INSTITUTE FOR SUSTAINABLE RESOURCES

Why are some sectors of the economy so difficult to decarbonise?

Presentation to the Tyndall Centre Conference

'Our Critical Decade for Climate Action'

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Structure of book

For book orders and to see endorsements: https://routledge.pub/Stopping-Climate-Change

Chapter 0: Introduction
Chapter 1: Why Real Zero
Chapter 2: The global context and pathways to Net Zero
Chapter 3: Energy efficiency, the ‘first fuel’
Chapter 4: Kicking the addiction to fossil fuels
Chapter 5: The future is electric
Chapter 6: Filling the gaps with bioenergy and hydrogen
Chapter 7: Carbon capture, use, storage and removal, and climate geoengineering
Chapter 8: The great enablers: digitalisation, the circular economy, and critical minerals for the clean energy transition
Chapter 9: Decarbonisation of buildings, transport, industry and business
Chapter 10: Feeding the world, reducing waste
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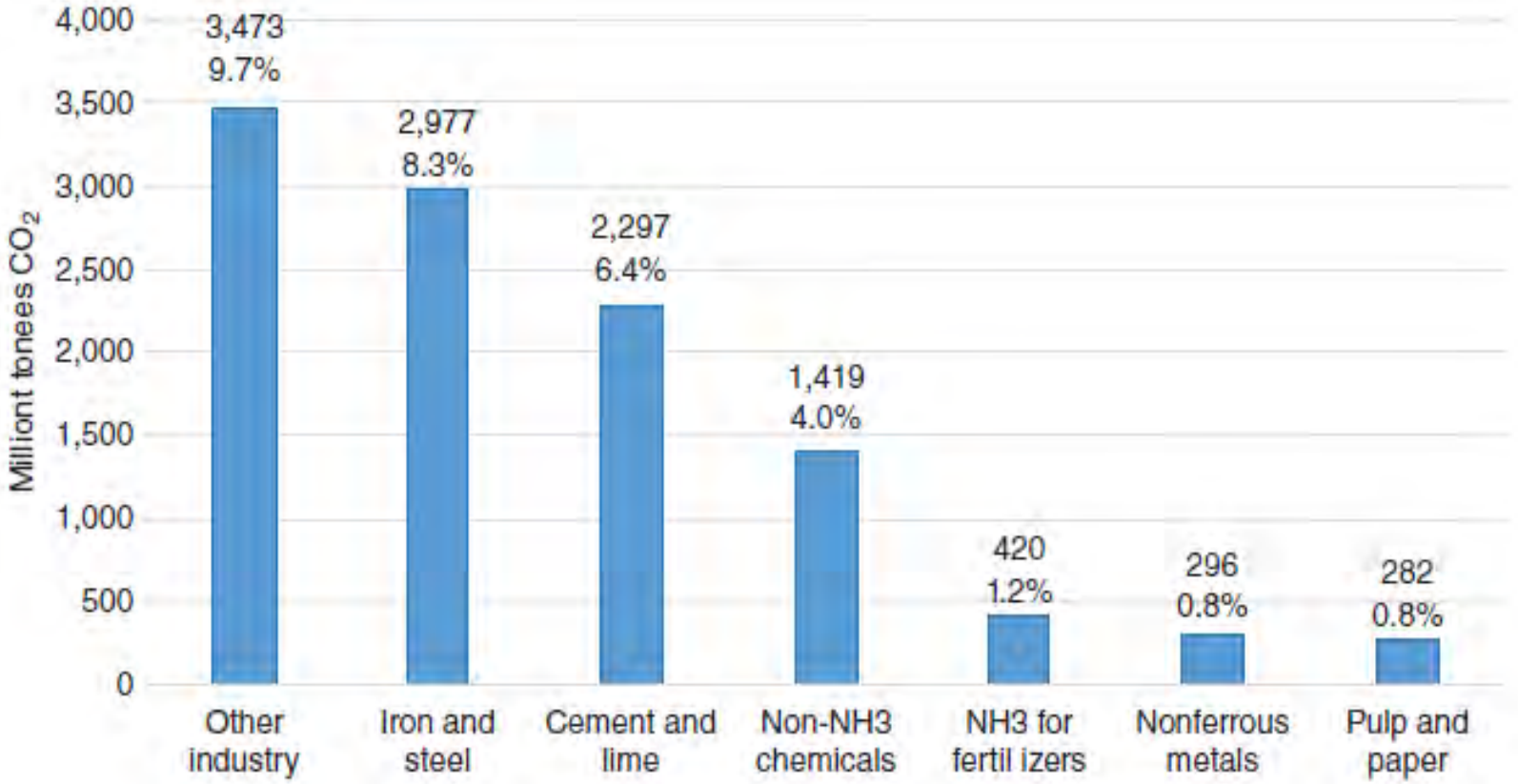
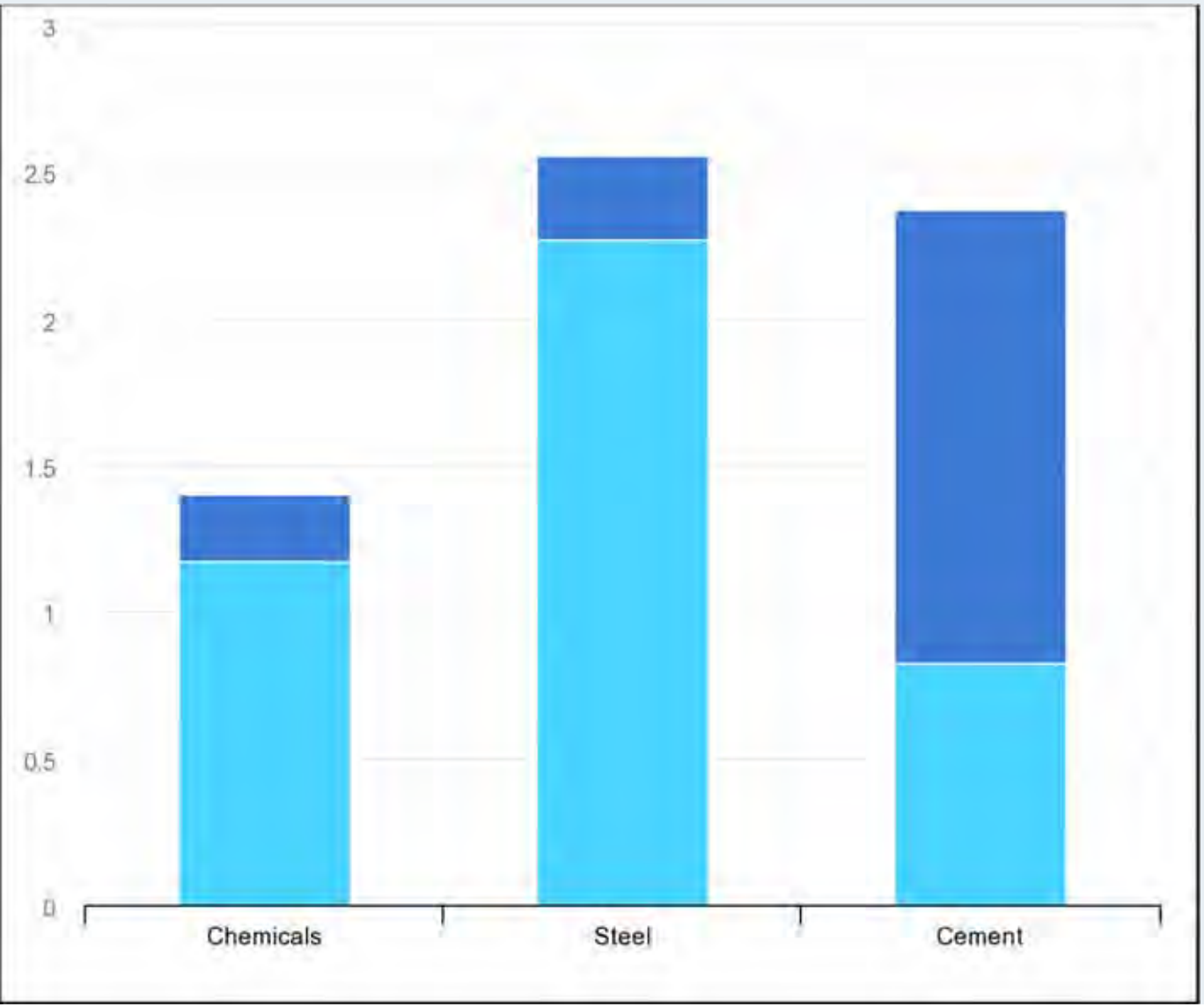
Global CO2 emissions from energy-intensive industries (2016)



