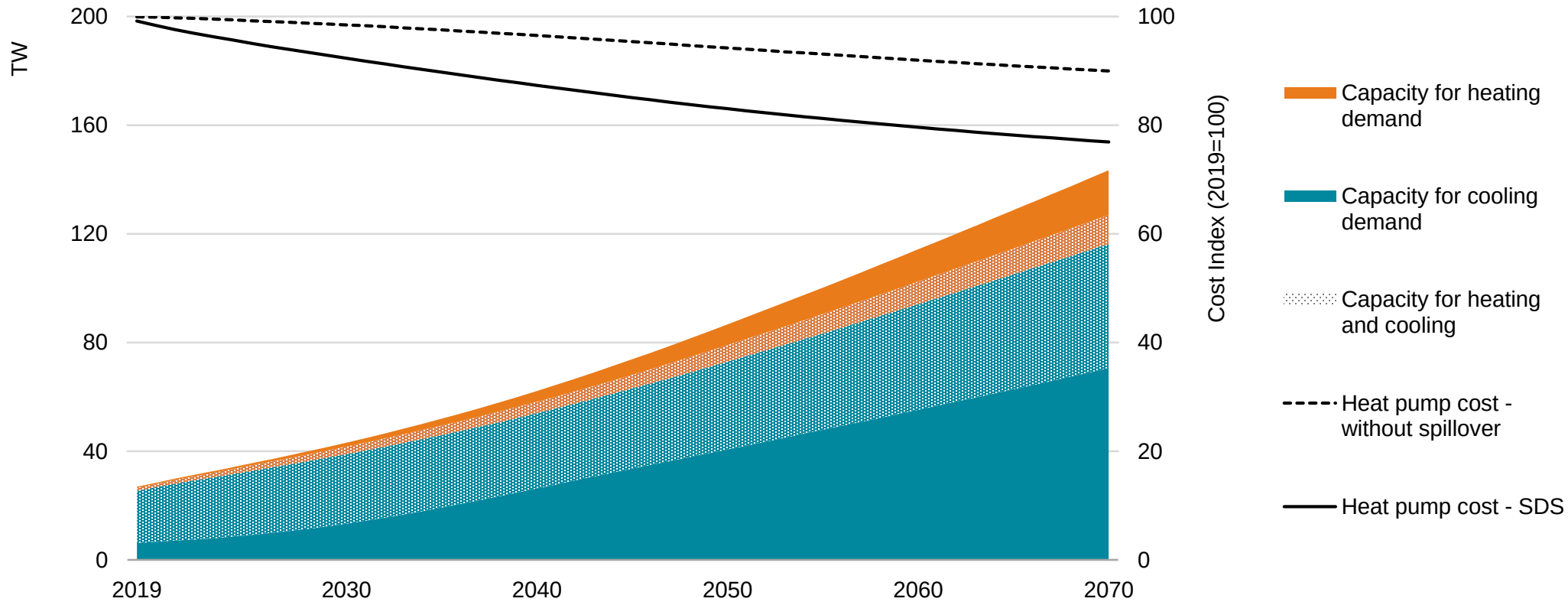


Local thermal needs are at the heart of building decarbonisation strategies. A third of global population needs both heating and cooling and an additional 5 billion people will gain access to cooling by 2070.

Source: IEA (2020), Is cooling the future of heating?, https://www.iea.org/commentaries/is-cooling-the-future-of-heating. All rights reserved.

Spillovers between air conditioners and heat pumps

Cumulative capacity and capital cost learning curve for vapour compression applications in the SDS



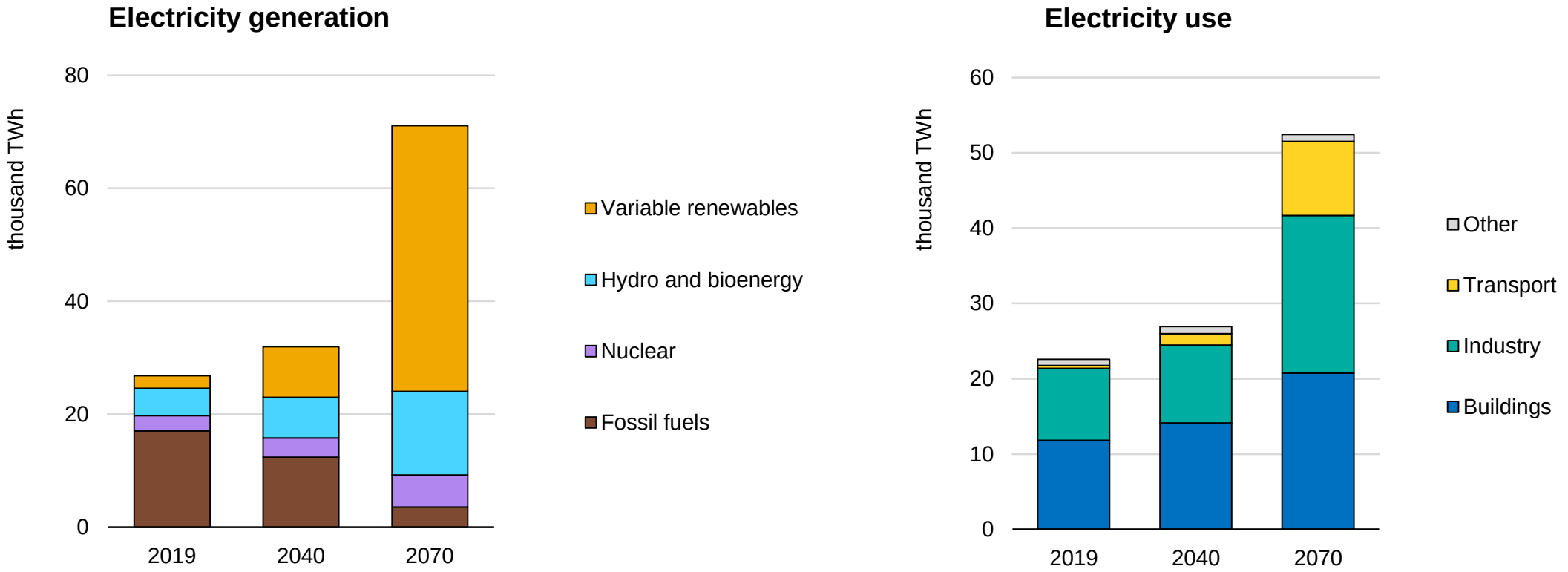
Synergies between heating and cooling results in around 15% lower cost for heating equipment

