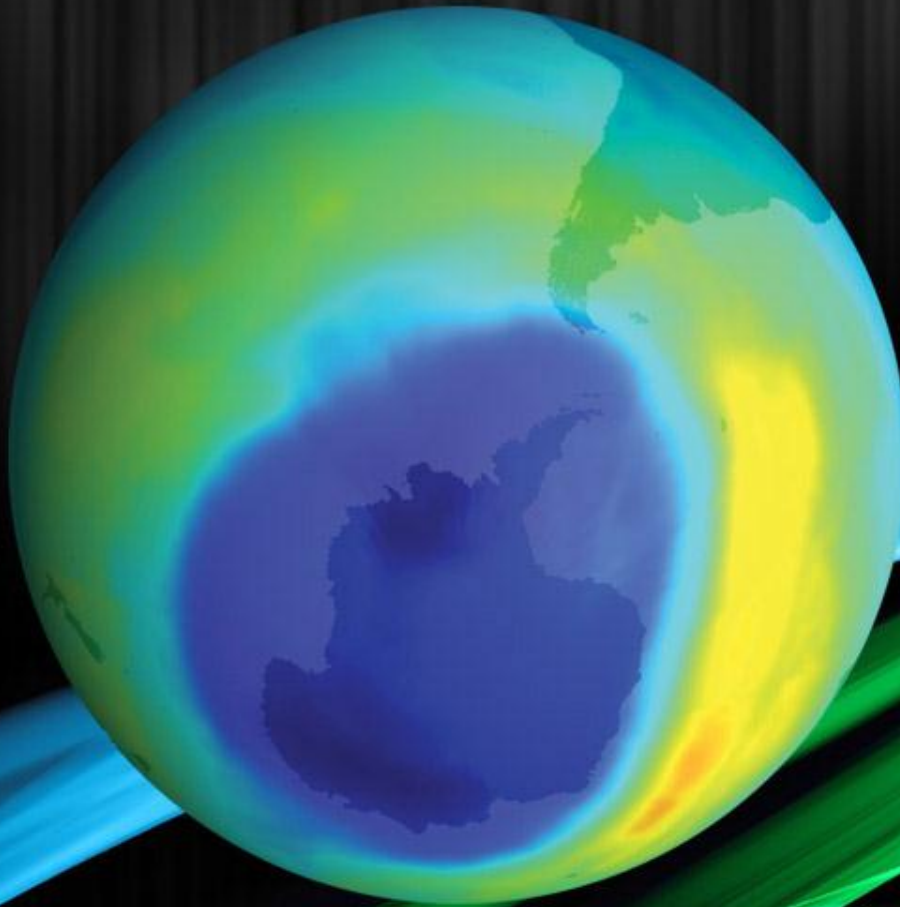
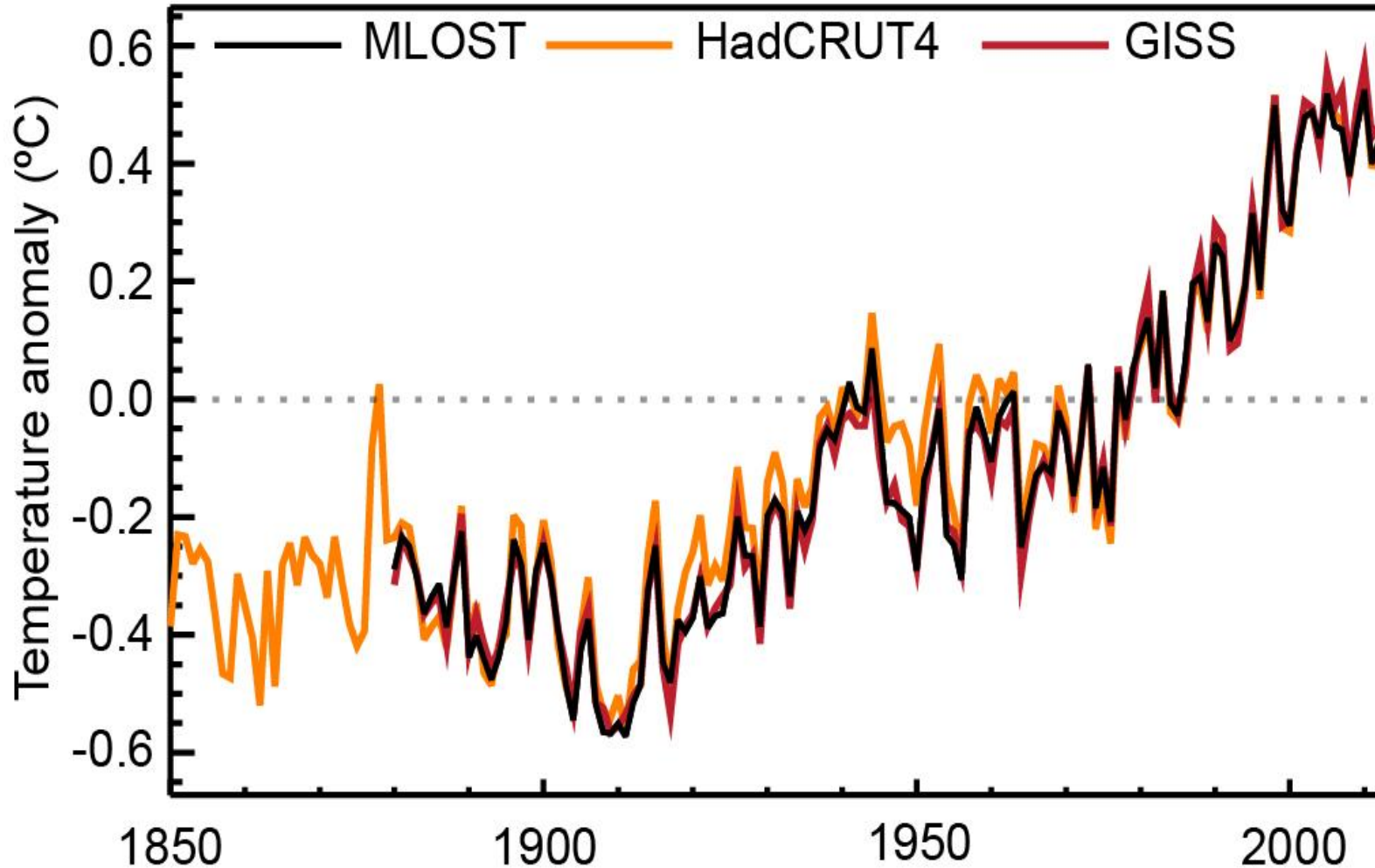


The co-benefit & the leapfrog agenda

— Chandra Bhushan



1. Temperature: 0.85°C over 1880-2012; last 3 decades warmest

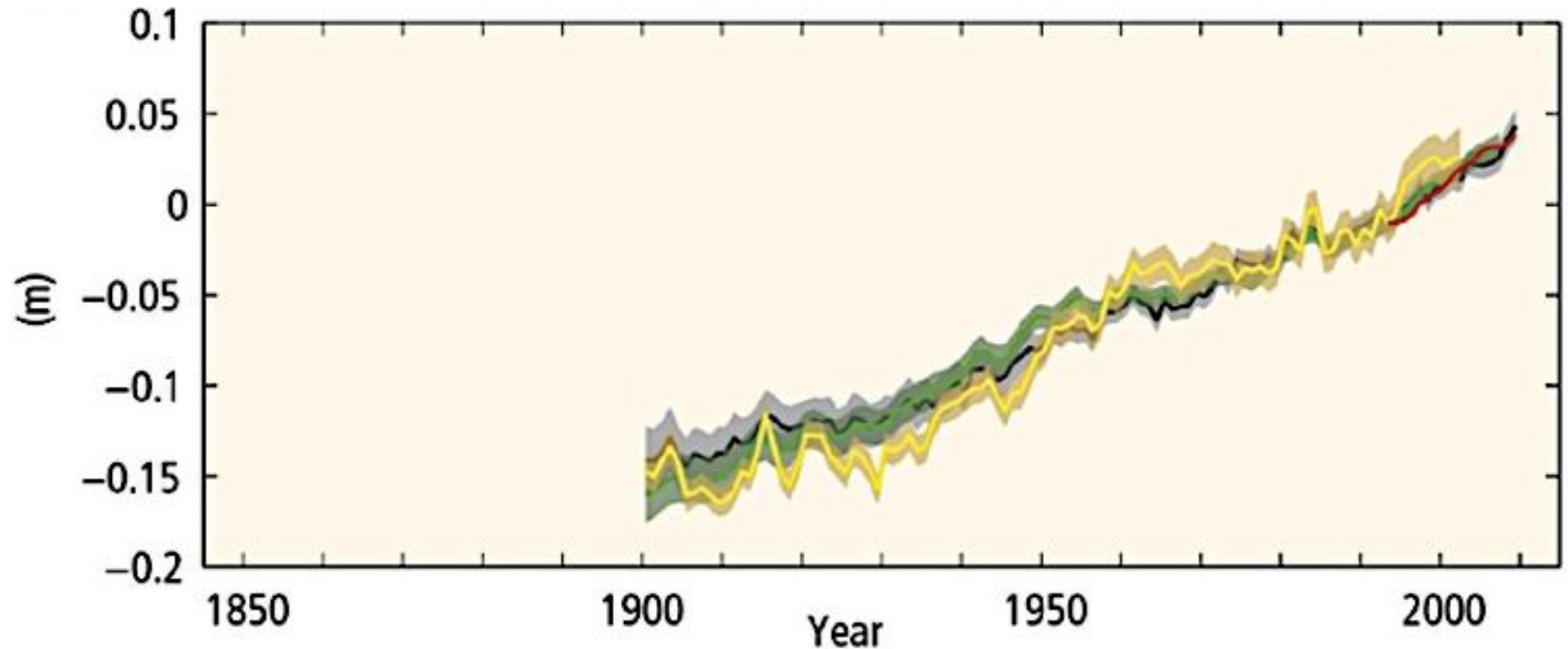


2. Impacts are unprecedented

Since 1950s many of the observed changes are unprecedented over decades to millennia

- Oceans are acidifying and sea level is rising.
- Arctic ice cover is shrinking.
- Extreme weather events are increasing in number and intensity.
- Many terrestrial, freshwater, and marine species have started to “adapt” (shifted their geographic ranges, seasonal activities, migration patterns etc.) in response to ongoing climate change

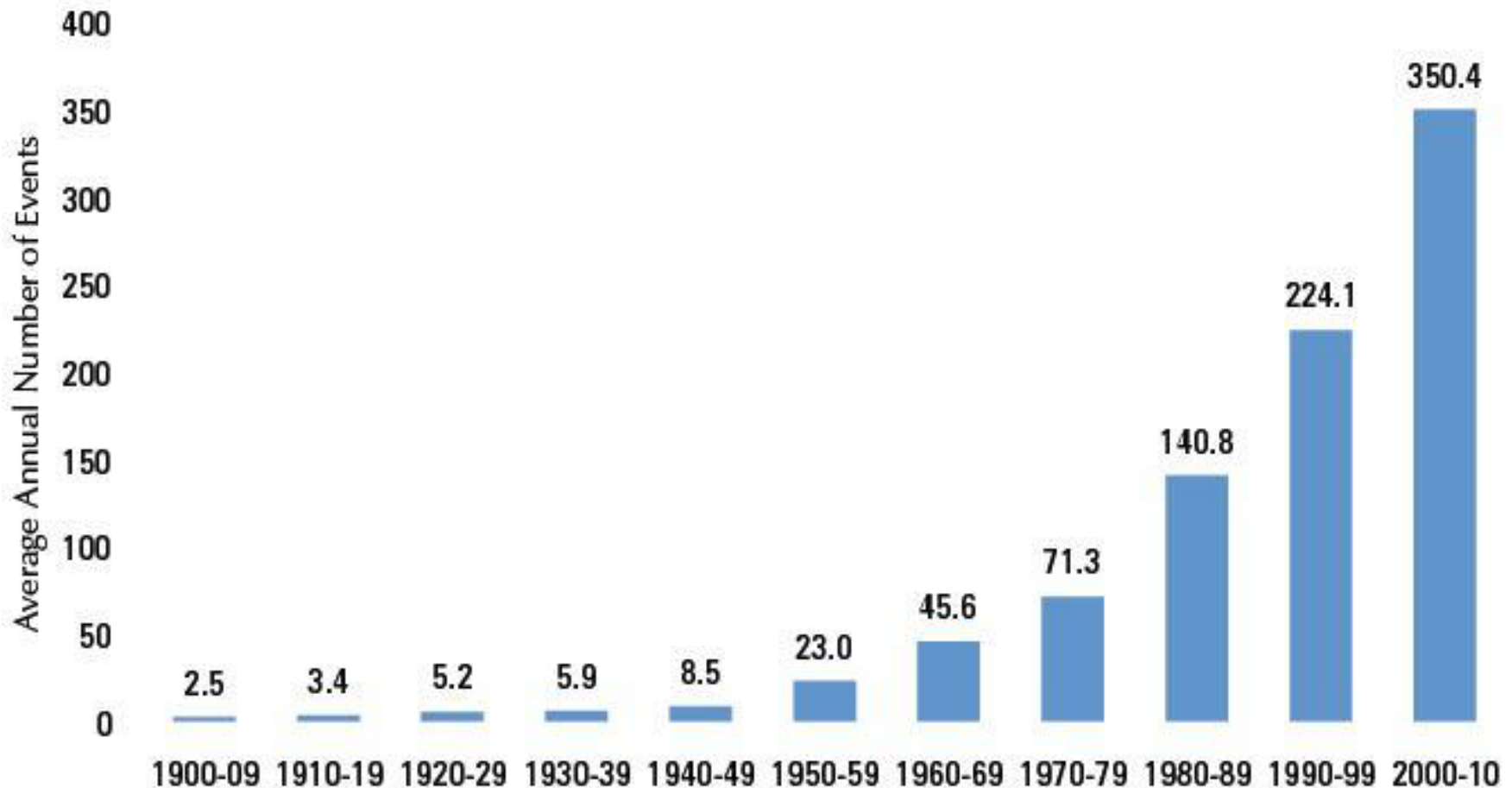
Sea level rise and Ocean acidification: *Over 1901–2010 by 0.19 m and 26% more acidic*



Global averaged sea-level rise was 1.7 mm/yr between 1901–2010 and 3.2 mm/yr between 1993–2010.