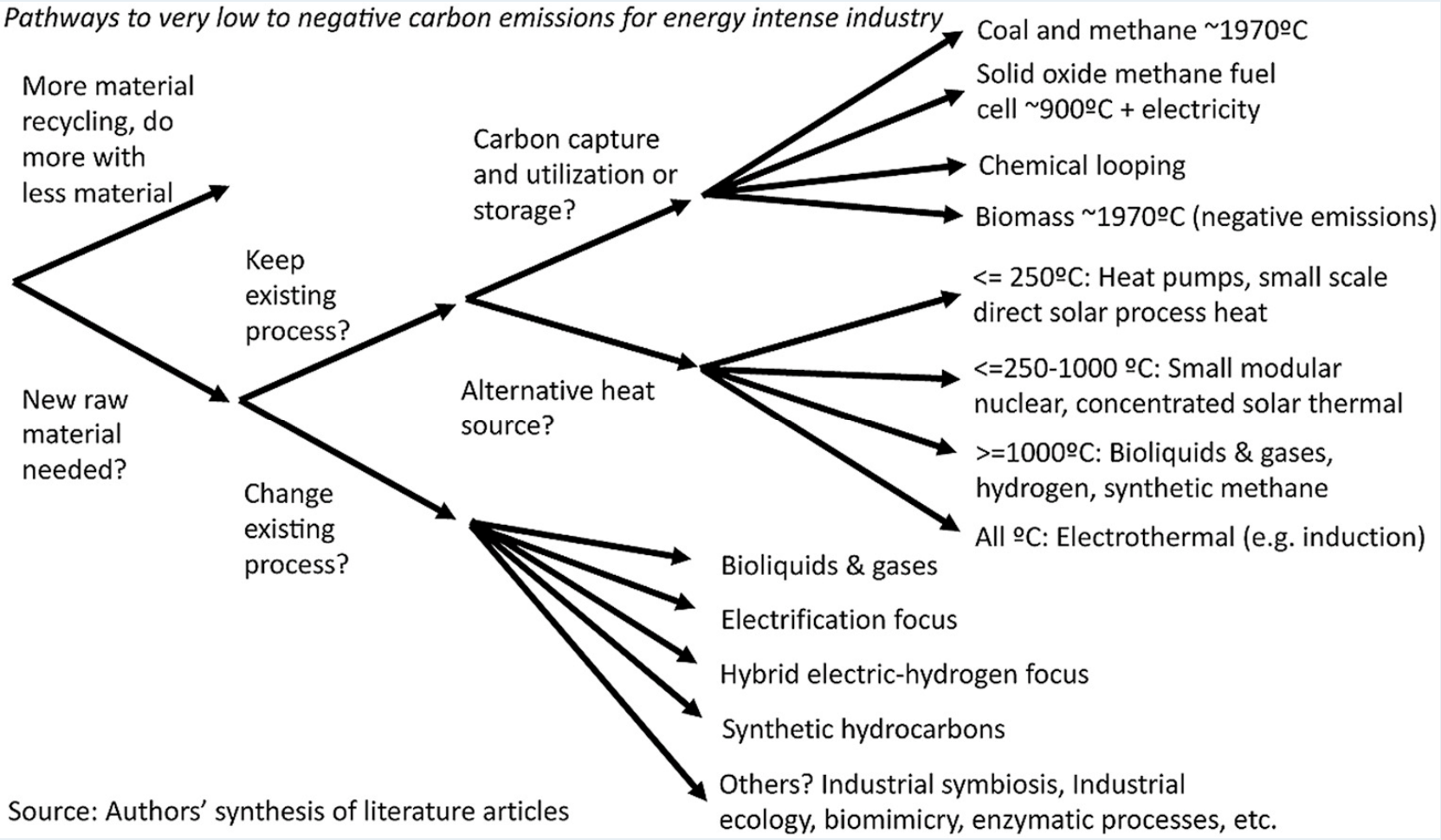
Source:
Bataille 2020
https://doi.org/10.1002/wcc.633