2.1

Integration with power systems

A growing electricity demand met by intermittent sources

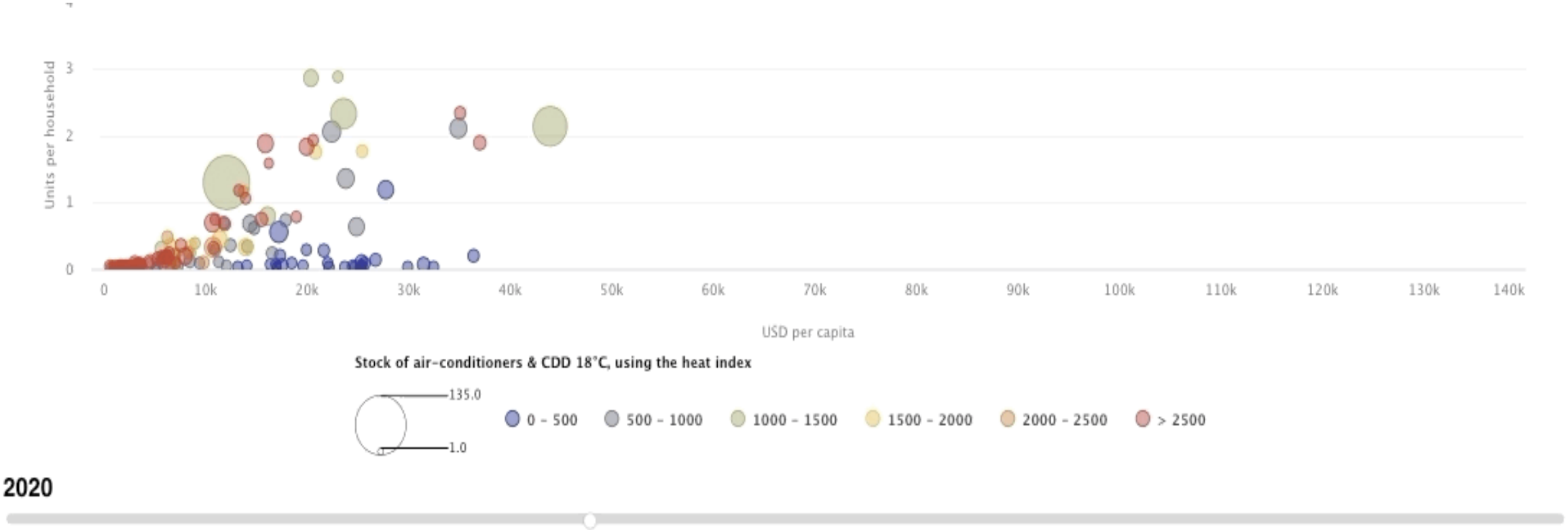
Global electricity use and generation in the Sustainable Development Scenario, 2019-70



Variable renewables dominate the electricity generation mix in 2070 as emissions reach net-zero. Buildings hold both the potential and responsibility to provide flexibility services.

Cooling is one of the drivers of building electricity demand growth

Average number of air-conditioners per household by country relative to income per capita and heat-index cooling degree-days, 2020-2070