Extreme weather events are increasing

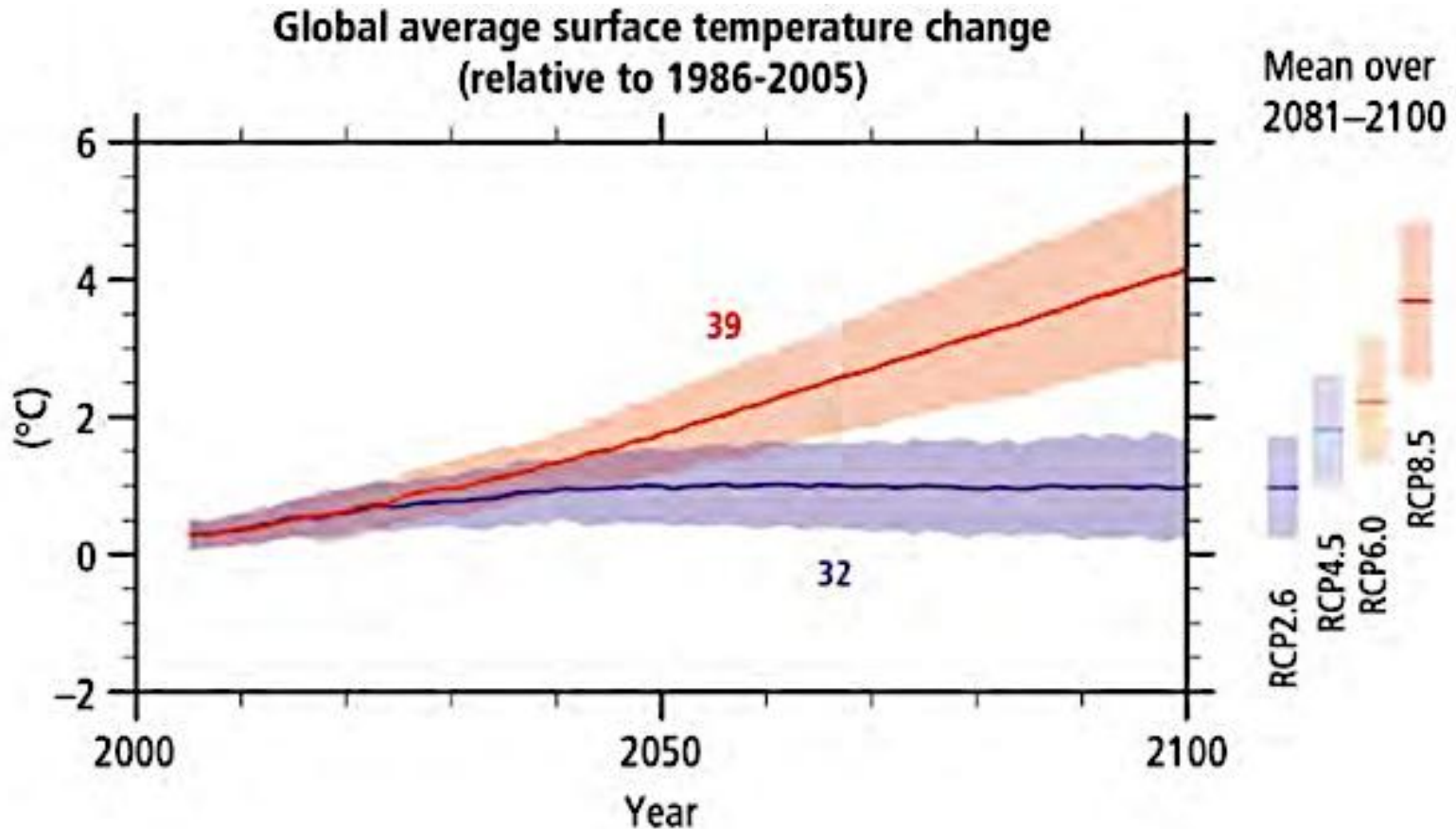
Figure 1: Average Number of Extreme Weather Events per Year by Decade, 1900–2010



4. Impacts are going to get worse

- Surface temperature is projected to rise over the 21st century under all scenarios.
- Heat waves will occur more often and last longer
- Extreme precipitation events will become more intense and frequent in many regions.
- Ocean will continue to warm and acidify, and global mean sea level to rise.
- Increasing magnitudes of warming increase the likelihood of severe, pervasive, and irreversible impacts for people, species and ecosystems.

Additional temperature increase of 0.3°C - 0.7°C certain till 2016-35

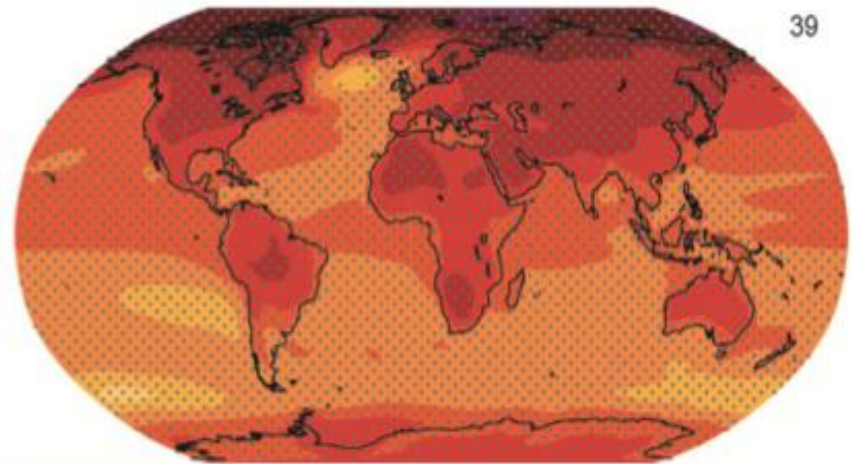
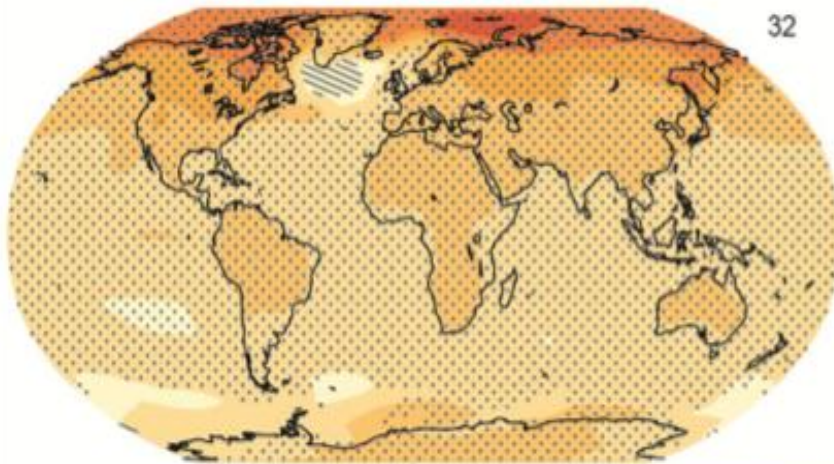


The Atlas of Our Changing World

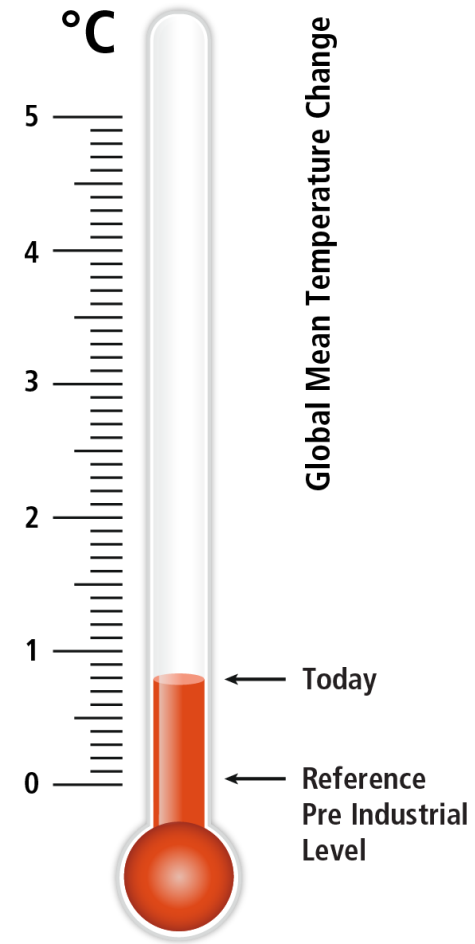
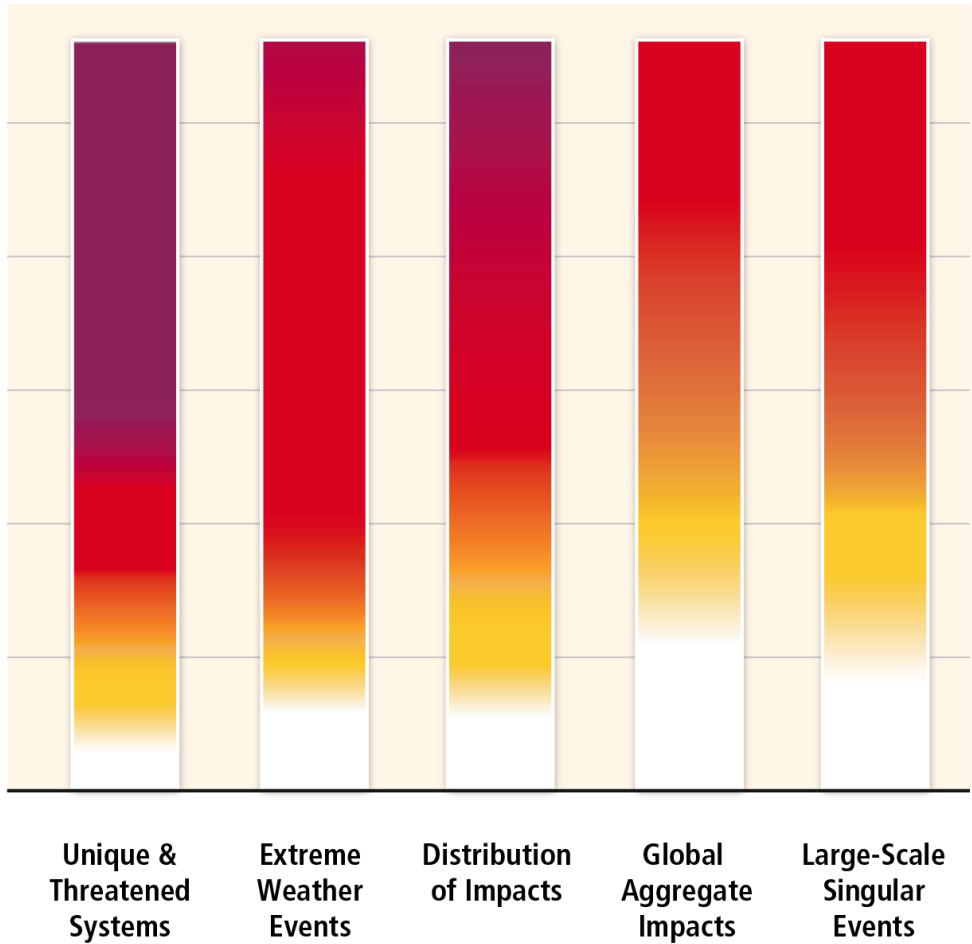
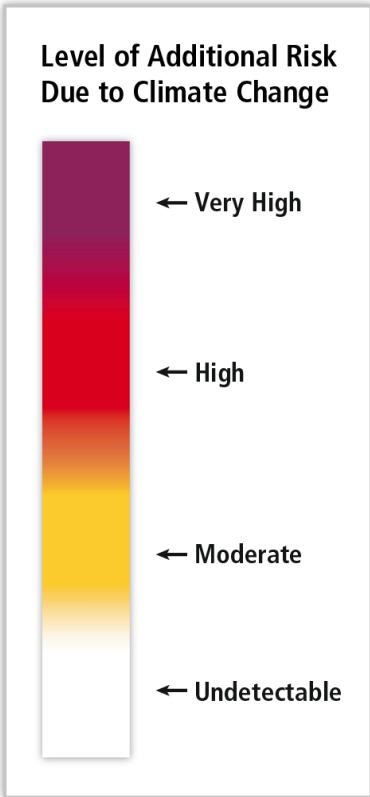
Aggressive mitigation

