Tyndall Centre
for Climate Change Research

CLIMATE CHANGE & CARBON BUDGETS:

the contribution of international transport emissions

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Exeter 2008

(based on work by Alice Bows & Kevin Anderson)

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Summary

- Policy context
- Aviation & Shipping – historical emissions
- Climate change emission pathways
- Aviation & Shipping – future scenarios
- Compatibility with emission pathways

Context

Any target based on global temperatures or CO_2 concentrations is credible only if applied to an aggregate of all sectors

… and therefore must include

International aviation
International shipping

… the two fastest growing sectors of the OECD economies in both activity and carbon emissions.

Policy context

Kyoto Protocol:

"*The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organisation (ICAO) and the International Maritime Organisation (IMO) respectively*".

Policy context

ICAO & **IMO** are both currently exploring inclusion within (ideally global) emissions trading schemes

But, failure to take any action to mitigate to date has led to criticism by the EU…

Policy context

EU Commission 2007:

"Regrettably, it has become clear to us…that, ten years after having been requested by the UNFCCC to take action to limit or reduce emissions, it has not been possible for ICAO to agree on essential elements of this comprehensive approach. In particular, the programme put forward for agreement at this Assembly is unambitious, piecemeal and lacking in credibility on market-based measures (both greenhouse gas emissions charges and emissions trading)."

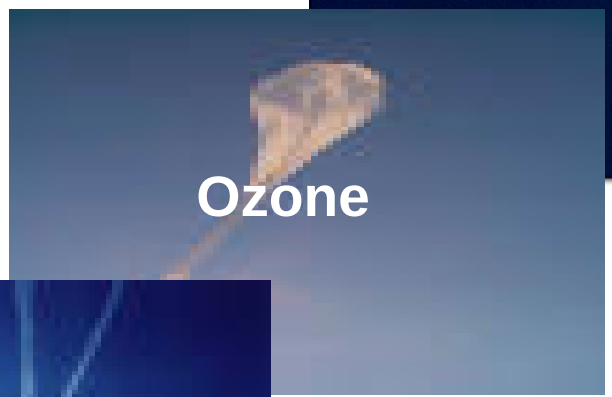
Aviation

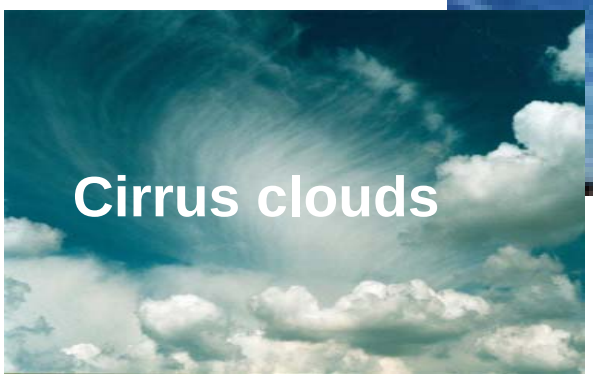
Challenges for the aviation industry

Anderson et al. (2005) Tyndall Decarbonisation Scenarios concluded that all sectors have opportunities to significantly reduce emissions in real terms in short-medium term apart from aviation

- Medium-long term reliance on kerosene
- Aircraft have long lifetimes – 60 year lock-in
- No short-term technological fixes
- Growth is higher than in any other sector
- Most of the population currently don’t fly
- Aircraft cause additional climate warming

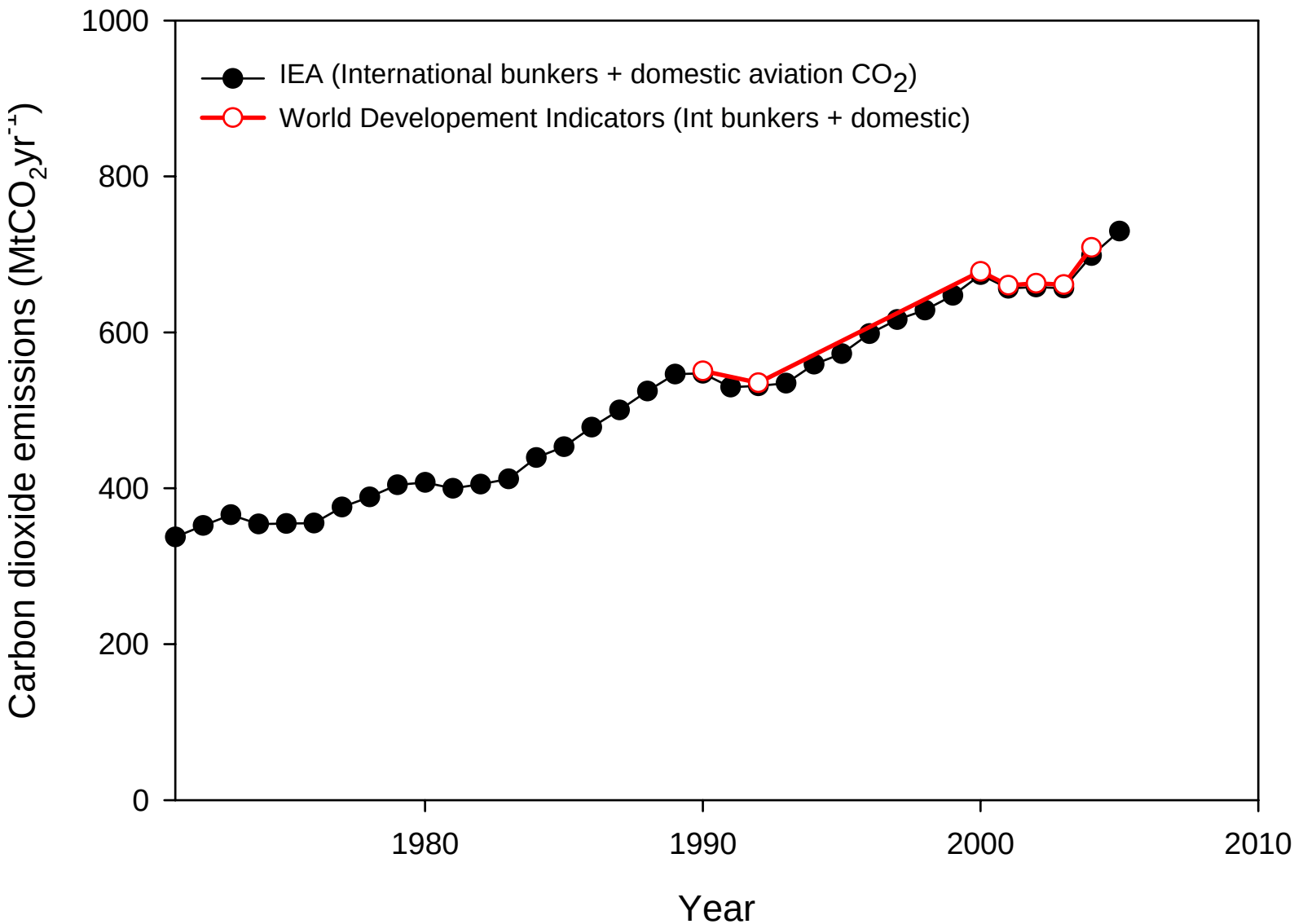
Emissions from aviation





Combination of effects leads to aviation contributing to ~double the equivalent historical warming of CO_2 alone

Historical aviation CO_2 emissions



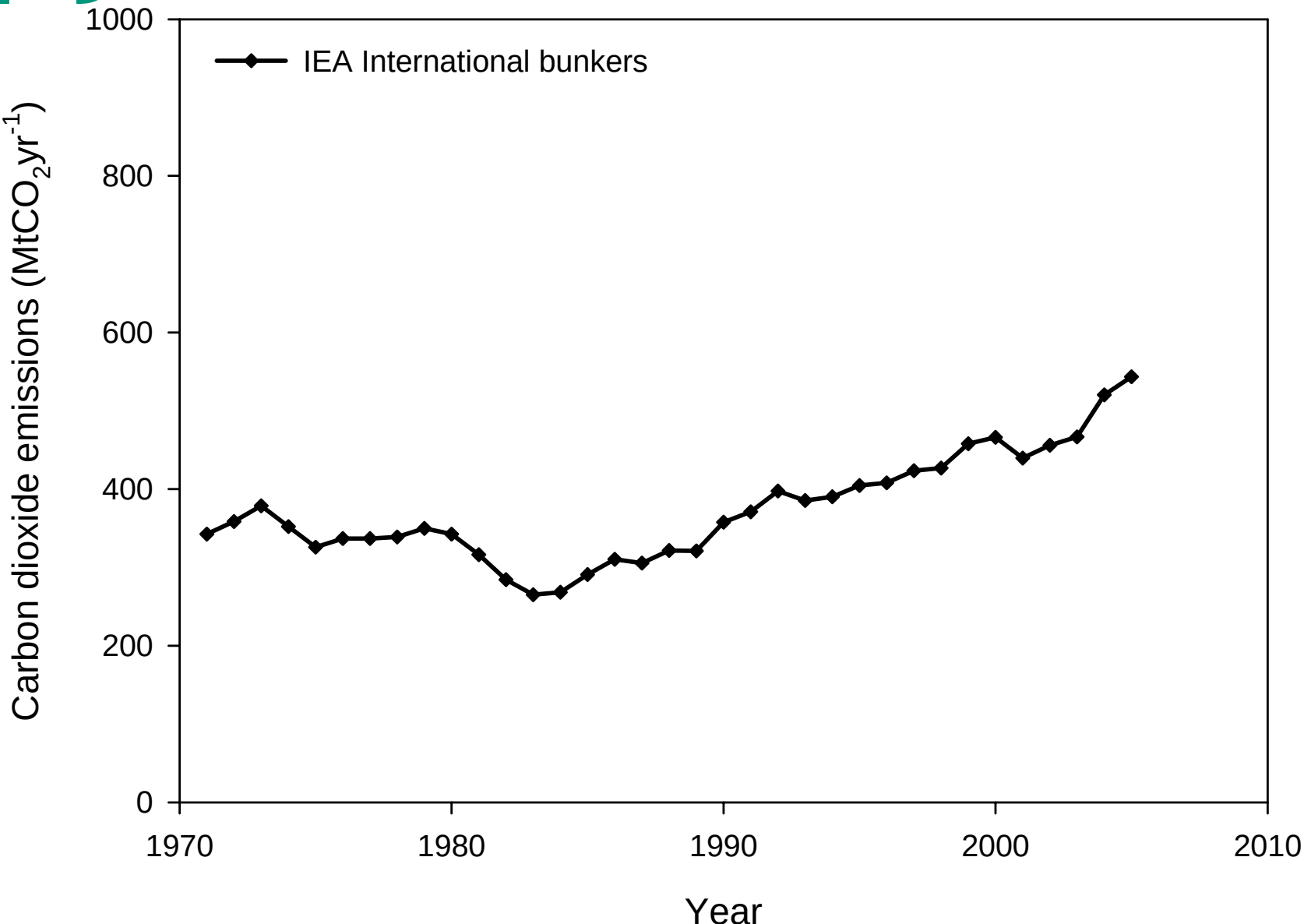
Shipping

Challenges for the shipping industry

Despite being the most fuel-efficient mode of transport in relation to tonne-km moved, CO_2 emissions may already be a larger proportion of global CO_2 than aviation