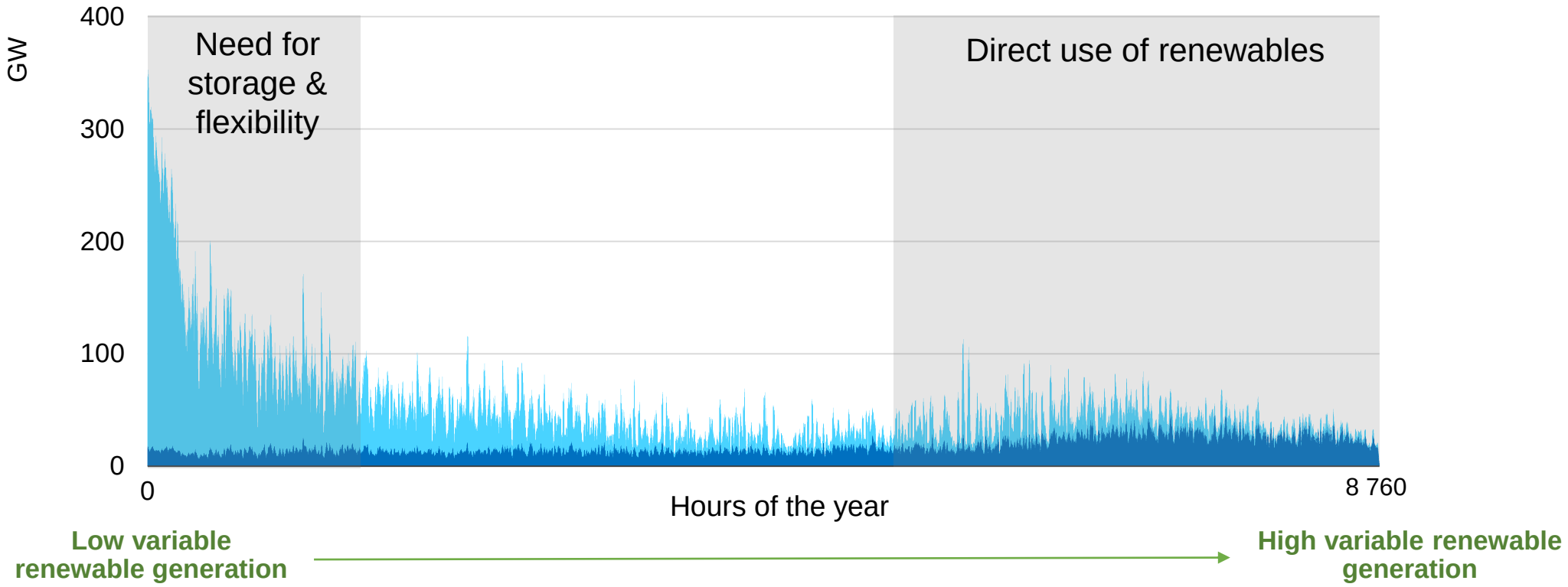


The number of installed air conditioners could quadruple by 2070, but more efficient air-conditioners and building envelopes could halve electricity demand for cooling relative to baseline trends.

Source: IEA (2020), IEA (2020), Is cooling the future of heating?, https://www.iea.org/commentaries/is-cooling-the-future-of-heating. All rights reserved.

Thermal demand is set to be driving the peak load in key regions

Cooling load profile in China, 2030
(Cooling demand of the Sustainable Development Scenario)

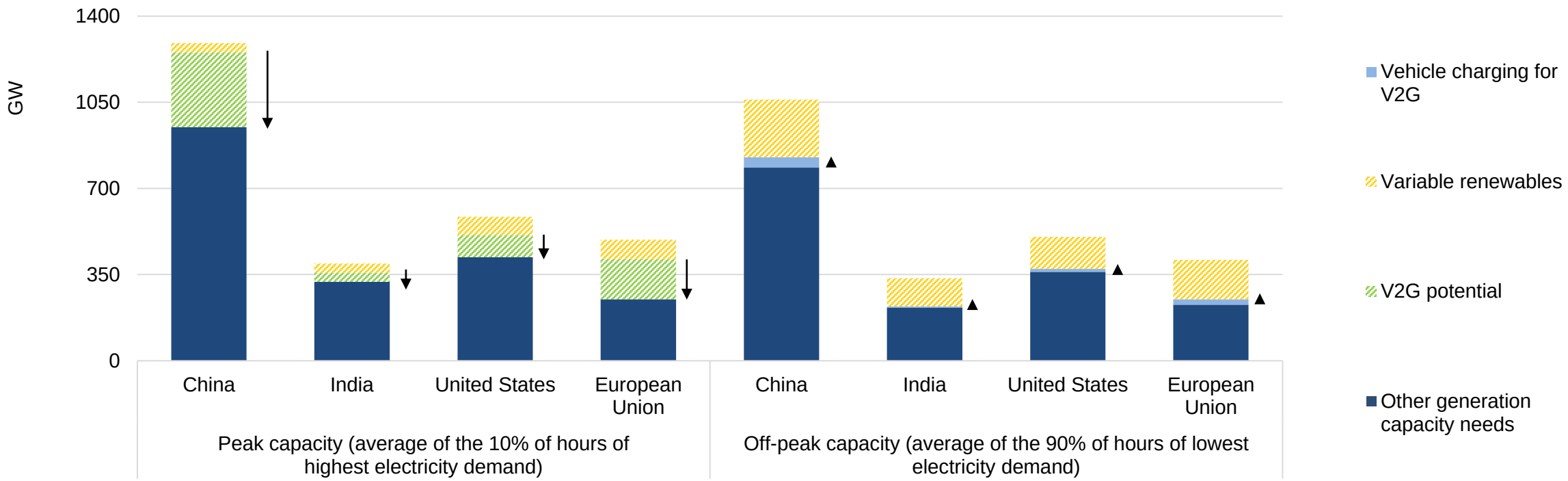


Growing cooling demand may lead to additional power capacity needs of more than 150 GW in China by 2030. Cooling storage systems and other flexibility measures need to address such variability in demand.

Coupling buildings and EVs to deliver flexibility services

Vehicle-to-grid potential relative to total generation capacity, 2030

(EV deployment of the Sustainable Development Scenario)



Vehicle-to-grid services could unlock up to 600 GW of flexible capacity in 2030 (distributed across EV markets). 600 GW represents nearly half of current hydropower capacity.