Business as usual

Change in average surface temperature (1986–2005 to 2081–2100)

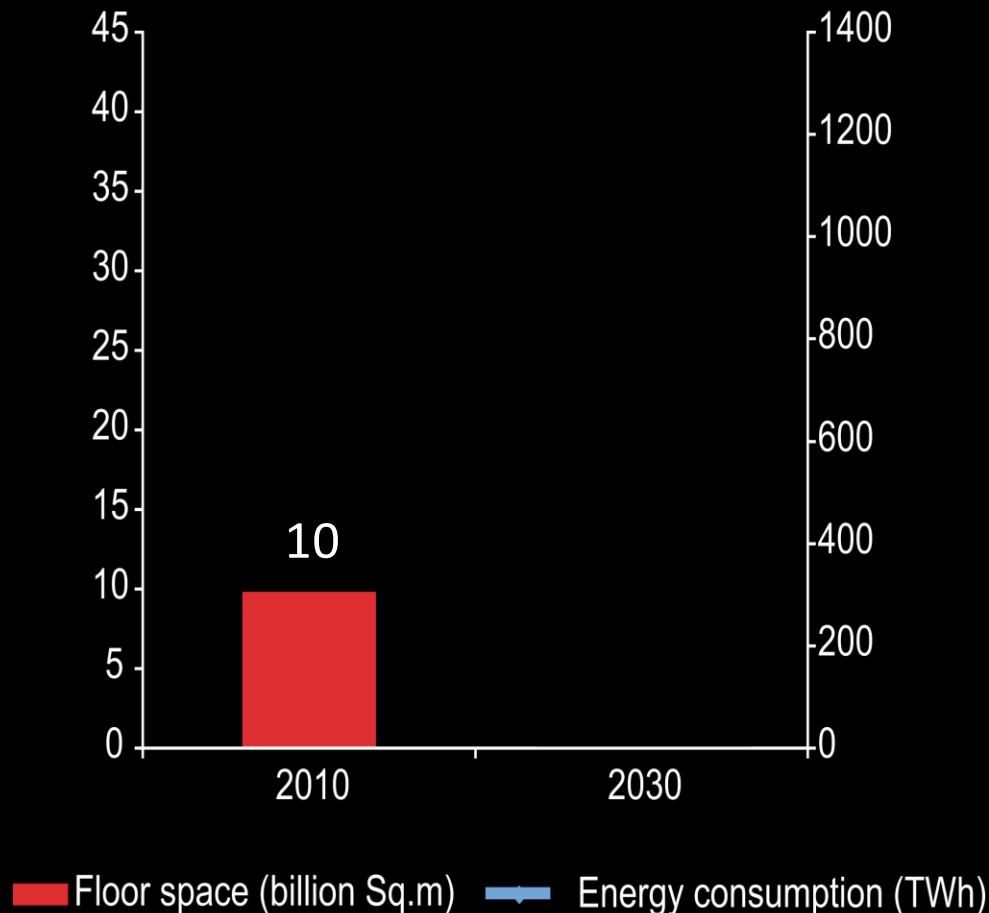


Severe, pervasive, and irreversible impacts



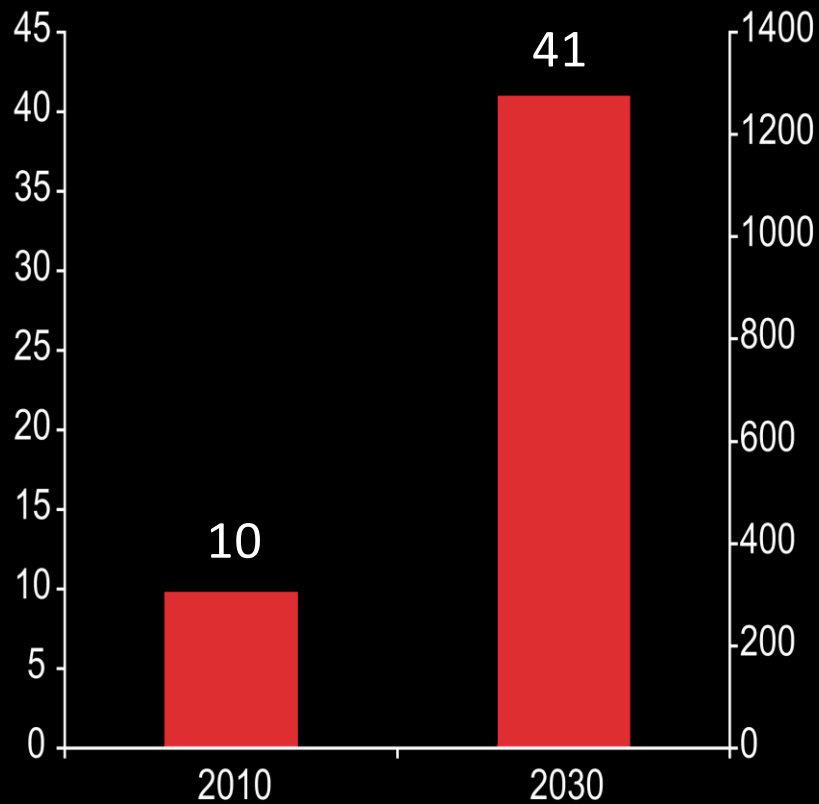
Connecting the dots- the Indian case

Indian building sector



Connecting the dots- the Indian case

Indian building sector



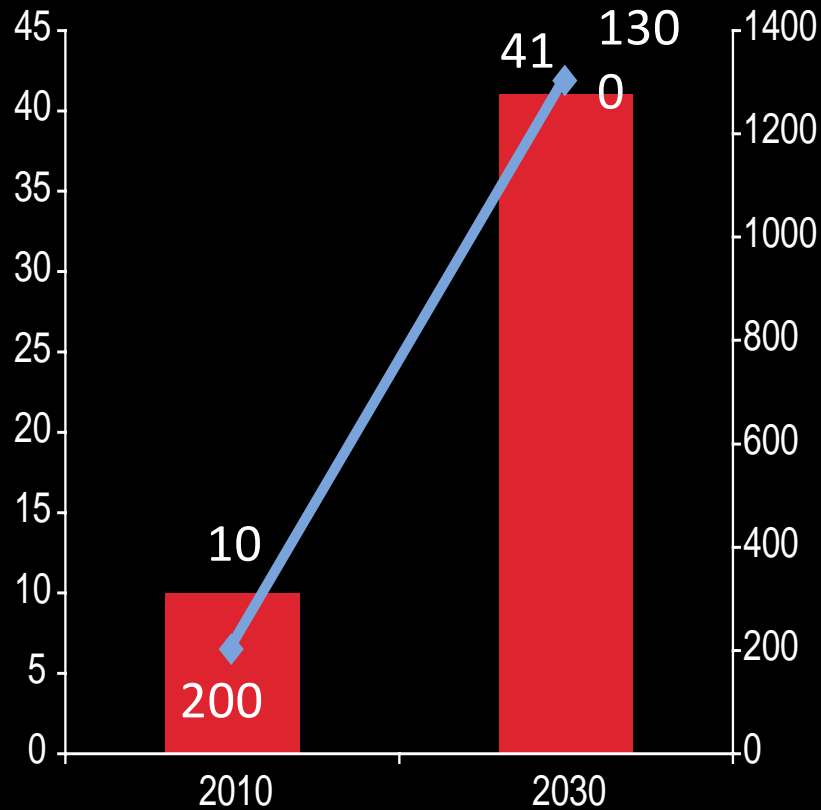
■ Floor space (billion Sq.m) ■ Energy consumption (TWh)



Centre for Science and Environment

Connecting the dots- the Indian case

Indian building sector



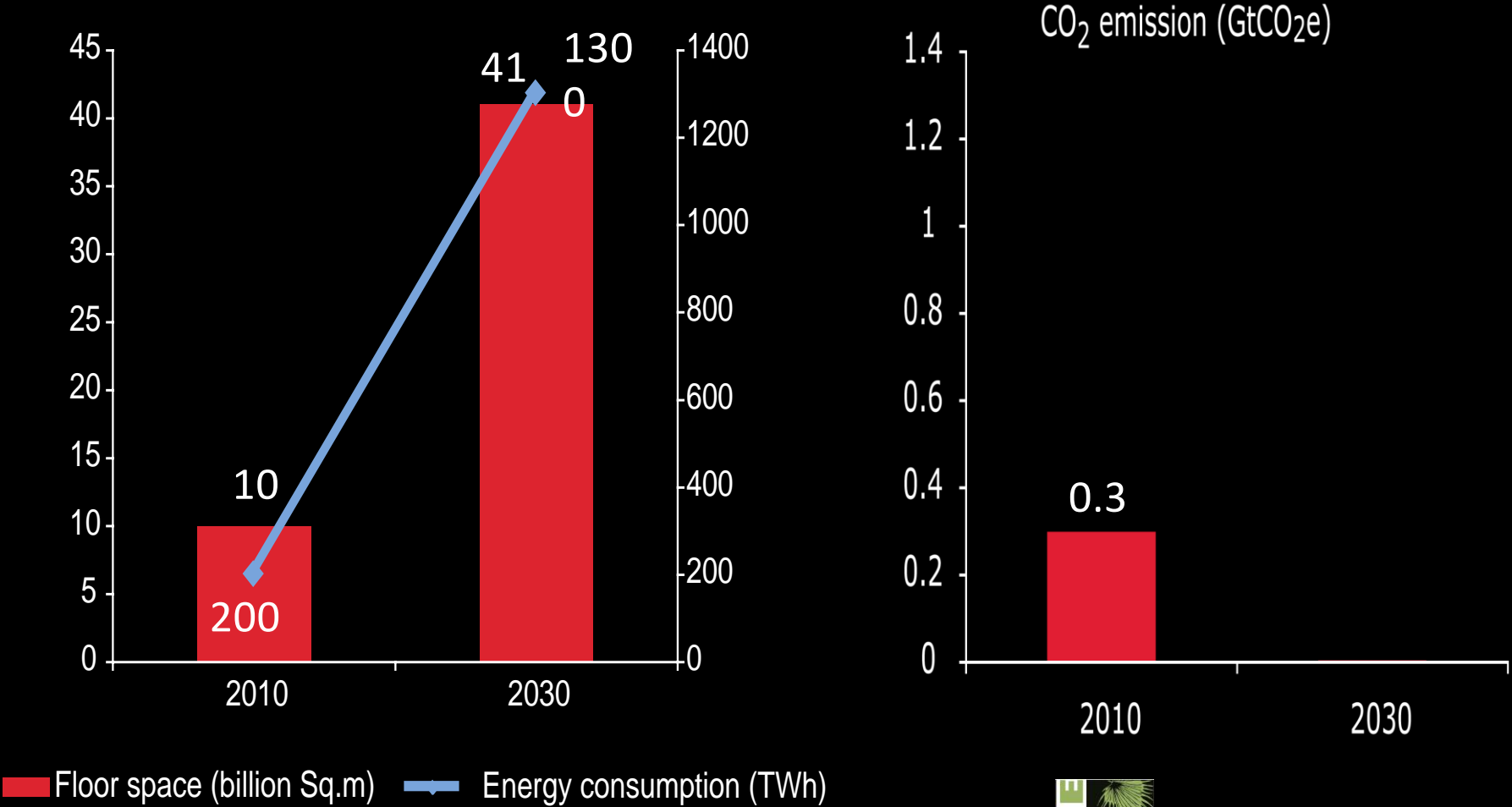
■ Floor space (billion Sq.m) — Energy consumption (TWh)