- Use ‘dirtiest’ fuels – heavy fuel oil
- Truly global infrastructure
- Overloaded ship building industry
- Very high growth – closely aligned with global GDP growth
- Difficult to incentivise fuel efficiency
- Emissions regulations only recently started to consider to CO_2

Global CO_2 emissions from international shipping



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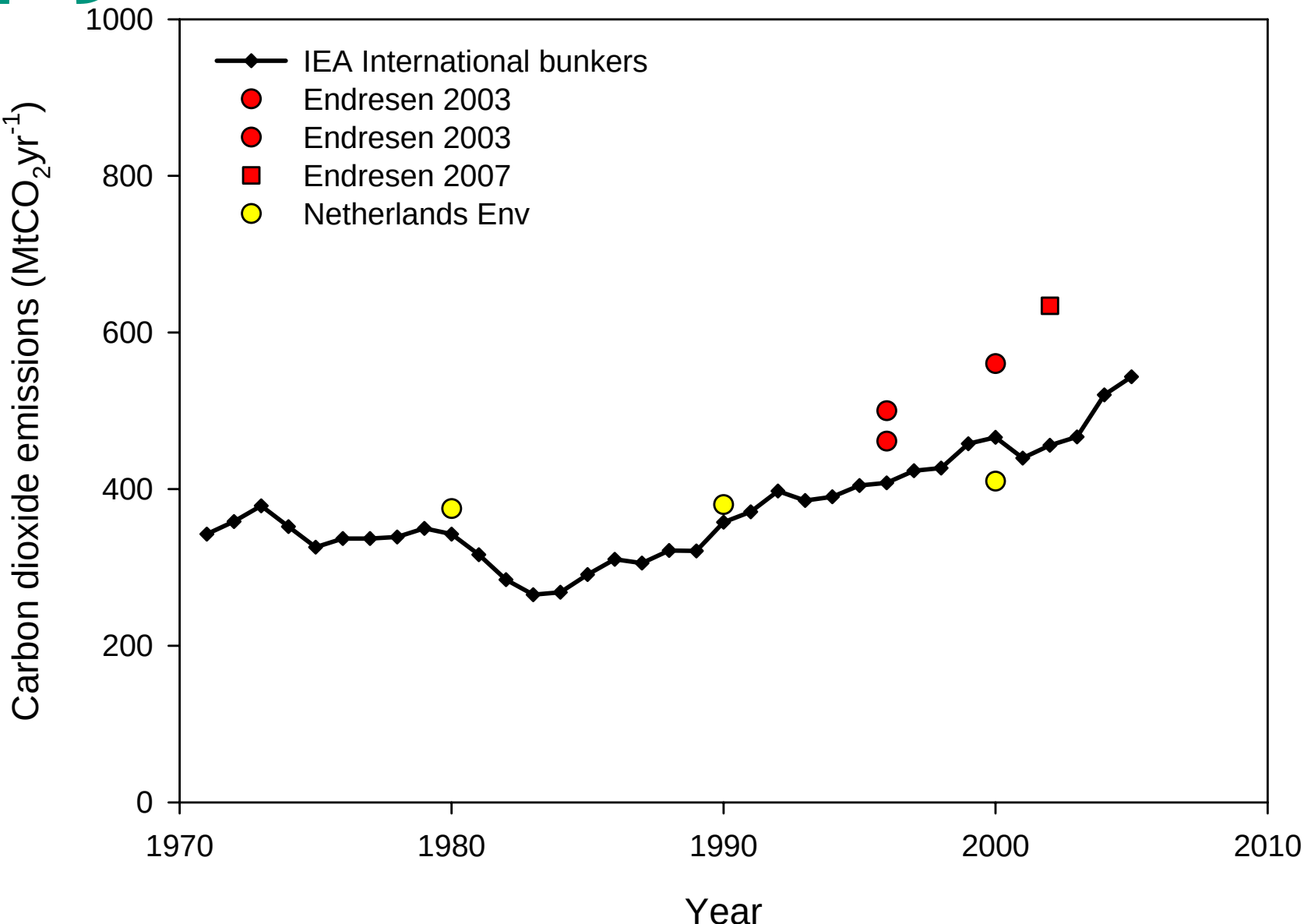

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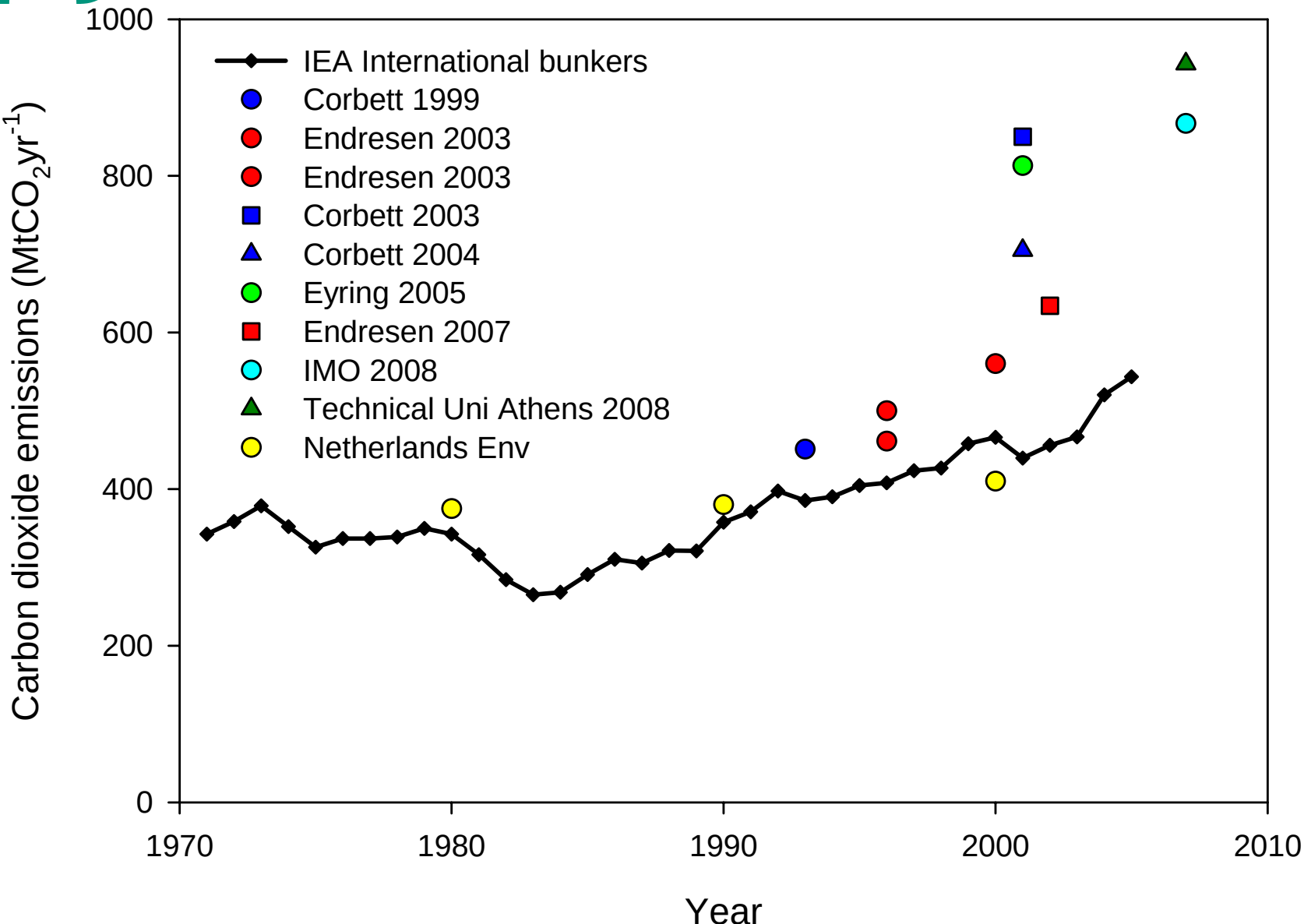

