IGSD

Institute for Governance & Sustainable Development

Reducing Hydrofluorocarbons Through the Montreal Protocol

Durwood Zaelke

IGSD/INECE

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Need for Speed

- Warming already too high, impacts already here

- To return to safety we must:
  - Limit emissions, and capture & re-use CO_2
  - Cut short-lived pollutants: HFCs, BC, CH_4, O_3
  - Deliberately remove previously emitted CO_2

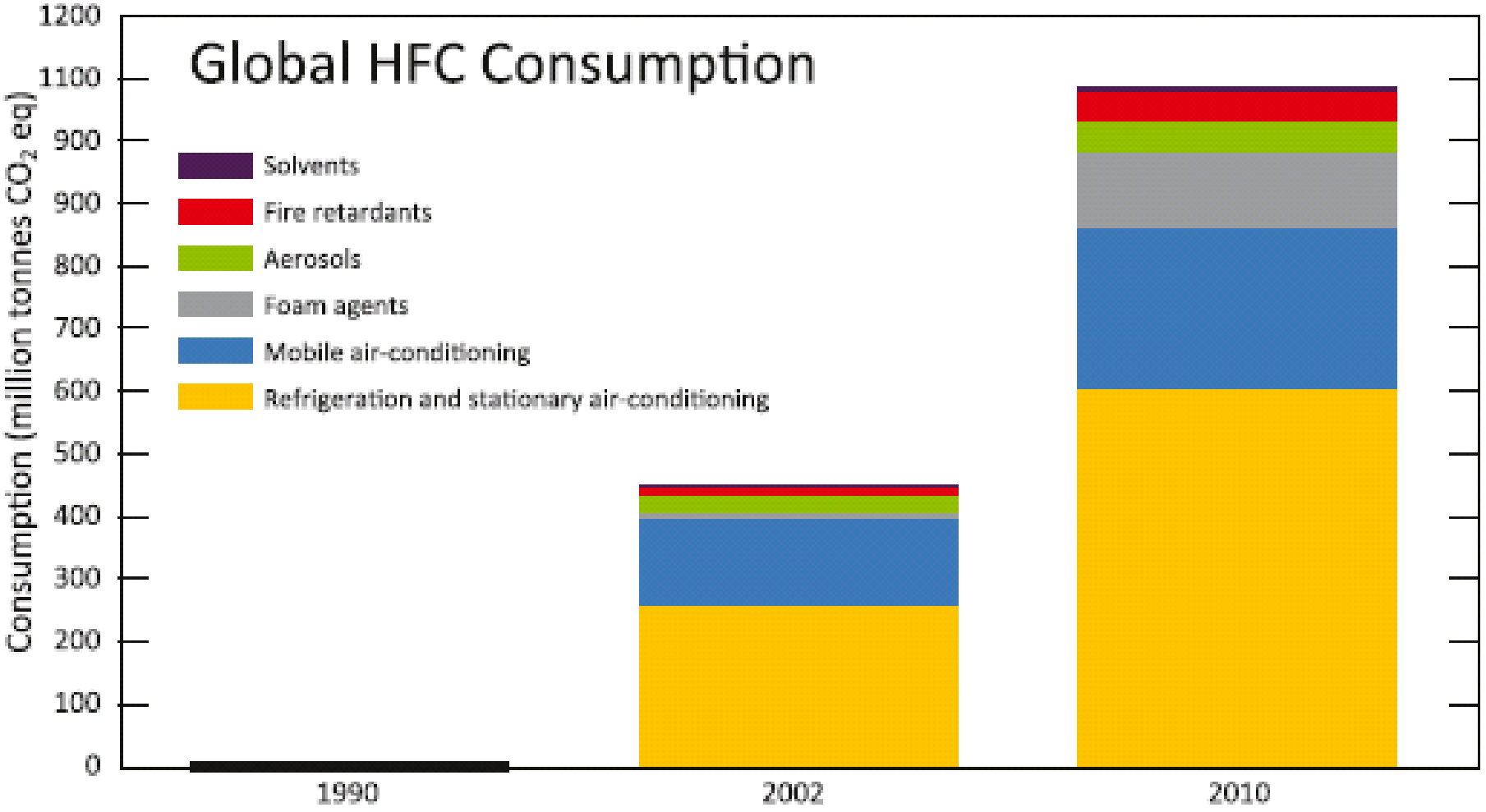
- And we must do this fast (need speed & scale)

