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Integration of Non-CO₂ Gas Mitigation in Climate Policy

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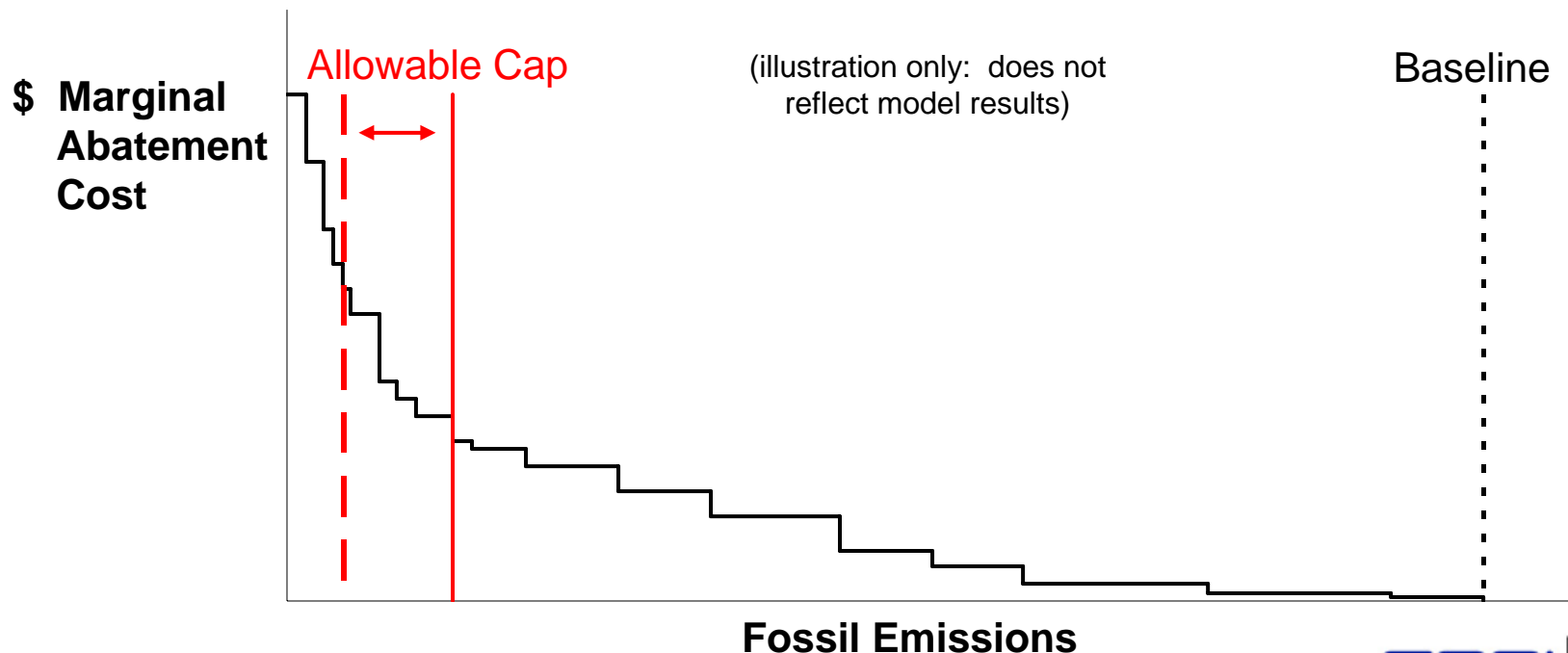
Washington, DC

Why are non-energy/non-CO₂ sectors important?

- CO₂ from fossil fuel is ~80% of total GHGs in US
- But there are good abatement opportunities elsewhere:
 - Energy-related CH₄
 - Agricultural sources of CH₄ and N₂O
 - Landfill / Industrial sources of CH₄ and N₂O
 - ODS substitutes, in particular refrigerants
 - Other high-GWP gases, e.g. SF₆ from electric T&D
 - Avoided deforestation, afforestation, forest management
- How will these sectors be treated by policy?

Why are non-energy/non-CO₂ sectors important?

- Treatment of non-fossil abatement governs the amount of allowable emissions from the energy sector
- Particularly for stringent targets, small changes have a large effect on marginal cost



Policy Alternatives for Non-Fossil Abatement

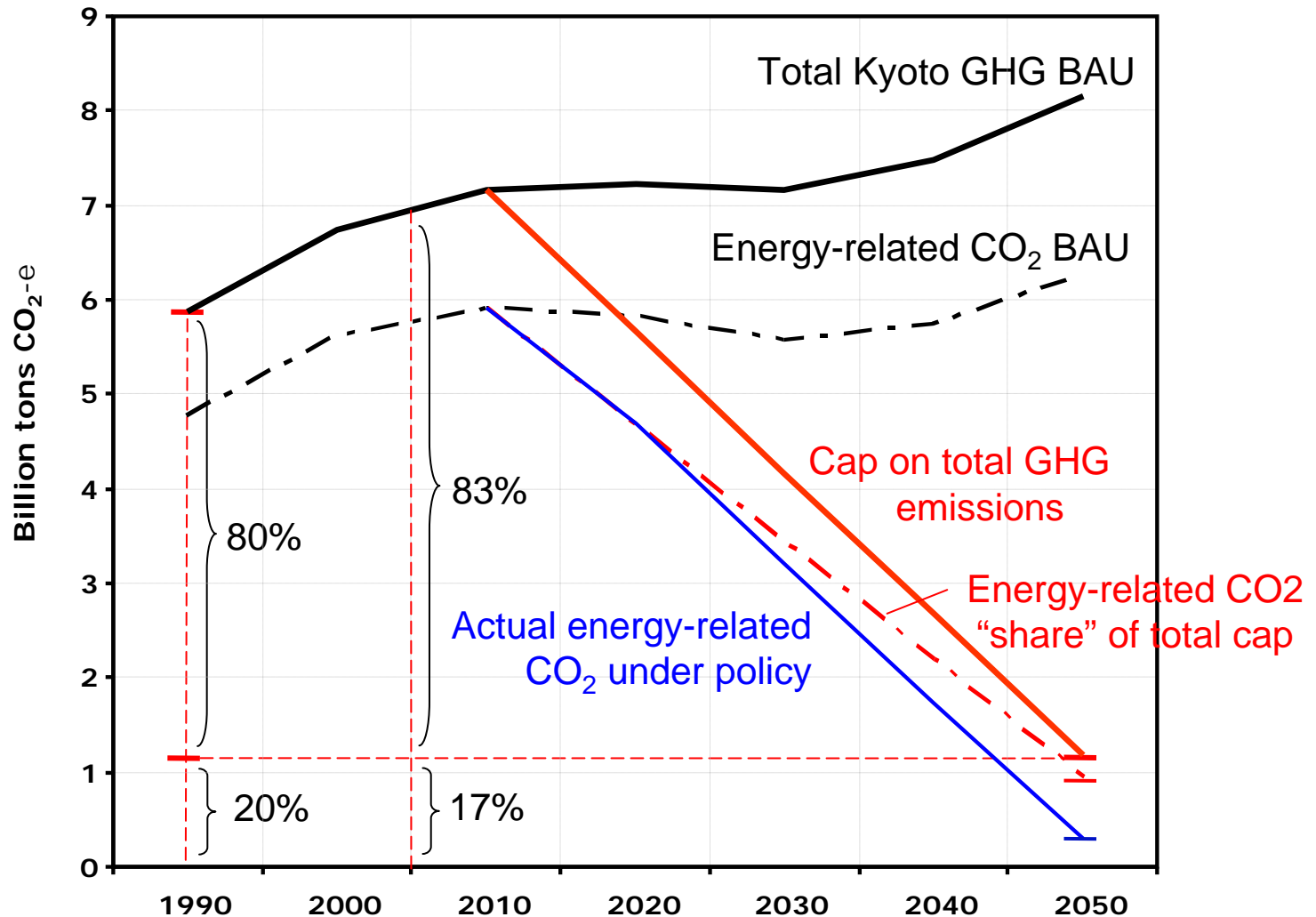
- Capped emissions
 - Permits can be traded with energy sector (e.g. SF₆, cement)
 - Closed permit trade (e.g. separate HFC cap)
- Required by command-and-control (e.g. NSPS for some CH₄)
- Funded directly through subsidies (e.g. “set-asides” for forestry)
- Project-based abatement to generate a tradeable “offset”
 - Domestic non-CO₂ Kyoto GHG abatement (e.g. Ag CH₄/N₂O)
 - Domestic forest-carbon abatement
 - International abatement in any sector
- Or, source can be left uncovered