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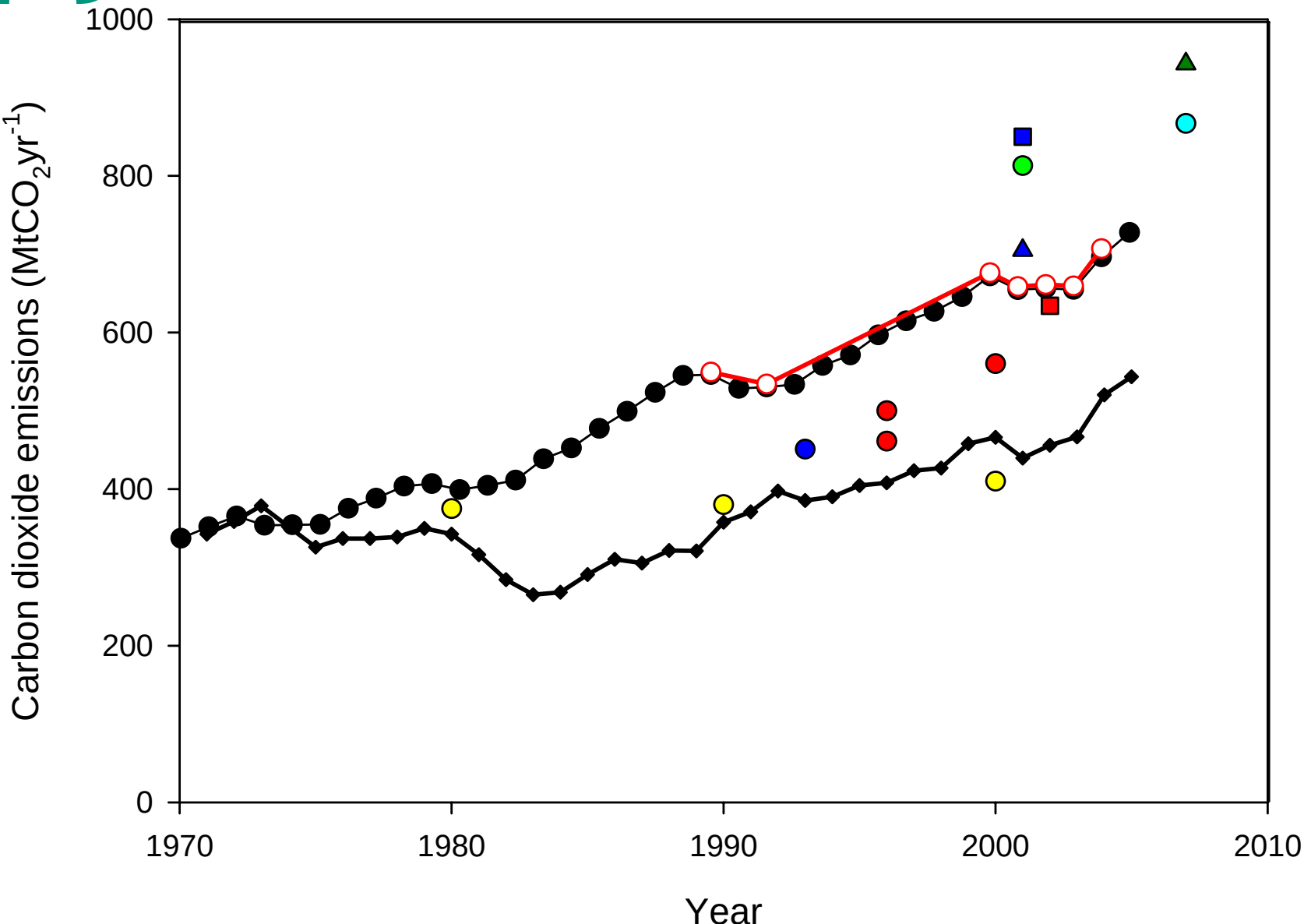
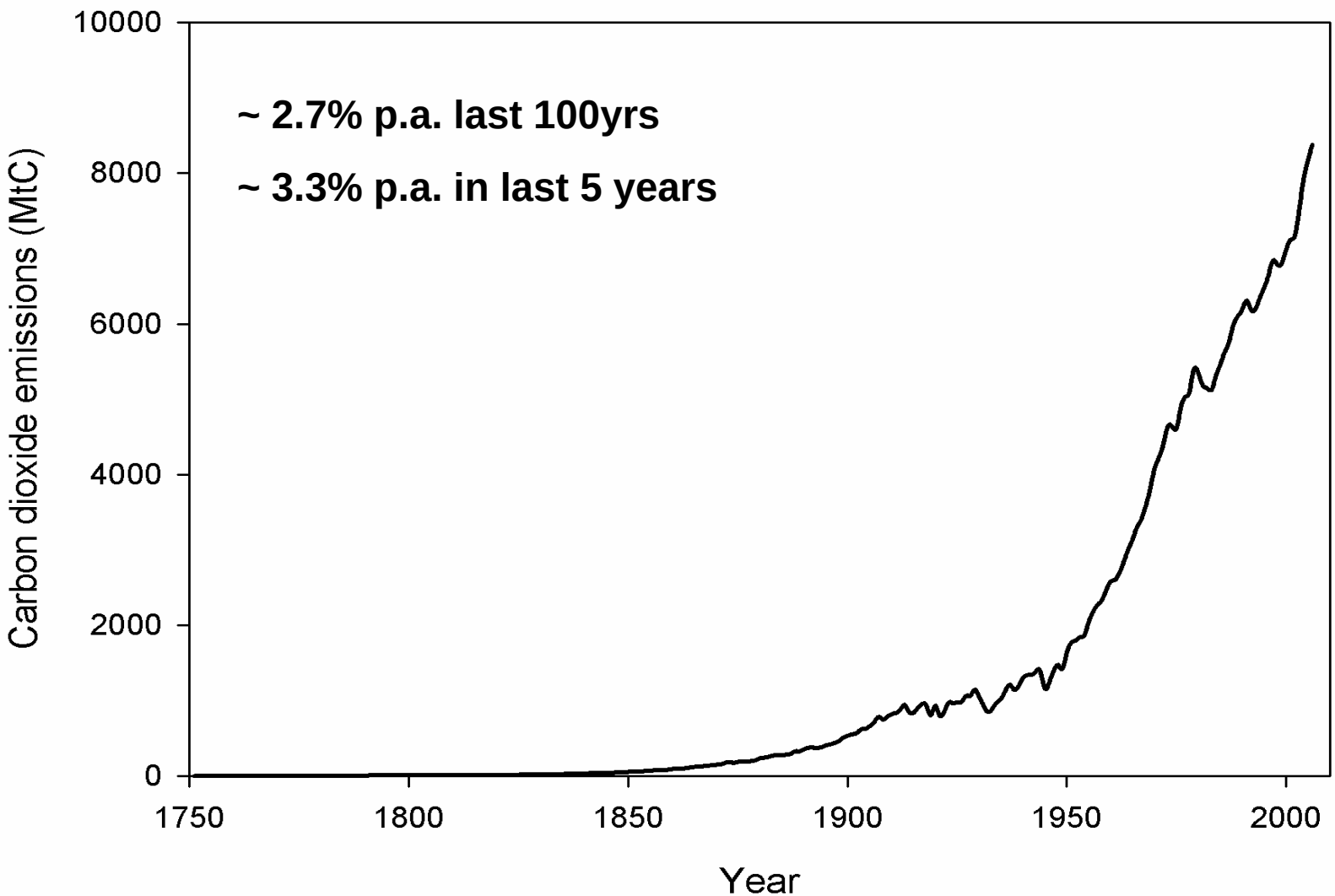
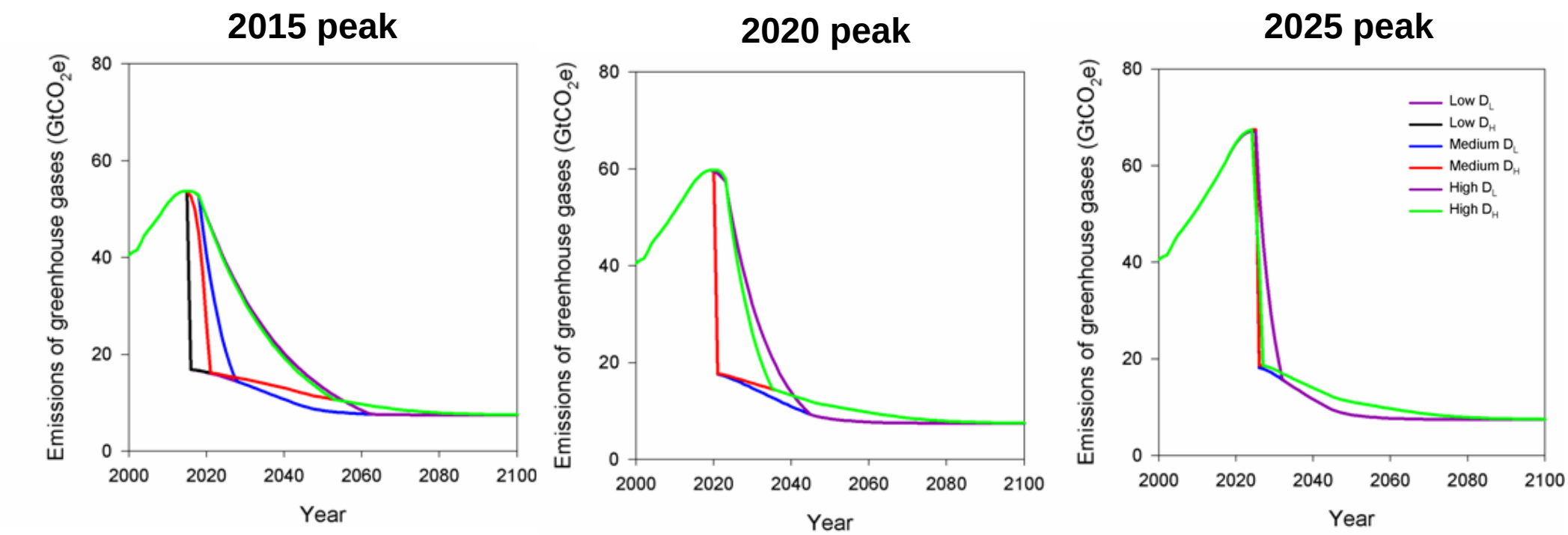