Molina, Zaelke, Sarma, Andersen, Ramanathan, & Kaniaru, *Reducing abrupt climate change risk using the Montreal Protocol and other regulatory actions to complement cuts in CO_2 emissions*, PNAS (2009)

HFCs Fastest Growing GHG

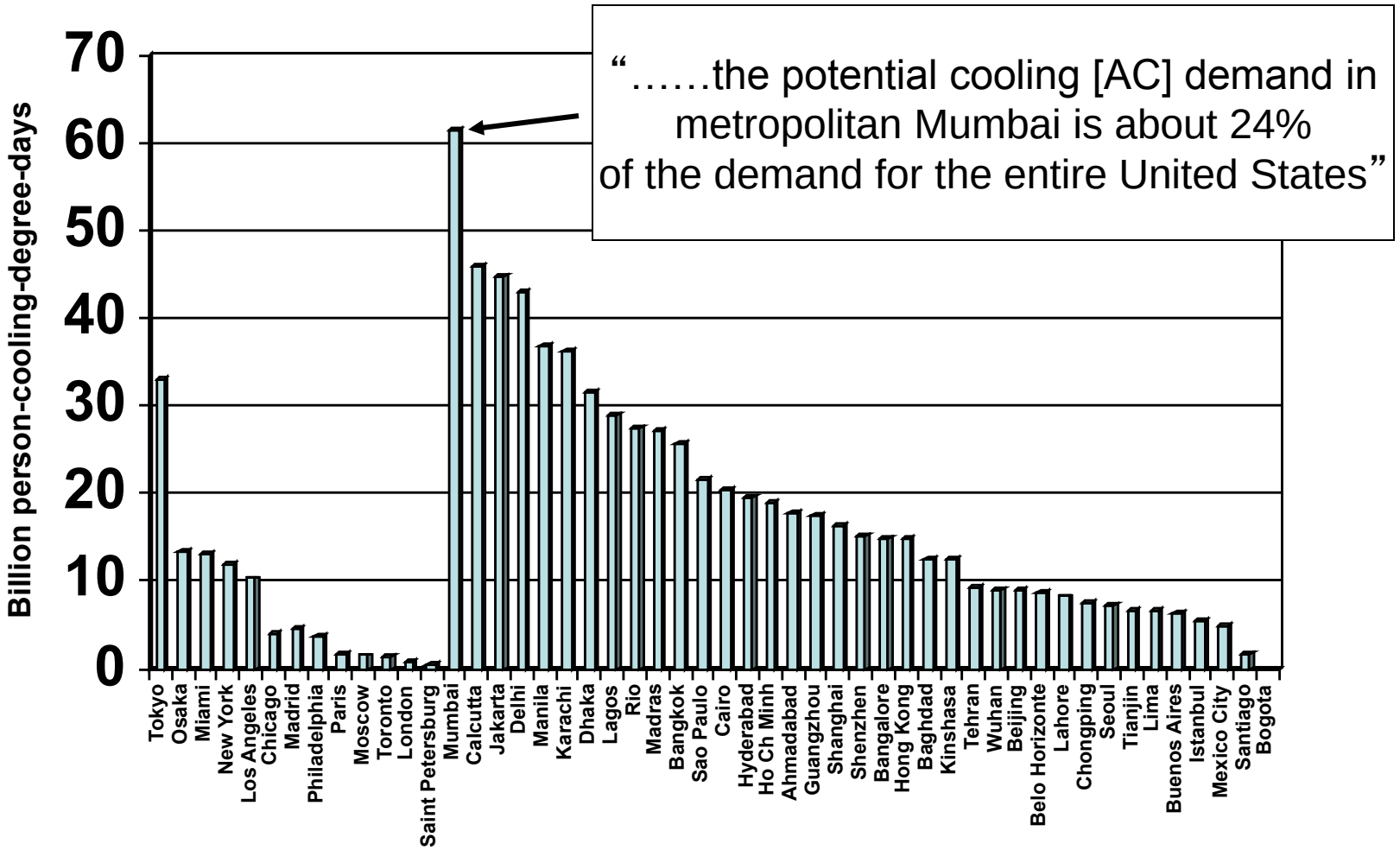
- HFCs are “super greenhouse gases”, replacing ODS being phased out under Montreal Protocol
- HFCs currently <2% of U.S. GHG emissions, and ~1% globally
- But are the fastest growing:
  - ~9% 2009-10 in U.S., doubling by 2020
  - 10%-15% per year worldwide, doubling in 5 years
- HFCs up to **27%** of CO_2 by 2050, or up to **45%** if CO_2 limited to 450 ppm (to prevent 2^{o}C)