Large Potential
High Uncertainty

What does 80% below 1990 really mean?

- Nominal target is typically expressed as a percentage reduction in total Kyoto GHG inventory in a base year
- If this is **literally** to be achieved:
 - Energy sector must reduce beyond 80% to make up for limited potential in some non-energy sectors
 - Expected offsets from Kyoto gases must be *implicitly removed* from the capped sectors' allowance!
- Leads to drastic outcome

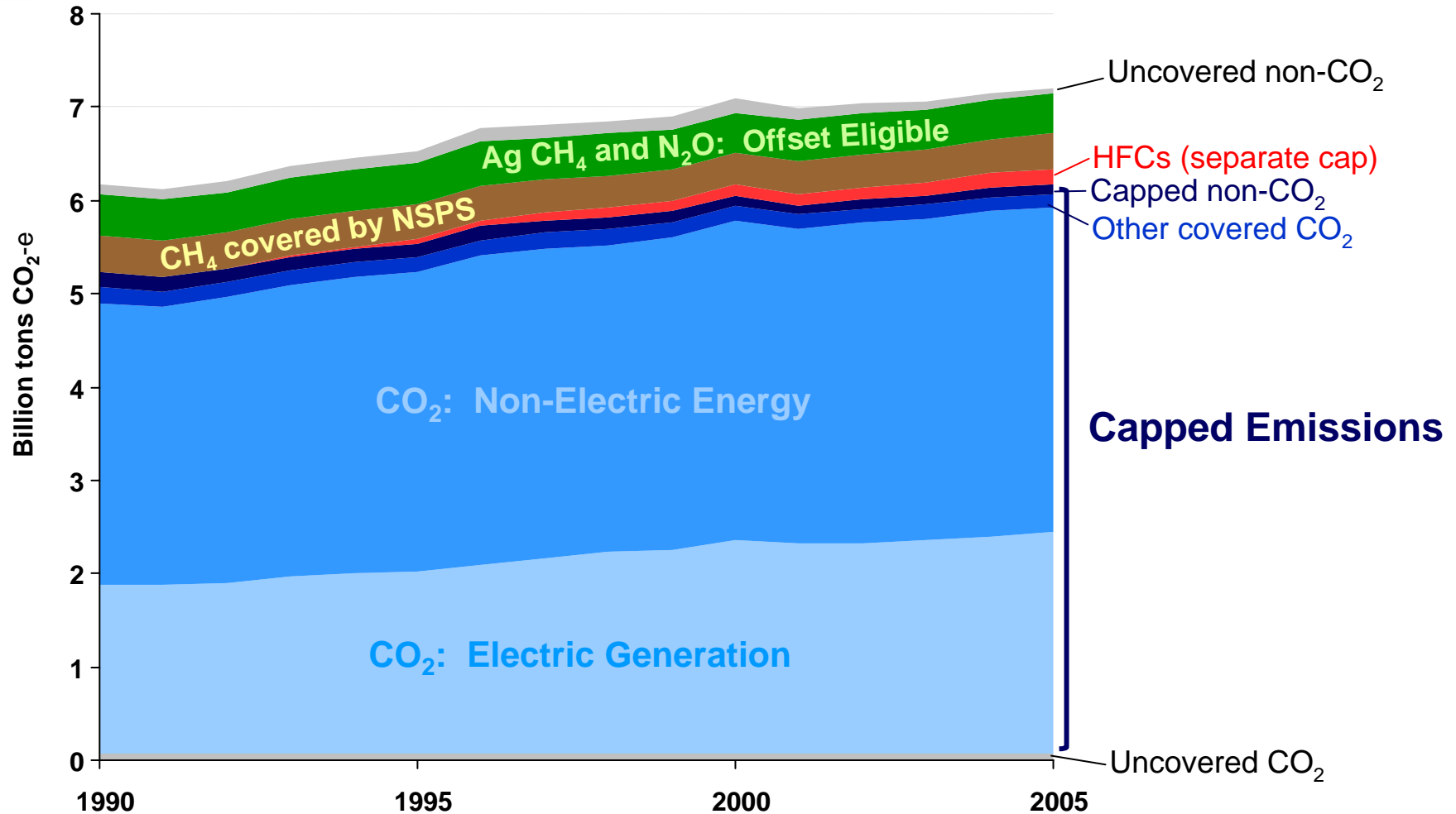
Literal 80% below 1990 by 2050 using MERGE