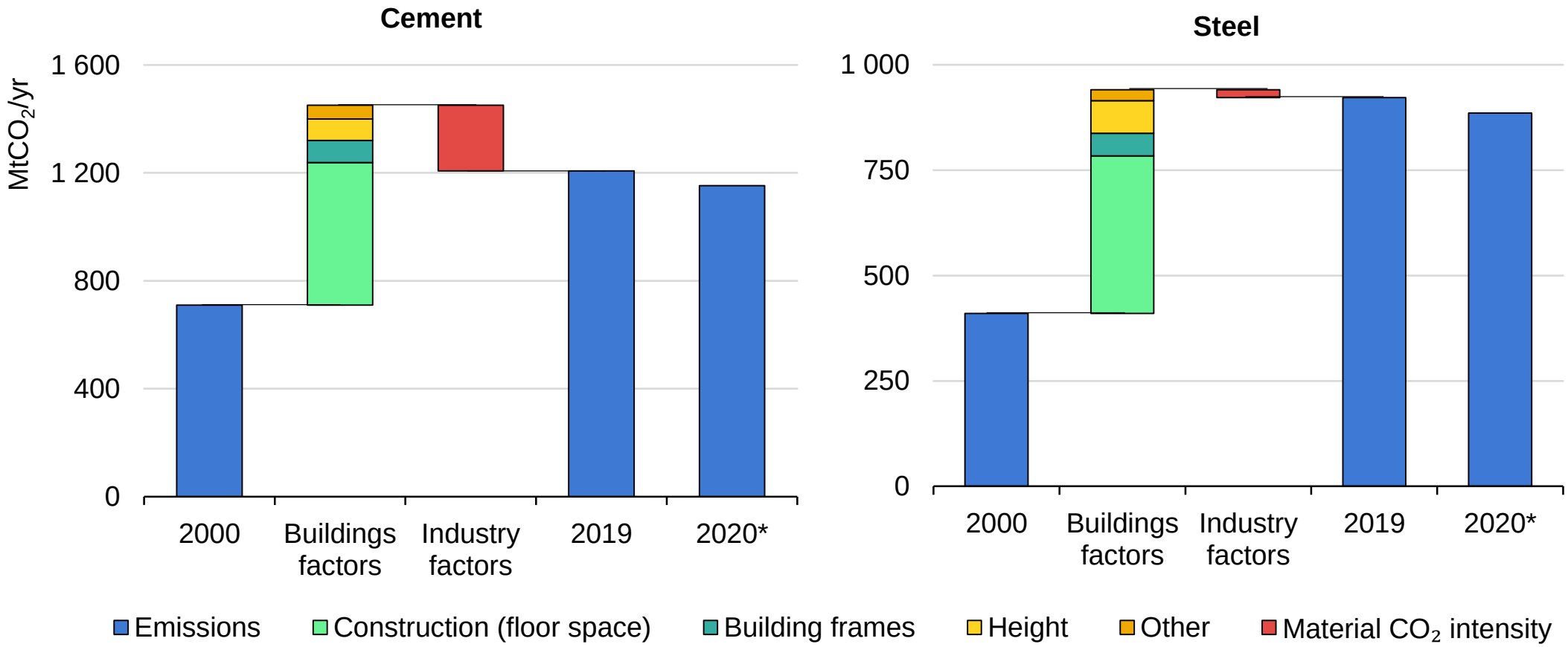
Note: V2G = Vehicle-to-grid

2.2

Integration with material manufacturing value chains

Embodied emissions rise due to growing floor area

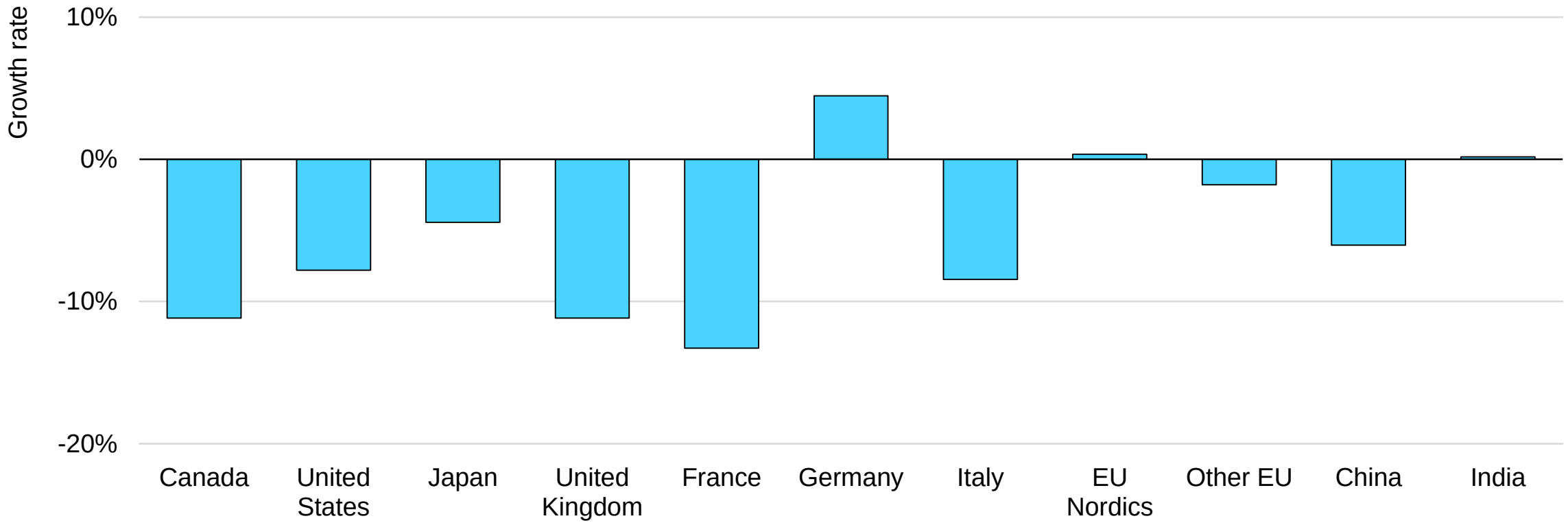
Decomposition of CO_2 emissions from steel and cement manufacturing for buildings construction, 2000-2020



Embodied emissions in the cement and steel used in buildings have increased sharply since 2000, with increased construction outweighing the effect of a fall in the carbon intensity of both materials.