Centre for Science and Environment

Connecting the dots- the Indian case

Indian building sector



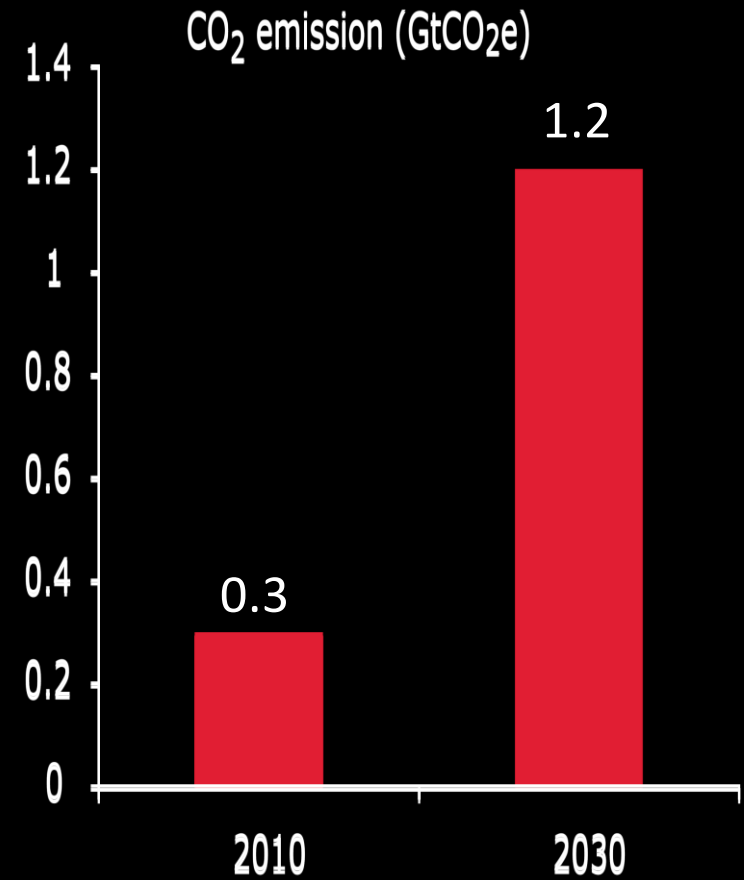
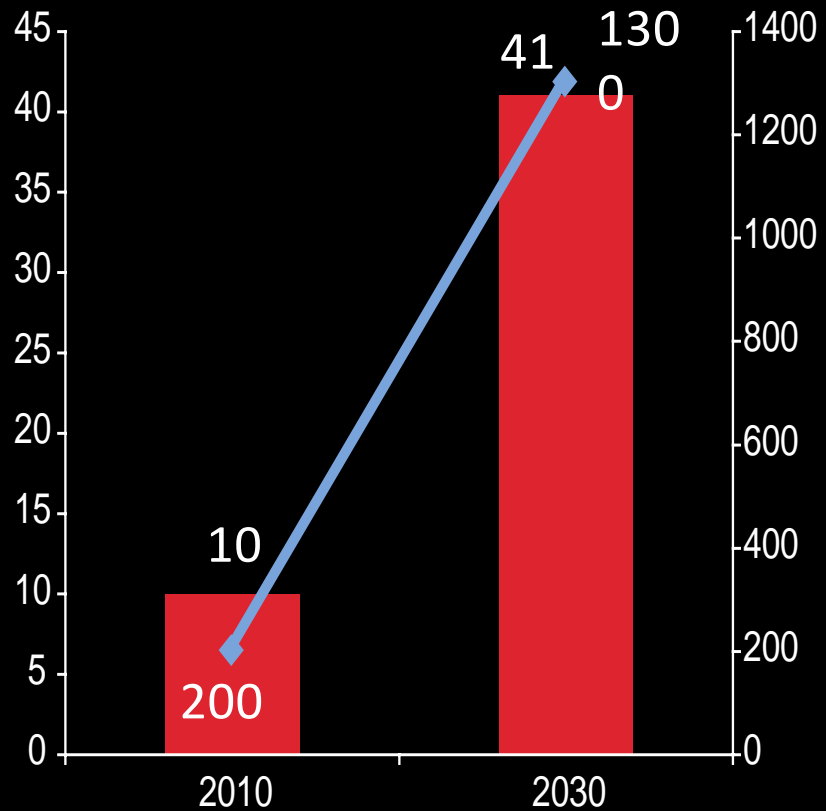
■ Floor space (billion Sq.m) — Energy consumption (TWh)



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Connecting the dots- the Indian case

Indian building sector



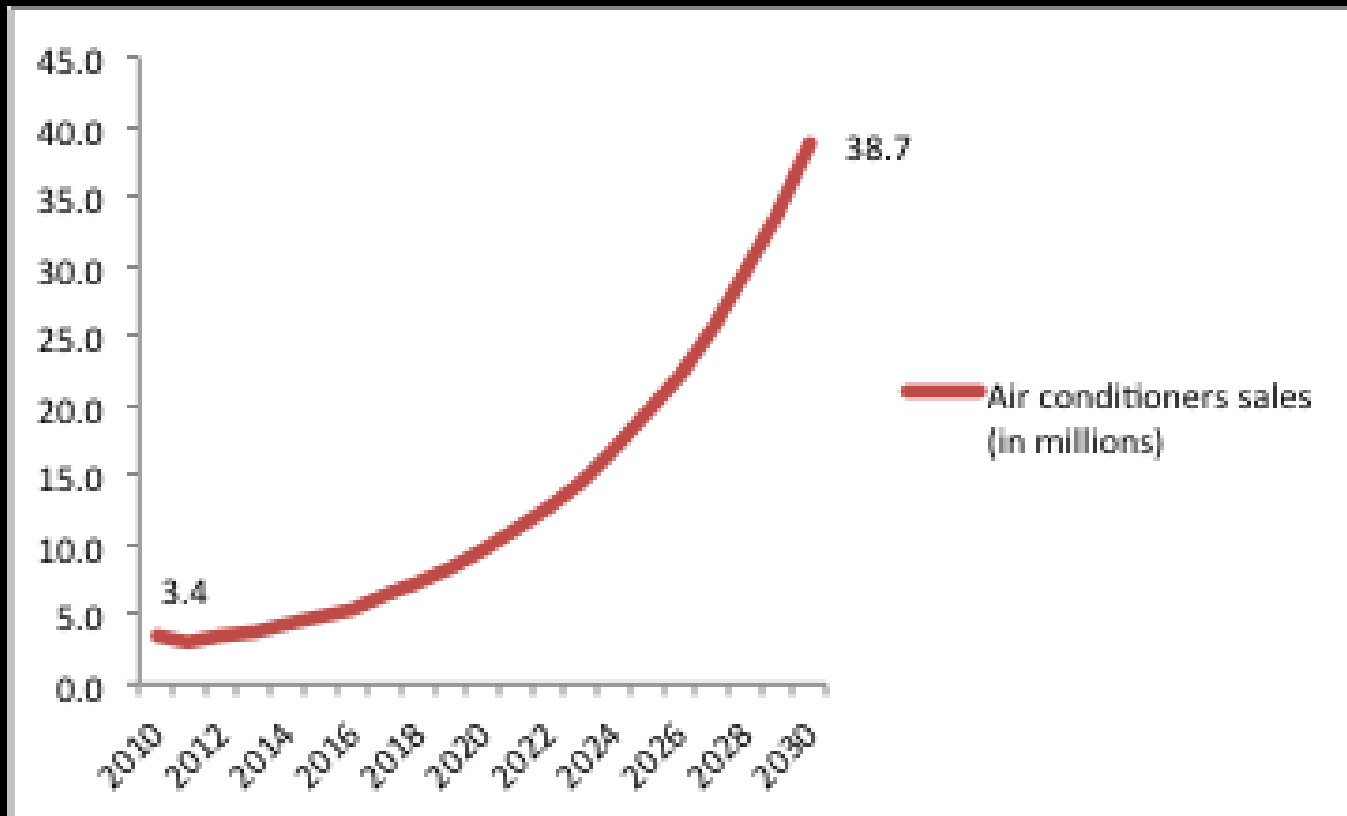
■ Floor space (billion Sq.m) — Energy consumption (TWh)



Centre for Science and Environment

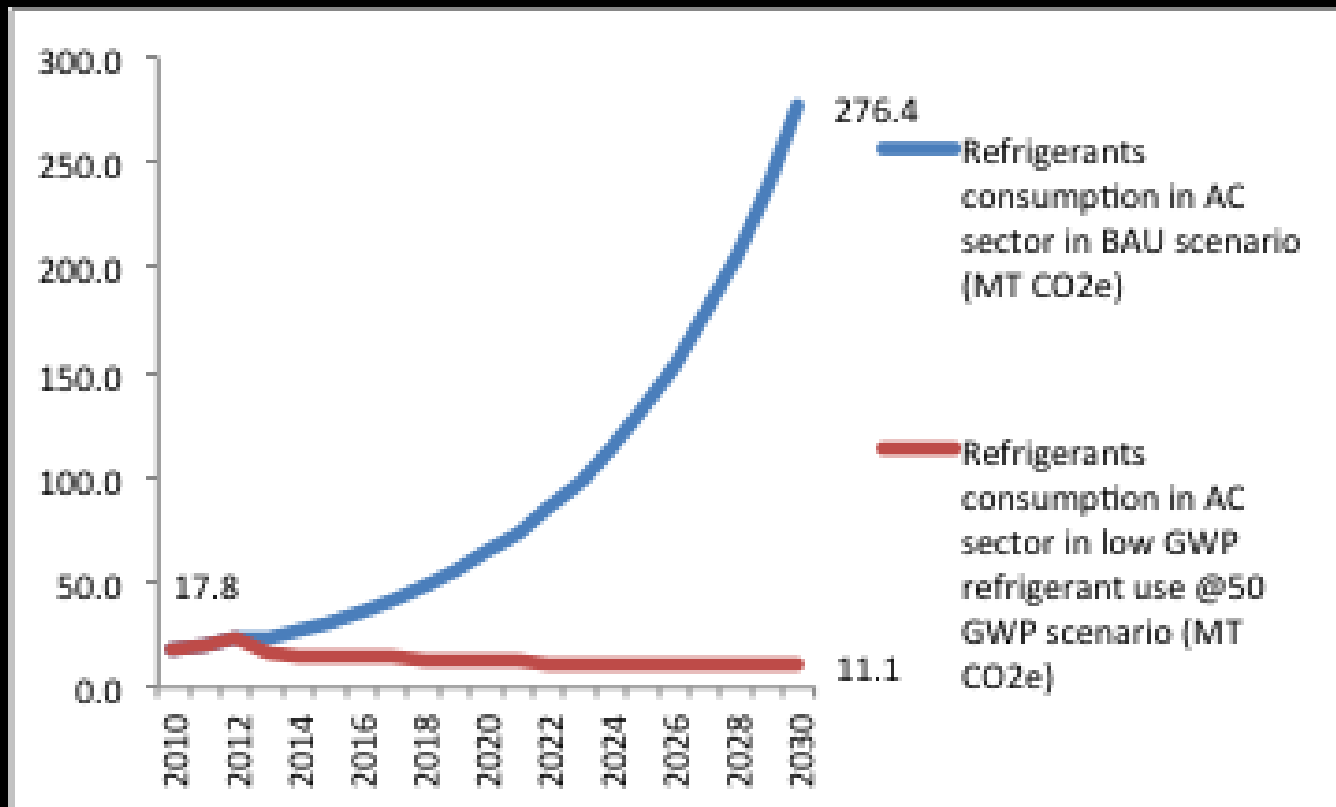
Connecting the dots- the Indian case

AC sector



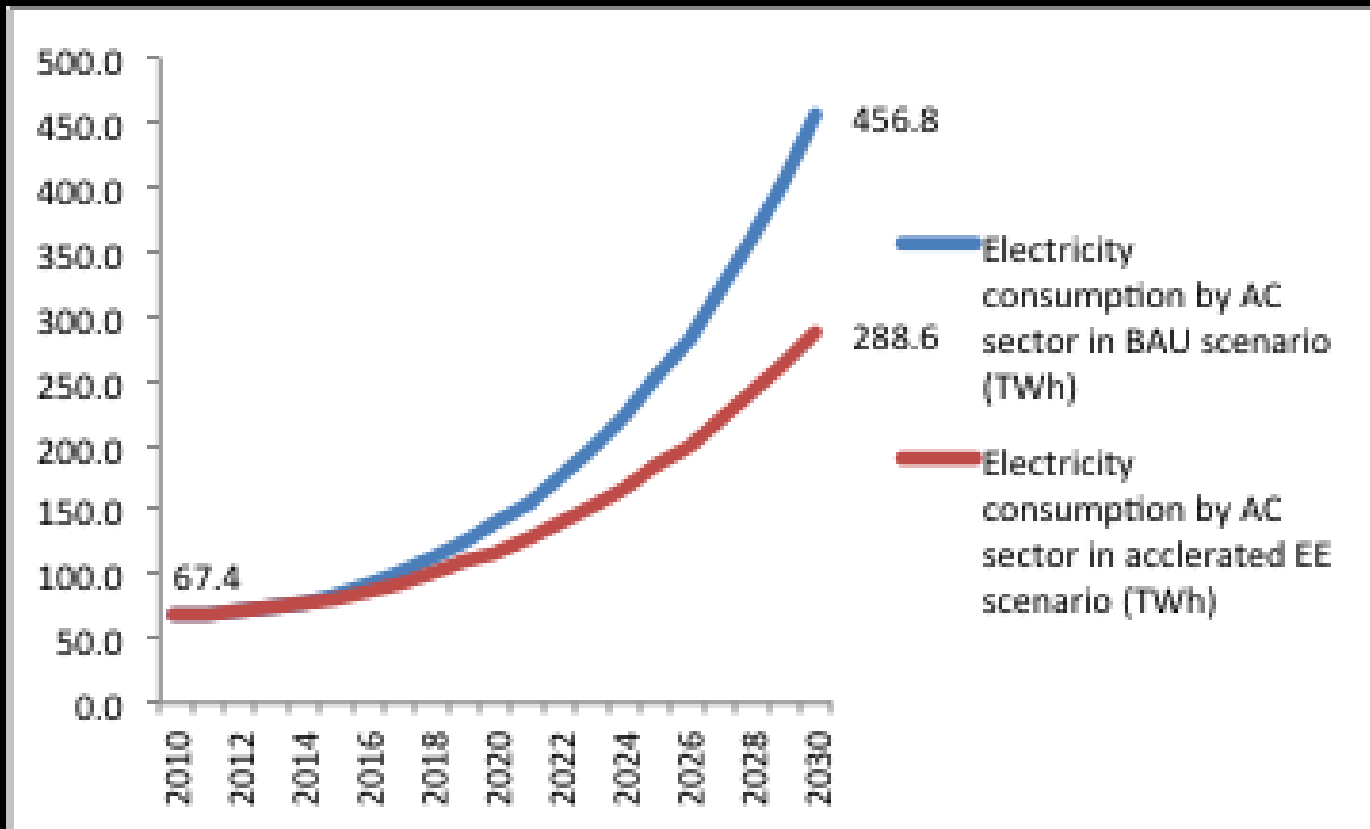
Connecting the dots- the Indian case

AC sector



Connecting the dots- the Indian case

AC sector



Connecting the dots- the Indian case

AC sector

Year	Emissions in business-as-usual scenario (in MTCO2e)			Emissions in low GWP & accelerated EE scenario (in MTCO2e)		
	Direct	Indirect	Total	Direct	Indirect	Total
2010	15	52	67	15	52	67
2030	153	288	441	10	182	192