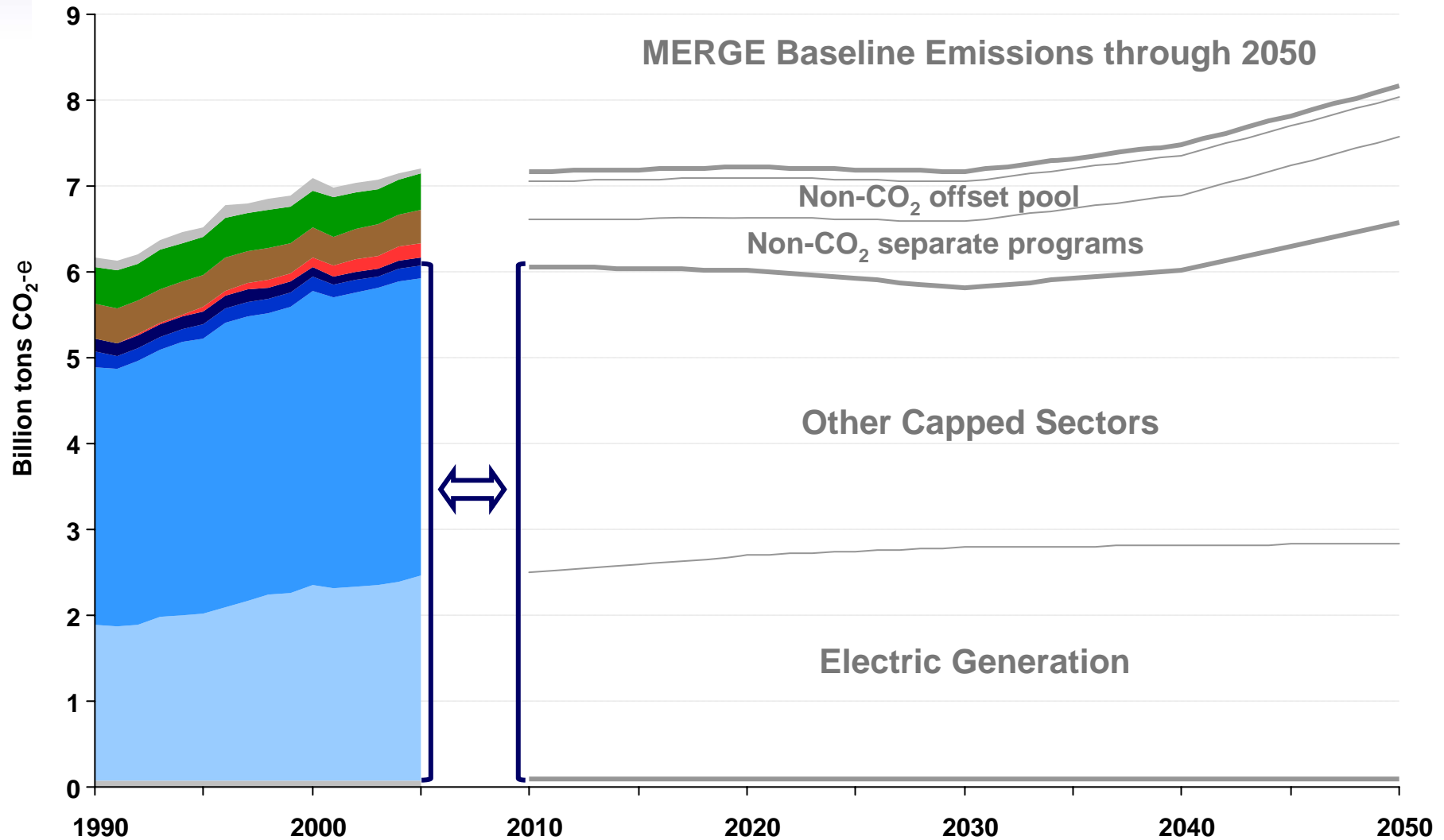
How is 80% below 1990 interpreted in real life?

- Key differences:
 - Target only applies to capped sectors
 - 85% of 2005 sources are capped in H.R. 2454
 - Remaining sectors are handled separately
 - Offsets from eligible Kyoto GHGs can relax the cap
 - Offsets from “outside the system” are also available:
 - Domestic forestry
 - International

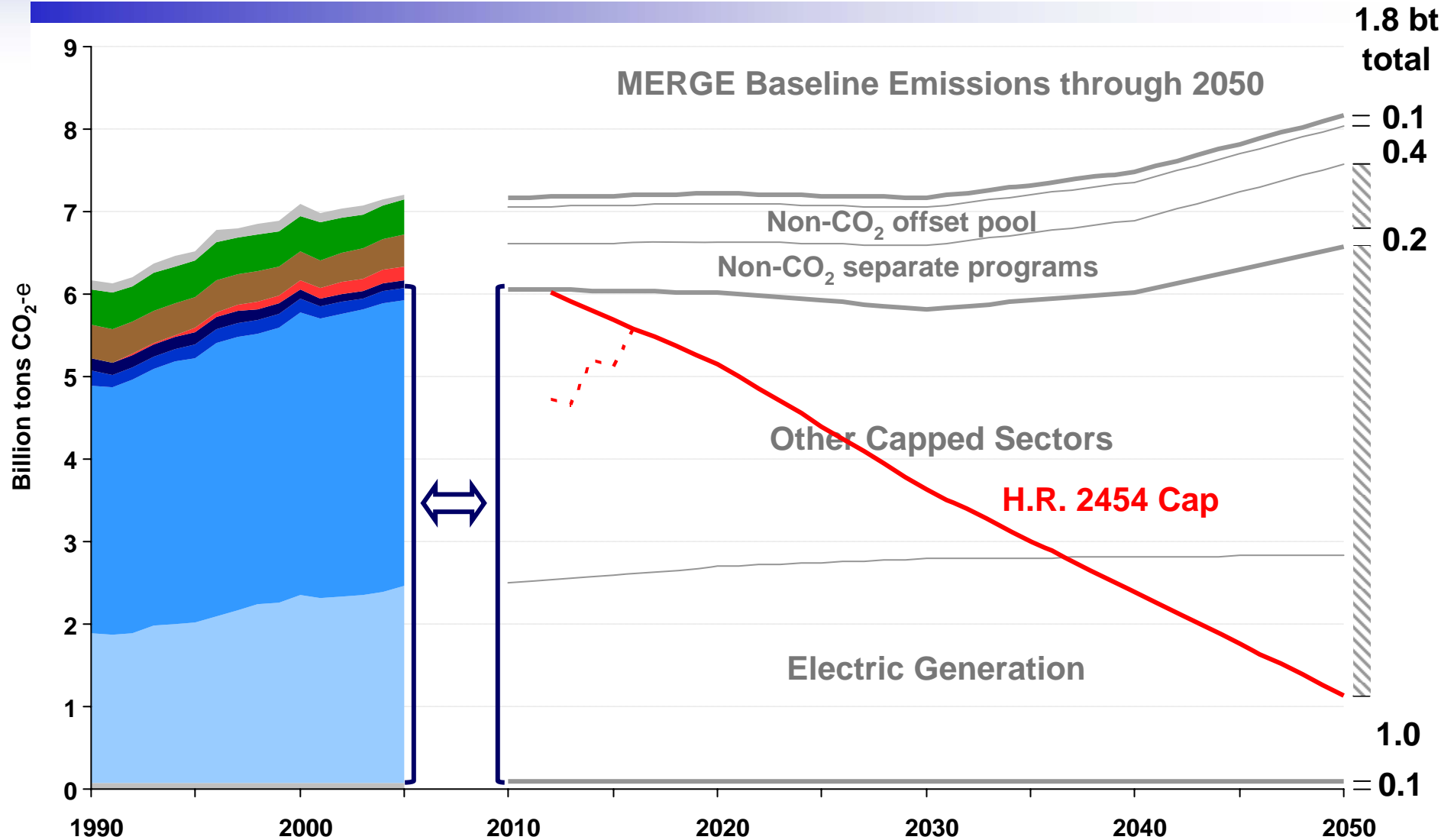
Treatment of Kyoto GHGs by H.R. 2454



Treatment of Kyoto GHGs by H.R. 2454



Capped Sectors: 80% below 1990 by 2050



What does this imply for total Kyoto GHGs?