Construction activity fell in the wake of the pandemic

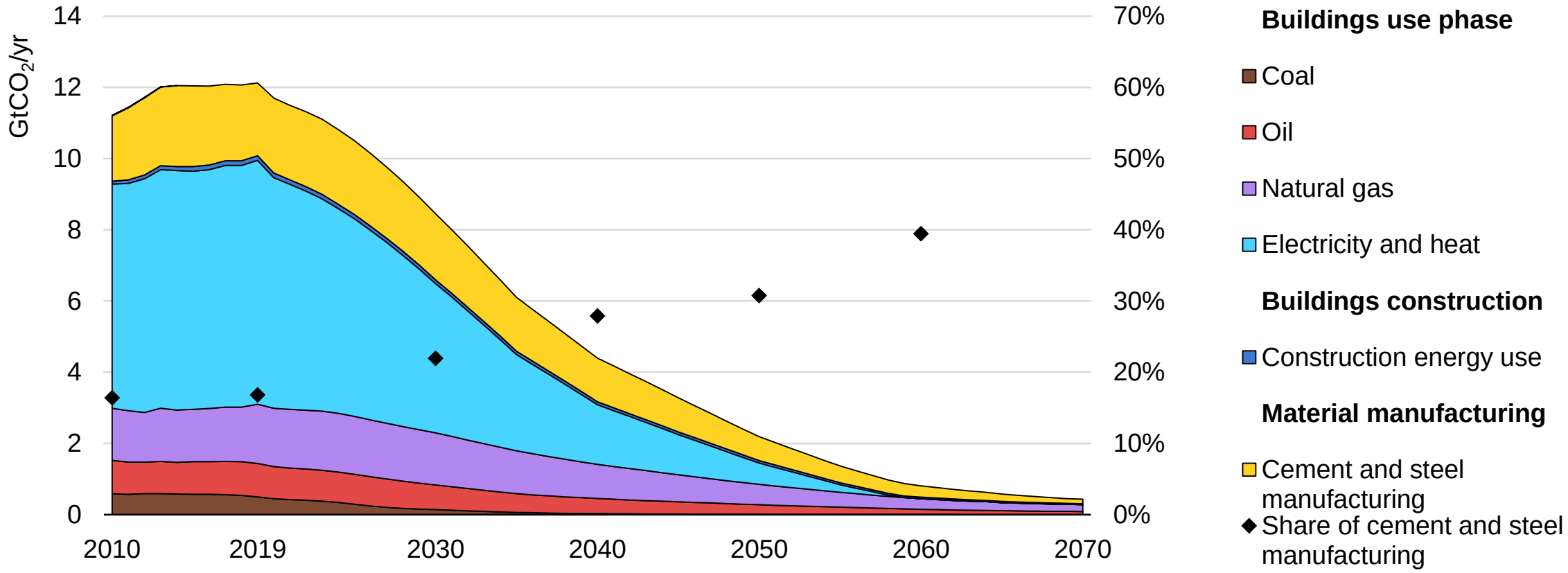
Projected year-to-year growth of residential construction activity in 2020 relative to 2019



Material demand is strongly affected by the Covid-19 pandemic; residential construction activity could decline by up to around 15% in 2020 relative to 2019, depending on the country.