Global Growth in HFC Consumption

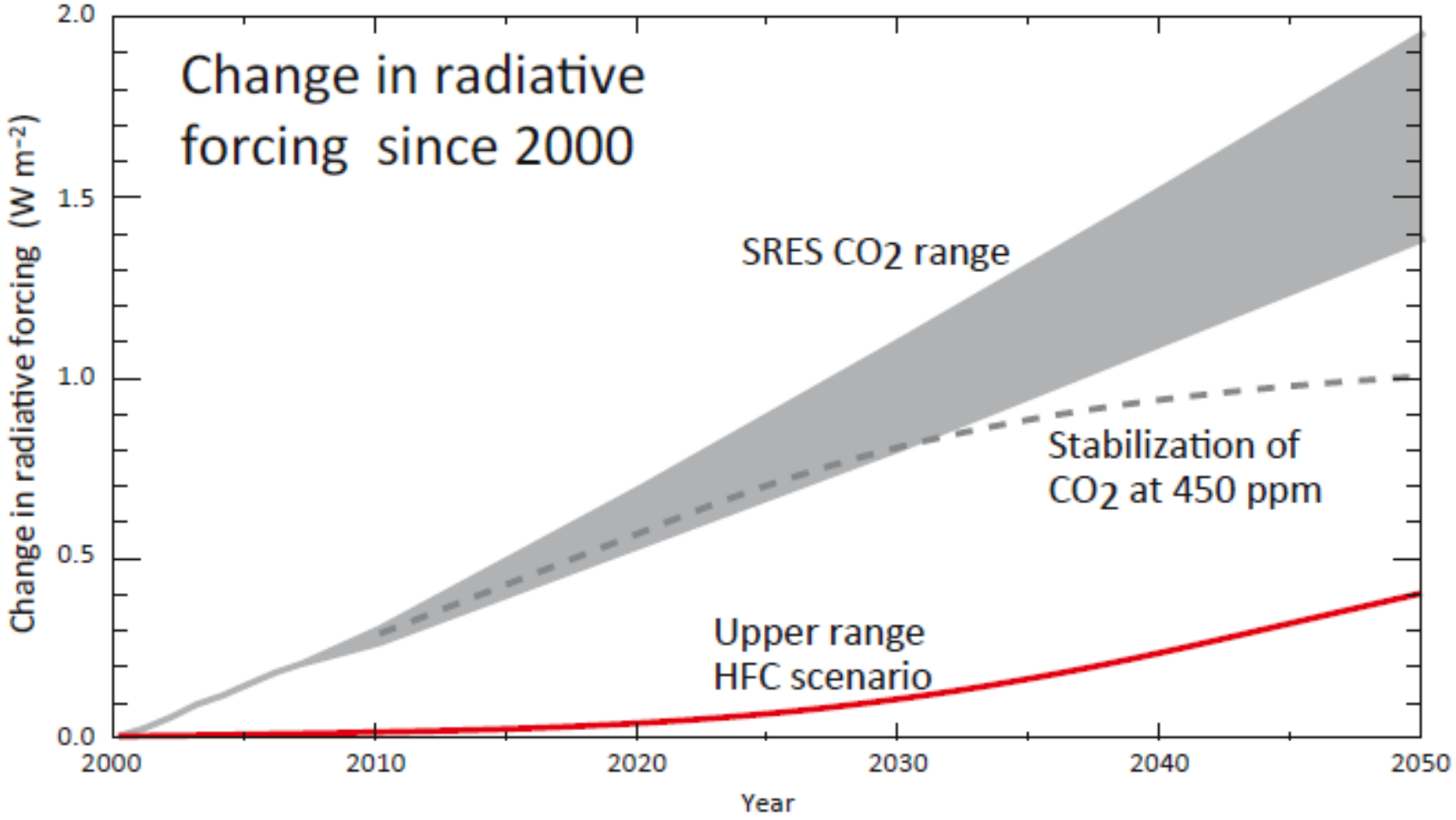


Source: UNEP (2011)

Increasing Cooling Demand



Projected Increase in Radiative Forcing of HFC Compared to CO_2