- Assuming no “outside system” offsets, total emissions in 2050 are ~ 1.8 billion tons (bt), or 70% below 1990
 - 1.0 bt from capped sectors
 - 0.4 bt from offset pool (baseline)
 - 0.2 bt from separate programs (estimate)
 - 0.2 bt from uncovered sectors (constant)
- Domestic forestry and international offsets could replace substantial amounts of capped Kyoto GHG abatement

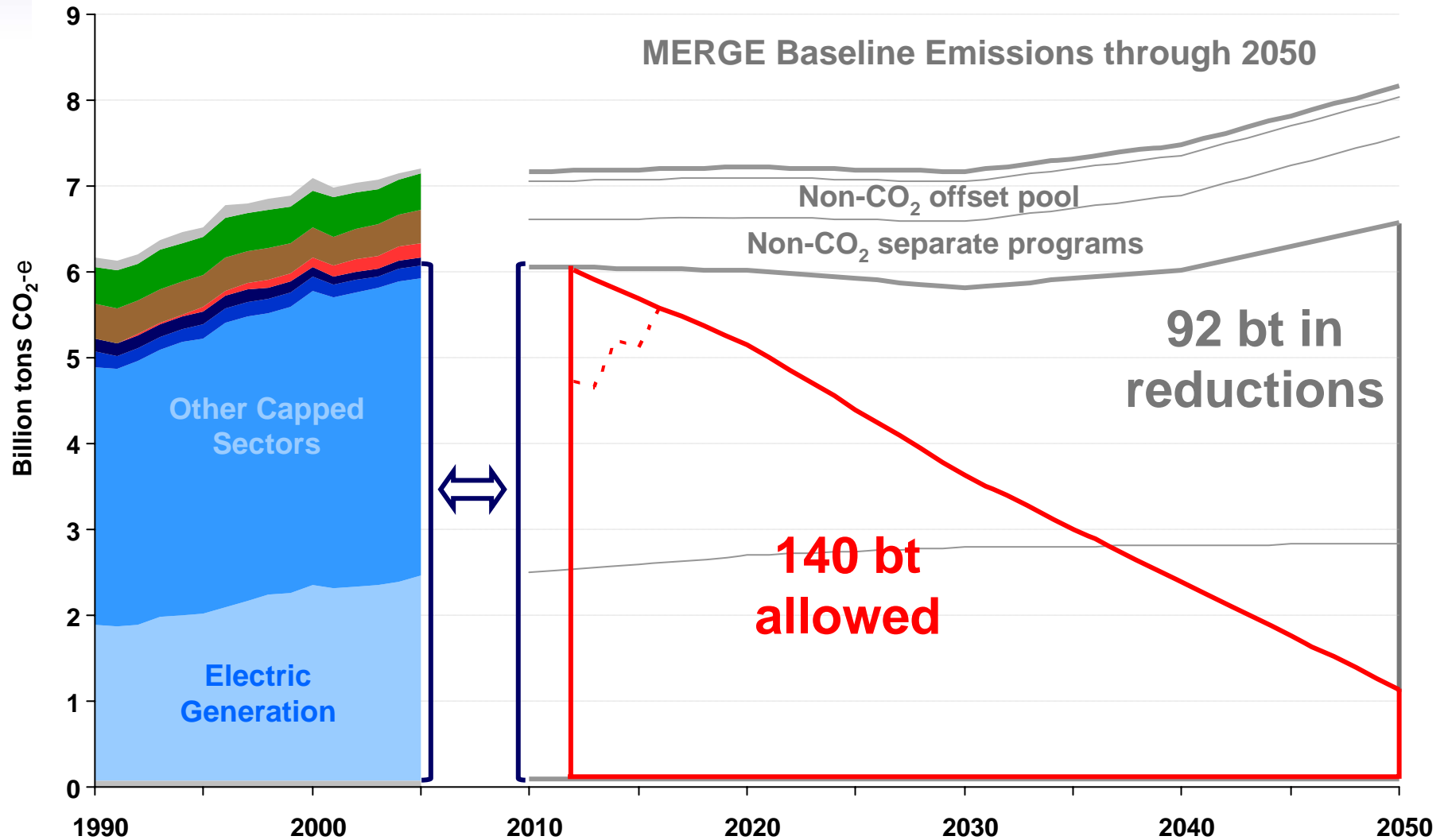
Cumulative Emissions vs. Cumulative Cap

- Assume immediate phase-in of cap in 2012:
 - 232 bt CO₂ through 2050 from capped sectors in BAU
 - 140 bt CO₂ through 2050 allowed by cap
 - 92 bt CO₂ reductions
- What can offsets do?
 - Maximum allowable is **still** 2 bt/year (up to 1.5 intl.)
 - Over 39 years, this means 78 bt
 - 81% of required reductions!
- But will they be available?