Climate Change

The latest global CO_2 emission trends

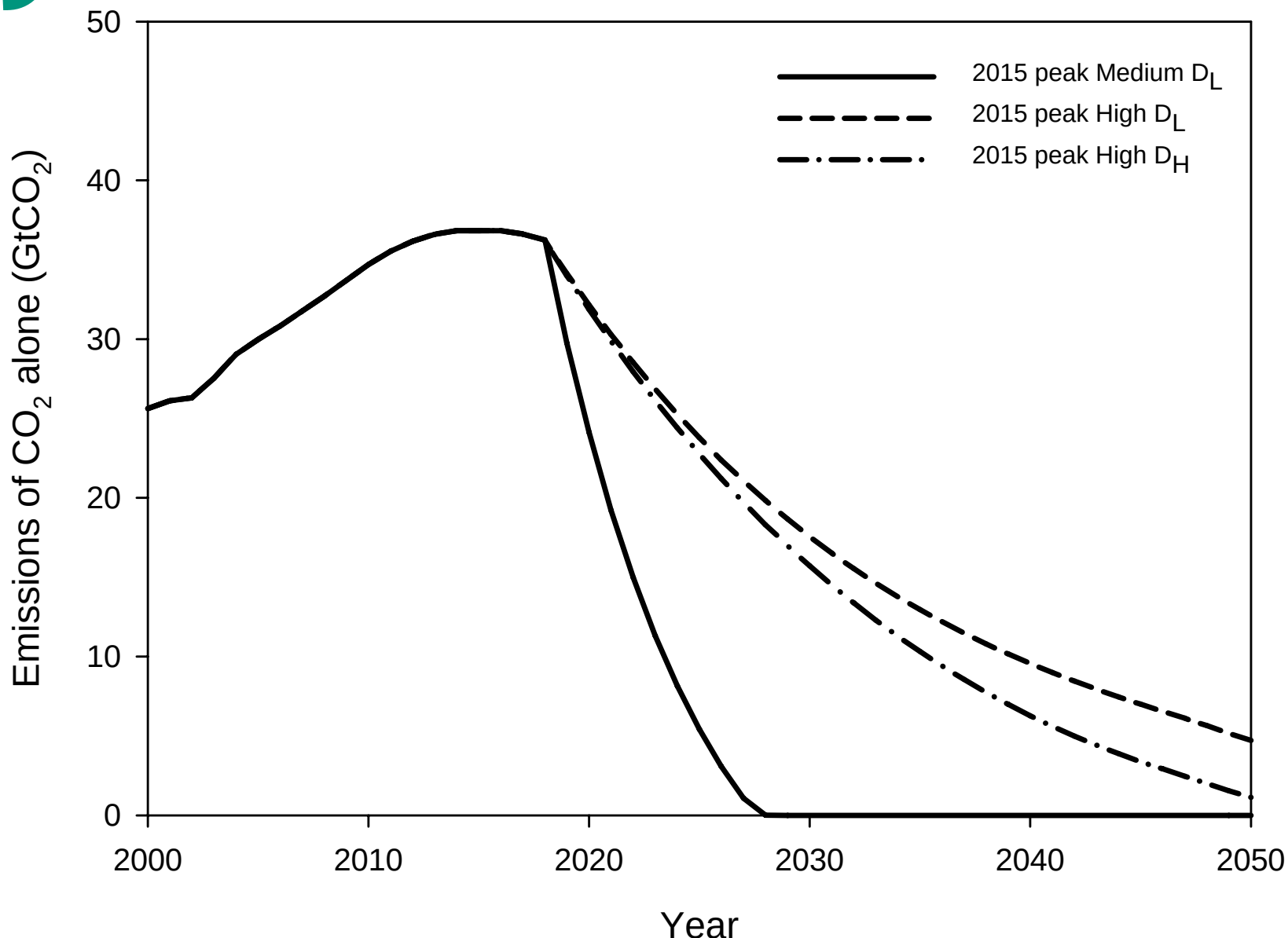


Greenhouse gas pathways for 2ºC



(Anderson & Bows, 2008, *Philosophical Transactions of the Royal Society A*, **366**, pp.3863-3882)

CO_2 from energy & processes for 2ºC



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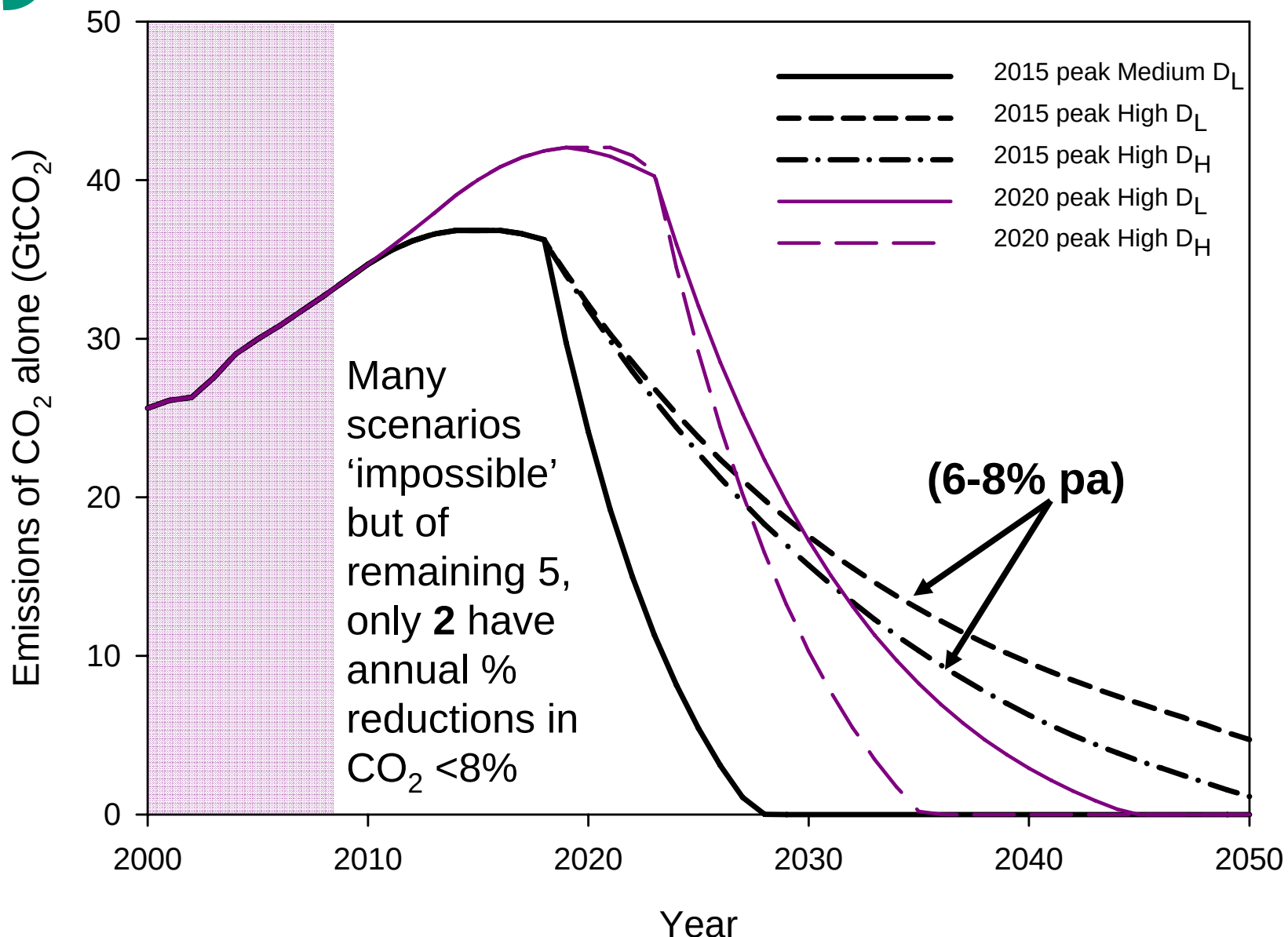
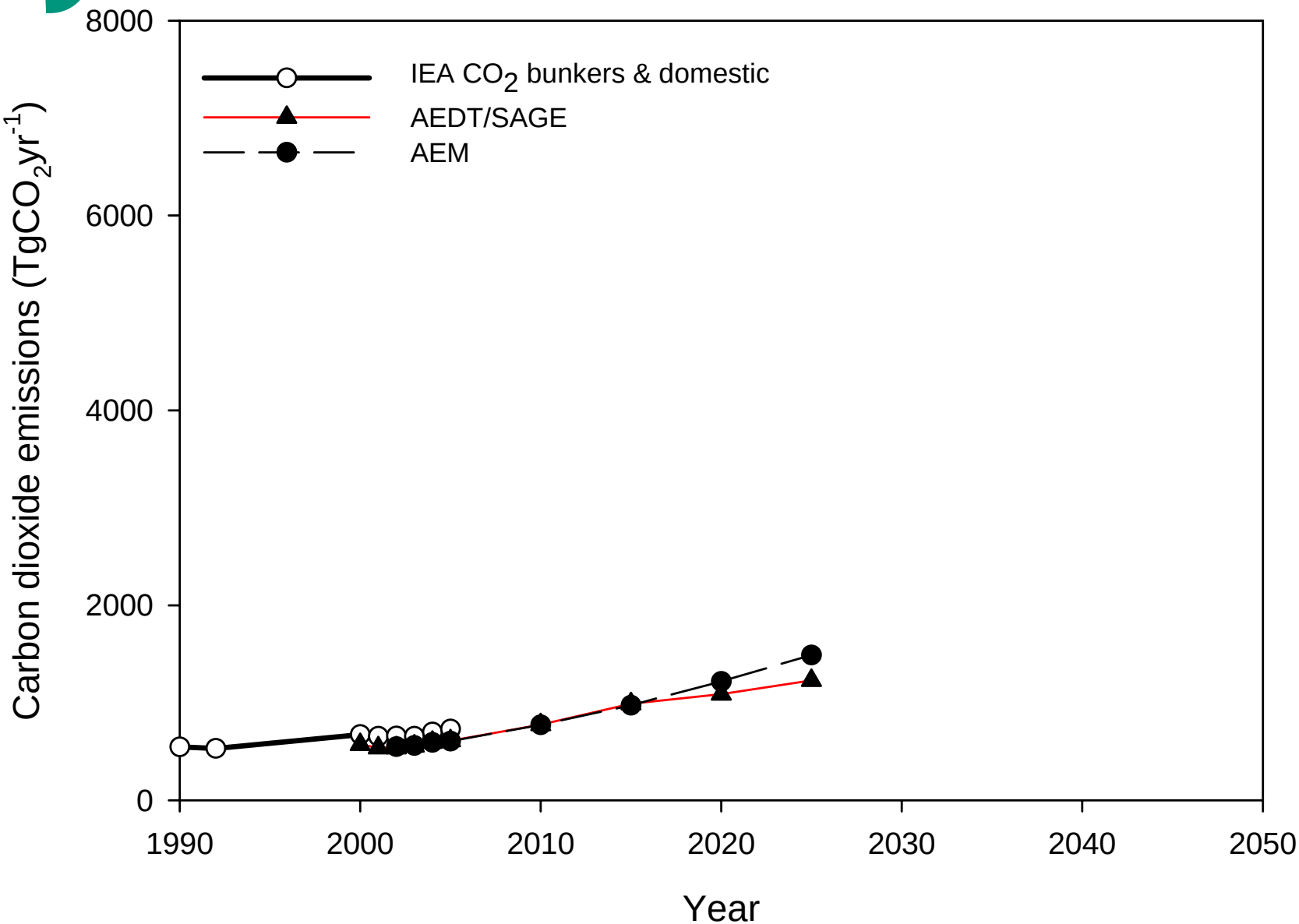