Source: UNEP (2011)

Good News: HFCs Short-Lived

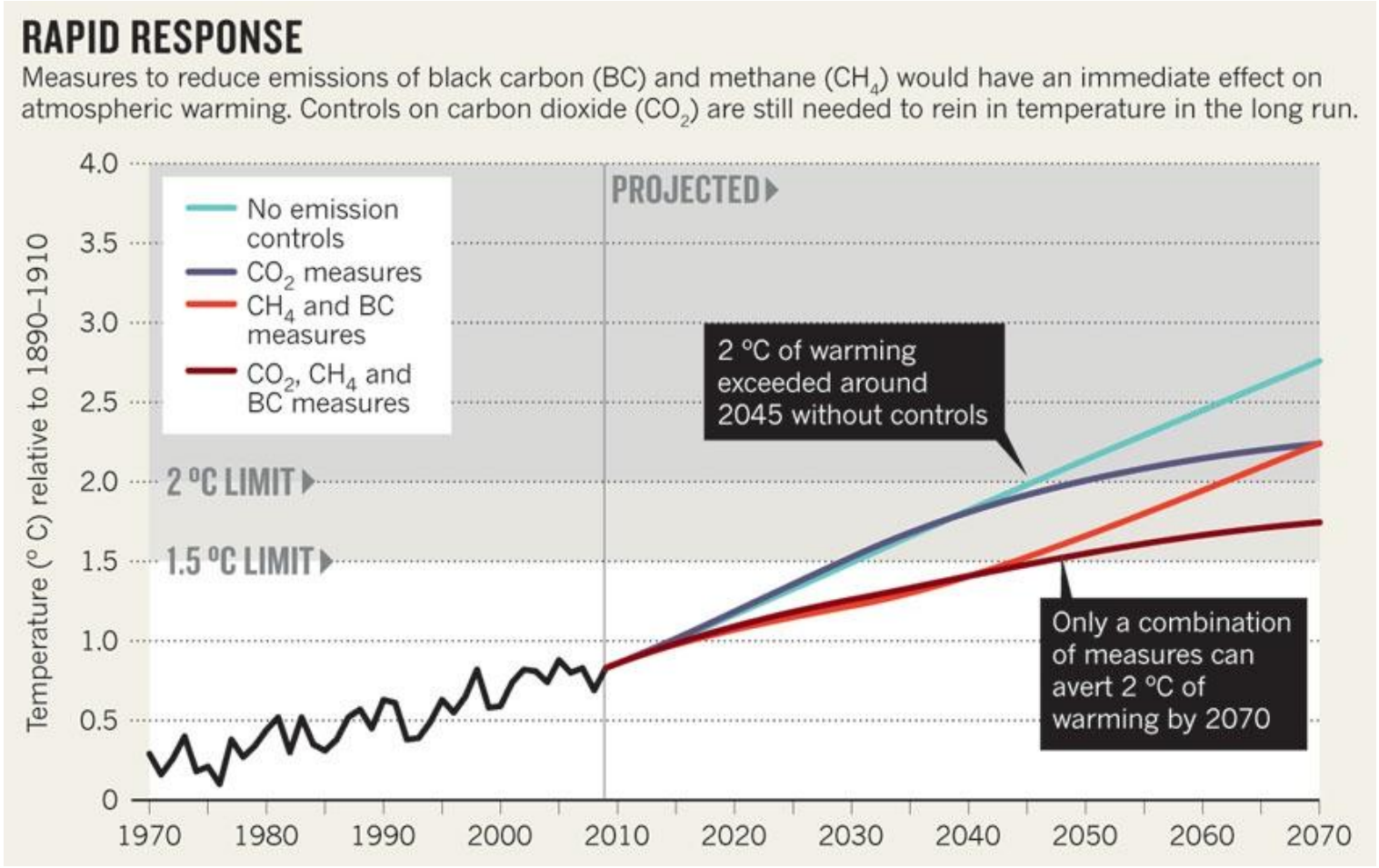
*"The mix of HFCs in current use, weighted by usage (tonnage), has an average lifetime of **15 years**."* (UNEP, 2011)