Energy (light blue) and process (dark blue) emissions from the three most carbon-emitting industrial sectors, GtCO2 per year, 2019

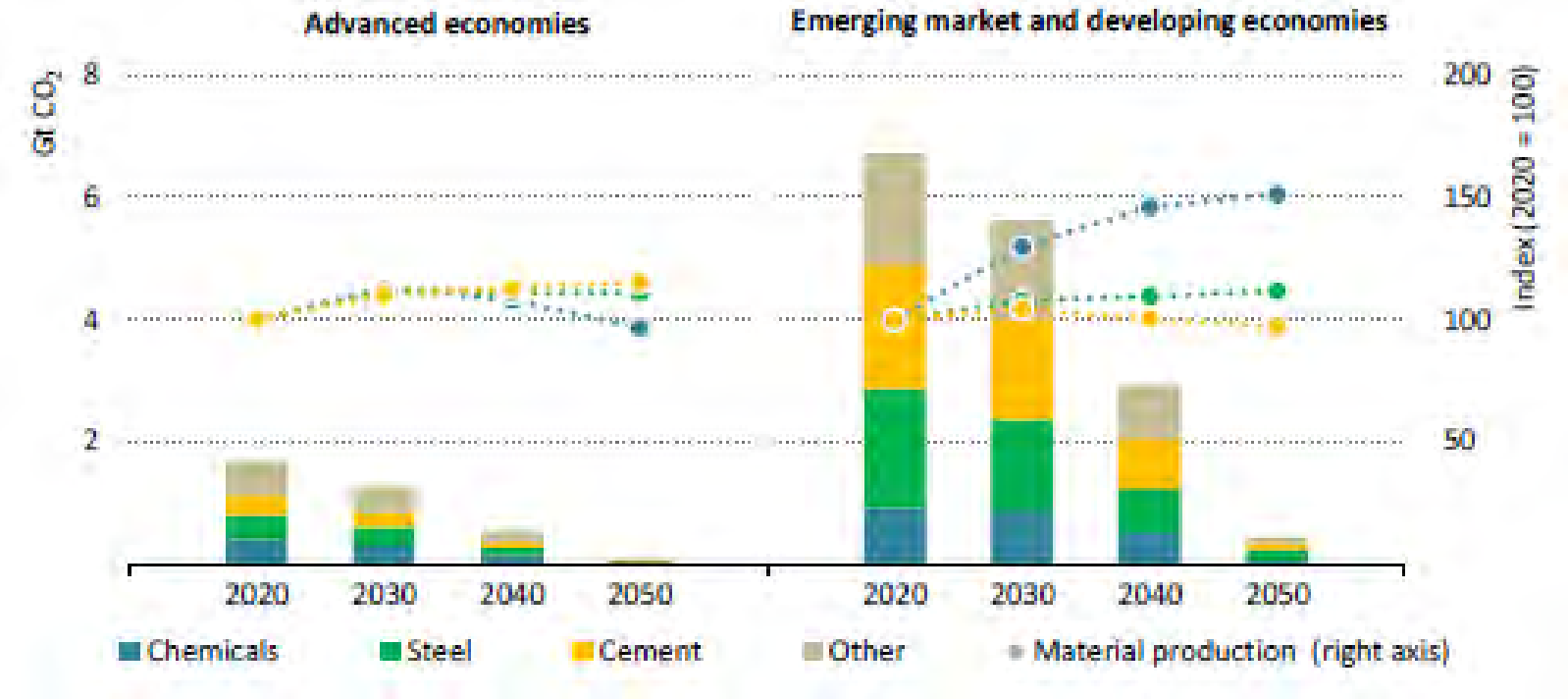
Source:
IEA, 2019
https://www.iea.org/articles/the-challenge-of-reaching-zero-emissions-in-heavy-industry

Options for decarbonising energy-intensive industries



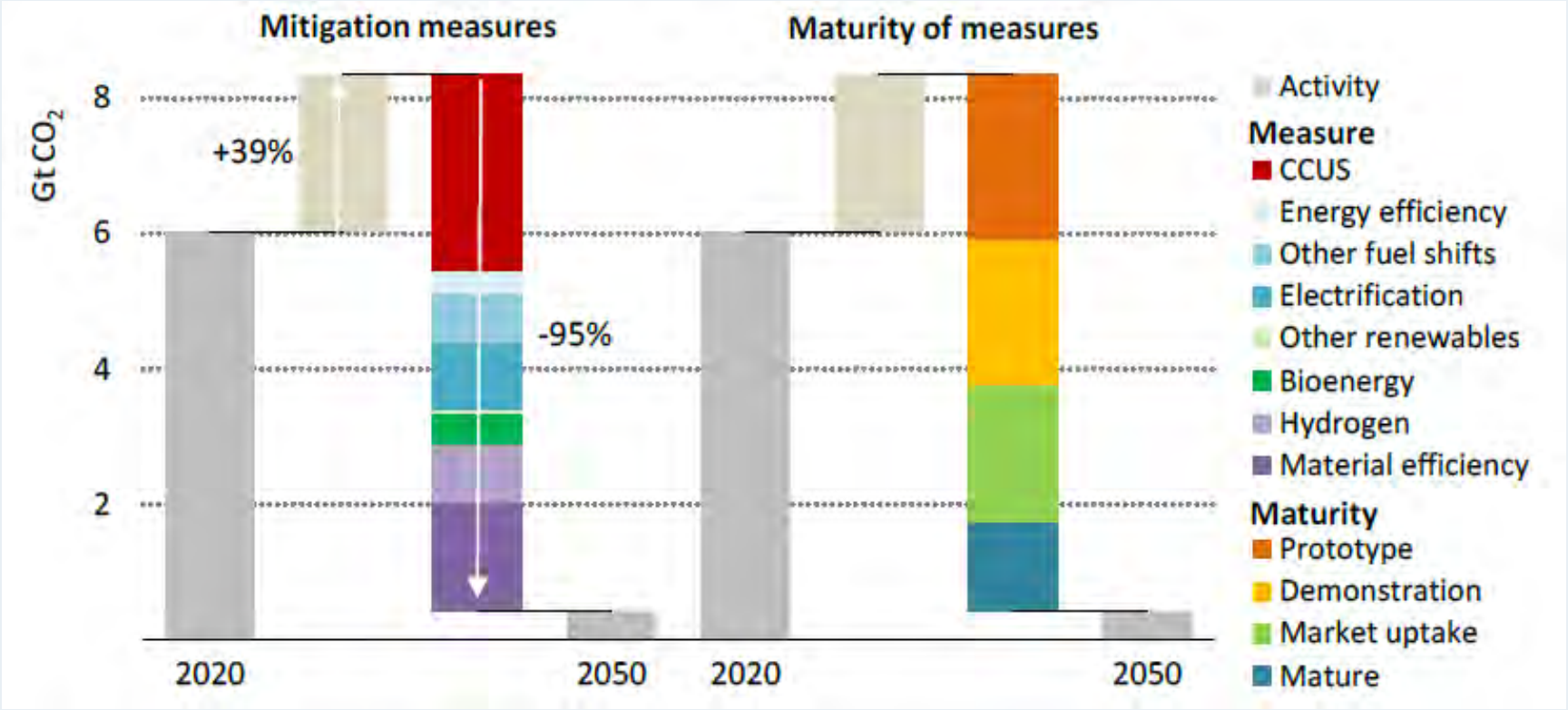
Source:
Bataille et al.
2018
https://doi.org/10.1016/j.jclepro.2018.03.107