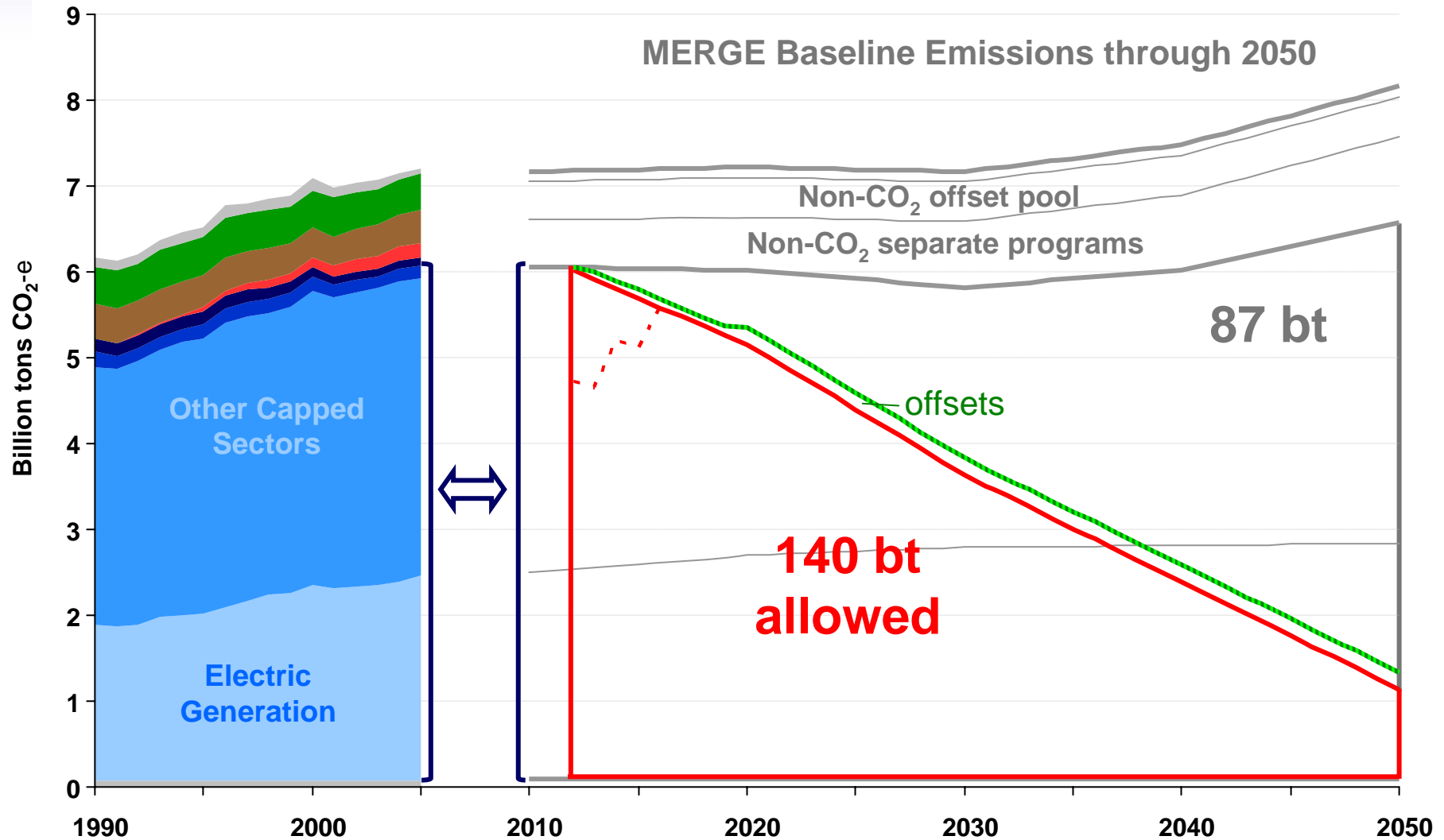
Potential Offset Supply: Domestic

- Domestic Kyoto GHGs (Agricultural CH₄ and N₂O):
 - Baseline is around 0.4 billion tons per year
 - EPA mitigation potential is ~0.1 billion tons in 2020
 - Maximum of 0.2 billion tons seems reasonable
- Domestic forestry
 - Mitigation supply curves from Rose *et al* indicate that 0.6 – 1.0 billion tons per year is possible
 - However, there are significant legal/procedural hurdles