Aviation

Aviation CO_2 emission scenarios



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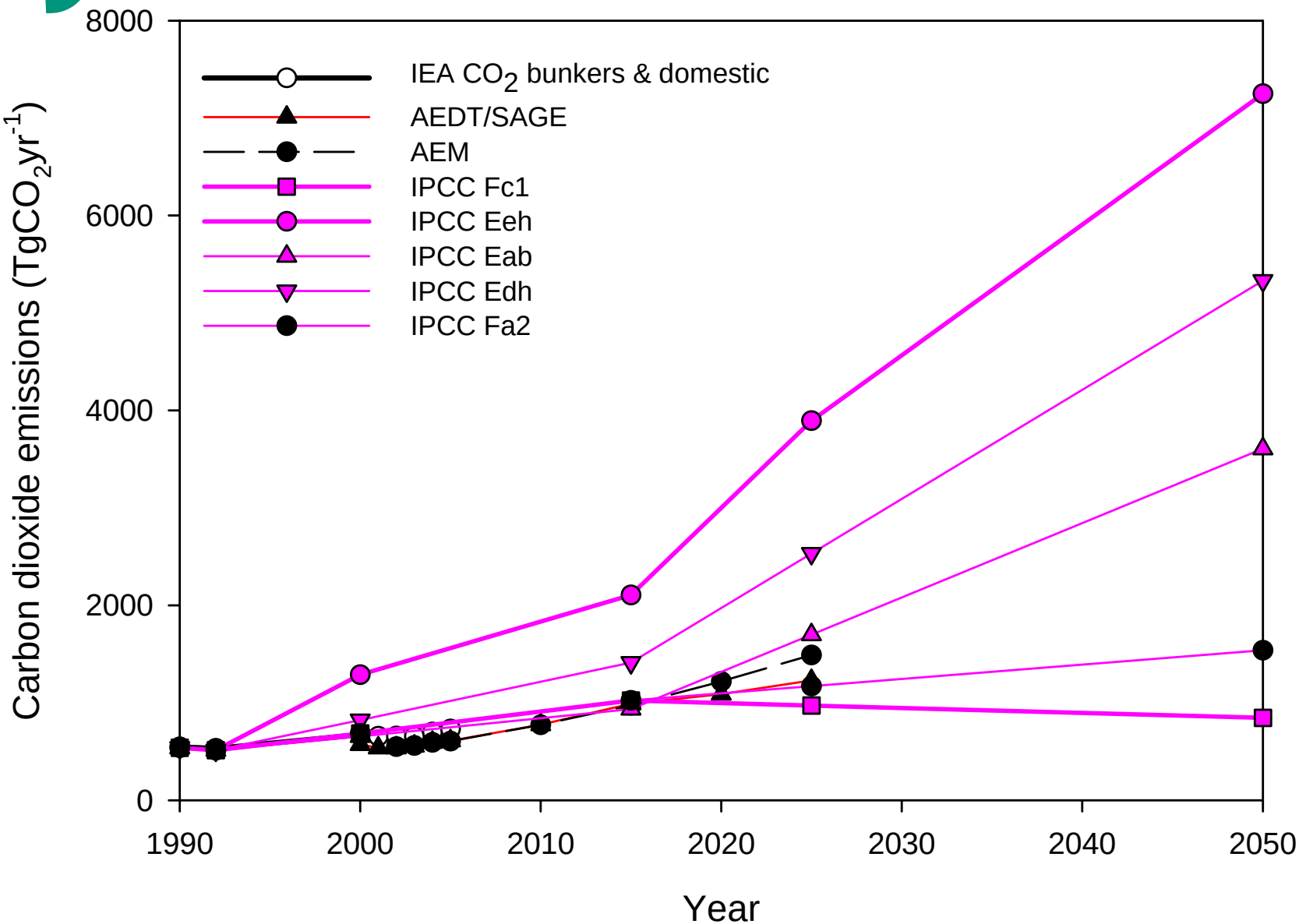

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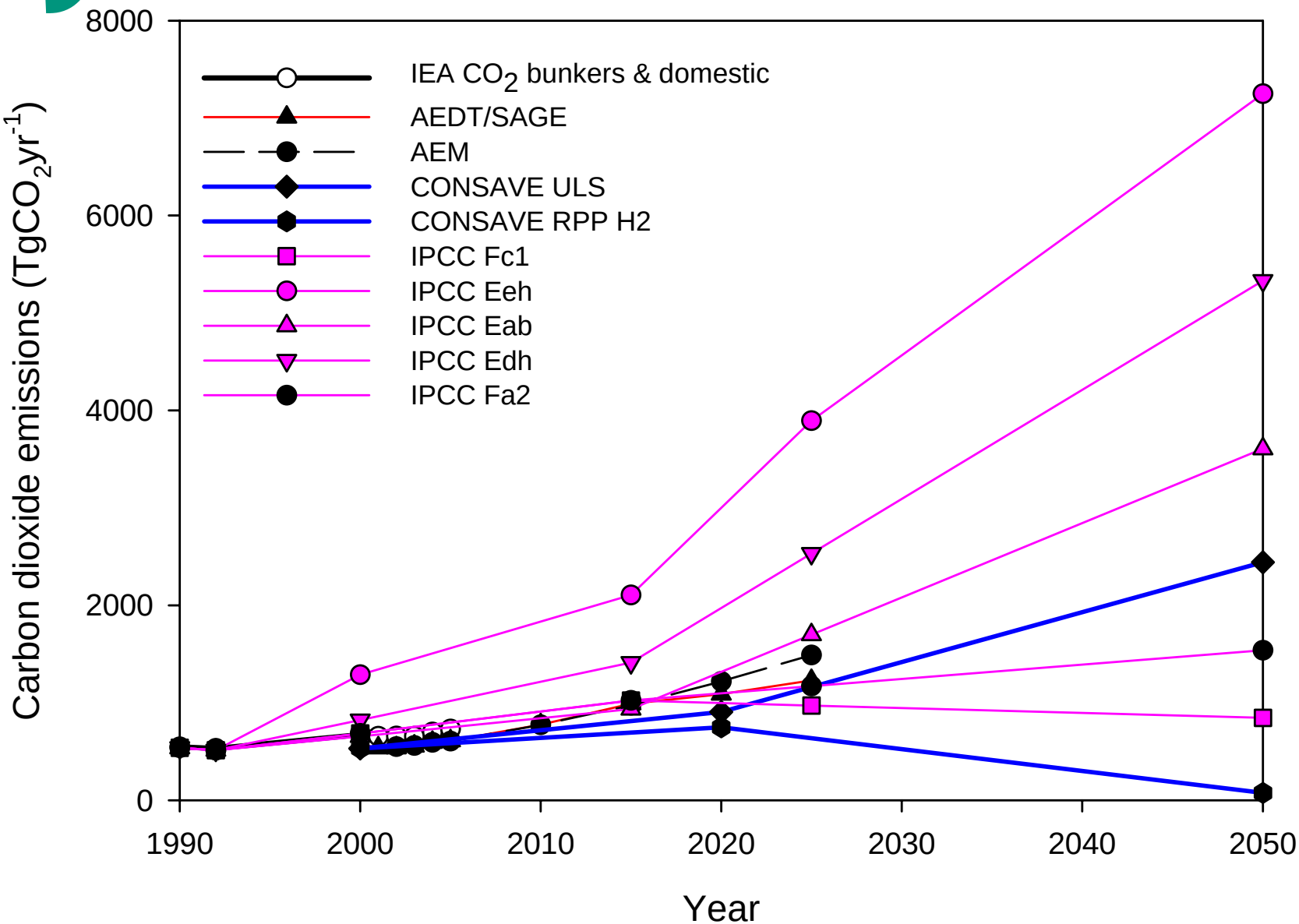