CO2 emissions (left axis) of chemicals, steel and cement from 2020 to 2050 in the IEA Net Zero Emissions (NZE) scenario, by advanced, and emerging and developing, economies; material production (right axis)

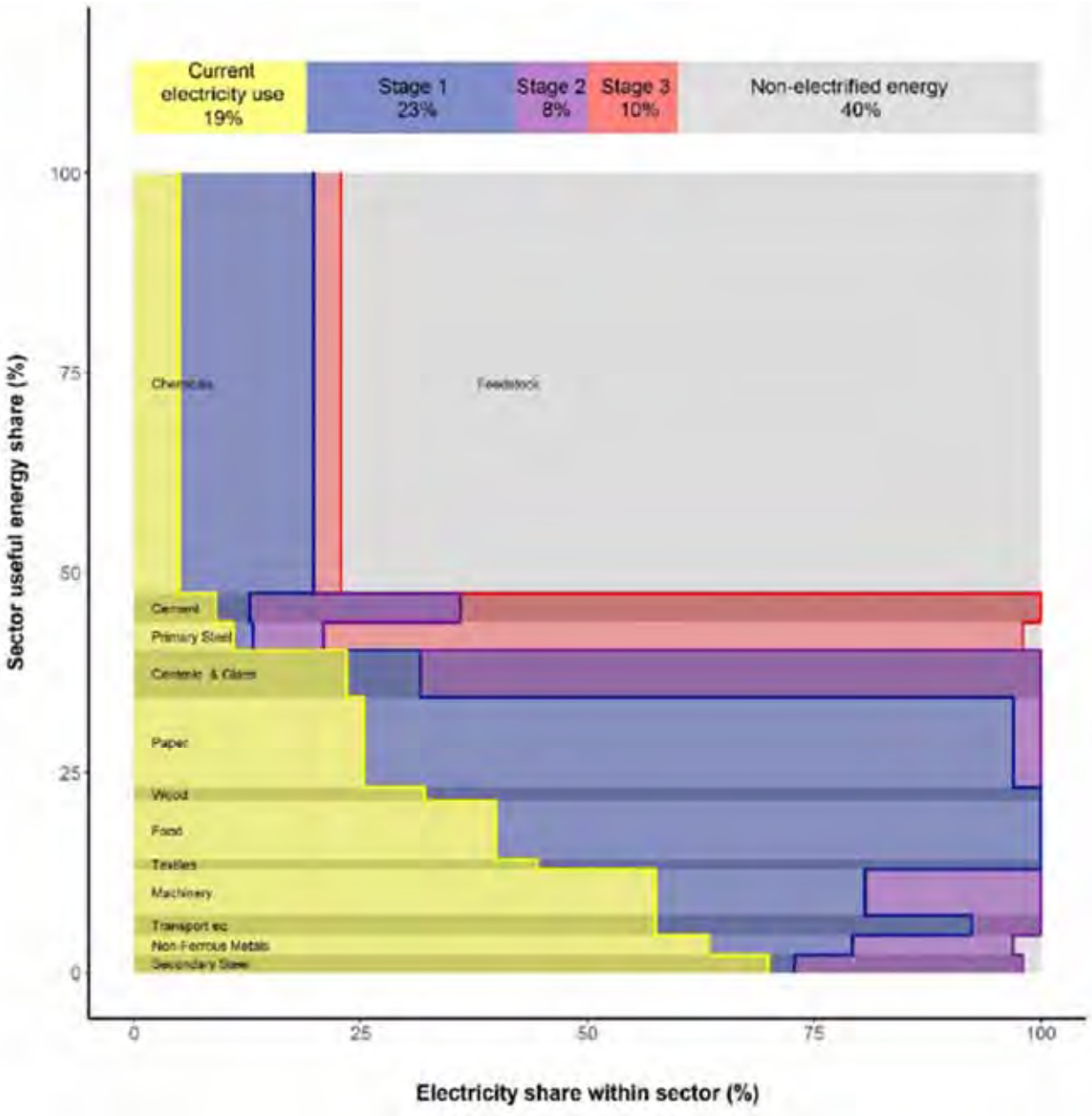


Source: IEA, 2021, Figure 3.15, p.122, https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