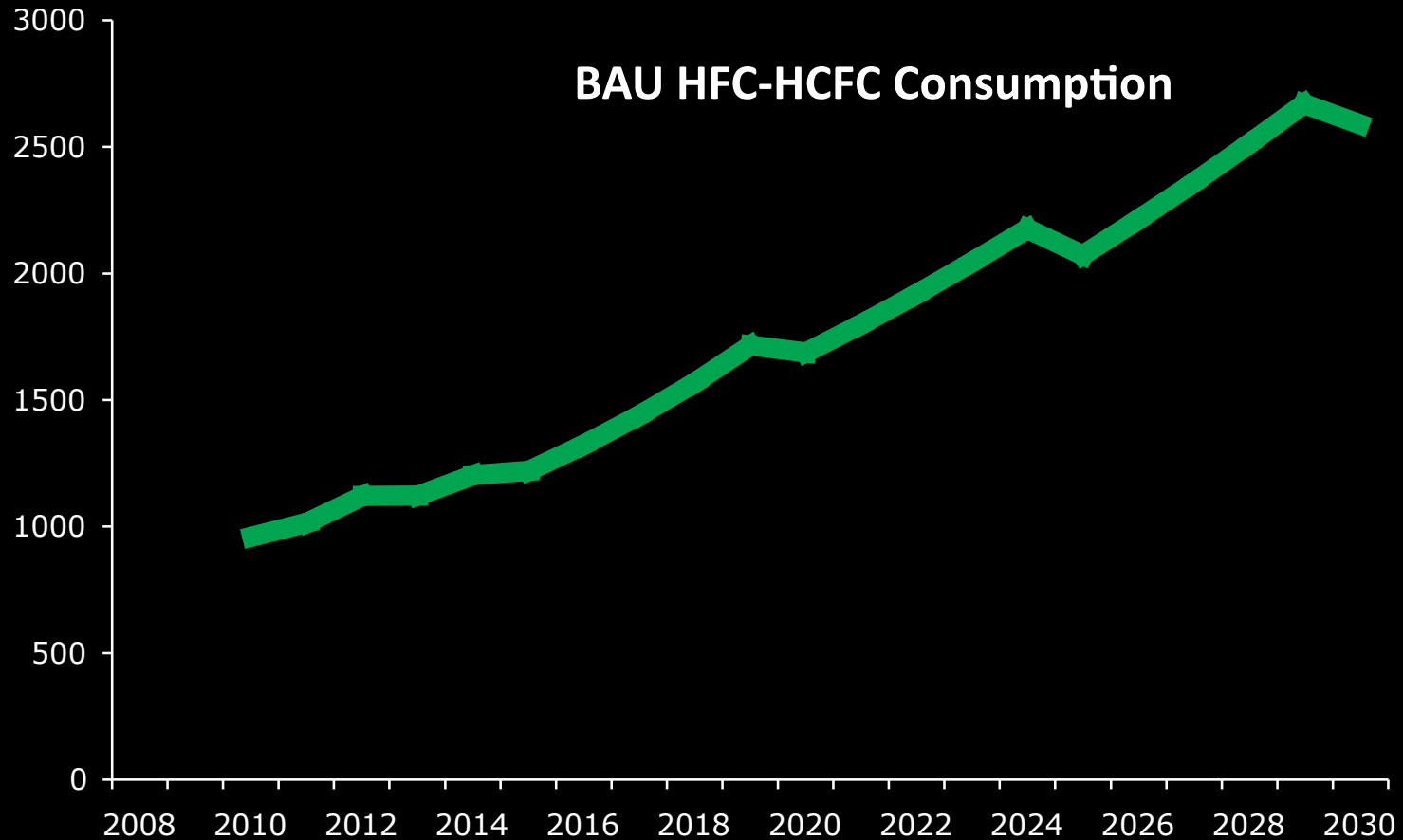


Connecting the dots

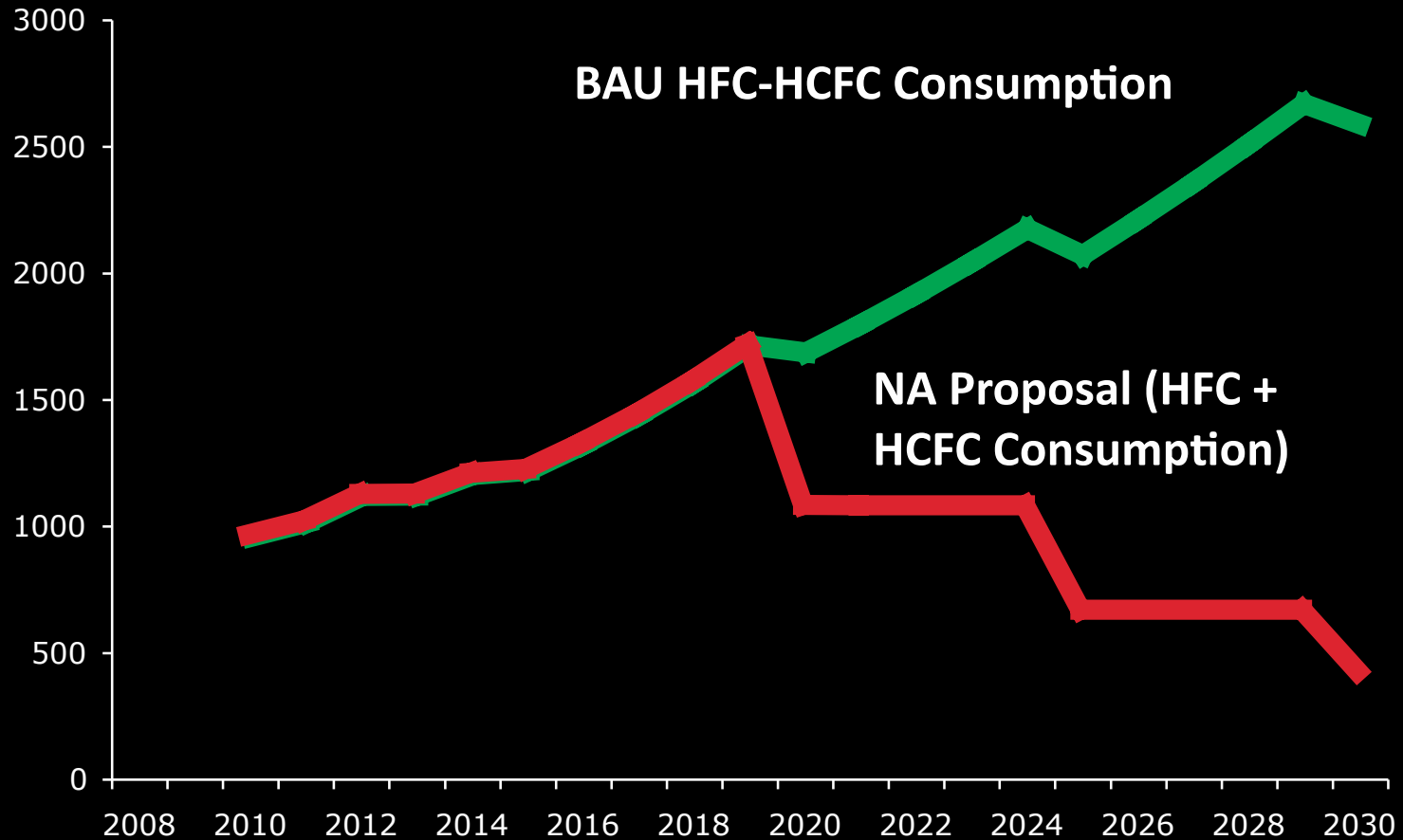
- **Doubling of annual energy efficiency improvements in AC sector will alone eliminate 150 million tonnes coal (worth US\$ 12 billion) by 2030**
- **Shifting from high GWP refrigerants to low GWP will reduce annual emissions by 140 MT CO₂e in 2030. This equivalent to another 100 million tonnes coal**
- **Emissions equivalent to 250 million tonnes coal can be avoided from AC sector alone**
- **Clear pointer: Avoiding high GWP refrigerants and accelerating energy efficiency is a major co-benefit agenda**