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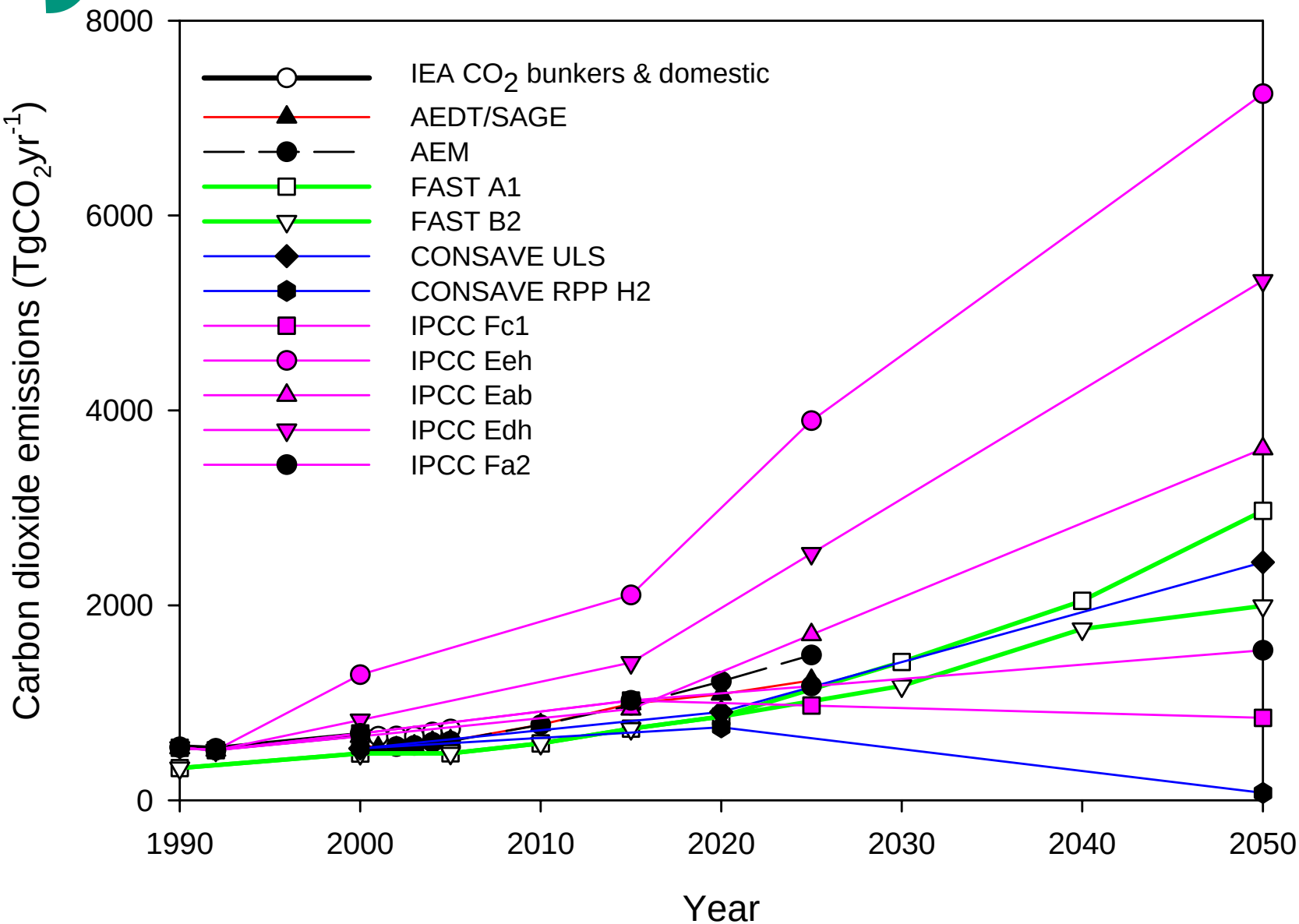
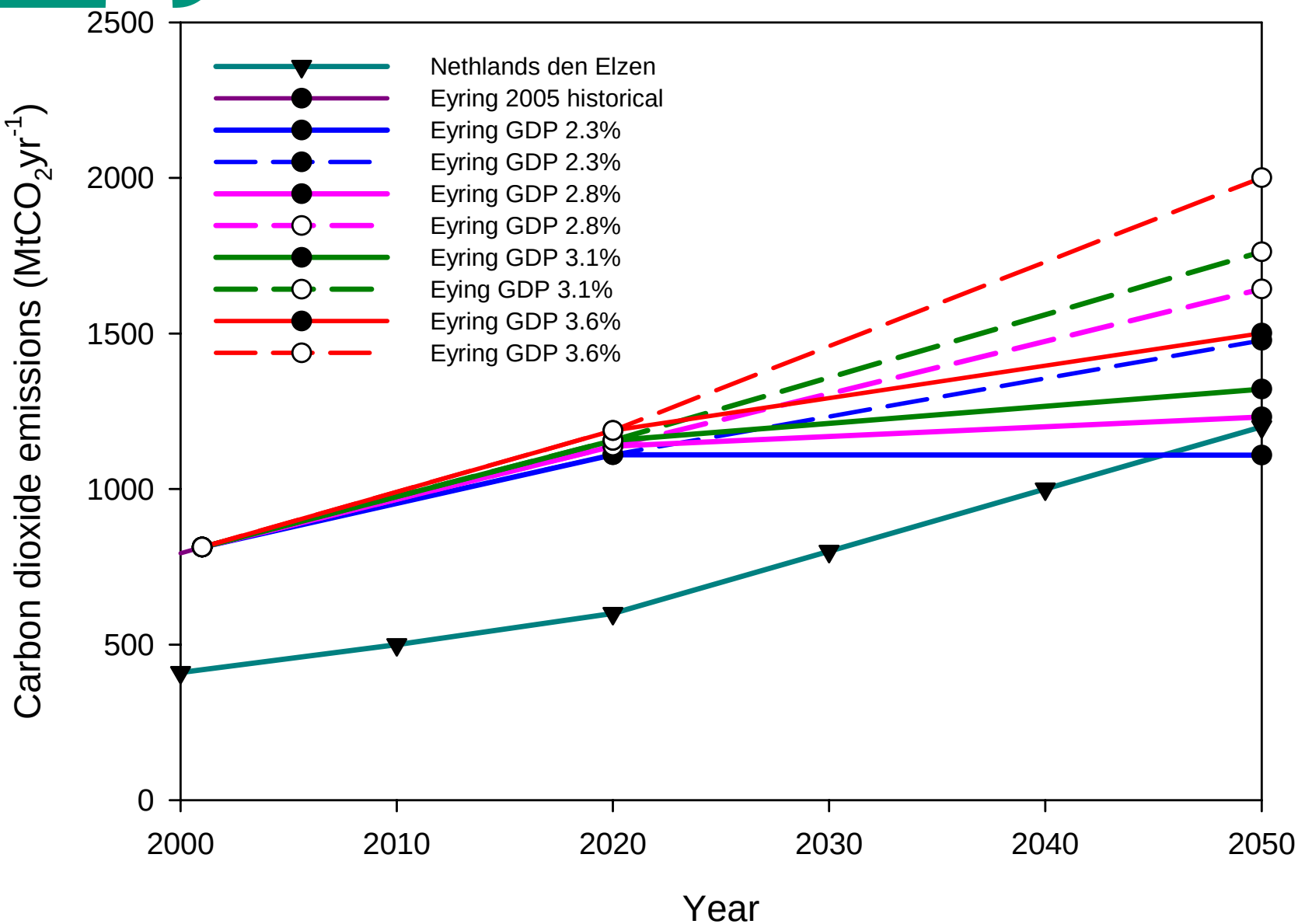
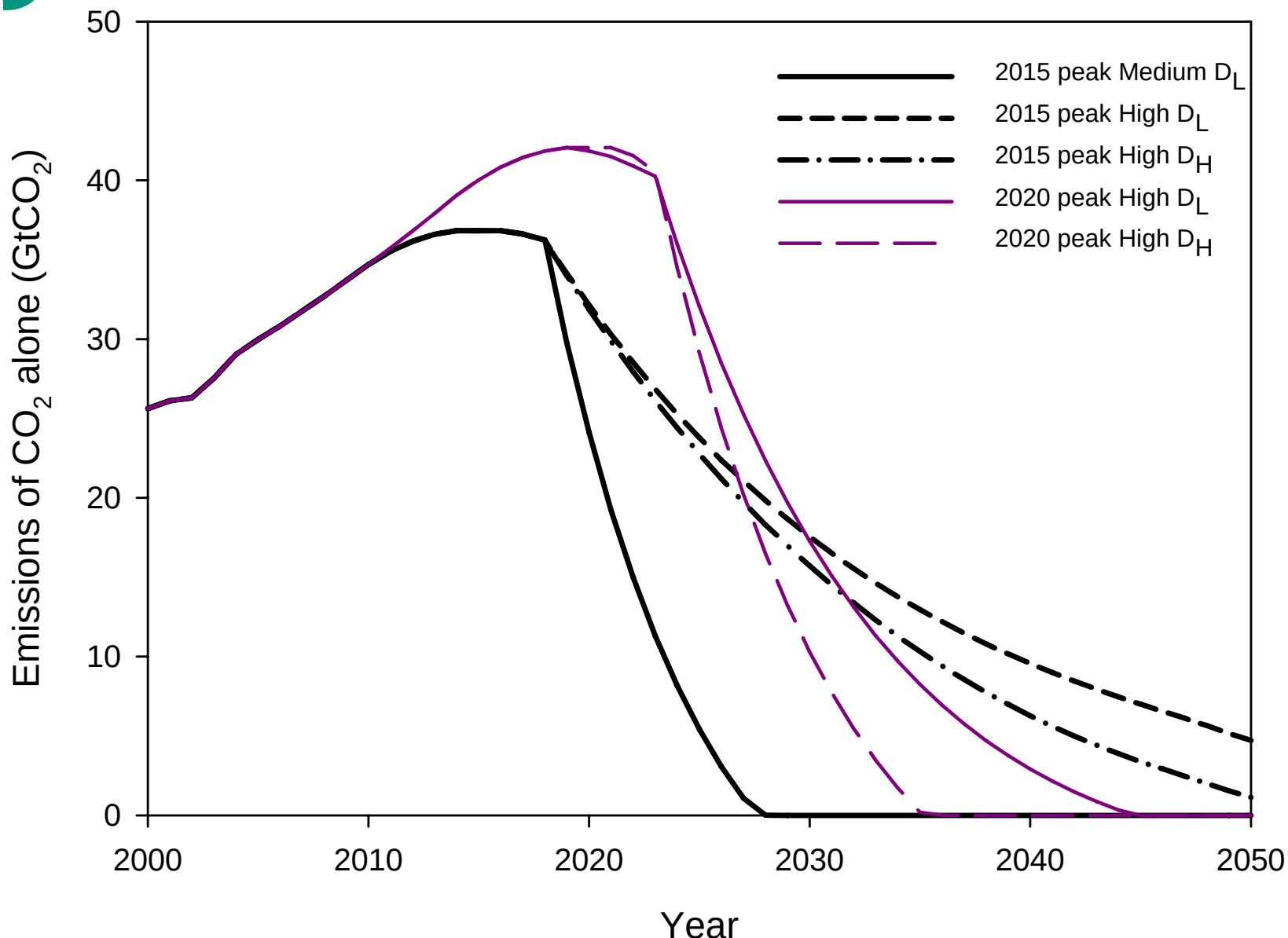


Shipping

Shipping CO_2 emission scenarios



Aviation & Shipping cf global energy pathways



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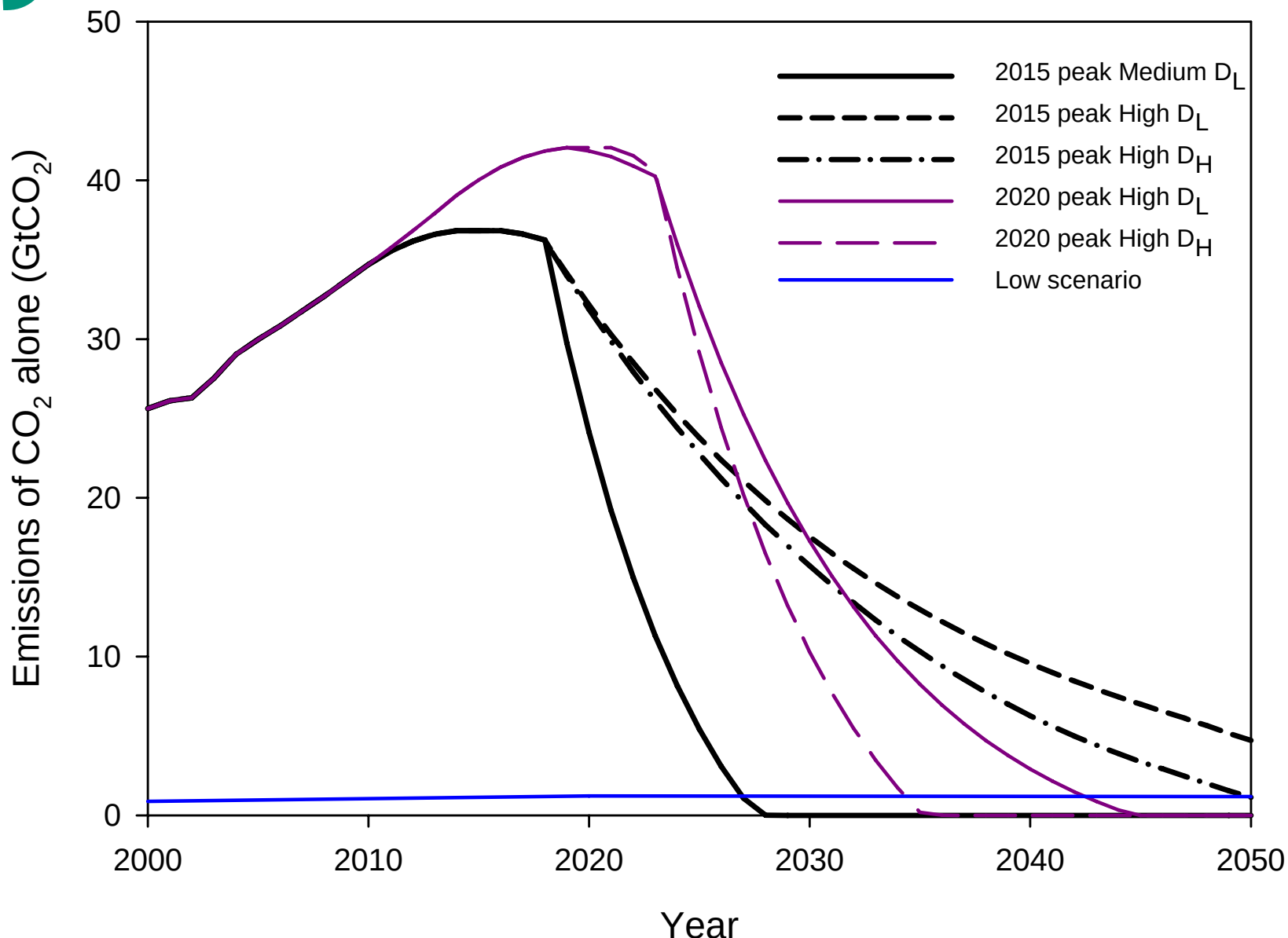