Compared to the millennial lifetime of CO_2

"While more than half of the CO_2 emitted is currently removed from the atmosphere within a century, … about 20% … remains … for many millennia." (IPCC AR4, 2007)

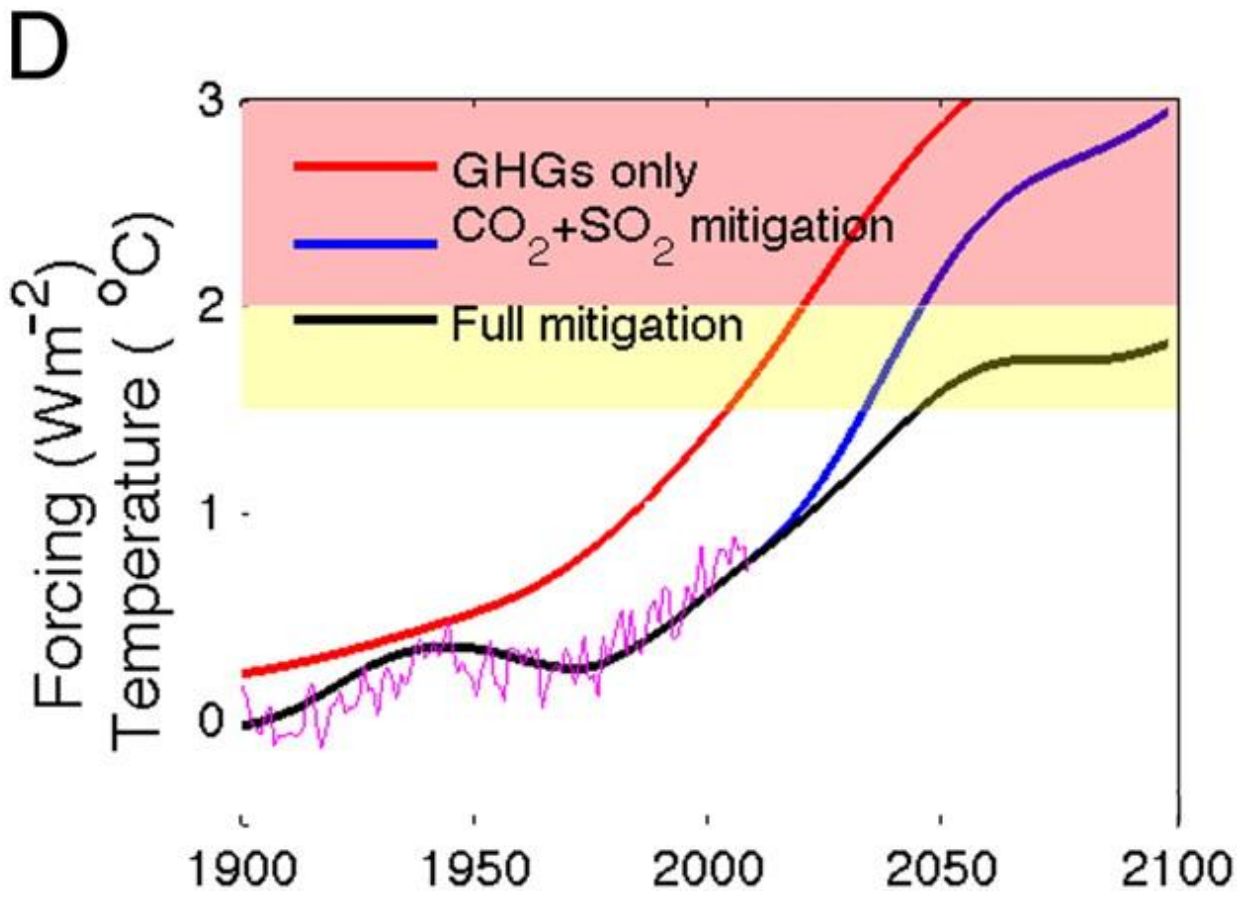
"About one-quarter of fossil fuel CO_2 emissions will stay in the air "forever", i.e. more than 500 years…. Resulting climate changes would be … irreversible." (Hansen *et al.*, 2007)