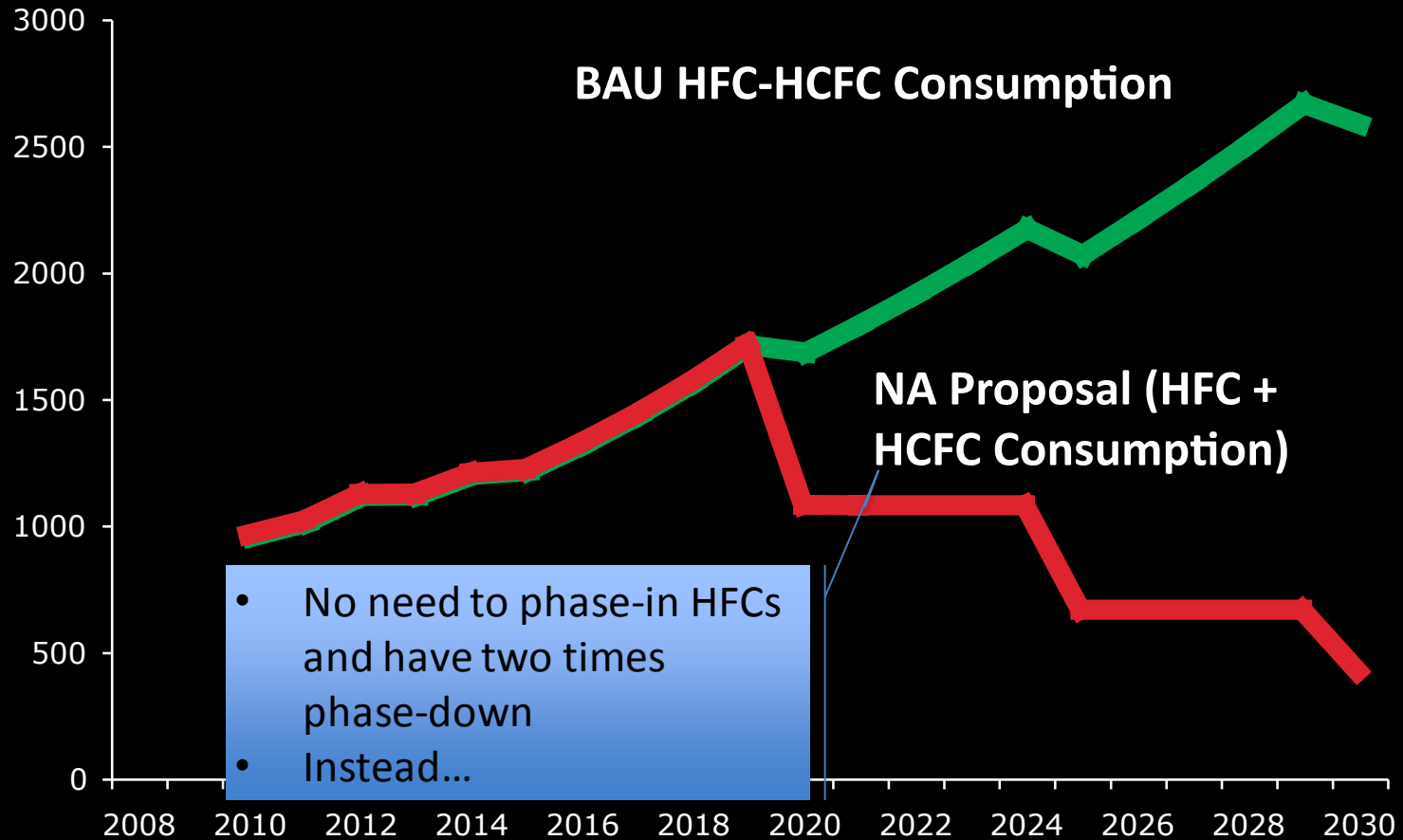
The HFC Deal – A5 countries



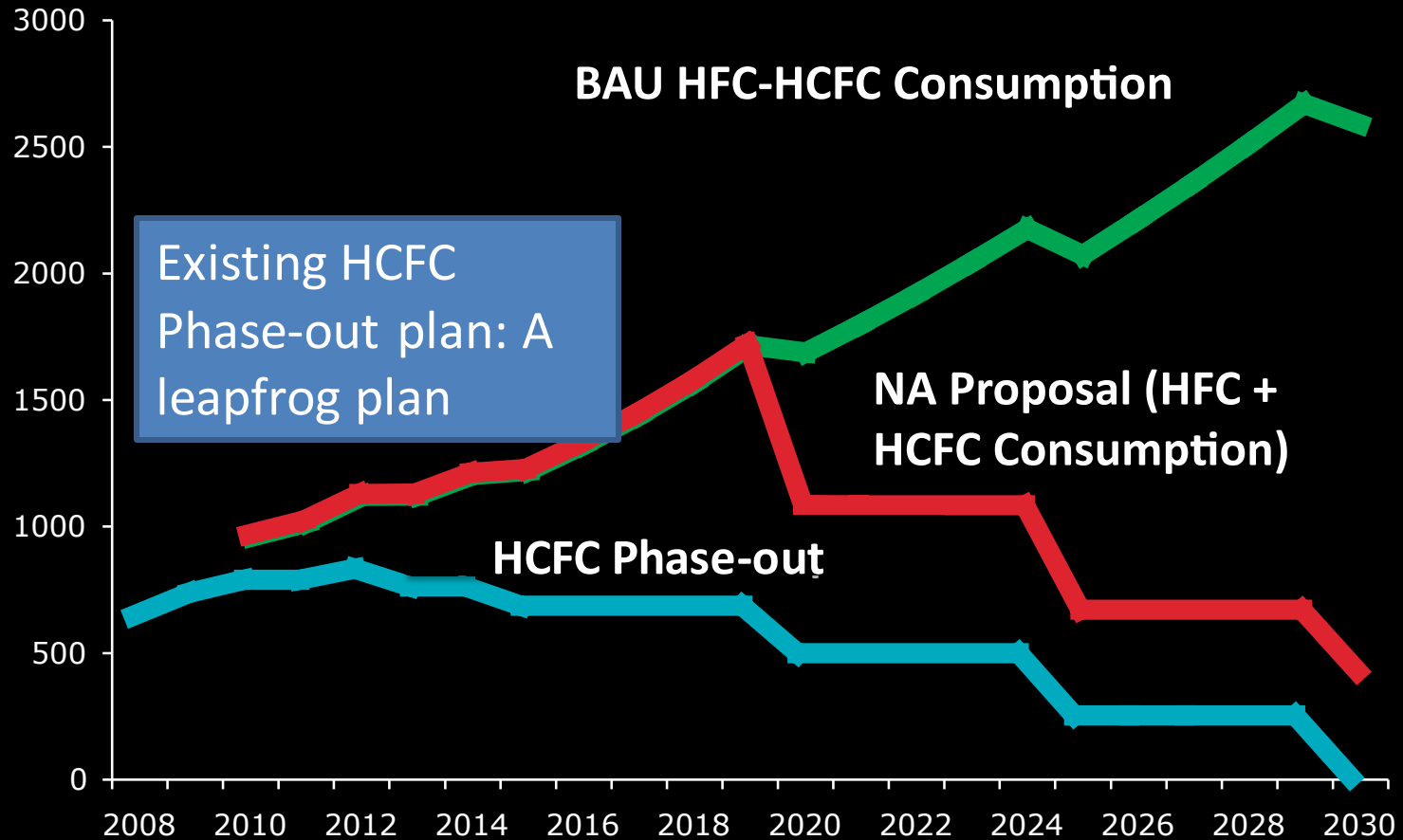
The HFC Deal – A5 countries



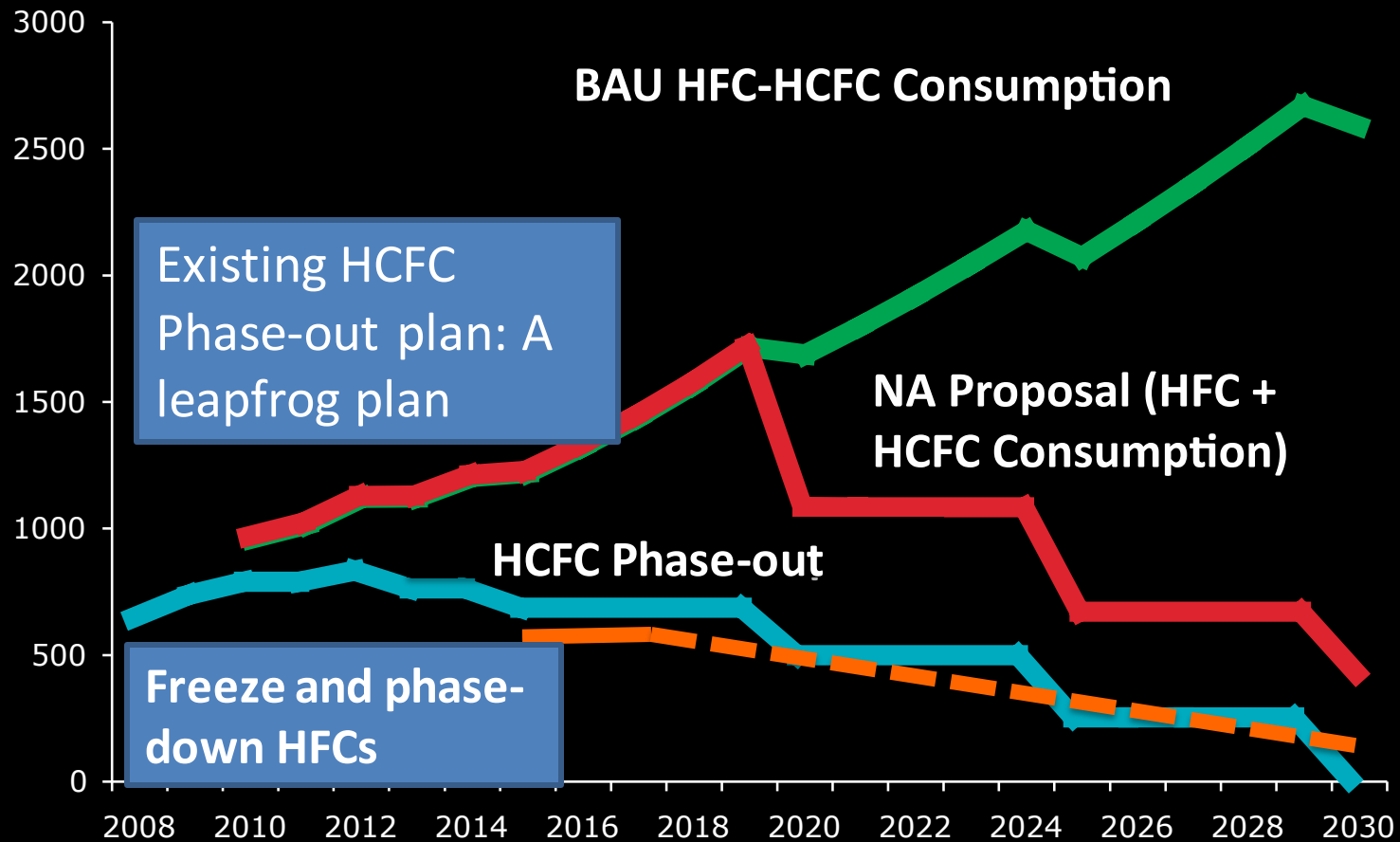
The HFC Deal – A5 countries



The leapfrog Deal – A5 countries



The leapfrog Deal – A5 countries

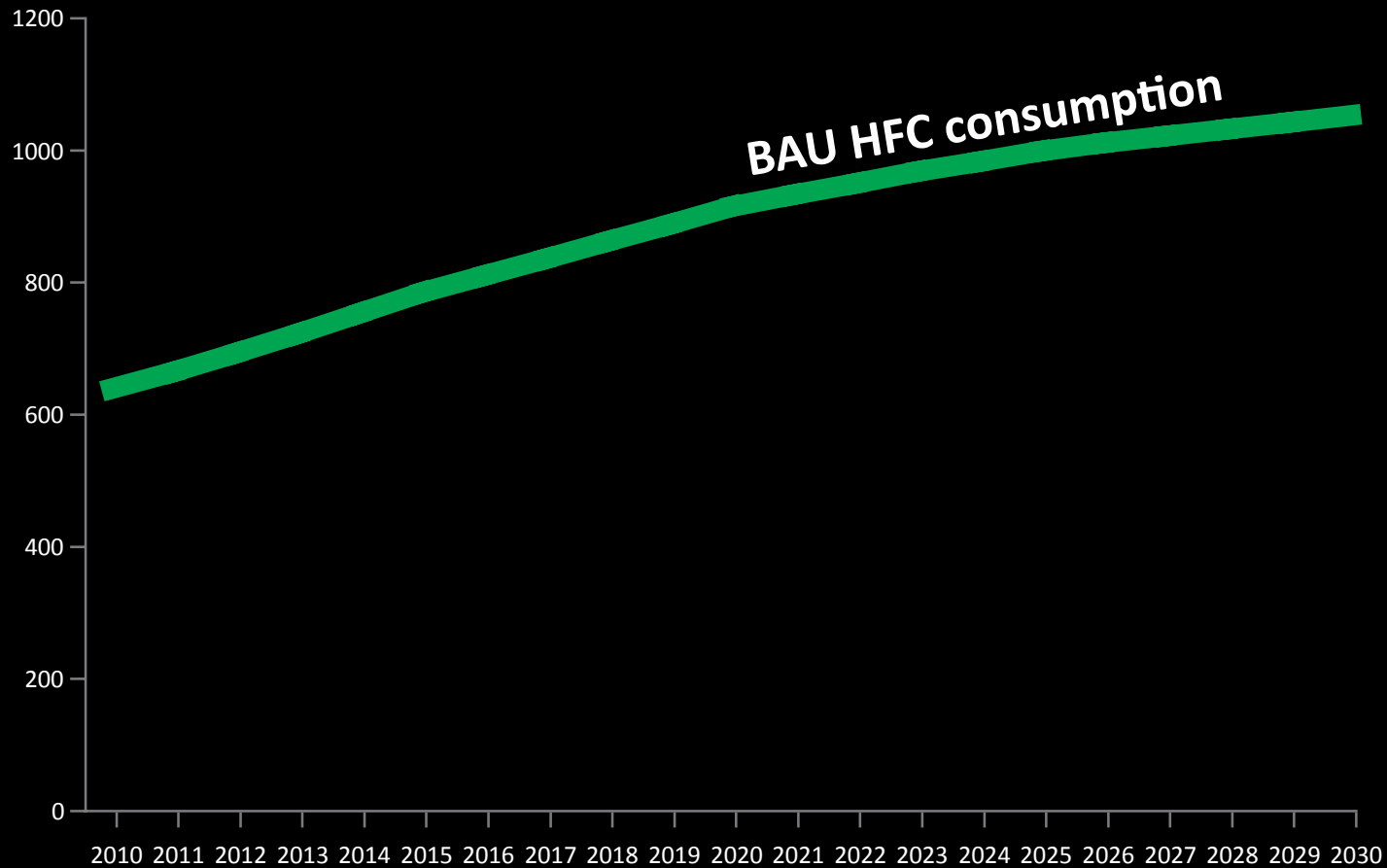


The leapfrog Deal – A5 countries

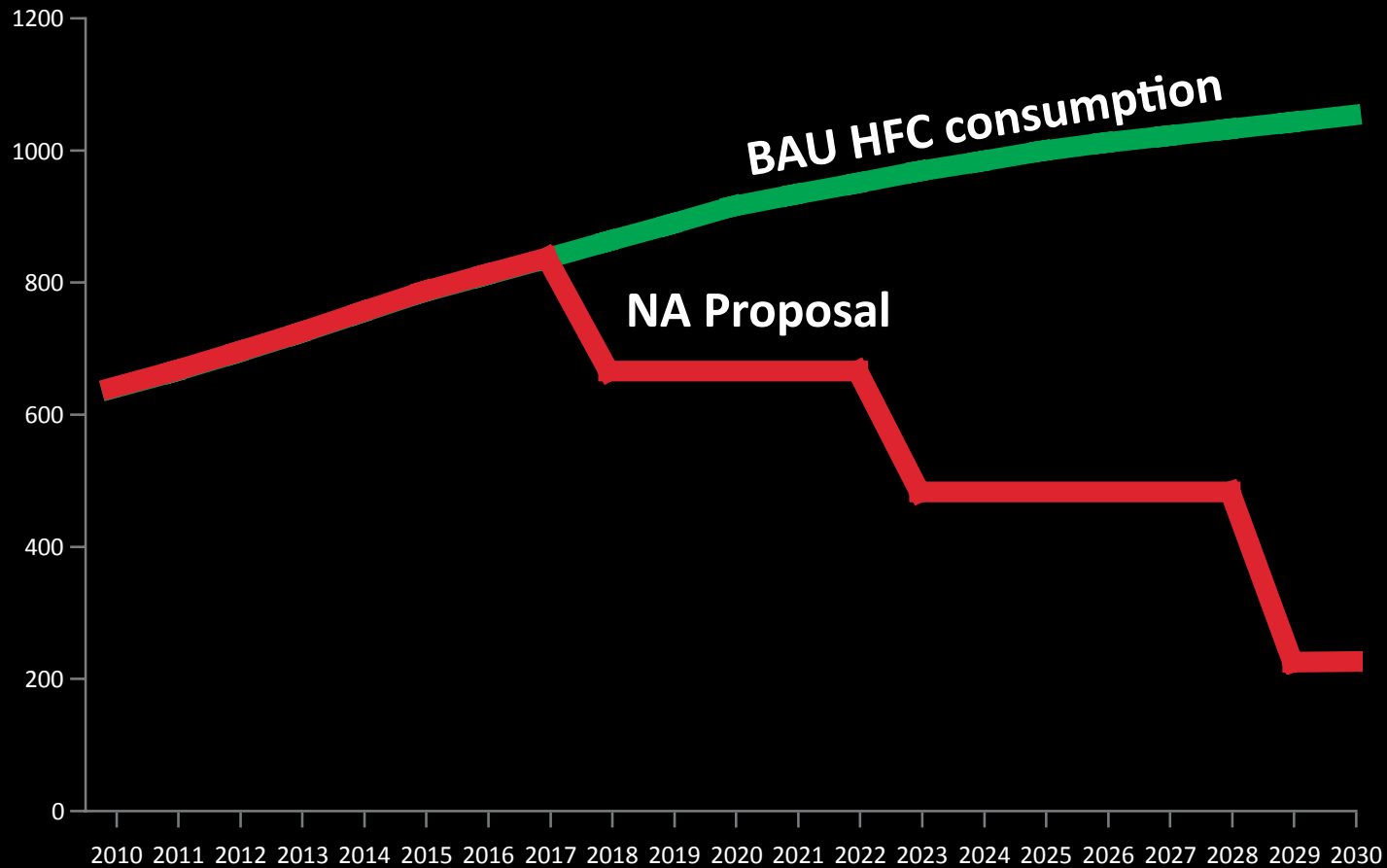
- HCFC phase-down plan to become the leapfrog plan
- Article-5 countries agree to freeze HFCs at **X year levels**
- Article-5 countries to negotiate HFC phase-down schedule individually
- Time limited exemption of SOME sectors from HCFC phase out where non-HFC alternatives are commercial.
- Simultaneous phase down of HCFC and freeze in HFC galvanizes markets and R&D towards finding non-HFC and other not-in-kind technologies