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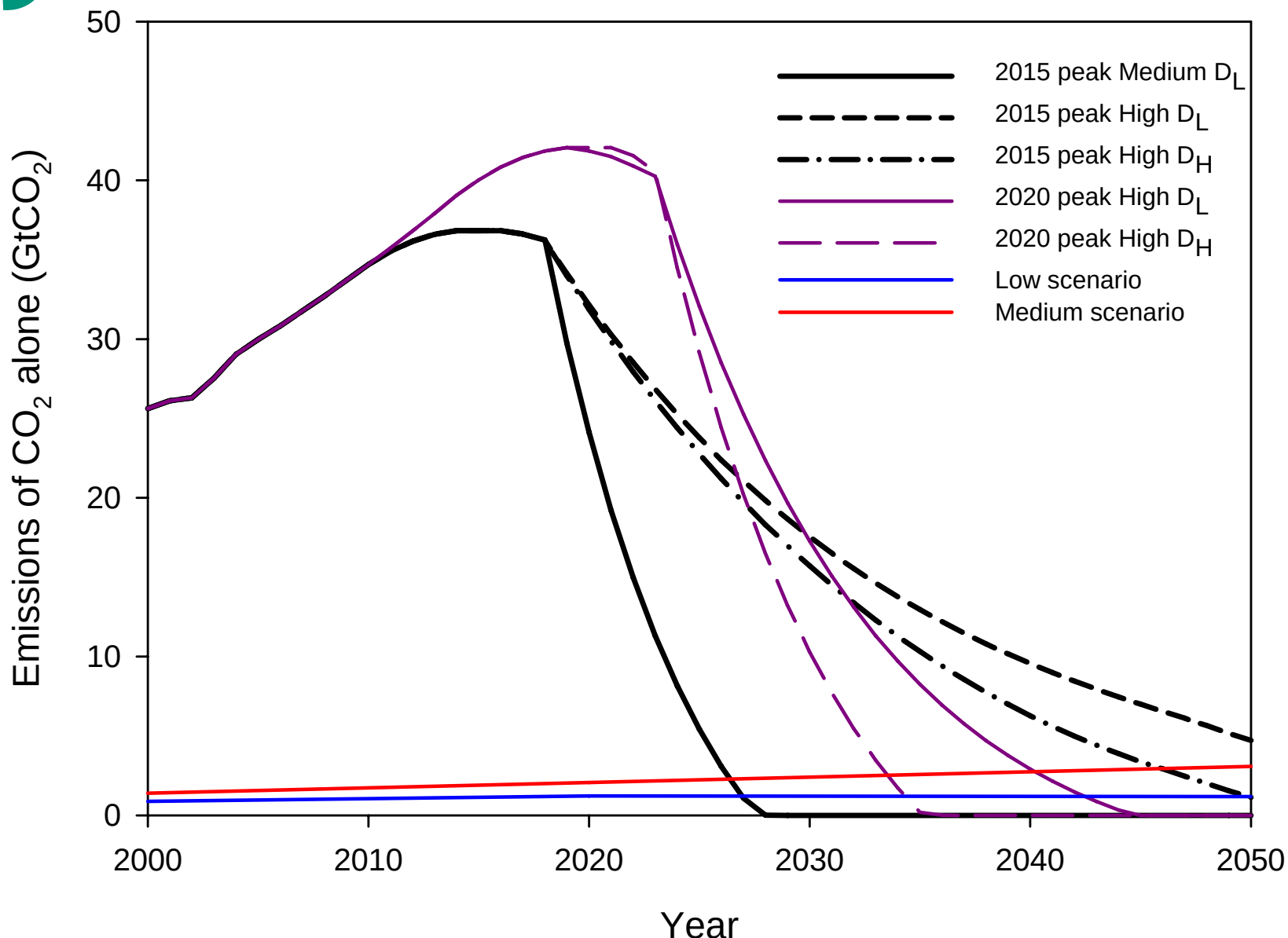

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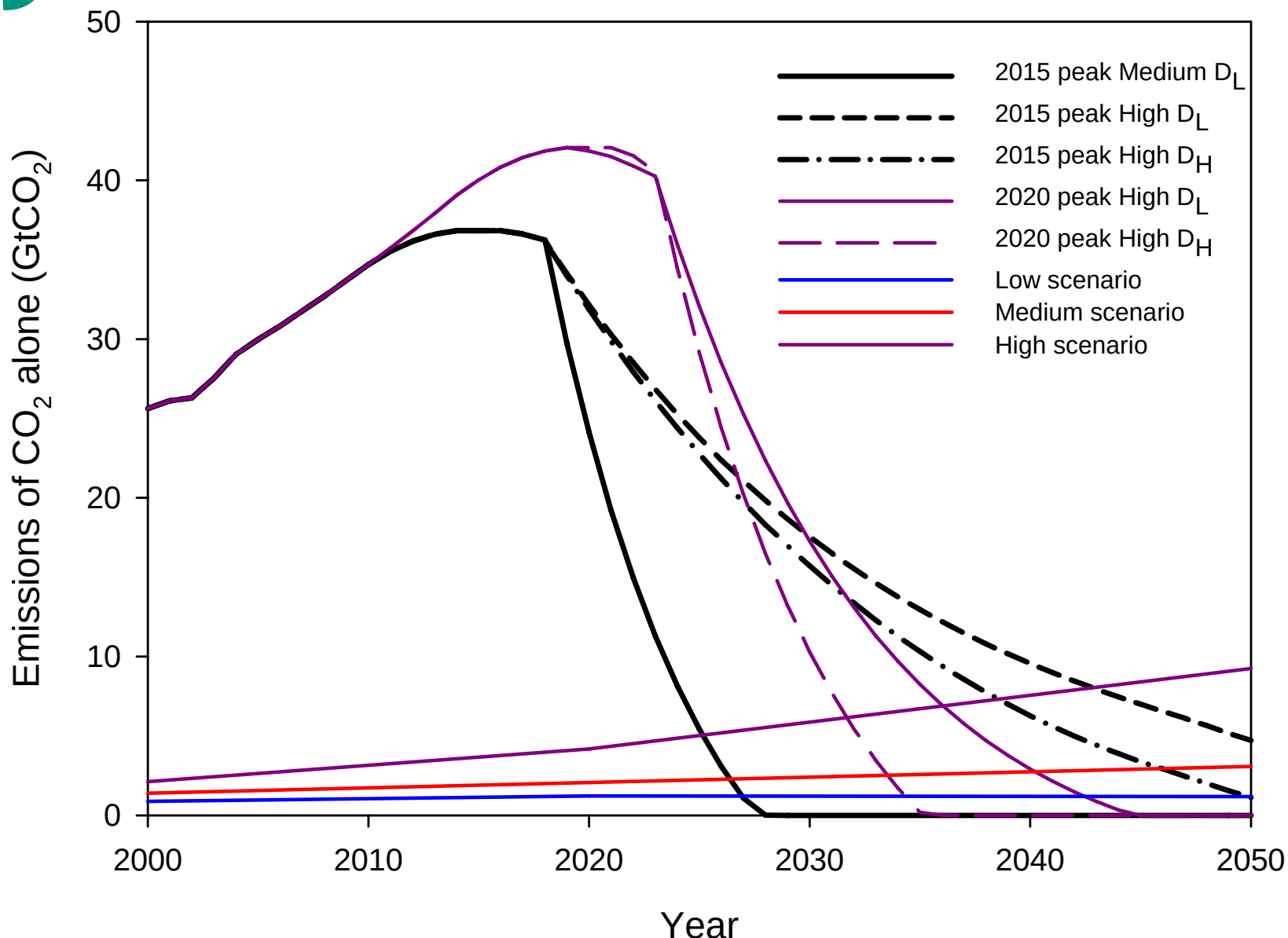