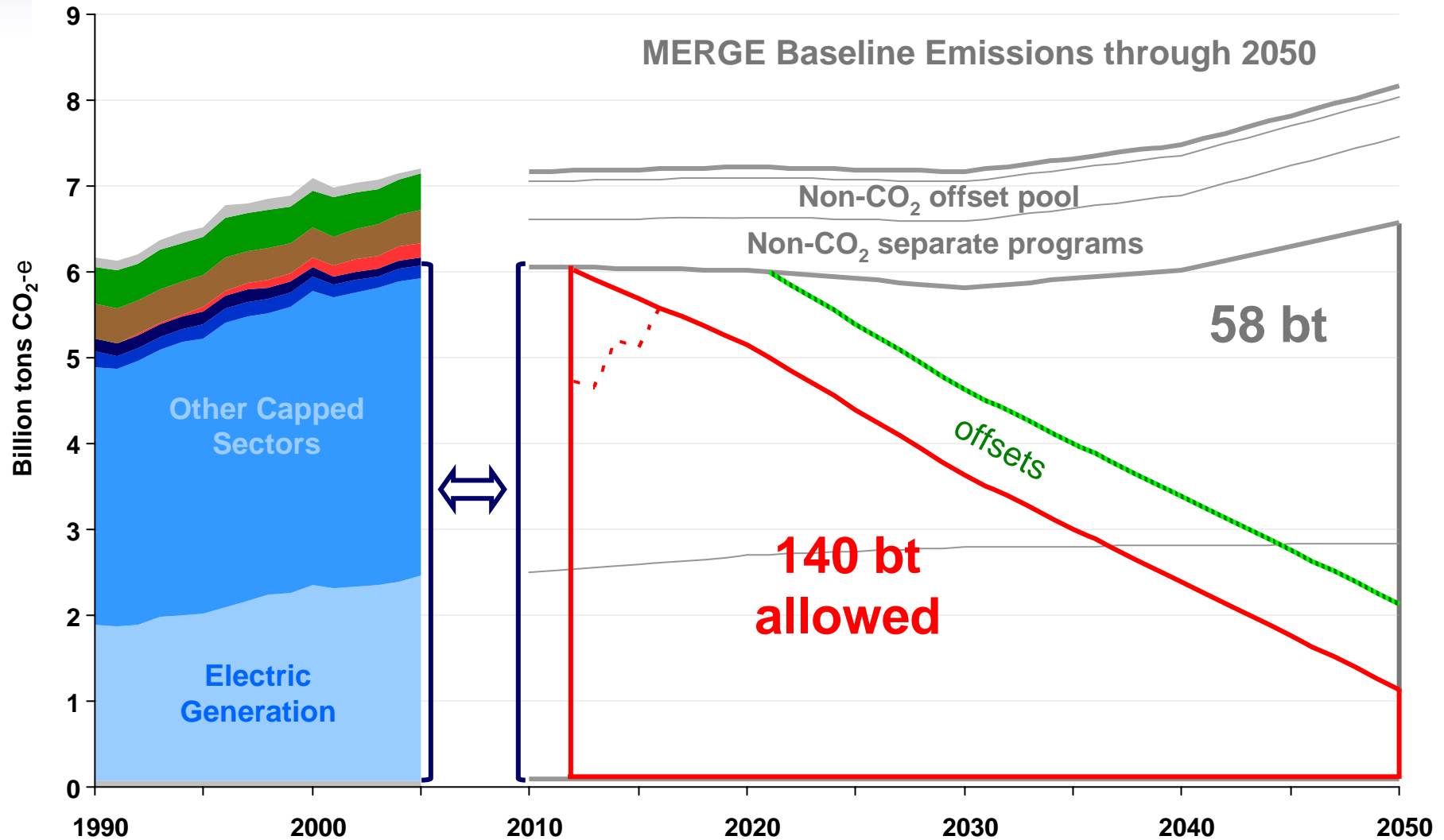
Cumulative Emissions: 2012 - 2050



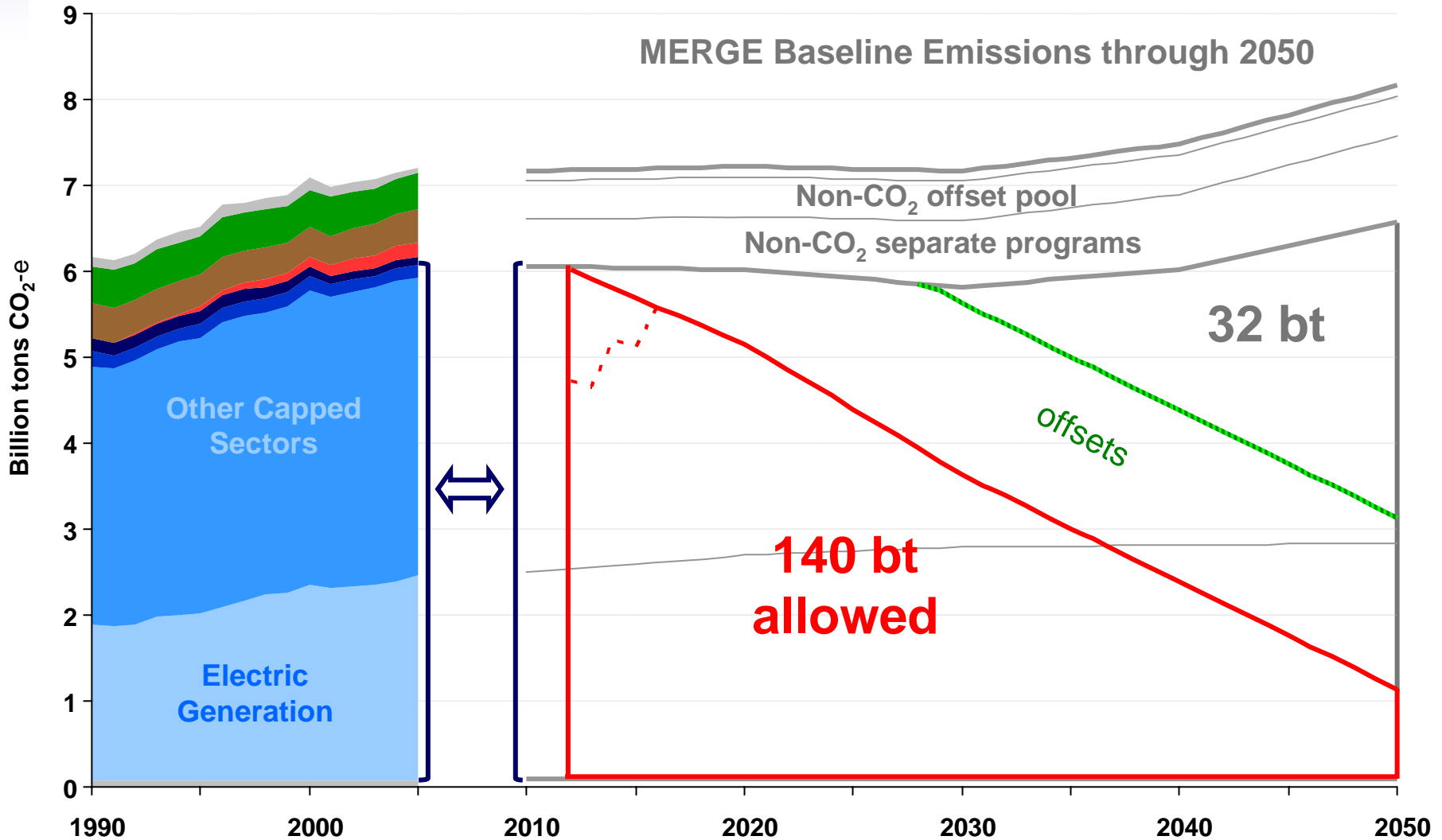
Domestic Kyoto GHG Offsets Only



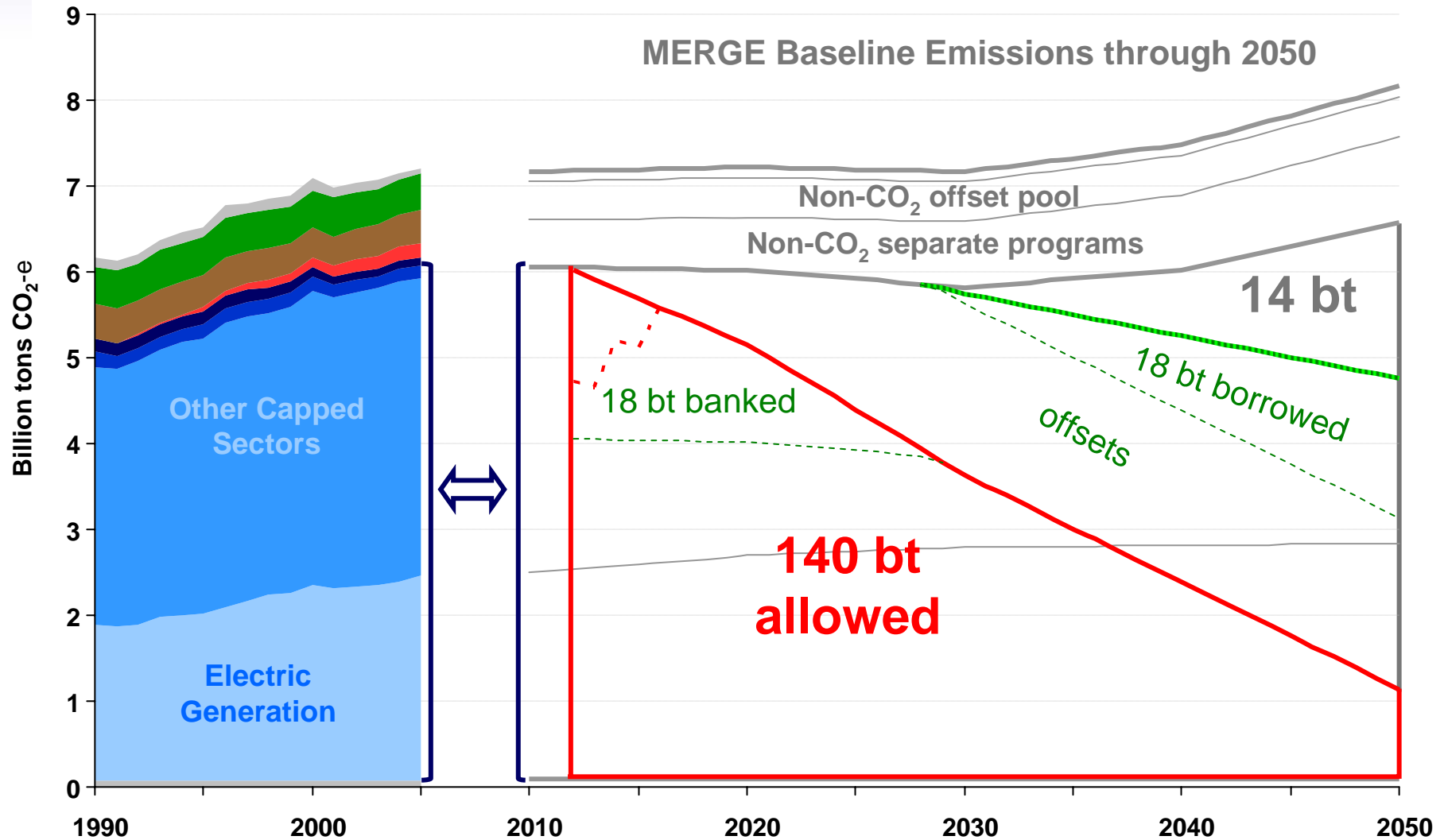
Full 1 bt/year from domestic only (no banking)