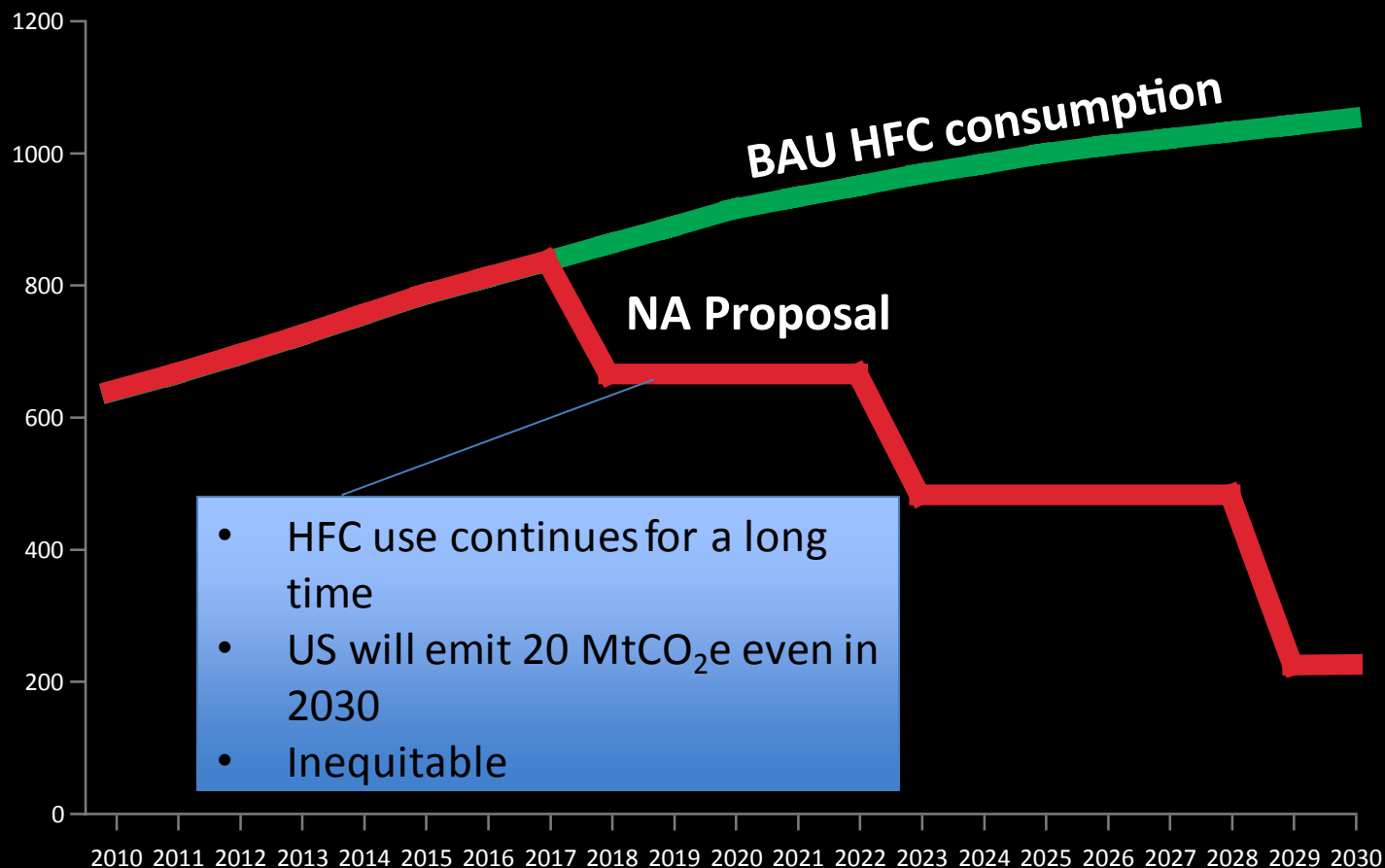
The HFC Deal – A2 countries



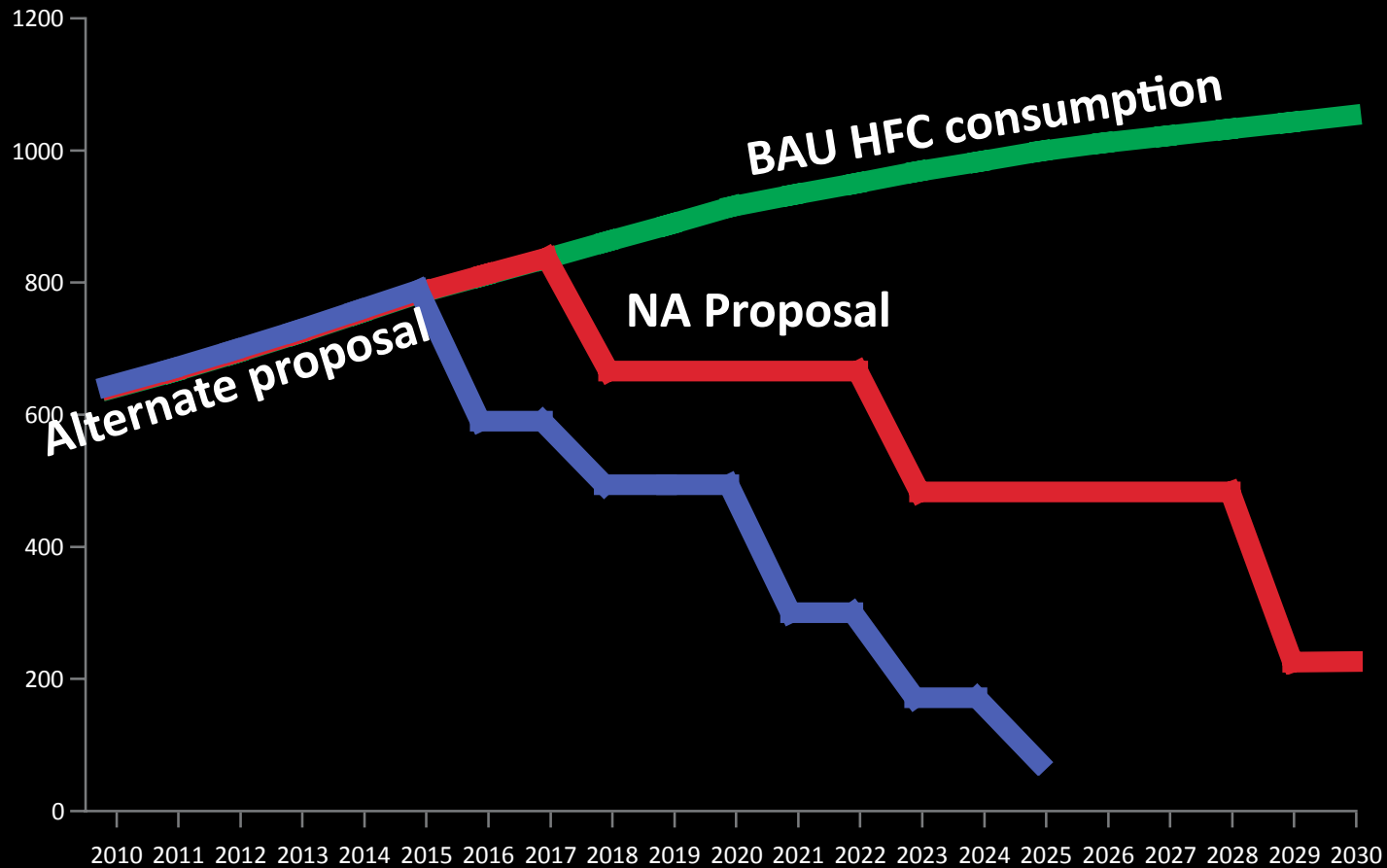
The HFC Deal – A2 countries



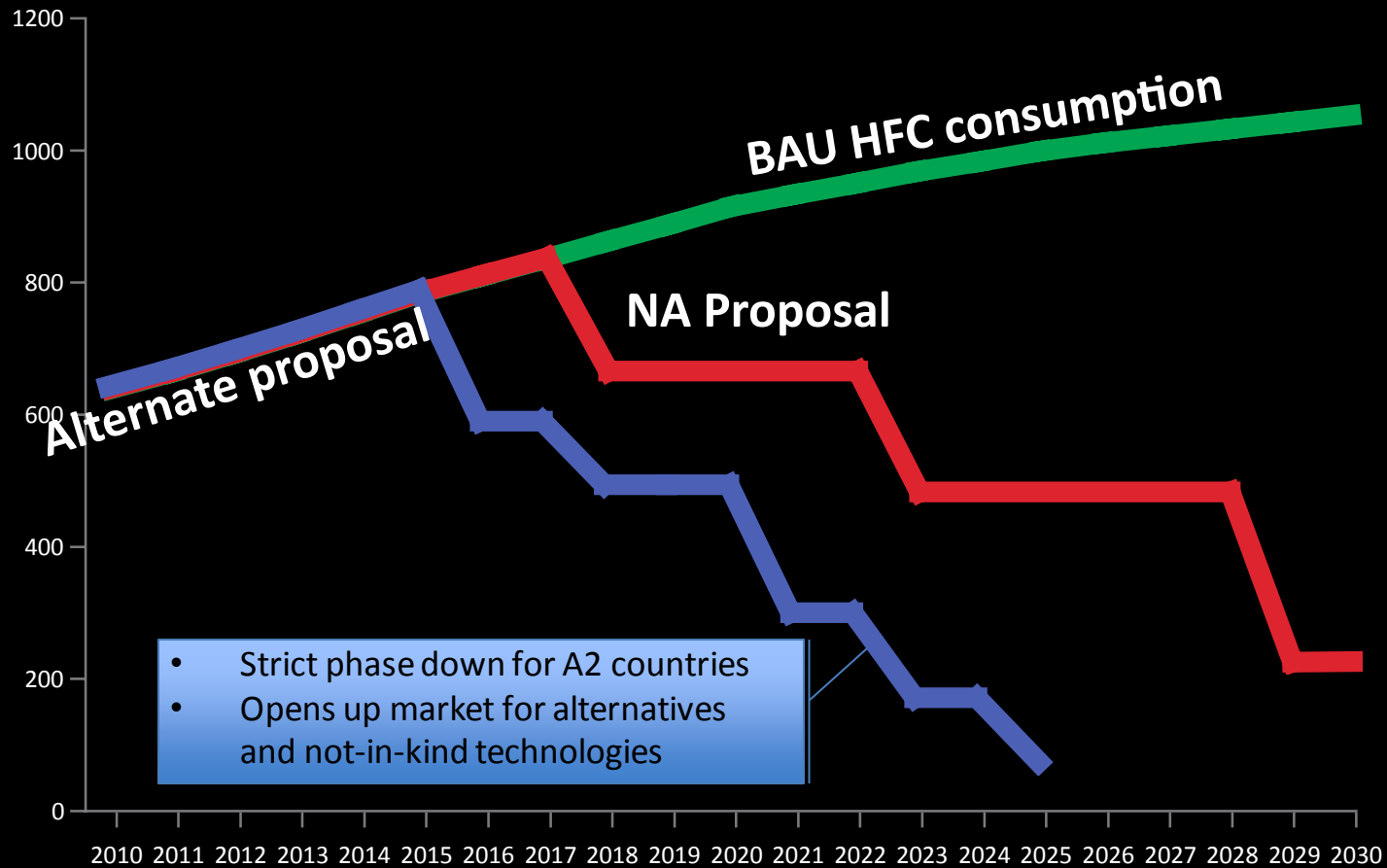
The HFC Deal – A2 countries



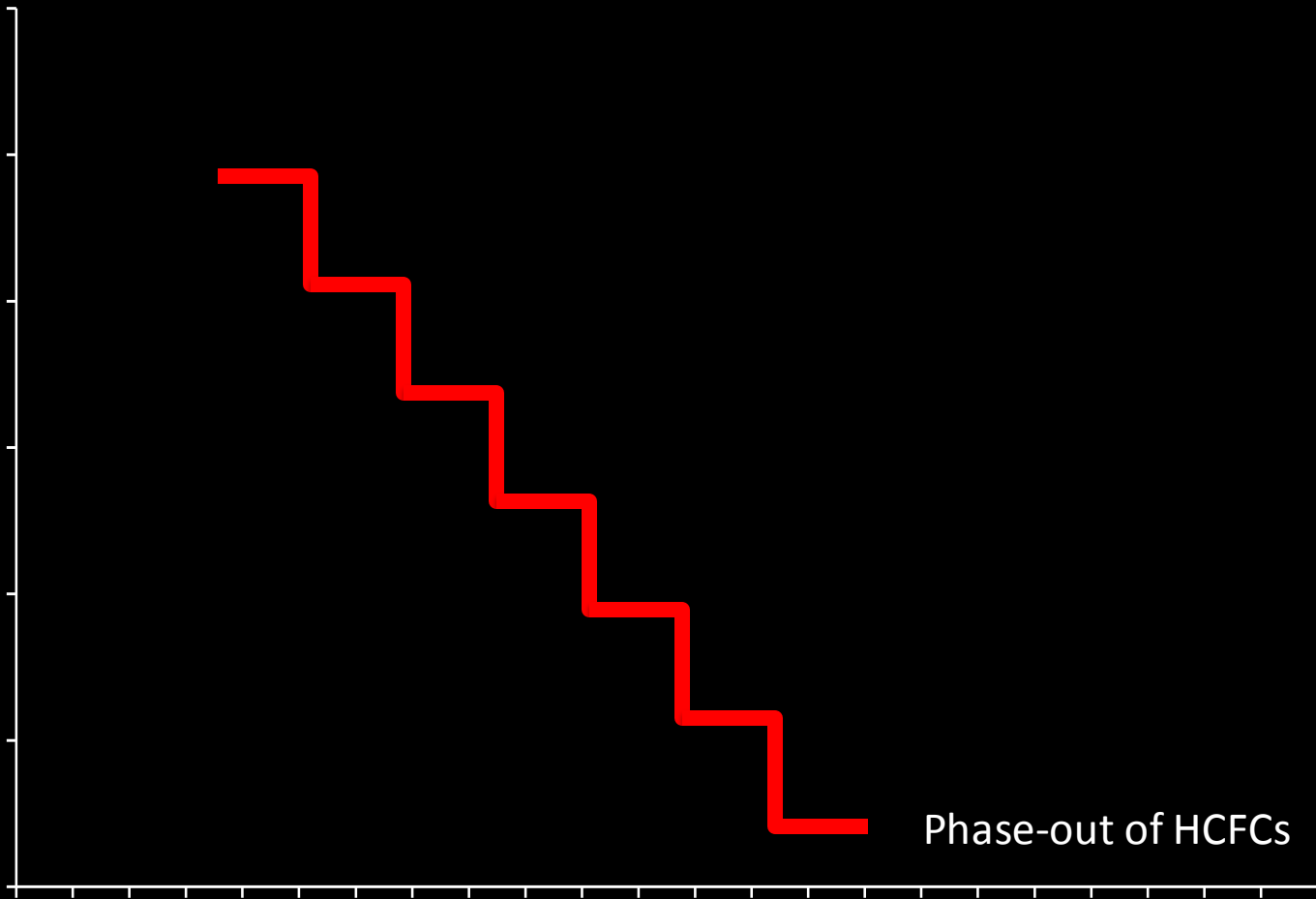
The Leadership Deal – A2 countries



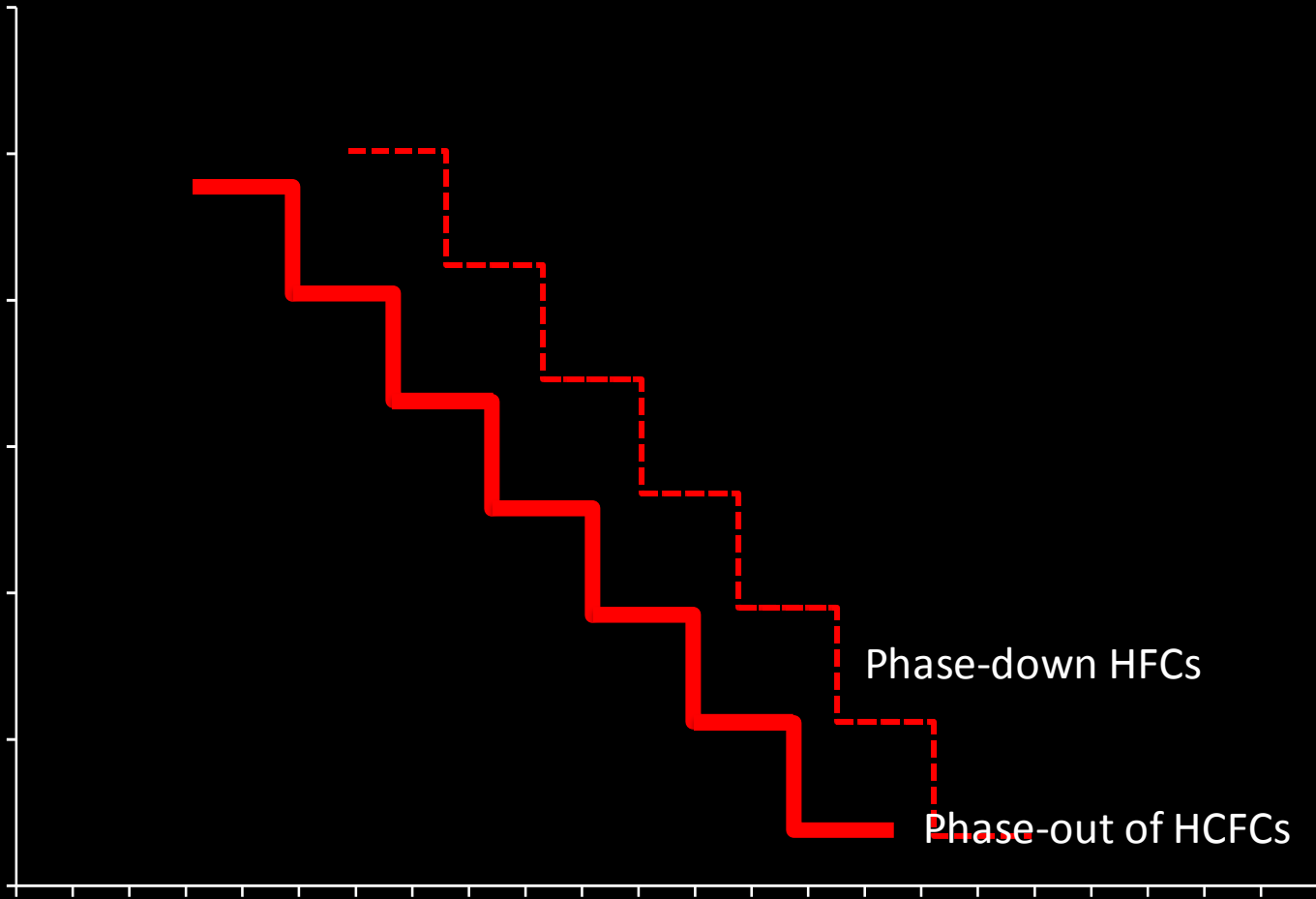
The Leadership Deal – A2 countries



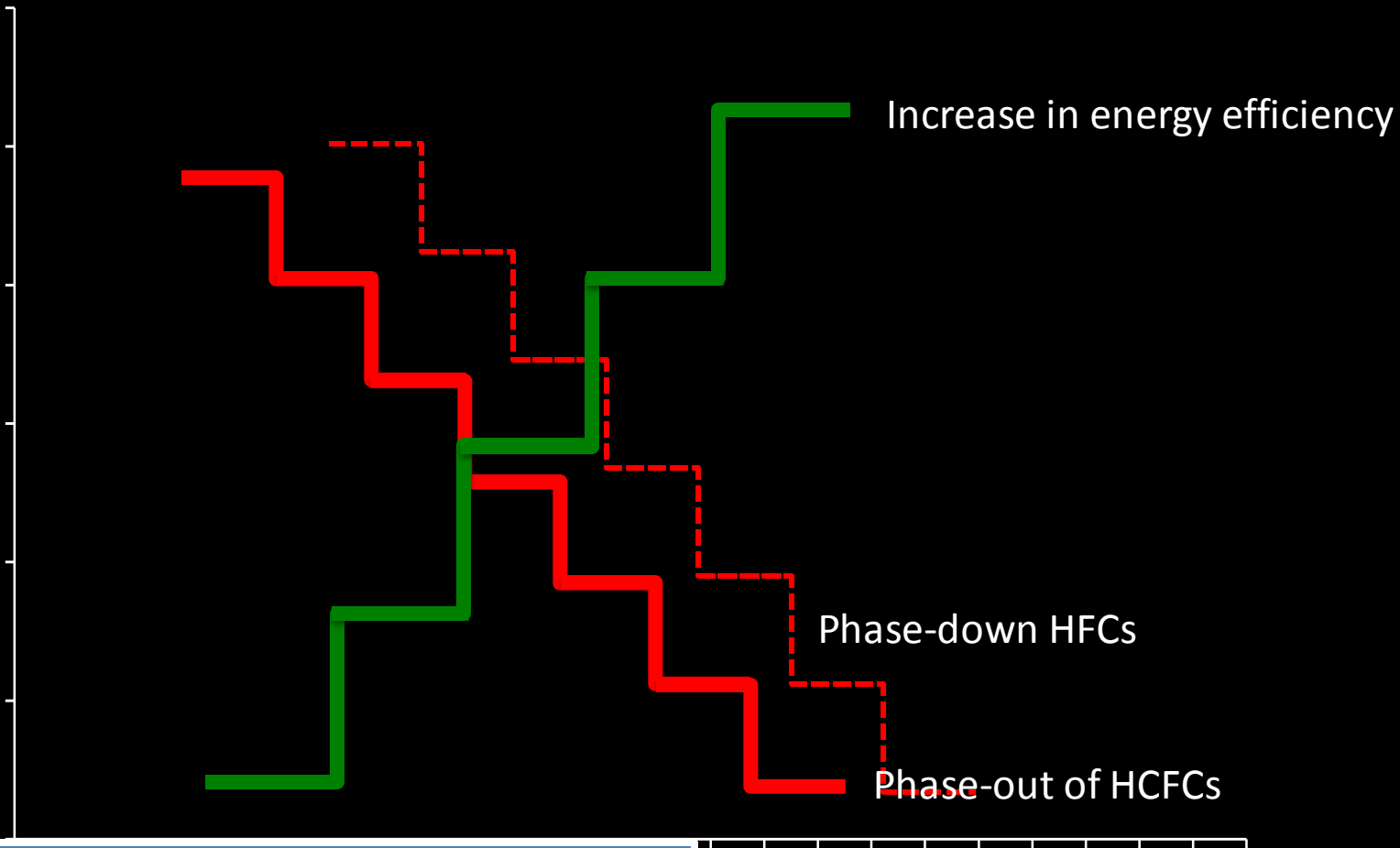
A complete deal: HFC+ Deal



A complete deal: HFC+ Deal



A complete deal: HFC+ Deal



HFC phase down a means to achieve overall GHG emission reductions and not an end in itself



Getting serious about Finance, Patents, Technology transfer and RD&D

- In the past, Montreal Protocol has facilitated technology transfer, but formula of unit abatement costs never paid the full cost for conversion
- Funding in local R&D was discouraged and technology demonstration was not a priority
- **Both essential for the leapfrog deal**
- **Reform MLF:** Funding criteria and procedures to facilitate leapfrog and transition to low/zero carbon technologies
- Funding guideline will have to incorporate energy efficiency and technology improvements
- Patents will have to be licensed for all - process, usage and application (learn from health industry)



Getting serious about Finance, Patents, Technology transfer and RD&D

- Funding requirements will be higher. How much ????
- An additional USD 3.5 billion a year needs to be made available for research, development and demonstration (RD&D) by 2030 to mainstream low/zero carbon technologies in Heating and Cooling equipment's in building sector (IEA, 2011).
- RD&D not just for gas-based alternatives but also for not-in-kind technologies such as solar cooling, district heating & cooling, heat pumps, absorption cooling technology etc.



Saying YES to precautionary principle

- Breakdown products, especially Trifluoroacetic acid (TFA), a persistent pollutant is an issue. It is phytotoxic and some studies find it to be toxic to aquatic ecosystems as well.
- While environment effects are considered negligible currently, but alternatives such as HFO1234yf are expected to contribute 5 times as much. Also, the use of HFOs will be far higher
- Need to study overall impact of growth in HFOs on TFA levels an other potential environmental impacts **especially in hot and humid conditions.**
- Need to avoid the situation where we will have to create a global convention 20 years from now to address increasing levels of TFA