Embodied carbon is harder to abate than use phase emissions

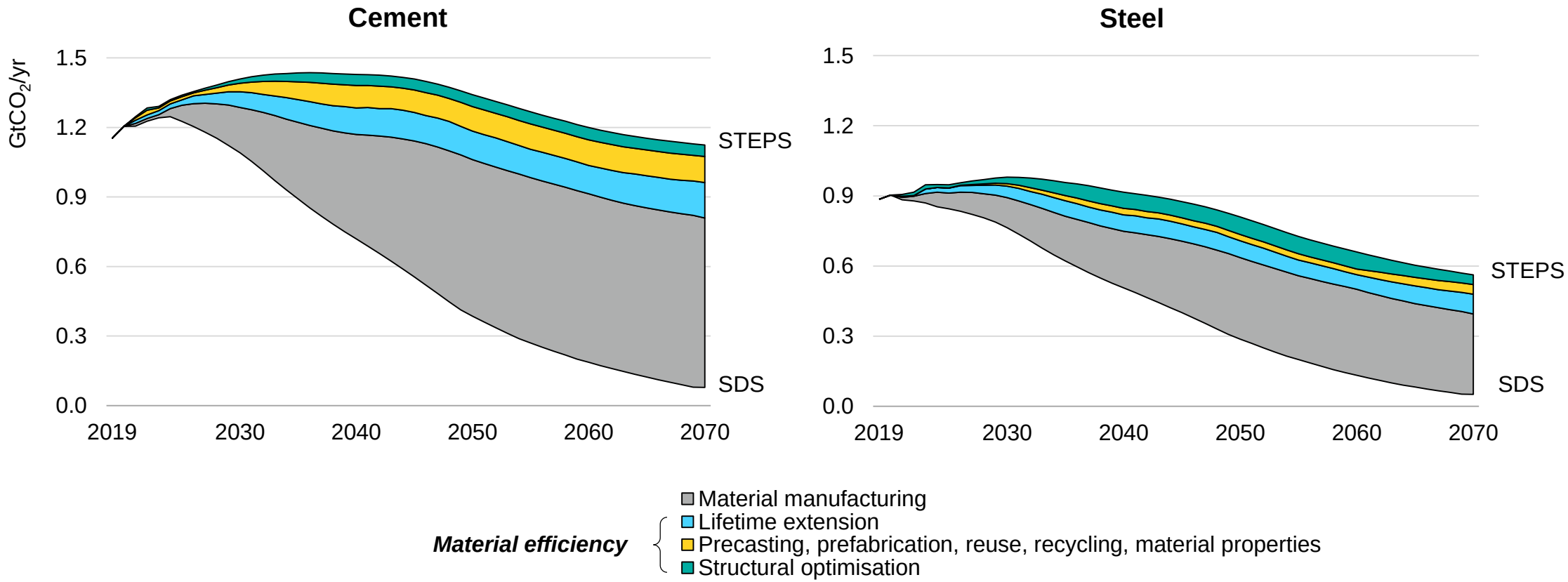
CO_2 emissions in the buildings and construction value chain in the Sustainable Development Scenario



Despite reductions in material use and material manufacturing emissions, the share of cement- and steel-related emissions in total buildings emissions jumps from less than a fifth today to 40% by the 2060s.

Sustainable action needs to be stimulated along value chains

World cement- and steel-related CO_2 emissions in the buildings construction sector by scenario and driver

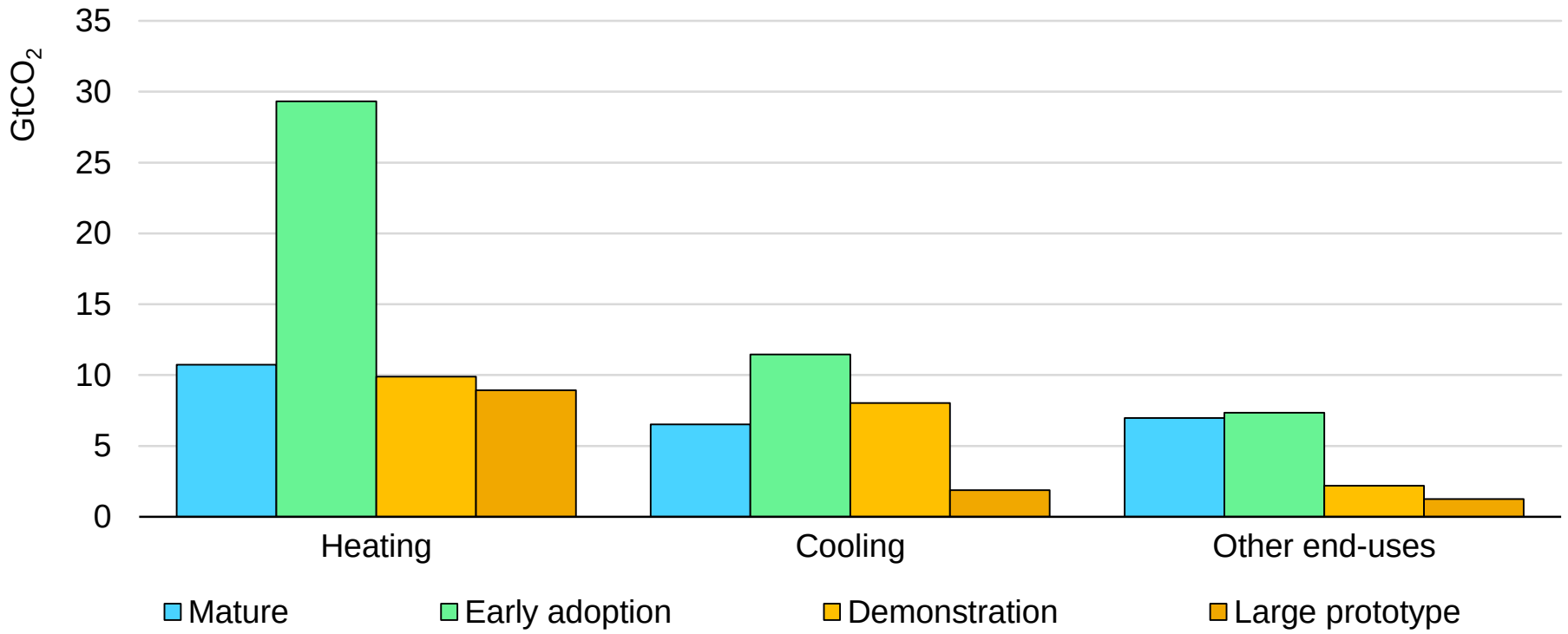


Material efficiency measures contribute to around a third of the total reduction in emissions by 2070 in the Sustainable Development Scenario relative to the Stated Policies Scenario.