Full 2 bt/year from dom. + intl. (no banking)



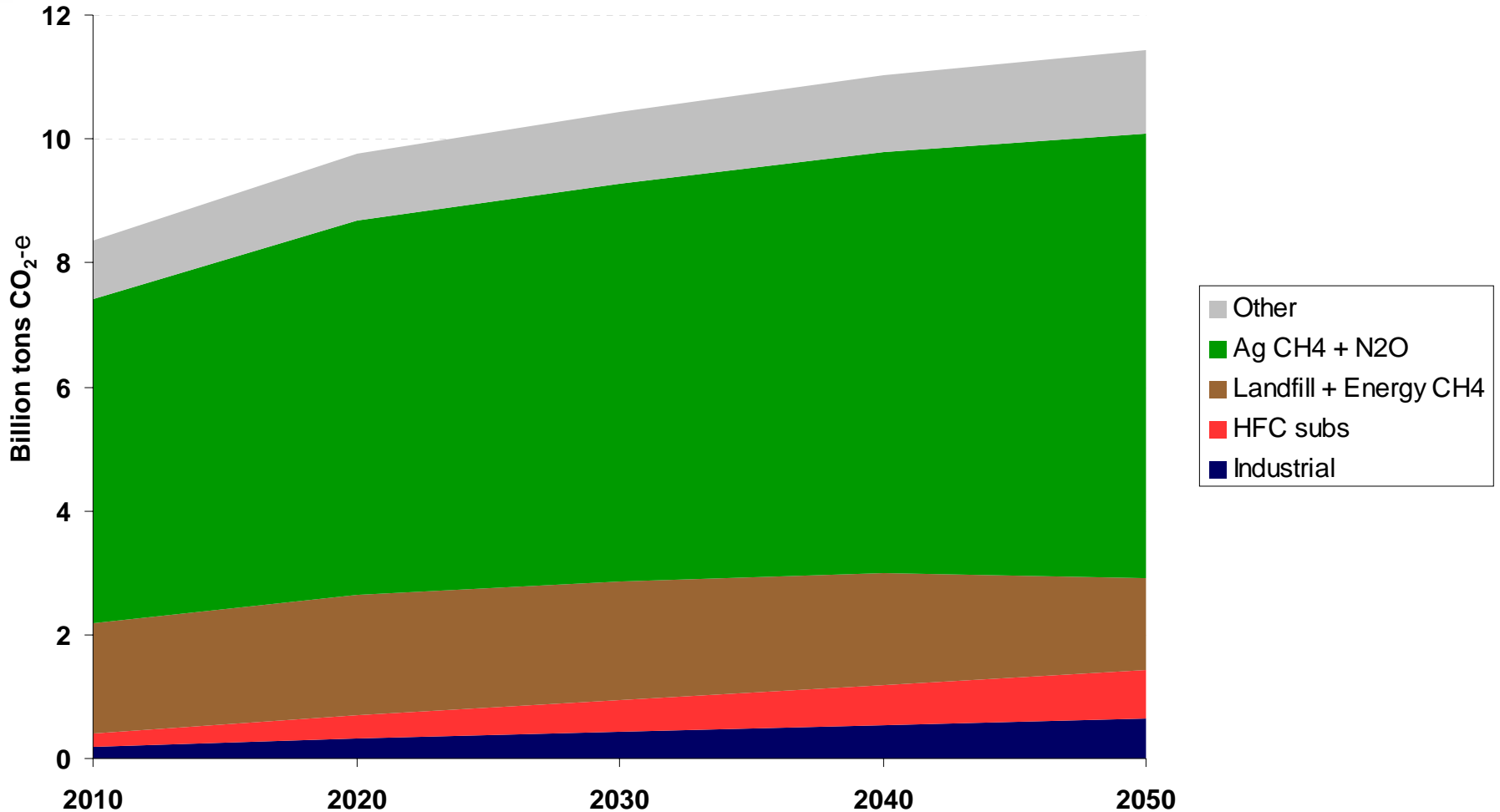
Full 2 bt/year from dom. + intl. (with banking)