Least-cost decarbonisation of heavy industry in the IEA's NZE scenario



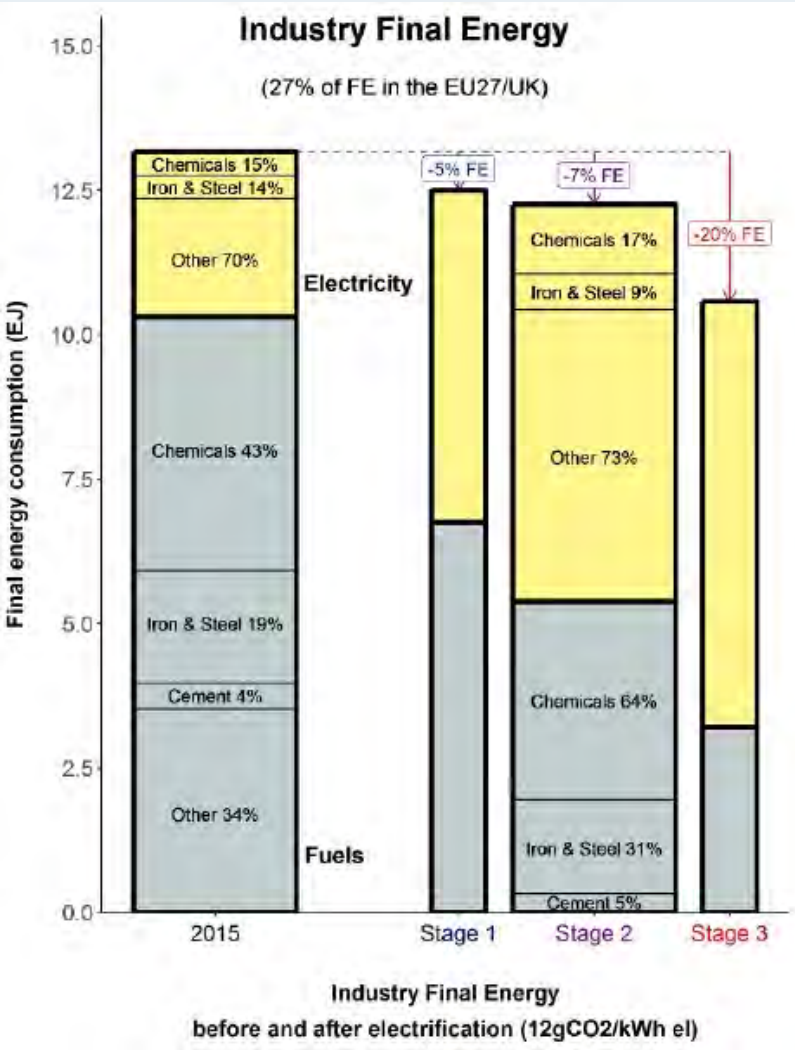
Source: IEA, 2021, Figure 3.16, p.123, https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