Good News: Reducing SLCP Provides Significant Near-Term Benefits



Source: Tollefson, NAT (2012), based on Shindell *et al.*, SCI (2012), which in turn is based on Ramanathan & Xu, Fig 1D, PNAS (2010)

Observed Temperatures Through 2009 and Projected Temperatures Thereafter Under Various Scenarios

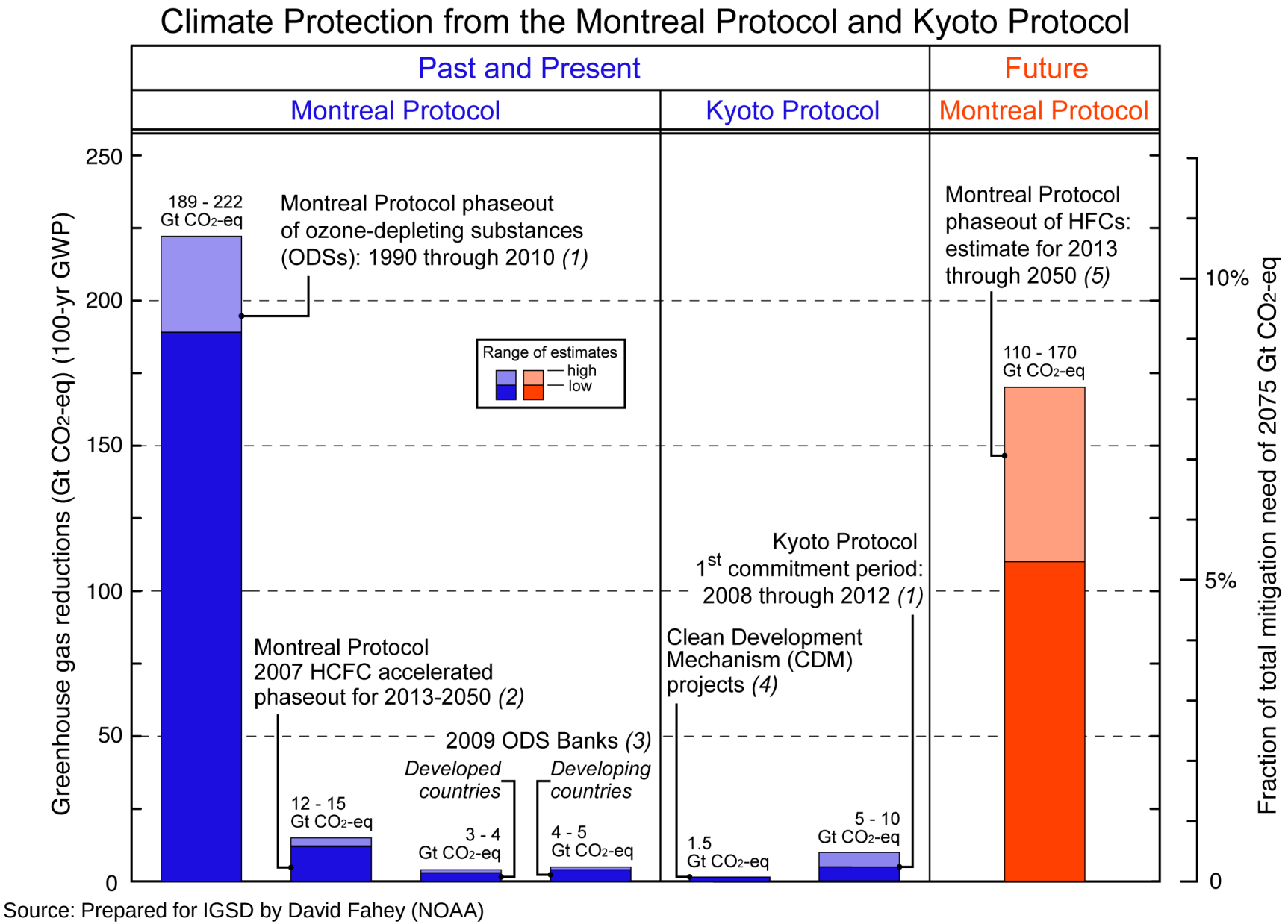


*** Full mitigation includes HFCs**

Source: Ramanathan & Xu, PNAS (2010)

Good News: Montreal Protocol

- World's most successful environmental treaty
  - Put ozone layer on path to recover by 2075, preventing ~6 million skin cancer deaths in US alone
  - Phased out nearly 100 factory-made chemicals, nearly 100%
  - Enormous climate co-benefit
- Built capacity in every country of the world to reduce HFCs quickly



Source: Prepared for IGSD by David Fahey (NOAA)

Adding HFC to Montreal Protocol

- Equivalent to 100 billion tonnes CO_2 by 2050
- Federated States of Micronesia proposal in 11 May 2012
- U.S., Canada, Mexico similar proposal; 108 parties support
- But opposition from China and India (as HFCs not ODS)
- Low global warming alternatives available or soon to be commercialized
  - Hydrocarbons used around the world
  - Mobile a/c refrigerant safety approved and factory in permit phase
  - Residential refrigerants and foam blowing agents being tested
  - HFOs
- Public cost under MP is pennies per tonne of CO_2-eq.

Climate and Clean Air Coalition

- February 17 launch by Secretary Clinton: 6 States, UNEP
- April 24 inaugural Ministerial: 13 Members: U.S., Mexico, Canada, Sweden, Ghana, Bangladesh, Nigeria, Colombia, Japan, Norway, UNEP, EC, World Bank
- May 19 G8 leaders joined: 18 Members: Russia, Italy, France, UK, Germany
- G8 commissioned World Bank study on integrating SLCP into their activities (already $12 billion from Bank contributing to Coalition goals)
- Accelerating HFC alternatives one of five fast-track initiatives

Summary

- HFCs (ODS replacements) currently ~2% of U.S. GHG emissions, but are the fastest growing sector, expected to double by 2020
- Climate co-benefit of Montreal Protocol for ODS many times benefit of Kyoto Protocol
- Climate vulnerable islands, U.S., Mexico, Canada propose controlling HFCs under Montreal Protocol; 108 countries support
- Low GWP replacements available now
- Public MP cost is pennies for an equivalent ton of CO_2