3. Innovation

Deployment is a priority, but innovation remains necessary

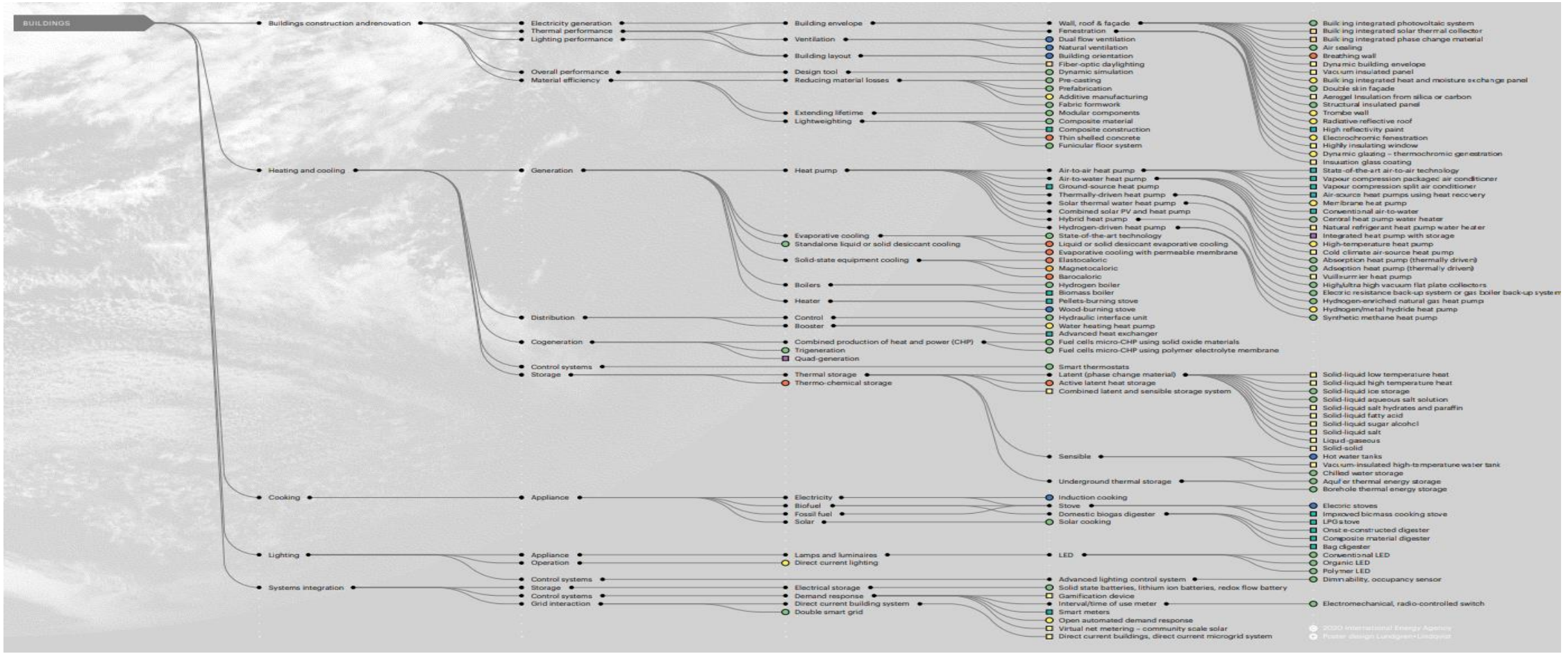
Cumulative global buildings sector emissions reduction by maturity category in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2020-2070



Three quarters of necessary emissions reductions could be achieved through the use of mature and early adoption technologies, but further innovation is also required to achieve the full decarbonisation of heating and cooling.

Building energy storage and integration in the *ETP Clean Energy Technology Guide*