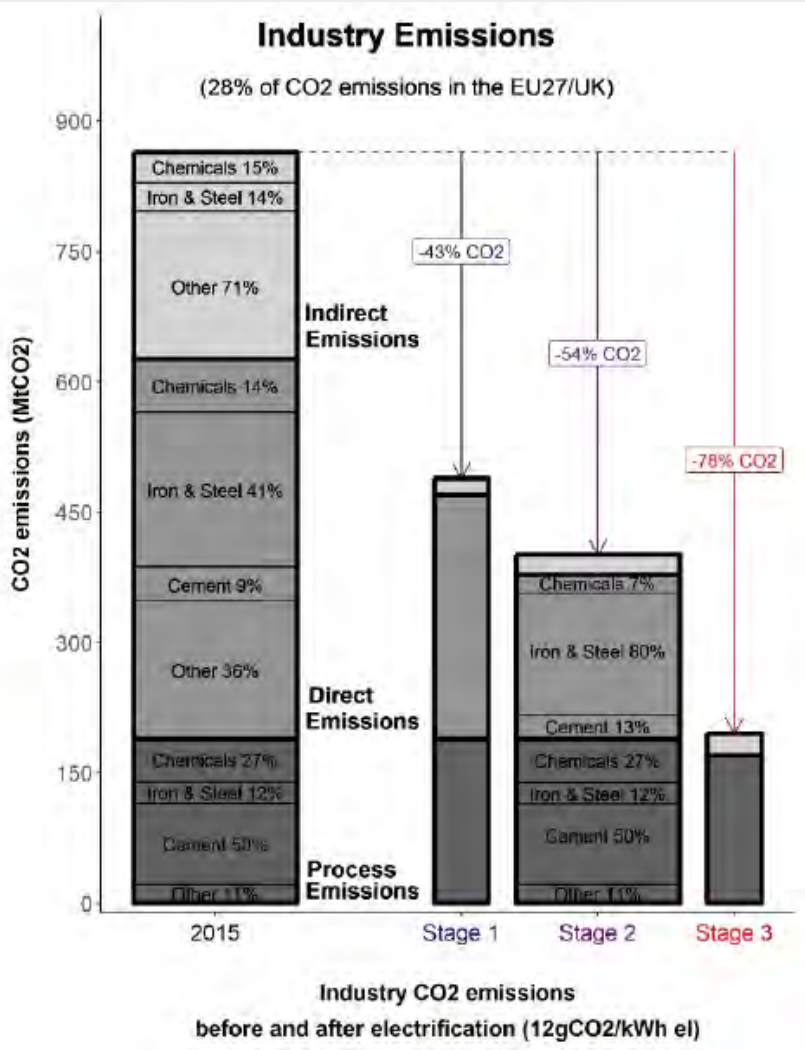


Decarbonisation of industry through electrification (1)

Source: Madeddu et al., 2020, Figure 2B, p.6, https://doi.org/10.1088/1748-9326/abbd02

Decarbonisation of industry through electrification (2)



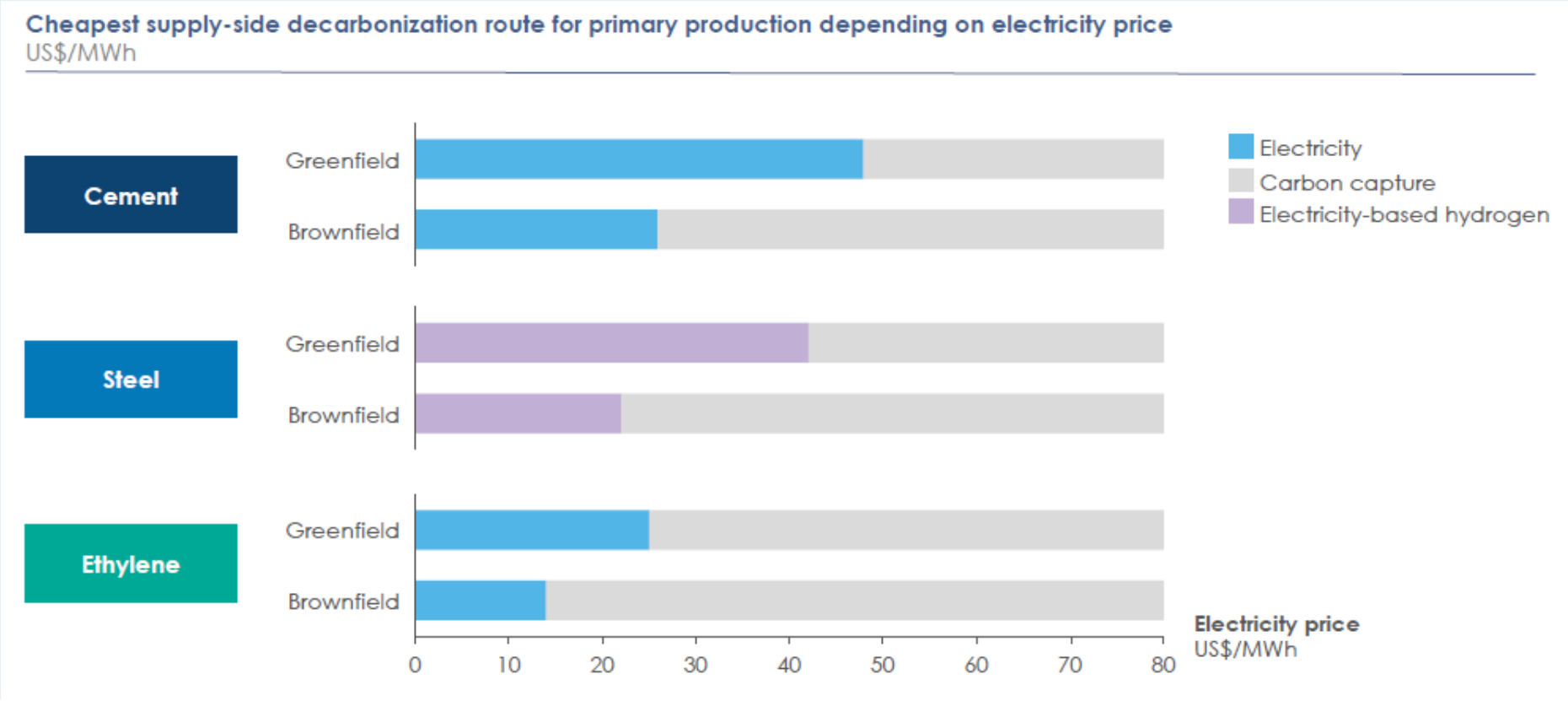


Source: Madeddu et al., 2020, Figure 2B, p.6, https://doi.org/10.1088/1748-9326/abbd02