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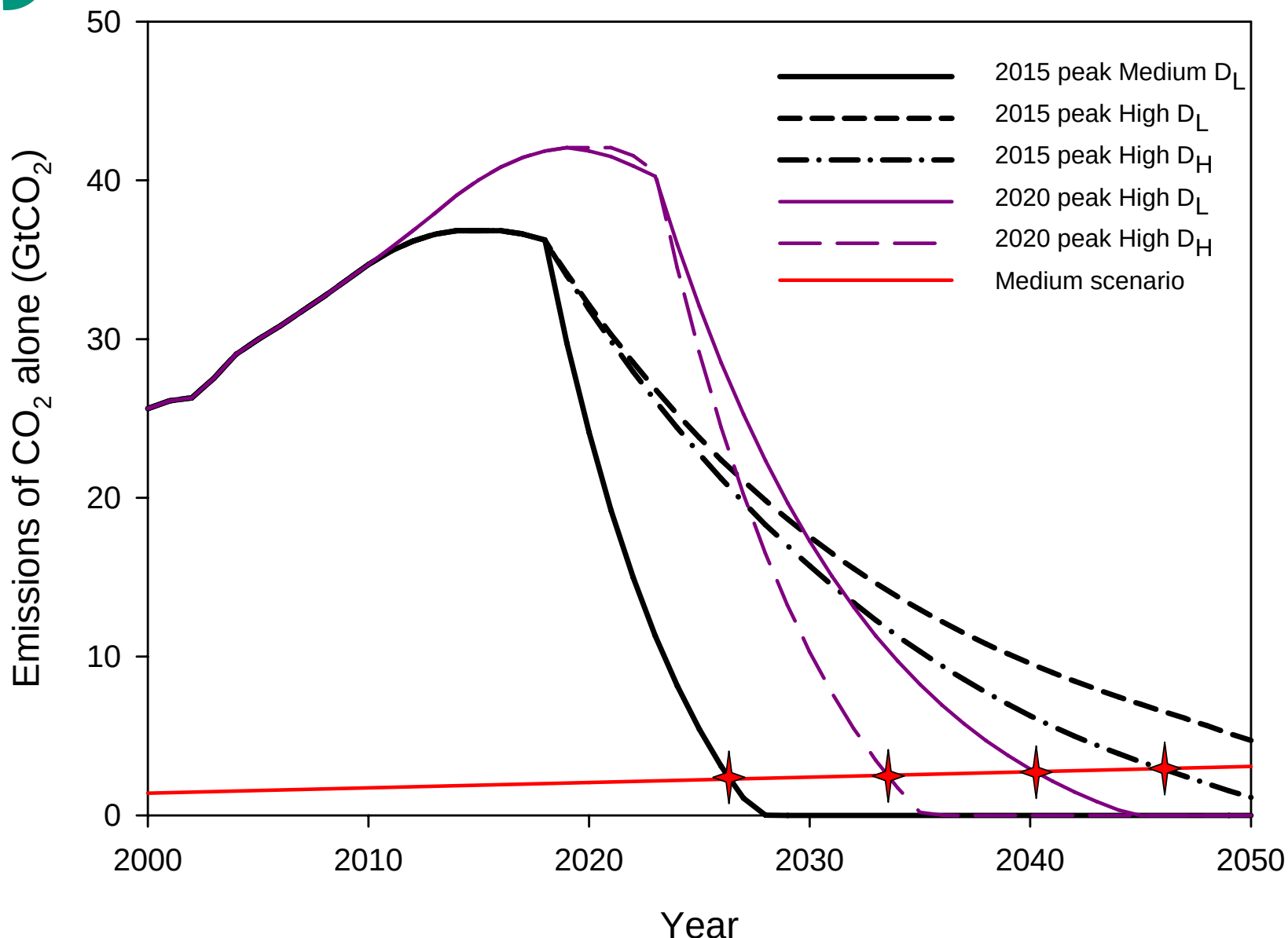

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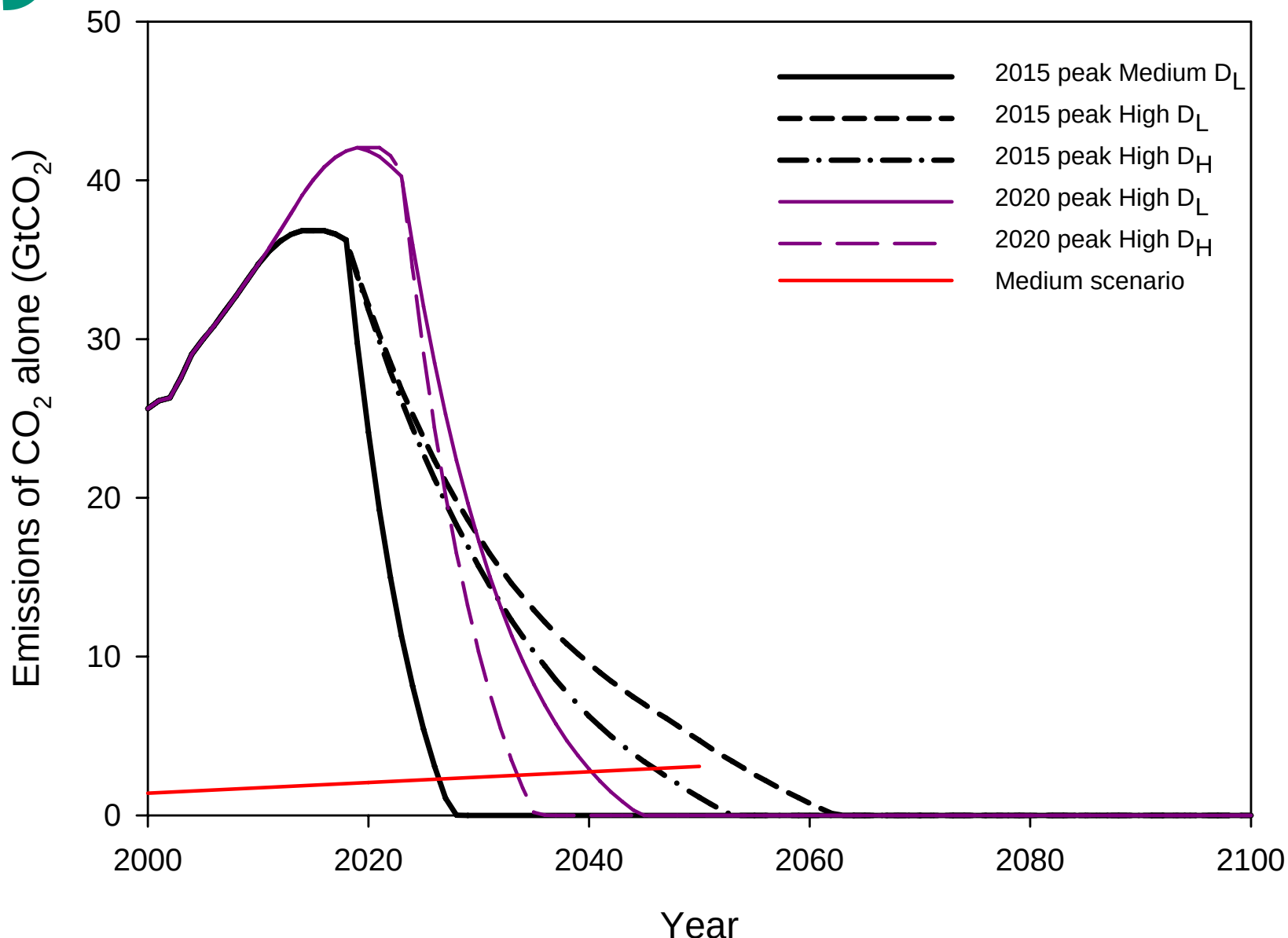

Headline messages

- All scenarios either exceed or consume significant portions of CO_2 budget for energy by 2050
- Lowest scenario is the only one compatible with a 450ppmv CO_2 pathway – but global peak must be 2015 & IPCC upper range
- Continued emission growth to post-2060 for any economic sector is not compatible with 2ºC future – even with emissions trading

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Conclusions

- CO_2 emission pathways commensurate with a 2ºC temperature threshold are at best extremely challenging, at worst impossible

- Adaptation to 3-4ºC will be necessary unless stringent & meaningful policies aimed *all* sectors deliver a global emission peak by 2015

- Large range of possibility for emissions associated with international transport but *all* consume considerable portions of budget

- No longer have the luxury of assuming technology will mitigate CO_2 – energy demand management must form part of the policy portfolio

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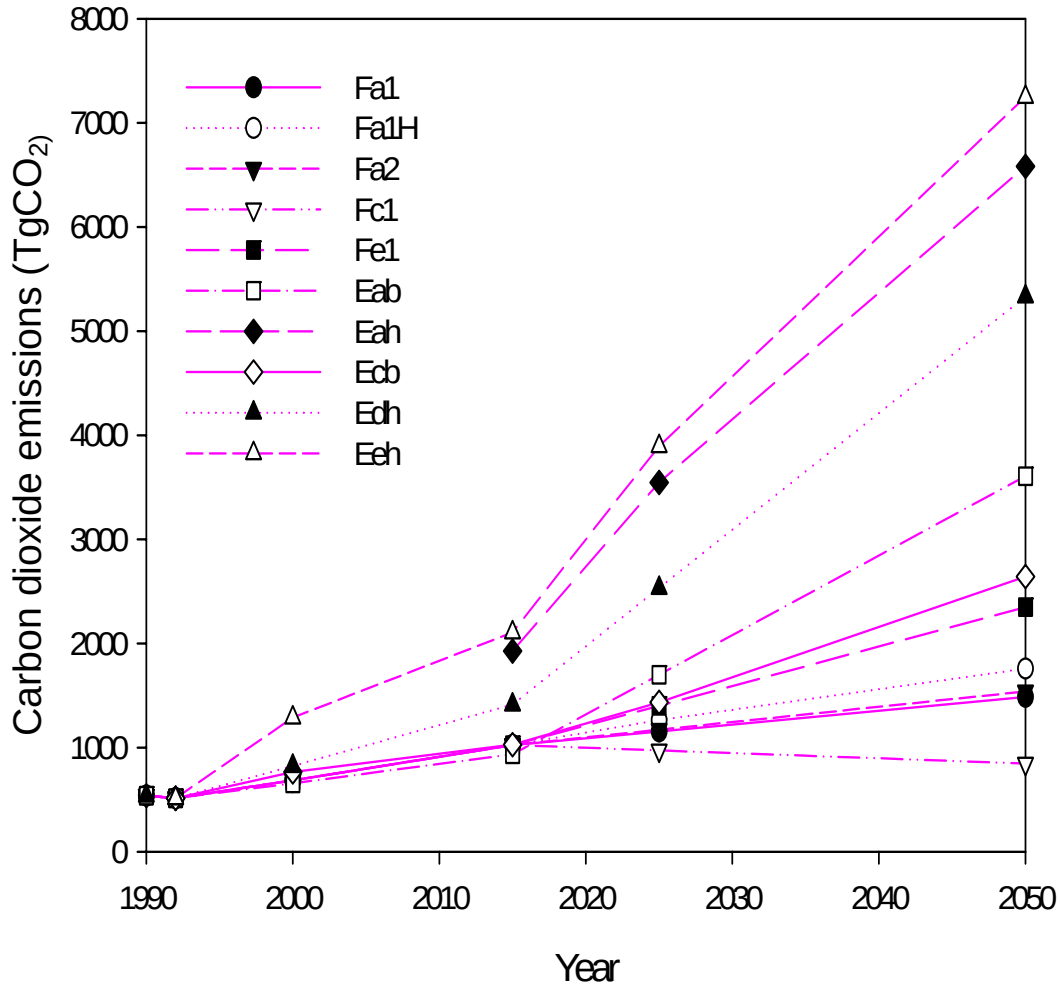
Thank you

Aviation CO_2 emission scenarios

IPCC Aviation Scenarios for CO_2



Aviation emission scenarios