Potential Offset Supply: International

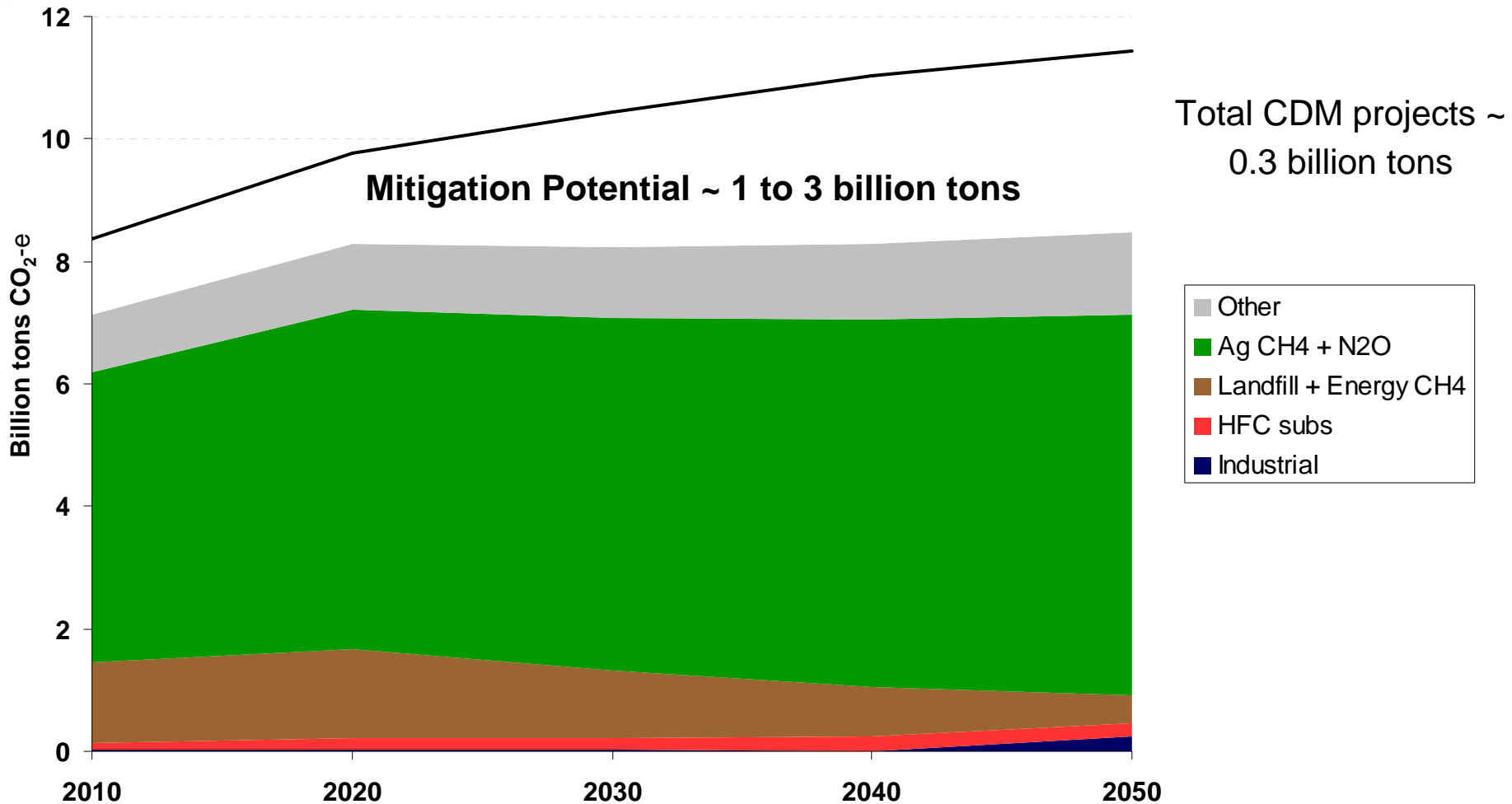
- Non-CO₂ sectors (agriculture, HFCs, etc.)
 - High baseline emissions
 - Limited mitigation potential
- Energy-related CO₂
 - Very high baseline, large mitigation potential
 - CDM is starting to move into this sector
- Forestry programs face even more difficulties than in US
 - Plus, set-asides will not be offset-eligible
- Other OECD countries will be competing for credits
- As developing countries join coalition, supply disappears

Non-Annex B Non-CO₂ Baseline Emissions



Source: EPA (2006) Global Emissions Report + MERGE projections

Non-Annex B Non-CO₂ with \$60/ton Mitigation



Source: EPA (2006) Global Emissions Report + MERGE projections

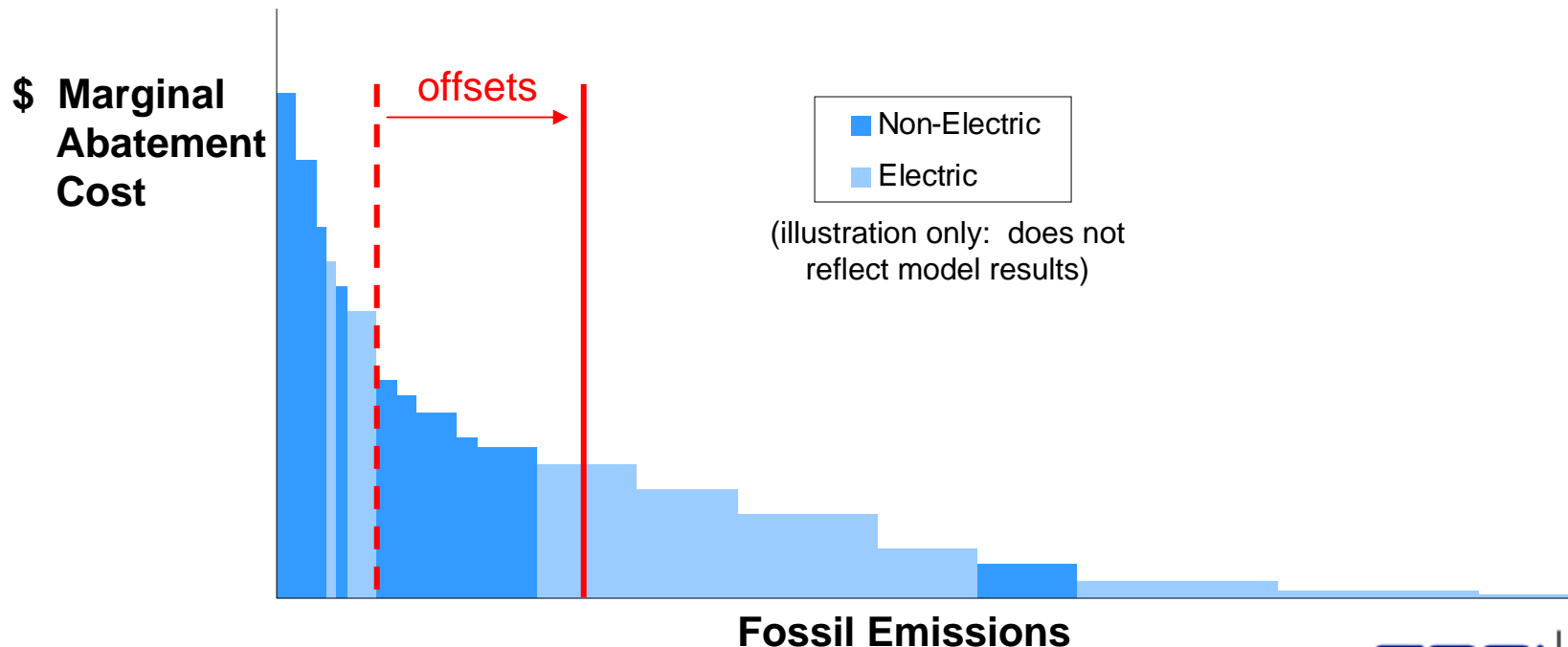
Implications for Energy Sector

In a world of “80% below 1990” + large offset pool:

- If forestry / intl offsets don't materialize, abatement in the energy sector will be much more substantial and costly than indicated in, e.g., the EPA analysis
- If forestry / intl offsets *do* materialize, abatement in the energy sector will be much more modest than 80% below

Implications for Electric Sector

- Contains most affordable supply-side reduction options
- Offsets are likely to disproportionately “offset” non-electric reductions → electric sector abatement still happens
- RPS and CCS bonuses could force in more



Conclusions

- Treatment of non-fossil abatement determines scope (and cost) of energy sector's challenge
- “80% below 1990 by 2050” can have very different implications depending on interpretation
- Allowable offset pool in current proposal is large in comparison to cumulative reduction requirement
- Do we understand these sectors well enough?
- More modeling attention on supply, costs, and real-world barriers to implementation

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