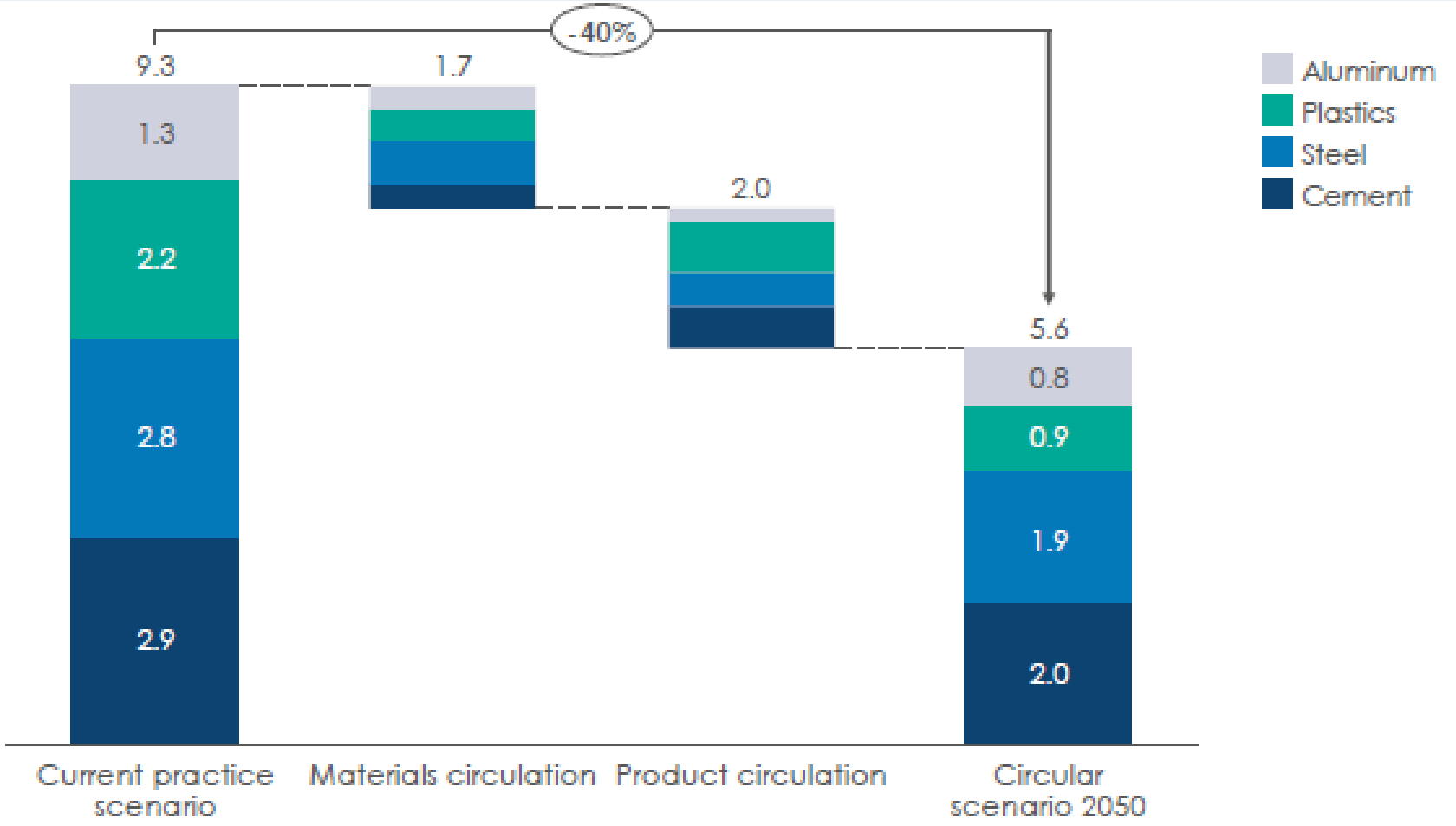
Use of electricity, hydrogen or CCUS in the decarbonisation of three heavy industry products

Source: Energy Transitions Commission, 2018, Exhibit 2, p.17

https://www.energy-transitions.org/publications/mission-possible/



Potential emissions reductions (GtCO2) from moving toward a more circular economy



Source: Energy Transitions Commission, 2018, Exhibit 2, p.17 https://www.energy-transitions.org/publications/mission-possible/

Conclusions

- Still a great continuing need for innovation, deployment of new technology to get costs down
- The critical issue is the cost of zero-carbon electricity
- The next most critical issue is the cost of electrolysers (plus availability of constrained renewables)
- Carbon capture and storage will be essential unless the costs of electricity and hydrogen fall to low levels
- Moving towards a circular economy (keeping products in use, recycling materials) can make a significant contribution
- Behaviour change least likely to make a significant difference

Thank you

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