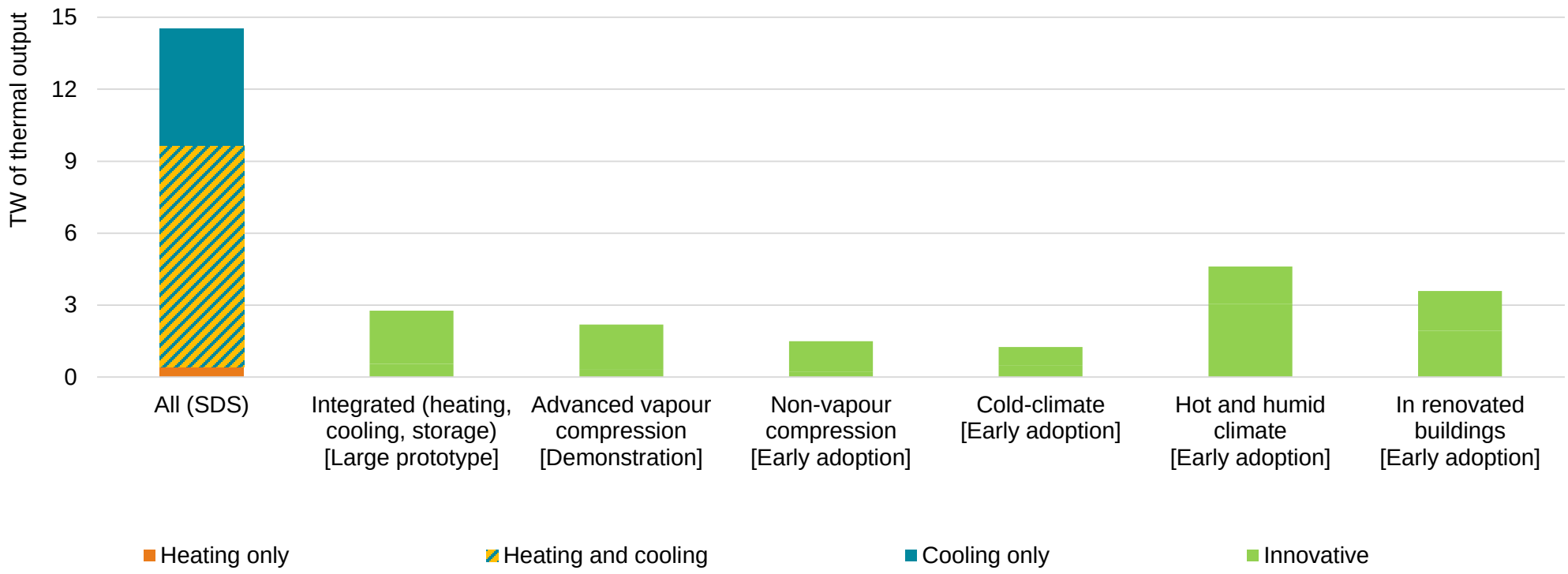
Buildings technologies



The ETP Clean Energy Technology Guide contains information for over 400 individual technology designs and components across the whole energy system that contribute to achieving net-zero emissions.

Greater adoption relies on innovation

Heat pumping technology deployment by market segment in the Sustainable Development Scenario in 2030



The deployment of heat pumping technologies is closely linked to innovation as they need to be scalable and suitable to many buildings, climate and operating conditions.

Innovation needs in the buildings sector

- **Packaged multi-service solutions**

To exploit synergies between technologies and deliver cost reduction and performance improvements.

- **Integration among different end-uses**

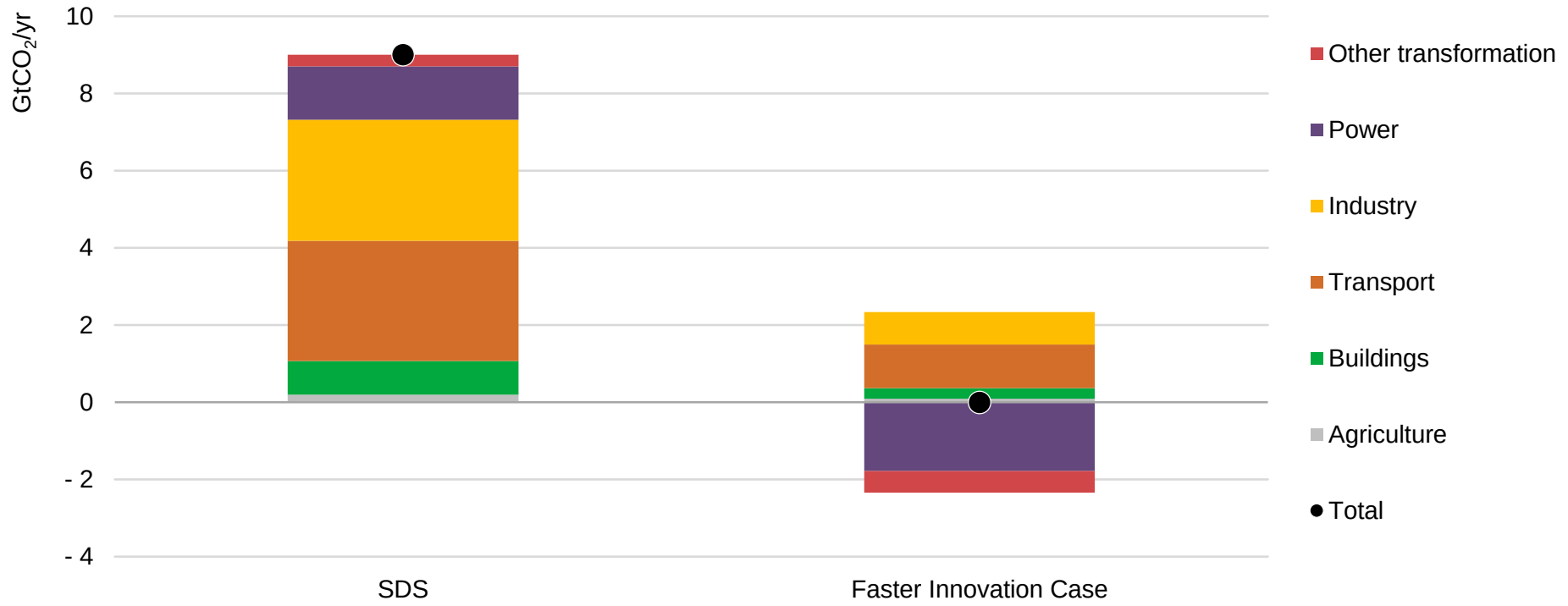
To exploit the and maximize the synergies of different services.

- **Solutions tailored to local conditions**

To guarantee high perfomances in all climates and buildings stock conditions

Reaching net-zero by 2050: the Faster Innovation Case

Global energy sector CO_2 emissions in 2050 by sector



In the Faster Innovation Case, in buildings, accelerated innovation in space cooling technologies, which also benefits the heating sector, contribute up to 60% of total annual emissions reductions in buildings.

Conclusions

- Tackle emissions from **existing buildings**.
- Strengthen markets for clean technologies at **early stage of adoption.**
- Develop and upgrade **infrastructure** that enables technology deployment.
- Boost support for **research, development and demonstration.**
- Expand **international technology collaboration** along material and energy value chains.

Questions & Answers

Panel discussion

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